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Annual Progress Report 2023



All India Coordinated Research Project on Rapeseed-Mustard

ICAR-Directorate of Rapeseed-Mustard Research

(Indian Council of Agricultural Research)

Sewar, Bharatpur- 321 303 (Rajasthan), India

Correct citation:

AICRP (Rapeseed-Mustard). 2023. Annual Progress Report.
ICAR-Directorate of Rapeseed-Mustard Research, Sewar, Bharatpur 321 303 Rajasthan

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Published by: ICAR-Directorate of Rapeseed-Mustard Research, Sewar, Bharatpur- 321 303 (Rajasthan), India

Acknowledgement

It is a matter of great pleasure and honour for me to express my sincere thanks and gratitude to Dr Himanshu Pathak, Secretary DARE, Government of India and Director General, ICAR, Dr.T R Sharma, Deputy Director General (Crop Science), Dr. Sanjeev Gupta, Assistant Director General (Oilseeds & Pulses), Dr. D. K. Yadav, Assistant Director General (Seeds) and other ADGs of the Council for their consistent guidance, suggestions and support extended for the planning and effective implementation of All India Coordinated Research Project on Rapeseed-Mustard.

My profound thanks to all the collaborators from 21 coordinating and 29 voluntary centres under the umbrella of AICRP-RM programme during 2022-23. I extend my sincere appreciation to the monitoring team leaders and members for giving valuable suggestions for further improvement of the programme and express my gratitude to all the Vice-Chancellors and Directors of Research of the concerned SAUs, Directors of ICAR/other institutes, Directors of State Department of Agriculture for their valuable and timely cooperation in the successful implementation of the envisaged research and development activities.

The overall seasonal weather conditions during crop season of 2022-23, across the rapeseed-mustard production zones were quite normal and favourable for crop growth and development. Good amount of precipitation received during monsoon in the month of September in almost all the centers. Performance of 180 strains, including 60 of toria, 12 of yellow sarson, 162 of Indian mustard and 01 of gobhi sarson was tested in initial evaluation trials consisting of toria (1), yellow sarson (01), gobhi sarson (1) and Indian mustard (16) at 40 locations across the 6 agro-climatic zones of the country. On the basis of superiority for seed & oil yield, earliness, quality, resistance over the best check 24 strains including yellow sarson (01), gobhi sarson (01) and Indian mustard (22) were promoted for advanced stage evaluation. 290.84 q breeder seed of 42 released mustard varieties was produced, indicating a surplus availability of 184.75 q.

Foliar application of all the tested PGRs were effective in improving yield at Bharatpur (15%), Hisar (46%) and Ludhiana (11%) centre with enhanced BWC, CSI, siliqua on main shoot, and total siliqua per plant. Total chlorophyll (16%) and osmoprotectant increased (8%) with the microbial treatments under moisture stress. RWC (34%), membrane stability (7%) and chlorophyll content (18%) improved with seed the microbial inoculation in normal and late sown varieties.

During cropping season moderate to severe incidence of WR, SR, PM was observed under artificial disease screening for WR, 17 germplasm showed immunity reaction. WR none of the tested tolerant to All. Foliar spray of Tebuconazole 50%+ trifloxystrobin 25% WG @ 0.5g/l at 40 and 70 DAS was effective in AB management under rice-fallow-mustard cropping system. Seed treatment and foliar spray with *Trichoderma harzianum* at 60 and 75 DAS was found best option for bio-management of rapeseed-mustard diseases.

Entries of VVTAVT quality trials were analyzed for nutritional quality index (NQI) of oil, screened for value addition in seed meal, anti-nutritional factors and different types of glucosinolates in meal. Data obtained in all the experiments was found significant.

Application of 150% NPK of the recommended dose of fertilizers as per location recorded maximum seed yield of mustard at all the centres except at Kota and Pantnagar (100% NPK+2.5 t FYM/ha). Application of fluazifop-p-butyl @ 125 g a.i./ha (post emergence) at Uchani and pendimethalin @ 1.0 kg a.i./ha (pre-emergence) at Ludhiana, Sri Nagar, Karnal, Imphal and Pantnagar recorded maximum seed yield of mustard and WCE. Seed inoculation with microbes like; MRD 17, Biophos and Biophos+, CRIDA M-I and CRIDA M-II, and NPK consortia+ZSB biofertilizers found promising in mustard and recorded higher seed yield over no inoculation. Application of 40 kg S+5 kg Zn+1 kg B/ha enriched with 500 kg FYM markedly increased mustard seed yield.

My sincere thanks and appreciation to all the principal investigators, associated scientists and other colleagues at the ICAR-DRMR especially Dr. V.V.Singh, Bhagirath Ram, R.S. Jat, A. K. Sharma, P.D.Meena, Pankaj Sharma, Amaldhal Sharma, R.L.Choudhary, M.D.Meena, B.L.Meena, L.K.Meena, R.S.Yogi, Kamal Singh and Ms. Mamta Sikarwar of ICAR-DRMR and Dr. Pushp Sharma and Sarwan Kumar of PAU Ludhiana for their painstaking efforts in compiling the data and timely bringing out the report in the present form.

Last but not the least, help rendered by the technical, administrative and supporting staff of DRMR, particularly by Mr. R. S. Meena, Mr. Anil Kumar, Mr. Veera Sharma, Anita, Mr. Lala Ram, Mr. Devki Nandan and Mr Krishnakant Singh is thankfully acknowledged.

July 15, 2023
ICAR-DRMR, Bharatpur

(P. K. Rai)
Director

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सारांश

सारांश

मौसम

वर्ष 2022–23 के दौरान सरसों फसल के लिये मौसम अनुकूल रहा। सितम्बर माह में देश के लगभग सभी केन्द्रों में अच्छी बारिश हुई। दिसम्बर माह में हिमाचल के बजौरा केन्द्र में न्यूनतम तापमान (-) 0.1 डिग्री सेल्सियस दर्ज किया गया। इस वर्ष कीड़ों एवं बीमारियों का प्रकोप भी बहुत कम रहा, जिसके कारण फसल की पैदावार अच्छी हुई।

आनुवांशिकी एवं पादप प्रजनन

किस्मों का सुधार/विकास

अखिल भारतीय राई सरसों समन्वित परियोजना के अन्तर्गत देश के 14 राज्यों के 19 विभिन्न अनुसंधान केन्द्रों पर राई–सरसों की उन्नत किस्मों के विकास हेतु कार्यक्रम कृषि पारिस्थितिकी तंत्र की आवश्यकताओं के अनुरूप किया गया। 180 किस्मों का मूल्यांकन 49 केन्द्रों, जिसमें 28 स्वैच्छिक एवं निजी केन्द्र सम्मिलित है, पर 21 समन्वित परीक्षणों में किया गया।

जननद्रव्य संसाधन प्रबंधन

कुल 8229 प्रारूपों जिनमें तोरिया (751), लाहा (6052), पीली सरसों (408), गोभी सरसों (258), भूरी सरसों (30), करन राई (272), तारामीरा (39), *ब्रेसिका काऊडेटस* (04), *ब्रेसिका नाइग्रा* (11), *ब्रेसिका टर्निफौर्टिज* (05) एवं अन्य वन प्रजाति (35) के प्रारूपों को उचित संकरण विधि द्वारा सुरक्षित रखा गया। तोरिया (21), लाहा (435), पीली सरसों (06), गोभी सरसों (28) एवं करन राई (05) के कुल 453 नये प्रारूप को एकत्र किया गया एवं लाहा (1299), तोरिया (162), पीली सरसों (123), गोभी सरसों (37), भूरी सरसों (35), तारामीरा (97) और *ब्रेसिका रुगोसा* (23) के 1783 प्रारूपों का मूल्यांकन किया गया। मूल्यांकन के आधार पर विभिन्न गुणों के लिए उपयोगी जननद्रव्यों की पहचान की गई।

संकरण एवं चयन

अधिक उपज, शीघ्र पकने वाली, बीज–आकार, कीट–रोग प्रतिरोधकता, उच्चताप सहनशीलता, गुणवत्ता एवं अधिक तेल मात्रा के आधार पर तोरिया (435), पीली सरसों (138), लाहा (775) के 1348 नए क्रॉसेस नवगांव, चट्ठा, भा कृ अं सं नई दिल्ली कानपुर, पंतनगर, भुवनेश्वर, मुरेना, हिसार, श्रीगंगानगर, लुधियाना, वाराणसी एवं एस.के. नगर में बनाए गए। तोरिया में समष्टि (पॉपुलेषन) सुधार कार्यक्रम, कम्पोजिट बनाकर एवं चयन पश्चात् समष्टि बनाकर किया गया। पीली सरसों के लिये पंतनगर एवं कानपुर में संकरण तथा एकल पौधे पृथक्करणीय पीढियों में चयन किया गया। लाहा के 5873 एकल पौधे एवं 118 पुंज (बल्क) पृथक्करणीय एवं अग्रिम पीढ़ियों में से चयन किये गये।

अग्रिम प्रजनन स्तर का मूल्याकंन

तोरिया के 116 प्रभेदों का कानपुर,भुवनेश्वर,जगदलपुर, पंतनगर,एवं चट्ठा में मूल्याकंन किया गया। पंतनगर में मानक पी०टी० 303 की तुलना में 30.04 प्रतिशत पैदावार वृद्वि दर्ज की गई। पीली सरसों के कुल 55 प्रभेदों को कानपुर, एवं पंतनगर में जॉचा गया और पंतनगर में वाई•एस•एच• 401 की तुलना में 24.77 प्रतिशत अधिक उपज वृद्वि हुई। लाहा के 1270 प्रभेदों को 10 केन्द्रो चट्ठा, हिसार, लुधियाना, पंतनगर, भुवनेश्वर, ढोली ,एस़ के़ नगर एवं वाराणसी पर 37 परीक्षणों में जॉचा गया। पंतनगर में क्राति की तुलना में 35.15 प्रतिशत उपज में वृद्धि पाई गई। गोभी संरसो के कुल 255 प्रभेदों का हिसार(10), लुधियाना(237) चट्ठा(08) उपज में वृद्धि में मूल्यांकन किया गया।

संकर विकास

आईसीएआर–डीआरएमआर भरतपुर, आईसीएआर–आईएआरआई नई दिल्ली, पीएयू लुधियाना और सीसीएस एचएयू हिसार सहित चार केंद्रों पर कंसोर्टिया रिसर्च प्लेटफॉर्म ऑन हाइब्रिड्स के तहत 2022–23 के दौरान हाइब्रिड विकास के प्रयास जारी रहे। भारतीय सरसों के बीस प्रयोगात्मक संकर, जिनमें प्रत्येक चार केंद्रों से पांच शामिल थे, का मूल्यांकन सभी चार केंद्रों पर प्रतिकृति ब्लॉक डिजाइन में किया गया था। चार स्थानों (भरतपुर, नई दिल्ली, लुधियाना और हिसार) में औसत बीज उपज के आधार पर, दो संकरय डीआरएमआरएचजे 410 (3101 किग्रा/हेक्टेयर) और आरएचएच 2205 (2950 किग्रा/हेक्टेयर) ने क्रमशः 5. 26 और 0.13ः के अंतर से सर्वश्रेष्ठ डीएमएच–1 (2946 किग्रा/हेक्टेयर) उपज दी। संवर्धित ब्लॉक डिजाइन (सीआरपीएमएलटी 2) में चालीस प्रायोगिक संकरों का मूल्यांकन किया गया। पांच प्रायोगिक संकरय डीआरएमआरएचजे 417 (2916 किग्रा/हेक्टेयर) आरएचएच 2214 (2883 किग्रा/हेक्टेयर), आरएचएच 2212 (2831 किग्रा/हेक्टेयर), आरएचएच 2213 (2818 किग्रा/हेक्टेयर) और पीएचआर 8207 (2763 किग्रा/हेक्टेयर) ने सबसे अच्छा डीएमएच 1 (2744 किग्रा/हेक्टेयर) प्राप्त किया। औसत बीज उपज के आधार पर क्रमशः 6.26, 5.05, 3.17, 2.71 और 1.0ः का मार्जिन। तीन स्थानों (भरतपुर, नई दिल्ली और लुधियाना) में तेल उपज के आधार पर एक हाइब्रिड डीआरएमआरएचजे 417 (1227 किग्रा/हेक्टेयर) की उपज सर्वश्रेष्ठ चेक डीएमएच– (1114 किग्रा/हेक्टेयर) से 10.7ः के अंतर से अधिक है। सभी चार केंद्रों पर संवर्धित ब्लॉक डिजाइन में 30 एफ1 क्रॉस का मूल्यांकन किया गया। तीन क्रॉस

ने चार स्थानों पर औसत बीज उपज के आधार पर सर्वश्रेष्ठ चेक डीएमएच 1 (2698 किग्रा/हेक्टेयर) की तुलना में झ 10: बीज उपज हेटेरोसिस प्रदर्शित किया। तीन स्थानों (भरतपुर, नई दिल्ली और लुधियाना) में तेल उपज के आधार पर तीन एफ1 क्रॉस डीआरएमआरएच 22–10 (1321 किग्रा/हेक्टेयर), डीआरएमआरएच 22–2 (1308 किग्रा/हेक्टेयर) और डीआरएमआरएच 22–6 (1260 किग्रा/हेक्टेयर) भी सर्वोत्तम चेक डीएमएच–1 (1093 किग्रा/हेक्टेयर) से अधिक उपज वाले थे। क्रमशः 20.9, 19.7 और 15. 2: का मार्जिन था । डीआरएमआर, सीसीएसएचएयू, आईएआरआई और पीएयू में क्रमशः 40, 195, 105 और 249 सहित 589 प्रायोगिक संकरों का संबंधित केंद्र में मूल्यांकन किया गया। प्रत्येक केंद्र ने अपने स्थान पर आशाजनक संकरों की पहचान की।आईसीएआर–डीआरएमआर में 144, आईसीएआर–आईएआरआई में 375, पीएयू में 167 और एचएयू में 194 सहित 888 एफ1 क्रॉस का मूल्यांकन किया गया। प्रत्येक केंद्र पर सुपीरियर क्रॉस की पहचान की गई। बैक–क्रॉसिंग के माध्यम से कुल सीएमएस और रेस्टोरर को क्रमशः 489 और 160 परमाणु पृष्ठभूमि में परिवर्तित किया जा रहा है। इसके अलावा 86 सीएमएस और 172 रेस्टोरर लाइनों का रखरखाव किया गया। अगले वर्ष के दौरान मूल्यांकन के लिए 105 प्रायोगिक संकर और 1051 एफ1क्रॉस के बीज का उत्पादन किया गया। सफेद रतुआ प्रतिरोध, गुणवत्ता लक्षण और कृषि संबंधी गुणों के लिए पैतृक वंशावली में सुधार के प्रयास चल रहे हैं। 60 साझा इनब्रेड लाइनों का एक सेट बनाए रखा गया था, जिसमें सीएमएस, अनुरक्षक और पुनर्स्थापक, प्रत्येक सहयोगी केंद्र से 15 शामिल थे। एसएसआर मार्करों के माध्यम से मूल्यांकन की गई आनुवंशिक विविधता के आधार पर 72 इनब्रेड लाइनों के एक सेट को दो विविध उप–आबादी में समूहीकृत किया गया था।

प्रजनक बीज उत्पादन

कृषि मंत्रालय, भारत सरकार द्वारा वर्ष 2022–23 के लिए प्रस्तावित 82 अनुमोदित किस्मों का प्रजनक बीज विभिन्न केन्द्रों पर आवंटित किया गया। 106.09 क्विंटल प्रजनक बीज की मांग की तुलना में 290.84 क्विंटल (जिसमें पिछले वर्ष का बीज सम्मिलित है) प्रजनक बीज तैयार किया गया।

समन्वित परीक्षण

तोरिया (06),पीली सरसों (11), लाहा (162) एवं गोभी सरसों (01) के 180 उन्नत प्रभेदों को देश के 6 कृषि जलवायु क्षेत्रों में 19 उपज परीक्षणों हेतु 49 स्थानों पर जॉचा गया। जिसके आधार पर कुल 24 जिसमें पीली सरसों (01), गोभी सरसों (01) एवं लाहा (24) सम्मिलित है, को अग्रिम स्तर की जाँच के लिए प्रोन्नत किया गया।

सर्वोत्तम जॉच किस्म की तुलना में 10 प्रतिशत अधिक उपज रोग, प्रतिरोधकता एवं तेल मात्रा वाले राई सरसों के उत्कृष्ट प्रभेद

जोन 01	जोन 02	जोन 03	जोन 04	जोन 05
पीली सरसों आई.वी.टी.,				
				पीवाईएस 2018–1 (1077,11.6)
सरसों, आई.वी.टी., समय से पहले बुवाई (सिंचित)				
				केएमआर(ई) 22–2 (1727,9.9)
सरसों, आई.वी.टी., समय पर बुवाई (सिंचित)				
	एनपीजे 262 (2861,17.5) एनपीजे 261 (2894,18.9) पीबीआर 813–2 (2766,13.6) आरजीएन**528 (2614,11.9)	आरजीएन 528 (2541,10.1)		
सरसों, ए.वी.टी.**I+II** समय पर बुवाई (सिंचित/ गुणवत्ता/ सफेद रोली प्रतिरोधी)				
	डीआरएमआरसीआई(क्यू)*** 47 (2294,2.3) एनपीजे 253 (2600,10.3)	एनपीजे 253 (2696,10.8) डीआरएमआर 2018–25 (2723,12.0)		
सरसों, ए.वी.टी.**I** समय पर बुवाई (सिंचित)				
			एनपीजे 252** (2284,11.2)	
सरसों, आई.वी.टी., समय पर बुवाई (असिंचित)				
				आरबी 113 (1404,10.8)
सरसों, ए.वी.टी.**I+II** देरी पर बुवाई				
		डीआरएमआरएचजे 430 (2062,9.9)		
सरसों, आई.एच.टी.				

	जेकेजेएच 11(3236,6.5) एसवीजेएच 73 (3286,15.6) क्यू 90007(3259,6.3)		जेकेजेएच 11(2397,9.0) एसवीजेएच 73 (2386,8.5) एसकेएमएच 1901(2404,9.3)	
सरसों,ए.एच.टी. **I**				
	आरएचएच 2101(2934,10.7) एसवीजेएच 71 (3064,15.6) आईजे16आर1168 (2808,5.9)		18जे408सी (2381,12.2)	
सरसों आई.वी.टी., (गुणवत्ता)				
	आरएच(ओई)1708# (2796,13.3) डीआरएमआरसीआई(क्यू)172# *** (2654,7.6) डीआरएमआरसीआई(क्यू)158@ ** (2624,9.7)	डीआरएमआरसीआई(क्यू)172# (2478,9.8) डीआरएमआरसीआई(क्यू)158@** (2499,15.3)		
गोभी सरसों ए.वी.टी.**I**				
जीएसएच . 2155 (2341,10.6)				

कोष्ठक के अन्दर दर्शायी संख्या क्रमशः उत्पादन, तेल मात्रा किलोग्राम/हैक्टेयर एवं उपज वृद्धि है।

*** सफेद रोली प्रतिरोधी ** अधिक तेल मात्रा # सिंगल लो.प्रभेद @ डबल.लो.प्रभेद के आधार पर उन्नति।

शस्य विज्ञान

वर्ष 2022–23 के दौरान पांच क्षेत्रों मे ंसस्य विज्ञान के छह अनुप्रयोग किए गए। इन परीक्षणों से प्राप्त परिणाम संक्षेप में प्रस्तुत हैः

3.1 राई–सरसों आधारित फसल प्रणालियों में दीर्घकालीन उर्वरता परीक्षण

150 प्रतिशत एनपीके के प्रयोग से 100 प्रतिशत एनपीके की तुलना में कांगड़ा (25 प्रतिशत), लुधियाना (5 प्रतिशत), हिसार (34 प्रतिशत) और भरतपुर (6 प्रतिशत) में बीज उपज में वृद्धि हुई। जबकि, 100 प्रतिशत एनपीके + 2.5 टन प्रति हैक्टर गोबर की खाद के एकीकृत प्रयोग से पंतनगर और कोटा में अधिकतम बीज उपज दर्ज की गई, जो 100 प्रतिशत एनपीके की तुलना में क्रमश : 13 और 101 प्रतिशत अधिक रही।

3.2 राई–सरसों में खरपतवार प्रबंधन के लिए शाकनाशीयों का मूल्यांकन

पेंडीमेथालिन 1.0 किलोग्राम सक्रिय तत्व प्रति हैक्टर के बीज अंकुरण पूर्व प्रयोग से लुधियाना, पंतनगर, एसकेनगर, रानीताल और इम्फ़ाल केंद्रो पर खरपतवार–सहित उपचार की तुलना में क्रमश : 26, 61, 18, 49 और 36 प्रतिशत सार्थक रूप से अधिक बीज उपज दर्ज की। जबकि, हिसार में बुआई के 25–30 दिन बाद फ्लूजीफॉप–पी–ब्यूटाइल 0.125 किलोग्राम सक्रिय तत्व प्रति हैक्टर का प्रयोग अधिक प्रभावी पाया गया और खरपतवार–सहित उपचार की तुलना में बीज उपज में 24 प्रतिशत की वृद्धि हुई। खरपतवार नियंत्रण दक्षता लुधियाना, पंतनगर, एसकेनगर, रानीताल और इम्फ़ाल केंद्रो पर पेंडीमेथालिन 1.0 किलोग्राम सक्रिय तत्व प्रति हैक्टर किलोग्राम के बीज अंकुरण पूर्व प्रयोग से अधिकतम दर्ज की। जबकि, हिसार में अधिकतम खरपतवार नियंत्रण दक्षता बुआई के 25–30 दिनबाद फ्लूजीफॉप–पी–ब्यूटाइल 0.125 किलोग्राम सक्रिय तत्व प्रति हैक्टर के प्रयोग से प्राप्त हुई।

3.3 राई–सरसों की होनहार (प्रोमिसिंग) प्रविष्टियों का सस्य–मूल्यांकन

समय पर बोई गई (सिंचित) सरसो ं: प्रविष्टि आरएच 1975 ने बावल, हिसार और श्रीगंगानगर में अधिकतम बीज उपज दर्ज की। प्रविष्टि आरएच 1975 ने बीज उपज में आरएच 749, क्रांति और डीआरएमआरआईजे 31 चेकों की तुलना में क्रमशः बावल में 17, 1 और 3 प्रतिशत, हिसार में 27, 38 और 28 प्रतिशत, लुधियाना में 1, –10 और 4 प्रतिशत, श्रीगंगानगर में 13, 47 और 15 प्रतिशत और नईदिल्ली में 21, –4 और 6 प्रतिशत की वृद्धि दर्ज की।

गुणवत्ता सरसों : प्रविष्टि पीडीजेड 15 ने तुलनात्मक रूप से अधिक बीज उपज दर्ज की जो कि झाँसी में पीडीजेड 1 से 7 प्रतिशत; कानपुर में पीएम 30, आरजीएन 73, क्रांति और पीडीजेड 1 से क्रमशः 36, 8, 21 और 13 प्रतिशत; कोटा में पीएम 30 और पीडीजेड 1 से क्रमशः 5 और 8 प्रतिशत; मुरैना में पीडीजेड 1 से 5 प्रतिशत और पंतनगर में पीडीजेड 1 से 8 प्रतिशत अधिक रही। प्रविष्टि पीडीजेड 14 ने तुलनात्मक रूप से अधिक बीज उपज दर्ज की जो कि झाँसी में पीएम 30, क्रांति और पीडीजेड 1 की तुलना में क्रमशः 2, 15 और 7 प्रतिशत; कानपुर में पीएम 30 से 11 प्रतिशत; कोटा में पीएम 30 और पीडीजेड 1 से क्रमशः 5 और 7 प्रतिशत और मुरैना में आरजीएन 73 और पीडीजेड 1 से क्रमशः 4 और 9 प्रतिशत अधिक रही।

देर से बोई गई सरसों : प्रविष्टि डीआरएमआर 2018–19 ने झाँसी, कोटा और वाराणसी में अधिकतम बीज उपज दर्ज की। डीआरएमआर 2018–19 ने सीएस 56, क्रांति और एनआरसीएचबी 101 चेकों की तुलना में क्रमशः झांसी में 15, 5 और 2 प्रतिशत, कोटा में 46, 16 और 41 प्रतिशत और वाराणसी में 37, 30 और 26 प्रतिशत अधिक बीज उपज दर्ज की।

3.4 सूक्ष्मजीवों के माध्यम से राई–सरसों में सूखा और ताप सहनशीलता बढ़ाना

वर्ष 2022–23 में बीजों का सूक्ष्मजीवों द्वारा उपचार से चट्टा (26 प्रतिशत), ढोली (29 प्रतिशत), मुरैना (63 प्रतिशत), जोबनेर (25 प्रतिशत) और इम्फाल (50 प्रतिशत) में सीआरआईडीए एमआई–II के साथ, श्रीगंगानगर (27 प्रतिशत) और वाराणसी (58 प्रतिशत) में सीआरआईडीए एमआई–I के साथ, बावल (12 प्रतिशत) और बांदा (12 प्रतिशत) में बायोफॉस और बायोफॉस$^{+}$ के साथ, तथा झाँसी (4 प्रतिशत) और नागपुर (52 प्रतिशत) में एमआरडी 17 के साथ करने पर कंट्रोल की तुलना में अधिक बीज उपज प्राप्त हुई।

3.5 राई–सरसों की उत्पादकता और मृदा स्वास्थ्य को बढ़ाने में तरल जैव–उर्वरकों की प्रतिक्रिया पर अध्ययन

जैव–उर्वरकों द्वारा बीजोपचार से चट्टा (20 प्रतिशत), पंतनगर (41 प्रतिशत), ढोली (21 प्रतिशत), कोटा (17 प्रतिशत), वाराणसी (40 प्रतिशत), कांके (8 प्रतिशत), बावल (14 प्रतिशत), भरतपुर (21 प्रतिशत) और श्रीगंगानगर (21 प्रतिशत) में एनपीके कंसोर्टिया + जेडएसबी के साथ, कांगड़ा (32 प्रतिशत), मुरैना (27 प्रतिशत) और रानीताल (23 प्रतिशत) में एज़ोटोबैक्टर के साथ, तथा इंफाल (58 प्रतिशत) में पीएसएमओ के साथ करने पर बीज उपज में कंट्रोल की तुलना में वृद्धि दर्ज की गई।

3.6 उच्च उत्पादकता के लिए खनिज पोषक तत्व प्रबंधन का अनुकूलन

500 किलोग्राम प्रति हैक्टर गोबर की खाद से समृद्ध 20 किलोग्राम गंधक + 2.5 किलोग्राम ज़िंक + 0.5 किलोग्राम बोरॉन प्रति हैक्टर के प्रयोग से चट्टा (18 प्रतिशत), रानीताल (6 प्रतिशत), इम्फाल (26 प्रतिशत), कानपुर (6 प्रतिशत), पंतनगर (4 प्रतिशत), श्रीगंगानगर (16 प्रतिशत) और ढोली (12 प्रतिशत) केंद्रो पर बीज उपज में अनुशंसित दर (40 किलोग्राम गंधक + 5 किलोग्राम ज़िंक + 1 किलोग्राम बोरॉन प्रति हैक्टर) की तुलना में सार्थक वृद्धि दर्ज की गई। जबकि, 500 किलोग्राम प्रति हैक्टर गोबर की खाद से समृद्ध 40 किलोग्राम गंधक + 5 किलोग्राम ज़िंक + 1 किलोग्राम बोरॉन प्रति हैक्टर के प्रयोग से झाँसी (6 प्रतिशत), कांगड़ा (9 प्रतिशत), मुरैना (19 प्रतिशत), नागपुर (7 प्रतिशत), एसकेनगर (16 प्रतिशत), कांके (2 प्रतिशत) और कोटा (1 प्रतिशत) केंद्रो पर बीज उपज में अनुशंसित दर (40 किलोग्राम गंधक + 5 किलोग्राम ज़िंक + 1 किलोग्राम बोरॉन प्रति हैक्टर) की तुलना में उल्लेखनीय वृद्धि दर्ज की गई। जोबनेर में, 40 किलोग्राम गंधक + 5 किलोग्राम ज़िंक + 1 किलोग्राम बोरॉन प्रति हैक्टर के प्रयोग से अनुशंसित दर की आधी मात्रा (20 किलोग्राम गंधक + 2.5 किलोग्राम ज़िंक + 0.5 किलोग्राम बोरॉन प्रति हैक्टर) की तुलना में सार्थक रूप से अधिक बीज उपज प्राप्त हुई।

पादप रोग विज्ञान

रोग परिदृश्य

वर्ष 2022–23 के दौरान, सभी जगह सफेद रोली एवं काला धब्बा रोग का प्रकोप औसत से तीव्र देखा गया। मुरैना और पंतननगर में पौध अवस्था पर मृदुरोमिल आसिता रोग का प्रकोप कम से मध्यम पाया गया। चूर्णिल आसिता रोग का प्रकोप एस. के. नगर, पंतनगर, जगदलपुर, झॉसी और मुरैना में मध्यम से तीव्र रहा। जबकि, तना गलन रोग का प्रकोप भरतपुर में मध्यम से तीव्र देखा गया। अलग–अलग स्थानों पर तकनीकी कार्यक्रम के अनुसार अलग–अलग परीक्षण की निर्धारित तिथियों पर बुआई की गई। मुरैना से प्राप्त आंकडे पिछले वर्ष की प्रतिलिपि होने के कारण प्रतिवेदन से बाहर रखा गया है।

राई–सरसों जननद्रव्य की विभिन्न रोगों से प्रतिक्रिया

प्राकृतिक एवं कृत्रिम परिस्थितियों में पाँच केद्रों पर उन्नत किस्म परीक्षण 1 और 2 (एवीटी 1 और एवीटी 2) की 57 जननद्रव्य से डीआरएमआर 2018–19, डीएमआरआईजे 20–157, आईजे 19 आर 5004, पीडीजेड 14, डीआरएमआर 2018–37, डीआरएमआरसीआई(क्यू) 47, पीडीजेड 15, पीडीजेड 16, डीआरएमआर 2018–25 (ब्रेसिका जुंसिया) सफेद रतुआ रोग के प्रति प्रतिरोधी पायी गई। ये सभी जननद्रव्य मुरैना और पंतनगर केद्र पर मृदु रोमिल आसिता रोग के प्रति प्रतिरोधी पाये गये।

प्रमुख बीमारियों के लिए समरूप रोग नर्सरी

प्राकृतिक परिस्थितियों में सरसों (ब्रेसिका जुंसिया) के 44 जननद्रव्य में से डीआरएमआरडीआर 2135 (2 वर्ष), डीआरएमआरएसजे 14, डीआरएमआरसीआई 169, डीआरएमआरएसजे 9, डीआरएमआर 2018–26, डीआरएमआर 2020–15, डीआरएमआरडीआर 2133, पीएबी 2017–25, डीआरएमआरसीआई(क्यू) 57, डीआरएमआरसीआई 153, डीआरएमआरसीआई 170, डीआरएमआरएसजे 12, पीएबी 2017–22, डीआरएमआरसीआई 171 और डीआरएमआर 2019–15 सफेद रतुआ प्रतिरोधी पाये गये।

काला धब्बा की राष्ट्रीय रोग नर्सरी

सरसों के जननद्रव्य डीआरएमआर 2018–19 (3 वर्ष), डीआरएमआरआईजेडब्ल्यूआर 20–11 और डीआरएमआरएसजे 349 सफेद रतुआ के लिये प्रतिरक्षित पाये गये। सरसों के कुछ अन्य जननद्रव्य पीएबी–2014–8 (2 वर्ष) डीआरएमआरआईजेडब्ल्यूआर 20–16, आरएच 1700–3, पीएबी 2014–7, पीएबी 2014–15 और डीआरएमआर–पीएमजे 17 सफेद रतुआ के लिये प्रतिरोधी पाये गये।

सफेद रतुआ की राष्ट्रीय रोग नर्सरी

कृत्रिम परिस्थितियों में सरसों (ब्रेसिका जुंसिया) के कुल 85 जननद्रव्य में से डीआरएमआर 2018–41 (5 वर्ष), आरएच 1700, आरएच 1700–1 (4 वर्ष), आरएच 1700–4, डीआरएमआरसीआई 131, डीआरएमआरसीआई 132, डीआरएमआर 18–35–11, डीआरएमआर 18–36–12, डीआरएमआरएम 18–37–13, डीआरएमआर 2018–19 (3 वर्ष), डीआरएमआरसीआई 139, डीआरएमआर 2141, डीआरएमआरएसजे 349, डीआरएमआरएसजे 206, डीआरएमआर 2018–1, पीडीजेड 16, डीआरएमआरडीआर 2195 (2 वर्ष) जननद्रव्य सफेद रतुआ रोग मुक्त पाये गये। जबकि कुछ आशाजनक जननद्रव्य जैसे डीआरएमआरडीआर 2151, डीआरएमआरडीआर 2155, डीआरएमआरडीआर 2196, डीआरएमआर आई जेड ब्ल्यू आर 20–12, डीआरएमआर आई जेड ब्ल्यू आर 20–13, डीआरएमआर आई जेड ब्ल्यू आर 20–14, डीआरएमआर आई जेड ब्ल्यू आर 20–15, डीआरएमआर आई जेड ब्ल्यू आर 20–17, डीआरएमआर आई जेड ब्ल्यू आर 20–18, डीआरएमआर आई जेड ब्ल्यू आर 20–19, डीआरएमआर आई जेड ब्ल्यू आर 20–20, डीआरएमआर आई जेड ब्ल्यू आर 20–21, डीआरएमआर आई जेड ब्ल्यू आर 20–23, डीआरएमआर आई जेड ब्ल्यू आर 20–24, डीआरएमआर आई जेड ब्ल्यू आर 20–26, डीआरएमआर आई जे 1–44, डीआरएमआर आई जे 12–37, डीआरएमआर डी आर 2235, डीआरएमआरएम 163, पीएमएएस ए 2010, पीएबी 14–7, पीएबी 14–8, पीएबी 14–18, डीआरएमआर डी आर 2135, डीआरएमआर डी आर 2143, जेसी 36, डीआरएमआर आई जे 20–11 पंतनगर, हिसार और भरतपुर केद्रों पर सफेद रतुआ प्रतिरोधी पाये गये।

तना गलन की राष्ट्रीय रोग नर्सरी

कुल 12 जननद्रव्य में से कोई भी जननद्रव्य तना गलन रोग के प्रति सहनशील तथा प्रतिरोधी नहीं पाये गये है। हालाँकि, एनआरसीएचबी 101 (63.5 प्रतिशत और 23.6 सेमी) और एनआरसीवाईएस–05–2 (72.6 प्रतिशत और 27.6 सेमी) में तना गलन का प्रकोप और घाव की लंबाई अधिकतम की तुलना में डीआरएमआरआईएस 20–1 (46.9 प्रतिशत) में तना गलन का प्रकोप और घाव का आकार (14.7 सेमी) सबसे कम पाया गया।

राई–सरसों का प्रांरम्भिक जननद्रव्य परीक्षण

सरसों (ब्रेसिका जुंसिया) के कुल 146 आईवीटी जननद्रव्य में से डीआरएमआर सी आई 160, आरएचएच 2202, क्यू 90007, डीआरएमआर सी आई(क्यू) 172, पीएमएएस 11, पीडीजेड 18, और पीडीजेड 19 एस के नगर और हिसार केन्द्रों पर सफेद रतुआ रोग के लिये प्रतिरोधी पाये गये।

धान–पड़त–सरसों फसल चक्र में काला धब्बा रोग की उपज हानि का आँकलन एवं प्रबंधन

आठ विभिन्न उपचारों मे से धान–पड़त–सरसों फसल चक्र में शिलोंगनि, जगदलपुर, बनारस और ढोली केन्द्रो पर लगातार तीसरे वर्ष टेबुकोनाजोल 50 प्रतिशत + ट्राइफ्लोक्सिस्ट्रोबिन 25 प्रतिशत डब्ल्यूजी का 0.5 ग्राम प्रति लीटर की दर से तथा आईप्रोडियोन 50 डब्ल्यूपी का 0.2 प्रतिशत की दर से पर्णीय छिड़काव काला धब्बा रोग के लिये कारगर पाया गया। बीज उपचार के साथ–साथ लहसुन के कंद के अर्क का 1 प्रतिशत की दर से पत्तियों पर छिड़काव और ट्राइकोडरमा हार्जियमम भी जांच के बाद काला धब्बा रोग की गंभीरता को कम करने में प्रभावी पाया गया। तीसरे वर्ष के आकड़ों के आधार पर फसल चक्र में शिलौंगनी, जगलपुर, बनारस और धौली केन्द्रो पर टेबुकोनाजोल 50 प्रतिशत + ट्राइफ्लोक्सिस्ट्रोबिन 25 प्रतिशत डब्ल्यूजी की 0.5 ग्राम प्रति लीटर की दर से बुवाई के 40 और 70 दिन के अंतराल पर पर्णीय छिड़काव करने से काला धब्बा रोग प्रबंधन में लाभ हुआ है। काला धब्बा रोग से सरसों में औसतन 49.8 प्रतिशत का उपज में कमी जॉची गयी है।

सफेद रतुआ, मृदुरोमिल आसिता, काला धब्बा, चूर्णिल आसिता व तना गलन रोगों की महामारी का अध्ययन

सरसों के सभी प्रमुख रोगों की महामारी विज्ञान पर प्रयोग वरुणा और स्थानीय किस्म का उपयोग करके आठ केन्द्रों, हिसार, शिलौंगनी, एस के नगर, जगलपुर, पंतनगर, ढौली, झॉसी और मुरैना में साप्ताहिक अंतराल पर 1 अक्टूबर से 19 नवंबर तक आठ अलग–अलग तिथियों पर बुवाई का प्रयोग किया गया। कीट और रोगों के प्रबंधन हेतु किसी भी सुरक्षा उपायों को नहीं अपनाया गया। बीमारी की शुरूआत और सप्ताह में दो बार के अतंराल पर प्रत्येक बुवाई में बीमारी कि प्रगति को दर्ज किया गया।

हिसार में सफेद रतुआ रोग पहली बार बुवाई के 38 दिनो के बाद 19 नवम्बर की बुवाई में आरएच 30 में पाया गया, जिसका बुवाई के 118 दिनों के बाद तक 5 नवम्बर की बुवाई में फैलाव देखा गया। पहली बार स्टेग हेड बनने की शुरूआत 19 नवम्बर की बुवाई में 83 दिनों के बाद वरूणा और आरएच 30 दोनों में पाया गया। काला धब्बा रोग पहली बार बुवाई के 86 दिनों के बाद 19 नवम्बर की बुवाई में आरएच 30 में पाया गया। तना गलन रोग की शुरूआत पहली बार 19 नवम्बर की बुवाई के 68 दिनों के बाद आरएच 30 और वरूणा में 69 दिनों के पाया गया। तना गलन की अधिकतम तीव्रता 22.1 प्रतिशत आरएच 30 में 29 अक्टूबर की बुवाई में और 44.8 प्रतिशत वरूणा में 05 नवम्बर की बुवाई में देखी गयी। अधिकतम उपज 15 अक्टूबर को वरूणा की बुवाई में 26.12 क्विंटल/हैक्टेयर और आरएच 30 में 25.01 क्विंटल/हैक्टेयर पायी गयी।

शिलोंगनी में काला धब्बा रोग पत्तियों पर पहली बार बुवाई के 34 दिनों के बाद जबकि फलियों पर बुवाई के 83 दिनों के बाद 19 नवम्बर को टीएम–2 पर रोग के लक्षण देखे गये। काला धब्बा रोग की अधिकतम गम्भीरता 19 नवम्बर की बुवाई के 110 दिनों के बाद 38.9 प्रतिशत टीएम 2 पर दिखाई दी। अधिकतम उपज 05 नवम्बर को बोई गयी वरूणा में 16.67 क्विंटल/हैक्टेयर और टीएम 2 फसल में 10.93 क्विंटल/हैक्टेयर हुई। आसाम के लिये उपज के आंकडों के आधार पर अक्टूबर का अंतिम सप्ताह **बुवाई का उचित समय है।**

एस के नगर में सफेद रोली रोग की उग्रता अधिकतम 23.5 प्रतिशत तक 22 अक्टूबर की बुवाई में देखी गयी जिसकी शुरूआत 12 नवम्बर की बुवाई वाली वरूणा किस्म पर 56 दिन तथा जीएम–2 बाद हुयी। चूर्णिल आसिता रोग वरुणा और जीएम–2 किस्मों पर 19 नवंबर को बोई गई फसल पर पहली बार बुवाई के 56 दिनों के बाद दिखाई दिया जो पिछले सालों 2021–22 में बुवाई के 88 दिनों के बाद, 2020–21 में बुवाई के 89 दिनों के बाद, 2019–20 में बुवाई के 79 दिनों के बाद और 2018–19 में बुवाई के 83 दिनों बाद, 2017–18 में 76 दिनों के बाद दिखाई दी। रोग की अधिकतम गंभीरता 19 नवम्बर की बुवाई पर वरुणा में 96.5 प्रतिशत और जीएम–2 में 92.0 प्रतिशत देखी गई। रोगों के कारण बीज उपज में कमी पछेती बुवाई में हुयी। यद्यपि 01 अक्टूबर को बोई गयी जीएम–2 में 20.30 क्विंटल/हैक्टेयर और वरुणा में 19.50 क्विंटल/हैक्टेयर अधिकतम बीज उपज प्राप्त हुई।

जगदलपुर में काला धब्बा रोग की शुरूआत वरूणा में 12 नवम्बर की बुवाई के 42 दिनों के बाद और सीजी सरसों में 45 दिनों के बाद पाया गया है। काला धब्बा रोग की पत्तियों पर अधिकतम तीव्रता वरूणा में 32.5 प्रतिशत बुवाई के 100 दिनों के बाद 01 अक्टूबर की बुवाई में पाया गया। चूर्णित आसिता रोग पहली बार बुवाई के 75 दिन बाद वरूणा में 19 नवम्बर की बुवाई में पाया गया है। अधिकतम उपज वरूणा में 22 अक्टूबर की बुवाई में 17.0 क्विंटल/हैक्टेयर प्राप्त हुयी।

पंतनगर में मृदुरोमिल आसिता रोग पहली बार 22 अक्टूबर को बोई गयी दोनों किस्मों वरुणा और क्रांति पर बुवाई के 11 दिन बाद दिखाई दिया। सफेद रोली रोग पहली बार 19 नवंबर की बुवाई में 46 दिनों के बाद जबकि 22 अक्टूबर की बुवाई में 50 प्रतिशत तक वृद्धि देखी गयी। काला धब्बा रोग को पहली बार बुवाई के 49 दिनों के बाद 19 नवंबर को बोई गयी क्रांति किस्म पर देखा गया। 01 अक्टूबर को बोई गयी फसल पर 81 दिनों के बाद तक रोग के लक्षण दिखाई दिये।

ढ़ोली में काला धब्बा रोग पहली बार क्रमशः बुवाई के 43 व 45 दिन के बाद वरूणा और राजेन्द्र सुफ्लाम में पाया गया। यह रोग पत्तियों पर लगातार 120 दिनों तक दोनों किस्मों में पाया गया।

झांसी में सफेद रोली रोग पहली बार बुवाई के 56 दिनों के बाद वरूणा पर 19 नवंबर को बोई गयी फसल पर और अधिकतम 50 प्रतिशत तक गिरीराज पर 05 नवबंर की बुवाई में पाया गया। काला धब्बा रोग पहली बार पत्तियों पर 19 नवबंर की बुवाई में 42 दिनों के बाद और फलियों पर 83 दिनों के बाद वरूणा में दिखाई दिया। बुदेलखण्ड क्षेत्र में अधिकतम बीज उपज प्राप्त करने के लिये बुवाई का उपयुक्त समय अक्टूबर का मध्य पखवाड़ा है। जो कि 22 अक्टूबर को बोई गयी वरूणा किस्म से 28. 60 क्विंटल/हैक्टेयर तक प्राप्त हुई।

राई–सरसों के प्रमुख रोगों के विरूद्ध कवकनाशियों की प्रभावकारिता

नये कवकनाशियों की प्रभावकारिता का परीक्षण 6 केन्द्रों (हिसार, झॉसी, मुरैना, धौली, भरतुपर और पंतनगर) पर किया गया। जाँच के लगातार तीसरे वर्ष के दौरान टेबुकोनाजोल 50 प्रतिशत + ट्राइफ्लोक्सिस्ट्रोबिन 25 प्रतिशत डब्ल्यूजी 0.1 प्रतिशत की दर से कवकनाशी के प्रयोग करने से काला धब्बा रोग की व्यापकता पत्तियों और फलियों दोनों पर न्यूनतम, जो कि बिना छिड़काव वाले परीक्षण में 31.5 प्रतिशत से कम पायी गई। हालांकि सभी कवकनाशी पत्तियों और फलियों दोनों पर काला धब्बा रोग की गंभीरता को कम करने के लिये प्रभावी पाये गये। मेटालेक्सिल 4 प्रतिशत + मैंनकोजेब 64 प्रतिशत का 0.25 प्रतिशत के घोल का प्रयोग करने से सफेद रोली को नियंत्रण की तुलना में पत्तियों पर और स्टेग हैड प्रभाव को कम करने में तीन वर्षों से लगातार प्रभावी पाया गया। टेबुकोनाजोल 50 प्रतिशत + ट्राइफ्लोक्सिस्ट्रोबिन 25 प्रतिशत डब्ल्यूजी 0.1 प्रतिशत की दर से घोल का प्रयोग करने से चूर्णित आसिता रोग की गंभीरता नियंणत्र की तुलना में कम पाया गया। दोनों कवकनाशी, प्रोपिकोनाजोल 25 ईसी 0.1 प्रतिशत और टेबुकोनाजोल 50 प्रतिशत + ट्राइफ्लोक्सिस्ट्रोबिन 25 प्रतिशत डब्ल्यूजी 0.1 प्रतिशत की दर से प्रयोग करने से तना गलन रोग में नियंत्रण की तुलना में उग्रता में कमी पायी गयी है एवं उच्चतम उपज 22.26 क्विंटल/हैक्टेयर और 21.08 क्विंटल/हैक्टेयर प्राप्त हुयी।

राई–सरसों रोगों का जैव प्रबंधन

ट्राइकोडर्मा हार्जियानम से बीज उपचार (10 ग्राम/किग्रा) के साथ 60 तथा 75 दिनों के बाद पत्तियों पर छिड़काव करने से नियंत्रण की तुलना में सफेद रोली रोग, काला धब्बा रोग, चूर्णित आसिता रोग और तना गलन रोग को कम करने में बेहतर पाया गया। सभी रोगों में कमी के कारण अधिकतम औसत उपज 1816 किलोग्राम/हेक्टेयर प्राप्त हुयी जोकि ट्राइकोडर्मा हर्जियानम से बीज उपचार के साथ पत्तियों पर 60 और 75 दिनों के बाद पत्तियों पर छिड़काव के साथ सरसों के भूसे का 2.5 टन/हैक्टेयर की दर से मिट्टी में मिश्रण (1835 किलोग्राम/हेक्टेयर) के बराबर है। हमारे परिणामों ने संकेत दिया है कि ट्राइकोडर्मा हर्जियानम से बीज उपचार (10 ग्राम/किग्रा) के साथ पत्तियों पर 60 और 75 दिनों के बाद छिड़काव से राई–सरसों रोगों का जैव–प्रबंधन के रूप में एक अच्छा विकल्प हो सकता है।

कीट विज्ञान

वर्ष 2022–23 में विभिन्न ब्रासिका प्रजातियों पर सरसों एफिड/ माहू की मध्यम से उच्च जनसंख्या का विकास देखा गया। परीक्षण की गई प्रविष्टियों में से कोई भी एफिड के लिए प्रतिरोधी नहीं पाया गया, हालांकि, स्ट्रेन प्री–2020–14, डीटीएम 341 और एकेएमएस 8141 अच्छे पाए गए।

एसके नगर में बृजराज (84.01:), जीडीएम–4 (82.3:) और राधिका (80.9:) में कीटों के कारण सबसे अधिक उपज नुकसान देखा गया, इसके बाद लुधियाना में पीबीआर 357 (33.12:), बृजराज (30.11:) और राधिका (27.20:), जबकि हिसार, आरएच 725 में कीटों के कारण 24.8: उपज का नुकसान हुआ। शिलांगनी में, पीएम 27 को 23.0: नुकसान हुआ। इसके बाद एसके नगर में राधिका में 22.9:, नई दिल्ली में बृजराज में 20.0:, ढोली और मुरैना में राधिका में 18.4:, पंतनगर और कानपुर में बृजराज में क्रमशः 8.3: और 8.0: नुकसान था।

अधिकांश केंद्रों पर सरसों एफिड की मध्यम से उच्च आबादी दूसरे से 13 वें सप्ताह में दर्ज की गई और 7 वें से 11 वें सप्ताह के दौरान चरम पर थी। लुधियाना में बंदगोभी की सुंडी की कम से मध्यम गतिविधि, समय पर और देर से बोई गई स्थितियों दोनों में दर्ज की गई थी। यह, समय पर और देर से बोए गए दोनों स्थितियों के तहत 8 वें से 12 वें सप्ताह से सक्रिय रहा। हिसार में 48 वें –1 वें सप्ताह से चित्रित बग की कम से मध्यम आबादी देखी गई, जबकि मुरैना में, यह 47 वें –51 वें मानक सप्ताह से सक्रिय रहा। 50 वें–13 वें मानक सप्ताह के दौरान लेडी बर्ड बीटल शिकारियों की गतिविधि कम से मध्यम थी। शिलांगनी में, 52 वें–3 वें सप्ताह के दौरान सलेटी सुंडी, 49 वें –12 वें सप्ताह के दौरान पिस्सू भृंग और 52 वें –13 वें सप्ताह के दौरान लेडी बर्ड बीटल शिकारियों को देखा गया।

पंख वाले एफिड् की आबादी सात केंद्रों द्वारा दर्ज की गई थी। पंख वाले एफिड् लुधियाना में 43 वें सप्ताह की शुरुआत में दिखाई दिया। यह 50 वें से 1 वें सप्ताह से अधिकांश केंद्रों पर बढ़ना शुरू हुआ और 5 वें से 11 वें सप्ताह तक अपने चरम पर पहुंच गया। 8 वें सप्ताह के दौरान एसके नगर से उच्चतम चोटी (1545.4 एफिड्स ६ ट्रैप) दर्ज की गई थी। 12 वीं सप्ताह के बाद एफिड आबादी में गिरावट की एक सामान्य प्रवृत्ति देखी गई जो 15 वीं कक्षा के सप्ताह के बाद अधिकांश केंद्रों से गायब हो गई।

पौधों की विविधता के एफिड आबादी पर प्रभाव से पता चला कि सरसों की हर 4 पंक्तियों के बाद धनिया की 4 पंक्तियों की बुवाई के परिणामस्वरूप अकेले सरसों की तुलना में एफिड की आबादी में महत्वपूर्ण कमी आई। ढोली, लुधियाना, शिलांगनी और हिसार में सरसों़धनिया की बुवाई के परिणामस्वरूप अकेले सरसों की तुलना में सरसों एफिड की आबादी काफी कम पाई गई, जबकि पंतनगर में सरसों. चने की बुवाई के लिए भी इसी तरह के परिणाम सामने आए।

एफिड के पौधों पर रस चूसने के परिणामस्वरूप मेजबान पौधे के जैव रासायनिक मापदंडों में परिवर्तन हुआ। हिसार में, विभिन्न जीनोटाइप में एफिड के रस चूसने के बाद क्रमशः पेरोक्सीडेज गतिविधि में 31.9 – 40.0: की वृद्धि दर्ज की गई थी। इसी तरह, एफिड फीडिंग के बाद मायरोसिनेज गतिविधि, ग्लूकोसाइनोलेट्स की मात्रा, ऑर्थो–डायहाइड्रॉक्सी फिनोल की मात्रा, फ्लेवोनोल्स की मात्रा में वृद्धि देखी गई। पंतनगर और लुधियाना में लगभग समान परिणाम प्राप्त किए गए थे। सामान्य तौर पर, सरसों और गोभी सरसों में एफिड फीडिंग के बाद अधिकांश रक्षा संबंधी यौगिकों का प्रेरण था।

पादप कार्यिकी

तीन प्रयोग विभिन्न कृषि–जलवायु क्षेत्रों में अजैविक तनावों के प्रभाव पर सरसों के जीनोटाइप का मूल्यांकन करने के लिए किये गएय एक प्रयोग वर्षा आधारित परिस्थितियों में पादप वृद्धि नियामको के प्रभाव का परीक्षण करने के लिए तीन स्थानों पर किया गयाय दो प्रयोगों सूखे और तापमान तनाव को कम करने के लिए रोगाणुओं की क्षमता के आकलन के लिए किये गए, जबकि एक प्रयोग रेपसीड–सरसों की पुनर्संयोजन दक्षता का मूल्यांकन करने के लिए किया गया। अंकुर मृत्यु दर $\leq 20\%$ और सूखा वजन/10 अंकुर ≥ 35 मिलीग्राम वाले जीनोटाइप को सहिष्णु माना जाता है। नियंत्रित और क्षेत्रीय परिस्थितियों में कोई भी जीनोटाइप भरतपुर, हिसार और लुधियाना केंद्रों पर चयन मानदंडों को पूरा नहीं कर पाया। हिसार केंद्र में, केवल एक जीनोटाइप DRMRCI 125 (16.7%) $\leq$20% अंकुर मृत्यु दर के साथ पाया गया तथा प्रयोगशाला स्थिति में एक जीनोटाइप को छोड़कर, सभी जीनोटाइप में सूखा वजन/10 अंकुर $\geq$35 मिलीग्राम था। लुधियाना केंद्र में, प्रयोगशाला स्थिति में सभी जीनोटाइप में सूखा वजन/10 अंकुर $\geq$35 मिलीग्राम था। तीन जीनोटाइप क्रांति, PM 25 और DRMRCI 167 में दोनों केंद्रों पर उच्चतम सूखा वजन/10 अंकुर (मिलीग्राम) पाया गया। भरतपुर और लुधियाना केंद्रों पर खेत में बोए गए परीक्षण में, 26 में से 16 जीनोटाइप $\leq$20% अंकुर मृत्यु दर के साथ देखे गए। लुधियाना केंद्र में, केवल एक यानी DRMR 20–33 (41.1 मिलीग्राम) जबकि भरतपुर में खेत की परिस्थितियों में कोई भी जीनोटाइप में शुष्क वजन/10 अंकुर $\geq$35 मिलीग्राम वाला नहीं देखा गया। 4 स्थानों पर 35 और 65 दिन के उपरांत सिंचाई रोकने से उत्पन्न नमी तनाव ने 23 जीनोटाइप के प्रदर्शन को काफी प्रभावित किया। कुल मिलाकर, DRMRCI 162, DRMRCI 163, DRMR 2020–3, DRMRSJ 276 और RGN 229 जीनोटाइप ने 2 स्थानों पर बीज उपज में $\leq$20% की कमी के साथ नमी के तनाव के प्रति सहनशीलता दिखाई। DRMR 1167, DRMR 20–33, NPJ 214, DRMRCI 162, DRMRCI 163, RGN 229 और DRMRCI 128 ने हिसार केंद्र में DSI $\leq$ 0.50 के साथ नमी के तनाव के प्रति सहनशीलता दिखाई। सरसों के 27 जीनोटाइप में से, DRMR 2019–19 और DRMR 2018–19 ने 3 स्थानों पर बीज उपज में $\leq$ 20%की कमी के साथ टर्मिनल ताप तनाव के प्रति सहनशीलता दिखाई और केवल दो जीनोटाइप यानी DRMR 2019–19 और राधिका ने

भरतपुर में; CS 56 और DRMRCI 166 ने हिसार केंद्रों पर HSI $\leq$ 0.50 दिखाया। इन जीनोटाइपों को झिल्ली स्थिरता तथा ठंडे पर्ण तापमान के साथ बीज प्रति सिलिका में कम अवसाद का सामना करना पड़ा।

भरतपुर और लुधियाना में Trehalose@10mM जबकि हिसार केंद्रों पर 2%पोटैशियम नाइट्रेट के पत्तों पर प्रयोग से मुख्य अंकुर पर सिलिका, कुल सिलिका प्रति पौधा और क्लोरोफिल स्थिरता सूचकांक में वृद्धि के साथ बीज उपज में सुधार हुआ। लुधियाना केंद्रों में नमी के तनाव के तहत माइक्रोबियल उपचार ने ऑस्मोप्रोटेक्टेंट्स के साथ–साथ कार्यिकी लक्षण को बढ़ाया। बायोफॉस और बायोफॉस$^{+}$ उपचार से कुल क्लोरोफिल, कैरोटीनॉयड और SPAD में; CRIDA MI से RWC में; CRIDA MI II से प्रोलाइन में और MKS 6 से कुल सर्करा में लुधियाना केंद्र पर अधिकतम वृद्धि दर्ज की गई। सामान्य और देर से बोई गई परिस्थितियों में माइक्रोबियल फॉर्मूलेशन और पूसा संजीवनी के साथ अध्ययन किए गए लक्षणों में तीनो किस्मों में भिन्नता मौजूद पाई गयी। सामान्य और देर से बोई गई किस्मों में माइक्रोबियल टीकाकरण से RWC और झिल्ली स्थिरता में सुधार हुआ। भरतपुर और लुधियाना केंद्रों पर सामान्य और देर से बोई गई किस्मों में माइक्रोबियल टीकाकरण के साथ क्लोरोफिल सामग्री में सुधार हुआ। हिसार और लुधियाना केंद्रों पर देर से बोई गई टीकाकृत किस्मों में चंदवा तापमान अधिक था। ढोली और लुधियाना केंद्रों में 3 किस्मों का माइक्रोबियल फॉर्मूलेशन और पूसा संजीवनी के टीका के साथ कुल सिलिका प्रति पौधा और बायोमास में वृद्धि हुई। माइक्रोबियल फॉर्मूलेशन के साथ PBR 357 और RH 725; पूसा संजीवनी के साथ PBR 357, गिरिराज और RH 725 में देर से बोई गई स्थिति में भरतपुर केंद्र और माइक्रोबियल फॉर्मूलेशन तथा पूसा संजीवनी के साथ गिरिराज सामान्य बुआई की स्थिति तथा माइक्रोबियल फॉर्मूलेशन के साथ गिरिराज देर से बुआई की स्थिति में हिसार केंद्र को छोड़कर सभी 4 स्थानों पर किस्मों में दोनों टीकाकरणों से बीज की उपज गैर–टीकाकृत नियंत्रण से अधिक हुई है।

जैव रसायन

26 आईवीटी/एवीटी जननद्रव्यों की गुणवत्ता परीक्षणों का मूल्यांकन भरतपुर, लुधियाना, हिसार, और पंतनगर में किया गया था। तेल स्थिरता सूचकांक, जो कि मुफा:पुफ़ा का अनुपात है, 0.67 (एनपीजे 253) से 1.64 (पीएम 30) (सी.वी. $\leq$ 0.25) तक थी। सभी प्रविश्टियाँ का विभिन्न वसीय अम्लों के लिए परीक्षण किया गया। पाल्मेटिक एसिडः 2.22% (प्रचलित किस्म) से लेकर 4.77 % (एलइएस–67) (सी.वी. $\leq$ 0.19) तक पाया गया। स्टैरिक एसिड : 0.85 % (प्रचलित किस्म) से लेकर 2.60(पीडीजेड 1) (सी.वी $\leq$ 0.27) तक पाया गया। ओलेइक एसिड : 11.74 % (एनपीजे 253) से 49.17 % (पीडीजेड 1) (सी.वी. $\leq$ 0.34) लिनोलेइक एसिड : 14.93 % (आरएच 0749) से 40.48 % (एलइएस–67)(सी.वी. $\leq$ 0.26) लिनोलेनिक एसिड : 7.98 % (पीडीजेड 1) से 19.11 % (आरएच 0749) (सी.वी. $\leq$ 0.27) ईकोसोनोइक एसिड : 0.34 : (डीआरएमआर क्यू 47) से 1.15 % (एनपीजे 253) (सी.वी. $\leq$ 0.32) एरुसिक् एसिड : 0.37 : (पीएम 32) से 47.82 % (एनपीजे 253) (सी.वी. $\leq$ 1.63)। ω6: ω3 अनुपात 0.80 (आरएच 0749) से 4.54 (एलइएस–67) (सी.वी.$\leq$ 0.45) तक पाया गया। एस एफ ए:मुफा:पुफ़ा अनुपात 1:06:06 से 1:21:11 के बीच पाया गया। संतृप्त और असंतृप्त का अनुपात 1:12 से 1:36 पाया गया। आईवीटी/एवीटी प्रविश्टियो का पोशकीय परीक्षण किया गया जिसमें कुल प्रोटीन : 29.43% (आरएच (ओई)–1806) से 32.95% (पीडीजेड 16) (सी.वी.$\leq$0.04)कुल एंटीऑक्सीडेंट क्षमता 14.21 (डीआरएमआर क्यू 47) से लेकर 20.87 (पीएम .30) मिलीग्राम प्रति ग्राम ए.ए.ई.(सी.वी. $\leq$ 0.11) β कैरोटीन की मात्रा 3.49% (पीडीजेड.14) से लेकर 5.44% (आरएच (ओई)–1806) (सी.वी.$\leq$ 0.14) दर्ज की गई। कुल सिनैपिक एसिड की मात्रा 1.65% (पीडीजेड.18) से लेकर 2.40% (पीएम 32) (सी.वी.$\leq$ 0.11) के बीच थी। गुणवत्ता परीक्षणों का मूल्यांकन भरतपुर, लुधियाना, हिसार, और पंतनगर में कुल ग्लूकोसिनोलेट पीएएमएस11,पीडीजेड.18, पीएएमएस 7, पीडीजेड.19 डीआरएमआरक्यू 29–20, पीडीजेड.11,डीआरएमआर सीआई क्यू 158, पीडीजेड 15 और आईजे19आर 5004 मात्रा 30 माइक्रो मोल प्रति ग्राम से कम पायी गई। यह 19ण्11 माइक्रो मोल प्रति ग्राम (पीडीजेड.16) से 73ण्45 माइक्रो मोल प्रति ग्राम (डीआरएमआरक्यू 29–20) (सी.वी.$\leq$ 0.42) पाया गया। 2.60% से कम फाइटिक एसिड केवल पीडीजेड 18,आरएच (ओई)–1708, पीडीजेड–1,एनपीजे 252, पीडीजेड–14 और प्रचलित किस्म में पायी गई। यूपीएलसी का उपयोग करके एलीफैटिक ग्लूकोसाइनोलेट्स की पहचान सिनिग्रीन, ट्रोपोलिन, ग्लूकोनापिन और कुछ अज्ञात चोटियों के रूप में की गई। एसपीएसएस संस्करण 22 सॉफ्टवेयर का उपयोग करके डेटा का सांख्यिकीय विश्लेषण किया गया है।

अग्रिम पंक्ति प्रदर्शन

वर्ष 2022–23 में तिलहनों के अग्रिम पंक्ति प्रदर्शन और अन्य संबंधित गतिविधियोंकी योजना के तहत 20 राज्यों के 172 जिलों में सिंचित एवं बारानी अवस्था में राई सरसों के 6462 अग्रिम पंक्ति प्रदर्शन, 46 अखिल भारतीय राई–सरसों समन्वित अनुसंधान परियोजना के केन्द्रों/भारतीय कृषि अनुसंधान परिषद और कृषि विश्वविद्यालय/गैर सरकारी संस्थाओं/एफ.पी.ओद्वारा आयोजित किये गये। जिसमें राजस्थान में सर्वाधिक 1651 एवं उत्तरप्रदेश, आसाम,तथा मध्य प्रदेश में क्रमशः 1178, 703, 550 अग्रिम पंक्ति प्रदर्शनो का आयोजन किया गया। इसमें 1472 राई समूह के फसलों पर तथा 4990 सरसों समूह की फसलों पर थे, जिन्हें सिंचित (4649) एवं बारानी (1813) अवस्था में लगाया गया था।

सिंचित अवस्था में राई–सरसों की अधिकतम औसत पैदावार 2,200 किलोग्राम प्रति हैक्टेयर हरियाणा में प्राप्त हुई। इसके बाद पंजाब, मध्य प्रदेश, पश्चिम बंगाल, उत्तरप्रदेश, बिहार, राजस्थान, उत्तराखण्ड, जम्मूएवंकश्मीर, आसाम, झारखण्ड, तेलंगाना,

उडीसा, महाराष्ट में क्रमश : 2,197; 2,055; 2,052; 2012; 1,999; 1,946; 1,447; 1,418; 1,201; 1,132; 1,052; 993; एवं 993 किलोग्राम प्रति हैक्टेयर औसत पैदावार दर्ज की गई। सम्पूर्ण तकनीकी प्रदर्शनों से उपज में अधिकतम बढोत्तरी 67.81] 58-8] 53-7] 27-18] 25*-3] 24-2] 18-44] 17-86] 15-97] 15-12] 15-09] 14-8] 9-73] एवं 4-76 प्रतिशत क्रमशः जम्मू एवं कश्मीर, उडीसा, आसाम, उत्तरप्रदेश, झारखण्ड, पश्चिम बंगाल, महाराष्ट्र, बिहार,मध्य प्रदेश, उत्तराखण्ड, तेलंगाना, राजस्थान, हरियाणा, तथा पंजाब में प्राप्त हुई।

अधिकतम अतिरिक्त शुद्व लाभ 25,001, 20,226, 19,570, 19,507, 14,449, 13,937, 13,893, 12,877, 12,726, 11,696, 8,888, 8,648, 8,342, 7,045, रूपये प्रति हैक्टेयर क्रमशः जम्मू एवं कश्मीर, उत्तरप्रदेश ,पश्चिम बंगाल, आसाम,राजस्थान, उडीसा,मध्य प्रदेश, हरियाणा, झारखण्ड, बिहार,तेलंगाना, उत्तराखण्ड, पंजाब, एवं महाराष्ट्र, में प्राप्त हुआ। सिंचित अवस्था में राई–सरसों की उत्पादन लागत सबसे कम 16,985 रूपये प्रति हैक्टेयर झारखण्ड, में तथा अधिकतम 39,005 रूपये प्रति हैक्टेयर हरियाणा में आई।

बारानी अवस्था में राई–सरसों की अधिकतम औसत पैदावार 1848 किलोग्राम प्रति हैक्टेयर हिमाचल प्रदेश में प्राप्त हुई। इसके बाद, जम्मू एवं कश्मीर,राजस्थान,झारखण्ड, त्रिपुरा,आसाम,उत्तराखण्ड, अरूणाचल प्रदेश, उडीसा,मणीपुर एव मेघालय में क्रमशः 1,286; 1,187; 1,152, 1,041, 947, 859, 825, 719, 684 एवं 635 किलोग्राम प्रति हैक्टेयर औसत पैदावार दर्ज की गई।अधिकतम 74. 95 प्रतिशत तक उपज में बढोत्तरी त्रिपुरा में प्राप्त हुई। उडीसा,हिमाचल प्रदेश,झारखण्ड, जम्मू एवं कश्मीर, मेघालय, आसाम,मणीपुर, राजस्थान, उत्तराखण्ड, अरूणाचल प्रदेश,में क्रमशः 59.4251.84, 48.45, 46.30, 42.37,34.32, 33.3, 20.88, 18.32 तथा 14.74 प्रतिशत तक उपज में बढोत्तरी दर्ज की गई।अधिकतम अतिरिक्त औसत शुद्व लाभ 30.959, 18,901, 17,726, 17,432 एवं 10,703, 8,671, 8,249, 7,686, 7,606, 6,010 एवं 4,238 रूपये प्रति हैक्टेयर, हिमाचल प्रदेश, त्रिपुरा, झारखण्ड,जम्मू एवं कश्मीर,आसाम, राजस्थान, मेघालय, मणीपुर, उडीसा,उत्तराखण्डएवं अरूणाचल प्रदेश में प्राप्त हुई। असिंचित अवस्था में राई–सरसों की उत्पादन लागत सबसे कम 10,309 रूपये प्रति हैक्टेयर राजस्थान में तथा अधिकतम 33,500 रूपये प्रति हैक्टेयर हिमाचल प्रदेश में आई।

सम्पूर्ण तकनीकी प्रदर्शनों में भारतीय राई की 18, पीली सरसों की 5 एवं तोरिया की 7 तथा गोभी सरसों की 2 उन्नत प्रजातियों को 14 राज्यों में सिंचित अवस्था में प्रयोग किया गया। भारतीय राई के प्रदर्शनों में उत्तरप्रदेश में सिंचित अवस्था में 99 प्रथम पंक्ति प्रदर्शनों में आर. एच.–749 प्रजाति का प्रयोग था जिससे 30.8 प्रतिशत उपज बढोत्तरी के साथ अधिकतम उपज 2,510 किलोग्राम प्रति हैक्टेयर प्राप्त हुई। इसके बाद उत्तरप्रदेश, में ही 75 प्रदर्शनों में प्रदर्शित सुरेखाप्रजाति की औसत पैदावार 2,442 किलो प्रति हैक्टेयर तथा 54.5 प्रतिशत उपज में बढोत्तरी दर्ज की गई। पंजाब में 27 प्रदर्शनों में प्रदर्शित पीएचआर–126 प्रजाति से न्यूनतम 2.1 प्रतिशत उपज बढोत्तरी दर्ज की गई जबकि न्यूनतम औसत पैदावार 663 किलोग्राम प्रति हैक्टेयर असम मे 25 प्रदर्शनों में प्रदर्शित डी. आर. एम.आर. 150–35 प्रजाति में दर्ज की गई। हालांकि जम्मू एवं कश्मीर में ब्रजराज किस्म से सिंचित अवस्था मे किसान की स्थानीय प्रजाति की तुलना में सर्वाधिक 68.5 प्रतिशत तक उपज बढोत्तरी के साथ औसत पैदावार 1,336 किलोग्राम प्रति हैक्टेयर दर्ज की गई।

सिंचित अवस्था मे उत्तरप्रदेश, मे पीली सरसों की पीताम्बरी प्रजाति, पंजाब में गोभी सरसों की पी.जी.एस.एच –1707 प्रजाति एवं आसाम में तोरिया की टी. एस.–38 प्रजाति से उपज में अधिकतम बढोत्तरी क्रमशः 27.8, 3.2 एवं 66..2 प्रतिशत तक प्राप्त हुई।

भारतीय राई के असिंचित अवस्था में जम्मू एवं कश्मीर में प्रदर्शित राधिका प्रजाति से अधिकतम औसत पैदावार 1,429 किलोग्राम प्रति हैक्टेयर के साथ 60.2 प्रतिशत तक उपज में बढोत्तरी दर्ज की गई। मणिपुर में 21 प्रदर्शनों में प्रदर्शित एन.आर.सी. एच.बी.–101 प्रजाति से न्यूनतम औसत पैदावार 749 किलोग्राम प्रति हैक्टेयर के साथ 26.7 प्रतिशत तक उपज में बढोत्तरी प्राप्त हुई। असिंचित अवस्था मे झारखण्ड, मे भारतीय राई की बी.बी.एम.–1 प्रजाति एवं राजस्थान में तारामीरा की आर. टी. एम. 1624 प्रजाति से उपज में अधिकतम बढोत्तरी क्रमशः 70.8 एवं 22.2 प्रतिशत तक प्राप्त हुई।

असिंचित अवस्था मे त्रिपुरा में तोरिया की टी. एस.–38एवंहिमाचल प्रदेश में गोभी सरसों की जी. एस. सी.–7 प्रजाति एवं और जम्मू एवं कश्मीर में भूरी सरसों की शालीमार सरसों–2 प्रजाति से उपज में बढोत्तरी क्रमशः 75.0एवं 53.3और 17.8प्रतिशत तक प्राप्त हुई।

विभिन्न केन्द्रो ने भारतीय राई के 13 तकनीकी अवयवों पर कुल 481 तकनीकी अग्रिम पंक्ति प्रदर्शनों का आयोजन किया। सभी अवयवों में से, हिसार केन्द्र द्वारा प्रदर्शित सभी घटकों में प्रजाति एवं स्क्लेरोटिनिया रोट प्रबंधन द्वारा` अधिकतम औसत उपज 2,678 किलोग्राम प्रति हैक्टेयर प्राप्त हुई । हालांकि भूवनेश्वर केन्द्र द्वारा प्रदर्शित समय से बुबाईएवं पौधों की सुरक्षा तथादेर से बुबाईएवं पौधों की सुरक्षाऔर बोरोन घटक एवं देर से बुबाईएवंपौधों की सुरक्षाके साथ 59.5, 58.9,एवं 58.0 प्रतिशत की अधिकतम उपज वृद्धि दर्ज की गई ।इसके बाद बानसूर द्वारा प्रदर्शित प्रजाति एवं स्क्लेरोटिनिया रोट प्रबंधन और प्रजाति + सूक्ष्म पोषक (सल्फर 90 प्रतिशत+ जिंक सल्फेट + बोराक्स)द्वारा 24.7 प्रतिशत तथा 22.0 प्रतिशतउपज में वृद्धि दर्ज की गई और अधिकतम अतिरिक्त शुद्ध लाभ 20,772 तथा 16,612 प्रति हैक्टेयर अर्जित की गई।बावल केन्द्र द्वारा प्रदर्शित निराई और थिनिंग अवयवों ने बिना निराई और थिनिंग से क्रमशः 23.1 और 14.3 प्रतिशत उपज वृद्धि दर्ज की।

Summary

Summary

Seasonal Conditions

Weather was favourable for the mustard crop during the crop season 2022-23. Good rains were received during monsoon in the month of September at all the centres. The extremely low temperature, (-) 0.1^0C was reported at Bajaura centre in the month of December, 2022. Incidence of diseases and pest was very low resulting high production of the crop.

Genetics and Plant Breeding

Varietal Improvement

Sixteen centres, spread over 14 states, carried the varietal development activities as per the approved technical programme. The salient achievements during the year 2022-23 in toria (*Brassica rapa* var toria), yellow sarson (*B. rapa* var yellow sarson), gobhi sarson (*B. napus*), Indian mustard (*B. juncea*), karan rai (*B. carinata*) and taramira (*Eruca sativa*) are discussed below:

Genetic Resource Management

A total of 8229 accessions comprising toria (751), Indian mustard (6052), yellow sarson (408), gobhi sarson (258), brown sarson (30), karan rai (272), taramira (39), *B. caudatus* (04), *B. nigra* (11), *B. tournifortii* (05), *Crambe abyssinica* (07) *S. Alba* (09), Crambe sp (01), *B chinenesis (01)*, *B. fruticulosa* (07), *Camelina sativa* (02), *Capsella bursapastoris* (02), *Diplotaxis assurgens* (02), *Diplotaxis tenuisilique, Erucastrum spp* (02) and *Lepidium sp* (02) were maintained through appropriate mating system at Bhubneshawar, Dholi, Hisar, Pantnagar, Ludhiana, Kanpur, Hisar, IARI, New Delhi, Jobner, Morena, Pantnagar, Chatha-Jammu, Jagdalpur and SK Nagar (Table 2.1.1). In addition, 453 new accessions comprising toria (95), Indian mustard (231), yellow Sarson (79), gobhi sarson (07), Brown Sarson (08), Taramira (22) and karan rai (09) were collected. Further, 1783 accessions consisting of 1299 Indian mustard, 162 toria, 123 yellow sarson, 37 gobhi sarson, 35 brown sarson, 97 taramira and 23 *B. rugosa* accessions were evaluated. On the basis of germplasm evaluation, promising accessions were identified for seed yield, earliness, yield components, thermo-tolerant (early and terminal stages), resistance & tolerance to diseases & pests and quality traits in toria at Dholi, Chatha-Jammu, Jagdalpur and Pantnagar.

Creation of genetic variability through hybridization/ mutagenesis and selection

Creation of variability is the essence and backbone of the breeding programme. To cater the need of diverse agro-climatic conditions of the country, 435 crosses were attempted in toria, 138 in yellow sarson at Pantnagar, Bhubneshwar, Chatha-Jammu, Kalyani, and Morena and 775 in Indian mustard at Bhubneshwar, Chatha-Jammu, Sriganganagar, Hisar, IARI New Delhi, Ludhiana, Kanpur, Pantnagar,Morena,Jhansi Varanasi and SK Nagar to improve seed yield, earliness, seed size, component traits, disease/pest resistance, heat tolerance suitable for late sown condition, drought tolerance, “0” and “00” quality characters and high oil content (Table 2.1.2). Selection of superior plants/bulks at different centres was practised in toria, yellow sarson and Indian mustard. In toria, development of composites population after the selection was the main objective. In yellow sarson, hybridization and selection from segregating generations were attempted at Kanpur, Bhubneshwar and Pantnagar. In Indian mustard, 5873 single plants were selected at New Delhi, Hisar, Jhansi, Kanpur, Bhubneshwar, Chatha-Jammu, Pantnagar, Ludhiana, SK Nagar, Jagdalpur, Kota, Varanasi Dholi, Imphal, Nagpur, Kangra and Morena. In Indian mustard, about 118 bulks were selected from segregating and advanced generations.

Evaluation of advanced breeding lines

The advanced breeding lines were evaluated under different station/state /preliminary yield trials at various centres have been presented in Table 2.1.3. 116 strains of toria were tested at Kanpur, Bhubneshwar, Chatha-Jammu, Jagdalpur and Pantnagar. The yield superiority in toria station trial was up to 30.04 % over the check (PT-303) at Pantnagar. In yellow sarson, 55 strains were tested at Kanpur and Pantnagar. The yield superiority in station trial II up to 24.77 % over the check YSH-401 was recorded at Pantnagar. In Indian mustard, 1270 strains were evaluated at 10 centres; Chatha, Imphal, Hisar, Kanpur, Ludhiana, Pantnagar, Dholi, SK Nagar, Bhubneshwar and Varanasi in 37 trials. Seed yield superiority up to 35.15 % over the check Kranti was recorded at Pantnagar. Ten strains at Hisar, 237 strains at Ludhiana and 08 strains at Chatha of gobhi sarson were evaluated for seed yield and its component characters.

Hybrid development

Efforts for hybrid development continued during 2022-23 under “Consortia Research Platform on Hybrids”, at four centres including ICAR-DRMR Bharatpur, ICAR-IARI New Delhi, PAU Ludhiana and CCS HAU Hisar. Twenty experimental hybrids of Indian mustard, comprising five from each of four centers were evaluated in replicated block design at all four centers. On the basis of mean seed yield over four locations (Bharatpur, New Delhi, Ludhiana and Hisar), two hybrids; DRMRHJ 410 (3101 kg/ha) and RHH 2205 (2950 kg/ha) out yielded the best check DMH-1(2946 kg/ha) by a margin of 5.26 and 0.13% respectively. Fourty experimental hybrids were evaluated in augmented block design (CRPMLT 2). Five experimental hybrids; DRMRHJ 417 (2916 kg/ha); RHH 2214 (2883 kg/ha), RHH 2212 (2831 kg/ha), RHH 2213 (2818 kg/ha) and PHR 8207 (2763 kg/ha) out yielded the best check DMH 1 (2744 kg/ha) by a margin of 6.26, 5.05, 3.17, 2.71 and 1.0 %, respectively on the basis of average seed yield. On the basis of oil yield over three locations (Bharatpur, New Delhi and Ludhiana) one hybrid DRMRHJ 417 (1227 kg/ha) out yielded the best check DMH-(1114 kg/ha) by a margin of 10.7%. 30 F_1 crosses were evaluated in augmented block design at all four centers. Three crosses exhibited > 10% seed yield heterosis over the best check DMH 1 (2698 kg/ha) on the basis of average seed yield over four locations. On the basis of oil yield over three locations (Bharatpur, New Delhi and Ludhiana) three F_1 crosses; DRMRH 22-10 (1321 kg/ha), DRMRH 22-2 (1308 kg/ha) and DRMRH 22-6 (1260 kg/ha) also out yielded the best check DMH -1 (1093 kg/ha) by a margin of 20.9, 19.7 and 15.2 % respectively. 589 experimental hybrids including 40, 195, 105 and 249 at DRMR, CCSHAU, IARI, and PAU, respectively were evaluated at respective center. Each center identified promising hybrids at their location. 888 F_1 crosses including 144 at ICAR-DRMR, 375 at ICAR-IARI, 167 at PAU and 194 at HAU were evaluated. Superior crosses were identified at each center. A total of CMS and restorer are being converted to 489 and 160 nuclear backgrounds, respectively, through back-crossing. In addition 86 CMS and 172 restorer lines were maintained. Seed of 105 experimental hybrids and 1051 F_1 crosses was produced for evaluation during next year. Efforts are underway to improve parental lines for white rust resistance, quality traits and for agronomic traits. A set of 60 shared inbred lines, comprising of CMS, maintainer and restorer, 15 from each all collaborative center was maintained. A set of seventy two inbred lines was grouped into two diverse subpopulations on the basis of genetic diversity assessed through SSR markers.

Breeder seed production

Indents of 106.09q breeder seed of 82 Rapeseed-Mustard varieties were received from Department of Agriculture and Cooperation (DAC), Ministry of Agriculture and Farmers Welfare, Govt. of India for production during 2022-23. The allocation was made to 24 centers for the production of 106.09q of 84 Rapeseed-Mustard varieties during 29th Annual Group Meeting was held at SKNAU, RARI Durgapura, Jaipur (Rajasthan). Against the indent of 106.09q, 290.84q Breeder Seed was produced, indicating a surplus availability of 184.75q. Breeder seed of 02 varieties Pusa Saag-1 (MR 704) and PBR- 378 of Indian mustard could

not be produced. Further, less quantity of RVM-1 of Indian mustard; Benoy (B 9) of yellow sarson; Gluechin of brown sarson; RSPT-06 & T-9 of toria was produced. In addition, 35.40q breeder seed of 24 varieties was also produced by different centers. The center and variety wise details of breeder seed production are presented in Table 2.2.

Coordinated Trials

Performance of 180 strains including 06 of toria, 11 of yellow sarson, 162 of Indian mustard and 01 of gobhi sarson was tested in nineteen performance evaluation trials consisting of toria (1) yellow sarson (1), gobhi sarson (1) and Indian mustard (16) at 49 locations across the 6 agro-climatic zones of the country. On the basis of superiority for seed/oil yield/ earliness/quality/ resistance over the best check 24 strains including yellow sarson (01), gobhi sarson (01) and Indian mustard (22) were promoted for advanced stage evaluation.

Rapeseed-Mustard strains promoted for advance stage testing on the basis of higher seed/oil yield/quality/ disease resistance (2022-23)

Zone I	Zone II	Zone III	Zone IV	Zone V
Yellow Sarson, IVT				
				PYS 2018-1 (1077, 11.6)
Early Mustard, IVT, Irrigated				
				KMR(E) 22-2 (1727, 9.9)
Mustard, Timely Sown, Irrigated, IVT				
	NPJ 262 (2861, 17.5) NPJ 261 (2894, 18.9) PBR 813-2 (2766, 13.6) RGN 528** (2614,11.9)	RGN 528 (2541, 10.1)		
Mustard, AVT- I+II Timely Sown (Irrigated/ Quality/ WRR)				
	DRMRCI(Q) 47*** (2294, 2.3) NPJ 253 (2600, 10.3)	NPJ 253 (2696, 10.8) DRMR 2018-25 (2723, 12.0)		
Mustard, AVT-I Timely Sown (Irrigated)				
			NPJ 252** (2284, 11.2)	
Mustard, Timely Sown, Rainfed, IVT				
				RB 113 (1404, 10.8)
Mustard, Late Sown (Irrigated) AVT-I+II				
		DRMRHJ 430 (2062, 11.6)		
Mustard, Initial Hybrid Trial (IHT)				
	JKJH 11(3236, 5.5) SVJH 73 (3286, 7.0) Q90007 (3259, 6.3)		JKJH 11 (2397, 9.0) SVJH 73 (2386, 8.5) SKMH-1901 (2404, 9.3)	
Mustard, Initial Hybrid Trial (AHT-I)				
	RHH 2101 (2934, 10.7) SVJH 71 (3064, 15.6) IJ 16R1168 (2808, 5.9)		18J408C (2381, 12.2)	
Mustard, Quality IVT				
	RH(OE) 1708# (2796, 13.3)	DRMRCI(Q) 172** (2478, 9.8)		

	DRMRCI(Q) 172#*** (2654, 7.6) DRMRCI(Q) 158@** (2624, 9.7)	DRMRCI(Q) 158@** (2499, 15.3)		
Gobhi Sarson AVT-I				
GSH 2155** (2341, 10.6)				

Figures in parenthesis indicate seed yield/ oil yield** (kg/ha), percent superiority over best check
** promoted on the basis of oil yield
*** promoted on the basis of white rust resistance
# Single low strain @double low strain

Crop Production

Experiments on six major areas of agronomic aspects were conducted during 2022-23 across the five zones. The results are summarised as;

3.1 Long-term fertility experiment on cropping systems involving rapeseed-mustard

Application of 150% NPK increased seed yield at Kangra (25%), LDH (5%), HSR (34%) and BPR (6%) compared to 100% NPK. Whereas, application of 100% NPK+FYM @ 2.5 t/ha recorded highest seed yield at PNT and KOT which was higher by 13 & 101% over the 100% NPK, respectively during 2022-23.

3.2 Evaluation of herbicides for weed management in rapeseed-mustard

Pre emergence application of pendimethalin 1.0 kg a.i./ha recorded significantly higher seed yield at LDH, PNT, SKN, RNT and IMP by 26, 61, 18, 49 and 36% over the weedy check, respectively. Whereas at HSR, post emergence application of fluazifop-p-butyl 0.125 kg a.i./ha at 25-30 DAS found effective and increased seed yield by 24% over the weedy check. The weed control efficiency (WCE) was maximum with the pendimethalin 1.0 kg a.i./ha at LDH, PNT, SKN, RNT and IMP. Whereas, at HSR the maximum WCE was with PoE of fluazifop-p-butyl 0.125 kg a.i./ha at 25-30 DAS

3.3 Agronomic evaluation of promising rapeseed-mustard entries

Timely sown (irrigated) mustard: Entry RH 1975 recorded the maximum seed yield at Bawal, Hisar and Sriganganaga. Entry RH 1975 and showed higher seed yield by 17, 1 & 3% at Bawal, 27, 38 & 28% at Hisar, 1, -10 & 4% at Ludhiana, 13, 47 & 15% at Sriganganagar, 21, -4 & 6% at New Delhi over the checks RH 749, Kranti and DRMRIJ 31, respectively.

Quality mustard: Entry PDZ 15 recorded higher seed yield by 7% over PDZ 1 at Jhansi; 36, 8, 21 & 13% over PM 30, RGN 73, Kranti& PDZ 1 at Kanpur; 5 & 8% over PM 30 & PDZ 1 at Kota; 5% over PDZ 1 at Morena; and 8% over PDZ 1 at Pantnagar, respectively. Entry PDZ 14 recorded higher seed yield by 2, 15 & 7% over PM 30, Kranti& PDZ 1 at Jhansi; 11% over PM 30 at Kanpur; 5 & 7% over PM 30 & PDZ 1 at Kota; and 4 & 9% over RGN 73 & PDZ 1 at Morea, respectively.

Late sown mustard: Entry DRMR 2018-19 recorded the maximum seed yield at Jhansi, Kota and Varanasi. DRMR 2018-19 recorded higher seed yield by 15, 5 & 2% at Jhansi, 46, 16 & 41% at Kota, and 37, 30 & 26% at Varanasi over the checks CS 56, Kranti and NRCHB 101, respectively.

3.4 Enhancing drought and heat tolerance in rapeseed-mustard through microbes

Seed inoculation recorded maximum yield with CRIDA MI-II at Chatha (26%), Dholi (29%), Morena (63%), Jobner (25%) and Imphal(50%); CRIDA MI-I at Sriganganagar (27%) and Varanasi (58%); Biophos and Biophos^{+} atBawal(12%) and Banda (12%); and MRD 17 at Jhansi (4%) and Nagpur (52%)over no inoculation during 2022-23.

3.5 Response of macro and micro nutrient bio-fertilizers in enhancing rapeseed-mustard productivity and soil health

Seed inoculation increased seed yield with **NPK consortia+ZSB** at Chatha (20%), Pantnagar (41%), Dholi (21%), Kota (17%), Varanasi (40%), Kanke (8%), Bawal (14%), Bharatpur (21%) and Sriganganagar (21%); *Azotobacter* at Kangra (32%), Morena (27%), Ranital (23%); and PSMO at Imphal (58%) over the no seed inoculation.

3.6 Optimization of mineral nutrient management for higher productivity

Application of 20 kg S+2.5 kg Zn+0.5 kg B/ha enriched with 500 kg FYM/ha significantly increased seed yield at Chatha (18%), Ranital (6%), Imphal (26%), Kanpur (6%), Pantnagar (4%), Sriganganagar (16%) and Dholi (12%) over the recommended dose (40 kg S+5 kg Zn+1 kg B/ha). Whereas, application of 40 kg S+5 kg Zn+1 kg B/ha enriched with 500 kg FYM/ha recorded markedly higher seed yield at Jhansi (6%), Kangra(9%), Morena(19%), Nagpur (7%), SK Nagar (16%), Kanke (2%) and Kota (1%) over recommended dose (40 kg S+5 kg Zn+1 kg B/ha). At Jobner, application of 40 kg S+5 kg Zn+1 kg B/ha recorded significantly higher seed yield over the half of recommended dose (20 kg S+2.5 kg Zn+ 0.5 kg B/ha).

Plant Pathology

Disease Scenario

During 2022-23 crop season, moderate to severe incidence of white rust, and Alternaria blight diseases was recorded at all locations. Low to the moderate occurrence of downy mildew was recorded at cotyledonary stage from MOR and PNT. Occurrence of Powdery mildew noticed moderate to severe at SKN, PNT, JAG, JHS and MOR. Where as, moderate to severe incidence of Sclerotinia rot was observed at BPR. Different trials were sown on dates as per technical program at different locations.

Screening of *Brassica* breeding material

Among 57 AVT-I and AVT-II entries, DRMR 2018-19, DRMRIJ 20-157, IJ 19R5004, PDZ 14, DRMR 2018-37, DRMRCI (Q) 47, PDZ 15, PDZ 16, DRMR 2018-25 (*Bj*) were found resistant to WR at all five locations and resistant to DM at MOR and PNT, both under natural and artificial conditions.

Uniform Disease Nursery for major diseases

Among 44 entries, DRMRDR 2135 (2 years), DRMRSJ 14, DRMRCI 169, DRMRSJ 9, DRMR 2018-26, DRMR 2020-15, DRMRDR 2133, PAB 2017-25, DRMRCI (Q) 57, DRMRCI 153, DRMRCI 170, DRMRSJ 12, PAB 2017-22, DRMRCI 171, and DRMR 2019-15 of *B. juncea* showed resistance reaction to WR under natural conditions.

National Disease Nursery (NDN) for Alternaria blight

DRMR 2018-19, (3 years), DRMRIJWR 20-11, and DRMRSJ 349 were immune to WR. PAB 2014-8 (2 years), DRMRIJWR 20-16, RH 1700-3, PAB 2014-7, PAB 2014-15 and DRMR-PMJ-17 of *B. juncea* showed WR resistant reaction.

National Disease Nursery (NDN) for white rust

Among 85 entries, DRMR 2018-41 (5 years), RH 1700, RH 1700-1 (4 years), RH 1700-4, DRMRCI 131, DRMRCI 132, DRMRM 18-35-11, DRMRM 18-36-12, DRMRM 18-37-13, DRMR 2018-19 (3 years), DRMRCI 139, DRMRDR 2141, DRMRSJ 349, DRMRSJ 206, DRMR 2018-1, PDZ 16, DRMRDR 2195, (2 years) of *B. juncea* showed immune reaction to WR at four locations under artificial conditions. While, some of the promising strains DRMRDR 2151, DRMRDR 2155, DRMRDR 2196, DRMRIJWR-20-12, DRMRIJWR-20-13, DRMRIJWR-20-14,DRMRIJWR-20-15,DRMRIJWR-20-17,DRMRIJWR-20-18, DRMRIJWR-20-19,DRMRIJWR-20-20,DRMRIJWR-20-21,DRMRIJWR-20-23,DRMRIJWR-20-24, DRMRIJWR-20-26,DRMRIJ-1-44,DRMRIJ-12-37,DRMRDR 2235,DRMRM 163,PMAS A

2010,PAB 14-18,DRMRDR 2135,DRMRDR 2143, PAB 14-8,PAB 14-7, JC 36,DRMRIJ 20-11 were found resistant to WR.

National Disease Nursery (NDN) for Sclerotinia rot

Among 12 entries of *B. juncea,* none were found tolerant to SR. Although, the disease incidence was lowest in DRMRIS 20-1 (46.9%) with lowest lesion size 14.7 cm compared to maximum incidence and lesion length in checks NRCHB 101 (63.5%; 23.6 cm) and NRCYS-05-2 (72.6%; 27.6 cm).

Screening of IVT entries of Brassica against different diseases

Among 146 IVT entries, DRMRCI-160, RHH 2202, Q 90007, DRMRCI (Q) 172, PMAS 11, PDZ 18, PDZ 19 of *B. juncea* were resistant to WR in comparison to susceptible checks Rohini and NRCHB 101 at SKN and HSR.

Assessment of yield loss and management of Alternaria blight in rice-fellow-mustard cropping system

Among 8 different treatments, foliar spray of tebuconazole 50% + trifloxistrobin 25% WG @ 0.5g/l gave maximum reduction of AB disease over check followed by iprodion 50WP @ 0.2%. Seed treatment alonwith foliar spray of garlic bulb extract @ 1% w/v, and *T. harziamum* also found efective in reducing the AB severity over check.

Based on three years data it is concluded that foliar spray of Tebuconazole 50%+ trifloxistrobin 25% WG @ 0.5g/l at 40 and 70 days after sowing may be beneficial for the management of AB of under rice-fellow-mustard cropping system at SHL, JAG, VAR and DOL. The average yield losses caused by AB disease was recoded upto 49.8 per cent in mustard.

Epidemiology of Alternaria blight, white rust, powdery and downy mildew

Experiment on the epidemiological studies of rapeseed-mustard diseases was laid out at HSR, PNT, SHL, SKN, JAG, DOL, JHS and MOR using cv. Varuna and local cultivar with 8 sowing dates at weekly interval starting from Oct 01 to Nov 19 without adopting any protection measures against pest and diseases. First appearance of the disease followed by progress of disease severity was recorded twice a week in each plot.

HSR: WR appeared first at 38 DAS on Nov 19 sown RH 30 which was further spread upto 118 DAS on Nov 5 sown crop. Staghead formation was observed first at 83 DAS on both Varuna and RH 30 on Nov 19 sown crop. AB first appeared 86 DAS on Nov 19 sown RH 30. SR disease initiation was observed 68 DAS in Nov 19 sown RH 30 and 69 DAS on Nov 19 sown Varuna. Maximum SR incidence was 22.1% on Oct 29 sown RH 30, and 44.8% in Varuna sown on Nov 05. The maximum yield was obtained in Oct 15 sown Varuna (2612 kg/ha) and RH 30 (2501 kg/ha).

SHL: ABL was first observed 34 DAS, while on silique first appeared at 83 DAS on Nov 19 sown cv TM 2. Maximum AB severity was at 38.9% (110 DAS) on Nov 19 sown cv TM 2. Maximum yield was recorded in Nov 05 sown cv Varuna (1667 kg/ha) and 1093 kg/ha of TM 2 sown on Nov 5. Yield data revealed that the best sowing time of crop in Assam could be last week of October.

SKN: Powdery mildew disease first appeared at 56 DAS instead of 88 DAS, 89 DAS, 79 DAS, 83 DAS, 76 DAS during 2021-22, 2020-21, 2019-20, 2018-19, 2017-18, respectively on Nov 19 sown both Varuna and cv GM 2. The maximum disease severity was observed in Nov 19 sown cv Varuna (96.5%) and GM 2 (92.0%). The maximum seed yield reduction was observed in late sown crop. The highest yield was observed in Oct 01 sown GM 2 (2030 kg/ha) and Varuna (1950 kg/ha). WR was observed first 57 DAS on Varuna and 56 DAS on GM 2 on Nov 19 sown crop which was maximum (23.5%) on Oct 22 sown crop.

JAG: Initiation of AB was reported at 42 DAS on Nov 12 sown Varuna and 45 DAS on CG Sarson. Highest ABL severity was 32.5% at 100 DAS in Oct 01 sown Varuna. PM was

appeared first at 75 DAS on Nov 19 sown Varuna. Maximum yield (1700 kg/ha) was recorded in Oct 22 sown Varuna.

PNT: Downy mildew disease first appeared 11 DAS on Oct 22 sown Varuna and Kranti cultivars. WR disease first appeared 46 DAS on Nov 19 sown crop which was increased upto 50% on Oct 22 sown crop. AB disease was first observed at 49 DAS on Nov 19 sown Kranti. On Oct 01 sown crop, the disease appeared late i.e. 81 DAS.

DOL: AB was first observed at 43 DAS and 45 DAS on Varuna and Rajendra Suflam, respectively. The disease continued to progress on leaves up to 120 DAS on both cultivars.

JHS: WR appeared first at 56 DAS on Nov 19 sown Varuna and was highest 50% observed on Nov 05 sown Giriraj. AB appeared first on leaves at 42 DAS on Nov 19 sown Varuna and seen on pods at 83 DAS on Nov 19 sown Varuna. AB appeared first on leaves at 42 DAS and seen on siliquae at 83 DAS on Nov 19 sown Varuna. PM initiated at 80 DAS on Nov 19 sown Varuna. Optimum time of sowing in the Bundelkhand region for obtaining higher seed yield is the mid of October, which was obtained 2860 kg/ha in Oct 22 sown Varuna.

Efficacy of fungicides against major rapeseed-mustard diseases

The experiment was conducted at HSR, JHS, MOR, DOL, BPR and PNT. Results revealed that AB severity was minimum in Tebuconazole 50% + Trifloxostrobin 25% WG@0.1% over control (32.3%) for third year. All tested fungicides effectively reduced the AB severity over control both on leaves and pods. Metalaxyl 4% + Mancozeb 64% @ 0.25% was found effective to minimize both WR severity on leaf and staghead incidence in comparison to check for third year. PM severity was observed minimum in Tebuconazole 50% + Trifloxostrobin 25% WG@ 0.1% over control. Both Propiconazole 25% EC @0.1% and Tebuconazole 50% + Trifloxostrobin 25% WG@0.1% was found effective in reducing the incidence of SR as compared to control. Seed yield 2226 kg/ha and 2108 kg/ha was obtained highest in Propiconazole 25% EC @0.1% and Tebuconazole 50% + Trifloxostrobin 25%, respectively. Based on three years results, it is concluded that the foliar spray of Tebuconazole 50% + Trifloxostrobin 25% at 40 and 70 DAS could be effective in managing rapeseed-mustard diseases.

Bio-management of rapeseed-mustard diseases

Seed treatment (10g/kg) + foliar spray with *Trichoderma harzianum* at 60 and 75 DAS was found superior over check in per cent reduction of WR, ABL, PM and SR. Maximum average yield was 1816 kg/ha in seed treatment (10g/kg) + foliar spray with *T. harzianum* at 60 and 75 DAS at par to soil incorporation of *T. harzianum* with mustard straw @ 2.5t/ h (1835 kg/ha). Results indicate that seed treatment (10g/kg) + foliar spray with *T. harzianum* at 60 and 75 DAS may be the best option for bio-management of rapeseed-mustard diseases.

Entomology

The crop season 2022-23 witnessed moderate to high population development of mustard aphid on different Brassica species. None of the entries tested was found to be resistant to mustard aphid, however, strain PRE-2020-14, DTM 341 and AKMS 8141 were found promising.

The highest yield losses were observed in Brijraj (84.01%), GDM-4 (82.3%) and Radhika (80.9%) at SK Nagar followed by PBR 357 (33.12%), Brijraj (30.11%) and Radhika (27.20%) at Ludhiana while at Hisar RH 725 suffered 24.8% yield loss due to insect-pests. At Shillongani, PM 27 suffered 23.0% loss. It was followed by 22.9% in Radhika at SKN, 20.0% in Brijraj at NDH, 18.4% in Radhika at Dholi and Morena, respectively, 8.3% and 8.0% in Brijraj at Pantnagar and Kanpur, respectively.

Moderate to high population of mustard aphid was reported at most of the centres from 2nd to 13th standard week with peak during 7th to 11th standard week. Low to moderate

activity of cabbage caterpillar was recorded both under timely and late sown conditions at LDH. It remained active from 8th-12th standard week under both timely and late sown conditions. Low to moderate population of painted bug was observed from 48th-1st standard week at HSR, while at MOR, it remained active from 47th-51st standard week. The activity of coccenellid predators was low to moderate during 50th-13th standard week. At SHL, sawfly observed during 52nd-3rd std. week, flea beetle 49th-12th std. week and coccinellid predators during 52nd-13th std. week.

The alate aphid population was recorded by seven centres. Alate aphid appeared as early as 43rd week at LDH. It started increasing at most of the centres from 50th-1st std. week and reached its peak from 5th-11th std week. The highest peak (1545.4 aphids/ trap) was recorded from SKN during 8th std. week. After 12th std. week a general trend of decline in aphid population was observed which disappeared from most of centres after 15th standard week.

Effect of plant diversity on aphid population revealed that sowing of 4 rows of coriander after every 4 rows of mustard resulted in significant reduction in mustard aphid population than mustard alone. At DHO, LDH, SHL and HSR sowing of mustard+coriander resulted in significantly low population build up of mustard aphid than mustard alone while the similar results were reported for mustard+chickpea sowing at PTN.

Aphid herbivory resulted in changes in biochemical parameters of host plant. At HSR, 31.9 – 40.0% increase in peroxidase activity was recorded after aphid feeding in different genotypes, respectively. Similarly, increase in myrosinase activity, glucosinolates content, ortho-dihydroxy phenols content flavonols content was observed after aphid feeding. Almost similar results were obtained at PTN and LDH. In general, there was an induction of most of the defense related compounds after aphid feeding in *B. juncea* and *B. napus.*

Plant Physiology

Three experiments were conducted to evaluate mustard genotypes from different agro-climatic zones to abiotic stresses; one experiment was at three locations to test the efficacy of PGR's under rainfed conditions; two experiments assessed the potentials of microbes to mitigate drought and temperature stress while one experiment evaluated the remobilization efficiency of rapseed-mustard lines. Seedling mortality ≤20% and DW/10 seedlings ≥ 35 mg rated genotypes tolerant. None of the genotype met the selection criteria at Bharatpur, Hisar and Ludhiana centres under controlled and field conditions. At Hisar centre, only one genotype i.e. DRMRCI 125 (16.7%) found with ≤20% seedling mortality and except for one genotype, all the genotypes had ≥35 mg dry weight/10 seedlings under laboratory conditions. At Ludhiana centre, all the genotypes had ≥35 mg dry weight/10 seedlings under laboratory conditions. Three genotypes Kranti, PM 25 and DRMRCI 167 gave the highest DW/10 seedlings (mg) at both centres. In the field sown trial, at Bharatpur and Ludhiana centres, out of 26, sixteen genotypes were observed with ≤20% seedling mortality. At Ludhiana centre, only one i.e. DRMR 20-33 (41.1 mg) whereas at Bhartpur none of the genotypes was observed having ≥35 mg dry weight/10 seedlings under field conditions. Moisture stress imposed by withholding irrigations at 35 and 65 DAS significantly affected the performance of twenty-three genotypes tested at 4 locations. Overall, DRMRCI 162, DRMRCI 163, DRMR 2020-3, DRMRSJ 276 and RGN 229 genotypes showed tolerance to moisture stress with seed yield reduction ≤20% at 2 locations. DRMR 1167, DRMR 20-33, NPJ 214, DRMRCI 162, DRMRCI 163, RGN 229 and DRMRCI 128 showed tolerance to moisture stress with DSI≤0.50 at Hisar centre. Out of twenty-seven mustard genotypes, DRMR 2019-19 and DRMR 2018-19 showed tolerance to terminal heat stress with seed yield reduction ≤20% at 3 locations and only two genotypes i.e. DRMR 2019-19 and Radhika shows HSI ≤0.50 at Bharatpur and CS56 and DRMRCI 166 at Hisar centres. These genotypes suffered lesser depression in membrane stability, seeds per siliqua with cooler canopies.

Foliar application of Trehalose @10mM at Bharatpur and Ludhiana while potassium nitrate @2% at Hisar centres improved the seed yield with increased siliquae on main shoot, total siliquae per plant and chlorophyll stability index. Physiological traits and osmoprotectants enhanced with the microbial treatments under moisture stress at Ludhiana centres. The maximum increase in total Chlorophyll, carotenoids and SPAD with Biophos and Biophos^{+} treatment; RWC with CRIDA MI; proline with CRIDA MI II and total sugar was recorded with MKS 6 at Ludhiana centre. Variation existed in the three varieties for the studied traits with microbial formulation and Pusa Sanjeevni under normal and late-sown conditions. The RWC and membrane stability improved with both microbial inoculations in normal and late-sown varieties. Chlorophyll content improved with both microbial inoculations in normal and late-sown varieties at Bharatpur and Ludhiana centres. CT was higher in late-sown inoculated varieties at Hisar and Ludhiana centres. Total siliquae per plant and biomass increased with microbial formulation and Pusa Sanjeevni inoculated 3 varieties at Dholi and Ludhiana centres. Seed yield improved with both the inoculations under normal and late sown varieties at all 4 locations except for PBR 357 and RH725 inoculated with microbial formulation; PBR 357, Giriraj and RH725 with pusa sanjeevani under the late sown condition at Bharatpur centre and for Giriraj inoculated with microbial formulation; Giriraj with pusa sanjeevani under the normal sown condition as well as for Giriraj inoculated with microbial formulation under the late sown condition at Hisar centre over non-inoculated control.

Biochemistry

IVT/AVT quality trials were evaluated at Bharatpur, Pantnagar, Hisar and Ludhiana. Among the 26 genotypes analyzed, Oil stability index which is the ratio of MUFA: PUFA, it ranged from 0.67 in NPJ 253 to 1.64 in PM-30 (CV ≤ 0.25). Entries were also analyzed for fatty acid profile and it has **Palmitic acid** ranged from 2.22% (Released Variety) to 4.77 % (LES 67). (CV ≤ 0.19).**Stearic acid**: 0.85% (Released Variety) to 2.60% (PDZ 1) (CV ≤ 0.27).**Oleic acid**ranged11.74 % (NPJ 253) to 49.17 % (PDZ 1). (CV ≤ 0.34).However one genotype i.e. PDZ 1 has oleic acid more than 45%. **Linoleic acid**: 14.93 % (RH 0749) to 40.48 % (LES 67). (CV ≤ 0.26).**Linolenic acid**: 7.98 % (PDZ 1) to 19.11% (RH 0749). (CV ≤ 0.27).**Eicosanoic acid**: 0.34 % (DRMRC1Q 47) to 1.15 % (NPJ 253). (CV ≤ 0.32).**Erucic acid**: 0.37 % (PM-32) to 48.28 % (Released Variety). (CV ≤ 1.63) **ω6: ω3 ratio** ranged from 0.80 (RH 0749) to 4.54 (LES 67). (CV ≤ 0.45).**SFA: MUFA: PUFA** ratio ranged between 1:06:06 to 1:21:11. **Unsaturated and saturated ratio** ranged between 13.04 (LES 67) to 26.84 (NPJ252) (CV ≤ 0.25).Nutritional Profiling of entries of IVT/AVT quality trials observe **total protein ranged** from 29.43 (RH(OE)1806) to 32.95% (PDZ-16)(CV ≤ 0.04).**Total antioxidant capacity** ranged from 14.21 (DRMRC1Q 47) to 20.87 (PM 30) mg/g (CV ≤ 0.11). **β-carotene** ranged from 3.49% (PDZ 14) to 5.44% (RH(OE)1806) (CV ≤ 0.14).**Total sinapine content** ranged from 1.55% (PMAS 7) to 2.40% (PM 32) (CV ≤ 0.11).Estimation of anti-nutritional factors in quality breeding materials includes total glucosinolate content and phytic acid analysis. **Total Glucosinolate**mean values for fourcenters (Bharatpur, Pantnagar, Ludhiana, Hisar) were <30 µmol/g in PMAS 11, PDZ 18, PMAS 7, PDZ 19, PDZ 11, DRMR C1Q158, PDZ 15, IJ19R5004, PDZ 16, PDZ 1, PDZ 14, DRMRCIQ 47 genotypes. It ranged from 19.11% (PDZ-16) to 73.45% (DRMRQ 29-20) (CV ≤ 0.42).**Phytic acid content** mean values were < 2.60% in PMAS 11, PDZ 18, Rh(OE)1708, PDZ 1, NPJ 252, PDZ 14 and Released variety. Aliphatic glucosinolates were identified as sinigrin, glucobrassicanapin, gluconapin, nasturtin and few unknown peaks were unidentified using UPLC.Data was statistically analysed using SPSS version 22 software.

Frontline demonstrations

Under the scheme “Frontline demonstrations and other related activities of Oilseeds” funded under the NFSM-Oilseed by DAC&FW, Ministry of Agriculture and Farmers’ Welfare, Govt. of India, 6462 frontline demonstrations (FLDs) were conducted in 172 districts across 20 states during 2022-23 through 46 cooperating centres of AICRPRM/ ICAR institutes/ Ag.

Universities / NGOs / FPOs. The maximum FLDs were conducted in Rajasthan (1651) followed by Uttar Pradesh (1178), Assam (703) and Madhya Pradesh (550).

The maximum average yield of 2,200 kg/ha from the IP under irrigated condition was in Haryana followed by 2,197 kg/ha in Punjab; 2,055 kg/ha in Madhya Pradesh; 2,052 kg/ha in West Bengal; 2,012 kg/ha in Uttar Pradesh; 1,999 kg/ha in Bihar; 1,946 kg/ha in Rajasthan; 1,447 kg/ha in Uttrakhand; 1,418 kg/ha in J&K; 1,201 kg/ha in Assam; 1,132 kg/ha in Jharkhand; 1,052 kg/ha in Telengana; 993 kg/ha in Odisha and 989 kg/ha in Maharashtra. The maximum yield gap of 67.8% was recorded in Jammu & Kashmir followed by 58.8% in Odisha; 53.7% in Assam; 27.2% in Uttar Pradesh; 25.3% in Jharkhand; 24.2% in West Bengal; 18.44% in Maharashtra; 17.86% in Bihar;15.97% in Madhya Pradesh; 15.12% in Uttrakhand;15.09% in Telengana; 14.8% in Rajasthan; 9.73% in Haryana; and 4.76% in Punjab.The maximum ANMR/ha were Rs 25,001; Rs 20,226; Rs. 19,570; Rs. 19,507; Rs. 14,449; Rs. 13,937; Rs. 13,893; Rs. 12,877; Rs.12,726; Rs. 11,696; Rs. 8,888; Rs. 8,648, Rs.8,342; Rs. 7,045; in Jammu & Kashmir, Uttar Pradesh, West Bengal, Assam, Rajasthan, Odisha, Madhya Pradesh, Haryana, Jharkhand, Bihar, Telangana,Uttarakhand, Punjab, Maharashtra respectively. The cost of cultivation ranged from Rs. 16,985/ha in Jharkhand to Rs. 39,005 /ha in Haryana in IP under irrigated Whole package demonstrations.

The maximum average yield of 1848 kg/ha from the IP of WP demonstrations under rainfed conditions was in Himachal Pradesh followed by 1,286 kg/ha in Jammu & Kashmir; 1,187 kg/ha in Rajasthan; 1,152 kg/ha in Jharkhand; 1,041 kg/ha in Tripura; 947 kg/ha in Assam; 859 kg/ha in Uttrakhand; 825 kg/ha Arunachal Pradesh; 719 kg/ha in Odisha; 684 kg/ha in Manipur; 635 kg/ha Meghalaya. The maximum yield gap of74.95% was recorded in Tripura followed by 59.42% in Odisha; 51.84% in Himachal Pradesh; 48.45% in Jharkhand;46.30% in Jammu & Kashmir; 42.37% in Meghalaya; 34.32% in Assam; 33.3% in Manipur; 20.88% in Rajasthan; 18.32% in Uttrakhand; 14.74% in Arunachal Pradesh. The maximum ANMR/ha were Rs 30,959;Rs 18,901; Rs 17,726; Rs 17,432; Rs 10,703; Rs 8,671; Rs 8,249; Rs 7,686; Rs 7,606; Rs 6,010 and Rs. 4,238 in Himachal Pradesh, Tripura, Jharkhand, Jammu & Kashmir, Assam,Rajasthan, Meghalaya, Manipur, Odisha, Uttrakhand, and Arunachal Pradesh respectively. The cost of cultivation ranged from Rs. 10,309/ha inRajasthan to Rs 33,500/ha in Himachal Pradesh in IP under rainfed Whole package demonstrations.

A total of 18 improved varieties of Indian mustard, 5 yellow sarson and 7 of toria and 2of gobhi sarson were used in WP covering 14 states under irrigated condition. Under irrigated condition, improved variety RH 749 demonstrated in 99 FLDs in Uttar Pradesh, recorded highest average yield of 2,510 kg/ha with a yield improvement of 30.8% over local (FP) practice followed by Surekha (75 FLDs) with average seed yield of 2,442 kg/ha with yield improvement 54.5%. The minimum yield improvement of 2.1% was reported from PHR 126 variety from 27 FLDs in Punjab, while minimum average seed yield of 663 kg/ha was reported from DRMR 150-35 variety from 25 FLDs in Assam. However, the variety Brajraj in Jammu & Kashmir, under irrigated condition, recorded highest yield improvement of 68.5% with average seed yield of 1,336 kg/ha.

The maximum yield improvement of 27.8% from Pitambari variety of yellow sarson in Uttar Pradesh, 3.2 % from PGSH 1707 variety of gobhi sarson in Punjab, 66.2% from TS 38 variety of toria in Assam were recorded under irrigated condition.

Under rainfed condition, the demonstrations with Radhika recorded the highest average seed yield of 1,429 kg/ha with yield improvement of 60.2% in Jammu& Kashmir under rainfed situation. In Manipur, 21 demonstrations with NRCHB-101 recorded lowest average seed yield of 749kg/ha with yield improvement of 26.7% over FP. However, the variety BBM-1 in Jharkhand under rainfed condition recorded highest yield improvement of 70.8% with average seed yield of 1093 kg/ha.

The maximum yield improvement of 75.0% from TS 38 variety of toria in Tripura, 39.7% from NRCYS-05-02 variety of Yellow Mustard in Manipur, 53.3% from GSC 7 variety of Gobhi Sarson in Himachal Pradesh, 17.8% from Shalimar Sarson variety of brown Mustard in Jammu &Kashmir and 22.2% from RTM 1624 oftaramira in Rajasthan were recorded under rainfed condition.

A total of 481 FLDs with 13 component technologies for Indian mustard, Toria and Yellow Mustard were carried out by different centres. Among the components, Varietal and Sclerotinia stem rot demonstrated by Hisar centre had maximum average yield of 2,678 kg/ha. However, maximum yield increase of 59.5%, 58.9% and 58.0% was recorded with plant protection in timely sown Irrigated, plant protection in late sown irrigated and Boron application and Plant protection in late sown irrigated demonstrated by Bhubaneswar centre followed by 24.7% and 22% yield increase with varietal and Sclerotinia stem rot management and varietal + Micronutrient (SA of Sulphur 90% + Zinc sulphate + Borax) demonstrated by Bansur resulting maximum ANMR of Rs 20,772/ha.

Weeding and thinning component demonstrated by Bawal centre gave 23.1 and 14.3% yield enhancement over FP, respectively.

Monitoring Report

Monitoring Report

Six teams comprising scientists from ICAR-DRMR and other AICRP-R&M Centres were constituted to monitor coordinated trials, breeder seed production and front line demonstrations conducted of different coordinating and voluntary centres. Monitoring was conducted during Feb. – March, 2023 by the monitoring teams as per the schedule given below:

Zone	Team	Centres	Duration
I	**Team Leader** Dr. Kartikeya Srivastava, Professor , Pl. Breeding, IAS, BHU, Varanasi **Team Members** Dr. Pankaj Sharma, Pr.Scientist, Pl. Pathology, ICAR-DRMR, Bharatpur Dr. H. K .Sharma, Sr. Scientist, Pl.Breeding, ICAR-DRMR, Bharatpur Dr. Rajeev Bharat, Assoc. Prof. G&PB, SKAUST, Chatha, Jammu	Kangra Dhaula kuan Bajaura Una Chatha Ludhiana	March 13-18, 2023
II	**Team Leader** Dr. V.V.Singh. Pr. Scientist, Pl. Breeding, ICAR-DRMR, Bharatpur **Team Members** Dr. R.S.Jat, Pr. Scientist, Agronomy, ICAR-DRMR, Bharatpur Dr. Rakesh Punia, Jr. Pl. Pathologist, CCSHAU, Hisar Dr. Rakesh Chaudhary, Scientist ,G&PB, RLBCAU, Jhansi	New Delhi Bharatpur Morena Banda Jhansi	February 13-16, 2023
III	**Team Leader** Dr. P.D.Meena, Pr. Scientist, Pl. Pathology, ICAR-DRMR, Bharatpur **Team Members** Dr. H. S. Meena. Pr. Scientist, Pl.Breeding, ICAR-DRMR, Bharatpur Dr. Sarwan Kumar, Entomologist, PAU, Ludhiana Dr. A.L.Jat, Agronomist, SDAU, SK Nagar	Pantnagar Kanpur Faizabad (Namdhari seeds) Varanasi	February 21-25, 2023
IV	**Team Leader** Dr. Naveen Singh, Pr. Scientist,Pl.Breeding , IARI-New Delhi **Team Members** Dr. Chhaya Arti, Sr. Breeder, Plant Breeding, PAU, Ludhiana Dr. D.K.Singh, Entomologist, CSAUAT, Kanpur Dr. Laxman Prasad, Sr. Scientist, Pl. Pathology , IARI-New Delhi Dr. R. L. Choudhary, Sr. Scientist, Agronomy, ICAR-DRMR, Bharatpur	Hisar Palwal (Advanta) Mahendragarh (Shaktivardhak) Alwar (Corteva) Bawal Karnal Sriganganagar, Abohar	February 11-15, 2023
V	**Team Leader** Dr. Mahak Singh, Professor & Head, Pl. Breeding,CSAUA&T, Kanpur **Team Members** Dr. S.S.Rathore, Pr. Scientist, Agronomy , IARI-New Delhi Dr. Ashish Gupta, Pahologist, NIPB, New Delhi Dr. B.L.Meena, Scientist, Plant Breeding, ICAR-DRMR Bharatpur	Jobner Mandore Pali S.K.Nagar Kota Jaipur (Crystal)	February 5-9, 2023
VI	**Team Leader** Dr.Virendar Sardana, Pr. Agronomist, PAU, Ludhiana **Team Members** Dr. Bhagirath Ram, Pr,Scientist, Pl. Breeding, ICAR-DRMR, Bharatpur Sh. DC Salam, Pathologist, SGCARS, IGKV, Jagadalpur Dr. M. S. Khan, Entomologist, GBPUA&T, Pantnagar	Shillongani Kalyani Dholi Kanke Jagdalpur	February 18-23, 2023

Centre wise salient observations

Zone I

KNG

Coordinated trials, breeder seed production plots and FLDs were conducted properly with given design and layout. There was land constraint for breeder seed production with proper isolation.

DLK

Coordinated trials were well conducted .The centre is good for conducting trials of Indian mustard and Gobhi Sarson.

BJR

Climatic conditions were not suitable for conducting Indian mustard trials: However, Expression of Gobhi Sarson was good. Due to land constraint design layout was not followed.

UNA

Due to low fertility of soil, there was poor expression of the crop. Hence, centre was not considered suitable for conducting such important breeding trials.

Zone II

LDH

Allotted trials of all disciplines were conducted as per technical programme. Plant growth and expression was good.

CHT

All trials allotted to this centre were conducted as per technical programme. Expression of the crop was good and the field experiments were very well managed and were in good condition.

ABH

Trials were conducted as per the technical programme. Expression of crop was poor in AVT (LS) and IVT (LS) trials. Therefore, these two trials were rejected.

NDH

All the trials were conducted nicely as per the technical programme. Growth and expression of crop was very good. Breeder seed production plots were very good. Seed production plot of PM 30 was excellent. Pathology & Entomology trials were conducted as per plan of work. Agronomical trials were conducted as per technical programme

BAW

Trials were conducted as per the technical programme and expression of crop in trials was good. In IVT (TS) proper experiment design was not followed.

KAR

Trials were conducted as per the technical programme.

PAL (Advanta)

The trial was conducted as per the technical programme and expression of crop was good. The trials were well managed. The early entries, especially MH 22-8, MH 22-22 and MH 22-13, in the trials suffered due to frost.

HSR

Trials were conducted as per the technical programme. Trial conductance was outstanding and expression of crop was excellent. Gujhia weevil attacked crop in the early stage and was controlled by insecticide application.

ALW (Corteva)

Trials were conducted as per the technical programme and expression of crop in trials was good.

MDG (Shaktivardhak)

Trials were conducted as per the technical programme and expression of crop in trials was good.

SGN

Trials were conducted as per the technical programme and expression of crop in trials was good.

Zone III

PNT

Trials were conducted as per the technical programme. Attempts are required to maintain optimum and uniform plant population.

FZB

IHT trial was planted in RBD instead of Alpha Lattice design

BPR

All trials were conducted as per the technical programme and crop was excellent. Pathological trials were conducted as per plan of work. Agronomical & Physiological trials were conducted as per plan.

MOR

Trials were conducted as per the technical plan & layout. Expression of trials was also good. Pathology and Entomology trials were conducted as per technical programme. Agronomical trials were conducted nicely but need to maintain the plot to plot demarcation. The treatment application in fertility trials should be as per SOP. Over all good performance.

BND

Trials were conducted properly and as per the technical programme. Performance was very good. Centre may be assigned more number of trials and FLDs. Agronomic trials were conducted properly.

VAR

All the allotted trials were well conducted as per the technical programme and expression of crop was excellent. IHT was conducted in RBD instead of Alpha Lattice design.

KPR

All the allotted trials were well conducted as per the technical programme and expression of crop was good. However, in agronomical trials plant population was poor. Weeding and plant population need to be maintained properly.

JHS

Trials were conducted as per the technical plan & layout. Expression of crop in trials was good expect quality trials. In future additional trials may be allotted to the centre.

DOL

All the allotted trials were well conducted as per the technical programme and expression of the crop was very good.

KOT

The trials were conducted as per the technical programme. All five trials of agronomy conducted as per technical plan.

JPR (Crystal)

IHT trial was conducted as per the technical programme and expression of the crop was good.

ZONE IV

SKN

All trials were conducted as per the technical programme including Plant breeding, Agronomy and Pathology.

PLI

All assigned trials were successfully conducted. The monitoring team could not monitor the trials as they were not tagged.

MDR

All trials were conducted as per the technical programme and expression was crop is excellent. Pathology trials conducted as per technical plan.

JBN

Both the Agronomy trials were conducted as per technical plan.

ZONE V

KNK

Majority of allotted trials were conducted as per the technical programme. The trials and expression of the crop was very good.

JAG

All the allotted trials were conducted as per the technical programme and expression of the crop was excellent.

SHL

All the allotted trials were conducted as per the technical programme and expression of the crop was excellent. Altenaria blight and White rust incidence was moderate.

KLN

All the allotted trials were conducted as per the technical programme and expression of the crop was excellent.

Seasonal Conditions

1. Seasonal Conditions

Weather was favorable for the mustard during the crop season 2022-23. Good rains were received during monsoon in the month of September at almost all the locations.

Zone I

The lowest temperature (-) 0.1^{0}Cwas reported in the month of December, 2022 at Bajaura with temperature ranged from 16.9 to 27.8^{0}C.355.0 mm rainfall was received in 50 rainy days from October to April 2022-23 at Bajaura center whereas 283.0 mm rainfall was received in 26 rainy days at Kangra center.

Table: 1.1 Weather conditions during crop season in Zone I

Location	Sep. 22	Oct.22	Nov. 22	Dec. 22	Jan. 23	Feb. 23	Mar. 23	Apr. 23
Max. Temp. (^{0}C)								
BJR	-	27.8	22.4	20.1	16.9	20.4	22.8	24.6
KNG		31.2	25.6	22.5	18.9	22.5	24.7	30.6
Min. Temp. (^{0}C)								
BJR	-	9.1	3.3	(-) 0.1	0.8	2.9	5.9	6.9
KNG		18.1	12.7	7.9	4.4	10.5	16.1	21.3
Rainfall (mm) (rainy days)								
BJR	-	54.5 (4)	35.2 (3)	9.5 (2)	37.9 (6)	37.8 (8)	81.7 (16)	98.4 (11)
KNG		29.4 (1)	8.2 (1)	18.6 (4)	62.6	NIL	80.0 (10)	84.4 (7)
Max. R.H. (%)								
BJR	-	86.3	89.5	90.8	88.5	90.5	89.6	87.3
KNG		83.8	78.9	80.6	73.3	87.8	85.5	90.1
Min. R.H. (%)								
BJR		44.5	48.6	39.7	44.5	43.8	41.5	43.4
KNG	-	65.4	65.5	70.6	73.2	77.9	77.6	78.6

Zone II

The mean maximum temperature varied from 15.8^{0}C (Abohar) in January, 2023to 35.3^{0}C (Bawal) in the month of April, 2023. The minimum temperature 4.1^{0}C reported at Bawal center during the month of January, 2023.Good precipitation was received during crop season at all the centers except Kota. Maximum morning humidity was observed at Chatha (95.0%) in the month of January, 2023

Table: 1.2 Weather conditions during crop season in Zone II

Location	Sep. 22	Oct. 22	Nov. 22	Dec. 22	Jan. 23	Feb. 23	Mar. 23	Apr. 23
Max. Temp. (^{0}C)								
BAW	34.7	32.2	30.5	22.5	18.4	26.2	30.1	35.3
SGN	-	33.0	28.8	21.7	17.6	27.1	28.5	34.9
LDH	32.8	31.2	26.3	20.1	17.2	25.5	27.2	33.5
CHT	33.4	31.2	25.8	21.0	15.9	24.5	27.1	32.2
NDH	34.2	31.3	28.1	22.6	18.6	27.2	29.9	35.1
ABR	-	31.5	26.0	19.3	15.8	24.3	26.4	35.0
Min. Temp. (^{0}C)								
BAW	24.1	18.8	12.3	6.8	4.1	9.4	14.9	18.7
SGN	-	19.1	15.2	9.2	6.7	14.0	15.6	19.6
LDH	25.0	18.5	11.4	7.6	6.8	11.3	15.0	17.9
CHT	23.6	17.3	10	5.7	5.1	8	12.6	16
NDH	24.1	20.0	14.4	6.7	5.7	10.6	14.9	18.9
ABR	-	16.2	10.1	5.2	8.3	13.7	13.0	26.1

Rainfall (mm) (rainy days)								
BAW	219.4 (6)	84.0 (2)	NIL	NIL	NIL	44.0 (1)	113.0(7)	2.0
SGN	-	NIL	1.4 (1)	NIL	1.1	NIL	37.7 (5)	14.8 (3)
LDH	190.1 (4)	5.4 (2)	NIL	0.6	32.1 (2)	2.8 (1)	62.6 (1)	23.9 (5)
CHT	137.6 (9)	48.2 (2)	24.8 (3)	9.6 (1)	51.8 (4)	0.4	65.4 (6)	71.4 (5)
NDH	191.4 (9)	134.9 (4)	NIL	NIL	33.4	NIL	102.7(5)	8.6 (2)
ABR	-	NIL	1.0	0.8	NIL	NIL	162.5	175.0
Max. R.H. (%)								
BAW	84.8	81.3	75.8	83.0	90.5	88.3	87.0	58.3
SGN	-	90.5	83.7	84.5	17.6	27.1	28.5	34.9
LDH	88.0	87.2	90.3	93.5	92.0	88.0	87.8	68.3
CHT	88.0	85.0	90.0	93.0	95.0	89.0	91.0	77.0
NDH	84.4	89.1	88.8	87.9	89.6	82.8	83.9	73.6
ABR	-	32.2	30.6	42.7	83.5	80.7	84.3	69.1
Min. R.H. (%)								
BAW	57.0	41.8	27.8	38.5	52.5	40.5	36.6	21.8
SGN	-	62.2	56.4	59.0	6.7	14.0	15.6	19.6
LDH	61.5	42.2	35.5	50.8	58.4	42.3	47.0	27.0
CHT	62.0	48.0	48.0	53.0	72.0	49.0	51.0	34.0
NDH	68.4	55.5	42.4	47.6	60.5	44.4	44.1	31.3
ABR	-	22.8	16.7	11.1	69.0	56.3	41.4	43.0
Sunshine (hours/day)								
BAW	5.8	6.7	6.5	6.0	4.4	7.4	5.9	7.1
SGN	-	5.3	3.7	2.9	2.9	5.6	4.9	5.6
LDH	6.5	6.9	6.1	5.4	-	-	-	-
CHT	.0	7.4	5.7	5.3	2.6	5.3	5.2	6.6
NDH	5.7	6.1	5.2	5.3	3.5	7.7	6.8	8.1
ABR	-	-	-	-	-	-	-	-

Zone III

Maximum temperature varied from 17.3^{0}C at Pantnagar in January, 2023 to 41.6^{0}C at Varanasi in April2023. The minimum temperature ranged from 2.6^{0}C to 25.6^{0}C during the crop season. Dholi and Varanasi centers continuously reported higher morning humidity during the crop season.

Table: 1.3 Weather conditions during crop season in Zone III

Location	Sep. 22	Oct. 22	Nov. 22	Dec. 22	Jan. 23	Feb. 23	Mar. 23	Apr. 23
Max. Temp. (^{0}C)								
PNT	31.6	29.8	27.3	22.7	17.3	25.3	29.1	33.9
KPR	32.5	30.8	28.5	23.5	18.9	28.2	30.7	35.2
BPR	33.5	32.0	28.9	22.4	17.5	27.8	30.9	36.0
KOT	-	34.0	31.0	26.3	22.2	32.0	33.8	-
DOL	31.4	32.2	29.8	24.8	19.3	26.5	30.3	35.6
MOR	32.3	31.0	28.6	25.8	19.9	30.0	33.1	-
VAR	-	35.0	33.2	28.4	26.8	33.4	35.6	41.6
Min. Temp. (^{0}C)								
PNT	24.2	18.3	12.2	7.1	7.6	9.9	13.5	15.7
KPR	24.4	19.3	12.9	8.8	7.0	13.3	15.7	19.1

BPR	25.6	20.2	13.7	7.1	5.7	9.5	15.7	20.7
KOT	-	19.6	14.4	10.9	9.3	13.9	16.8	-
DOL	25.3	21.0	13.8	9.5	8.5	11.1	15.6	17.9
MOR	25.0	18.6	12.4	8.4	7.2	13.1	15.1	-
VAR	-	13.8	8.0	6.0	2.6	7.0	15.0	16.0
Rainfall (mm) (rainy days)								
PNT	401.9(11)	294.3(6)	NIL	NIL	15.7(3)	8.4(1)	73.2(4)	39.6(2)
KPR	257.4(9)	221.6(7)	NIL	NIL	19.2 (2)	NIL	24.0 (2)	47.8 (2)
BPR	171.3(8)	159.1(3)	4.6(1)	NIL	29.5(3)	NIL	38.1(6)	4.0 (1)
KOT	-	28.3 (5)	NIL	NIL	24.1 (1)	NIL	24.0(2)	-
DOL	209.4 (10)	64.6(3)	NIL	NIL	NIL	NIL	14.4 (2)	2.4(1)
MOR	125.2(10)	173.9(3)	NIL	NIL	21.5 (4)	NIL	NIL	-
VAR	-	10.0	NIL	0.2	9.2	NIL	2.4	0.2
Max. R.H. (%)								
PNT	89.0	88.0	90.0	93.0	90.0	89.0	87.0	72.0
KPR	88.0	90.0	88.0	92.0	94.0	89.0	88.0	57.0
BPR	86.1	85.5	82.2	86.9	89.1	84.4	80.9	72.4
KOT	-	87.7	83.6	86.0	73.8	55.4	56.8	
DOL	97.5	98.0	98.6	99.1	99.4	99.0	99.1	94.4
MOR	74.5	76.1	62.3	55.7	72.6	60.1	54.8	-
VAR	-	98.0	98.0	98.0	98.0	96.0	94.0	83.0
Min. R.H. (%)								
PNT	69.0	55.0	46.0	52.0	67.1	46.0	40.0	24.0
KPR	72.0	58.0	44.0	51.0	65.0	50.0	56.0	30.0
BPR	73.7	75.2	64.7	73.5	77.3	69.6	71.5	68.7
KOT	-	57.6	56.9	61.4	60.4	43.3	37.7	-
DOL	81.7	72.5	86.6	90.5	85.7	78.3	77.0	62.8
MOR	58.9	61.4	47.4	46.5	51.3	42.4	36.4	-
VAR	-	41.0	36.0	33.0	45.0	31.0	30.0	18.0
Sunshine (hours/day)								
PNT	5.5	7.3	6.3	6.3	3	7.4	7.8	8.9
KPR	4.6	5.7	3.7	2.8	1.6	7.9	6.7	7.8
BPR	5.7	7.0	6.6	6.6	3.6	8.7	6.4	8.1
KOT	-	7.5	9.1	9.4	8.0	9.3	8.7	-
DOL	-	-	-	-	-	-	-	-
MOR	-	-	-	-	-	-	-	-
VAR	-	10.0	8.8	9.2	9.4	10.0	10.0	10.5

Zone IV

The maximum temperature ranged from 21.7^{0}C to 36.8^{0}C, while minimum remained from 2.4^{0}Cto 23.4^{0}C during crop season. The noon hour humidity ranged from 28.0 to 67.5% while highest morning hour relative humidity was reported at Nagpur center during the month of September, 2022. Bright sunshine hours from 2.2 to 9.2 hours were observed during the crop season.

Table: 1.4 Weather conditions during crop season in Zone IV

Location	Sep. 22	Oct. 22	Nov. 22	Dec. 22	Jan. 23	Feb. 23	Mar. 23
Max. Temp. (^{0}C)							
JUG	35.0	35.2	33.6	31.0	28.1	-	-
SKN	34.1	35.4	33.0	29.8	25.8	33.5	36.1

NGP	32.1	32.1	31.5	29.2	31.4	33.9	36.8
JOB	-	32.4	29.2	25.2	21.7	29.8	-
Min. Temp. (^{0}C)							
JUG	23.4	20.9	15.9	15.5	13.1	-	-
SKN	23.2	17.8	12.5	9.1	7.5	12.6	17.1
NGP	22.2	20.1	16.0	12.4	9.0	11.9	19.9
JOB	-	12.5	7.3	3.8	2.4	8.6	-
Rainfall (mm) (rainy days)							
JUG	70.0 (6)	64.0 (1)	78.0	71.0	NIL	-	-
SKN	100.0 (5)	NIL	NIL	NIL	28.5 (2)	NIL	NIL
NGP	296.2 (14)	108.6(6)	NIL	8.2 (1)	NIL	NIL	12.6(1)
JOB	-	46.0	NIL	NIL	17.0	NIL	-
Max. R.H. (%)							
JUG	85.0	72.0	67.0	69.0	68.0	-	-
SKN	78.5	64.8	58.6	62.5	65.8	65.8	72.5
NGP	87.8	65.2	59.0	75.5	61.6	58.0	51.3
JOB	-	41.2	43.3	55.8	60.0	51.3	-
Min. R.H. (%)							
JUG	47.0	34.0	28.0	31.0	32.0	-	-
SKN	63.0	44.2	42.5	60.3	27.4	30.0	32.8
NGP	67.5	44.4	41.0	35.3	36.4	45.8	45.8
JOB							
Sunshine (hours/day)							
JUG	6.9	8.8	9.2	7.6	7.4	-	-
SKN	-	-	-	-	-	-	-
NGP	2.2	4.1	5.0	3.8	5.2	4.8	6.8
JOB	-	6.7	8.5	6.8	6.9	9.0	-

Zone V

Good rain (464.4 mm) was received during the September month at Kanke center. The maximum temperature ranged from 24.2^{0}Cto 34.9^{0}Cwhile minimum temperature ranged from5.8 to 24.8^{0}Cduring the crop season. Maximum relative humidity ranged from85.6 to 86.8 during crop season.

Table: 1.5 Weather conditions during crop season in Zone V

Location	Sep. 22	Oct. 22	Nov. 22	Dec. 22	Jan. 23	Feb. 23	Mar. 23	Apr. 23
Max. Temp. (^{0}C)								
KNK	33.4	30.7	26.5	24.9	24.2	28.1	29.9	34.9
Min. Temp. (^{0}C)								
KNK	24.8	20.8	8.3	5.8	6.7	10.8	13.4	18.5
Rainfall (mm) (rainy days)								
KNK	464.4	17.4	0.0	0.0	0.0	0.0	24.4	23.2
Max. R.H. (%)								
KNK	85.7	85.6	86.2	86.5	86.1	86.3	85.7	86.8
Min. R.H. (%)								
KNK	69.9	69.7	69.5	69.2	69.8	69.7	69.7	69.6
Sunshine (hours/day)								
KNK	-	-	-	-	-	-	-	-

Genetics
&
Plant Breeding

2. Genetics & Plant Breeding

2.1 Varietal Improvement

Sixteen centres, spread over 14 states, carried out the varietal development activities as per the approved technical programme. The salient achievements during the year 2022-23 in toria (*Brassica rapa* var toria), yellow sarson (*B. rapa* var yellow sarson), gobhi sarson (*B. napus*), Indian mustard (*B. juncea*), karan rai (*B. carinata*) and taramira (*Eruca sativa*) are discussed below:

2.1.1 Genetic Resource Management

A total of 8229 accessions comprising toria (751), Indian mustard (6052), yellow sarson (408), gobhi sarson (258), brown sarson (30), karan rai (272), taramira (39), *B. caudatus* (04), *B. nigra* (11), *B. tournifortii* (05), *Crambe abyssinica* (07) *S. Alba* (09), Crambe sp (01), *B chinenesis (01)*, *B. fruiticulosa* (07), *Camelina sativa* (02), *Capsella bursapastoris* (02), *Diplotaxis assurgens* (02), *Diplotaxis tenuisilique, Erucastrum spp* (02) and *Lapidium sp* (02) were maintained through appropriate mating system at Bhubneshawar, Dholi, Hisar, Pantnagar, Ludhiana, Kanpur, Hisar, IARI, New Delhi, Jobner, Morena, Pantnagar, Chatha-Jammu, Jagdalpur and SK Nagar (Table 2.1.1). In addition, 453 new accessions comprising toria (95), Indian mustard (231), yellow Sarson (79), gobhi sarson (07), Brown Sarson (08), Taramira (22) and karan rai (09) were collected. Further, 1783 accessions consisting of 1299 Indian mustard, 162 toria, 123 yellow sarson, 37 gobhi sarson, 35 brown sarson, 97 taramira and 23 *B. rugosa* accessions were evaluated. On the basis of germplasm evaluation, promising accessions were identified for seed yield, earliness, yield components, thermo-tolerant (early and terminal stages), resistance/tolerance to diseases/pests and oil content in toria at Dholi, Chatha-Jammu, Jagdalpur and Pantnagar.

2.1.2 Creation of genetic variability through hybridization/ mutagenesis and selection

Creation of variability is the essence and backbone of the breeding programme. To cater the need of diverse agro-climatic conditions of the country, 435 crosses were attempted in toria, 138 in yellow sarson at Pantnagar, Bhubneshwar, Chatha-Jammu, Kalyani, and Morena and 775 in Indian mustard at Bhubneshwar, Chatha-Jammu, Sriganganagar, Hisar, IARI New Delhi, Ludhiana, Kanpur, Pantnagar, Morena, Jhansi, Varanasi and SK Nagar to improve seed yield, earliness, seed size, component traits, disease/pest resistance, heat tolerance suitable for late sown conditions, drought tolerance, “0” and “00” quality characters and high oil content (Table 2.1.2). Selection of superior plants/bulks at different centres was practised in toria, yellow sarson and Indian mustard. In toria, development of composites population after the selection was the main objective. In yellow sarson, hybridization and selection from segregating generations were attempted at Kanpur, Bhubneshwar and Pantnagar. In Indian mustard, 5873 single plants were selected at New Delhi, Hisar, Jhansi, Kanpur, Bhubneshwar, Chathha-Jammu, Pantnagar, Ludhiana, SK Nagar, Jagdalpur, Kota, Varanasi Dholi, Imphal, Nagpur, Kangra and Morena. In Indian mustard, about 118 bulks were selected from segregating and advanced generations.

2.1.3 Evaluation of advanced breeding lines

The advanced breeding lines were evaluated under different station/state /preliminary yield trials at various centres have been presented in Table 2.1.3. 116 strains of toria were tested at Kanpur, Bhubneshwar, Chatha-Jammu, Jagdalpur and Pantnagar. The yield superiority in toria station trial was up to 30.04 % over the check (PT-303) at Pantnagar. In yellow sarson, 55 strains were tested at Kanpur and Pantnagar. The yield superiority in station trial II up to 24.77 % over the check YSH-401 was recorded at Pantnagar. In Indian mustard, 1270 strains were evaluated at 10 centres; Chatha, Imphal, Hisar, Kanpur, Ludhiana, Pantnagar, Dholi, SK Nagar, Bhubneshwar and Varanasi in 37 trials. Seed yield superiority up to 35.15 % over the check Kranti was recorded at Pantnagar. Ten strains at Hisar, 237 strains at Ludhiana and 08 strains at Chatha of gobhi sarson were evaluated for seed yield and its component characters.

2.1.4 Hybrid Development

Efforts for hybrid development continued during 2022-23 under "Consortia Research Platform on Hybrids", at four centres including ICAR-DRMR Bharatpur, ICAR-IARI New Delhi, PAU Ludhiana and CCS HAU Hisar. Twenty experimental hybrids of Indian mustard, comprising five from each of four centers were evaluated in replicated block design at all four centers. On the basis of mean seed yield over four locations (Bharatpur, New Delhi, Ludhiana and Hisar), two hybrids; DRMRHJ 410 (3101 kg/ha) and RHH 2205 (2950 kg/ha) out yielded the best check DMH-1(2946 kg/ha) by a margin of 5.26 and 0.13% respectively. Fourty experimental hybrids were evaluated in augmented block design (CRPMLT 2). Five experimental hybrids; DRMRHJ 417 (2916 kg/ha); RHH 2214 (2883 kg/ha), RHH 2212 (2831 kg/ha), RHH 2213 (2818 kg/ha) and PHR 8207 (2763 kg/ha) out yielded the best check DMH 1 (2744 kg/ha) by a margin of 6.26, 5.05, 3.17, 2.71 and 1.0 %, respectively on the basis of average seed yield. On the basis of oil yield over three location (Bharatpur, New Delhi and Ludhiana) one hybrid DRMRHJ 417 (1227 kg/ha) out yielded the best check DMH- (1114 kg/ha) by a margin of 10.7%. 30 F_1 crosses were evaluated in augmented block design at all four centers. Three crosses exhibited > 10% seed yield heterosis over the best check DMH 1 (2698 kg/ha) on the basis of average seed yield over four locations. On the basis of oil yield over three location (Bharatpur, New Delhi and Ludhiana) three F_1 crosses; DRMRH 22-10 (1321 kg/ha), DRMRH 22-2 (1308 kg/ha) and DRMRH 22-6 (1260 kg/ha) also out yielded the best check DMH -1 (1093 kg/ha) by a margin of 20.9, 19.7 and 15.2 % respectively. 589 experimental hybrids including 40, 195, 105 and 249 at DRMR, CCSHAU, IARI, and PAU, respectively were evaluated at respective center. Each center identified promising hybrids at their location. 888 F_1 crosses including 144 at ICAR-DRMR, 375 at ICAR-IARI, 167 at PAU and 194 at HAU were evaluated. Superior crosses were identified at each center. A total of CMS and restorer are being converted to 489 and 160 nuclear backgrounds, respectively, through back-crossing. In addition 86 CMS and 172 restorer lines were maintained. Seed of 105 experimental hybrids and 1051 F_1crosses was produced for evaluation during next year. Efforts are underway to improve parental lines for white rust resistance, quality traits and for agronomic traits. A set of 60 shared inbred lines, comprising of CMS, maintainer and restorer, 15 from each all collaborative center was maintained. A set of seventy two inbred lines was grouped into two diverse subpopulations on the basis of genetic diversity assessed through SSR markers.

2.2 Breeder seed production

Breeder seed production:

Indent of 106.09q breeder seed of 82 Rapeseed-Mustard varieties were received from Department of Agriculture and Cooperation (DAC), Ministry of Agriculture and Farmers Welfare, Govt. of India for production during 2022-23. The allocation was made to 24 centers for the production of 106.09q of 84 Rapeseed-Mustard varieties during 29th Annual Group Meeting was held at SKNAU, RARI Durgapura, Jaipur (Rajasthan). Against the indent of 106.09q, 290.84q Breeder Seed was produced, indicating a surplus availability of 184.75q. Breeder seed of 02 varieties Pusa Saag-1 (MR 704) and PBR- 378 of Indian mustard could not be produced. Further, less quantity of RVM-1 of Indian mustard; Benoy (B 9) of yellow sarson; Gluechin of brown sarson; RSPT-06 & T-9 of toria was produced. In addition, 35.40q breeder seed of 24 varieties was also produced by different centers. The center and variety wise details of breeder seed production are presented in Table 2.2.

Table 2.1.1 Genetic Resource Management activities

Crop	Centre	No. of accessions procured/ collected	No. of lines maintained	No. of lines Evaluated	Promising accessions identified	Traits for which identified
1	**2**	**3**	**4**	**5**	**6**	**7**
Toria	Bhubaneswar Ranital (OUAT)	2	132	21	ORT 18-6-16, ORT 2019-18, RAUDT 14-09, ORT-2020-02	Earliness, High Yield under late sown conditions
	Chatha Jammu	-	46	08	-	Earliness & high seed yield
	Dholi	16	16	--	IGT-2, IGT-64, IGT-91, RAUDT-62, RAUDT-15, RAUDT-7, RAUDT-67, RAUDT-36, RAUDT-16, RAUDT-74, RAUDT-79, RAUDT-7, DC9401, TH-9802, Dwarf Toria, Satha local	Earliness and yield components
	Jagdalpur	01	49	38	02	-
	Imphal (CAU)	2	9	-	-	-
	Hisar	-	100	-		
	Kanpur	-	255	-	-	-
	Pantnagar	74	95	95	IC 363300, DRMR 1701, DRMR 2391, DRMR 2392, GP-2017-771 Anchali, GP2017-772, PCPGR-7971, PCPGR-7810	For long main raceme, Profuse branching, Seed yield
	SK Nagar		19			
	Morena		30			
Total		**95**	**751**	**162**	**-**	**-**
Indian mustard	Bhubaneswar Ranital (OUAT)	3	123	19	TM 307, ORM 2019-35, NRCHB(m)29, ORM 2020-06	Earliness, High Yield under late sown conditions
	Chatha-Jammu	-	104	26	-	White rust resistance & High seed yield
	Dholi	42	42	-	MDOC-8, MDOC-53, MDOC-27, TPM-1, RK-8401, NDRE -4, IC -401574, IC-399788, TM-12, BIO94, Domo, Jatai Local, EC 339000, EC 338997, EC-399301, PAB 9511, PAB 9534, IC401574, IC-399788, RAURDA09-32, RAURDA 09-34, RAURDA 09-78, RAURDA 09-153,RAURDA 09-170, RAURDA 09-172, RAURDA 09-212, RAURDA 09-214, RE11, NC 37362, RE44, CN 105364, IC 597880, RLC 3, RE8, DRMR MJA 35, DRMR IJ 12-48, DRMR IJ 12-40, DRMR IJ 31, LES 39, TN3, NPJ 112, M34	Yield, Earliness, Yield components, Thermo-tolerant (Early and Terminal stages); Resistance/Tolerance to Diseases –Pests and Oil Content.
	Kangra	5	15	20	-	-
	Jagdalpur	05	86	52	03	

	Imphal (CAU)	16 (local yella collections)	43	16	CAU RM 4-1S, LYC 7	Higher yield, early maturity
	Hisar	-	301	-	-	-
	IARI, New Delhi	-	176	176	-	Reproductive phase heat and drought stress tolerance
		-	397	-	-	Germplasm maintained by selfing under timely sown conditions
		-	89	89	-	Low erucic/ Low Glucosinolates content
	Kanpur	-	1465	--	-	-
	Ludhiana		Germplasm lines :241+ 420	-	-	-
			Radiation panel : 439	-	-	-
			Diversity fixed foundation set-1 (Newton Pori Indo-UK Project): 263	-	-	-
			Diversity fixed foundation set-2 (ICAR-NASF): 289	270	Under compilation	Shade tolerance Photosynthetic efficiency, Mn toxicity, NUE
			Introgression lines: 340	229	Under compilation	Tolerance to salinity
			Brassica juncea (0/00):	70		
	Nagpur	40	200	240	-	Thermo tolerance (terminal stage), earliness Low erucic acid & glucosinolate
	Pantnagar	120	215	25	DRMR-1483, DRMR-1485, DRMR-1491, DRMR-1495, DRMR-1496, DRMR-1517, DRMR-1518, PCPGR-7601, PCPGR-7813, PCPGR 57, PCPGR 54, PCPGR 53	Bold seeded, High yield, Quality traits and disease resistance, *Alternaria* blight resistance, Good for vegetable purpose

	SK Nagar	-	407	--	--	--
	Morena		61			
	Varanasi	-	336	67	--	-
Total		**231**	**6052**	**1299**		
Yellow Sarson	Bhubaneswar	-	13	-		
	Dholi	05	05	--	RAUDYS-89-111, RAUDYS-9701, RAUDYS-9702, RS-1, Pendent Local	Yield, Earliness, Yield components Resistance/Tolerance to AB Disease and Oil Content.
	Imphal (CAU)	-	19	-	-	-
	Hisar	-	12	-	-	-
	Delhi	-	26			
	Pantnagar	74	132	123	EC-414301, EC-414284, IC267704, DRMR-2379, DRMR-2382, DRMR-2383, DRMR-2386, DRMR-2388, DRMR-2509, DRMR-2510, DRMR 2511, GP-2016-3, PYSC-12-48, PYSC-12-53, PYSC-12-54, PYSC-55, DRMR 2689	Good plant type, Basal branching, long main raceme and long pod length, Laxed bearing
	Kanpur	-	155	--	-	-
	S K nagar	-	46	-		
Total		**79**	**408**	**123**		
Gobhi sarson	Dholi	03	03	--	Tower, HNS 0004 and HYOLA 401	Resistance/Tolerance to AB Disease and Quality traits like Oil Content.
	Hisar	-	39	-	-	-
	IARI, New Delhi	-	16	-	-	-
	Ludhiana		150			
	Chatha-Jammu	-	36	18	-	High seed yield
	Kangra	4	15	19	-	-
	SK Nagar	--	14	--	--	-
Total		**07**	**258**	**37**		
Brown Sarson	Pantnagar		-	17	-	GP-2011-162, PCPGR-2018-1333, GP-2015-38, PCPGR-7782
	Kangra	8	10	18	-	-
	S K Nagar	--	20	--	-	-
Total		**8**	**30**	**35**		
Karan rai	Dholi	05	05	--	Kiran, PBN-2001, PBN-2002, PBN9501, PBC9221	Resistance/Tolerance to AB Disease
	Hisar	-	8	-	-	-

	Kangra	4	3	7	-	-
	Pantnagar		39		IARI-11, IARI-7. IARI-13	Dwarf and Early, Flower color, Earliness and dwarf height
	IARI, New Delhi	-	170	-	-	-
	Ludhiana		40			
	S K Nagar		07			
Total		**09**	**272**	**7**	**-**	
B rapa	IARI, New Delhi	-	26	-	-	-
	Ludhiana	-	150			
		-	Diversity set:192			Agronomic traits, seed and leaf
Total		**-**	**368**	**-**		
Taramira	Jobner	20	30	95		Seed yield
	SK Nagar	--	02	--	--	
	IARI, New Delhi	2	7	2	-	-
Total		**22**	**39**	**97**		
R. caudatus	IARI, New Delhi	-	4	-	-	-
Total		**-**	**04**	**-**		
B. nigra	IARI, New Delhi	-	10	-	-	-
B. nigra	Hisar		01			
Total		**-**	**11**	**-**		
B. rugosa	Pantnagar	-	-	23	-	EEC-5, EEC-3, EEC-1
Total		**-**		**23**		
S. Alba	IARI, New Delhi	-	3	-	-	-
S. Alba	Hisar		4			
S. Alba	Ludhiana		2			
Total			**09**			
Crambe sp	Hisar		1			
Total			**01**			
Crambe abyssinica	IARI, New Delhi	-	7	-	-	-
Total			**07**			
Lapidium sp	IARI, New Delhi	-	2	-	-	-
	Hisar	-	01			
Total			**03**			
Lepidium sativum	IARI, New Delhi	-	2	-	-	-
Total			**02**	**-**	**-**	**-**
B. tournifortii	IARI, New Delhi	-	2	-	-	-
B. tournifortii	Hisar		1			

B. tournifortii	Ludhiana		2			
Total			**05**			
B. chinenesis	IARI, New Delhi	-	1	-	-	-
Total			**01**			
B. fruticulosa	IARI, New Delhi	-	2	-	-	-
B. fruticulosa	Hisar		1			
B. fruticulosa	Ludhiana		4			
Total			**07**			
Sisimbrium (BWMR)	IARI, New Delhi	-	1	-	-	Aphid reaction
Total			**01**			
Camelina sativa	IARI, New Delhi	-	1	-	-	-
Camelina sativa	Hisar		1			
Total			**02**			
Capsella-bursapastoris	IARI, New Delhi	-	2	-	-	-
Total			**02**			
Diplotaxis assurgens	IARI, New Delhi	-	1	-	-	--
Diplotaxis assurgens	Hisar		1			
Total			**02**			
Brassica oxyrrhina	IARI, New Delhi	-	1	-	-	-
Total			**01**			
Diplotaxis muralis	IARI, New Delhi	-	1	-	-	
Total			**01**			
Diplotaxis siettiana	IARI, New Delhi	-	1	-	-	
Total			**01**			
Diplotaxis tenuisilique	IARI, New Delhi	-	1	-	-	Aphid reaction
Diplotaxis tenuisilique	Hisar		01			
Total			**02**			
Enarthrocarpus lyratus	IARI, New Delhi	-	1	-	-	-
Total			**01**			
Erucastrum canariense	IARI, New Delhi	-	1	-	-	
Erucastrum spp	Hisar		01			
Total			**02**			
Diplotaxis viminea	IARI, New Delhi	-	1	-	-	
Total			**01**			
Diplotaxis gomez-campoi	IARI, New Delhi	-	01	-	-	

Total			**01**			
Diplotaxis erucoides	IARI, New Delhi	-	1	-	-	-
Total			**01**			
Grand Total		**451**	**8229**	**1783**		

Table 2.1.2: Number of crosses, their generation and number of selections practiced.

Centre	Objective (s)	Generation	Pedigree	No. of crosses/ lines	Selection	
					No. of single plants	No. of bulks
1	2	3	4	5	6	7
Crop: Toria						
Bhubaneswar (OUAT RRTTS, Ranital)	Breeding for early maturity, high seed yield strains of Toria suitable for rice-fallows	Fresh Single Crosses	Anuradha, Tapeswari, ORT 18-6-16, Sushree	11		
		Multiple crosses	F1 x F1	3		
		F1	12 F1s derived from the crosses among Toria genotypes :(RMT 19-14, Sushree, PT 2015-8, PT 303)	6		
		F2	PT303 x TKM 18-2 , Tapeswari x Sushree	Three F2 populations were grown in large plots and desirable plants having target trait combinations were selected		
		Segregating generations (F3 -F7)	Derived from the crosses: Sushree x PT303, Anuradha x TS-38, PT303 x Panchali, PT 303 x TS 38, Parbati x TKM 18-2	15	62	4
Chatha-Jammu	Early, high yielding	Fresh cross	RSPT-2, RSPT-9 with Pant hill toria-1, PT-508 & Uttara	06		
		F_1	Composite populations	07		
		F_2	RSPT-1,RSPT-6,TL-15,PT-303& Uttara , Satha local	08		
		F_3	Six single crosses using parents RSPT-6, Bhawani, Uttara, PT-303, TL-15&RSPT-9.	06		
		F_4	PT-2013-5,PT-2013-8,TS-38,TRS-79,TKM-16-1 With Bhawani, PT-303 &Tapeswari	12		
		F_5	RSPT-3, RSPT-11,TL15 & RSPT-8 With Bhawani &satha local	07		
		F_6	Composite populations	12		
		F_7	Open pollination (Early and late populations)	06		
			RSPT-1, RSPT-2, RSPT- 6 cross with PT-303, PTC-2009-3, RAUDT-10, TL15, TL-21 lines.	10		
Imphal	Earliness, high seed yield, bold seed and quality	F_2	Crosses among PT-303, TKM—20-02, BAUST-08-08,RMT-19-14, CG Toria-3, TKM-20-1,ORT 2019-01, Tapeswari, CG Toria-4, Bhawani,RMT-19-14,PT-2015-08	09	45	

		F_3	CG Toria-2-, TKM 19-01, TL-19, ORT 18-6-16, Tapeswari, CAU Toria-2, JT 13-8,PT 2015-6,TL-18, TKM 19-2,BAUT 08-06,PT 303, CAU Toria-1-1, RMT 10-5-18, BAUT-08-07	13	65	
		F_4	Crosses among JT-1, PT-303, TKM-18-2, RMT-10-15, TKM-18-1, Bhawani, Tapeswari, PT-2015-10, PT-2013-1, RVT-1, RVT-2	13	65	
		F_5	JT-1 x BAUT-08-01, TKM 17-1, TKM 17-2, PT-2015-3, PT- 303	5	25	
		F_6	JT-1 x TS-36, JT-1 x TRL-79 (ASR), RMT-10-9-1,TH-1502, PT-2013-8	5	25	
		F_7	JT-1 x PT-303, TKM-15-1 Tapeswari	3	15	
		F_{12}	RMT-02-6, RMT-10-6	1	5	
		F_{13}	NDT 5-3,JT-1	1	5	
		F_{15}	PT-2004-3, TH-0302, Bhawani, TL-2013	2	10	
		Germplasm	MRNT-1 to MRNT-31	30	150	
Jagdalpur		Fresh cross	Indira Toria x GPT-1, Indira Toria x GPT-61, Indira Toria x GPT-83, Indira Toria x PT-303, Indira Toria x T-9, PT-303 x GPT-1	06		
		Segregating generations advanced	Indira Toria x GPT-61, Indira Toria x T-9		49	
Kanpur	Development of early maturing high yielding varieties	F_4 Population	PT-303 x Bhwani , PT-303 x Tapeswari, PT-303 x ORT-11, PT-303 x ORT-11, PT-303 x PT507, PT-303 x Anuradha , T9 x Bhwani, T9 x Tapeswari, T9 x ORT-11, T9 x PT507, T9 x Anuradha , Bhwani x tapeswari, Bhwani x ORT-11, Bhwani x PT507, Bhwani x Anuradha, Tapeswari x ORT-11, Tapeswari x PT507, Tapeswari x Anuradha, ORT-11 x PT507, ORT-11 x Anuradha, PT-507 x Anuradha	382		
Morena	Earliness, high seed yield bold seed and quality	F_2	Crosses among PT-303, TKM—20-02, BAUST-08-08,RMT-19-14, CG Toria-3, TKM-20-1,ORT 2019-01, Tapeswari, CG Toria-4, Bhawani,RMT-19-14,PT-2015-08,	09	45	
		F_3	CG Toria-2-, TKM 19-01, TL-19, ORT 18-6-16, Tapeswari, CAU Toria-2, JT 13-8,PT 2015-6,TL-18, TKM 19-2,BAUT 08-06,PT 303, CAU Toria-1-1, RMT 10-5-18, BAUT-08-07	13	65	
		F_4	Crosses among JT-1, PT-303, TKM-18-2, RMT-10-15, TKM-18-1, Bhawani, Tapeswari, PT-2015-10, PT-2013-1, RVT-1, RVT-2	13	65	
		F_5	JT-1 x BAUT-08-01, TKM 17-1, TKM 17-2, PT-2015-3, PT- 303	5	25	
		F_6	JT-1 x TS-36, JT-1 x TRL-79 (ASR), RMT-10-9-1,TH-1502, PT-2013-8	5	25	
		F_7	JT-1 x PT-303, TKM-15-1 Tapeswari	3	15	
		F_{12}	RMT-02-6, RMT-10-6	1	5	
		F_{13}	NDT 5-3,JT-1	1	5	
		F_{15}	PT-2004-3, TH-0302, Bhawani, TL-2013	2	10	
		Germplasm	MRNT-1 to MRNT-31	30	150	
Pantnagar	Earliness	Fresh crosses	RAUDT-10-33 × PT-141, RAUDT-10-33 × Bhawani, PHT-1 × PT-141, PHT-1 × Bhawani, Tapeswari × PT-141, Tapeswari × Bhawani, TS-46 × PT-141, TS-46 × Bhawani, PRT-1 × PT-141, PRT-1 × Bhawani, PT-30 × PT-141, PT-30 × Bhawani,	12		
		F1	PT-30 × Bhawani, , PT-507 × Bhawani, , PHT-1 × Bhawani, , Uttara × Bhawani, PT-2015-6 × Bhawani, PT-2017-2 × Bhawani	7	-	6
		F2	T-9 × PT-141, T-9 × PT-2020-9, PT-2020-2 × PT-141	5	-	3

		F3	Tapeswari × PT-141, PCPGR 5764× PCPGR 7870	3		02
		F4	(PT-15-6 × PT-16-24) × PT-141	1		1
	Seed yield	Fresh crosses	Tapeswari × Uttara, PT-30 × Uttara, PT-2015-7 × Tapeswari, PT-2015-7 × TS-46, PT-2015-7 × RAUDT-10-33, PT-2018-3 × TS-38, PT-2018-3 × RAUDT-10-33, PT-2018-6 × Tapeswari, PT-2018-6 × TS-46, PT-2018-6 × RAUDT-10-33, PT-2018-9 × Tapeswari, PT-2018-9 × TS-46, PT-2018-9 × RAUDT-10-33, PT-2018-8 × Tapeswari, PT-2018-8 × TS-38, PT-2018-8 ×RAUDT-10-33, PT-2018-7 × PT-508, PT-2018-7 × Uttara,	18		
		F1	PT-2017-2 × PT-2017-3, PT-2018-6 × PT-2017-2, PT-2018-6 × PT-2017-3, PT-2018-3 × PT-2018-6, PT-2018-3 × PT-2017-2, PT-2018-3 × PT-2017-3, PT-30 × Tapeswari, PT-507 × Tapeswari, PT-507 × T-9	10	-	09
		F2	PT-2020-1 × PT-2018-8, PT-2020-5 × PT-2018-8, PT-2020-5 × PT-15-4, PT-2020-7 × PT-2015-4	05	-	04
		F3	Tapeswari × TCN-19-15, PT-30×TCN-19-9, PCPGR 7810× PCPGR 84, PCPGR 7813× PCPGR 8222-2,	6		4
		F4	PT-15-3×TKM-17-1, TKM-18-2× PT2017-3	3		2
	Composite for Seed yield	C0	PTC-2022-1, PTC-2022-4, PTC-2022-5, PTC-2022-6, PTC-2022-8, PTC-2022-9, PTC-2022-10, PTC-2022-14	12	-	08
		C1	PTC-2021-3, PTC-2021-4, PT-2021-11, PT-2021-12, PT-2021-24, PT-2021-31	9		6
		C3	PTC-2020-1	2		1
		Recurrent selection	PT 2020-3, PT 2020-6, PT-2018-9×Uttara, PT 2008-7×RAUDT-10-22, PT-303, Uttara			
		Development of inbred in toria				
		Fresh crosses	JT-1 × Uttara, RAUDT-10-33 × Uttara, PHT-1 × Uttara, TS-46 × Uttara, PRT-1 × Uttara, JT-1× RAUDT-10-23, JT-4 × Tapeswari, JT-28 × PT-508, JT-28 × Tapeswari, JT-11 × Tapeswari, JT-11 × TS-46, JT-11 × PT-508, JT-14 × TS-38	13		
		F1	PHT-1 × Tapeshwari, PHT-1 × T-9, Uttara × Tapeshwari, Uttara × T-9, PT-2017-2 × Tapeshwari, PT-2017-2 × T-9, PT-2015-6 × Tapeshwari, PT-2015-7 × Tapeshwari, PT-2015-7 × T-9,	10	-	09
	Specific adaptation to hill	F2	BSGP-6 × PT-2018-9, BSGP-25 × PT-2018-9, PT-2020-5 × PCPGR-348	03	-	02
		F3	PT-2018-1×PHT-1, TCN-19-4 ×PHT-1, PCPGR 7807× PCPGR 7978	04		03
		F4	Uttara × KBS-49	02		01
Crop: Yellow Sarson						
Bhubaneswar (OUAT RRTTS, Ranital)	Development of high - yielding strains of Yellow Sarson suitable for rice-fallow s of Odisha	Fresh Single crosses	12 fresh single crosses were done in a line x tester design involving parents: YSH 401, ORYS 2018-09, NRCYS-05-02, B9, DRMYS-02, PYS 2018-02, ORYS 2019-03, Pitambari	12		
		F2	Pitambari ,x YSH 04-01	One F2 population was grown in large plots and desirable plants having target trait combinations		

				were selected		
		M5-generation (EMS-induced mutation breeding)	Parents: NRCYS 05-02 YSH 04-01 Mutagen: 0.5% EMS	64 plants were selected for yield component traits		
Pantnagar	High seed yield	Fresh crosses	YSGP-43 × NRCYS-502, YSGP-43 × PYS-2017-8, YSGP × NYM-6001, YSGP-61 × NRCYS-502, YSGP-61 × PYS-2017-8, YSGP-61 × NYM-6001, YSGP-65 × NRCYS-502, YSGP-65 × PYS-2017-8, YSGP-65 × NYM-6001, YSGP-66 × NRCYS-502, YSGP-66 × PYS-2017-8, YSGP-66 × NYM-6001, YSGP-68 × NRCYS-502, YSGP-68 × PYS-2017-8, YSGP-68 × NYM-6001, YSGP-69 × NRCYS-502, YSGP-69 × PYS-2017-8, YSGP-69 × NYM-6001, PYS-2021-1 × NRCYS-502, PYS-2021-1 × Pitambari, PYS-2021-1 × PYS-2021-2, PYS-2021-1 × PYS-2020-7, PYS-2021-4 × NRCYS-502, PYS-2021-4 × Pitambari, PYS-2021-4 × PYS-2021-2, PYS-2021-8 × Pitambari, PYS-2021-8 × PYS-2018-1, PYS-2022-2 × NRCYS-502, PYS-2022-2 × Pitambari, PYS-2022-2 × PYS-2021-2, PYS-2022-2 × PYS-2018-1, PYS-2022-4 × NRCYS-502, PYS-2022-4 × Pitambari, PYS-2022-4 × PYS-2021-2, PYS-2022-4 × PYS-2020-7, PYS-2022-7 × NRCYS-502, PYS-2022-7 × Pitambari, PYS-2022-7 × PYS-2021-2, PYS-2022-7 × PYS-2020-7, PYS-2022-7 × PYS-2021-4, PYS-2022-8 × NRCYS-502, PYS-2022-8 × Pitambari, PYS-2022-8 × PYS-2021-2, PYS-2022-8 × PYS-2018-1, PYS-2022-9 × NRCYS-502, PYS-2022-9 × Pitambari, PYS-2022-9 × PYS-2021-2, PYS-2022-9 × PYS-2020-7, NRCYS-502 × NYM-6001, Pitambari × NYM-6001, PYS-2018-1 × NYM-6001, PYS-2021-4 × PYS 841, PYS-2021-4 × NRCYS 0502, PYS-2021-4 × PYS-2017-8, PYS-2021-4 × PYS-2018-1, PYS-2021-6 × PYS-841, PYS-2021-6 × NRCYS 0502, PYS-2021-6 × PYS-2017-8, PYS-2017-11 × NRCYS 0502, PYS-2017-11 × PYS-2017-8, PYS-2017-13 × PYS-2021-4, PYS-2017-13 × PYS-2018-3, PYS-2017-13 × PYS-2018-7, PYS-2018-3 × PYS-2021-4, PYS-2018-3 × PYS-2018-7, PYS-2018-3 × NRCYS 0502, PYS-2018-7 × PYS-2017-8, PYS-2018-7 × NRCYS 0502, PYS-2018-7 × PYS-2021-4, PYS-2018-8 × PYS-2017-11, PYS-2018-8 × NRCYS 0502, PYS-2018-8 × YSH 0401	72		
		F1	PYS 841 x Pitambari, PYS 841 x PYS-21-21, PYS 841 x PYS-21-4, PYS 842 x PYS 21-12, PYS 842 x YSH 0401, PYS 89-7 x PYS-21-21, PYS 89-7 x PYS-21-4, PYS-17-11 x PYS-21-4, PYS-17-13 x NRCYS 0502, PYS-18-7 x PYS-21-21, PYS-18-7 x PYS-21-15, PYS-18-7 x PYS-21-12, PYS-21-1 x Pitambari, PYS-21-6 x NRCYS 0502, PYS-21-6 x PYS-21-2, PYS-21-7 x NDYS-107, PYS-21-7 x NDYS 2018, PYS-21-14 x PYS-21-18, PYS-21-14 x NRCYS 0502, PYS-21-20 x NRCYS 0502, PYS-21-20 x YSH 0401, PYS-21-21 x PYS-21-2, YSCN-20-1 x NRCYS 0502, YSCN-20-2 x NRYS-05-02, PYS-18-8 x PYS-18-1, PYS-18-1 x YSH 0401, PYS-18-2 x Pitambari, PYS-18-3 x YSH 0401, PYS-18-3 x NRCYS 0502, PYS-18-3 x Pitambari, PYS-18-6 x YSH 0401, PYS-18-6 x NRCYS 0502, PYS-18-6 x Pitambari	59	-	31

		F2	PYS-2018-1 × PYS-842, PYS-2018-1 × PYS-20-7, PYS-17-8 × PYS-842, PYS-17-11 × PYS-16-15, PYS-17-11 × PYS-17-6, YSGP6 × Pant Sweta, PYS-18-3 × PYS-842, GP-49 × GP-55, GP-49 × GP-52, PYS-18-1 × GP-49, PYS-18-1 × PYS-841, YSGP 49 × YS-89-1, YSGP 49 × PYS-17-6, YSGP 55 × PYS-841, YSGP 55 × YSGP 51, YSGP 55 × PYS-17-8, EC-7×EC-13, EC-10×EC-2, EC-11×EC-8, EC-12×EC-4, EC-14×EC-6, EC-15×EC-6	22	16 (330IPS)	-
		F3	B-9×PYS-2017-6, PPS-1×PYS-2017-6, Pant Sweta × PYS-2018-4, Pant Sweta × PYS-2017-6, Pant Girija × PYS-2017-6, NRCYS-0502×PYS-2018-4, NRCYS-0502×PYS-2017-6, NRCYS-0502×PYS-2017-8, Pitambari × PYS-2017-8, YSH-401×PYS-2017-6, YSH-401×PYS-2017-8, NDYS 2018×PYS-6	12	10 (218 IPS)	-
		F4	YS-89-7×NDYS-107, PYS-17-6× PYS-16-7, PYS-17-6× NDYS-2018, PYS-17-6× PYS-2016-15, PYS-17-11× NDYS-2018, PYS-17-11× NDYS-123	10		6 (145 IPS)
		F5	PYSC-21-6 × YS-89-7, PYSC-40-4 × RAUDYS-14-9, PYS-841 × RAUDYS-14-9, PYSC-53-5 × RAUDYS-14-9, (PYS-2016-6 × PYS-6) × RAUDTYS-14-9	5		5 (133 IPS)
		F6	PYS-6 × NDYS-115 (ML), DRMRYS-2016-42 × YSH-842, PYS-2016-6 × PYS-6, PYS-2011-43 × PYS-2012-4, PYS-6 × NDYS-115 (BL)	5 (83 IPS)		5 (32 lines)
Kanpur	Breeding early maturing and high yielding varieties of Yellow sarson	F_3	YSKM 15-2 x YSH – 401, YSKM 16-2 x Benoy, YSKM 17-2 x Pitambari, YSKM 18-1 x Benoy, YSKM 18-2 xPitambari, YSKM 19-1 x YSH-401	126		
		F_4	YSC-63 x NRCYS-05-02, YSC-63 x YSH-401, YSC-63 x Benoy, YSC-63 x Pitambari, YSC-41 x NRCYS-05-02, YSC-41 x YSH-401, YSC-41 x Benoy, YSC-41 x Pitambari, YSC-09 x NRCYS-05-02, YSC-09 x YSH-401, YSC-09 x Benoy,YSC-09 x Pitambari, YSC-71 x NRCYS-05-02, YSC-71 x YSH-401, YSC-71 x Benoy, YSC-71 x Pitambari, YSKM11-02 x NRCYS-05-02, YSKM11-02 x YSH-401, YSKM11-02 x Benoy, YSKM11-02 x Pitambari, YSC-76 x NRCYS-05-02, YSC-76 x YSH-401, SC-76 x Benoy 21, YSC-76 x Pitambari, YSKM-10-1 x NRCYS-05-02, YSC -10-1 x YSH-401, YSKM-10-1 x Benoy, YSKM-10-1 x Pitambari, YSKM-11-1 x NRCYS-05-02, YSKM-11-1 x YSH-401, YSKM-11-1 x Benoy, YSKM-11-1 x Pitambari, YSC-75 x NRCYS-05-02, YSC-75 x Benoy, YSC-75 x Pitambari, YSKM-10-2 x NRCYS-05-02, YSKM-10-2 x YSH-401, YSKM-10-2 x Benoy, YSKM-10-2 x Pitambari, YSK9-01 x NRCYS-05-02, YSK9-01 x YSH-401, YSK9-01 x Benoy, YSK9-01 x Pitambari, YSC-80 x NRCYS-05-02, YSC-80 x YSH-401, YSC-80 x Benoy, YSC-80 x Pitambari, K88 x NRCYS-05-02, K88 x YSH-401, K88 x Benoy, K88 x Pitambari, YSC-15 x NRCYS-05-02, YSC-15 x YSH-401, YSC-15 x Benoy, YSC-15 x Pitambari, T42 x NRCYS-05-02, T42 x YSH-401, T42 x Benoy, T42 x Pitambari, YSC-18 x NRCYS-05-02,YSC-18 x YSH-401,YSC-18 x Benoy, YSC-18 x Pitambari, YSK-03 x NRCYS-05-02, YSK-03 x YSH-401, YSK-03 x Benoy, YSK-03 x Pitambari, YSC-21 x NRCYS-05-02, YSC-21 x YSH-401, YSC-21 x Benoy, YSC-21 x Pitambari, YSC-92 x NRCYS-05-02, YSC-92 x YSH-401, YSC-92 x Benoy, YSC-92 x Pitambari, YSC-45 x NRCYS-05-02, YSC-45 x YSH-401, YSC-45 x Benoy, YSC-45 x Pitambari, YSC-30 x NRCYS-05-02, YSC-30 x YSH-401, YSC-30 x Benoy, YSC-30 x Pitambari, YSC-95 x NRCYS-05-02, YSC-95 x YSH-401, YSC-95 x Benoy,YSC-95 x Pitambari, YSC-40 x NRCYS-05-02, YSC-40 x YSH-401, YSC-40 x Benoy, YSC-40 x Pitambari, YSC-46 x NRCYS-05-02, YSC-46 x YSH-401, YSC-46 x Benoy, YSC-46 x Pitambari,	1979		

			YSC-84 x NRCYS-05-02, YSC-84 x YSH-401,YSC-84 x Benoy, YSC-84 x Pitambari			
		F_5	YST-151 x T-44, YST-151 x K88, YST-151 x T-3, YST-151 x T-4, YST-151 x B-9, YST-151 x YSK-1, T-44 x K88,T-44 x T-3, T-44 x T-4, T-44 x B-9, T-44 x YSK-1, K-88 x T-3, K-88 x T-4, K-88 x B-9, K-88 x YSK-1, T-3 x T-4, T-3 x B-9 21, T-3 x YSK-1, T-4 x B-9, T-4 x YSK-1, B-9 x YSK-1	384		
		F_6	YST-151 x YSK-3, YST-151 x YSK-24, YST-151 x YSK-28, YST-151 x YSK-42, YST-151 x K88, YST-151 x YSK-2, YST-151 x YSK-4, YSK-3 x YSK-2 15, YSK-3 x YSK-28, YSK-3 x YSK-42, YSK-3 x K88, YSK-3 x YSK-2, YSK-3 x YSK-4, YSK-24 x YSK-28, YSK-24 x YSK-42, YSK-24 x K88, YSK-24 x YSK-2, YSK-24 x YSK-4, YSK-28 x YSK-42, YSK-28 x K88, YSK-28 x YSK-2, YSK-28 x YSK-4, YSK-42 x K88, YSK-42 x YSK-2, YSK-42 x YSK-4, K88 x YSK-2, K88 x YSK-4, YSK-2 x YSK-4	401		
Crop: Indian mustard						
Bhubaneswar (OUAT RRTTS, Ranital)	Breeding for early maturity, high seed yield strains Mustard suitable for rice-fallows	Fresh single crosses	Agronomic bases: ORM 2019-25, TM 258, NRCHB 101 Donors: DRMRIJ 31(bold seed, high yield, good combining ability) TM 307: Earliness, dwarf height	6 crosses		
		F1		11		
		F2	PM 28 x KMR(E) 19-1, TM 106 x NRCHB 101, PM 25 x ORM 41-3-5	Three F2 populations were grown in large plots and desirable plants having target trait combinations were selected		
	Earliness and high yield	Segregating generations (F3 to F6)		12 crosses	61	
	High yield under late sown conditions	M5-generation	Parents: Kranti, NRCHB101 Dosage: 0.4% EMS, 8hr and 0.7% for 6 hr		57 single plants selected	
Chatha-Jammu	High Seed yield	Fresh crosses	SKJM-5,RH-1676,NPJ-223,PR-2016-4,PBR-385,PR-17-7,DRMR-2018-25,RGN-462,AKMS19-2&DRMRCI-96With DRMRIJ-31,RH-749,NRCHB-101,PM-27&RGN-73	50		
	High Seed yield & White rust resistance	F_1	RSPR-69, RSPR-01, RSPR-03 With RE-11, NC 37362, RE-44, CN105364, IC-597880, RLC-3, RE-8, DRMRMJB-35, DRMRIJ 12-48, DRMRIJ 12-40, NPJ-112,TN-3 , M-34 ,DRMR-2035, DRMR-2019 &Bioysr.	48		
	Breeding for Stress (Moisture Stress)	F_2	RH-1658,SKJM-16,PBR-378,RH-1584,RH-1424,PMM 12-2-18,RSPR-01,DRMR 15-35&OMR4-3-5 With RH-406,RGN-48, RB-50 & RH-725	28		
	High Seed yield	F_3	Attempted using agronomically superior 15 genotypes with RH-761,RB-24& RH725.	36		
		F_4	RSPR-69,RSPR-5,RSPR-1,RSPR-3,RH-1209,RH-0923,SKJM-5,SKJM-3 With NRCHB-101,RH-406 & RH-749	22		
		F_5	RGN-400,DRMRIJ-16-1,PRE-2013-10,DRMRCI-55,NRCHB-101,RH-1207 WITH RH-	15		

			406,PM-25&RH-1573			
		F_6	RSPR-01, RH-30, RSPR-03, RH-749,RSPR-69 & RB-24 with RH-406,RB-50, RH-819 & DRMR 541-44	18		
		F_7	NRCDR-2, NRCHB-101, NPJ-112, DRMRIJ-31, PUSA BOLD, RB-50, RH-749 with RSPR-69 , RSPR-01& RSPR-03	10		
		Advanced lines		14		
Dholi	To develop high temperature tolerant mustard strains for early sown condition	M6	Source material :Rajendra Suflam (i)Dosages of Gamma Rays: 05, 80Kr, 90Kr, 100Kr, 110Kr, 120 Kr (ii) Dosages of Gamma Rays +EMS: 0490Kr +0.2%EMS, 90 Kr+0.3% EMS, 100Kr +0.2%EMS, 100 Kr+0.3% EMS	09	351	199
	Early Maturity, Yield & component traits	Fresh crosses	**Set 01** : RX*DRMRIJ-31, RS*CN-105364, VARUNA*DRMRIJ-31, VARUNA*CN105364, RS*RE44, RS*DRMRJA-35, RS*TN-3, RS*NPJ112, RS*DRMRJA-35, RS*DMRIJ-12-48, RS*DRMRIJ-12-40, RS*NC-37362, RS*RE11, RS*IC597880, RS*M-34 (15 Crosses) **Set 02** : RS*RE11, RS*NC-37362, RS*RE44, RS*CN105364, RS*IC59M880, RS*RE-8, RE-11*NC37362, RE11*RE44, RE11*CN-105364, RE11*IC-597880, RE11*RE8,NC37362*RE44, NC*37362*CN-105364, NC37362*IC597880, NC37362*RE8, RE44*CN105364, RE44* IC594880 , RE44*RE8,CN105364*IC-597880, CN-105364*RE-8,IC597880*RE-8 (21 Crosses)	36	--	--
Kangra	High yielding, early, bold seed, plant architecture	Fresh crosses	DRMRIJ 31 X AKMS 3745,CS 54 X NRCKR 314,NRCKR 314 X CT 517,RLC 3 X Karan rai, AKMS 22 6 X Karan rai brown, AKMS 22-1 X DRMR 6,AKMS 22-2 X NRCHB 101, AKMS 22-3 X NRCHB 101, AKMS 22-4 X DRMR 6, AKMS 22-5 X NRCHB 101, AKMS 22-7 X CS 54, AKMS 22-8 X DRMRIJ 31, AKMS 22-9 X DRMRIJ 31, AKMS 22-10 X DRMR 6, AKMS 22-14 XDRMR 6, AKMS 22-15 X DRMR 6,AKMS 22-18 X Cs 54, AKMS 22-22 X DRMRIJ 31,AKMS 22-22 X CS 54,AKMS 22-28 X NRCHB 101, AKMS 22-24 XDRMR 6,AKMS 22-25 X DRMR 6,AKMS 22-26 X CS 54, AKMS 22-29 X CS 54,AKMS 22-30 X CS 54	25		
		F_1	RE 11 X RE 44,RE 11 X CN 105364,RE 11 X IC 597880, NC 37362 X R E 11, NC 37362 X DRMRJA 35,NC 37362 X DRMRIJ 12-48, NC 37362 X DRMRIJ 12-40, NC 37362 X DRMRIJ 31,RE 44 X NC 37362, RE 44 X CN 105364, RE 44 X DRMRIJ 12-48, RE 44 X LES 39,RE 44 X TN 3,RE 44 X M 34,CN 105364 X Re 11, CN 105364 X NC 37362, CN 105364 X RLC 3,CN 105364 X DRMRIJ 12-40, CN 105364 X DRMRIJ 31,CN 105364 X LES 39,CN 105364 X NPJ 112,IC 597880 X NC 37362,IC 597880 X RE 44,IC 597880 X DRMRJA 35,IC 597880 X M34, RLC 3 X DRMRIJ 12-48, RLC 3 X DRMRIJ 12-40, RLC 3 X LES 39, RLC 3 X NPJ 112, RLC 3 X M 34, RE 8 X RE 11 , RE 8 X RE 44, RE 8 X CN 105364, RE 8 X RLC 3, RE 8 X DRMRIJ 12-40, RE 8 X DRMRIJ 31, DRMRMJA 35 X DRMRIJ 31, DRMRMJA 35 X CN 105364, DRMRMJA 35 X RLC 3, DRMRIJ 12-48 X RE 11.DRMRIJ 12-48 X Les 39, DRMRIJ 12-48 X M 34, DRMRIJ 12-40 X RE 8, DRMRIJ 12-40 X DRMRJA 35, DRMRIJ 12-40 X DRMRIJ 12-48, DRMRIJ 12-40 X NPJ 112DRMRIJ 31 X NC 37362, DRMRIJ 31 X RE 44, DRMRIJ 31 X CN 105364, DRMRIJ 31 XRE 8, DRMRIJ 31 X DRMRIJ 12-48, DRMRIJ 31 X DRMRIJ 12-40, , DRMRIJ 31 X LES 39, DRMRIJ 31 X TN 3, DRMRIJ 31 X NPJ 112, DRMRIJ 31 X M 34, LES 39 X RE 11, LES39 X NC 37362, LES 39 X CN 105364, LES 39 X RLC 3, LES 39 X DRMRIJ 12-48, Les 39 X DRMRIJ 12-40, LES 39 X TN 3, LES 39 X NPJ 112, LES 39 X M 34, TN 3 X RE 44, TN 3 X RLC 3, TN 3 X DRMRIJ 12-40, TN 3 X DRMRIJ 31, TN 3 X M 34, NPJ 112 X RE 11, NPJ 112 XRE 8, NPJ 112 XDRMRMJA 35, NPJ 112 X LES 39, NPJ 112 X M 34,M 34 X Re 11, M 34 X RE 44,M 34 X DRMRIJ 12-48, M 34 X	75		

			DRMRIJ 12-40,M 34 X DRMRIJ 31, M 34 X NPJ 112			
		F_4	AKMS 3745 XAKMS 1002, AKMS 3745 x AKMS 9329, RCC 4 x CT 463, RCC 4 X CT 465	4	20	
		F_5 & Advanced	RCC 4, Kranti, Varuna, Pusa Bold, Geeta, RH 749, DRMRIJ 20, Divya 33, Bausum 2002, NDRE 4, NDRE 7, RH 735, RMM 09-2, SKM 815, NDRE7, NDRE 4, JMM 11, DRMRIJ 31, EC 399299, EC 399301, EC399313, LES 43, PHR2, PBR 378,PAB 2005-19, RH 903, RH 906,NDN11-23, CJ 3761,JMR 08-3, Heera, KBJ80,EJ17,OMK4,RGN 236,NPJ151, ELM 123,	60	30	40
Jhansi	Breeding for high yielding varieties of Indian Mustard	F_1	RE 11 X RE 44,RE 11 X CN 105364,RE 11 X IC 597880, NC 37362 X R E 11, NC 37362 X DRMRJA 35,NC 37362 X DRMRIJ 12-48, NC 37362 X DRMRIJ 12-40, NC 37362 X DRMRIJ 31,RE 44 X NC 37362, RE 44 X CN 105364, RE 44 X DRMRIJ 12-48, RE 44 X LES 39,RE 44 X TN 3,RE 44 X M 34,CN 105364 X Re 11, CN 105364 X NC 37362, CN 105364 X RLC 3,CN 105364 X DRMRIJ 12-40, CN 105364 X DRMRIJ 31,CN 105364 X LES 39,CN 105364 X NPJ 112,IC 597880 X NC 37362,IC 597880 X RE 44,IC 597880 X DRMRJA 35,IC 597880 X M34, RLC 3 X DRMRIJ 12-48, RLC 3 X DRMRIJ 12-40, RLC 3 X LES 39, RLC 3 X NPJ 112, RLC 3 X M 34, RE 8 X RE 11 , RE 8 X RE 44, RE 8 X CN 105364, RE 8 X RLC 3, RE 8 X DRMRIJ 12-40, RE 8 X DRMRIJ 31, DRMRMJA 35 X DRMRIJ 31, DRMRMJA 35 X CN 105364, DRMRMJA 35 X RLC 3, DRMRIJ 12-48 X RE 11.DRMRIJ 12-48 X Les 39, DRMRIJ 12-48 X M 34, DRMRIJ 12-40 X RE 8, DRMRIJ 12-40 X DRMRJA 35, DRMRIJ 12-40 X DRMRIJ 12-48, DRMRIJ 12-40 X NPJ 112DRMRIJ 31 X NC 37362, DRMRIJ 31 X RE 44, DRMRIJ 31 X CN 105364, DRMRIJ 31 XRE 8, DRMRIJ 31 X DRMRIJ 12-48, DRMRIJ 31 X DRMRIJ 12-40, , DRMRIJ 31 X LES 39, DRMRIJ 31 X TN 3, DRMRIJ 31 X NPJ 112, DRMRIJ 31 X M 34, LES 39 X RE 11, LES39 X NC 37362, LES 39 X CN 105364, LES 39 X RLC 3, LES 39 X DRMRIJ 12-48, LES 39 X DRMRIJ 12-40, LES 39 X TN 3, LES 39 X NPJ 112, LES 39 X M 34, TN 3 X RE 44, TN 3 X RLC 3, TN 3 X DRMRIJ 12-40, TN 3 X DRMRIJ 31, TN 3 X M 34, NPJ 112 X RE 11, NPJ 112 XRE 8, NPJ 112 XDRMRMJA 35, NPJ 112 X LES 39, NPJ 112 X M 34,M 34 X Re 11, M 34 X RE 44,M 34 X DRMRIJ 12-48, M 34 X DRMRIJ 12-40,M 34 X DRMRIJ 31, M 34 X NPJ 112	75		
		F_4	AKMS 3745 XAKMS 1002, AKMS 3745 x AKMS 9329, RCC 4 x CT 463, RCC 4 X CT 465	4	20	
		F_5 & Advanced	RCC 4, Kranti, Varuna, Pusa Bold, Geeta, RH 749, DRMRIJ 20, Divya 33, Bausum 2002, NDRE 4, NDRE 7, RH 735, RMM 09-2, SKM 815, NDRE7, NDRE 4, JMM 11, DRMRIJ 31, EC 399299, EC 399301, EC399313, LES 43, PHR2, PBR 378,PAB 2005-19, RH 903, RH 906,NDN11-23, CJ 3761,JMR 08-3, Heera, KBJ80,EJ17,OMK4,RGN 236,NPJ151, ELM 123,	60	30	40
		F_3	Conventional crosses among improved genotypes of *B. juncea/ B. juncea*	10	30	8
		F_4	Juncea YS x RE 14, Juncea x RE 551, HB 9918 x RE 18, HB 9918 x RE 14, EH 2 x RE 44, EH 2 x RE 551, MJB 3 x Donskaja, MJB 3 x RE 8, MJB 3 x RE 13 and IJ 31 x RE 44	10	27	4

		F_4	HB 9925 x RGN 73, HB 9925 x RH 749, DRMR-IJ-31 x RGN- 73, DRMR-IJ-31 x EH_2, DRMR-IJ-31 x DRMR-IJ-17-40, DRMR-IJ-31 x RH- 749, MJB-10 x EH_2, MJB-10 x DRMR-IJ-17-40, MJB-11 x RGN-73, MJB-5 x RH-749	10	15	5
Imphal (CAU)	High yield and non shattering habit suitable for rainfed condition	F6	Local Yella x Kranti	2		
	High yield and oil content	F3	Local Yella x PM 25, Local Yella x JD 6, Local Yella x Pusa bold, Local Yella x DRMR 150-35	4		
Hisar	Breeding for early raya	F1(New crosses)	PM 25 and PM 28 as agronomically superior backgrounds and RH 1999-23, RH 1999-38, IC 520747, IC 426383 and MCN 21-24 and RH 2199-11 as donor sources	10	-	-
		F2	-	3	63/10	-
		F3	-	5	28/12	-
		F4	-	13	41/11	-
		F5	-	4	30/9	-
		F6	-	8	26	-
	Breeding for component traits	F1(New crosses)	RH 1974, RH 2109, RH 2136, RH 2148, RH 2150, RH 2168, RH 2173 and RH 2192 as base population and RH 1424, HEB 1, IC589656, IC 490999, MCN 07-2 and RH 0555 as donor sources	48	-	-
		F2	-	17	424/64	-
		F3	-	9	221/40	-
		F4	-	10	230/71	-
		F5	-	3	112/35	-
		F6	-	13	239	40+91
	Breeding for Disease resistance	F1(New crosses)	RH 1974, RH 2109, RH 2136, RH 2148, RH 2150, RH 2168, RH 2173 and RH 2192 as base population and Pusa Bold (A4-A5)-842 as donor source for white rust resistance	8	-	-
		F2	-	2	32/10	-
		F3	-	2	65/22	-
		F4	-	2	44/11	-
		F5	-	1	31/9	-
		F6	-	1	71	13+12
	Breeding for aphid tolerance	F1(New crosses)	RH 1974, RH 2109, RH 2136, RH 2148, RH 2150, RH 2168, RH 2173 and RH 2192 as base population and RH-7846 as donor source for aphid tolerance	8	-	-
		F2	-	2	20/11	-
		F3	-	1	34/10	-
		F4	-	2	36/17	-
		F5	-	1	28/9	-
		F6	-	1	65	10+14
	Breeding for quality traits	F1(New crosses)	PM 30 (0) as base population and RH (OE) 1706, RH (OE) 1708, RH (OE) 1804, RH (OE) 1806, RH (OE) 1807 and PDZ-1 as donour sources for '0 erucic acid'.	6	-	-
		Intermate	Third, second and first inter mate in 9, 17 and 6 low erucic acid progenies	9,17,6	-	-
		BC 3	-	7	-	-

		BC 2	-	6	-	-
		BC 1	-	10	-	-
		F1	Diverse *B. juncea* genotypes	324	50	50
		MCF1	Diverse *B. juncea* genotypes	42	76	0
		F2	Diverse *B. juncea* genotypes	49	158	0
		MCF2	Diverse *B. juncea* genotypes	66	28	0
		F3	Diverse *B. juncea* genotypes	213	110	0
		MCF3	Diverse *B. juncea* genotypes	49	47	0
		F4	Diverse *B. juncea* genotypes	79	48	0
		F5	Diverse *B. juncea* genotypes	29	26	3
		MCF5	Diverse *B. juncea* genotypes	27	14	14
		F6	Diverse *B. juncea* genotypes	42	4	22
		F7	Diverse *B. juncea* genotypes	6	0	6
		Pedigree Wellington (F7/BC2F6)	White rust resistant parents	37	37	0
	Development of High yielding hybrids- : To identify good combiners	F1 (Single Crosses)	Heera/ DRMRIJ 31,Heera/ Bio-YSR,Heera/ RH 725,Heera/ EC 27-9,Heera/ RC 273,EC61-52-1/DRMR IJ 31,EC61-52-1/ Bio-YSR,EC61-52-1/ RH 725,EC61-52-1/ EC 27-9,EC61-52-1/ RC 273,EC 27-21/ DRMRIJ 31,EC 27-21/ Bio-YSR,EC 27-21/ RH 725,EC 27-21/ EC 27-9,EC 27-21/ RC 273,NPJ 124/ DRMRIJ 31,NPJ 124/ Bio-YSR,NPJ 124/ RH 725,NPJ 124/ EC 27-9,NPJ 124/ RC 273,EC-29-9-1/DRMR IJ 31,EC-29-9-1/ Bio-YSR,EC-29-9-1/ RH 725, EC-29-9-1/ EC 27-9,EC-29-9-1/ RC 273,	25	-	-
	Development of High yielding hybrids-:To identify high yielding combinations	New F1s generated (AxR) for evaluation	PusaAgarni (mori)/RP 11-2-3-1-3-3 , PusaAgarni (mori)/RP 11-2-3-1-3-3, EJ 20 (mori)/RP 11-2-3-1-3-3,EJ 20 (mori)/RP 11-2-3-1-3-3, NPJ 176 (mori)/NPJ 93(mori) R,PusaAgarni (eru)/RP 11-2-3-1-3-3, NPJ 176 (mori)/RP 11-2-3-1-3-3, EJ 17 (eru)/RP 11-2-3-1-3-3, MJA 38 (DRMR mori)/NPJ 93(mori) R, M 37 A/Ogu R F5-46, M 37 A/Ogu R F5-50, M 37 A/Ogu R F5-54, M 37 A/Ogu R F5-66,M 37 A/Ogu R F5-72, M 37 A/Ogu R F5-79, M 37 A/Ogu R F5-107, M 37 A/Ogu R F5-127, M 37 A/Ogu R F5-154, M 37 A/Ogu R F5-169, M 39 A/Ogu R F5-46, M 39 A/Ogu R F5-127, M 39 A/Ogu R F5-138, M 39 A/Ogu R F5-154, M 39 A/Ogu R F5-169, M 39 A/Ogu R F5-177, M 39 A/Ogu R F5-194, M 78A/Ogu R F5-21, M 78A/Ogu R F5-46, M 78A/Ogu R F5-66, M 78A/Ogu R F5-72, M 78A/Ogu R F5-79, M 78A/Ogu R F5-90, M 78A/Ogu R F5-107, M 78A/Ogu R F5-177, DRMRAB 714/Ogu R F5-21, DRMRAB 714/Ogu R F5-50, DRMRAB 714/Ogu R F5-54, DRMRAB 714/Ogu R F5-72, DRMRAB 714/Ogu R F5-79, DRMRAB 714/Ogu R F5-90DRMRAB 714/Ogu R F5-107, PusaKisan (mori) / NPJ 156 (mori)R, PusaKisan (mori) / BPR 543-2(mori)R, PusaKisan (mori) / TN 3(mori)R, PusaKisan (mori) / Heera (long siliqa)mori R, PusaBarani (mori) / NPJ 156 (mori)R, PusaBarani (mori) / LET 17 (mori) R, PusaBarani (mori) / DRMRIJ 31(eru)R, PusaBarani (mori)/EC 27-1 (mori) R, Laxmi (mori) / TN 3 (mori) R, Laxmi (mori) / BPR 543-2 (mori) R, Laxmi (mori) / Heera (long siliqa) (mori) R, Laxmi (mori) / PusaJagannath (eru) R, NPJ 161 (mori) / EC62-1 (mori) R, NPJ 161 (mori) / NPJ 93 (mori) R, NPJ 161 (mori) / RP 4-3-2-3-2-1, NPJ 161 (mori) / SEJ 8 (mori) R, DRMRIJ 31 (mori) / EC 27-2 (mori) R, DRMRIJ 31 (mori) / RP 11-2-2-1-1-3, DRMRIJ 31 (mori) / RP 11-2-2-1-3-2, DRMRIJ 31 (mori) / MJR 13, PusaKisan (eru) / NPJ 156 (mori)R, PusaKisan (eru) / EC 27-2 (mori) R, PusaKisan (eru) / RP 11-2-2-1-1-3, PusaKisan (eru) / RP 4-	82		

			3-2-3-2-1, BioYSR (bar) / EC 27-2 (mori) R, BioYSR (bar) / EC62-1 (mori) R, BioYSR (bar) / SEJ 8 (mori) R, BioYSR (bar) / MJR 13, EJ 17 (bar) / EC 27-2 (mori) R, EJ 17 (bar) / EC62-1 (mori) R, EJ 17 (bar) / SEJ 8 (mori) R, EJ 17 (bar) / RP 11-2-2-1-3-2, MJA 9(DRMR mori) / PusaJagannath (eru) R, MJA 9(DRMR mori) / RP 11-2-2-1-1-3, MJA 9(DRMR mori) / NPJ 93 (mori) R, MJA 9(DRMR mori) / RP 4-3-2-3-2-1, MJA 11(DRMR mori) / Heera (long siliqa)mori R, MJA 11(DRMR mori) / EC 27-2 (mori) R, MJA 11(DRMR mori) / EC62-1 (mori) R DRMRAB 714 / Ogu R F5-96 MJA 11(DRMR mori) / NPJ 93 (mori) R,			
		New Hybrids multiplied for evaluation (AxR)	LES 43 A (mori)/Heera R (BS), LES 43 A (eru)/Heera R (BS LES 43 A (ber)/Heera R (BS,LES 43 A (mori)/LET 17 R, LES 43 A (eru)/LET 17 R,LES 43 A (ber)/LET 17 R, P.Bahar (bar)/NPJ 93R ,P.Kisan (eru)/NPJ 93R,P.Barani (mori)/NPJ 93R, P.Tarak (eru)/NPJ 93R,MA 345 (mori)/NPJ 93R,Vasundra (mori)/NPJ 93R, MJA 9 (mori)/NPJ 93R,MJA 38 (mori)/NPJ 93R,MA 8701 (mori)/NPJ 93R,NPJ 161 (bar)/NPJ 93R,SEJ 8 (mori)/NPJ 93R,SEJ 8 (eru)/NPJ 93R,SEJ 8 (bar)/NPJ 93RLaxmi (eru)/NPJ 93R,Laxmi (mori)/NPJ 93R,SEJ 8 (mori/VSL 11R ,SEJ 8 (eru)/VSL 11R ,P. Tarak (mori)/VSL 11R ,P. Tarak (eru)/VSL 11R,Laxmi (mori)/VSL 11R,Laxmi (eru)/VSL 11R ,NPJ 161 (eru)/VSL 11R ,NPJ 161 (bar)/VSL 11R,P. Kisan (mori)/VSL 11R, P. Kisan (eru)/VSL 11R ,P. Barani (mori)/VSL 11R ,NPJ 139 (bar)/VSL 11R ,NPJ 139 (eru)/VSL 11R,NRCDR-02 (mori)/VSL 11R ,Vasundra (eru)/VSL,11R DRMRIJ-31 (mori)//VSL 11R ,MJA 9 (mori)//VSL 11RMJA 38 (mori)/VSL 11R ,MA 8701 (mori)/VSL 11R ,Laxmi mori /EC62-1R, Laxmieru/EC62-1R,SEJ 8 eru/EC62-1R, P Tarakeru/EC62-1R,P Kisaneru/EC62-1R,NPJ 161 ber /EC62-1R,Laxmi mori /EC62-1R,PusaTarak(eru)/EC 62-67-1R,SEJ-8(mori)/EC 62-67-1R,NPJ 139(eru)/EC 62-67-1R,NPJ 161(mori)/EC 62-67-1R,Laxmi(bar)/EC 62-67-1R,MJA-5(mori)/EC 62-67-1R,MJA 9 (mori)/EC 62-67-1R,MJA 11(mori)/EC 62-67-1R,MA 8701(mori)/EC 62-67-1R	56		
	Development of new CMS lines for hybrid breeding	Backcrosses for development of new CMS lines	BC1/BC3/BC5 generation	10	10	-
	Multiplication of CMS lines for further use	Hand pollination of A line with B	RGN -48 (Mori)/ RGN48,PM -21 (Mori),NRCDR 02 (Mori),Vasundhra (Mori), PusaTarak (Mori),IC 355399 (Mori), SEJ -8 (Mori),PusaAgarni (Mori),PusaAgarni (Mori),PusaBarani (Mori),Laxmi (Mori), EJ -20 (Mori) YS,EJ -20 (Mori) YS,NPJ -161 (Mori),NPJ -176 (Mori),LES - 43 (Mori),DRMRIJ - 31 (Mori),NPJ -93 (Eru),PusaTarak (Eru),Laxmi (Eru), PusaAgarni (Eru),NPJ 176 (eru EJ 17 (eru),LES 43 (eru NPJ 161 (eru), SEJ 8 (bar),Laxmi (bar),PusaAgarni (bar), NPJ 124 (bar),EJ 17 (bar),NPJ 161 (bar),MA 8701 (Hisar, mori),MJA 5 (DRMR mori),MJA 9 (DRMR mori),MJA 11 (DRMR mori), MJA 38 (DRMR mori),Pusa MS 2-3A (ber)			
	Development of new fertility restorers for hybrid breeding	Backcrosses/pedigree selection	BC1F5/BC1	8	8	-
	Generating mapping populations (RIL) for mapping of powdery mildew resistance	F7:F8	PMW25/RDV 29	246	246	-
ICAR-IARI,	Enhancement of oil and meal quality coupled with	F_1	MSTQ21-22/PDZM33, MSTQ21-22/RLC3, RH1706/PM32, QM21-1/PM32, RH(0E)1612/PM32, RH(0E)1808/PM32, PDZM33/PM32, IVT22-14/PM32, IVT22-15/PM32	9	-	-

New Delhi	improved yield in Indian mustard					
		Multiple crosses F_1	MSTQ21-22/RCH1, PDZ11// PM32/PDZM33, PDZ11 //PM32/RCH-1,DRMRQ 143-9 // PDZM31/RCH-1, DRMRQ 143-9 //PDZ11/PDZM33, DRMRQ 143-9 //PDZ11/RLC3, RH (0E) 1808// PDZM31/PDZM33, RH (0E) 1808 // PDZM31/RLC3 etc.	19	-	-
		F_2	Improved genotypes, conventional varieties, low erucic and/or low glucosinolates varieties	33	189(0/00)	-
		BC_1F3	Improved genotypes, conventional varieties, low erucic and/or low glucosinolates varieties	40	69(0) + 52(00)	-
		F_3	Improved genotypes, conventional varieties, low erucic and/or low glucosinolates varieties	42(0)+11(00)	86(0) + 24(00)	-
		F_4	Improved genotypes, conventional varieties, low erucic and/or low glucosinolates varieties	27(0)+34(00)	50(0) + 69(00)	-
		F_5	Improved genotypes, conventional varieties, low erucic and/or low glucosinolates varieties	23(0)+02(00)	42(0) + 07(00)	-
		F_6	Improved genotypes, conventional varieties, low erucic and/or low glucosinolates varieties	24(0)+38(00)	-----	16(0) +20(00)
		F_7	Improved genotypes, conventional varieties, low erucic and/or low glucosinolates varieties	20(0)+32(00)	-----	14(0) + 24(00)
Ludhiana	*Brassica juncea*(Conventional): Resistance to abiotic stresses	Introgression sets	*B. juncea x E. abyssinicum* *B. junceax D.tenisiliquae*	26	145	--
	Separating mustard gene pools (Cycle 3)	Chain crossing	Pool A (22), Pool B (17)	39	--	--
	For early maturity and productivity traits	Fresh cross	PBR-357 X IVT-TS-22-5, PBR-357 X IVT-TS-22-7, PBR-357 X IVT-TS-22-8, PBR-357 X IVT-TS-22-9, PBR-357 X IVT-TS-22-12, PBR-357 X IVT-TS-22-13, PBR-357 X IVT-TS-22-18, PBR-357 X IVT-TS-22-20, PBR-357 X IVT-TS-22-22, PBR-357 X IVT-TS-22-23, PBR-357 X IVT-TS-22-27, (JC-1 X DRMRIJ-31) X (JC-1 X NPJ-112), (JC-1 X DRMRIJ-31)X (JC-15 X NC-37362), (JC-1 X DRMRIJ-31) X (JC-15 X RE-44), (JC-1 X RE-44) X (JC-1 X NPJ-112), (JC-1 X NPJ-112) X (JC-15 X RE-8), (PBR-357X M-34) X (PBR-758-1 X IC-597880), (PBR-758-1 X RE-8) X (JC-36 X TN-3), (PBR-788-1 X IC-597880) X (PBR-758-1 X M-34), (PBR-788-1 X RE-8) X IVT-TS -22-23, (PBR-813-2 X RE-44) X IVT-TS -22-18, (PBR-813-2 X M-34) X IVT-TS -22-23, (PBR-813-2 X NPJ-112) X (PBR-814-1 X DRMRIJ-35), (PBR-814-1 X DRMRIJ-35) X (PBR-813-2 X NPJ-112), (PBR-814-1 X RE-8) X IVT-TS -22-12, (PBR-814-1 X RE-11) X IVT-TS -22-12, (PBR-814-1 X NPJ-112) X IVT-TS -22-18, (PBR-814-1 X NC-37362) X IVT-TS -22-18, (PBR-825-5 X RE-44) X IVT-TS -22-12, (PBR-939 X DRMRIJ-31) X (PBR-357 X NPJ 253), (PBR-939 X RE-8) X (PBR-939 X RE-11), (PBR-939 X RE-11) X IVT-TS-22-23, (RH-725 X PRB- 2016-1) X PBR-587, (RH-725 X PRB- 2016-1) X (PBR-552 X RB- 109), (RH-725 X PRB- 2016-1) X (PBR-587)	35		
	White Rust		PBR-357 X (EEC-2 X PWR-13-8 X PWR-13-8)	1		
	Alternaria Blight	F1	Higher yield and productivity related traits:	95		

			PBR-357 X HUJM- 20-9, PBR-357 X RB- 109, PBR-357 X DRMRIJ 18-62, PBR-357 X RH-1934, PBR-357 X DRMR- 2019-19, PBR-357 X NPJ 253, PBR-357 X PRB- 2016-1, PBR-357 X DRMRIJ-31, PBR-357X RE-8, PBR-357X RE-11, PBR-357X RE-44, PBR-357X M-34, PBR-357X NC-37362, PBR-357X NPJ-112, PBR-357 X IC-597880, PBR-552 X HUJM- 20-9, PBR-552 X RB- 109, PBR-552 X NPJ 252, PBR-552 X Kranti, PBR-552 X DRMR- 2019-19, PBR-552 X NPJ 253, PBR-552 X PRB- 2016-1, PBR-758-1 X DRMRIJ-31, PBR-758-1 X NC-37362, PBR-758-1 X NPJ-112, PBR-758-1 X RE-8, PBR-758-1 X RE-11, PBR-758-1 X RE-44, PBR-758-1 X IC-597880, PBR-758-1 X M-34, PBR-758-1 X TN-3, PBR-788-1 X DRMRIJ-31, PBR-788-1 X IC-597880, PBR-788-1 X NC-37362, PBR-788-1 X NPJ-112, PBR-788-1 X RE-8, PBR-788-1 X RE-11, PBR-788-1 X RE-44, PBR-788-1 X M-34, PBR-813-2 X DRMRIJ-31, PBR-813-2 X NPJ-112, PBR-813-2 X NC-37362, PBR-813-2 X RE-8, PBR-813-2 X RE-11, PBR-813-2 X RE-44, PBR-813-2 X M-34, PBR-813-2 X IC-597880, PBR-813-2 X TN-3, PBR-814-1 X DRMRIJ-31, PBR-814-1 X CN-105364, PBR-814-1 X DRMRIJ-35, PBR-814-1 X RE-8, PBR-814-1 X RE-11, PBR-814-1 X RE-44, PBR-814-1 X IC-597880, PBR-814-1 X M-34, PBR-814-1 X NPJ-112, PBR-814-1 X NC-37362, PBR-814-1 X TN-3, PBR-825-5 X CN-105364, PBR-825-5 X DRMRIJ-31, PBR-825-5 X DRMRIJ-35, PBR-825-5 X IC-597880, PBR-825-5 X NC-37362, PBR-825-5 X NPJ-112, PBR-825-5 X RE-8, PBR-825-5 X RE-11, PBR-825-5 X RE-44, PBR-825-5 X M-34, PBR-825-5 X TN-3, PBR-939 X DRMRIJ-31, PBR-939 X RE-8, PBR-939 X RE-11, PBR-939 X RE-44, PBR-939 X IC-597880, PBR-939 X M-34, PBR-939 X NC-37362, PBR-939 X NPJ-112, PBR-939 X TN-3 (79) Rainfed: PBR-91 X HUJM- 20-9, PBR-91 X RB- 109, PBR-91 X DRMRIJ 18-62, PBR-91 X NPJ 252, PBR-91 X NPJ 253, PBR-91 X PRB- 2016-1, RH-725 X HUJM- 20-9, RH-725 X DRMRIJ 18-62, RH-725 X DRMR- 2019-19, RH-725 X PRB- 2016-1 (10) White rust resistance: WRR-21-13 X NPJ 252, WRR-21-13 X NPJ 253, WRR-21-18 X NPJ 252, WRR-21-19 X NPJ 252, WRR-21-19 X NPJ 253, WRR-21-20 X NPJ 252 (6)			
		F2	High yield and early: BAUM-08-14 X DTM-220, BAUM-08-14 X DTM-235, DM-28 X RH-1999-18, DTM-220 X DTM-214, DTM-235 X DTM-214, DTM-235 X DTM-220, JC-40 X RLC-7, NPJ-229 X RH-1999-42, PM-28 X BAUM-8-14, PM-28 X DTM-214, PM-28 X DTM-220, PM-28 X NPJ-229, PM-28 X PRE-17-2, PM-28 X PRE-17-5, PM-28 X RH-1999-42, PRE-17-2 DTM-220, PRE-17-2 X BAUM-08-14, PRE-17-2 X DTM-220, PRE-17-2 X PRE-17-5, PRE-17-2 X RH-1999-18, PRE-17-2 X RH-1999-42, PRE-17-5 X DTM-214, PRE-17-5 X DTM-214, PRE-17-5 X DTM-220, PRE-17-5 X DTM-235, PRE-17-5 X RH-1999-18, PRE-17-5 X RH-1999-42, RH-1999-18 X BAUM-08-14, RH-1999-18 X DTM-214, RH-1999-18 X DTM-220, RH-1999-18 X DTM-235, RH-1999-42 X BAUM-H-14, RH-1999-42 X DTM-214, RH-1999-42 X DTM-235, RM-28 X NPJ-230 (34) Higher yield and productivity related traits: AD-101 X WRR-20-1, AD-101 X WRR-20-1, AD-101 X WRR-20-1, AD-104 X WRR-20-1, AD-64 X PBR-91, AD-64 X WRR-20-1, AD-64 X WRR-20-1, AKMS-19-2 X DRMR-CI-117, AKMS-19-2 X RE-11, AKMS-19-2 X SKM-17-12, AKMS-19-2 X XNPJ-232, DRMR-CI-117 X IM-59, DRMR-CI-117 X NPJ-232, DRMR-CI-117 X RE-11, DRMR-CI-117 X RE-14,	215	127	

			DRMR-CI-118 X TM-236-6, Giriraj X DRMR-CI-117, GIRIRAJ X IM-59, GIRIRAJ X IVT TS-20-22, Giriraj X IVT-TS-20-15, Giriraj X IVT-TS-20-15, Giriraj X IVT-TS-20-15, GIRIRAJ X IVT-TS-20-22, GIRIRAJ X IVT-TS-20-22, Giriraj X PBR-357, GIRIRAJ X PBR-507, GIRIRAJ X RE-11, GIRIRAJ X RE-13, GIRIRAJ X RH-725, IM-39 X IM-59, JC-33 X RE-41, JC-6 X IM-59, JKMS-19-2 X RE-13, KMR-19-3 X DRMR-CI-117, KMR-19-3 X NPJ-232, KMR-19-3 X RE-11, KMR-19-3 X RH-1799-24, KMR-19-3 X SKM-17-12, NPJ-229 X PRE-7-5, NPJ-229 X RH-1999-18, NPJ-472 X JA-39, NPJ-472 X JA-42, BR-357 X AKMS-19-2, PBR-357 X DRMR-CI-117, PBR-357 X IM-59, PBR-357 X IVT-15-20-15, PBR-357 X IVT-TS-20-22, PBR-357 X JC-21, PBR-357 X JC-33, PBR-357 X JC-36, PBR-357 X NPJ-231, PBR-357 X PBR-507, PBR-357 X RH-725, PBR-357 X RL-1359, PBR-357 X SKM-1712, PBR-378 X GIRIRAJ, PBR-378 X PBR-357, PBR-378 X RH-725, PBR-385 X IM-39, PBR-385 X IM-59, PBR-385 X RH-1599-41, PBR-450 X JA-23, PBR-450 X JA-42, PBR-91 X JC-33, PHR-126 X WRR-20-1, PM-26 X RLM-619, PR-17-7 X DRMR-CI-117, PR-17-7 X RH-1799-24, PRE-17-5 X RH-1999-18, RB-50 X RH-1424, RCH-1 X WRR-20-1, RE-11 X JC-6, RE-11 X JM-59, RE-11 X RE-13, RE-11 X RE-14, RE-13 X IM59, RE-13 X RE-14, RE-13 X TC-6, RE-14 X JC-6, RH-749 X IM-59, RH-0725 X DRMR-CI-118, RH-0725 X NPJ-233, RH-0725 X PBR-450, RH-1424 X DRMR-CI-117, RH-1424 X IM-59, RH-1424 X JC-6, RH-1424 X NPJ-232, RH-1424 X RE-11, RH-1424 X RE-13, RH-1424 X RE-14, RH-1799-24 X RGN-472, RH-725 X JA-23, RH-725 X PBR-357, RH-725 X RH-1424, RH-749 X DRMR-CI-117, RH-749 X PBR-357, RH-749 X PBR-507, RH-749 X RE-13, RH-749 X RH-1424, RLC-10 X PDZ-12, RLC-10 X RE-46, RLC-619 X PBR-450, RLM-69 X PBR-385, SKM-1712 X IM-59, SKM-1712 X RE-11, SKM-1712 X RE-13, TM-263-6 X NPJ-233, EC 414319 X IL 18-5121, EC 414319 X IL 18-5246, EC 414319 X IL 18-5258, DRMR 40 X IL-18-5123, DRMR 40 X IL-18-5151, (DRMR IJ 31 X BC-14) X (PUSA AGRANI X BC1-5), (DRMR IJ 31 X BC-14) X (DRMR IJ 51 X BC1-4) Rainfed: BAUM-08-18 X JA-39, BAUM-8-18 X PBR-450, DRMR-5J-47 X JA-39, DRMR-CI-118 X BAUM-8-18, DRMR-CI-118 X JA-39, DRMR-CI-118 X JA-42, DRMR-CI-118 X JA-42, DRMR-CI-118 X RGN-472, DRMR-CI-118 X TM-236-6, DRMR-CI-118 X WPJ-233, DRMR-SI-47 X DRMR-CI-118, DRMR-SI-47 X JA-23, DRMR-SJ-47 X BAUM-08-18, DRMR-SJ-47 X TM-263-C, NPJ-233 X BAUM-08-18, NPJ-233 X JA-42, PBR-450 X JA-39, PBR-91 X JC-40, PBR-91 X RLC-3, PBR-97 X BAUM-08-18, PBR-97 X JA-23, PBR-97 X JA-39, PBR-97 X JA-42, PBR-97 X PBR-450, PBR-97 X RB-50, PBR-97 X RH-1424, PBR-97 X TM-263-6, RB-50 X BAUM-0-18, RB-50 X DRMR-CI-118, RB-50 X JA-39, RB-50 X NPJ-233, RB-50 X PBR-450, RB-50 X RGN-472, RB-50 X RH-0725, RB-50 X TM-263-6, RGN-472 X BAUM-08-18, RGN-472 X JA-39, RGN-472 X JA-39, RGN-472 X NPJ-233, RGN-472 X PBR-450, RGN-472 X TM-263-6, RH-0725 X BAUM-08-18, RH-0725 X RGN-472, RH-0725 X RH-1424, RH-0725 X RH-1799-24, RH-1799-24 X BAUM-08-18, RH-1799-24 X DRMR-SJ-47, RH-1799-24 X JA-39, RH-1799-24 X JA-42, RH-1799-24 X NPJ-232, RH-1799-24 X NPJ-233, RH-1799-24 X PBR-450, RH-1799-24 X TM-263-6, RH-1799-4 X JA-39, RH-725 X DRMR-SI-47, RH-725 X JA-39, RH-725 X PM-263-6 White rust: AD-104 X WRR-20-1, DONSKAZA X PBR-507, PBR-97 X RH0725, PDZ-11 PBR-450, PDZ-11 X DONSKAZA, PDZ11 X PBR-450, PDZ-11 X PDZ-12, PDZ-11 XPBR-385, PDZ-12 X DONSKAZA, PDZ-12 X PBR-507, PDZ-12 X RLM-619, PHR-126 X WRR-			

			20-1, PM-25 X PRE-17-5, PRE-17-2 X BAUM-08-14			
		F3		26	7	
		F4		67	21	
		F5/F6		168	57	
	Heat and Drought	F2	DRMR 150-35 X DRMR 541-44	1	5	
	Heat tolerant at early stage	F2	JN 032 X DRMR CI 116	1	5	
	Drought	F3	NRCHB 101 X RH 725, DRMR 1165-40 X DRMR CI 70, DRMR 1165-40 X RH 406	3	12	
	Heat tolerant at seedling and terminal stage	F3	DRMR 150-35 X DRMR 2059, NRCDR-02 X DRMR 2059	2	10	
Brassica juncea (0/00):	For early maturity and productivity traits	F_1	JC-1 X DRMRIJ-31, JC-1 X RE-11, JC-1 X RE-44, JC-1 X NPJ-112, JC-1 X TN-3, JC-15 X DRMRIJ-31, JC-15 X DRMRIJ-35, JC-15 X NC-37362, JC-15 X NPJ-112, JC-15 X IC-597880, JC-15 X CN-105364, JC-15 X TN-3, JC-15 X RE-8, JC-15 X RE-11, JC-15 X RE-44, JC-16 X DRMRIJ-31, JC-16 X RE-44, JC-16 X M-34, JC-16 X TN-3, JC-36 X DRMRIJ-31, JC-36 X NPJ-112, JC-36 X RE-44, JC-36 X TN-3 , PDZ-11 X DRMRIJ-31, PDZ-11 X M-34, PDZ-11 X NPJ-112, PDZ-11 X RE-44, PDZ-11 X TN-3, RCH-1 X DRMRIJ-31, RCH-1 X NPJ-112, RCH-1 X RE-44, RCH-1 X TN-3, RLC-3 X CN-105364, RLC-3 X DRMRIJ-31, RLC-3 X DRMRIJ-35, RLC-3 X IC-597880, RLC-3 X RE-8, RLC-3 X RE-11, RLC-3 X RE-44, RLC-3 X NE-37362, RLC-3 X NPJ-112, RLC-3 X TN-3	42		
		F_2		35		
		F_3		65		
		F_4		50		
		F_5		25		
	For quality traits	RILs	NUDHYJ-4 x RL 1359 RL1359 x CBJ001	2		
Hybrid development *(B. juncea*-conventional mustard*)*	For higher productivity	Advanced generation CMS lines developed/ maintained	Natural mustard :89 Introgressed mustard: 151 Resynthesized mustard:36 Exotic mustard:25 Determinate mustard: 162	463		
	Fertility Restorers maintained	Fixed	06	06	-	-
	Improving fertility restorers for White rust resistance and Herbicide tolerance	Varied generations	Crosses with characterized donor genotypes, followed by backcrossing with the recipient fertility restorers.	36 10	35	3
	Induced mutagenesis for earliness and improved seed size in European gene pool restorers	M3-M4 generations	Induced mutagenesis	04		
Hybrid		CMS lines		100		

development (*B.juncea* Quality mustard)		developed/ maintained				
		Fertility Restorers		2		
Kanpur	Breeding mustard varieties for normal sown situation (Set I)	Fresh crosses Set -I	Azad Mahak, Surekha, NDR-8501, PR-21, PR-20, Kranti and Ashirwad were attempted F_0 seeds of 21	21		
		Set – II	NRCDR-2, Maya, RH-749, Giriraj, PR-21, Pusa Mustard-30 and RH-725 were attempted F_0 seeds of 21	21		
		Set – III	KMR(E)17-1, KMR(E)17-2, KMR(E)16-1, KMR(E)16-2, KMR(E)18-1, KMR(E)18-2, and TM-88 were attempted F_0 seeds of 21	21		
		Set – IV	KMR(L)17-5, Matura rai, NRCDR-2, Narendra Rai-4, Azad Mahak, PR-21, NDR-8501, Maya, Varuna and Rohini were attempted F_0 seeds of 45 crosses were procured	45		
		Set – V	Basanti, PR-20, Varuna, Azad Mahak, Maya, Rohini, NRCDR-2, Kanti, KMR(L)17-5, NDR 8501, Jagrati, Narendra Rai-4, Lahar, Lotni Gota and Guchhe Rai and 05 testers namely PR-21, Uravashi, NDRE-4, Mathura Rai and NDRE-7.	75		
		Set-VI	15 Parental lines viz:, RE-11, NC-3736, RE-44, CN-105364, IC-597880, RLC-3, RE-8, DRMRMJA-35, DRMRIJ-12-48, DRMRIJ 12-40, DRMRIJ-31, LES-39, TN-3 NPJ-112 and M-34 and 4 testers namely Varuna, Kanti, Basanti and Rohini	60		
		F_2	Basanti X Varuna , Basanti X Urvashi , Basanti X NRCDR-2, Basanti X KMR 19-1, Basanti X KMR 19-2 , Basanti X RH-749, , Basanti X RH-406 , Basanti X Azad Mahak , Varuna X Urvashi20 , Varuna X NRCDR-2, Varuna X RH-749 , Varuna X IJ -31, Varuna X RH-406, Varuna X Azad Mahak 18, Urvashi X NRCDR-2, Urvashi X KMR 19-1, Urvashi X KMR 19-2 , Urvashi X IJ -31 , Urvashi X RH-406, NRCDR-2 X KMR 19-1, NRCDR-2 X KMR 19-2, NRCDR-2 X RH-749 , KMR 19-1 X . KMR 19-2, KMR 19-1 X RH 749,, KMR 19-1 X IJ-31, 36. KMR 19-2 X RH 749,KMR 19-2 X IJ -31 , KMR 19-2 X Azad Mahak , RH 749 X IJ-31 , DRMR IJ-31 X RH-406	3011		
		F_3	NRCDR-2 x NRCHB-101, NRCDR-2 x Pusa mustard-2, NRCDR-2 x RLM-198, NRCDR-2 x KMR-13-4, NRCDR-2 x KMR-14-4, NRCDR-2 x Pusa bold, NRCHB-101 x Pusa mustard-21, NRCHB-101 x RLM-198, NRCHB-101 x KMR-13-4, NRCHB-101 x KMR-14-4, NRCHB-101 x Pusa bold, Pusa mustard-21 x RLM-19, Pusa mustard-21 x KMR-13-4, Pusa mustard-21 x KMR-14-4, RLM-198 x Pusa bold, RLM-198 x KMR-13-4, RLM-198 x KMR-14-4, KMR-13-4 x KMR-14-4, KMR-13-4 x Pusa bold, KMR-14-4 x Pusa bold	370		
		F_4	NRCDR-2 x Pusa jai kisan, NRCDR-2 x JM-2, NRCDR-2 x Geeta, NRCDR-2 x Urvashi, NRCDR-2 x RGN-73, NRCDR-2 x Maya, NRCDR-2 x CS-52, Pusa jai kisan x JM-2, Pusa jai kisan x Geeta, Pusa jai kisan x Urvashi , Pusa jai kisan x RGN-73, Pusa jai kisan x Maya, Pusa jai kisan x CS-52, JM-2 x Geeta, JM-2 x Urvashi , JM-2 x RGN-73, JM-2 x Maya, Geeta x Urvashi, Geeta x RGN-73, Geeta x Maya,Geeta x CS-52,Urvashi x RGN-73,Urvashi x Maya, Urvashi x CS-52, RGN-73x Maya, RGN-73x CS-52, Maya x CS-52			
		F_5	Varuna x Pusa bold,Varuna x RLM 198, Varuna x Rajat, Kranti x Rajat, Pusa bold x RLM 198, Pusa bold x Maya, Vardan x Pusa bold, Vardan x NDR-8501, Vardan x Laha-101, Vaibhav x Pusa bahar, Vaibhav x Pusa bold, Vaibhav x NDR-8501, Vaibhav x Laha-101, Pusa bahar x Pusa bold, Pusa bahar x NDR-8501, Pusa bahar x Laha-101, Pusa bold x NDR-8501, Pusa bold	390		

			x Laha-101, NDR-8501 x Laha -101			
		F_6	Varuna x Pusa bold, Varuna x RC-781,Varuna x RH-198,Varuna x Pusa Jagannath,Varuna x Jawahar mustard-1,NUDH x Pusa bold,NUDH x RC-781,NUDH x RH-198,NUDH x Pusa Jagannath,NUDH x Jawahar mustard-1	201		
		F_7	Varuna x Urvashi, Varuna x Maya, Varuna x Kranti, Varuna x NDR-8501, Varuna x Pusa bold, Varuna x Aravali, Urvashi x Maya, Urvashi x Kranti, Urvashi x NDR-8501, Urvashi x Pusa bold, Urvashi x RH-30, Maya x Kranti, Maya x NDR-8501, Maya x Pusa bold, Maya x Pusa bold, Maya x RH-30, Kranti x NDR-8501	319		
		F_8	Kranti x Pusa bold, Seeta x Varuna, Seeta x Pusa bold, Seeta x Aravali, Seeta x Sej-2, Pusa bold x Sej-2, Pusa bold x Durgamani, Pusa bold x Aravali, Ashirwad x Varuna, Ashirwad x Maya, Ashirwad x Kanti, Ashirwad x Jawahar-1, Ashirwad x Vaibhav, Rohini x Vardan, Rohini x Basanti, Rohini x Maya, Rohini x Pusa bold, Rohini x Kranti, Rohini x Pusa basant			
Morena	High seed yield and quality	F_1	Crosses among RE-11,NC-37362,RE-44,CN-105364,IC-597880,RLC-3,RE-8,DRMRMJB-35,DRMRIJ-12-48,DRMRIJ-12-40,DRMRIJ-31,LES-39,TN-3,NPJ-112,M-34	60	300	
		F_2	Crosses among JM-1, RMM 10-1-1, JM-2, JMM991,JMWR 945-2-2, JMM 927, RVM-3, Giriraj, L-4, L-6, RVM-2, RH 749,Kranti,Vasundhara,PM 25,PM 27,PM 30	45	225	
		F_3	RGN 73, Kranti, PM 25,PM 26,PM 27,PM 28, JMWR 908-1,Giriraj,RH 749,	23	115	
		F_4	Crosses among Pusa Jagannath, JM-2, DRMRIJ-31, NRCHB-101, RVM-1	4	20	
		F_5	Crosses among JMM-09-1-1 x Kranti	1	5	
		F_6	Crosses among JM 4, RDZ-6 x MRNJ-77, DRMRIJ-15-85	2	10	
		F_7	Crosses among 44 S 31 x Kranti , 44 S 31 x DMH 1, PM-28 x Pusa Mustard- 25, Pusa Mustard-25 x PM-28, Pusa Mustard- 25	4	20	
		F_{11}	JM-1 x L-4	1	5	
		F_{14}	MJA-3 x HUJM 0201	1	5	
	Identification of good combiners for seed yield and WRR quality	Fresh crosses	Fresh crosses were made during rabi 2022-23 Crosses among Radhika, Brijraj, RVM-3,DRMR-1165-40	12		
Nagpur	Development of high yielding varieties with high oil content and boldness.	F_1	Agronomical superior genotypes ACN 141, ACN 184, TAM 108-1 and NRCHB 101 as base population and RE 11, NC 37362,RE 44, CN 105364, IC 597880, RLC 3, RE 8, DRMRIJ 12-48, DRMRIJ 12-40, DRMRIJ 31, LES 39, TN 3, NPJ 112 and M34 as donor source	60 crosses		
		F_3	Kranti, RH 406, NRCHB 101, RH 749 and Giriraj as base population and Geeta as donor for tetra loccule	9 Crosses		
		F_4	NRCHB 101, RH-749, Giriraj, RH 406, P M-31 and Kranti	28 Crosses		
		F_5	Pusa bold and Bio-902 mutants were crossed	28 Crosses		
	Development of short duration varieties	Fresh crosses	Agronomical superior genotypes, TAM 108-1, Kranti , ACN 9, JD -6, Bio 902 and NRCHB 101 as base population and 10 Early lines *B. juncea* (EC-414283, IC-267699, IC-414294, IC-332734, EC-414298, IC-337386, IC-355350, IC-375924, IC-426322 and IC-491600) and 10 early lines of Toria (IC-23011, IC122567, IC-76640, IC363694, IC 363300, IC-19218, IC-399782, IC363639, IC- 23081 and IC-76678) as donor source	120 crosses		

		F_2	Bhawani, TAM 108-1, Kranti, Bio 902, ACN-9, PM 28, PM 26, NRCHB 101, and Local (lambat)	45		
	Development of varieties resistant to powdery mildew	F_1	RE 11, NC 37362,RE 44, CN 105364, IC 597880, RLC 3, RE 8, DRMRIJ 12-48, DRMRIJ 12-40, DRMRIJ 31, LES 39, TN 3, NPJ 112 and M34 as base population and as PC-6 donor source	15 crosses		
		F_1, F_2, and BC_1	TAM 108-1, ACN -9 and Kranti base population and PC-6 as donor source	3 crosses		
	Development of varieties for terminal heat tolerance	Fresh crosses	Attempted using terminal heat tolerance Line – Radhika, Krishna, Brijraj and Narendra rai Tester-TAM 108-1, Kranti and ACN 237	12 crosses		
		F_1	ACN 9, Bhavani, and CG Sarso as base population and agronomical superior genotypes RE 11, NC 37362,RE 44, CN 105364, IC 597880, RLC 3, RE 8, DRMRIJ 12-48, DRMRIJ 12-40, DRMRIJ 31, LES 39, TN 3, NPJ 112 and M34 as donor source	45 crosses		
	Development of varieties for double zero.	Fresh crosses	Attempted using quality mustard lines -PDZM-31, DRMRQ-1-5, LES 39, RLC 3, NUDH YJ 6 and NUDH 18, Tester-TAM 108-1, Kranti and ACN 237	18		
		F_1	Quality mustard lines viz. LES 39, RLC 3, NUDH YJ 6, NUDH 18, PDZM-31 and DRMRQ-1-5 were crossed in full diallel fashion	30		
	Transferring of powdery mildew resistance and terminal heat tolerance into *B. juncea*	BC_1 F_3	(ACN 9 x ACN 202) x TAM 108-1	20		-
			(P. Bold x ACN 202) x TAM 108-1	20		-
			(ACN 9 x ACN 202) x ACN 9	3		-
			(P. Bold x ACN 202) x P. Bold	10		-
		BC_2 F_2	(ACN 9 x ACN 202) x TAM 108-1) x TAM 108-1	20		
			(ACN 9 x ACN 202) x ACN 9) x ACN 9)	05		
		BC_2 F_3	(P. Bold x ACN 202) x P. Bold) x P. Bold	07		-
		BC_1F_2	(TAM 108-1 x PC 5) x TAM 108-1	05		
			(PC 6 x TAM 108-1) x TAM 108-1	11		-
			(ACN 9 x PC 6) x ACN 9	06		-
			(Kranti x PC 6) x Kranti	04		
			(Bio 902 x PC 6) x Bio 902	14		
			(NRCHB 101 x PC 6) x NRCHB 101	02		
			(NRCHB 101 x PC 5) x NRCHB 101	03		
			(PC 6 x NRCHB 101) x NRCHB 101	04		
		Interspecific F_4	NRCHB 101 x *B. rapa*	05		
		Interspecific F_3	NRCHB 101 x *B. napus*	06		
			Bio 902 x *B. rapa*	06		
			ACN 9 x ACN 202	10		
			P. Bold x ACN 202	10		
			TAM 108-1 x *B. rapa*	07		
			Kranti x *B. rapa*	03		
			ACN 9 x *B. rapa*	02		
		Interspecific Multiple crosses	(Bio 902 x *B. rapa*) x ((ACN 9 x ACN 202) x TAM 108-1)	06		
			(Bio 902 x *B. rapa*) x NRCHB 101 x *B. napus)*	04		

			ACN 9 x *B. rapa*) x (ACN 9 x ACN 202) x ACN 9)	12		
Pantnagar	Early sown	Fresh crosses	NPJ-209 × PRE-18-1, NPJ-209 × PRE-18-10, NPJ-209 × PRE-22-10, NPJ-209 × PRE-2018-3, PR- 19 × PRE-18-1, PR- 19 × PRE-18-10, PR- 19 × PRE-22-10, PR- 19 × PRE-2018-3, PM-27 × PRE-18-1, PM-27 × PRE-18-10, PM-27 × PRE-22-10, PM-27 × PRE-18-3, PM-25 × PRE-18-3, PM-25 × PRE-18-3, PM-25 × PRE-18-1, PM-25 × PRE-18-10, PM-25 × PRE-22-10, PM-25 × PRE-2018-3, PM-28 × PRE-18-1, PM-28 × PRE-18-10, PM-28 × PRE-22-10, PM-28 × PRE-2018-3, NPJ-253 × NDRE-4, NPJ-253 × PR-19, NPJ-253 × NPJ-209, NPJ-253 × PM-25, Giriraj × NDRE-4, Giriraj × PR-19, Giriraj × NPJ-209, Giriraj × PM-25, PRB-16-1 × NDRE-4, PRB-16-1 × PR-19, PRB-16-1 × NPJ-209, PRB-16-1 × PM-25, PRB-21-2 × NDRE-4, PRB-21-2 × PR-19, PRB-21-2 × NPJ-209, PRB-21-2 × PM-25, PRB-21-2 × PRE-18-9, PRB-21-2 × PRE-16-4, Albeli × NDRE-4, Albeli × PR-19, Albeli × NPJ 209, Albeli × PM-25, PRE-20-1 × NDRE-4, PRE-20-1 × PR-19, PRE-20-1 × NPJ 209, PRE-20-1 × PM-25, PRE-15-1 × NDRE-4, PRE-15-1 × PR-19, PRE-15-1 × NPJ 209, PRE-15-1 × PM-25, PRE-16-4 × NDRE-4, PRE-16-4 × PR-19, PRE-16-4 × NPJ 209, PRE-16-4 × PM-25, PRE-17-2 × NDRE-4, PRE-17-2 × PR-19, PRE-17-2 × NPJ 209, PRE-17-2 × PM-25, PRE-17-2 × PRE-18-9, PRE-17-2 × PRE-16-4, RH 1656 × NDRE-4, RH 1656 × PR-19, RH 1656 × NPJ 209, RH 1656 × PM-25, RH 1656 × PRE-18-9, RH 1656 × PRE-16-4, PRHC-13-7-3 × NDRE-4, PRHC-13-7-3 × PR-19, PRHC-13-7-3 × NPJ 209, PRHC-13-7-3 × PM-25, PRH-13-7-8 × NDRE-4, PRH-13-7-8 × PR-19, PRH-13-7-8 × NPJ 209, PRH-13-7-8 × PM-25, PRH-13-7-8 × PRE-18-9, PRH-13-7-8 × PRE-16-4, PRH-13-7-7 × NDRE-4, PRH-13-7-7 × PR-19, PRH-13-7-7 × NPJ 209, PRH-13-7-7 × PM-25, RB 57 × PRHC 13-7-3, NPJ 253 × PRHC-13-7-3, DRMR-IJ-31× PRCH-13-7-3, PRB-15-2 × PRHC-13-7-3, RB 109 × PRHC-13-7-3, DM 1521 × PRHC-13-7-3 PM-209 × PRE-2018-1, PM-209 × PRE-2018-10, PM-209 × PRE-2022-10, PM-209 × PRE-2018-3, PR-19 × PRE-2018-1, PR-19 × PRE-2022-10, PM-27 × PRE-2018-1, PM-27 × PRE-2018-10, PM-27 × PRE-2022-10, PM-25 × PRE-2018-1, PM-25 × PRE-2018-10, PM-25× PRE-2022-10, PM-28× PRE-2018-1, PM-28 × PRE-2018-10, PM-28 × PRE-2022-10, NDRE-4 × TM-304, NDRE-4 × TM-313, NDRE-4 × TM-310-1, PR-19 × TM-304, PR-19 × TM-313, PR-19 × TM-310-1, TM-317-2 × PR-19, TM-317-2 × NPJ-112, TM-316 × TM-313, TM-316 × PR-19, TM-316 × NDRE-4,	112		
		F1	PRE-15-1 × NPJ 112, PRE-15-1 × NDRE-4, PRE-15-1 × PRE-18-10, PRE-13-3 × PR-19, PRE-13-3 × NPJ 112, PRE-13-3 × NDRE-4, PRE-17-2 × NPJ 112, PRE-21-17 × NPJ-112, PRE-21-17 × PRE-18-10, PRE-16-5 × PRE-18-10, CRP-2 × PRHC-14-5-1, PRE-16-5 × PRE-18-10, PRE-16-5 × PR-19, PRE-21-2 × PRE-21-17, PRE-21-2 × PR-19, PRE-21-17 × PR-19, PRE-21-17 × PRHC-14-5-1, PRE-21-17 × CRP-5, PR-17-8 × CRP-5, PR-17-8 × PRE-20-16, PR-18-6 × CRP-5, PR-18-6 × PRE-20-16, NPJ-209 x PR-19, NPJ-209 x NPJ-112, NPJ-209 x PRE-18-10, DRMR-IJ-16-51 x PR-19, DRMR-IJ-16-51 x PRE-18-10, RH-1656 x PR-19, RH-1656 x NPJ-112, RH-1656 x PRE-18-10,	48	-	30
		F2	PRE-13-3 × PRE-20-12, PRE-13-3 × CRP-8, PRE-13-3 × CRP-12, PRE-17-5 × PRHC-13-7-5, Alblei × PRHC-13-7-5, PRE-16-2 × CRP-8, PRE-16-2 × PRHC-14-15, PRE-16-5 × PRHC-14-15, PRE-19-7 × PRE-20-12, PRE-19-7 × CRP-8, CRP-11 × PRE-20-12, CRP-11 × CRP-8, CRP-11 × PRHC-14-15, PRHC-13-7 × PRE-20-12, PRHC-13-7 × CRP-12, PRHC-13-7 × PRHC-14-15, PRHC-13-7 × PRHC-14-1-1, CRP-17 × PRE-2012, CRP-12 × PRE-2020-12,	31		19
		F3	PR-19×PRHC-14-10, PM-25×CRP-5, PM-25×PRHC-14-5, PRE-18-14×PRHC-14-1-1, PRE-18-8×CRP-15, PR-20×PRHC-6-3, PR-16-4×CRP-3, PM-27×CRP-8, PM-28×PRHC-14-5,	14		13

			DRMRIJ-16-15×CRP-5, PRE-18-1×PM-25, PRE-18-13× DRMRIJ-16-51, PRE-18-13×PM-25, PR-2019-10×Raj Vijay			
		F4	NDRE-4×DRMR-IJ-16-56, DRMR-IJ-16-51×PM-25, RH-1656×PM-25, (RH-1209×GP1-8)×NPJ-112, (RH-1209×GP-1-4)×PR-19, (RH-1209×GP-1-7)×NPJ-112, (PR-2015-1×CRP-3)×PR-19, (PRE-13-13×PR-20)×NPJ-112	10		07
		F5	Giriraj × GP-I-3, PR-19 × EJ-17, NPJ-203 × GP-I-7, NPJ-203 × GP-1-3, PR-2012-4 × CRP-3, Rohini × PRHC-17-7-10,	12		6(110 IPS)
		F6	PRE-13-19 × PBML-2, PRE-13-19 × Divya-88, PRHC-13-7 (MH) × PRHC-13-7(DH), PRHC-13-7 (MH2) × PRHC-13-7(DH), PRE-10-7 × PRHC-13-7, PRHC-13-7 (MH) × PRHC-17-7	5 (93 IPS)	-	5 (20 lines)
		F7	Albeli × NPJ-112, PR-21 × NDRE-4, PRE-11-6 × Albeli, RGN-145 × NDYR-8, NPJ-203 × GP1-5, PR-2013-2 × PRHC-14-10	6 (53 lines)	-	6 (22 lines)
	Timely sown	Fresh crosses	PR-20 × Giriraj, PR-20 × NPJ 253, PR-20 × Albeli, PR-20 × Rajvijay, Krishna × Giriraj, Krishna × NPJ 253, Krishna × Albeli, Krishna × Rajvijay, RGN 73 × Giriraj, RGN 73 × NPJ 253, RGN 73 × Albeli, RH 1585 × PRHC-13-7-3, RH 1585 × NPJ 253, RH 1585 × PR-20, RH 1585 × Giriraj, RB 57 × NPJ 253, RB 57 × PR-20, RB 57 × Giriraj, PR-2017-5 × PRHC-13-7-3, PR-2017-5 × NPJ 253, PR-2017-5 × PR-20, PR-2017-5 × Giriraj, DRMR-19-19 × PRHC-13-7-3, DRMR-19-19 × NPJ 253, DRMR-19-19 × PR-20, NPJ 253 × PR-20, NPJ 253 × Giriraj, DRMR-IJ-31× NPJ 253, DRMR-IJ-31× PR-20, DRMR-IJ-31× Giriraj, PRB-15-2 × NPJ 253, PRB-15-2 × PR-20, PRB-15-2 × Giriraj, RB 109 × NPJ 253, RB 109 × PR-20, RB 109 × Giriraj, DM 1521 × NPJ 253, DM 1521 × PR-20, DM 1521 × Giriraj, PR-21× PRHC-13-7-3, PR-21× NPJ 253, PR-21× Giriraj, Kranti × TM-304, Kranti × TM-313, Kranti × TM-310-1, RB-109 × NPJ-253, RB-109 × PR-2019-1, RB-109 × PR-21, RB-109 × (PR-2019-1 × PR-21), PRB-2006-5 × NPJ-253, PRB-2006-5 × PR-2019-1, PRB-2006-5 × PR-21, PRB-2006-5 × (PR-2019-1 × PR-21), Krishna × NPJ-253, Krishna × PR-2019-1, Krishna × PR-21, Krishna × (PR-2019-1 × PR-21), RB-57 × NPJ-253, RB-57 × PR-2019-1, RB-57 × PR-21, RB-57 × (PR-2019-1 × PR-21), RGN-73 × NPJ-253, RGN-73 × PR-2019-1, RGN-73 × PR-21, RGN-73 × (PR-2019-1 × PR-21)	65		
		F1	CRP-2 × PR-21, Albeli x PR-21, PR-18-5 x Giriraj, PR-19-1 x RH-1585, PR-19-1 x Giriraj, PR-19-1 x PR-21, PR-19-5 x RH 1585, PR-19-5 x Giriraj, DRMRIJ-31 x PR-21, PR-20-1 x RH-1585, PR-20-1 x Giriraj, RB-57 x PR-2019-7, RB-57 x RH-1585, PR-19-2 x PR-2019-7	30	-	14
		F2	Giriraj × PRHC-13-7-5, Giriraj × PRHC-13-7-10, PR-17-2 × PRHC-13-7-5, PR-17-2 × PRHC-13-7-10, PR-17-2 × PRB-16-1, PR-17-5 × PR-13-7, PR-19-8 × PR-13-7, PRL-2017-3× CRP-14, CRP-14× PR-2018-2, MJB-9× RGN-73, MJB-5× Heera, MJB-10× Heera, DRMRAR-158× IC-18-5123-73, IC-277699× IC-185123	22	-	14
		F3	PM-26×Albeli, PM-26×PR-18-6, RH-749×Rajvijay, PR-19-11×RH-749, PR-19-10× RH-749, PR-19-2×RH-749, PR-18-5×PR-2012-4, RH-1599-41×Rajvijay, PR-18-6×RH749, PRL-2017-5× NRCHB101, RGN-73×PYR-2009-5, PR-20×NDYR-8	15		12
		F4	(Rohini ×PRHC-13-7-10)×Albeli, (PR-2013-2×PRHC-13-7-10)×RH-749, (RGN-394×PRHC-13-7-1)×Giriraj, PR-15-7× Kranti, RH-749× PR-12-4, PR-17-5× RH-749,	07		06
		F5	RGN-394 × PRHC-14-7-1, RGN-394 × PRHC-13-7-1, PR-2013-7 × PRHC-14-10, (PR-15-5 × Divya) × PRHC-14-9, PRE-10-15×NDRE-4, EJ-17×PRE-2007-6,	06		06 (73 IPS)
		F6	PRE-2013-10 × RH-749, PRE-2013-10 × PBML-2, PR-2015-1 × Maya, PR-2016-3 × Giriraj, PR-2015-1 × Giriraj, PR-20 × IC-355931, RRN-9-11 × RH-749, Giriraj × NDYR-8, (PRE-	13	48 IPS	9 (37 lines)

			2011-6 × Rajvijay) × RH-1209, PR-2019-11×RH749, PR-2019-10 × RH749, PR-2019-2 × RH749, PM-26 × PR-2018-6			
		F7	ACN-83 × PR-20, Divya 55 × Kranti, RH-1019 × Raj Vijay, NPJ-191 × Albeli, NPJ-191 × Raj Vijay, (RMM-09-4 × NPJ-112) × Albeli, (DRMR-675-3 × PRE-11-15) × Albeli, Giriraj × PR-20	8 (36) lines	-	10 lines
	Late sown	Fresh crosses	Vardan × Kranti, Vardan × NRCHB-101, Vardan × NPJ-251, RMWR 0901× Kranti, RMWR 0901× NRCHB 101, RMWR 0901× NPJ 196, RMWR 0901× NPJ 251, RH-1599-41× NRCHB 101, RH-1599-41× NPJ 251, Raj vijay × NRCHB 101, Raj vijay × NPJ 251, DRMR-IC-16-38 × NRCHB 101, DRMR-IC-16-38 × NPJ 251, PRL-2020-2 × NRCHB 101, PRL-2020-2 × NPJ 251, DRMRHJ-430 × Kranti, DRMRHJ-430 × NRCHB 101, DRMRHJ-430 × NPJ 196, DRMRHJ-430 × NPJ 251, Kranti × NPJ-196, Kranti × NPJ-251, Kranti × Rajvijay, NRCHB-101× NPJ-196, NRCHB-101 × NPJ-251, NRCHB-101 × NPJ-253, NRCHB-101 × PR-2019-1, NRCHB-101 × PR-21, NRCHB-101 × (PR-2019-1 × PR-21), Vardan × NPJ-253, Vardan × PR-2019-1, Vardan × PR-21, Vardan × (PR-2019-1 × PR-21), Kranti × NPJ-253, Kranti × PR-2019-1, Kranti × PR-21, Kranti × (PR-2019-1 × PR-21)	36		
		F1	PRL-20-2 x NRCHB 101, PRL-20-2 x PRL-20-20, PRL-20-5 x NRCHB 101, PRL-20-5 x PRL-20-20, PRL-20-5 x PRL-20-9, PRL-20-16 x PRL-20-20, PRL-20-16 x PRL-20-9, PRL-20-19 x PRL-20-20, PRL-20-19 x PRL-20-9, Giriraj x PRL-20-9, RGN 73 x PRL-20-20, PRL-20-22 x NRCHB 101, PRL-20-22 x PRL-20-9, Krishna x PRL-20-20, PRL-20-22 x NRCHB 101, Vardan x NRCHB 101, Vardan x NPL-196, Raj Vijay x NRCHB 101, Raj Vijay x NPJ-196, PR-20x PRL-20-20, PRL-20-27 x NRCHB-101, PRL-20-27 x PRL-20-9 , PR-20 x PRL-20-9	34	-	23
		F2	PAB-17-11 × NPJ-113, PAB-17-11 × PRL-17-3, PRL-2017-3 ×CRP-14, PRL-2017-5 ×NRCHB-101	7	-	4
		F3	PRL-17-1×NPJ-126, PRL-17-2×NRCHB-101, PRL-17-2×NPJ-126, PRL-17-3×NRCHB-101, NPJ-216×Albeli	7		5
		F4	PRL-2013-9×DRMR-2017-5, PRL-2018-5×PRL-2018-19, PRL-2017-1×NRCHB-101, PRL-2017-2×MCN-2018-14, PRL-2017-2×NRCHB-101	7		5
		F5	PRL-2013-17 × Ashirwad, DRMR-2035 × NRCHB-101, NRCHB-101× PRHC-14-8, PR-2015-1× GP-1-22, PR-2015-1× GP-1-23, RH-1599 × Ashirwad	7	6 (156 IPS)	-
		F6	NPJ-113 × NRCHB-101, PR-2016-3 × PAB-9511, PR-2016-5 × PWR-2013-8, (Albeli × NPJ-113) × NRCHB-101, (NRCHB-101× Vardan) × NPJ-113	6 (65 IPS)		6 (22 lines)
		F7	PRL-10-8 × NRCHB-101, PRD-13-2 × NRCHB-101, PRD-13-9 × Ashirwad, PRD-13-9 × NRCHB-101, PRL-12-13 × Raj Vijay, PRB-2013-2 × NRCHB-101,	6 (19 lines)	-	09 lines
	Yellow seed coat color	Fresh crosses	PYR-2020-11 × PYR-2009-5, PYR-2020-11 × PYR-2012-5, PYR-2018-1 × PYR-2009-5, PYR-2018-1 × PYR-2012-5, PYR-2021-6 × PYR-2009-5, PYR-2021-6 × PYR-2012-5, PYR-2020-11, PYR-2021-2 × PYR-2009-5, PYR-2021-2 × PYR-2012-5, PYR-2021-2 × PYR-2020-11, PYR-2019-3 × PYR-2009-5, PYR-2019-3 × PYR-2012-5, PYR-2020-11, PYR-2019-5 × PYR-2012-5, PYR-2019-5 × PYR-2020-11, PYR-2021-5 × PYR-2009-5, PYR-2021-5 × PYR-2012-5, PYR-2021-5 × PYR-2020-11	16		
		F1	NDYR 10 × PYR-2009-5, NDYR 10 × PYR-2017-1, NDYR 10 × PYR-2017-3, Basanti × PYR-2017-1, PYR-2017-5 × PYR-2017-3, PYR-2017-7 × PYR-2009-5, PYR-2017-7 × PYR-2017-3, PYR-2017-9 × PYR-2009-5, PYR-2018-6 × PYR-2009-5, PYR-2018-6 × PYR-2017-3, PYR-2018-6 × PYR-2017-1	21	-	11

		F2	(PR-2017-5×PYR-2009-13) ×Pro 0306, (PR-2019-8×PYR 2009-13) ×Pro 0306, (PR-2017-2×PYR-2009-13) ×Pro 0306, (Giriraj× PYR 2009-13) ×Pro 0306	6	-	4
		F3	DRMR-61-106×NDYR-8, DRMR-61-106×PYR-12-5, (NDYR-10 × PR-20) ×NDYR-10	3	-	3
		F5	NDYR-10 × Maya, NDYR-10 × RH-749,	2	2(20 IPS)	-
		F6	(NDYS-12-5 × NDYR-8) × DRMR-101, (NDYR-10 × PRY-2009-8) × PR-2012-12, (PYR-2012-5 × NDYR-8) × PR-2012-12, (PYR-2012-5 × NDYR-8) × NPJ-112, Griraj × NDYR-8	5 (65 IPS)	-	5 (22 lines)
		F7	Navgold× NDYR-8, PYR-2012-5 × NDYR-8,	2 (10 lines)		4 lines
	Alternaria blight resistance	F1	Krishna X PAB-9511, RGN 73 X PAB-17-3, RGN 73 X PHR-2, Rohini x PAB-9511, (Krishna X PAB-9511) X PAB-9511, (RGN 73 X PAB-17-3) X RGN 73, (RGN 73 x PHR-2) x RGN 73, (Rohini x PAB-9511) x Rohini, (Krishna x PAB-9511) x Krishna, (RGN 73 x PAB-17-3) x PAB-17-3, (RGN 73 x PHR-2) x PHR-2, (Rohini x PAB-9511) x PAB-9511, PR-20× PAB9511, PR-21× PHR 1, NPJ-126 × PAB9534 PAB-9511 x PAB-17-1, PAB-9511 x PAB-17-3, PAB-17-1 x PAB-17-3, PAB-17-1 x PHR-2, PHR-2 x PAB-17-3, PHR-2 x PAB-9534, PAB-9511 x PAB-9534, PHR-1 x PAB-9511	33	-	23
		F2	Rohini × PAB-9511, RGN73 × PHR-2, RGN 73 × PAB-17-3, NRCHB101 × PAB-9511, RCHB101 × PAB-17-1, Krishna × PAB 9511, PR 20 × PAB 9511, PR 21 × PHR1, NPJ-126× PAB-9534, PAB 9511 × PAB 17-3, PAB 9511 × PAB-17-1, PHR-2 × PAB-17-3, PHR-2 × PAB-9511, PAB-17-1 × PHR-2, PAB-17-1 × PAB-17-3, PHR-1 × PAB-9511, PHR-1× PAB-9534, PAB 9511× PAB-9534	34	-	18
		F3	PAB-14-15 × MCNL-19-6, PAB-2014-4 × RH-1590-41, PAB-2014-25 × MCNL-19-6, PAB-14-1 × DRMR-2017-5, PAB-2014-17 × MCNL-19-6, PAB-2014-7 × MCNL-19-55	12	-	6
		F4	PHR-1 × PAB 9511, PAB-06-5 × NRCHB-101, PAB-14-7 × MCN-18-5, PAB-14-4 × MCN-18-5, MCN-14-5 × MCN-18-19, PAB-14-4 × PAB9511, PAB-17-5 × PHR-2, PAB-17-5 × PHR-1, PAB-17-20 × PAB 9511, PAB-17-20 × PHR-2, PAB-17-21 × NRCHB 101, PAB-17-2×PHR-1, (PAB-17-1×PHR-1) × PAB-17-1, (PAB-17-1×PHR-1) × PHR-1, (PAB-17-2×PHR-1) × PHR-1, PAB-17-4×PHR-1, (PAB-17-4×PHR-1) × PAB-17-4, (PAB-17-4×PHR-1) × PHR-1	17 12	-	11 7
		F5	Varuna × PAB-06-5, PRB06-5× PRB-04-3-4, PRB-04-304×NRCHB-101, PRB-06-5× NRCHB-101, Varuna×NRCHB-101, Varuna×PRB-04-3-04, PWR-13-8× NRCHB-101, Donskaja× PWR-13-8	8	114 IPS	-
		F6	PR-16-6 × PAB-9511, PR-16-5 × PAB-9511, Donskaja× PAB9511	3 (15 IPS)		9 lines
		Advanced lines		-	-	44 lines
	White rust resistance	Fresh crosses	Giriraj× Donskaja, Giriraj× BIOYSR, Kranti× Donskaja, NRCHB-101× PWR-13-8, Kranti× Heera, (Giriraj× Donskaja) × Donskaja, (Giriraj× Donskaja) × Giriraj, (Giriraj× BIOYSR) × BIOYSR, (Giriraj× BIOYSR) × Giriraj, (Kranti× Donskaja) × Donskaja, (Kranti× Donskaja) × Kranti, (NRCHB-101× PWR-13-8) × PWR-13-8, (NRCHB-101× PWR-13-8) × PWR-13-8, (Kranti× Heera) × Heera, (Kranti× Heera) × Heera, Donskaja× PWR-13-8, Donskaja× BIOYSR, Donskaja× Heera, PWR-13-8× BIOYSR, PWR-13-8× Heera, Heera× BIOYSR	21	-	-
		F1	NRCHB 101 x WR-II, RGN 73 x PWR-13-8-7, NRCHB 101 X Donskaja, NRCHB 101 x PWR-13-8-7, (NRCHB 101 x WR-II) x NRCHB 101, (RGN 73 x PWR-13-8-7) x RGN 73, (NRCHB	45	-	20

			101 x Donskaja) x NRCHB 101, (NRCHB 101 x PWR-13-8-7) x NRCHB 101, (NRCHB 101 x WR-II) x WR-II, (RGN 73 x PWR-13-8-7) x PWR-13-8-7, (NRCHB 101 x Donskaja) x Donskaja, (NRCHB 101 x PWR-13-8-7) x PWR-13-8-7, Donskaja x PWR-9538, Donskaja x WR-II, Donskaja x PWR-13-8-1, PWR-9538 x PWR-13-8-1, WR-II x PWR-13-8-1, PWR-9538 x WR-II, Kranti×Donskaja, Ashirwad× WR-II, Giriraj× BIOYSR, Giriraj× Donskaja, Giriraj× PER-13-8-7, Giriraj× Heera, NRCHB101× BIOYSR, NRCHB101× Donskaja, NRCHB101× PWR-13-8-7, NRCHB101× Heera, NRCHB101× BIOYSR, NRCHB101× Donskaja, NRCHB101× PWR-13-8-7, NRCHB101× Heera, Kranti× BIOYSR, Kranti× Donskaja, Kranti× PWR-13-8-7, Kranti× Heera, Donskaja× BIOYSR, Donaskaja× PWR-13-8-7, Donskaja× Heera, PWR-13-8-7× BIOYSR, PWR-13-8-7× Heera, Heera× BIOYSR			
		F2	Rohini × PWR 9541, RGN 73 × PWR-13-8-7, RGN 73 × WRII, RGN 73 × PWR-9541, RGN 73 × Donskaja, NRCHB101 × Donskaja, NRCHB101 × PWR-13-8-7, NRCHB101 × WR-II, NRCHB101 × PWR-9541, Krishna × WR-II, Krishna × PWR 9541, PWR-9541× Donskaja, WR-II × Donskaja, PWR-13-8-7 × Donskaja, PWR-13-8-7 × PWR-9541, WR-II × PWR-9541, WR-II × PWR-13-8-7, Kranti × Donskaja, Ashirwad × WR-II, WR-II × PWR 13-8-1, Giriraj × Donskaja, NRCBH 101× PWR-13-8, Kranti × Donskaja, Donskaja × PWR 9538, DONSKAJA × PWR 13-8-1, PWR 9538 × PWR 13-8-1, Donskaja × WR-II, Donskaja × WR-II, Giriraj× BIOYSR, Kranti× Heera	40	-	28
		F3	PWR-13-8 × PHR-1, PWR-13-8 × PHR-2, PWR-13-8 × PAB-9534, (PWR-13-8 × PRB-2006-5) × PRB-2006-5, (EC399301×Varuna) × Varuna, EEC-3 × Donskaja, PRD-2014-21 × NPJ 126	8	-	7
		F4	PAB 9511 × Donskaja, PWR-2012 × Donskaja, PWR-2012 × PAB 9511, PWR 9538 × Donskaja, PWR 9538 × PAB 9511, PHR-1 × Donskaja, PAB-14-4 × PWR-13-8	09	-	08
		F5	Donskaja × Kranti, PWR-13-8-2 × Donskaja, PR-16-5 × Donskaja, PWR-13-8-8-6 × Donskaja, PWR-13-8-14-1 × Donskaja, PR-16-3 × Donskaja, PWR-3-8-6 × Donskaja, (EEC-2 × PWR-13-8) × PWR-13-8, (EEC-4 × PWR-13-8) × PWR-13-8, (EEC-10 × PWR-13-8) × PWR-13-8, (FS-13-8 × PWR-13-8) × PWR-13-8, PR-21 × PWR-13-8, PR-2016-5 × PWR-13-8, (IC-320932 × Kiran) × PWR-13-8, (Kranti × PWR-13-8) × PWR-13-8, (Kranti × PWR-13-8) × Kranti, PWR-13-8-8-6 × EC-399299, (NRCHB-101 × PWR-13-8) × NRCHB-101, (NRCHB-101 × PWR-13-8) × PWR-13-8	24	19(285 IPS)	
		Advanced lines	-	3+23+14		
	Pyramiding of AB and WR	F1	PAB-17-3 x Donskaja, PAB-17-3 x WR-II, PAB-17-3 x PWR-13-8-7, PAB-17-3 x PWR-9541, PHR-2 x PWR-13-8-7, PAB-17-1 x PWR-13-8-7, PAB-17-1 x Donskaja, PAB-9511 x WR-II, PAB-9511 x PWR- 9541, PAB-9511 x Dosnkaja, PRL-20-20 x (PAB-9511 x Donskaja), PRL-20-22 x (PAB-9511 x Donskaja)	12		12
		F2	PAB-17-3 x Donskaja, PAB-17-3 x WR-II, PAB-17-3 x PWR-13-8-7, PAB-17-3 x PWR-9541, PHR-2 x Donskaja, PHR-2 x WR-II, PHR-2 x PWR-13-8-7, PHR-2 x PWR-9541, PAB-17-1 x PWR-13-8-7, PAB-17-1 x Donskaja, PAB-17-1 x PWR-9541, PAB-17-1 x WR-II, PAB-9511 x WR-II, PAB-9511 x PWR- 9541, PAB-9511 x Dosnkaja	15		15
	National crossing programme	Fresh crosses	RE-11 × NPJ-253, RE-11 × PR-2019-1, RE-11 × PR-21, RE-11 × (PR-2019-1 × PR-21), M-34 × NPJ-253, M-34 × PR-2019-1, M-34 × PR-21, M-34 × (PR-2019-1 × PR-21), RLC-3 × NPJ-253, RLC-3 × PR-2019-1, RLC-3 × PR-21, RLC-3 × (PR-2019-1 × PR-21), RE-8 × NPJ-253, RE-8 ×PR-2019-1, RE-8 × PR-21, RE-8 × (PR-2019-1 × PR-21)	16		
		F1	RE-11×CRP-5, LES-39×CRP-5, LES-39×PRHC-2014-5-1, M-34×CRP-5, M-34×PRE-2020-16,	21	-	10

			M-34×PRHC-2014-5-1, DRMRIJ-31×Giriraj DRMRIJ-31×PR-21, NC-37362×RH1585, NC-37362×Giriraj			
	Introgression of AB resistance	F1	ERJ-45×Kranti, ERJ-171×Kranti, ERJ-186×Kranti, ERJ-191×Karnti, ERJ-194×Kranti, ERJ-201×Kranti , ERJ-161×ERJ-8, ERJ-161×RGN-73, ERJ-113×Giriraj, ERJ-113×ERJ-3, ERJ-127×ERJ-1, ERJ-127×NRCHB101, ERJ-159×NRCHB-101, ERJ-59×ERJ-8, ERJ-164×ERJ-9, ERJ-108×Krishna, ERJ-108×ERJ-8, ERJ-189×Kranti, ERJ-111×RGN-73, ERJ-2×RGN-73, ERJ-39×ERJ-9, ERJ-39×NRCHB-101, ERJ-45×ERJ-1,	22	-	22
	Prebreeding activity	Fresh crosses	BJ × BN, BJ × BC, BJ × BR, BJ × BNi, BN × BJ, BN × BC, BN × BNi, BN× BR, BC × BR	09	-	-
		BC2	(BR-8×RGN-73) × BJ, (BR-8×RGN-73) × BC, (BR-8×PCPGR 7780) × BJ, (BR-8×PCPGR 7780) × BN, (BR-8×PCPGR 7780) × BC, (BR-8×BNi-5) × BJ, (BR-8×BNi-5) ×BN, (BR-1×BNi-4) ×BJ, (BR-1×BNi-5) ×BJ, (BR-8×BNi-5) ×BN, (BR-8×BNi-5) ×BC	16	-	11
		F3	BR-9×BNi-5, BR-8×RGN-73, BR-8×PCPGR 7780, BR-8×BNi-5	04		
SK Nagar	Early maturing & high seed yield	Fresh crosses	Fresh crosses were attempted using GM 1, GM 6, GM 7, NPJ 253, SKM 1801, KMR 21-3, NPJ 248, PRE 2018-9, HUJM 20-4 and Mali MS 90	45	--	--
	Early maturing, High seed yield & Bold seed	F_1	GM 1 x GDM 4, GM 1 x GM 6, GM 1 x RE 8, GM 1 x TN 3, GM 1 x RLC 3, GM 1 x LES 39, GM 1 x M 34, GM 1 x DRMR-JA 35, GM 1 x PM 25, GDM 4 x GM 6, GDM 4 x RE 8, GDM 4 x TN 3, GDM 4 x RLC 3, GDM 4 x LES 39, GDM 4 x M 34, GDM 4 x DRMR-JA 35, GDM 4 x PM 25, GM 6 x RE 8, GM 6 x TN 3, GM 6 x RLC 3, GM 6 x LES 39, GM 6 x M 34, GM 6 x DRMR-JA 35, GM 6 x PM 25, RE 8 x TN 3, RE 8 x RLC 3, RE 8 x LES 39, RE 8 x M 34, RE 8 x DRMR-JA 35, RE 8 x PM 25, TN 3 x RLC 3, TN 3 x LES 39, TN 3 x M 34, TN 3 x DRMR-JA 35, TN 3 x PM 25, RLC 3 x LES 39, RLC 3 x M 34, RLC 3 x DRMR-JA 35, RLC 3 x PM 25, LES 39 x M 34, LES 39 x DRMR-JA 35, LES 39 x PM 25, M 34 x DRMR-JA 35, M 34 x PM 25, DRMR-JA 35 x PM 25, CN 103364 x RLC 3, CN 103364 x LES 39, CN 103364 x M 34, CN 103364 x DRMR-JA 35, CN 103364 x PM 25	50	--	50
	Early maturing, High seed yield & Bold seed	F_2	RMM 10-1-1, SKM 1746-W, CS 56, GM 1, PM 26, NRCHB 101, IC 491448, IL 18-5255, IC 766512, IL 18-5121, IL 18-5123, IL 18-5245, IL 18-5255, DRMRIJ 31, BCI 4, PM 30 were used as parents	41	106	--
	Early maturing, high seed yield, Bold seed & Quality	F_3	SKM 1328, SKM 1746-W, NPJ 112, NPJ 203, KP 9905, ANDM 14-9, GM 1, GM 3, GDM 4, SKM 1621, SKM 1324, SKM 1319, Ranasan 2, RS 1, DRMR 659-49, RH 8812, LES 44, DRMR 150-35, DRMR 2059 were used as parents	90	245	--
	Early maturing, Dwarf & high seed yield	F_4 - I	ANDM 14-9, NPJ 203, DRMR-IJ 16-66, KM 126, 8IJ0116, SKM 1746, GM 1, GDM 4 were used	53	183	--
	Interspecific	F_4 - II	GM 1, GDM 4, BCRS 3 (*B. Carinata*) were used	04	18	--
	Early maturing, Temp. tolerance & High seed yield	F_5 - I	Urvashi, NPJ 112, ANDM 14-9, PDZM 31, P. Vijay, SKM 219, DRMR IJ-31, GM 3, DRMR 150-35, GM 1, PM 26, BPR 349-9, NRCDR 2, PM 21, NRCHB 101, GDM 4, PM 27, GM 2, NRCDR 601, PM 28, Kranti, PM 30 were taken as parents	69	160	--
	Interspecific	F_5 - II	GDM 4, BCRS 3 were used	02	25	--
	Early maturing, & High seed yield	F_6	PR 2012-2, SKJM 5, SYJ 64, PM 25, SKM 219, GM 1, RB 55, RB 50, GM 3, GDM 4, RB 24, KMR 15-4, KM 126 were used as parents	73	69	21
	Early maturing, Temp. tolerance & High seed yield	F_7	Urvashi, RH 1134, P. Vijay, Navgold, GM 2, RS 1, RB 50, GM 3, PM 25, PM 28, SKM 1313, BPR 540-6, TM 108, GDM 4 were taken as parents	15	-	10

	High seed yield, bold seed	F_8	GM 1, BPR 540-6, RB 50, GM 2, Bio 902, GDM 4, RB 50, GM 3, GM 2 were used	11	--	08
	Hybrid development	CMS lines maintained	Involving CMS lines with *Mori, Ogura, Oxyrrhina* and *Siffolia* system	36	--	--
		Restorer lines developed/ maintained		26	--	--
		F_1	New test hybrids based upon *Mori* CMS system were evaluated	20		
Sriganga nagar	High yield, white rust & alternaria blight resistance, high oil content, drought tolerance	Fresh crosses	Laxmi x RE 11,Laxmi x NC 37362, RH 761x Laxmi, Laxmi x IC 597880,Laxmi x RE 8, Laxmi, DRMRMJA 35x RH 761, Laxmi x DRMRIJ12-48, RH 761xLaxmi, DRMRIJ12-40x RH 761, Laxmi x DRMRIJ 31,RH 761x Laxmi x LES39XRH 761, Laxmi x TN 3,RH 761 Laxmi x NPJ 112,RH 761, Laxmi x M 34,RH 749 x RE 11,DRMRIJ 31xRH 749, NC 37362x DRMRIJ 31, RH 749 x RE 44,RH 749 x CN 105364,RH 749 x IC 597880, RH 749 x RLC 3,RH 749 x RE 8,RH 749 x DRMRMJA 35,RH 749 x DRMRIJ12-48,RH 749 x DRMRIJ12-40,RH 749 x DRMRIJ 31,RH 749 x LES 39,RH 749 x TN 3,RH 749 x NPJ 112,RH 749 x M 34	28		
		F1		45		
		F2		20	74	
		F3		116	116	
		F4		53	51	
		F5		40	39	
		F6		38		38
Varanasi	Seed yield and early maturity	F_1s	HUJM-10-6, HUJM-16-8, HUJM-20-4, hUJM-17-15, hUJM-17-8, HUJM-19-11, HUJM-17-6, , HUJM-18-6, HUJM-9-7, HUJM-18-7, HUJM-20-6, HUJM-19-18, HUJM-17-7, HUJM-21-4, HUJM-21-1, HUJM-18-9, HUJM-20-9, JD-6, NDRE-4 and Testers were Sej-2, NPJ-112, in Line x tester fashion.	72		
Kota	High yield, earliness, low erucic acid & white rust resistance	Fresh Single crosses	DRMRIJ-31, CN 105364, RCL 3, DRMRIJ 12-48, DRMRIJ 12-40, LES 39, NPJ 112 and station trial entries/ promising lines	24	-	-
		Multiple crosses	Kranti, Pusa Mustard 30, Pusa Mustard 27, RH-30, DRMRIJ-31, CN 105364, RCL 3, DRMRIJ 12-48, DRMRIJ 12-40, LES 39, NPJ 112 and station trial entries/ promising lines	24		
		Biparental crosses (NCD-II)	6 sets (4 males x 4 females) of 16 cross combinations in 3 F_2generations (2 sets/F_2) of *B. juncea.*	96		
	High yield, high oil content & earliness	F_1	RH 749 x PM-27, RH 749 x JM-1, RH 749 x CS-54, RH 749 x EJ-20, RH 74DRMRIJ-319 x PM-27, DRMRIJ-31 x JM-1, DRMRIJ-31 x CS-54, DRMRIJ-31 x EJ-20, NRCHB 101 x PM-27, NRCHB 101 x JM-1, NRCHB 101 x CS-54, NRCHB 101 x EJ-20, Kranti x PM-27, Kranti x JM-1, Kranti x CS-54, Kranti x EJ-20, PM-30 x PM-27, PM-30 x JM-1, PM-30 x CS-54, PM-30 x EJ-20, P. Mahak x PM-27, P. Mahak x JM-1, P. Mahak x CS-54, P. Mahak x EJ-20, P. Tarak x PM-27, P. Tarak x JM-1, P. Tarak x CS-54, P. Tarak x EJ-20, RH-30 x PM-27, RH-30 x JM-1, RH-30 x CS-54, RH-30 x EJ-20, IC 597889 x PM-27, IC 597889 x JM-1, IC 597889 x CS-54, IC 597889 x EJ-20, IC 597910 x PM-27, IC 597910 x JM-1, IC 597910 x CS-54, IC 597910 x EJ-20			

	Terminal heat tolerance, yield and contributing traits	F_2	RH 749 x RVM-2, RH 749 x Urvashi, RH 749 x DRMR 2059, RH 725 x RVM-2, RH 725 x Urvashi, RH 725 x DRMR 2059, DRMRIJ 31 x RVM-2, DRMRIJ 31 x Urvashi, DRMRIJ 31 x DRMR 2059, NRCHB 101 x RVM-2, , , NRCHB 101 x Urvashi, , NRCHB 101 x DRMR 2059, PM-27 x RVM-2, PM-27 x Urvashi, PM-27 x DRMR 2059, NPJ-231 x RVM-2, NPJ-231 x Urvashi, NPJ-231 x DRMR 2059, NPJ-232 x RVM-2, NPJ-232 x Urvashi NPJ-232 x DRMR 2059	21	74	-
	Breeding high yielding genotypes for different maturity groups	F_3	16 diverse genotypes of *B. juncea*in L x T fashion(12 Lines x 4 Testers)	48	318	-
	Development of high yielding bold seeded, disease resistant genotypesof*B.juncea*					
		F_4	Diverse genotypes *of Brassica juncea*	109/318	220	
		F_5	Diverse genotypes *of Brassica juncea*	16/215	187	
		F_6	Diverse genotypes *of Brassica juncea*	12/140	133	57
		F_7	Diverse genotypes *of Brassica juncea*	6/47	47	
Jagdalpur		Fresh Crosses	CG Sarson x Pusa Bold, RH-406 x Pusa Bold, Laxmi x Kranti, Pusa Agrim x Kranti, DRMR IJ-31 x Kranti, CG Sarson x Kranti, RH-406 x Kranti	08		
		Segregating generations advanced	RH-749 x RH-119, RH-749 x RH-406, RH-119 x RH-406	03	109	
Crop: Gobhi Sarson						
Chatha-Jammu.	High seed yield & oil contant	Fresh crosses	RSPN-28, DGS-6, RSPN-25,RSPN- 29 With AKMS 8141,GSC-6 & GSL-1	12		
		F_1	DGS-1, RSPN-25, GSL-1 With HNS 1102, DRMRIN 20-23, AKGS 8060 & GSH-1723	12		
		F_2	GSH-1699, RSPN-28, RSPN-25, DGS-1, GSH-1707, AKGS-8146, HNS-1102, GSH-1717& AKGS-8217 With GSC-6, GSL-1& AKMS-8141	24		
		F_3	Improved breeding lines/varieties	10		
		F_4	Advanced fixed genotypes with GSC-6,GSL-1&RSPN-25	14		
		F_5	CNH-11-1,RSPN-28,CNH-11-13,HNS0901,RSPN-25 With GSC-6,GSL-1&DGS-1	13		
		F_6	GSL-1 x RSPN-28, GSL-1x RSPN-29, DGS-1 x GSC-101, RSPN-25 x RSPN-28, RSPN-25 x GSC-101.	05		
Kangra	High yielding, Early, dwarf, good branching, bold seeded and quality, shatter resistance		GSC 7X Karan rai, Neelam X Karan Rai	2		
		F_1	HPGS 1 X RCC 4, HPGS 1 X ONK 1, HPGS 1 X GSC 7 HPGS 1 X Mustard 9, AKGS 8060 X AKGS 1135	5		
		F_2	AKGS 1242 X Brown Sarson, AKGS 1242 X GSH 2196,AKGS 1242 X PHR , AKGS 1242 X Chinese Sarson, AKGS 1242 X GSC 6, AKGS 3745 X Neelam, Mustard X AKGS 8141, GSC 7 X toria, AKGS 1235 X AKGS 1242,Brown sarson X GSC 6, GSC 7 X AKGS 8060, AKGS	17	51	10

			1135 X GSH 1699,AKGS 1135 X Chinese Sarson, AKGS 1242 X GSH 2196,GSC 7 X KBS 3, AKGS 8217 X GSC 6, AKGS 8217 X GSH 2196,			
		F_3	IC 279074X IC 399682,IC 298033 X IC 399684, IC 99684 X EC 271582,IC 399886 X EC 657073, IC 491586 X EC 400803	5	25	
		F_4& Advanced	Neelam, Sheetal, Him Sarson 1, GSC 7, GSL 1, CNH11-1, CNH-11-2, Hyola 401, HNS 0801, HNS 0901, NUDB 26-11, AG-13, NUDB 38, NUDH-86, AS-13, IC 552608, Y3000, MHO 173 , HNS 003, HNS 005, Y3000,MHO 173 NUDH 9, NUDB 26- 11, NUDH 86, NUDH 7, AS 12,AG 12,CA 12, QA 12,EC 552608, AKGS 8060, HPGS 1, Gobhi Sarson X RCC 4	60	30	40
Ludhiana	For early maturity and productivity	Fresh crosses	P-66 X GSC-7, D-25 X GSC-7, DM X GSC-7	3		
		F_1	P-68 X I-75, BLN-33-51 X I-75, NECN-12-6 X I-75, P-128 X I-75, P-140 X I-75, TRILOGY X I-75, P-80X I-75, P-125 X I-75, JCN-8 X I-75, P-125 X I-75, P 51 X I-75, D-21X I-75, HCN-12-12X I-75, DT-15-6-4 X I-75, DT-14-8-6 X I-75, P-174 X I-75, DT-6-19-P1 X I-75, P-123 X I-75, P-120 X I-75, P-139 X I-75, P-134 X I-75, P-85X I-75, P-124 X I-75, D-34X I-75, I-115 X I-75, I-129 X I-75, I-96 X I-75, P-89X I-75, P-100 X I-75, P-66X I-75, P-61X I-75, GSC-6 X I-75, P-113 X I-75, JCN-8 X D-22, PN-5-6-1 X D-22, DT-14-8-6 X D-22, BCN-28X D-22, P-125 X D-22, NECN-12-6 X D-22, I-115 X D-22, P-126 X D-22, OCN-98X D-22, P-132 X D-22, GSC-6 X D-22, I-96 X D-22, DT-15-6-4 X D-22, D-21X D-22, TRILOGY X D-22, P-134 X D-22, P-124 X D-22, I-129 X D-22, P-120 X D-22, P-68X D-22, NCN-11-6 X GSC-21, I-115 X GSC-21, NECN-12-6 X GSC-21,D-25X GSC-21, P-66X GSC-21, DT-6-19-P1 X GSC-21, P-68X GSC-21, P-85X GSC-21, I-96 X GSC-21, P-85X GSC-21, DT-14-8-6 X GSC-21, P-120 X GSC-21, P-123 X GSC-21, P-134 X GSC-21, BC-2 X GSC-21, P-126 X GSC-21, DM XGSC-21, P-140 X GSC-21, I-129 X GSC-21, P-132 X GSC-21, P-139 X GSC-21, D-34X GSC-21, GSC-6 X GSC-21, P-100 X GSC-21, DM X GSC-21, P-124 X GSC-21, P-89X GSC-21, P-80X GSC-6, P-124 X GSC-6, P-100 X GSC-6, P-89X GSC-6, P-113 X GSC-6, BC-2 X GSC-6, P-29X GSC-7, GSC-7 X DM, GSC-6 X DM, DT-6-19-P1 X GSC-22, P-85X GSC-22, P-80X GSC-22, DM X GSC-22	150		
		F_2		136		
		$F_{5/6}$	-	50		
	Early maturity, productivity, shatter tolerance and herbicide resistance	M_1 generation	Induced mutagenesis of GSC-7	M_1 bulk	--	
	For higher productivity	Advanced generation CMS lines developed/ maintained	Natural mustard :89 Introgressed mustard: 151 Resynthesized mustard:36 Exotic mustard:25 Determinate mustard: 162	463		
	Fertility Restorers	Fixed	06	06	-	-

	maintained					
	Improving fertility restorers for White rust resistance and Herbicide tolerance	Varied generations	Crosses with characterized donor genotypes, followed by backcrossing with the recipient fertility restorers.	36 10	35	3
	Induced mutagenesis for earliness and improved seed size in European gene pool restorers	M3-M4 generations	Induced mutagenesis	04		
	Hybrid development (*B. napus*)	Advanced generation CMS lines developed/ maintained	Indian group :92 Introgressed *B. napus* :73 Exotic *B. napus* -18 Determinate *B. napus* :48 Derived napus: 16	247	--	--
		Fertility Restorers maintained	06	-	-	-
	Improving fertility restorers for earliness and shorter plant stature		Induced mutagenesis: 1	12	26	3
Brown Sarson:						
Kangra	High yield	Fresh Cross	Brown Sarson X Chinese Sarson	1		
		Advanced populations	KBS 3, CLM 02, HPBS 1 , IC182671, KLM 4	4		4
Karan rai:						
Kangra	Earliness, high yield	Fresh crosses	NRCKR 314 X Karan rai yellow, Karan rai D Y X Kiran, Karan rai yellow X NRCKR 314	3	0	0

Table 2.1.3 Evaluation of advanced breeding lines at different centres.

Centre	Name of trials	No. of trials	No. of strains tested	Name of best strain excelling the check	Yield (kg/ha)	Check	Superiority over the check (%)	Specific objective
1	2	3	4	5	6	7	8	9
Crop: Toria								
Kanpur	PYT	01	12	TKM 22-108	1729	Tapeshwari		High seed yield
				TKM 22-103	1643			
				TKM 22-107	1590			
	SVT	01	10	TKM 19-2	1685	Azad Chetna		High seed yield
				TKM 22-2	1643			

				TKM 22-1	1567			
Bhubaneswar	PYT	01	16	ORT 17-5	1098	Sushree	10.7	Earliness and High yield under late sown conditions
	State MLT	01	12	ORT 18-6-16	1157	Sushree	11.4	Earliness and High yield under late sown conditions
Dholi	CSVT(Toria)	01(Three locations)	07	Multi location data under Analysis	-	Bhawani	-	To develop high yielding varieties for Bihar
Pantnagar	ST-I	1	16	PT-2017-2	1968		30.0	Earliness and high yield
				PT-2020.2	1786		18.3	
				PT-2020-4	1786		18.3	
	ST-II	1	11	PT-2021-2	1893		15.1	High yield
				PT-2021-1	1883		14.5	
				PT-2020-1	1800		9.5	
	SVT	1	09	TP-202	1889			
				TP-205	1851			
				TP-207	1849			
Chatha-KS	Station trial	01	08	JT-13-5	1322	PT-303	11.6	Earliness and high yield
Jagdalpur	Station trial	01	15			01 (CG Sarnso 01)		
Crop: Yellow Sarson								
Pantnagar	ST-I	1	18	PYS-2021-5	2253	Pitambari (1944)	15.9	High yield
				PYS-2020-3	2207		13.5	
				PYS-2021-8	2100		8.04	
	ST-II	1	18	PYS-2022-8	1908	YSH-0401 (1526)	25.0	High yield
				PYS-2022-4	1904		24.8	
				PYS-2022-6	1735		13.7	
	SVT	1	07	YPS-303	2037			High yield
				YSP-307	1917			
				YSP-302	1573			
Kanpur	PYT	01	12	YSKM 22-208	2060	Pitambari		High yield
				YSKM 22-207	1812	YST -151		
				YSKM 22-209	1736			
	S.V.T.	01		YSKM 19-1	2064	Pitambari and		High yield
				YSKM 19-2	1951	NDYS-2		
				YSKM 22-1	1812			
Crop: Indian Mustard								
Bhubaneswar	PYT	01	24	TM 258, TM 307, TM 308 ORM 26-37-2,	1192 - 1614	NRCHB 101	10.1- 21.3	High yield under late sown conditions
	State MLT	01	10	ORM 18-29-5, TM 316	1278 - 1571	NRCHB 101	9.8 - 12.7	High yield under late sown conditions

Chatha	Station trial	01	14	JM-16-9	1865	Kranti	14.8	High Yield
Dholi	CSVT	01 (Eleven locations)	07	Multi location data under Analysis	--	PM 25, RGN 73, & Kranti	--	To develop high yielding varieties for Bihar
ICAR-IARI, New Delhi	MST TS Irrigated	1	16	MST TS 22-2 MST TS 22-4	3589 3776	Kranti (3279) Pusa Vijay DRMRIJ 31 RH 749	9.45 15.2	High seed and oil yield under timely sown irrigated conditions
	MST TS Rainfed	1	18	MST CDL-22-5 MST CDL-22-11	3264 3316	Kranti (2885) DRMRIJ 31 RH 725	13.1 14.9	High seed and oil yield under timely sown rainfed conditions
	MSTH (E)-1	1	7	Pusa MH 135 Pusa MH 138 Pusa MH 140 (Extra early)	3399 3382 2990	PM 25 (3151) PM 28 JD-6	7.9 7.3 -5.1	Short duration hybrids
	MSTH 2	1	35	Pusa MH 170 Pusa MH 150	3424 3644	NRCHB 506 Giriraj RH 749 (3029)	13.0 20.0	High yielding hybrids for timely sown conditions
	MSTH 3	1 with small plot size	63	-	-	-	-	High yielding hybrids for early &timely sown conditions
	MSTH 4	1 with small plot size	66	-	-	-	-	High yielding hybrids
	MST (Early)	1	14	MSTE22-1 MSTE22-5	3555 3461	PM25	9.7 6.7	Short duration for early sown
	MST (Late)	1	18	MSTL22-7 MSTL22-11	2679 2849	PM 26	7.5 14.0	Short duration for late sown
	MST (Quality)	1	19	MSTQ22-1 (0) MSTQ22-4 (0) MSTQ22-11 (00) MSTQ22-15 (00)	2933 2761 2928 3002	PM32 PDZM-33 RH-749	19.4 12.4 3.0 5.6	Brown seeded genotypes with high seed and oil yield with low erucic acid and/or glucosinolates
Jagdalpur	Station trial	01	22	BR-67, BR-64		01 (CG Sarnso 01)		High yielding genotypes
Imphal (CAU)	STIM	1	19	CAU RM 4-1S	1025	NRCHB 101 (945)	8.5	High yield
Hisar	FYT	1	10	-	-			
	FYT (LS)	1	10	-	-			
	FYT (Toria+early raya)	1	10	-				
	LST	3	30	-	-			
	SST	8	189	-	-			

	SST (ER)	1	25	-	-			
	SST (hybrid)	2	32	-	-			
Kanpur	PYT (Early sown Mustard)	1	12	KMR(E) 22-301	1376	Kanti		High yield
				KMR(E) 22-310	1260			
				KMR(E) 22-302	1183			
	SVT (Early sown Mustard)	1	12	KMR (E) 19-1	1378	Azad Mahak		High yield
				KMR(E) 20-1	1362			
				KMR (E) 21-2	1018			
	PYT (Timely sown Mustard)	1	12	KMR 22-408	3009	Maya		High yield
				KMR 22-405	2828			
				KMR 22-403	2726			
	SVT.): (Timely Sown Mustard)	1	11	KMR 19-4	2828	Surekha		High yield
				KMR 20-4	2777			
				DRMRCI-173	2649			
Ludhiana (*Brassica juncea* (conventional)	Multilocation – Timely sown	1	10+3©	PBR-813-2, PBR 939, PBR-788-1,	>10%productivity as compared to the best check	PBR-357, PHR-126, RCH-1	--	Productivity Assessment
	Multilocation – Rainfed	1	16+2©	PMAS-07, PMAS-09, PMAS-B-28, PBR 825-2	>10%productivity as compared to the best check	PBR-97 PBR-357	--	Productivity Assessment under moisture stress conditions
	Large scale trial	1	16+2©	PBR-879, PBR-846, PBR-965	>10%productivity as compared to the best check	PBR-357, PHR 126	-	Productivity Assessment
	Large Scale Trial-Introgressed Mustard	1	24	JT-181,JT-529,JT-502,JA-331,JA-16,Giriraj, JT-666	-	PBR357, 45S46, PHR 126	-	Yield, earliness, abiotic stresses
	Small Scale Trial-Introgressed Mustard	1	44	909-75,896 – 42,914 – 87,274 - 918 P1,C 480,C 479,470 - 919 P1,414 – 87,895 – 39,C 464 - C48,899 – 50,903 -60,C 477,C 480-481,906 - 62		PHR 126, PBR357	--	Yield, earliness, biotic stresses

	Large Scale Trial-Determinate mustard	1	32	DTM-239-3,DTM-295-6,DTM-300,DTM-308,DTM-315,IAN-DT-Raya-2,DTM-341	-	PBR 357 Giriraj	-	Yield, earliness, determinacy
Ludhiana (*Brassica juncea* (0,00)	Multilocation – Timely sown	1	10+3©	PMAS-07, PMAS-09	>10%productivity as compared to the best check	RCH-1 RLC-3 PBR 357	-	Productivity Assessment
	Station trial	1	12+3©	PMAS 1604, PMAS 1607, PMAS 1609, PMAS 1611	>10%productivity as compared to the best check	RCH-1 PBR-357, PBR 91	-	Productivity Assessment
Ludhiana : Hybrid Development in *B. juncea*	MLT - Ludhiana	1	12	PHR 5175,PHR 3278,PHR 1293	-	PHR 126, 45S46, PBR- 357	-	High yield, earliness and oil content
	LSHT-1	1	28	PHR 3322,PHR 5175, PHR 8135,PHR 8425, PHR 8207,PHR 3281, PHR 80241	-	PBR 357, 45S46 , PHR -126	-	High yield, earliness and oil content
	SSHT-1	1	22	PHR 9017, PHR 9080, PHR 9081,PHR 9016, PHR 9054,PHR 9085, PHR 9034,PHR 9169, PHR 9173,PHR 9033, PHR 9051,PHR 9097, PHR 9099,PHR 9159, PHR 9105, PHR 9178		45S46, PHR-126	-	High yield, earliness and oil content
	SSHT-2	1	52	PHR 10067,PHR 10076,PHR 10206,PHR 10265,PHR 10291,PHR 10327,PHR 5111	-	PHR-126, PBR 357	-	High yield, earliness and oil content
	SSHT-3	1	48	PHR 9147,PHR 9099,PHR 9106,PHR 9138,PHR10029,PHR 4019,PHR 10040,PHR 3283,PHR 5119	-	PHR-126, 45S46		High yield, earliness and oil content.
	PRHT	1	192	PHR 10199,PHR-10154,PHR- 9127,PHR-10251,PHR- 9122,PHR-10138,PHR- 10159,PHR-10182,PHR-9134,PHR-3283,PHR-8081,PHR-10215	-	PHR-126, 45S46	-	High yield, earliness and oil content

	MLT - Ludhiana	1	12	PHR 5175,PHR 3278,PHR 1293	-	PHR 126, 45S46, PBR-357	-	High yield, earliness and oil content
	LSHT-1	1	28	PHR 3322,PHR 5175, PHR 8135,PHR 8425, PHR 8207,PHR 3281, PHR 80241	-	PBR 357, 45S46 , PHR -126	-	High yield, earliness and oil content
	SSHT-1	1	22	PHR 9017, PHR 9080, PHR 9081,PHR 9016, PHR 9054,PHR 9085, PHR 9034,PHR 9169, PHR 9173,PHR 9033, PHR 9051,PHR 9097, PHR 9099,PHR 9159, PHR 9105, PHR 9178		45S46, PHR-126	-	High yield, earliness and oil content
	SSHT-2	1	52	PHR 10067,PHR 10076,PHR 10206,PHR 10265,PHR 10291,PHR 10327,PHR 5111	-	PHR-126, PBR 357	-	High yield, earliness and oil content
Pantnagar	ST-I	1	16		2142	PM-25(1906)	12.4	Earliness and high yield
					2126		11.5	
					2106		10.5	
	ST-II	1	20		1768	PM-25 (1444)	22.4	Earliness and high yield
					1731		19.9	
					1706		18.1	
	ST-III	1	14		2658	RGN-73(2260)	17.6	Timely sown and High yield
					2629		16.3	
					2545		12.6	
	ST-IV	1	18		3122	Kranti (2310)	35.2	Timely sown and High yield
					2913		26.1	
					2910		26.0	
	ST-V	1	14		2550	NDYR-8 (2268)	12.4	Yellow seed color
					2530		11.6	
					2520		11.1	
	ST-VI	1	12		2456	Kranti (1946)	26.3	Late sown and high yield
					2204		13.3	
					2095		7.7	
	ST-VII	1	14		2143	NRCHB-101 (1710)	25.3	Late sown and high yield
					2085		21.9	
					1962		14.7	
	SVT	1	08		3176			High yield

					2867			
					2844			
Dholi	CSVT	01 (Eleven locations)	07	Multi location data under Analysis	--	PM 25, RGN 73, & Kranti	--	To develop high yielding varieties for Bihar
S K Nagar	LSVT	01	10	SKM 2012	3833	GDM 4	11.1	High seed yield & Medium maturing
				SKM 1801	3810		10.5	
	SSVT	01	16	SKM 2030	3882	GDM 4	12.7	High seed yield
				SKM 2104	3872		12.4	
				SKM 2120	3849		11.8	
	PYT – I	01	22	SKM 2204	3895	GDM 4	13.4	Early maturing. High seed yield & Dwarf
				SKM 2209	3802		10.7	
				SKM 2202	3757		09.4	
	PYT - II	01	22	SKM 2225	3612	Kranti	12.9	High seed yield & Bold seed
				SKM 2232	3556		11.2	
				SKM 2227	3502		09.5	
	PYT - III	01	22	SKM 2236	3802	GDM 4	14.9	High seed yield & Medium maturing
				SKMH 2202	3650	NRCHB 506	13.1	
Varanasi	SVT-1 (EARLY)	1	12	HUJM-(E)-22-5	2529		27.8	High yield
				HUJM (E)-22-1	2430		22.8	
				HUJM (E)- 22-6	2272		14.8	
	SVT-2 (TIMELY)	1	16	HUJM-21-13	2913	Giriraj	18.5	
				HUJM-21-2	2829	Kranti	9.5	
Crop: Gobhi Sarson								
Hisar	LST	1	10	Compilation in progress				
Chatha	Station trial	01	08	JGS 16-2	1936	GSL-1	13.2	High Yield
Ludhiana: Hybrid Development in Gobhi sarson	GSMLT-Ludhiana	1	12	GSH 2155, GSH 1699, GSH 1711	-	GSH 1707, GSC7	-	High yield
	LSHTGS	1	20	GSH-2531,GSH-2556, GSH-2557,GSH-2550, GSH-2560,GSH-2549, GSH-2565	-	GSH-1707, GSC-7, GSC-6		High yield
	PRT	1	120	GSH-2637, GSH-2620, GSH-2537, GSH-1754, GSH-2501, GSH-1709, GSH-2418, GSH-2619, GSH-2561, GSH -1703, GSH-2530, GSH-2507	-	GSH-1707, GSC-7		High yield
Ludhiana: Varietal development in *B.napus*	PRT	1	85	D 13, P 66	>10%productivity as compared to the best check	GSC-6, GSC 7, GSH-1699, GSH-1707	-	Early maturity productivity and shattering tolerance

Table 2.2: Breeder Seed production of indented Rapeseed-Mustard varieties during 2022-23

S. No.	State	Producing centre	Crop	Name of variety	Year of notification	DAC indent (q)	Actual allocation as per BSP-1 target(q)	Actual production (q)	Production surplus/deficit as per BSP-1 target(q)
1	Assam	AAU, Shilongani, Assam	Toria	TS-38	2021	1	1	27.76	26.76
2	Assam	AAU, Shilongani, Assam	Toria	M-27	1978	0.05	0.05	0.2	0.15
3	Assam	AAU, Shilongani, Assam	Toria	Jeuti (JT 90-1)	2022	0.12	0.12	0.12	0
4	Chhattisgarh	IGKVV Jagdalpur	Indian mustard	Chhattisgarh Sarson	2010	5.5	5.5	5.5	0
5	Gujarat	SDAU, SKNagar	Indian mustard	Gujarat Mustard -4	2015	0.05	0.05	0.7	0.65
6	Gujarat	SDAU, SKNagar	Indian mustard	Gujarat Mustard -3	2015	0.05	0.05	2	1.95
7	H.P.	Kangra	Gobhi Sarson	ONK-1 (Him Sarson)	2019	0.75	0.75	0.8	0.05
8	Haryana	CSSRI Karnal	Indian mustard	CS-58	2017	1.05	1.05	8	6.95
9	Haryana	CSSRI Karnal	Indian mustard	CS-60	2018	2.68	2.68	12	9.32
10	Haryana	CCS HAU Hisar	Indian mustard	RH-725	2018	3.17	3.17	11	7.83
11	Haryana	CCS HAU Hisar	Indian mustard	RH 406	2013	0.1	0.1	0.15	0.05
12	Haryana	CCS HAU Hisar	Indian mustard	RH 0749	2013	1.52	1.52	1.55	0.03
13	Haryana	CCS HAU Hisar	Indian mustard	RH-761	2019	4.82	4.82	4.85	0.03
14	Haryana	CCS HAU Hisar	Indian mustard	RH-1424	2022	0.02	0.02	0.1	0.08
15	Haryana	CCS HAU Hisar	Indian mustard	RH-1706	2022	0.02	0.02	0.1	0.08
16	Haryana	CCS HAU Hisar	Yellow Sarson	YSH 0401	2009	0.2	0.2	0.35	0.15
17	Haryana	CCS HAU Hisar	Indian mustard	RH 30	1985	0.76	0.76	3.37	2.61
18	Haryana	CCS HAU Hisar	Indian mustard	Laxmi (RH-8812)	1997	0.75	0.75	0.91	0.16
19	Haryana	Bayer Bioscience	Indian mustard	Kesari 5111	2019	1.55	1.55	3	1.45
20	Haryana	Shakti Vardhak	Indian mustard	Albeli-1	2015	0.2	0.2	0.5	0.3
21	Jammu & Kashmir	SKUAT, Jammu	Toria	RSPT-06	2019	0.55	0.55	0.25	-0.3
22	Jammu & Kashmir	SKUAT, Jammu	Brown Sarson	Gluechin	1996	0.4	0.4	0.08	-0.32
23	Jammu & Kashmir	SKUAT, Jammu	Brown Sarson	Shalimar sarson-1	2019	0.2	0.2	4.5	4.3
24	Jammu & Kashmir	SKUAT, Jammu	Brown Sarson	Shalimar sarson-2	2019	0.4	0.4	2.5	2.1
25	Jharkhand	BAU, Ranchi	Indian mustard	Birsa Bhabha Mustard 1	2021	1.5	1.5	1.5	0
26	Madhya Pradesh	ZARS, Morena	Indian mustard	RVM-1	2016	9.5	9.5	3.45	-6.05
27	Madhya Pradesh	ZARS, Morena	Indian mustard	RVM-2	2013	0.73	0.73	2.8	2.07
28	Madhya Pradesh	ZARS, Morena	Toria	RVT 1	2017	0.25	0.25	1.83	1.58
29	Madhya Pradesh	ZARS, Morena	Toria	RVT 3 (RTM 08-6)	2020	0.5	0.5	2.52	2.02
30	New Delhi	IARI, New Delhi	Indian mustard	Pusa Mustard-32	2020	5.4	5.4	5.4	0
31	New Delhi	IARI, New Delhi	Indian mustard	Pusa Double Zero Mustard-31 (PDZ-1)	2016	10.69	10.69	10.5	-0.19
32	New Delhi	IARI, New Delhi	Indian mustard	Pusa Double Zero Mustard-33	2021	0.7	0.7	1.5	0.8
33	New Delhi	IARI, New Delhi	Indian mustard	Pusa Mustard-25 (NPJ112)	2010	2.67	2.67	3	0.33
34	New Delhi	IARI, New Delhi	Indian mustard	PM 30	2013	4.25	4.25	5	0.75
35	New Delhi	IARI, New Delhi	Indian mustard	Pusa Muastard-27 (EJ17)	2011	0.65	0.65	1	0.35
36	New Delhi	IARI, New Delhi	Indian mustard	Pusa Mustard 28 (NPJ124)	2012	2.32	2.32	4	1.68
37	New Delhi	IARI, New Delhi	Indian mustard	Pusa Mustard-30 (LES-43)	2013	0.25	0.25	5	4.75

38	New Delhi	IARI, New Delhi	Indian mustard	Pusa Saag-1 (MR 704)	2004	0.25	0.25	-	-0.25
39	New Delhi	IARI, New Delhi	Indian mustard	Pusa Vijay (NPJ 93)	2008	0.5	0.5	0.5	0
40	New Delhi	IARI, New Delhi	Indian mustard	Pusa Bold	1985	1.05	1.05	1.1	0.05
41	New Delhi	NRCPB, New Delhi	Indian mustard	Pusa Jai Kissan (BIO 902)	1994	0.08	0.08	0.1	0.02
42	Orrisa	OUAT Bhubaneswar	Toria	Sushree	2016	2.03	2.03	2.1	0.07
43	Punjab	PAU, Ludhiana	Indian mustard	PBR- 357	2013	0.03	0.03	1	0.07
44	Punjab	PAU, Ludhiana	Indian mustard	PBR- 378	2021	0.1	0.1	-	-0.1
45	Punjab	PAU, Ludhiana	Indian mustard	RCH 1	2021	0.1	0.1	0.1	0
46	Punjab	PAU, Ludhiana	Indian mustard	RLC-3	2016	0.1	0.1	1	0.9
47	Punjab	PAU, Ludhiana	Indian mustard	PBR- 91	1996	0.01	0.01	1	0.99
48	Punjab	PAU, Ludhiana	Toria	TL-17	2016	0.03	0.03	0.7	0.67
49	Punjab	PAU, Ludhiana	Gobhi sarson	GSC-7	2014	0.13	0.13	1	0.87
50	Rajasthan	DRMR, Bharatpur	Indian mustard	Giriraj (DRMRIJ 31)	2013	9	9	11.5	2.25
51	Rajasthan	DRMR, Bharatpur	Indian mustard	DRMR 1165-40	2020	0.35	0.35	1	0.65
52	Rajasthan	DRMR, Bharatpur	Indian mustard	NRCHB-506 (F)	2009	0.1	0.1	0.5	0.4
53	Rajasthan	DRMR, Bharatpur	Indian mustard	NRCHB-506 (M)	2009	0.05	0.05	0.5	0.45
54	Rajasthan	DRMR, Bharatpur	Indian mustard	NRCHB 101	2009	2	2	6	4
55	Rajasthan	DRMR, Bharatpur	Indian mustard	DRMR 2017-15 (Radhika)	2021	1.31	1.31	5	3.69
56	Rajasthan	DRMR, Bharatpur	Indian mustard	DRMR 150-35	2020	5.63	5.63	12.3	6.67
57	Rajasthan	DRMR, Bharatpur	Indian mustard	DRMRIC 16-38	2020	0.2	0.2	0.5	0.3
58	Rajasthan	DRMR, Bharatpur	Yellow Sarson	NRCYS 05-02	2009	0.05	0.05	0.2	0.15
59	Rajasthan	SK RAU, Sriganganagar	Indian mustard	RGN-298	2014	0.63	0.63	1.75	1.12
60	Rajasthan	SK NAU, Jobner	Taramira	RTM-1351	2018	0.35	0.35	1.55	1.12
61	Rajasthan	SK NAU, Jobner	Taramira	RTM-1355 (Jwala Tara)	2017	1.55	1.55	3.7	2.15
62	Uttar Pradesh	CSAUA&T Kanpur	Indian mustard	Azad Mahak (KMR 15-2)	2021	0.23	0.23	3.8	3.57
63	Uttar Pradesh	CSAUA&T Kanpur	Indian mustard	Varuna (T 59)	1975	0.73	0.73	4.35	3.62
64	Uttar Pradesh	CSAUA&T Kanpur	Toria	Azad Chetna (TKM 14-2)	2021	1.3	1.3	3.2	1.9
65	Uttar Pradesh	CSAUA&T Kanpur	Toria	Tapeshwari TK 06-1	2014	3.49	3.49	7.35	3.86
66	Uttar Pradesh	CSAUA&T Kanpur	Toria	T-9	1975	0.22	0.22	0	-0.22
67	Uttar Pradesh	CSAUA&T Kanpur	Yellow sarson	Pitambari (RYSK-05-02)	2010	0.7	0.7	4.44	3.74
68	Uttarakhand	GBPUAT, Pantnagar	Indian mustard	Pant Rai-20	2015	0.05	0.05	0.2	0.15
69	Uttarakhand	GBPUAT, Pantnagar	Indian mustard	Pant Rai-21	2011	0.2	0.2	8	7.8
70	Uttarakhand	GBPUAT, Pantnagar	Toria	Uttara	2010	1.12	1.12	4	2.88
71	Uttarakhand	GBPUAT, Pantnagar	Toria	Pant Hill Toria-1 (PT 2006-4)	2017	0.2	0.2	1.5	1.3
72	Uttarakhand	GBPUAT, Pantnagar	Toria	Pant Toria-508 (PTE-2008-2)	2017	2.1	2.1	8	5.9
73	Uttarakhand	GBPUAT, Pantnagar	Yellow sarson	Pant Pili Sarson -1	2010	0.5	0.5	25	24.5
74	Uttarakhand	GBPUAT, Pantnagar	Yellow sarson	Pant Sweta (PYS 2007-10)	2017	1.15	1.15	25	23.85
75	Uttarakhand	GBPUAT, Pantnagar	Yellow sarson	Pant Girija	2018	0.53	0.53	3	2.47
76	Maharashtra	COA Nagpur	Indian mustard	Shatabdi (ACN 9)	2007	0.01	0.01	0.01	0
77	West Bengal	PORS, Behampore	Yellow sarson	Benoy (B 9)	1980	1.83	1.83	1.03	-0.8
78	West Bengal	PORS, Behampore	Yellow sarson	Agrani (B-54)	2003	0.1	0.1	0.15	0.05
79	West Bengal	PORS, Behampore	Yellow Sarson	Anushka	2020	0.17	0.17	0.17	0
80	West Bengal	PORS, Behampore	Yellow Sarson	Sachita	2020	0.14	0.14	0.14	0
81	West Bengal	BCKV, Kalyani	Indian mustard	TBM-209 (TM 204)	2019	0.36	0.36	0.6	0.24
82	Maharashtra	BARC Trombay	Indian mustard	TPM-1	2007	0.01	0.01	0.015	-0.08
	Total					**106.09**	**106.09**	**290.845**	**184.755**

Additional Breeder Seed Produced

S. No.	State	Crop	Name of the Variety	Actual production (q)
	Jammu & Kashmir			
1	SKUAT, Jammu	Indian mustard	JM- 135	0.60
2		Gobhi sarson	JGS- 123	0.70
	West Bengal			
3	BCKV, Kalyani	Indian mustard	TBM 143	125
	Uttar Pradesh			
4	CSAUA&T Kanpur	Indian mustard	Ashirwad	2.40
5				2.40
6			Maya	2.05
7			Surekha	3.30
8		Toria	Bhawani	2.25
	Gujarat			
9	SDAU, S K Nagar	Indian mustard	GM 1	0.80*
10			GM 2	0.90*
11			GDM 5	0.80
	Haryana			
12	IARI, RS Karnal	Indian Mustard	Pusa Mustard 34	0.20
13			PusaAgrani	0.20
14			Pusa Bold	1.40#
15			PM 26	3.12#
16			PusaJaikisan	0.43#
17			PusaTarak	0.10#
18			Pusa Vijay	0.17#
19			Pusa Mustard 32	0.33#
	Uttarakhand			
20	GBPUAT, Pantnagar	Indian Mustard	Kranti	1.00
21		Toria	PT-303	5.00
	Assam			
22	AAU-ZRS, Shillongani	Toria	TS 46	1.00
23			TS 36	3.00
24			TS 67	2.00

*** Carry over breeder seed produced during rabi 2021-22.** # **Carry over breeder seed produced during rabi 2020-21**

2.3 Coordinated Trials

Performance of 180 strains, including 06 toria, 11 of yellow sarson, 162 of Indian mustard and 01 of gobhi sarson was tested in nineteen performance evaluation trials consisting of toria (1), yellow sarson (01), gobhi sarson (01) and Indian mustard (16) at 49 locations across the 6 agro-climatic zones of the country. On the basis of superiority for seed/oil yield/ earliness/quality / resistance over the best check 24 strains including yellow sarson, gobhi sarson (01) and Indian mustard (22) were promoted for advanced stage evaluation. The performance of the strains was tested against following national check (NC), zonal check (ZC) and the latest release (LR) varieties/hybrids.

Trial	NC	ZC	LR
Toria	PT 303	Bhawani	Azad Chetna, TS 38
Yellow sarson	YSH 401	Benoy, NRCYS 05-2	Pitambari
Indian mustard			
Early mustard	Pusa Mustard 25	JD 6 PRO 5111 (Hybrid Check)	Pusa Mustard 28, GDM 4, NRCHB 101
Timely sown irrigated	Kranti	RCC 4, RH 749, Maya, Bio 902	Giriraj, RGN 73, GDM 4,
Rainfed	Kranti	RH 725, NRCHB 101	RH 0761, DRMR 150-35,
Late sown	Kranti	PM 26, NRCHB 101	Radhika, CS 56
Hybrid	Kranti	RGN 73, RH 749,GDM 4	DMH 1, 45S46
Quality	PM 30	RGN 73, RH 749, PDZ-1 PDZ 11 (Double low check)	Pusa Mustard 30, PM 32
Salinity	Kranti	CS 54	CS 60
White Rust Resistance	Basanti	RH 749, Maya	Giriraj, RGN 73
Gobhi Sarson	Kranti	GSL 1	GSC 6, AKMS 8141

Table 1.a Performance of toria strains in IVT Zone-III

S.No.	Code	Strain	Seed Yield (Kg/ha)					Plant Stand				Days to Maturity					1000-Seed Wt. (g)			
			KPR	PNT	MOR	DOL$	Mean	KPR	PNT	MOR	DOL	KPR	PNT	MOR	DOL	Mean	KPR	PNT	MOR	DOL
			1	2	3	4	(1-3)	1	2	3	4	1	2	3	4	(1-3)	1	2	3	4
1	TCN-22-1	JT-14-9	1173	1315	2279	833	**1589**	119	153	129	161	94	90	108	104	97	3.0	2.9	3.2	2.8
2	**TCN-22-2**	**PT- 303 (NC)**	**1335**	**1965**	**2478**	**863**	**1926**	**116**	**173**	**133**	**170**	**93**	**94**	**109**	**109**	**99**	**3.4**	**3.2**	**3.8**	**3.1**
3	TCN-22-3	TKM 21-2	1582	1277	2702	940	**1854**	124	164	128	164	96	98	114	109	103	3.2	3.3	3.5	2.7
4	TCN-22-4	PT- 2019-4	1273	1762	2685	839	**1907**	118	169	129	168	95	93	112	109	100	2.7	3.4	4.1	3.3
5	TCN-22-5	TKM 21-1	1427	1688	2511	940	**1875**	114	169	135	166	94	96	116	110	102	3.1	3.3	3.7	2.5
6	TCN-22-6	Azad Chetna (LR)	1235	1098	2507	0	**1613**	116	160	127	0	97	113	118	0	109	3.1	2.7	3.3	0.0
7	TCN-22-7	Bhawani (ZC)	1505	1586	2496	1002	**1862**	119	177	131	166	99	97	116	107	104	3.1	3.2	3.8	3.2
8	TCN-22-8	PT- 2016-9	1543	2021	2430	925	**1998**	122	154	135	166	94	95	116	108	102	3.4	3.0	3.5	3.1
9	TCN-22-9	BAUT-08-09	1265	1779	2564	863	**1870**	118	160	131	164	97	94	111	106	101	3.5	3.3	3.6	3.0
		GM	**1371**	**1610**	**2517**	**901**	**1833**													
		CD (5 %)	184	285	223	171														
		CV (%)	7.7	10.2	5.1	12.4														
		DOS	30.9.2022	6.10.2022	10.10.2022	10.10.2022														

$ data of DOL excluded from computation of mean due to lower experimental mean of trial than state mean

Table 1.b Performance of toria strains in IVT Zone-III

S.No.	Code	Strain	1000-Seed Wt. (g)				Oil Content %					Oil Yield kg/ ha
			KPR	PNT	MOR	DOL	KPR	PNT	MOR	DOL$	Mean	
			1	2	3	4	1	2	3	4	(1-3)	
1	TCN-22-1	JT-14-9	3.0	2.9	3.2	2.8	38.9	43.2	42.8	38.5	41.6	**661**
2	**TCN-22-2**	**PT- 303 (NC)**	**3.4**	**3.2**	**3.8**	**3.1**	**39.6**	**44.5**	**43.0**	**39.9**	**42.4**	**816**
3	TCN-22-3	TKM 21-2	3.2	3.3	3.5	2.7	40.4	43.3	44.9	39.8	42.9	**795**
4	TCN-22-4	PT- 2019-4	2.7	3.4	4.1	3.3	39.5	42.5	43.5	39.1	41.8	**798**
5	TCN-22-5	TKM 21-1	3.1	3.3	3.7	2.5	40.1	43.3	42.7	39.0	42.0	**788**
6	TCN-22-6	Azad Chetna (LR)	3.1	2.7	3.3	0.0	42.8	43.4	44.4	0.0	43.5	**702**
7	TCN-22-7	Bhawani (ZC)	3.1	3.2	3.8	3.2	39.3	42.7	44.2	39.0	42.1	**783**
8	TCN-22-8	PT- 2016-9	3.4	3.0	3.5	3.1	39.7	44.3	42.8	40.0	42.3	**844**
9	TCN-22-9	BAUT-08-09	3.5	3.3	3.6	3.0	39.8	43.4	44.2	39.6	42.5	**794**

Table 1.1.a Performance of toria strains in IVT Zone-V Rainfed

S.No	Code	Strain	Seed Yield (Kg/ha)							Plant Stand						Days to Maturity						
			KNK	BHU	SHL	JAG$	IMP$	KLN$	Mean	KNK	BHU	SHL	JAG	IMP	KLN	KNK	BHU	SHL	JAG	IMP	KLN	Mean
			1	2	3	4	5	6	(1-3)	1	2	3	4	5	6	1	2	3	4	5	6	(1-3)
1	**TCN-22-1**	JT-14-9	922	931	1031	1159	883	1114	**961**	177	123	226	327	145	224	77	85	78	60	95	83	**80**
2	TCN-22-2	PT- 303 (NC)	983	1002	1123	1580	864	1188	**1036**	178	128	257	253	152	220	82	87	84	61	96	84	**84**
3	TCN-22-3	TKM 21-2	1070	1084	389	1248	840	1546	**847**	181	131	183	412	151	221	86	88	84	71	97	85	**86**
4	TCN-22-4	PT- 2019-4	994	1037	728	1277	1025	1210	**920**	188	131	295	295	159	217	85	85	84	64	95	84	**85**
5	TCN-22-5	TKM 21-1	931	804	741	1413	877	1491	**825**	171	125	265	259	154	221	83	84	81	74	96	85	**83**
6	**TCN-22-6**	**TS- 38 (LR)**	**1125**	**826**	**1173**	**1710**	**938**	**1312**	**1041**	**175**	**122**	**326**	**332**	**155**	**217**	**88**	**85**	**81**	**68**	**94**	**82**	**85**
7	TCN-22-7	Bhawani (ZC)	864	865	815	1484	883	1401	**848**	179	121	211	332	154	219	89	83	83	68	96	85	**85**
8	TCN-22-8	PT- 2016-9	1049	941	1111	1297	926	1173	**1034**	188	123	336	238	159	214	86	87	81	64	95	87	**85**
9	TCN-22-9	BAUT-08-09	1188	867	833	1521	914	1157	**963**	179	125	256	254	165	227	87	82	81	65	94	85	**83**
		GM	**1014**	**929**	**883**	**1410**	**905**	**1288**	**942**													
		CD 5%	159	89.4	89.5	NS	NS	NS														
		CV (%)	9.1	5.6	5.9	14.9	7.5	15.0														
		DOS	8.10.2022	31.10.2022	30.10.2022	15.10.2022	28.10.2022	30.10.2022														

$ Data of JAG, IMP and KLN excluded in computation of mean due to non significant data

Table 1.1.b Performance of toria strains in IVT Zone-V Rainfed

S.No	Code	Strain	1000-Seed Wt. (g.)					
			KNK	BHU	SHL	JAG	IMP	KLN
			1	2	3	4	5	6
1	**TCN-22-1**	JT-14-9	3.4	3.7	2.5	2.4	2.8	3.2
2	TCN-22-2	PT- 303 (NC)	2.6	3.9	3.5	3.0	2.6	3.1
3	TCN-22-3	TKM 21-2	2.8	4.0	2.8	2.9	2.7	3.3
4	TCN-22-4	PT- 2019-4	3.1	3.8	3.0	3.1	3.3	3.3
5	TCN-22-5	TKM 21-1	2.7	3.6	3.1	2.9	3.0	3.4
6	**TCN-22-6**	**TS- 38 (LR)**	**3.2**	**3.4**	**3.5**	**3.3**	**3.2**	**3.5**
7	TCN-22-7	Bhawani (ZC)	2.8	3.7	2.8	2.9	3.4	3.1
8	TCN-22-8	PT- 2016-9	2.6	3.9	3.2	2.7	3.3	3.3
9	TCN-22-9	BAUT-08-09	2.8	3.6	3.3	2.8	2.8	3.2

Table 2.a Performance of yellow sarson strains in IVT Zone-III

S.No.	Code	Strain	Seed yield (kg/ha)					Plant Stand				Days to Maturity				1000-seed wt. (g)			
			KPR	PNT	MOR	DOL$	Mean	KPR	PNT	MOR	DOL	KPR	PNT	MOR	DOL	KPR	PNT	MOR	DOL
			1	2	3	4	(1-3)	1	2	3	4	1	2	3	4	1	2	3	4
1	YSCN-22-1	AAUJYS 14-2	1505	1903	2500	870	**1969**	121	171	134	166	120	111	121	109	4.3	3.4	3.4	2.9
2	YSCN-22-2	DRMRYS 205	1427	2057	2805	848	**2097**	122	152	148	166	118	124	127	107	4.6	4.7	5.0	4.0
3	**YSCN-22-3**	**NRCYS-05-02 (ZC)**	**1389**	**1988**	**2677**	**817**	**2018**	**117**	**156**	**134**	**164**	**122**	**117**	**124**	**106**	**4.6**	**3.8**	**3.8**	**3.5**
4	YSCN-22-4	PYS-2018-1	1659	2168	2716	1002	**2181**	123	160	141	166	125	122	135	108	4.6	4.0	3.8	3.8
5	YSCN-22-5	RMYS 4	1335	1146	2693	768	**1725**	116	162	154	163	123	124	133	107	3.9	3.1	4.6	3.9
6	YSCN-22-6	DRMRYS 204	1350	1336	2820	820	**1835**	118	157	157	160	119	115	124	108	4.0	4.0	4.4	3.7
7	YSCN-22-7	YSKM 21-1	1505	1598	3138	863	**2080**	122	135	152	164	124	121	125	109	5.0	3.9	3.6	3.6
8	YSCN-22-8	AAUJYS 15-2	1196	1958	2296	768	**1817**	118	158	148	165	117	109	130	107	4.0	3.3	3.4	4.0
9	YSCN-22-9	YSH 401 (NC)	1350	1732	2552	894	**1878**	120	166	154	165	120	124	122	108	5.0	4.1	3.7	5.3
10	YSCN-22-10	PYS 2018-4	1543	1760	2873	863	**2059**	119	169	139	163	123	123	126	108	3.8	4.0	3.4	3.9
11	YSCN-22-11	DRMRYS-18-15	1736	1468	3054	780	**2086**	124	162	140	169	121	117	127	107	4.8	4.2	3.8	5.3
12	YSCN-22-12	YSKM 21-2	1312	1806	2695	799	**1938**	116	163	156	161	118	121	130	107	4.1	4.4	4.5	4.6
13	YSCN-22-13	Pitambari (LR)	1349	1464	2855	863	**1889**	121	158	144	167	122	122	120	106	5.0	3.9	4.1	4.9
14	YSCN-22-14	RMYS 5	1427	1093	1995	888	**1505**	120	135	143	168	120	121	119	106	5.1	2.5	3.9	5.5
		GM	1435	1677	2691	846	**1934**												
		CD (5%)	178	344	293	NS													
		CV (%)	7.4	12.2	6.5	8.8													
		DOS	30.9.2022	20.10.2022	24.10.2022	10.10.2022													

$ Data of DOL not included in computation of mean due to non significant data

Table 2.b Performance of yellow sarson strains in IVT Zone-III

S.No.	Code	Strain	Oil Content %					Oil Yield (kg/ha)
			KPR	PNT	MOR	DOL$	Mean	
			1	2	3	4	(1-3)	
1	YSCN-22-1	AAUJYS 14-2	41.5	43.3	42.7	40.0	**42.5**	**837**
2	YSCN-22-2	DRMRYS 205	40.9	45.1	44.5	39.8	**43.5**	**912**
3	**YSCN-22-3**	**NRCYS-05-02 (ZC)**	**41.0**	**44.1**	**44.4**	**39.1**	**43.2**	**871**
4	YSCN-22-4	PYS-2018-1	41.1	40.1	43.7	40.2	**41.6**	**908**
5	YSCN-22-5	RMYS 4	39.3	45.0	44.9	38.9	**43.1**	**743**
6	YSCN-22-6	DRMRYS 204	41.9	44.6	44.8	41.4	**43.8**	**803**
7	YSCN-22-7	YSKM 21-1	41.4	47.1	45.1	41.5	**44.5**	**926**
8	YSCN-22-8	AAUJYS 15-2	39.3	48.9	43.1	38.8	**43.8**	**795**
9	YSCN-22-9	YSH 401 (NC)	43.7	44.8	45.0	41.3	**44.5**	**836**
10	YSCN-22-10	PYS 2018-4	44.3	44.9	46.2	41.5	**45.1**	**929**
11	YSCN-22-11	DRMRYS-18-15	42.6	44.7	45.2	41.1	**44.2**	**921**
12	YSCN-22-12	YSKM 21-2	43.5	44.9	44.5	40.7	**44.3**	**859**
13	YSCN-22-13	Pitambari (LR)	42.4	46.9	46.5	40.3	**45.3**	**855**
14	YSCN-22-14	RMYS 5	42.5	42.3	43.0	41.4	**42.6**	**641**

Table 2.1 Performance of yellow sarson strains in IVT Zone-V (RF)

S.No.	Code	Strain	Seed yield (kg/ha)							Plant Stand					Days to maturity					1000-Seed wt. (g)				
			SHL#	IMP	KNK	KLN$	BHU	Mean		SHL	IMP	KNK	KLN	BHU	SHL	IMP	KNK	KLN	BHU	SHL	IMP	KNK	KLN	BHU
			1	2	3	4	5	(2-3,5)		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1	YSCN-22-1	AAUJYS 14-2	1759	1006	957	1414	845	**936**		272	155	172	186	125	98	104	96	88	86	3.8	3.7	2.9	3.6	4.0
2	YSCN-22-2	DRMRYS 205	1265	951	783	1448	1004	**913**		261	155	177	187	126	101	103	102	86	91	4.5	4.5	4.2	3.7	4.1
3	**YSCN-22-3**	**Binoy (ZC)**	**1235**	**1049**	**1038**	**1333**	**807**	**965**		**263**	**139**	**185**	**188**	**125**	**99**	**103**	**96**	**87**	**86**	**4.2**	**3.6**	**2.7**	**4.5**	**4.0**
4	**YSCN-22-4**	**PYS-2018-1**	**1451**	**1160**	**1032**	**1701**	**1037**	**1077**	*	**282**	**152**	**175**	**198**	**128**	**109**	**105**	**103**	**89**	**93**	**3.7**	**3.8**	**3.6**	**4.2**	**4.0**
5	YSCN-22-5	RMYS 4	463	0	919	1123	744	**832**		152	0	180	183	124	101	0	112	87	85	3.8	0.0	2.3	4.1	3.8
6	YSCN-22-6	DRMRYS 204	1327	870	1128	1404	993	**997**		255	147	174	197	128	109	103	103	91	87	4.1	4.1	4.1	3.4	3.8
7	YSCN-22-7	YSKM 21-1	1698	907	954	1846	722	**861**		274	162	182	186	126	108	105	102	87	84	3.4	3.6	3.6	3.8	4.0
8	YSCN-22-8	AAUJYS 15-2	2191	1346	1032	1608	741	1040		311	153	185	193	125	102	100	94	87	83	3.5	3.9	2.7	3.5	3.8
9	YSCN-22-9	YSH 401 (NC)	1759	858	861	1559	787	**835**		262	161	173	190	126	114	104	104	91	85	3.8	4.0	3.4	4.1	3.7
10	YSCN-22-10	PYS 2018-4	1327	975	890	1605	849	**905**		177	144	181	190	127	108	104	105	89	86	4.2	3.6	3.7	3.6	4.0
11	YSCN-22-11	DRMRYS-18-15	1512	1037	1093	1660	940	**1023**		249	157	175	194	129	109	102	100	87	91	4.3	3.7	4.0	3.9	4.0
12	YSCN-22-12	YSKM 21-2	1080	883	945	1571	986	**938**		199	156	185	194	125	111	105	102	87	92	4.5	3.9	4.4	3.7	4.3
13	YSCN-22-13	Pitambari (LR)	1543	1049	1000	1627	824	958		251	163	175	189	124	108	105	103	86	85	4.1	3.8	3.2	4.0	3.9
14	YSCN-22-14	RMYS 5	710	0	728	1027	755	**742**		127	0	183	193	121	127	0	106	87	84	3.5	0.0	4.5	3.6	3.8
		GM	**1380**	**1008**	**954**	**1495**	**750**	**904**																
		CD (5%)	297	144	138	387	82																	
		CV (%)	12.8	9.9	8.6	15.4	5.7																	
		DOS	30.10.2022	29.10.2022	17.10.2022	30.10.2022	31.10.2022																	

$ Data of KLN excluded from computation of mean due to high C.V.of the expt.

Data of SHL excluded from computation of mean due to four time variation in entries mean of particular trial and also two time higher mean of entry of developing centre.

* Strain outyielding the best check by a margin of more than or equal to 10 percent on the basis of seed yield

Table 3.a Performance of early Indian mustard strains in IVT Zone-IV

S.No.	Code	Strain	Seed Yield (kg/ha)					Plant Stand				Days to maturity				
			SKN	NGP	MDR	JUG	Mean	SKN	NGP	MDR	JUG	SKN	NGP	MDR	JUG	Mean
			1	2	3	4	(1-4)	1	2	3	4	1	2	3	4	(1-4)
1	MCN (E)-22-01	Pusa MH 126 (Hybrid)	2970	1782	2206	1877	**2208**	180	115	161	178	112	104	115	106	**109**
2	MCN (E)-22-02	BAUM-2022-1	3110	1743	2737	2549	**2535**	178	116	166	178	112	101	114	107	**109**
3	MCN (E)-22-03	DRMRHT-1712	3050	1662	2757	2660	**2532**	178	114	167	179	111	101	113	97	**106**
4	MCN (E)-22-04	ACN 247	3303	1761	3274	2222	**2640**	178	114	166	176	111	102	113	100	**107**
5	MCN (E)-22-05	JD 6 (ZC)	3013	2013	2769	2537	**2583**	177	116	168	177	111	102	114	100	**107**
6	MCN (E)-22-06	PRE-2018- 1	2709	1858	2379	2272	**2304**	181	113	160	178	103	99	116	90	**102**
7	MCN (E)-22-07	DRMRCI- 156	3465	1617	2557	1944	**2396**	181	117	169	178	112	104	111	109	**109**
8	MCN (E)-22-08	KMR(E) 22-2	2799	1946	2978	2444	**2542**	182	114	158	178	108	104	115	100	**107**
9	MCN (E)-22-09	NPJ 257	2306	1885	2426	1969	**2147**	160	114	158	179	108	105	109	98	**105**
10	MCN (E)-22-10	TM 314-1	2878	1696	2806	2346	**2431**	158	115	169	178	112	105	116	100	**108**
11	MCN (E)-22-11	PM 25 (NC)	2702	1872	2597	2346	**2379**	160	111	157	178	104	101	109	94	**102**
12	MCN (E)-22-12	SVJH- 72 (Hybrid)	3749	1840	3231	2920	**2935**	180	116	168	176	108	99	113	97	**104**
13	MCN (E)-22-13	RH 2199-11	2373	1853	2564	2679	**2367**	180	112	157	177	105	99	112	95	**103**
14	MCN (E)-22-14	DRMRSJ 272	2951	1618	2599	1759	**2232**	161	112	160	179	104	109	110	97	**105**
15	MCN (E)-22-15	NPJ 258	3138	1825	2625	2352	**2485**	179	114	159	179	103	96	110	89	**100**
16	MCN (E)-22-16	KMR(E) 22-1	2759	1665	2813	2222	**2365**	175	112	167	178	108	107	113	100	**107**
17	MCN (E)-22-17	DRMRIJ 20-117	2356	1725	2767	2580	**2357**	176	113	164	179	105	101	113	90	**102**
18	MCN (E)-22-18	Q80623	2329	1803	2526	3086	**2436**	175	112	170	179	107	102	114	91	**104**
19	**MCN (E)-22-19**	**GDM 4 (LR)**	**3563**	**1990**	**2686**	**2130**	**2592**	**180**	**112**	**172**	**179**	**110**	**105**	**107**	**104**	**107**
20	MCN (E)-22-20	ANDM 14-09	2850	1714	3189	1926	**2420**	169	109	170	178	110	102	114	109	**109**
21	**MCN (E)-22-21**	**PRO 5111 (Hybrid Check)**	**2513**	**1643**	**2904**	**2346**	**2351**	**169**	**116**	**160**	**177**	**102**	**96**	**111**	**84**	**98**
22	MCN (E)-22-22	HUJMI 21-1	2961	1559	3217	2296	**2508**	181	112	167	177	108	98	119	99	**106**
23	MCN (E)-22-23	RH 1999-37	2343	1647	2463	1735	**2047**	179	111	166	178	107	99	113	95	**104**
24	MCN (E)-22-24	SHIVANI PLUS	3087	1641	2098	2660	**2372**	180	111	157	179	107	100	116	93	**104**
25	MCN (E)-22-25	PRE-2020-14	2848	1612	2133	2395	**2247**	170	110	162	178	103	99	109	97	**102**
		GM	**2885**	**1759**	**2692**	**2330**	**2416**									
		CD (5 %)	443	251	349	359										
		CV (%)	9.4	8.7	7.9	9.4										
		DOS	8.10.2022	10.10.2022	9.10.2022	10.10.2022										

Table 3.b Performance of early Indian mustard strains in IVT Zone-IV

S.No.	Code	Strain	1000 Seed Weight				Oil Content (%)				Oil Yield (kg/ha)
			SKN	NGP	MDR	JUG	SKN	NGP	JUG	Mean	
			1	2	3	4	1	2	4	(1-2,4)	
1	MCN (E)-22-01	Pusa MH 126 (Hybrid)	5.5	4.8	5.6	5.0	40.3	31.69	32.78	**34.9**	**771**
2	MCN (E)-22-02	BAUM-2022-1	5.5	4.5	4.9	4.6	37.3	29.46	35.69	**34.2**	**866**
3	MCN (E)-22-03	DRMRHT-1712	4.9	4.7	4.8	4.4	38.3	31.67	35.63	**35.2**	**891**
4	MCN (E)-22-04	ACN 247	4.7	4.1	5.0	4.4	39.4	32.65	35.33	**35.8**	**945**
5	MCN (E)-22-05	JD 6 (ZC)	4.9	5.7	4.1	3.9	40.5	35.64	36.11	**37.4**	**966**
6	MCN (E)-22-06	PRE-2018- 1	4.9	6.1	4.4	4.2	41.3	34.45	34.75	**36.8**	**849**
7	MCN (E)-22-07	DRMRCI- 156	5.7	4.1	4.3	4.7	40.8	33.84	36.73	**37.1**	**889**
8	MCN (E)-22-08	KMR(E) 22-2	4.8	5.5	5.9	4.4	38.6	35.65	34.47	**36.2**	**921**
9	MCN (E)-22-09	NPJ 257	5.9	4.7	5.3	5.1	36.9	35.18	36.72	**36.3**	**778**
10	MCN (E)-22-10	TM 314-1	6.4	4.2	6.2	5.4	39.7	30.54	35.42	**35.2**	**856**
11	MCN (E)-22-11	PM 25 (NC)	5.2	4.7	5.1	4.5	39.8	35.21	35.88	**37.0**	**879**
12	MCN (E)-22-12	SVJH- 72 (Hybrid)	5.2	4.5	6.1	4.7	42.5	36.43	37.43	**38.8**	**1138**
13	MCN (E)-22-13	RH 2199-11	5.4	5.1	5.6	5.2	37.1	36.50	36.88	**36.8**	**872**
14	MCN (E)-22-14	DRMRSJ 272	4.9	4.5	4.3	3.9	38.8	34.42	34.02	**35.7**	**798**
15	MCN (E)-22-15	NPJ 258	5.8	4.5	6.0	4.9	37.5	31.65	36.05	**35.1**	**871**
16	MCN (E)-22-16	KMR(E) 22-1	5.0	4.3	5.5	4.6	39.4	35.69	36.57	**37.2**	**880**
17	MCN (E)-22-17	DRMRIJ 20-117	4.8	4.5	5.3	4.1	38.9	32.24	37.4	**36.2**	**853**
18	MCN (E)-22-18	Q80623	4.5	4.8	4.2	4.1	42.9	36.53	36.51	**38.6**	**941**
19	**MCN (E)-22-19**	**GDM 4 (LR)**	**5.6**	**5.1**	**4.6**	**4.2**	**39.2**	**34.92**	**34.99**	**36.4**	**943**
20	MCN (E)-22-20	ANDM 14-09	5.4	4.5	4.4	4.3	38.2	35.22	36.37	**36.6**	**886**
21	**MCN (E)-22-21**	**PRO 5111 (Hybrid Check)**	**3.9**	**4.2**	**5.2**	**3.3**	**40.1**	**34.43**	**36.01**	**36.8**	**866**
22	MCN (E)-22-22	HUJMI 21-1	5.1	4.0	4.7	4.6	40.9	33.13	35.1	**36.4**	**912**
23	MCN (E)-22-23	RH 1999-37	5.2	4.4	4.7	3.9	39.4	33.04	33.63	**35.4**	**724**
24	MCN (E)-22-24	SHIVANI PLUS	4.8	4.5	4.0	4.5	38.9	35.67	34.88	**36.5**	**865**
25	MCN (E)-22-25	**PRE-2020-14**	5.3	5.7	5.0	4.6	40.1	32.92	36.76	**36.6**	**822**

Table 3.1.a. Performance of early Indian mustard strains in IVT Zone-V

S.No	Code	Strain	Seed Yield (Kg/ha)								Plant Stand					
			KNK	SHL	BHU	JAG	IMP	KLN$	Mean		KNK	SHL	BHU	JAG	IMP	KLN
			1	2	3	4	5	6	(1-5)		1	2	3	4	5	6
1	MCN (E)-22-01	Pusa MH 126 (Hybrid)	1185	2115	966	1477	1012	1941	**1351**		191	312	143	292	165	210
2	MCN (E)-22-02	BAUM-2022-1	1289	1881	1226	1933	1333	2085	**1533**		193	177	168	272	145	200
3	MCN (E)-22-03	DRMRHT-1712	1451	1586	1230	1479	957	1820	**1341**		190	272	156	291	148	203
4	MCN (E)-22-04	ACN 247	1373	2305	1008	1671	1105	2119	**1492**		192	257	140	265	157	199
5	MCN (E)-22-05	JD 6 (ZC)	1532	1295	1255	1841	1259	2170	**1437**		190	277	159	279	154	205
6	MCN (E)-22-06	PRE-2018- 1	1286	2694	1158	968	1006	1998	**1423**		200	293	139	286	161	195
7	MCN (E)-22-07	DRMRCI- 156	1417	1636	1139	1798	1302	1730	**1458**		182	285	131	282	167	199
8	**MCN (E)-22-08**	**KMR(E) 22-2**	**1359**	**2031**	**1263**	**2500**	**1481**	**2160**	**1727**	*	**195**	**170**	**160**	**281**	**155**	**202**
9	MCN (E)-22-09	NPJ 257	1156	1216	1292	2336	1228	1954	**1446**		191	204	152	289	151	195
10	MCN (E)-22-10	TM 314-1	1454	2519	1132	1422	1111	1996	**1528**		187	262	133	291	149	209
11	MCN (E)-22-11	PM 25 (NC)	1474	1605	1117	1339	1031	2046	**1313**		193	270	130	274	158	205
12	MCN (E)-22-12	SVJH- 72 (Hybrid)	1489	2598	1407	1768	957	2049	**1644**		189	288	171	282	150	209
13	MCN (E)-22-13	RH 2199-11	1448	2401	1249	1196	1167	1850	**1492**		190	233	162	290	157	202
14	MCN (E)-22-14	DRMRSJ 272	1171	2222	1098	1958	969	1657	**1484**		191	223	133	263	144	201
15	MCN (E)-22-15	NPJ 258	1573	2278	1169	970	938	1994	**1386**		190	245	142	292	143	211
16	MCN (E)-22-16	KMR(E) 22-1	1330	1581	1167	1847	1358	2169	**1457**		190	157	146	273	140	205
17	MCN (E)-22-17	DRMRIJ 20-117	1341	1800	1186	1773	833	1979	**1387**		200	170	136	281	142	206
18	MCN (E)-22-18	Q80623	1315	2556	1123	1480	870	1913	**1469**		188	249	141	277	148	204
19	**MCN (E)-22-19**	**NRCHB- 101 (LR)**	**1197**	**2457**	**1252**	**2021**	**932**	**2178**	**1572**		**193**	**252**	**161**	**279**	**159**	**205**
20	MCN (E)-22-20	ANDM 14-09	1388	1543	1121	1572	926	2483	**1310**		198	244	147	289	153	204
21	MCN (E)-22-21	PRO 5111 (Hybrid Check)	1570	2242	1479	1432	1031	1920	**1551**		185	285	171	281	145	203
22	MCN (E)-22-22	HUJMI 21-1	1344	2896	1351	1220	969	2028	**1556**		188	235	164	290	155	204
23	MCN (E)-22-23	RH 1999-37	1298	2241	1252	1636	914	2179	**1468**		189	152	159	282	162	210
24	MCN (E)-22-24	SHIVANI PLUS	1344	1543	1120	2085	1315	1991	**1481**		197	146	138	289	162	207
25	MCN (E)-22-25	PRE-2020-14	1706	2556	1024	1496	1191	2168	**1594**		189	207	131	292	153	211
		GM	**1380**	**2072**	**1191**	**1649**	**1088**	**2023**	**1476**							
		CD (5 %)	236	367	103	278	174	NS								
		CV (%)	10.7	10.8	5.3	10.3	9.7	12.4								
		DOS	18.10.2022	11.11.2022	7.11.2022	28.10.2022	13.11.2022	7.11.2022								

$ Data of KLN excluded from computation of mean due to non significant data

* Strain outyielding the best check by a margin of more than or equal to 10 percent on the basis of seed yield

Table 3.1.b. Performance of early Indian mustard strains in IVT Zone-V

S.No	Code	Strain	Days to Maturity							1000-Seed Wt.(g)					
			KNK	SHL	BHU	JAG	IMP	KLN$	Mean	KNK	SHL	BHU	JAG	IMP	KLN
			1	2	3	4	5	6	(1-5)	1	2	3	4	5	6
1	MCN (E)-22-01	Pusa MH 126 (Hybrid)	110	104	107	102	112	92	**107**	4.6	4.5	4.3	3.4	3.5	3.9
2	MCN (E)-22-02	BAUM-2022-1	116	103	110	113	113	94	**111**	4.5	5.0	4.6	3.3	3.8	4.4
3	MCN (E)-22-03	DRMRHT-1712	117	103	111	111	113	94	**111**	4.7	3.8	4.1	3.4	3.5	4.5
4	MCN (E)-22-04	ACN 247	115	103	108	106	111	103	**109**	3.9	2.6	4.3	4.2	4.0	4.9
5	MCN (E)-22-05	JD 6 (ZC)	113	103	112	107	111	91	**109**	4.5	3.1	4.1	3.6	3.5	4.8
6	MCN (E)-22-06	PRE-2018- 1	110	110	108	107	109	94	**109**	4.4	3.5	3.9	3.5	3.7	4.0
7	MCN (E)-22-07	DRMRCI- 156	114	109	108	106	112	96	**110**	5.1	4.5	4.0	2.7	4.0	4.6
8	**MCN (E)-22-08**	**KMR(E) 22-2**	**112**	**109**	**109**	**106**	**111**	**98**	**109**	**4.0**	**3.6**	**4.3**	**4.4**	**3.6**	**3.6**
9	MCN (E)-22-09	NPJ 257	112	105	113	108	111	96	**110**	5.2	4.3	4.1	4.4	3.9	4.4
10	MCN (E)-22-10	TM 314-1	116	106	107	113	114	92	**111**	6.2	4.3	4.3	3.7	4.2	5.0
11	MCN (E)-22-11	PM 25 (NC)	112	104	107	103	110	93	**107**	4.8	5.7	4.0	3.4	3.6	4.0
12	MCN (E)-22-12	SVJH- 72 (Hybrid)	112	103	111	106	110	95	**109**	4.7	4.1	4.2	3.1	3.8	4.0
13	MCN (E)-22-13	RH 2199-11	109	101	112	107	110	93	**108**	4.9	4.3	4.0	3.7	4.1	3.8
14	MCN (E)-22-14	DRMRSJ 272	112	104	105	103	110	93	**107**	4.7	4.3	4.1	3.3	3.7	3.5
15	MCN (E)-22-15	NPJ 258	108	103	108	105	110	98	**107**	4.3	4.2	4.0	3.4	3.6	3.6
16	MCN (E)-22-16	KMR(E) 22-1	112	103	106	112	112	100	**109**	4.6	4.1	4.0	3.4	3.9	4.5
17	MCN (E)-22-17	DRMRIJ 20-117	112	103	108	103	110	95	**107**	3.9	3.7	4.1	3.5	3.7	3.8
18	MCN (E)-22-18	Q80623	110	105	107	106	111	103	**108**	4.2	3.8	4.3	2.9	3.6	4.0
19	MCN (E)-22-19	NRCHB- 101 (LR)	114	105	105	114	111	105	**110**	4.2	4.3	4.2	3.8	4.4	4.5
20	MCN (E)-22-20	ANDM 14-09	113	105	106	114	111	104	**110**	4.4	4.0	4.1	3.2	3.4	4.5
21	MCN (E)-22-21	PRO 5111 (Hybrid Check)	107	103	114	107	109	98	**108**	3.3	3.8	4.0	3.8	3.6	3.9
22	MCN (E)-22-22	HUJMI 21-1	116	106	110	106	111	103	**110**	4.5	4.4	4.0	3.6	3.8	4.3
23	MCN (E)-22-23	RH 1999-37	113	103	112	107	110	97	**109**	4.3	4.0	4.3	3.6	3.3	4.1
24	MCN (E)-22-24	SHIVANI PLUS	108	103	111	108	110	99	**108**	4.2	4.5	4.0	3.2	3.6	3.7
25	MCN (E)-22-25	PRE-2020-14	110	103	111	106	110	100	**108**	4.3	3.4	4.1	3.3	3.5	4.5

Table 3.2. Performance of early Indian mustard strains in IVT Zone-VI

S.No.	Code	Strain	Seed Yield (Kg/ha)				Plant Stand	Days to Maturity	1000 Seed Weight	
			DWD#	RAI$	JGT	Mean	JGT	JGT	DWD	JGT
			1	3	4	(4)	4	4	1	4
1	MCN (E)-22-01	Pusa MH 126 (Hybrid)	1543	772	577	**577**	193	100	5.0	6.2
2	MCN (E)-22-02	BAUM-2022-1	629	839	1239	**1239**	199	94	5.0	5.9
3	MCN (E)-22-03	DRMRHT-1712	1024	1087	960	**960**	187	97	5.0	5.7
4	MCN (E)-22-04	ACN 247	1042	900	1255	**1255**	184	89	7.0	5.5
5	MCN (E)-22-05	JD 6 (ZC)	1174	1248	1156	**1156**	200	92	7.0	5.4
6	MCN (E)-22-06	PRE-2018- 1	1121	1681	583	**583**	170	82	5.0	5.4
7	MCN (E)-22-07	DRMRCI- 156	753	930	1257	**1257**	208	93	5.0	5.7
8	MCN (E)-22-08	KMR(E) 22-2	1095	1362	994	**994**	183	95	5.0	5.4
9	MCN (E)-22-09	NPJ 257	1739	1255	927	**927**	190	97	7.0	6.0
10	MCN (E)-22-10	TM 314-1	941	956	977	**977**	201	98	5.0	6.0
11	MCN (E)-22-11	PM 25 (NC)	1429	1330	1225	**1225**	158	84	7.0	5.2
12	MCN (E)-22-12	SVJH- 72 (Hybrid)	2017	1433	1538	**1538**	203	84	8.0	5.8
13	MCN (E)-22-13	RH 2199-11	1179	1200	808	**808**	160	92	5.0	6.1
14	MCN (E)-22-14	DRMRSJ 272	1565	946	1335	**1335**	195	94	5.0	5.8
15	MCN (E)-22-15	NPJ 258	1417	1392	964	**964**	166	82	7.0	5.9
16	MCN (E)-22-16	KMR(E) 22-1	1498	994	1194	**1194**	207	92	5.0	5.6
17	MCN (E)-22-17	DRMRIJ 20-117	1509	1434	1094	**1094**	191	92	8.0	5.5
18	MCN (E)-22-18	Q80623	1557	1418	699	**699**	176	98	7.0	5.5
19	MCN (E)-22-19	NRCHB- 101 (LR)	1365	1202	1648	**1648**	224	83	7.0	6.5
20	MCN (E)-22-20	ANDM 14-09	1148	1178	1404	**1404**	198	89	5.0	6.0
21	MCN (E)-22-21	PRO 5111 (Hybrid Check)	1404	1096	1035	**1035**	212	81	5.0	4.9
22	MCN (E)-22-22	HUJMI 21-1	1448	964	1543	**1543**	202	92	7.0	5.8
23	MCN (E)-22-23	RH 1999-37	1621	1151	1109	**1109**	185	91	8.0	5.8
24	MCN (E)-22-24	SHIVANI PLUS	1034	1434	765	**765**	198	85	5.0	5.5
25	MCN (E)-22-25	**PRE-2020-14**	980	1311	672	**672**	182	87	5.0	6.2
		GM	**1289**	**1181**	**1078**	**1078**				
		CD (5 %)	288	314	256					
		CV (%)	13.6	16.6	14.5					
		DOS		11/11/2022	29.10.2022					

$ data of RAI centres excluded from computation of mean due to high CV and plant stand

data of DWD centres excluded from computation of mean due to date of sowing and plant stand

Table 3.3.a. Performance of early Indian mustard strains in AVT-I Zone-II

S.No.	Code	Strain	Seed Yield (Kg/ha)					Plant Stand				Days to Maturity				Mean
			CHT	LDH$	NDH	ABR	Mean	CHT	LDH	NDH	ABR	CHT	LDH	NDH	ABR	
			1	2	3	4	(1,3-4)	1	2	3	4	1	2	3	4	(1,3-4)
1	MCN (E)-22-26	RH 1999-42##	1428	1954	2835	2718	**2327**	310	271	211	276	121	128	133	130	**128**
2	MCN (E)-22-27	DRMRHT 13-13-5-5	1996	2083	3163	2448	**2535**	288	286	217	279	118	129	120	130	**123**
3	MCN (E)-22-28	JD 6 (ZC)	1751	1852	3060	2278	**2363**	297	262	205	281	126	140	135	136	**132**
4	MCN (E)-22-29	DRMRHT 13-13-5-4	1914	1979	3125	2212	**2417**	278	268	208	261	120	132	130	133	**128**
5	MCN (E)-22-30	PM 28 (Filler)	1701	2112	3313	2665	**2560**	294	288	211	268	118	138	130	129	**126**
6	MCN (E)-22-31	ORM 2019-25	1696	1991	2956	2576	**2409**	282	274	211	282	127	134	137	138	**134**
7	MCN (E)-22-32	PM 28 (LR)	1696	1863	3512	2399	**2536**	296	274	215	270	122	132	130	130	**127**
8	MCN (E)-22-33	KMR(E) 21-1	1712	1921	3142	2108	**2321**	314	271	204	275	128	133	137	135	**133**
9	MCN (E)-22-34	PRE 2018-10#	1851	1741	3445	2404	**2566**	322	282	243	262	116	128	114	128	**119**
10	**MCN (E)-22-35**	**PM 25 (NC)**	**1890**	**1725**	**3202**	**2327**	**2473**	**278**	**287**	**215**	**267**	**117**	**129**	**107**	**127**	**117**
		GM	**1763**	**1922**	**3175**	2413	**2450**									
		CD (5 %)	303	245	395	340										
		CV (%)	11.8	8.8	8.6	9.7										
		DOS	15.9.2022	30.9.2022	30.9.2022	28.9.2022										

$ Data of LDH excluded from computation of mean due to significant difference in seed yield of same genotype being used as filler and check

RH 1999-42## second time repeat entry

PRE 2018-10 # Repeat entry

Table 3.3.b. Performance of early Indian mustard strains in AVT-I Zone-II

S.No.	Code	Strain	1000-Seed Wt. (g)				Oil Content (%)				Oil Yield (kg/ha)
			CHT	LDH	NDH	ABR	CHT	LDH$	NDH	Mean	
			1	2	3	4	1	2	3	(1,3)	
1	MCN (E)-22-26	RH 1999-42	4.5	4.5	3.9	4.7	38.5	40.3	40.2	**39.3**	**916**
2	MCN (E)-22-27	DRMRHT 13-13-5-5	3.9	4.8	3.9	4.8	40.3	41.1	38.6	**39.4**	**1000**
3	MCN (E)-22-28	JD 6 (ZC)	4.1	4.2	3.5	4.7	38.4	37.7	38.3	**38.4**	**907**
4	MCN (E)-22-29	DRMRHT 13-13-5-4	4.2	4.7	4.0	4.9	37.8	37.2	35.8	**36.8**	**890**
5	MCN (E)-22-30	**PM 28 (Filler)**	3.4	4.3	3.6	4.8	38.3	39.3	39.2	**38.8**	**993**
6	MCN (E)-22-31	ORM 2019-25	4.4	4.9	4.3	4.9	36.3	38.5	39.6	**37.9**	**914**
7	MCN (E)-22-32	PM 28 (LR)	4.5	4.5	4.1	4.1	35.0	38.3	38.3	**36.7**	**929**
8	MCN (E)-22-33	KMR(E) 21-1	4.3	4.8	4.7	5.2	35.0	37.9	39.5	**37.2**	**864**
9	MCN (E)-22-34	PRE 2018-10	4.2	5.0	4.4	5.1	37.0	35.7	37.6	**37.3**	**957**
10	**MCN (E)-22-35**	**PM 25 (NC)**	**3.9**	**4.6**	**4.6**	**5.2**	**36.0**	**39.2**	**39.3**	**37.6**	**931**

Table 3.4. Performance of Indian mustard strains in IVT timely sown (Irrigated), Zone - I

S.No.	Code	Strain	Seed Yield (kg/ha)					Plant Stand				Days to Maturity				1000 Seed Wt. (g)			
			KNG	DLK	BJR$	UNA$	Mean	KNG$	DLK	BJR	UNA	KNG$	DLK	BJR	UNA	KNG	DLK	BJR	UNA
			1	2	3	4	(1-2)	1	2	3	4	1	2	3	4	1	2	3	4
1	MCN-22-1	RMM-19-12	897	1084	885	803	**991**	136	146	92	119	150	127	189	124	4.9	5.0	4.7	4.7
2	MCN-22-2	DRMRHT 18-141	897	1218	1016	872	**1058**	136	145	97	123	137	126	187	124	4.3	4.6	5.2	4.3
3	MCN-22-3	Kranti (NC)	646	906	931	803	**776**	137	146	124	118	138	124	187	124	4.8	4.9	4.4	4.6
4	MCN-22-4	PR-2019-1	1068	1044	1354	612	**1056**	132	148	145	122	136	123	187	121	5.9	5.7	5.5	5.3
5	MCN-22-5	KMR 22-4	1107	869	1260	488	**988**	137	146	98	120	151	126	190	129	5.5	5.6	5.2	5.4
6	MCN-22-6	RH 2187	1030	1070	1055	751	**1050**	134	147	102	120	152	128	188	125	5.6	5.3	4.9	5.4
7	MCN-22-7	DRMRIJ 21-37	772	1136	689	798	**954**	136	145	66	121	151	127	187	126	5.5	5.4	6.4	5.6
8	MCN-22-8	DRMRCI- 154	1264	1240	918	704	**1252**	131	145	86	122	148	126	189	126	6.3	6.1	5.6	5.7
9	MCN-22-9	ACNMM- 3	1231	1232	747	836	**1231**	137	145	85	118	153	127	189	128	4.7	4.8	4.2	3.8
10	MCN-22-10	RGN 528	944	1128	938	612	**1036**	136	148	107	289	155	125	186	124	5.4	5.5	4.8	5.4
11	MCN-22-11	RCC 4 (ZC)	1093	1369	1381	825	**1231**	135	146	129	122	155	128	189	127	3.5	3.5	3.3	3.3
12	MCN-22-12	NPJ 262	1038	1128	858	896	**1083**	134	144	83	122	155	125	188	124	6.0	5.8	5.8	5.7
13	MCN-22-13	DRMR 2020-8	960	744	1361	868	**852**	135	147	119	125	146	127	187	129	6.2	6.0	5.0	5.9
14	MCN-22-14	HUJM-21-4	1046	732	899	807	**889**	136	146	99	122	140	123	187	126	4.9	5.4	4.6	4.7
15	MCN-22-15	DM 2020-3	1058	1157	806	696	**1108**	136	145	99	122	146	126	188	126	6.8	6.3	6.4	5.8
16	MCN-22-16	RAURD 18-1	1234	1119	915	683	**1177**	135	146	94	123	150	126	189	129	6.6	6.3	6.6	5.9
17	MCN-22-17	GIRIRAJ (LR)	1200	1099	1226	918	**1150**	136	147	117	122	141	122	187	125	6.4	6.1	5.7	5.8
18	MCN-22-18	NPJ 261	1291	1157	886	617	**1224**	139	149	112	123	148	128	188	127	5.7	5.5	5.5	5.4
19	MCN-22-19	RH 2199	1138	1138	919	672	**1138**	136	148	99	119	150	128	188	128	5.9	5.6	5.8	5.3
20	MCN-22-20	PR-2020-14	1382	913	1091	707	**1147**	133	148	111	121	152	129	189	131	4.9	4.9	5.9	4.8
21	MCN-22-21	SKM 1924	965	1224	908	916	**1094**	137	146	103	116	155	127	187	131	5.3	4.9	5.7	4.8
22	MCN-22-22	KMR 22-3	1211	1136	1105	660	**1173**	136	145	146	125	154	127	188	130	4.9	5.0	6.0	4.6
23	MCN-22-23	SKM 2012	1243	1178	1108	766	**1210**	133	149	101	123	153	125	186	125	5.1	5.3	5.1	5.0
24	MCN-22-24	TM316	1170	1253	961	844	**1212**	140	150	103	123	153	124	186	126	4.6	4.6	5.8	4.5
25	MCN-22-25	DTM- 341	1089	1182	887	579	**1136**	139	147	88	120	138	126	187	126	4.6	4.9	4.3	4.6
26	MCN-22-26	PBR 813-2	1307	910	1217	641	**1108**	136	147	125	119	152	125	188	125	4.6	4.7	4.7	4.5
27	MCN-22-27	RB- 110	1187	1000	973	670	**1094**	135	146	121	122	151	128	188	127	6.0	5.8	6.0	5.8
		GM	**1091**	**1088**	**1011**	**742**	**1090**												
		CD (5%)	139	125	211	97													
		CV(%)	8.0	7.2	13.1	8.2													
		DOS	9.10.2022	28.10.2022	29.10.2022	29.10.2022													

$ data of BJR and UNA centre excluded from computation of mean due to rejection of trials by monitoring team

only two valid locations data, hence no promotion of strain(s)

Table 3.5.a. Performance of Indian mustard strains in IVT timely sown (Irrigated), Zone - II

S.No.	Code	Strain	Seed Yield (Kg/ha)										Plant Stand							
			ABR	BWL$	LDH	HSR	SGN	NDH	CHT	MOD	Mean		ABR	BWL	LDH	HSR	SGN	NDH	CHT	MOD
			1	2	3	4	5	6	7	8	(1,3-8)		1	2	3	4	5	6	7	8
1	MCN-22-1	RMM-19-12	2439	2121	1975	2992	2734	2701	1938	1810	**2370**		130	117	133	121	115	171	140	103
2	MCN-22-2	DRMRHT 18-141	2588	1982	1677	2070	2341	2722	1677	1583	**2094**		133	126	127	121	116	158	122	106
3	MCN-22-3	Kranti (NC)	2614	1795	1938	2137	2533	2513	1772	1697	**2172**		133	125	132	124	120	163	127	115
4	MCN-22-4	PR-2019-1	2683	3002	1936	2790	2646	3030	2058	1998	**2449**		138	128	138	120	114	158	130	122
5	MCN-22-5	KMR 22-4	2635	2625	2046	2880	2514	2854	1733	2011	**2382**		138	128	132	125	118	156	129	120
6	MCN-22-6	RH 2187	2608	2084	1856	3448	2572	2992	1959	2048	**2497**		136	126	125	125	116	161	132	110
7	MCN-22-7	DRMRIJ 21-37	2418	1860	1853	2348	2068	2636	1631	2223	**2168**		139	116	125	123	112	168	120	127
8	MCN-22-8	DRMRCI- 154	2567	2056	2366	2553	2647	3059	1812	2111	**2445**		139	120	132	124	120	156	115	123
9	MCN-22-9	ACNMM- 3	2798	3192	2055	3312	2437	2943	1761	2059	**2481**		137	129	125	123	114	168	136	119
10	**MCN-22-10**	**RGN 528**	**2479**	**3076**	**2793**	**3254**	**2976**	**2787**	**1803**	**2206**	**2614**	**	**130**	**120**	**140**	**120**	**117**	**155**	**138**	**146**
11	**MCN-22-11**	**RH 0749 (ZC)**	**2804**	**2262**	**2202**	**2628**	**2454**	**2831**	**2034**	**2092**	**2435**		**139**	**123**	**128**	**120**	**114**	**161**	**116**	**109**
12	**MCN-22-12**	**NPJ 262**	**3068**	**2963**	**2839**	**3452**	**2754**	**3330**	**2080**	**2507**	**2861**	*	**137**	**129**	**137**	**123**	**118**	**159**	**132**	**138**
13	MCN-22-13	DRMR 2020-8	2523	2203	2310	2844	2476	3102	1927	2208	**2484**		130	117	123	123	114	157	135	112
14	MCN-22-14	HUJM-21-4	2432	2765	2081	2840	2640	2622	1901	2098	**2373**		139	116	129	120	122	150	125	116
15	MCN-22-15	DM 2020-3	2810	2188	1985	2913	2484	3041	2046	2139	**2488**		138	123	133	124	121	152	118	112
16	MCN-22-16	RAURD 18-1	2232	2770	1836	3120	2001	2576	2121	1809	**2242**		135	126	128	123	118	162	138	110
17	MCN-22-17	GIRIRAJ (LR)	2725	2398	2359	2568	2290	2791	1737	2084	**2365**		139	118	121	120	120	149	119	127
18	**MCN-22-18**	**NPJ 261**	**2971**	**2322**	**3251**	**3414**	**2990**	**3413**	**1930**	**2292**	**2894**	*	**135**	**118**	**139**	**124**	**114**	**162**	**124**	**135**
19	MCN-22-19	RH 2199	3030	3221	2227	3247	2613	3134	1898	2123	**2610**		130	120	138	120	116	164	130	122
20	MCN-22-20	PR-2020-14	2763	2947	1866	3030	2602	2565	1818	1998	**2377**		139	120	136	127	120	163	135	128
21	MCN-22-21	SKM 1924	2613	2524	2304	3231	2614	3197	1793	2156	**2558**		133	123	138	122	118	159	125	121
22	MCN-22-22	KMR 22-3	2546	2576	2569	3006	2098	2912	1712	2078	**2417**		131	123	133	128	123	160	118	116
23	MCN-22-23	SKM 2012	2951	3086	2005	2545	2180	2628	1885	2086	**2325**		132	129	129	124	117	159	116	120
24	MCN-22-24	TM316	2671	2230	2136	3216	2302	2971	2171	2136	**2515**		136	123	127	122	120	159	125	119
25	MCN-22-25	DTM- 341	2346	2319	2052	2382	1631	2500	1699	1954	**2081**		130	117	138	121	112	160	118	88
26	**MCN-22-26**	**PBR 813-2**	**2804**	**2314**	**2907**	**3218**	**3014**	**3103**	**2113**	**2200**	**2766**	*	**136**	**118**	**137**	**120**	**124**	**160**	**112**	**119**
27	MCN-22-27	RB- 110	2570	2833	2439	2989	2750	2936	1917	2219	**2546**		134	121	138	122	116	153	126	138
		GM	**2655**	**2508**	**2217**	**2905**	**2495**	**2885**	**1886**	**2071**	**2445**									
		CD (5%)	552	304	339	520	417	337	328	289										
		CV(%)	13.0	7.6	9.5	11.2	10.4	7.3	10.9	8.7										
		DOS	26.10.2022	17.10.2022	15.10.2022	16.10.2022	29.10.2022	16.10.2022	23.10.2022	22.10.2022										

$ data of BWL centres excluded from computation of mean due to improper experimental design

* Strain outyielding the best check by a margin of more than or equal to 10 percent on the basis of seed yield

** Strain outyielding the best check by a margin of more than or equal to 10 percent on the basis of oil yield

Table 3.5.b. Performance of Indian mustard strains in IVT timely sown (Irrigated), Zone - II

S.No.	Code	Strain	Days to Maturity								1000 Seed Weight (g)						
			ABR	BWL	LDH	HSR	SGN	NDH	CHT	MOD	ABR	BWL	LDH	HSR	SGN	NDH	CHT
			1	2	3	4	5	6	7	8	1	2	3	4	5	6	7
1	MCN-22-1	RMM-19-12	142	148	140	146	149	147	145	145	4.6	3.7	4.5	4.8	4.5	4.4	4.1
2	MCN-22-2	DRMRHT 18-141	140	142	139	138	150	143	142	140	5.4	3.7	4.4	3.9	5.4	3.5	4.1
3	MCN-22-3	Kranti (NC)	136	141	140	136	151	136	144	140	4.9	4.7	5.8	4.1	4.7	4.4	4.4
4	MCN-22-4	PR-2019-1	143	143	142	144	150	144	143	144	5.0	4.1	4.8	6.3	6.0	4.9	4.3
5	MCN-22-5	KMR 22-4	141	146	140	147	149	145	147	145	5.4	4.2	5.7	5.5	5.6	4.2	4.9
6	MCN-22-6	RH 2187	142	142	139	139	149	144	141	142	4.8	4.6	5.1	6.4	4.9	4.5	4.1
7	MCN-22-7	DRMRIJ 21-37	145	142	138	138	150	142	142	143	5.5	4.5	5.4	4.2	4.3	4.6	4.0
8	MCN-22-8	DRMRCI- 154	146	143	141	145	149	146	146	144	4.9	5.1	5.7	6.6	5.4	5.2	5.0
9	MCN-22-9	ACNMM- 3	142	148	138	148	148	146	142	144	4.0	3.9	4.9	5.9	5.9	4.0	4.1
10	MCN-22-10	RGN 528	150	145	143	146	150	148	146	147	4.6	4.2	5.2	5.9	4.1	4.7	4.5
11	MCN-22-11	RH 0749 (ZC)	145	146	140	142	149	146	149	145	5.8	4.4	5.4	6.6	5.9	5.6	4.9
12	MCN-22-12	NPJ 262	144	143	139	144	150	145	142	146	5.9	4.6	5.9	6.2	5.4	5.4	4.8
13	MCN-22-13	DRMR 2020-8	140	143	137	142	150	141	143	143	5.8	4.4	4.4	6.4	5.4	5.3	4.5
14	MCN-22-14	HUJM-21-4	143	142	141	144	150	143	145	144	4.9	3.9	4.3	5.3	4.9	4.5	4.2
15	MCN-22-15	DM 2020-3	145	144	139	140	149	143	148	145	5.8	6.1	6.0	5.9	5.9	6.1	4.5
16	MCN-22-16	RAURD 18-1	142	145	142	146	150	144	144	145	5.8	4.7	5.9	6.0	5.9	5.1	5.1
17	MCN-22-17	GIRIRAJ (LR)	145	144	141	147	149	145	146	145	5.9	4.8	5.7	6.5	6.3	5.7	4.8
18	MCN-22-18	NPJ 261	144	147	138	139	150	144	144	143	5.9	4.1	6.1	6.0	4.9	5.3	4.8
19	MCN-22-19	RH 2199	144	140	135	142	150	140	149	142	6.0	4.2	4.8	6.8	5.4	5.4	4.3
20	MCN-22-20	PR-2020-14	143	147	138	143	150	144	142	143	5.4	3.9	5.0	6.6	5.5	4.6	3.6
21	MCN-22-21	SKM 1924	145	147	137	145	150	147	140	144	5.7	4.2	5.0	6.0	6.1	4.7	5.2
22	MCN-22-22	KMR 22-3	145	143	139	146	149	143	145	145	4.8	4.3	5.8	6.0	5.4	4.3	4.8
23	MCN-22-23	SKM 2012	146	144	140	146	149	144	143	141	5.5	4.1	4.7	6.4	5.6	4.2	4.4
24	MCN-22-24	TM316	144	142	135	143	150	142	147	142	4.5	4.2	4.5	6.3	4.5	4.2	5.0
25	MCN-22-25	DTM- 341	145	147	138	142	149	145	144	144	4.2	4.3	4.8	5.7	5.6	3.7	4.2
26	MCN-22-26	PBR 813-2	145	144	136	147	150	145	145	145	4.6	3.9	5.8	6.0	4.8	3.9	4.6
27	MCN-22-27	RB- 110	144	143	139	142	149	143	142	144	6.0	5.2	5.1	6.5	5.8	5.2	4.5

Table 3.5.c. Performance of Indian mustard strains in IVT timely sown (Irrigated), Zone - II

S.No.	Code	Strain	Oil Content (%)								Oil Yield (kg/ha)
			ABR	BWL$	LDH	HSR	SGN	NDH	CHT	Mean	
			1	2	3	4	5	6	7	(1,3-7)	
1	MCN-22-1	RMM-19-12	36.1	0.0	38.3	38.9	36.4	37.3	38.1	**37.5**	**889**
2	MCN-22-2	DRMRHT 18-141	37.7	40.2	35.9	40.2	41.0	39.8	36.2	**38.5**	**805**
3	MCN-22-3	Kranti (NC)	38.6	34.6	35.2	38.1	38.6	36.9	35.2	**37.1**	**806**
4	MCN-22-4	PR-2019-1	36.8	36.4	37.3	37.4	39.4	35.4	37.9	**37.4**	**915**
5	MCN-22-5	KMR 22-4	39.6	35.3	34.7	39.8	36.5	36.4	36.8	**37.3**	**888**
6	MCN-22-6	RH 2187	38.7	33.6	37.6	40.2	38.8	39.6	43.3	**39.7**	**991**
7	MCN-22-7	DRMRIJ 21-37	37.0	35.7	38.0	38.2	0.0	38.6	36.2	**37.6**	**815**
8	MCN-22-8	DRMRCI- 154	39.5	34.8	37.4	38.8	40.6	37.0	37.0	**38.4**	**939**
9	MCN-22-9	ACNMM- 3	37.2	37.9	37.6	39.2	0.0	35.8	35.3	**37.0**	**918**
10	**MCN-22-10**	**RGN 528**	**39.6**	**39.7**	**39.2**	**40.1**	**39.0**	**40.7**	**42.8**	**40.2**	**1052**
11	**MCN-22-11**	**RH 0749 (ZC)**	**39.0**	**0.0**	**37.7**	**37.7**	**38.7**	**36.1**	**36.8**	**37.7**	**917**
12	**MCN-22-12**	**NPJ 262**	**35.0**	**35.5**	**37.6**	**40.2**	**38.2**	**37.2**	**36.0**	**37.4**	**1069**
13	MCN-22-13	DRMR 2020-8	40.6	38.3	35.9	41.1	36.0	39.4	36.0	**38.2**	**948**
14	MCN-22-14	HUJM-21-4	38.5	38.7	38.4	40.1	39.3	40.0	37.6	**39.0**	**925**
15	MCN-22-15	DM 2020-3	37.8	40.1	37.5	38.9	37.2	37.1	36.1	**37.4**	**932**
16	MCN-22-16	RAURD 18-1	36.4	39.2	38.7	39.4	39.7	38.9	36.6	**38.3**	**859**
17	**MCN-22-17**	**GIRIRAJ (LR)**	**37.8**	**36.1**	**38.9**	**41.4**	**42.1**	**40.3**	**38.0**	**39.8**	**940**
18	**MCN-22-18**	**NPJ 261**	**39.2**	**39.0**	**39.2**	**42.4**	**40.3**	**39.5**	**42.3**	**40.5**	**1172**
19	MCN-22-19	RH 2199	36.0	35.7	38.3	39.0	39.5	40.1	36.1	**38.1**	**996**
20	MCN-22-20	PR-2020-14	37.1	36.1	36.7	37.8	38.1	37.0	35.6	**37.0**	**881**
21	MCN-22-21	SKM 1924	38.1	36.0	37.3	40.9	0.0	37.5	36.2	**38.0**	**972**
22	MCN-22-22	KMR 22-3	35.8	38.6	37.8	38.5	39.4	35.5	35.0	**37.0**	**894**
23	MCN-22-23	SKM 2012	33.9	38.2	40.8	40.1	39.6	33.4	32.7	**36.7**	**855**
24	MCN-22-24	TM316	35.6	34.2	37.6	39.0	39.7	37.9	33.1	**37.2**	**934**
25	MCN-22-25	DTM- 341	37.2	38.0	36.5	38.5	38.4	37.9	39.9	**38.1**	**792**
26	**MCN-22-26**	**PBR 813-2**	**35.9**	**37.2**	**41.1**	**41.0**	**39.5**	**39.8**	**38.9**	**39.4**	**1089**
27	MCN-22-27	RB- 110	38.9	38.9	38.2	39.5	39.4	38.1	36.2	**38.4**	**977**

Table 3.6.a. Performance of Indian mustard strains in IVT timely sown (irrigated), Zone - III

S.No	Code	Strain	Seed Yield (Kg/ha)											Plant Stand								
			KPR$	PNT	KOT	VAR	DOL	JHS	TKM#	BND	BPR	Mean		KPR	PNT	KOT	VAR	DOL	JHS	TKM	BND	BPR
			1	2	3	4	5	6	7	8	9	(2-6,8-9)		1	2	3	4	5	6	7	8	9
1	MCN-22-1	RMM-19-12	2594	2369	2327	1765	2992	1487	1285	2189	2341	**2210**		121	136	168	167	162	140	318	136	138
2	MCN-22-2	DRMRHT 18-141	2200	1673	2330	1573	2070	1312	1444	2119	2268	**1906**		120	162	159	165	165	137	328	136	142
3	MCN-22-3	Kranti (NC)	2187	1534	2743	1331	2137	1649	1387	2257	2412	**2009**		122	140	160	166	167	136	310	145	161
4	MCN-22-4	PR-2019-1	2322	2229	2419	1942	2790	1641	1482	2126	2740	**2269**		121	132	167	159	164	152	318	129	171
5	MCN-22-5	KMR 22-4	2291	2170	2928	1801	2880	2172	1372	2411	2317	**2383**		125	154	161	156	163	138	338	142	135
6	MCN-22-6	RH 2187	2723	2104	2864	1994	3448	2342	1382	2448	2267	**2495**		124	137	171	175	161	149	362	149	174
7	MCN-22-7	DRMRIJ 21-37	2295	1587	2709	1997	2348	2394	1218	2620	2557	**2316**		121	145	170	157	167	135	315	142	151
8	MCN-22-8	DRMRCI- 154	2225	1937	2729	2043	2553	2072	1444	2217	2402	**2279**		124	132	164	166	162	143	337	143	176
9	MCN-22-9	ACNMM- 3	2779	1900	2618	1984	3312	1547	1297	1834	2943	**2305**		123	138	166	164	164	156	354	146	170
10	**MCN-22-10**	**RGN 528**	**2548**	**2257**	**2793**	**1984**	**3254**	**2424**	**1413**	**2304**	**2768**	**2541**	*	**116**	**142**	**162**	**158**	**163**	**135**	**336**	**147**	**174**
11	MCN-22-11	**Maya (ZC)**	**2368**	**2240**	**2195**	**1844**	**2628**	**1987**	**1321**	**2413**	**2841**	**2307**		**118**	**143**	**152**	**161**	**161**	**130**	**292**	**143**	**172**
12	MCN-22-12	NPJ 262	2954	2013	2798	2218	3452	2141	1331	2165	2304	**2442**		122	121	156	175	163	137	352	143	160
13	MCN-22-13	DRMR 2020-8	2573	1768	3008	1704	2844	2005	1028	2770	2486	**2369**		123	137	162	167	167	160	316	138	174
14	MCN-22-14	HUJM-21-4	2647	1971	2877	1805	2840	1601	1411	2409	2626	**2304**		118	146	162	177	162	146	343	145	157
15	MCN-22-15	DM 2020-3	2265	2763	2539	1760	2913	1685	1524	1932	2372	**2280**		124	134	159	161	163	153	305	135	168
16	MCN-22-16	RAURD 18-1	2161	1667	2534	1833	3120	1533	1241	2008	2488	**2169**		121	133	159	172	166	141	335	146	170
17	MCN-22-17	RGN 73 (LR)	2271	1864	2640	1911	2568	1825	1365	2554	1966	**2190**		123	140	158	182	169	147	359	145	148
18	MCN-22-18	NPJ 261	2229	1758	3037	1805	3414	1373	1204	1850	3316	**2365**		121	171	164	163	164	138	289	134	184
19	MCN-22-19	RH 2199	2178	1910	3026	1980	3247	1866	1113	2279	2655	**2423**		125	156	161	168	166	150	338	139	178
20	MCN-22-20	PR-2020-14	2343	1673	2656	2299	3030	2164	1269	2401	2299	**2360**		122	161	166	170	163	135	323	136	158
21	MCN-22-21	SKM 1924	2439	1479	2921	1879	3231	1730	1451	2257	2813	**2330**		117	154	156	168	161	140	322	131	172
22	MCN-22-22	KMR 22-3	2234	1951	2648	1986	3006	2496	1285	1827	2191	**2301**		119	130	158	161	165	146	376	134	171
23	MCN-22-23	SKM 2012	2162	1611	2777	2007	2545	1535	1706	2213	3067	**2250**		116	173	167	150	165	131	356	135	185
24	MCN-22-24	TM316	2218	2047	2804	1949	3216	2149	1427	2334	2184	**2383**		122	165	159	173	165	142	358	131	165
25	MCN-22-25	DTM- 341	2428	2181	2212	1589	2382	1258	1397	2399	2149	**2024**		116	158	161	150	163	125	374	145	170
26	MCN-22-26	PBR 813-2	2359	2369	3130	2195	3218	1471	1519	2266	2253	**2415**		121	165	168	171	161	145	348	133	167
27	MCN-22-27	RB- 110	2291	2089	2912	2111	2989	2420	1435	2199	2323	**2435**		116	141	160	164	160	130	321	145	156
		GM	**2381**	**1967**	**2710**	**1900**	**2905**	**1862**	**1361**	**2252**	**2494**	**2299**										
		C.D. (5%)	185	363	312	234	520	384	256	371	237											
		CV (%)	4.9	11.5	7.2	7.7	11.2	13	11.8	10.3	5.9											
		DOS	19.10.2022	28.10.2022	18.10.2022	20.10.2022	15.10.2022	29.10.2022	30.10.2022	31.10.2022	19.10.2022											

$ data of KPR centres excluded from computation of mean due to low CV

data of TKM centre excluded from computation of mean due to lower experimental mean than state mean

*Strain outyielding the best check by a margin of more than or equal to 10 percent on the basis of seed yield

Table 3.6.b. Performance of Indian mustard strains in IVT timely sown (Irrigated), Zone-III

S.No.	Code	Strain	Days to Maturity									1000-Seed Wt. (g)								
			KPR	PNT	KOT	VAR	DOL	JHS	TKM	BND	BPR	KPR	PNT	KOT	VAR	DOL	JHS	TKM	BND	BPR
			1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
1	MCN-22-1	RMM-19-12	134	140	133	121	135	130	90	128	130	4.2	4.0	4.9	4.2	3.4	4.4	4.8	3.8	4.3
2	MCN-22-2	DRMRHT 18-141	135	131	125	117	130	130	86	133	129	4.7	3.2	4.4	4.5	4.2	4.1	4.4	3.3	3.8
3	MCN-22-3	Kranti (NC)	132	129	125	115	131	126	86	135	121	4.1	3.7	4.6	4.1	4.0	4.0	4.3	4.0	4.1
4	MCN-22-4	PR-2019-1	136	137	132	123	137	132	86	136	129	4.7	4.3	5.6	4.7	3.5	4.8	5.1	2.9	4.9
5	MCN-22-5	KMR 22-4	134	137	133	120	134	132	93	130	134	3.9	4.0	5.1	4.3	3.9	4.4	4.6	4.2	4.7
6	MCN-22-6	RH 2187	135	135	131	119	134	133	92	128	127	4.7	4.1	5.3	4.4	3.2	4.6	5.0	4.4	4.7
7	MCN-22-7	DRMRIJ 21-37	137	135	129	119	131	132	91	130	121	3.9	4.2	5.4	4.6	3.0	5.0	4.6	4.6	4.8
8	MCN-22-8	DRMRCI- 154	132	139	131	118	133	130	91	139	126	5.5	4.8	5.6	4.9	3.2	4.9	4.6	5.2	5.4
9	MCN-22-9	ACNMM- 3	131	135	131	123	132	129	91	128	135	4.3	3.7	4.5	4.2	2.9	4.5	5.4	4.1	4.8
10	**MCN-22-10**	**RGN 528**	**135**	**142**	**137**	**125**	**133**	**130**	**91**	**129**	**134**	**4.5**	**4.6**	**6.1**	**4.5**	**3.5**	**4.6**	**4.8**	**3.3**	**4.7**
11	**MCN-22-11**	**Maya (ZC)**	**133**	**138**	**131**	**119**	**133**	**131**	**94**	**127**	**132**	**4.4**	**3.8**	**5.4**	**4.5**	**3.1**	**4.0**	**4.9**	**4.2**	**4.8**
12	MCN-22-12	NPJ 262	132	138	134	120	134	134	92	131	129	5.6	5.0	5.9	4.2	2.9	5.1	6.1	4.6	5.2
13	MCN-22-13	DRMR 2020-8	134	136	129	120	133	133	93	127	123	3.9	4.7	6.0	4.3	3.2	5.2	4.5	4.7	5.1
14	MCN-22-14	HUJM-21-4	132	135	133	121	134	131	91	128	132	6.0	3.9	5.0	4.1	2.8	4.7	5.3	4.7	4.7
15	MCN-22-15	DM 2020-3	131	135	134	123	129	130	92	135	133	5.8	5.2	5.9	4.9	3.4	5.4	4.2	3.6	5.8
16	MCN-22-16	RAURD 18-1	132	136	131	120	134	130	90	138	128	3.9	5.1	5.9	4.6	3.7	4.9	6.3	5.2	5.7
17	MCN-22-17	RGN 73 (LR)	136	140	136	124	133	132	93	127	126	4.5	3.7	4.8	4.0	2.9	4.3	4.8	5.2	4.0
18	MCN-22-18	NPJ 261	128	136	133	120	131	131	91	136	131	5.1	3.6	5.5	4.5	3.3	4.3	5.0	5.0	5.0
19	MCN-22-19	RH 2199	132	137	130	120	134	130	92	130	131	4.6	4.8	5.9	4.6	3.2	5.3	4.2	5.4	5.0
20	MCN-22-20	PR-2020-14	135	136	131	121	135	132	89	128	133	4.0	4.3	5.7	4.9	4.8	4.8	4.1	5.3	4.6
21	MCN-22-21	SKM 1924	133	134	132	120	132	133	91	130	127	5.5	4.2	5.8	5.0	3.7	4.8	4.1	4.5	5.1
22	MCN-22-22	KMR 22-3	132	139	135	124	134	132	94	139	133	4.9	3.7	4.6	4.1	3.5	4.3	4.3	3.7	4.1
23	MCN-22-23	SKM 2012	134	134	134	123	135	131	93	128	133	3.9	3.7	4.5	4.5	3.6	4.1	5.0	4.2	4.2
24	MCN-22-24	TM316	136	134	131	119	132	128	91	127	129	4.4	3.7	4.3	4.1	4.3	4.1	4.4	5.3	4.2
25	MCN-22-25	DTM- 341	129	140	133	120	130	130	92	134	130	3.8	4.0	4.7	4.3	3.2	4.4	3.9	5.0	4.1
26	MCN-22-26	PBR 813-2	134	139	131	122	133	138	88	131	125	3.9	3.8	4.8	3.8	3.6	4.0	4.5	4.4	4.0
27	MCN-22-27	RB- 110	131	133	133	119	135	131	90	127	131	5.5	4.8	6.3	5.0	3.9	5.3	5.8	4.5	5.7

Table 3.6.c. Performance of Indian mustard strains in IVT timely sown (Irrigated), Zone-III

S.No.	Code	Strain	Oil Content (%)										Oil Yield (kg/ha)
			KPR$	PNT	KOT	VAR	DOL	JHS	TKM#	BND	BPR	Mean	
			1	2	3	4	5	6	7	8	9	(2-6,8-9)	
1	MCN-22-1	RMM-19-12	41.4	40.7	40.1	37.7	39.6	41.1	40.2	38.6	39.6	**39.6**	**876**
2	MCN-22-2	DRMRHT 18-141	41.9	43.5	41.7	40.0	41.3	40.3	40.8	41.7	39.2	**41.1**	**784**
3	MCN-22-3	Kranti (NC)	42.2	38.8	41.9	40.7	37.4	39.1	39.8	40.9	39.7	**39.8**	**799**
4	MCN-22-4	PR-2019-1	40.8	41.8	40.1	41.2	40.2	38.8	41.1	40.2	39.7	**40.3**	**914**
5	MCN-22-5	KMR 22-4	41.2	41.2	40.5	38.3	40.7	38.4	40.6	42.6	39.1	**40.1**	**956**
6	MCN-22-6	RH 2187	41.1	41.3	40.6	37.4	41.6	36.8	40.7	42.9	40.5	**40.2**	**1002**
7	MCN-22-7	DRMRIJ 21-37	42.1	41.2	42.0	41.2	38.6	41.4	41.2	40.7	39.6	**40.7**	**942**
8	MCN-22-8	DRMRCI- 154	41.3	42.7	42.0	37.1	38.7	38.1	41.8	42.0	40.4	**40.1**	**915**
9	MCN-22-9	ACNMM- 3	41.9	41.9	42.4	37.9	42.2	40.4	40.5	42.4	38.7	**40.8**	**942**
10	**MCN-22-10**	**RGN 528**	**41.0**	**43.3**	**40.5**	**40.8**	**41.7**	**39.7**	**38.7**	**37.3**	**41.6**	**40.7**	**1034**
11	**MCN-22-11**	**Maya (ZC)**	**40.6**	**42.6**	**41.6**	**36.5**	**40.4**	**40.0**	**38.8**	**40.2**	**38.0**	**39.9**	**921**
12	MCN-22-12	NPJ 262	41.4	42.5	39.3	39.0	39.0	41.3	38.1	36.9	38.3	**39.5**	**964**
13	MCN-22-13	DRMR 2020-8	41.3	42.7	41.6	41.9	37.6	37.0	40.2	43.3	42.0	**40.9**	**968**
14	MCN-22-14	HUJM-21-4	42.1	44.0	41.7	38.3	41.0	38.7	41.1	42.4	41.1	**41.0**	**945**
15	MCN-22-15	DM 2020-3	42.5	41.8	41.8	40.4	42.4	41.4	39.2	36.6	38.2	**40.4**	**921**
16	MCN-22-16	RAURD 18-1	43.5	41.0	41.8	39.7	42.7	41.5	41.2	39.3	41.6	**41.1**	**891**
17	MCN-22-17	RGN 73 (LR)	42.3	40.4	39.7	40.3	41.2	42.0	41.4	40.1	42.6	**40.9**	**896**
18	MCN-22-18	NPJ 261	42.8	**41.6**	42.1	40.4	42.3	40.9	43.4	**39.6**	42.2	**41.3**	**976**
19	MCN-22-19	RH 2199	41.0	43.4	41.7	42.2	40.0	40.2	39.9	40.6	40.8	**41.3**	**1000**
20	MCN-22-20	PR-2020-14	42.9	42.4	40.1	35.5	38.8	38.0	40.5	39.1	40.1	**39.1**	**924**
21	MCN-22-21	SKM 1924	42.8	42.3	41.5	39.6	41.0	39.7	40.8	40.0	38.0	**40.3**	**939**
22	MCN-22-22	KMR 22-3	42.0	42.0	41.3	38.2	38.6	39.6	40.6	38.6	40.0	**39.8**	**915**
23	MCN-22-23	SKM 2012	41.3	43.1	41.6	38.3	41.5	37.8	40.8	38.8	42.9	**40.6**	**913**
24	MCN-22-24	TM316	41.4	43.6	38.3	37.9	41.7	39.2	40.9	41.0	41.8	**40.5**	**965**
25	MCN-22-25	DTM- 341	40.4	**40.0**	41.0	40.4	40.8	41.5	39.6	**39.6**	39.4	**40.4**	**817**
26	MCN-22-26	PBR 813-2	42.8	40.4	42.1	41.6	43.4	42.7	42.3	40.7	41.3	**41.8**	**1008**
27	MCN-22-27	RB- 110	40.7	43.3	41.1	39.9	40.4	38.4	40.0	36.6	40.7	**40.1**	**975**

Table 3.7.a. Performance of Indian mustard strains in IVT timely sown (Irrigated), Zone - IV

S.No.	Code	Strain	Seed Yield (Kg/ha)							Plant Stand					
			SKN	NGP	JAL	MDR	PLI$	WSM	Mean	SKN	NGP	JAL	MDR	PLI$	WSM
			1	2	3	4	5	6	(1-4,6)	1	2	3	4	5	6
1	MCN-22-1	RMM-19-12	3170	1632	929	2500	2066	1715	**1989**	177	114	140	163	130	127
2	MCN-22-2	DRMRHT 18-141	2734	1962	1045	1942	2721	1335	**1804**	178	113	155	152	126	123
3	MCN-22-3	Kranti (NC)	2723	1720	989	2124	1794	1542	**1820**	177	113	146	166	112	128
4	MCN-22-4	PR-2019-1	3095	2071	865	1987	2112	1270	**1858**	179	113	126	164	117	128
5	MCN-22-5	KMR 22-4	3571	1979	973	2838	1862	1803	**2233**	178	110	154	162	112	129
6	MCN-22-6	RH 2187	2794	2129	1256	2173	2207	1248	**1920**	168	113	178	158	117	128
7	MCN-22-7	DRMRIJ 21-37	2700	1922	891	2637	1752	1392	**1908**	174	112	130	174	104	128
8	MCN-22-8	DRMRCI- 154	3179	1878	1044	1858	1980	1318	**1855**	173	110	164	165	115	124
9	MCN-22-9	ACNMM- 3	3576	1999	804	2303	2049	1605	**2058**	174	115	114	156	117	126
10	MCN-22-10	RGN 528	2918	1759	1036	2030	1729	1196	**1788**	157	114	161	167	110	127
11	**MCN-22-11**	**BIO- 902 (ZC)**	**3779**	**2106**	**1162**	**2576**	**2004**	**1729**	**2270**	**172**	**112**	**170**	**161**	**108**	**122**
12	MCN-22-12	NPJ 262	3542	2074	928	2374	2854	1576	**2099**	168	110	137	148	148	122
13	MCN-22-13	DRMR 2020-8	3142	2019	1242	2370	1848	1256	**2006**	177	113	174	153	126	126
14	MCN-22-14	HUJM-21-4	3413	1852	816	2160	2159	1305	**1909**	180	115	120	168	108	127
15	MCN-22-15	DM 2020-3	3068	1994	930	2198	1945	1346	**1907**	154	118	145	160	130	125
16	MCN-22-16	RAURD 18-1	3109	1775	1363	1987	2242	1312	**1909**	180	117	184	157	117	129
17	MCN-22-17	GDM 4 (LR)	2948	1753	900	2571	2080	1620	**1958**	168	113	139	162	126	128
18	MCN-22-18	NPJ 261	3537	2023	953	2981	2149	1303	**2159**	167	111	149	161	119	128
19	MCN-22-19	RH 2199	3018	1600	904	1980	1835	1694	**1839**	173	114	134	154	115	124
20	MCN-22-20	PR-2020-14	3535	1703	921	2192	1825	1430	**1956**	176	111	143	164	121	122
21	MCN-22-21	SKM 1924	3163	2110	961	2540	2258	1289	**2013**	174	110	146	162	142	128
22	MCN-22-22	KMR 22-3	3141	1830	988	1919	2433	1171	**1810**	171	110	152	157	142	121
23	MCN-22-23	SKM 2012	3416	1628	904	3232	2841	1457	**2127**	177	110	141	163	140	124
24	MCN-22-24	TM316	3283	1885	955	2449	2145	1464	**2008**	183	113	144	157	130	125
25	MCN-22-25	DTM- 341	2978	1607	965	1838	1638	1260	**1730**	178	111	148	159	113	123
26	MCN-22-26	PBR 813-2	3238	1694	975	2636	1738	1211	**1951**	176	112	150	163	99	125
27	MCN-22-27	RB- 110	3234	1779	1203	1698	2638	1301	**1843**	163	110	172	157	146	124
		GM	**3185**	**1870**	**997**	**2300**	**2108**	**1413**	**1953**						
		CD (5%)	549	289	121	352	320	245							
		CV (%)	10.8	9.7	7.6	9.6	9.5	10.9							
		DOS	11.10.2022	28.10.2022	20.10.2022	19.10.2022	18.10.2022	30.10.2022							

$ data of PLI centre excluded from computation of mean due to rejection of trial by monitoring team

Table 3.7.b. Performance of Indian mustard strains in IVT timely sown (Irrigated), Zone - IV

S.No.	Code	Strain	Days to Maturity						1000- Seed wt (g)						Oil Content (%)				Oil Yield (kg/ha)
			SKN	NGP	JAL	MDR	PLI	WSM	SKN	NGP	JAL	MDR	PLI	WSM	SKN	NGP	JAL	Mean	
			1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	(1-3)	
1	MCN-22-1	RMM-19-12	118	103	85	117	134	104	5.4	4.8	4.4	4.1	4.0	4.7	37.4	33.9	33.9	**35.1**	**698**
2	MCN-22-2	DRMRHT 18-141	117	101	85	117	131	99	4.8	5.3	4.8	5.0	5.2	4.9	39.9	36.8	39.9	**38.9**	**701**
3	MCN-22-3	Kranti (NC)	111	100	84	119	130	100	5.5	4.1	5.0	4.9	4.7	4.0	39.4	32.6	38.9	**37.0**	**672**
4	MCN-22-4	PR-2019-1	116	102	97	120	132	98	5.5	5.3	4.8	5.3	3.3	5.2	40.1	36.6	36.4	**37.7**	**700**
5	MCN-22-5	KMR 22-4	120	103	89	121	134	102	5.8	5.5	4.8	3.6	4.3	5.2	41.1	35.8	35.1	**37.3**	**833**
6	MCN-22-6	RH 2187	117	101	88	119	131	96	5.0	5.4	4.4	4.8	4.2	5.5	40.0	37.1	34.0	**37.0**	**711**
7	MCN-22-7	DRMRIJ 21-37	113	101	84	120	131	99	5.7	5.2	4.7	4.9	5.0	5.2	40.2	37.4	36.8	**38.1**	**728**
8	MCN-22-8	DRMRCI- 154	118	100	87	120	128	102	6.0	5.6	4.8	6.5	5.2	5.1	42.2	33.0	35.3	**36.8**	**684**
9	MCN-22-9	ACNMM- 3	117	103	92	122	132	100	5.5	5.3	4.8	4.6	4.5	5.2	40.7	34.2	38.8	**37.9**	**780**
10	MCN-22-10	RGN 528	120	102	97	120	130	96	5.8	4.9	4.6	5.0	4.6	5.0	41.6	36.8	36.7	**38.4**	**686**
11	**MCN-22-11**	**BIO- 902 (ZC)**	**119**	**103**	**94**	**119**	**132**	**101**	**5.7**	**5.7**	**4.8**	**4.5**	**4.8**	**5.7**	**42.6**	**37.3**	**37.5**	**39.1**	**888**
12	MCN-22-12	NPJ 262	118	103	96	120	132	99	6.3	5.3	4.6	5.7	4.7	5.5	39.2	36.5	36.9	**37.5**	**788**
13	MCN-22-13	DRMR 2020-8	114	102	84	121	132	102	6.4	5.3	4.7	6.3	4.0	5.2	41.5	38.7	38.5	**39.6**	**793**
14	MCN-22-14	HUJM-21-4	115	100	88	121	134	104	5.4	4.9	4.6	5.5	4.7	5.1	40.9	36.7	38.6	**38.7**	**739**
15	MCN-22-15	DM 2020-3	119	103	85	115	133	98	6.6	6.0	4.3	5.5	4.2	5.9	38.7	35.0	35.7	**36.5**	**696**
16	MCN-22-16	RAURD 18-1	120	103	85	120	132	97	6.7	5.8	4.5	6.6	5.1	5.7	40.1	36.6	37.9	**38.2**	**729**
17	MCN-22-17	GDM 4 (LR)	114	100	87	119	130	100	5.5	5.8	4.6	5.4	4.3	5.7	39.3	35.8	36.1	**37.1**	**726**
18	MCN-22-18	NPJ 261	116	102	87	121	132	99	6.3	5.5	4.7	5.8	5.3	5.0	42.7	35.6	38.0	**38.8**	**837**
19	MCN-22-19	RH 2199	113	103	88	120	132	97	6.4	4.5	4.7	6.1	5.2	4.8	39.4	32.4	37.3	**36.4**	**669**
20	MCN-22-20	PR-2020-14	116	101	100	122	132	97	5.7	4.0	4.7	5.5	6.1	4.6	40.1	37.3	37.9	**38.4**	**752**
21	MCN-22-21	SKM 1924	116	104	97	120	133	99	6.2	5.5	4.6	5.7	5.1	5.7	40.6	35.4	36.9	**37.6**	**758**
22	MCN-22-22	KMR 22-3	120	102	84	123	131	100	5.1	4.4	4.7	4.4	4.2	4.2	42.6	34.0	33.4	**36.7**	**664**
23	MCN-22-23	SKM 2012	115	99	95	120	133	100	5.2	4.2	4.6	4.4	5.2	4.3	42.6	33.9	37.1	**37.9**	**805**
24	MCN-22-24	TM316	114	100	99	120	133	102	4.9	4.2	4.9	4.3	4.5	4.3	40.2	36.3	35.9	**37.5**	**752**
25	MCN-22-25	DTM- 341	118	103	86	121	130	100	4.9	4.7	4.5	4.0	4.7	4.3	42.2	36.7	34.5	**37.8**	**654**
26	MCN-22-26	PBR 813-2	119	104	95	119	133	99	4.9	5.6	4.9	4.5	6.1	5.1	43.3	35.6	34.1	**37.7**	**735**
27	MCN-22-27	RB- 110	117	103	84	117	134	100	7.1	5.7	5.0	5.6	5.3	5.8	39.3	34.5	37.5	**37.1**	**684**

Table 3.8.a. Performance of Indian mustard strains in AVT-I Timely sown (Irrigated/ Quality/ WRR), Zone - II

S.No	Code	Strain	Seed Yield (Kg/ha)										Plant Stand							
			ABR	BAW	CHT	HSR	LDH	MOD	NDH	SGN	Mean		ABR	BAW	CHT	HSR	LDH	MOD	NDH	SGN
			1	2	3	4	5	6	7	8	(1-8)		1	2	3	4	5	6	7	8
1	MCN-22-28	Kranti (NC)	2650	2401	1820	2289	2353	1516	2638	1819	**2186**		285	260	290	265	289	218	321	229
2	MCN-22-29	**DRMRCI(Q) 47****	**2021**	**2308**	**1786**	**2729**	**2389**	**1763**	**2922**	**2438**	**2294**	***	**280**	**261**	**310**	**275**	**299**	**211**	**328**	**235**
3	MCN-22-30	Basanti (WRR Check)	2477	2642	1658	2813	2156	1790	2633	1718	**2236**		281	266	300	263	295	212	333	231
4	MCN-22-31	RH 1975#	3121	2846	2003	3267	2403	1771	3403	2287	**2637**		292	264	330	261	292	213	322	233
5	**MCN-22-32**	**NPJ 253***	**3341**	**2370**	**1980**	**3308**	**2085**	**2132**	**3521**	**2063**	**2600**	*	**292**	**260**	**328**	**273**	**298**	**214**	**322**	**238**
6	**MCN-22-33**	**RH 0749 (ZC)**	**2870**	**2429**	**1946**	**2674**	**2132**	**1795**	**2927**	**2077**	**2356**		**294**	**261**	**323**	**268**	**287**	**210**	**334**	**241**
7	MCN-22-34	PDZ 1 (DL Check)	2443	2340	1666	2698	2386	1683	2711	1850	**2222**		285	260	322	232	288	199	331	234
8	MCN-22-35	GIRIRAJ (LR)	2784	2538	1994	2629	2196	1643	2871	2026	**2335**		287	263	328	263	290	193	326	236
9	MCN-22-36	IJ 19R5004**	2373	2326	1879	2457	2255	1606	2569	2182	**2206**		273	260	312	261	291	200	294	241
10	**MCN-22-37**	**PM 32 (Quality LR)**	**2692**	**2386**	**2033**	**2692**	**2316**	**1536**	**2802**	**1985**	**2305**		**285**	**264**	**310**	**264**	**295**	**209**	**329**	**235**
11	MCN-22-38	DRMR 2018-25***	2342	2202	1885	2677	2105	1765	2921	2660	**2319**		285	261	321	263	298	226	330	236
12	MCN-22-39	SKM- 1801*	2227	2550	1971	2807	2119	1788	2886	2632	**2373**		280	266	298	261	286	218	320	239
13	MCN-22-40	RH 1934*	2747	2630	2119	3307	2483	1787	2869	2497	**2555**		287	267	288	262	288	209	310	230
14	MCN-22-41	RH 1974#	2967	2645	2020	3299	1824	1942	3327	2555	**2572**		292	262	310	262	293	222	330	231
15	MCN-22-42	PM 30 (NC)	2686	2568	1751	2803	1927	1657	2828	1790	**2251**		286	267	328	260	283	199	303	240
		GM	**2649**	**2479**	**1901**	**2830**	**2209**	**1745**	**2922**	**2172**	**2363**									
		CD (5%)	397	342.5	279	416	260	178	383	289										
		CV (%)	10.8	9.7	10.3	10.3	8.3	7.1	9.2	9.3										
		DOS	22.10.2022	18.10.2022	22.10.2022	16.10.2022	17.10.2022	21.10.2022	17.10.2022	29.10.2022										

Timely sown irrigated *; quality strain **; white rust resistant strain ***; AVT- II strain #

* Strain out yielding the best check by a margin of more than or equal to 10 percent on the basis of seed yield

***Strain possessing low erucic acid content in oil and possessing resistance against white rust and oil yield at par with the best check

Table 3.8.b. Performance of Indian mustard strains in AVT-I+II Timely sown (Irrigated/ Quality/ WRR), Zone - II

S.No	Code	Strain	Days to Maturity								1000 Seed wt. (g)							Oil Content (%)								Oil Yield (kg/ha)
			ABR	BAW	CHT	HSR	LDH	MOD	NDH	SGN	ABR	BAW	CHT	HSR	LDH	NDH	SGN	ABR	BAW	CHT	HSR	LDH	NDH	SGN	Mean	
			1	2	3	4	5	6	7	8	1	2	3	4	5	7	8	1	2	3	4	5	7	8	(1-8)	
1	MCN-22-28	Kranti (NC)	136	141	138	138	139	142	135	150	4.8	4.6	4.1	4.6	5.1	4.6	4.4	36.8	37.3	37.0	38.5	38.0	37.3	39.4	**37.7**	**825**
2	**MCN-22-29**	**DRMRCI(Q)47****	**144**	**145**	**145**	**143**	**139**	**145**	**143**	**150**	**4.0**	**5.0**	**3.5**	**4.6**	**4.1**	**3.8**	**3.6**	**43.1**	**42.0**	**42.3**	**42.1**	**43.2**	**44.3**	**42.2**	**42.7**	**981**
3	MCN-22-30	Basanti (WRR Check)	152	145	148	142	151	146	148	148	3.7	4.3	3.5	4.6	4.2	3.7	3.7	40.6	39.6	35.6	41.4	39.7	40.3	39.7	**39.6**	**884**
4	MCN-22-31	RH 1975#	145	140	145	140	146	144	139	149	6.4	5.8	4.5	6.6	5.2	5.8	5.1	38.1	42.0	39.4	41.3	38.6	39.1	39.4	**39.7**	**1047**
5	**MCN-22-32**	**NPJ 253***	**144**	**145**	**140**	**142**	**140**	**146**	**141**	**149**	**7.1**	**7.0**	**5.0**	**7.7**	**7.2**	**7.9**	**5.9**	**38.3**	**38.7**	**36.8**	**35.3**	**38.7**	**37.3**	**38.2**	**37.6**	**978**
6	**MCN-22-33**	**RH 0749 (ZC)**	**146**	**141**	**142**	**146**	**145**	**145**	**145**	**149**	**6.1**	**6.0**	**4.7**	**6.8**	**5.7**	**6.3**	**5.7**	**38.0**	**40.6**	**35.8**	**39.0**	**40.4**	**37.9**	**38.9**	**38.7**	**911**
7	MCN-22-34	PDZ 1 (DL Check)	144	144	145	139	139	142	139	148	3.9	4.0	3.6	3.8	3.5	3.2	2.9	42.1	43.4	43.2	43.7	40.4	43.9	0.0	**42.7**	**949**
8	**MCN-22-35**	**GIRIRAJ (LR)**	**145**	**141**	**145**	**140**	**146**	**144**	**140**	**150**	**5.6**	**5.9**	**4.7**	**6.6**	**5.9**	**5.4**	**5.7**	**39.1**	**40.1**	**37.4**	**41.4**	**39.7**	**40.3**	**37.9**	**39.4**	**920**
9	MCN-22-36	IJ 19R5004**	144	142	148	139	146	144	138	150	3.9	4.1	3.6	3.8	3.6	3.7	3.7	43.3	41.5	41.8	40.7	43.0	40.5	43.9	**42.1**	**929**
10	**MCN-22-37**	**PM 32 (Quality LR)**	**146**	**144**	**143**	**144**	**151**	**146**	**141**	**149**	**4.3**	**4.6**	**3.9**	**6.1**	**4.5**	**4.2**	**6.3**	**42.5**	**42.3**	**41.1**	**41.2**	**41.8**	**39.9**	**42.4**	**41.6**	**959**
11	MCN-22-38	DRMR 2018-25***	147	145	144	141	146	147	142	149	4.9	4.8	4.1	6.2	4.4	4.7	4.3	41.8	41.2	40.0	40.1	40.3	40.7	40.9	**40.7**	**944**
12	MCN-22-39	SKM- 1801*	145	143	142	139	151	145	141	150	4.9	4.5	3.9	5.0	4.4	4.1	3.6	39.2	38.7	36.4	39.8	38.3	38.2	38.1	**38.4**	**911**
13	MCN-22-40	RH 1934*	146	145	147	146	146	146	143	150	6.0	5.9	4.6	6.6	6.8	5.6	5.9	39.2	38.5	36.0	38.7	37.6	37.1	39.6	**38.1**	**973**
14	MCN-22-41	RH 1974#	143	141	143	139	145	146	139	149	5.9	6.0	4.6	7.1	6.3	6.2	6.0	38.3	37.7	39.0	34.4	39.2	38.5	41.4	**38.3**	**986**
15	MCN-22-42	PM 30 (NC)	145	145	139	137	146	145	142	148	6.1	6.2	4.9	7.0	6.7	6.3	4.7	44.3	41.1	40.1	42.2	42.2	39.9	40.2	**41.4**	**932**

Timely sown irrigated *; quality strain **; white rust resistant strain ***; AVT- II strain #

Table 3.9.a. Performance of Indian mustard strains in AVT-I+II Timely sown (Irrigated/ Quality/ WRR), Zone - III

S.No.	Code	Strain	Seed Yield (Kg/ha)									Plant Stand						
			PNT	KPR$	MOR	BPR	VAR	DOL#	JHS	Mean		PNT	KPR	MOR	BPR	VAR	DOL	JHS
			1	2	3	4	5	6	7	(1,3-5,7)		1	2	3	4	5	6	7
1	**MCN-22-43**	**RGN 73 (LR)**	**2192**	**2596**	**3397**	**2437**	**1702**	**1360**	**2431**	**2432**		**279**	**225**	**284**	**285**	**357**	**332**	**291**
2	MCN-22-44	Kranti (NC)	1876	2282	3708	2385	1569	1163	2109	**2329**		297	208	278	276	364	338	265
3	MCN-22-45	PDZ 15**#@	1729	2232	3535	2219	1712	1158	2022	**2243**		276	213	286	296	373	326	264
4	**MCN-22-46**	**NPJ 253***	**2716**	**2265**	**3377**	**2806**	**1867**	**1197**	**2714**	**2696**	*	**258**	**209**	**298**	**269**	**336**	**334**	**290**
5	MCN-22-47	DRMRIJ 20-157***	2288	2183	3173	2338	1423	1209	1604	**2165**		292	217	280	283	342	337	274
6	MCN-22-48	Basanti (WRR Check)	1792	2060	3311	2127	1262	1192	1806	**2059**		269	222	275	275	338	326	266
7	MCN-22-49	DRMR 2018-37***	1909	1870	3106	2699	1375	1244	2041	**2226**		280	221	283	280	373	323	295
8	MCN-22-50	IJ 19R5004***	1736	2497	3549	1975	1533	1070	2591	**2277**		248	210	285	276	348	330	268
9	MCN-22-51	PDZ 16**@	1407	2149	3366	1845	1467	1099	2473	**2112**		287	215	293	280	387	330	272
10	MCN-22-52	PDZ 1 (DLC)	1376	2100	3071	1788	938	1093	2268	**1888**		287	211	303	284	382	336	283
11	**MCN-22-53**	**DRMR 2018-25*** **	**2205**	**2075**	**3723**	**3162**	**1697**	**1209**	**2831**	**2723**	***	**268**	**218**	**287**	**282**	**368**	**335**	**296**
12	MCN-22-54	PDZ 14**#@	1480	2034	3219	2011	1433	1122	2304	**2090**		296	213	300	271	371	333	283
13	MCN-22-55	Maya (ZC)	1696	2001	3673	2176	1577	1221	2745	**2374**		276	216	290	274	371	337	288
14	MCN-22-56	PM 30 (Quality LR)	2228	2100	3409	2354	1615	1232	**2309**	**2383**		258	210	297	283	362	328	303
		GM	**1902**	**2175**	**3401**	**2309**	**1512**	**1183**	**2303**	**2286**								
		CD (5%)	268	NS	288	335	181	132	459									
		CV (%)	9.9	14.6	5.9	10.2	8.4	7.8	13.9									
		DOS	28.10.2022	19.10.2022	20.10.2022	21.10.2022	21.10.2022	18.10.2022	29.10.2022									

$ data of KPR centres excluded from computation of mean due to non significant differences among treatment means.

data of DOL excluded from computation of mean due to less experimental mean than state mean

Timely sown irrigated *; quality strain **; white rust resistant strain ***; AVT- II strain #; double low strain @

* Strain out yielding the best check by a margin of more than or equal to 10 percent on the basis of seed yield

*** Strain out yielding at par for seed yield with the best check and possessing resistance against whist rust

Table 3.9.b. Performance of Indian mustard strains in AVT-I+II Timely sown (Irrigated/ Quality/ WRR), Zone - III

S.No	Code	Strain	Days to Maturity								1000 Seed Weight (gm)							Oil Content (%)								Oil Yield (kg/ha)
			PNT	KPR	MOR	BPR	VAR	DOL	JHS	Mean	PNT	KPR	MOR	BPR	VAR	DOL	JHS	PNT	KPR$	MOR	BPR	VAR	DOL#	JHS	Mean	
			1	2	3	4	5	6	7	(1-7)	1	2	3	4	5	6	7	1	2	3	4	5	6	7	(1,3-5,7)	
1	**MCN-22-43**	**RGN 73 (LR)**	**140**	**130**	**138**	**137**	**123**	**129**	**130**	**132**	**3.8**	**4.6**	**5.4**	**4.1**	**3.6**	**3.7**	**4.3**	**41.2**	**42.0**	**44.2**	**43.7**	**40.9**	**39.3**	**41.1**	**42.2**	**1027**
2	MCN-22-44	Kranti (NC)	131	135	127	131	113	122	125	127	3.7	4.5	5.5	4.4	3.6	3.7	4.9	40.6	39.3	44.2	39.4	34.2	35.4	38.4	**39.4**	**917**
3	MCN-22-45	PDZ 15**#@	135	132	127	135	119	127	127	129	3.1	4.0	4.3	3.4	3.3	3.1	3.7	44.1	43.8	44.9	44.7	42.8	40.2	41.6	**43.6**	**979**
4	**MCN-22-46**	**NPJ 253***	**139**	**134**	**136**	**135**	**123**	**124**	**129**	**131**	**5.8**	**5.7**	**8.0**	**6.4**	**4.4**	**4.4**	**6.0**	**42.3**	**40.8**	**43.6**	**42.7**	**42.6**	**41.8**	**38.2**	**41.9**	**1129**
5	MCN-22-47	DRMRIJ 20-157***	137	130	128	129	122	124	129	128	4.2	4.3	5.8	4.5	3.3	3.2	4.2	41.2	42.1	39.9	39.6	38.1	37.5	37.4	**39.2**	**850**
6	MCN-22-48	Basanti (WRR Check)	144	133	138	139	124	129	133	133	3.6	4.4	5.2	4.1	3.2	3.3	4.6	42.2	43.5	42.8	42.8	39.0	35.7	40.6	**41.5**	**854**
7	MCN-22-49	DRMR 2018-37***	139	132	138	133	122	125	130	131	3.5	4.6	4.4	4.7	3.9	3.2	4.2	43.1	42.9	42.5	43.2	40.9	39.6	40.0	**42.0**	**934**
8	MCN-22-50	IJ 19R5004***	137	134	130	132	121	126	128	130	3.3	4.3	4.0	3.6	3.5	3.4	4.0	43.7	41.8	45.6	43.9	40.6	42.2	40.5	**42.9**	**976**
9	MCN-22-51	PDZ 16**@	139	129	131	135	119	125	129	130	2.8	4.3	3.6	3.2	3.3	3.4	3.9	44.7	43.4	44.0	45.0	39.7	40.2	40.1	**42.7**	**902**
10	MCN-22-52	PDZ 1 (DLC)	135	135	132	137	118	129	127	130	2.8	4.8	3.9	3.3	3.7	3.7	5.0	45.8	42.7	45.6	43.3	42.5	41.9	44.7	**43.2**	**816**
11	**MCN-22-53**	**DRMR 2018-25*** **	**139**	**132**	**136**	**135**	**123**	**126**	**131**	**131**	**4.2**	**4.6**	**5.6**	**5.7**	**3.4**	**3.6**	**4.4**	**44.3**	**43.1**	**43.9**	**43.3**	**40.0**	**37.7**	**38.0**	**41.9**	**1141**
12	MCN-22-54	PDZ 14**#@	140	138	135	139	120	127	126	132	3.2	3.8	5.0	3.4	4.2	3.4	4.1	45.2	42.6	43.8	43.3	42.9	42.1	42.4	**43.2**	**903**
13	MCN-22-55	Maya (ZC)	134	136	137	136	119	126	127	131	3.7	3.9	5.3	4.7	3.4	4.1	4.8	41.0	41.3	41.1	42.4	38.9	36.1	38.9	**40.5**	**960**
14	MCN-22-56	PM 30 (Quality LR)	141	134	135	138	123	127	129	133	5.1	4.8	5.8	5.9	4.2	3.5	5.3	43.7	41.9	42.3	42.4	43.6	37.3	43.4	**43.1**	**1027**

dl-double low; sl-single low;DLC- double low check;

Table 3.10.a. Performance of Indian mustard strains in AVT-I Timely sown (Irrigated), Zone - IV

S.No.	Code	Strain	Seed Yield (Kg/ha)								Plant Stand					
			SKN	NGP	JAL	MDR	PLI$	WSM	Mean		SKN	NGP	JAL	MDR	PLI	WSM
			1	2	3	4	5	6	(1-4,6)		1	2	3	4	5	6
1	MCN-22-57	SKM 1801	3489	1784	1058	2683	2067	1421	**2087**		351	260	277	288	198	281
2	**MCN-22-58**	**NPJ 252**	**3500**	**2150**	**1236**	**2764**	**1589**	**1770**	**2284**	**	**355**	**260**	**314**	**291**	**166**	**283**
3	**MCN-22-59**	**GDM 4 (LR)**	**3107**	**1929**	**1343**	**2526**	**1814**	**1532**	**2087**		**333**	**260**	**348**	**301**	**180**	**283**
4	MCN-22-60	Kranti (NC)	2919	1867	1090	2343	1311	1553	**1954**		331	277	287	281	151	283
5	MCN-22-61	PBR 939	3139	1922	1188	2877	1754	1327	**2090**		349	260	301	291	220	278
6	MCN-22-62	KMR 21-3	3126	1830	1308	2563	1978	1373	**2040**		327	260	328	296	198	277
7	MCN-22-63	RGN 524	3414	1896	1230	2757	2728	1296	**2119**		347	276	307	298	202	280
8	MCN-22-64	BIO- 902 (ZC)	3545	1751	1116	2292	2367	1266	**1994**		357	275	288	287	166	267
9	MCN-22-65	ACN 237	3156	1718	903	2381	1623	1458	**1923**		343	271	263	299	220	264
10	MCN-22-66	NPJ 253	3584	1791	1033	2620	1964	1391	**2084**		359	267	270	286	198	266
		GM	**3298**	**1864**	**1150**	**2580**	**1919**	**1439**	**2066**							
		CD (5%)	399	223	163	374	268	216								
		CV (%)	8.3	8.2	9.8	10.0	8.2	10.3								
		DOS	11.10.2022	30.10.2022	22.10.2022	19.10.2022	19.10.2022	30.10.2022								

$ data of PLI centre excluded from computation of mean due to conduction of the trial under three replications and rejected by monitoring team.

**Strain outyielding the best check by a margin of more than or equal to 10 percent on the basis of oil yield

Table 3.10.b. Performance of Indian mustard strains in AVT-I Timely sown (Irrigated), Zone - IV

S.No	Code	Strain	Days to Maturity							1000 Seed Weight (gm)						Oil Content (%)				Oil Yield (kg/ha)
			SKN	NGP	JAL	MDR	PLI$	WSM	Mean	SKN	NGP	JAL	MDR	PLI	WSM	SKN	NGP	JAL	Mean	
			1	2	3	4	5	6	(1-4,6)	1	2	3	4	5	6	1	2	3	(1-3)	
1	MCN-22-57	SKM 1801	113	98	93	117	133	96	**103**	4.6	4.2	4.8	4.3	5.4	4.1	39.4	34.9	37.9	**37.4**	**780**
2	**MCN-22-58**	**NPJ 252**	**117**	**99**	**92**	**121**	**135**	**101**	**106**	**5.9**	**5.4**	**4.8**	**6.0**	**5.7**	**5.2**	**41.4**	**33.5**	**37.2**	**37.4**	**853**
3	**MCN-22-59**	**GDM 4 (LR)**	**114**	**98**	**90**	**118**	**136**	**99**	**104**	**5.3**	**4.7**	**4.5**	**5.4**	**4.9**	**4.6**	**40.3**	**33.9**	**36.0**	**36.7**	**767**
4	MCN-22-60	Kranti (NC)	111	97	91	119	136	100	**104**	5.0	4.8	4.6	4.7	5.9	4.6	39.2	34.9	39.4	**37.8**	**739**
5	MCN-22-61	PBR 939	118	99	90	121	134	100	**106**	5.3	4.9	4.3	5.4	4.5	4.6	39.9	36.2	39.4	**38.5**	**805**
6	MCN-22-62	KMR 21-3	113	98	90	120	136	101	**104**	5.6	5.3	4.7	5.4	5.2	4.4	39.6	36.3	36.6	**37.5**	**764**
7	MCN-22-63	RGN 524	118	99	89	119	136	100	**105**	4.8	4.9	4.3	5.1	4.5	4.3	39.8	35.9	36.7	**37.5**	**794**
8	MCN-22-64	BIO- 902 (ZC)	115	97	90	118	134	99	**104**	5.9	4.9	4.4	5.5	5.4	4.9	40.2	33.9	38.5	**37.5**	**748**
9	MCN-22-65	ACN 237	117	100	92	120	134	102	**106**	5.4	5.0	4.6	4.9	4.9	4.7	39.1	34.0	40.2	**37.8**	**727**
10	MCN-22-66	NPJ 253	115	100	92	117	136	101	**105**	6.9	6.3	4.4	6.8	5.3	5.6	42.3	37.0	37.7	**39.0**	**812**

Table 3.11.a. Performance of Indian mustard strains in IVT Timely sown (Rainfed), Zone - II

S.No.	Code	Strain	Seed Yield (Kg/ha)						Plant Stand				
			SGN	HSR	BAW	LDH	ABR	Mean	SGN	HSR	BAW	LDH	ABR
			1	2	3	4	5	(1-5)	1	2	3	4	5
1	MCNR-22-1	JM-15-8	1463	2439	2021	1889	2633	**2089**	113	114	126	131	133
2	MCNR-22-2	NPJ 264	1403	2801	2333	1683	2668	**2178**	117	115	123	128	134
3	MCNR-22-3	Kranti (NC)	1548	2076	1962	1284	2298	**1834**	120	115	122	130	125
4	MCNR-22-4	RH 2199-6	1422	2557	2419	1424	2250	**2014**	115	115	123	126	134
5	MCNR-22-5	NPJ 263	1901	2774	2983	1745	2568	**2394**	117	118	125	133	124
6	MCNR-22-6	DRMRCI- 155	1841	2498	2072	2012	2688	**2222**	114	115	122	137	130
7	MCNR-22-7	RB- 113	1054	2147	2443	1848	2618	**2022**	118	114	119	129	123
8	MCNR-22-8	BAUM- 17	1478	2494	1954	1695	2095	**1943**	116	116	124	132	125
9	MCNR-22-9	DRMR 2020-3	1486	2664	2979	1519	2017	**2133**	112	116	123	124	141
10	MCNR-22-10	DRMRRIL 21-1	1754	2061	2758	1868	1949	**2078**	120	115	126	131	133
11	MCNR-22-11	RH 2148	1616	2514	1832	1835	2101	**1980**	121	118	118	135	133
12	MCNR-22-12	DRMRHT- 17-2	1620	2041	2258	1687	2681	**2057**	114	114	121	132	128
13	**MCNR-22-13**	**RH 725 (ZC)**	**1886**	**2600**	**2277**	**1667**	**2919**	**2270**	**117**	**116**	**119**	**125**	**137**
14	MCNR-22-14	DTM- 341	1352	2088	1935	1650	1726	**1750**	118	111	124	129	124
15	MCNR-22-15	TM260	1537	2029	1690	1675	2119	**1810**	113	117	117	134	132
16	MCNR-22-16	RH 761 (LR)	1755	2309	2002	1625	2542	**2046**	117	115	122	132	134
17	MCNR-22-17	RGN 526	1852	2730	2813	1819	2266	**2296**	115	114	125	135	131
18	MCNR-22-18	JKJH12	1737	2029	2644	1379	2619	**2082**	112	114	121	129	130
		GM	**1595**	**2381**	**2299**	**1684**	**2375**	**2066**					
		CD (5%)	267	461	439	322	398						
		CV (%)	10.5	11.7	11.5	11.5	10.1						
		DOS	30.10.2022	18.10.2022	18.10.2022	14.10.2025	22.10.2022						

Table 3.11.b. Performance of Indian mustard strains in IVT Timely sown (Rainfed), Zone - II

S.No.	Code	Strain	Days to Maturity					1000 - Seed Weight (g)					Oil Content (%)					Oil Yield (kg/ha)
			SGN	HSR	BAW	LDH	ABR	SGN	HSR	BAW	LDH	ABR	SGN	HSR	LDH	ABR	Mean	
			1	2	3	4	5	1	2	3	4	5	1	2	4	5	(1-2,4-5)	
1	MCNR-22-1	JM-15-8	141	134	147	142	141	4.1	5.4	3.7	4.9	5.8	40.4	41.3	37.2	38.7	**39.4**	**823**
2	MCNR-22-2	NPJ 264	**143**	134	146	138	141	5.4	6.0	5.4	4.7	5.4	40.1	40.9	37.4	39.3	**39.4**	**858**
3	MCNR-22-3	Kranti (NC)	**141**	132	145	137	137	4.1	6.0	5.2	5.0	5.4	40.6	38.2	38.9	39.2	**39.2**	**719**
4	MCNR-22-4	RH 2199-6	142	135	147	145	139	5.1	6.1	5.6	5.2	5.7	40.2	41.1	36.7	39.1	**39.3**	**791**
5	MCNR-22-5	NPJ 263	143	136	146	138	139	5.6	6.1	5.9	5.3	5.8	41.8	41.9	36.1	40.6	**40.1**	**960**
6	MCNR-22-6	DRMRCI- 155	141	133	146	142	140	5.4	6.3	5.1	5.2	5.9	41.6	40.9	37.5	41.0	**40.2**	**894**
7	MCNR-22-7	RB- 113	141	132	148	139	137	5.8	6.3	4.7	5.3	6.3	39.7	39.6	37.7	40.3	**39.3**	**795**
8	MCNR-22-8	BAUM- 17	142	134	148	142	135	4.7	5.2	4.3	5.0	5.3	42.3	41.4	35.8	41.7	**40.3**	**783**
9	MCNR-22-9	DRMR 2020-3	142	134	145	139	136	5.0	6.7	6.0	6.1	5.0	34.9	40.8	39.0	38.9	**38.4**	**819**
10	MCNR-22-10	DRMRRIL 21-1	143	134	145	143	137	6.1	5.8	6.0	4.9	5.1	42.6	40.4	37.7	41.8	**40.6**	**844**
11	MCNR-22-11	RH 2148	144	135	146	141	137	5.5	6.6	5.9	5.6	6.1	41.5	41.0	37.7	43.0	**40.8**	**808**
12	MCNR-22-12	DRMRHT- 17-2	142	132	147	142	137	6.1	5.5	4.7	4.6	5.1	41.0	40.5	37.9	40.0	**39.8**	**820**
13	**MCNR-22-13**	**RH 725 (ZC)**	**141**	**136**	**145**	**139**	**141**	**6.1**	**6.0**	**5.7**	**5.4**	**6.2**	**42.3**	**40.7**	**35.8**	**41.4**	**40.1**	**909**
14	MCNR-22-14	DTM- 341	143	135	146	145	138	5.3	5.0	5.0	5.1	6.0	39.9	39.7	37.9	40.0	**39.4**	**689**
15	MCNR-22-15	TM260	142	137	148	143	139	6.3	7.8	6.3	4.6	6.3	39.9	35.2	34.4	41.4	**37.7**	**683**
16	MCNR-22-16	RH 761 (LR)	142	135	146	139	139	5.4	6.5	4.9	5.6	6.0	42.5	40.4	38.7	37.4	**39.8**	**814**
17	MCNR-22-17	RGN 526	143	137	148	144	142	4.3	5.0	4.9	5.2	4.3	40.1	41.2	39.1	38.3	**39.7**	**911**
18	MCNR-22-18	JKJH12	143	135	146	143	138	6.1	7.3	6.1	4.7	6.7	40.2	39.6	37.6	39.9	**39.3**	**819**

Table 3.12. Performance of Indian mustard strains in IVT Timely sown (Rainfed), Zone - V

S.No.	Code	Strain	Seed Yield (Kg/ha)							Plant Stand					Days to Maturity					1000-Seed Wt. (g)				
			KNK	JAG	SHL$	BHU	IMP	Mean		KNK	JAG	SHL	BHU	IMP	KNK	JAG	SHL	BHU	IMP	KNK	JAG	SHL	BHU	IMP
			1	2	3	4	5	(1-2,4-5)		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1	MCNR-22-1	JM-15-8	1229	1745	581	970	1086	**1257**		195	288	251.7	129	141	110	110	112.7	107	111	4.2	3.8	5.2	4.1	3.3
2	MCNR-22-2	NPJ 264	1313	1327	552	1077	1173	**1222**		195	293	234.3	136	150	111	108	112.7	109	112	5.4	4.1	5.2	3.9	4.0
3	MCNR-22-3	**Kranti (NC)**	**1331**	**1514**	**531**	**865**	**1358**	**1267**		**192**	**269**	**238.7**	**126**	**173**	**109**	**105**	**112**	**106**	**111**	5.2	4.3	3.0	4.2	3.7
4	MCNR-22-4	RH 2199-6	1437	1378	478	863	1160	**1210**		198	279	222.7	123	153	113	111	109	107	112	4.9	3.8	4.0	3.9	3.6
5	MCNR-22-5	NPJ 263	1491	1757	283	856	1037	**1285**		195	287	184	120	154	111	110	110	110	111	4.3	4.0	4.5	3.9	3.6
6	MCNR-22-6	DRMRCI- 155	1420	1750	1377	823	1142	**1284**		191	256	318	125	154	115	115	109	110	112	5.5	4.6	3.8	4.0	3.9
7	MCNR-22-7	**RB- 113***	**1593**	**1629**	**562**	**993**	**1401**	**1404**	*	**195**	**293**	**247**	**131**	**160**	**116**	**109**	**114**	**112**	**112**	5.6	4.5	4.4	4.2	4.2
8	MCNR-22-8	BAUM- 17	1371	1393	284	932	1302	**1249**		193	269	181.7	134	161	118	114	112	109	113	4.7	3.5	3.6	3.9	3.7
9	MCNR-22-9	DRMR 2020-3	1408	1819	463	924	1191	**1336**		193	280	216.7	132	162	114	111	112	107	110	5.1	4.9	4.6	4.1	4.4
10	MCNR-22-10	DRMRRIL 21-1	1086	1707	426	965	1173	**1233**		193	262	216.7	127	147	112	107	110.7	108	111	5.2	4.7	3.0	4.0	3.3
11	MCNR-22-11	RH 2148	1301	1582	746	917	1377	**1294**		190	276	443.3	125	142	114	114	109	106	114	5.8	4.8	4.5	3.9	3.5
12	MCNR-22-12	DRMRHT- 17-2	1272	1337	796	808	1407	**1206**		192	286	268.3	122	166	115	111	109	108	112	4.6	3.6	4.1	3.8	3.2
13	MCNR-22-13	DRMR 150-35 (ZC)	1229	1600	1019	1009	1185	**1256**		191	278	306.7	134	164	112	114	112	107	112	5.4	5.3	3.9	4.2	4.2
14	MCNR-22-14	DTM- 341	1283	1570	601	851	1302	**1252**		191	287	218.3	119	150	111	116	112	109	113	5.5	3.2	3.2	4.0	3.3
15	MCNR-22-15	TM260	1385	1618	1196	926	1148	**1269**		194	279	265.7	124	148	115	116	106.7	107	114	4.1	5.0	4.5	4.3	4.2
16	MCNR-22-16	NRCHB- 101 (LR)	1347	1185	385	978	1290	**1200**		196	287	155.3	127	161	113	116	106	106	113	5.6	3.9	3.4	4.2	3.9
17	MCNR-22-17	RGN 526	1534	1164	407	973	1154	**1206**		196	295	208.3	135	149	122	115	112	105	113	4.4	3.7	3.3	4.0	3.6
18	MCNR-22-18	JKJH12	1201	915	438	1016	1247	**1095**		192	294	218.3	131	152	116	113	114	110	111	5.2	5.5	4.9	4.3	3.7
		GM	**1346**	**1499**	**618**	**930**	**1230**	**1251**																
		CD (5%)	168	304	79	94	176																	
		CV (%)	7.8	12.2	7.7	6.1	8.6																	
		DOS	7.11.2022	14.10.2022	26.11.2022	14.11.2022	13.11.202																	

$ data of SHL excluded from computation of mean due to four time variation among different strains

*Strain outyielding the best check by a margin of more than or equal to 10 percent on the basis of seed yield

Table 3.13.a. Performance of Indian mustard strains in AVT I Timely sown (Rainfed), Zone - II

S.No.	Code	Strain	Seed Yield (Kg/ha)						Plant Stand					Days to maturity				
			ABR	BAW	HSR	LDH	SGN	Mean	ABR	BAW	HSR	LDH	SGN	ABR	BAW	HSR	LDH	SGN
			1	2	3	4	5	(1-5)	1	2	3	4	5	1	2	3	4	5
1	MCNR-22-19	RH 761 (Filler)	2277	2541	2503	1542	1438	**2060**	283	260	260	270	237	140	141	135	143	143
2	**MCNR-22-20**	RH 761 (LR)	2614	2468	**2275**	1854	1432	**2128**	274	271	267	276	241	141	142	135	142	142
3	MCNR-22-21	Kranti (NC)	2753	1958	1763	1502	1685	**1932**	276	271	264	275	239	135	138	131	149	142
4	MCNR-22-22	**RH 725 (ZC)**	**2493**	**2515**	**2364**	**1861**	**1545**	**2156**	**277**	**274**	**262**	**276**	**236**	**140**	**141**	**135**	143	141
5	MCNR-22-23	DRMRHJ 1117	2130	2438	2113	1738	1289	**1942**	276	269	265	284	233	138	140	134	142	141
		GM	**2453**	**2384**	**2204**	**1699**	**1478**	**2043**										
		CD (5%)	359	239	373	281.1	211											
		CV (%)	9.5	6.5	11.0	10.7	9.2											
		DOS	22.10.2022	18.10.2022	18.10.2022	14.10.2022	30.10.2022											

Table 3.13.b. Performance of Indian mustard strains in AVT I Timely sown (Rainfed), Zone - II

S.No.	Code	Strain	1000 Seed Weight (g)					Oil Content (%)					Oil Yield (kg/ha)
			ABR	BAW	HSR	LDH	SGN	ABR	BAW	HSR	LDH	Mean	
			1	2	3	4	5	1	2	3	4	(1-4)	
1	MCNR-22-19	RH 761 (Filler)	6.0	5.5	6.3	5.7	5.2	39.4	39.3	40.1	38.3	**39.3**	**809**
2	**MCNR-22-20**	RH 761 (LR)	6.7	5.2	6.3	5.6	5.3	40.1	38.8	42.5	38.8	**40.0**	**852**
3	MCNR-22-21	Kranti (NC)	6.0	4.7	5.3	4.6	5.2	38.3	35.8	36.1	36.6	**36.7**	**709**
4	MCNR-22-22	RH 725 (ZC)	5.7	5.1	6.2	5.6	5.5	40.1	37.4	42.3	39.0	**39.7**	**856**
5	MCNR-22-23	DRMRHJ 1117	5.1	4.8	5.2	5.4	5.1	42.6	37.3	42.1	36.8	**39.7**	**771**

Table 3.13.a. Performance of Indian mustard strains in IVT Late sown (Irrigated) Zone - II

S.No.	Code	Strain	Seed Yield (Kg/ha)						Plant Stand					Days to Maturity				
			SGN#	HSR	NDH	LDH	ABR$	Mean	SGN	HSR	NDH	LDH	ABR	SGN	HSR	NDH	LDH	ABR
			1	2	3	4	5	(2-4)	1	2	3	4	5	1	2	3	4	5
1	MCNL-22-1	NPJ 259	1793	2470	2347	1462	1911	**2093**	114	126	157	125	114	133	128	127	133	129
2	MCNL-22-2	HUJM-21-1	1601	1856	2175	2114	1805	**2048**	117	124	157	125	114	135	135	135	138	131
3	MCNL-22-3	PM 26 (ZC)	1817	2258	2368	1413	1749	**2013**	119	128	153	127	112	131	132	130	127	127
4	MCNL-22-4	TM258	1672	1862	2126	1444	1755	**1811**	117	123	153	126	113	137	136	136	139	133
5	MCNL-22-5	RH 1999-22	1721	2671	2284	1861	1721	**2272**	122	126	150	124	114	131	129	128	134	128
6	MCNL-22-6	DRMRIJ 21-51	1844	1933	2329	1907	2123	**2056**	120	123	154	129	119	135	130	135	137	132
7	MCNL-22-7	PRL-2020-8	1944	2246	2145	1931	2025	**2107**	116	124	151	131	116	136	134	134	138	132
8	**MCNL-22-8**	**Kranti (NC)**	**1580**	**2234**	**2397**	**1987**	**1863**	**2206**	**112**	**125**	**152**	**124**	**117**	**132**	**128**	**131**	**140**	**129**
9	MCNL-22-9	RGN 534	2204	2270	2256	1894	1596	**2140**	116	127	146	130	113	131	136	134	128	131
10	MCNL-22-10	NPJ 265	1905	2500	2490	1743	1791	**2244**	117	125	154	131	110	131	129	135	138	129
11	MCNL-22-11	KMR(L) 22-6	2078	2258	2098	1799	1566	**2052**	113	128	154	126	114	132	134	133	144	130
12	MCNL-22-12	KMR(L) 22-5	1689	1909	1814	1693	1604	**1805**	119	126	143	131	113	134	137	134	140	132
13	MCNL-22-13	DRMRHT-13-28-13	1095	1992	2573	1845	1561	**2136**	109	127	159	125	112	135	132	136	139	130
14	MCNL-22-14	PRL-2020-5	1467	2382	2403	1572	1582	**2119**	114	117	142	131	121	134	133	134	140	131
15	MCNL-22-15	Radhika (LR)	2207	2122	2101	2307	1736	**2177**	116	120	159	134	115	133	132	135	133	129
16	MCNL-22-16	BAUM-2022-2	2011	1678	2317	1872	1589	**1956**	119	120	157	135	119	132	133	133	134	130
17	MCNL-22-17	NPJ 260	2414	2317	2633	1804	1597	**2251**	122	115	162	131	124	130	127	128	125	127
18	MCNL-22-18	RH 2199-11	1703	2417	2554	1466	1733	**2146**	115	119	158	132	115	130	128	128	126	128
19	MCNL-22-19	DRMRSJ 294	1809	2216	2033	1647	1808	**1966**	118	117	154	128	115	135	133	133	139	129
20	MCNL-22-20	DRMRCI- 160	1631	2157	2563	1352	1550	**2024**	117	120	161	129	112	136	133	134	137	130
		GM	**1819**	**2187**	**2300**	**1756**	**1733**	**2081**										
		CD (5%)	320	396	413	360	NS											
		CV (%)	10.7	11.0	10.9	12.4	17.7											
		DOS	22.11.2022	15.11.2022	17.11.2022	15.11.2022	18.11.2022											

$ data of ABR excluded from computation of mean due to non significant differences, high CV and also rejection of the trial by monitoring team.

data of SGN excluded from computation of mean due to two times higher mean of entry of developing centre than any entry of particular trial

Table 3.13.b. Performance of Indian mustard strains in IVT Late sown (Irrigated) Zone - II

S.No.	Code	Strain	1000-Seed Wt. (g)					Oil Content (%)						Oil Yield (kg/ha)
			SGN	HSR	NDH	LDH	ABR	SGN#	HSR	NDH	LDH	ABR$	Mean	
			1	2	3	4	5	1	2	3	4	5	(2-4)	
1	MCNL-22-1	NPJ 259	4.0	4.9	3.1	6.2	5.4	39.1	41.4	35.4	40.2	37.3	**39.0**	**816**
2	MCNL-22-2	HUJM-21-1	5.5	4.6	2.9	4.9	4.6	38.9	40.5	34.1	40.4	35.9	**38.3**	**785**
3	MCNL-22-3	PM 26 (ZC)	3.6	4.1	2.6	3.8	3.6	38.4	39.9	36.5	41.8	39.2	**39.4**	**793**
4	MCNL-22-4	TM258	3.7	4.3	2.7	5.3	3.6	35.7	38.7	33.1	36.4	40.2	**36.1**	**653**
5	MCNL-22-5	RH 1999-22	4.5	3.8	2.5	3.3	3.7	38.9	41.3	37.9	41.1	39.6	**40.1**	**911**
6	MCNL-22-6	DRMRIJ 21-51	5.1	6.0	3.9	6.5	5.4	39.5	41.2	34.4	40.7	38.9	**38.8**	**797**
7	MCNL-22-7	PRL-2020-8	4.4	4.6	3.0	4.8	4.6	38.3	38.7	33.6	39.8	40.0	**37.4**	**787**
8	**MCNL-22-8**	**Kranti (NC)**	**4.0**	**4.4**	**2.9**	**4.2**	**4.0**	**36.6**	**39.1**	**38.2**	**38.1**	**38.6**	**38.5**	**849**
9	MCNL-22-9	RGN 534	3.8	4.3	3.3	4.4	4.5	38.4	39.6	37.0	40.4	40.4	**39.0**	**835**
10	MCNL-22-10	NPJ 265	4.1	5.2	4.0	5.1	5.5	38.5	41.5	37.5	38.6	39.2	**39.2**	**880**
11	MCNL-22-11	KMR(L) 22-6	3.7	4.3	2.8	4.4	3.9	36.4	40.2	35.6	38.7	38.7	**38.2**	**783**
12	MCNL-22-12	KMR(L) 22-5	3.9	4.2	2.5	4.2	4.5	35.6	39.3	37.3	38.5	39.6	**38.4**	**693**
13	MCNL-22-13	DRMRHT-13-28-13	4.2	5.3	3.8	5.0	4.6	37.7	38.5	34.1	37.3	36.6	**36.6**	**782**
14	MCNL-22-14	PRL-2020-5	4.3	4.1	2.5	5.2	3.7	37.0	38.8	33.9	37.5	35.4	**36.8**	**779**
15	MCNL-22-15	Radhika (LR)	4.4	4.7	3.7	4.4	4.4	36.7	41.4	38.1	38.7	40.5	39.4	858
16	MCNL-22-16	BAUM-2022-2	4.3	4.4	2.8	4.9	4.0	37.8	42.1	36.3	37.3	41.4	**38.6**	**754**
17	MCNL-22-17	NPJ 260	3.8	4.0	2.4	5.5	4.0	40.2	40.0	36.2	37.0	40.1	**37.7**	**850**
18	MCNL-22-18	RH 2199-11	3.9	4.5	3.1	5.4	4.0	38.0	41.8	35.6	39.2	40.5	**38.9**	**834**
19	MCNL-22-19	DRMRSJ 294	4.2	3.6	2.3	3.8	3.7	36.3	41.6	37.1	41.4	39.5	**40.0**	**787**
20	MCNL-22-20	DRMRCI- 160	3.4	4.1	2.6	4.3	4.1	0.0	42.3	37.6	39.0	38.2	**39.6**	**802**

Table 3.14.a. Performance of Indian mustard strains in IVT Late Sown (Irrigated) Zone - III

S.No.	Code	Strain	Seed Yield (Kg/ha)									Plant Stand								Days to Maturity							
			KPR	PNT	VAR	MOR	DOL	SBR	BPR	BND	Mean	KPR	PNT	VAR	MOR	DOL	SBR	BPR	BND	KPR	PNT	VAR	MOR	DOL	SBR	BPR	BND
			1	2	3	4	5	6	7	8	(1-8)	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1	MCNL-22-1	NPJ 259	1687	1480	1207	2238	1357	1550	2712	1321	**1694**	123	141	192	143	118	290	133	140	125	122	115	125	113	103	122	111
2	MCNL-22-2	HUJM-21-1	1749	1847	1835	1935	1249	1576	1953	1523	**1708**	120	165	197	147	115	298	138	133	123	133	117	124	118	110	128	116
3	MCNL-22-3	**NRCHB- 101 (ZC)**	**1795**	**2244**	**1701**	**2182**	**1850**	**1665**	**2070**	**1591**	**1887**	**117**	**153**	**186**	**143**	**117**	**297**	**127**	**131**	**127**	**129**	**114**	**122**	**116**	**106**	**125**	**122**
4	MCNL-22-4	TM258	1559	1581	2141	1899	1758	1354	1655	1777	**1715**	118	180	204	146	118	298	131	140	125	137	120	128	119	111	136	121
5	MCNL-22-5	RH 1999-22	1376	1599	1328	2606	1357	1717	2806	2198	**1873**	116	146	195	147	117	293	134	145	124	122	116	120	116	103	122	114
6	MCNL-22-6	DRMRIJ 21-51	1672	1986	2051	2212	1341	1191	2303	1683	**1805**	119	156	189	148	121	298	143	136	120	134	119	123	119	106	131	123
7	MCNL-22-7	PRL-2020-8	2392	1952	1859	2847	1264	1344	2093	1841	**1949**	121	169	201	147	117	297	126	139	122	131	116	125	119	108	130	118
8	MCNL-22-8	Kranti (NC)	2001	1738	1456	2228	1064	1591	2352	1885	**1789**	117	147	200	151	118	298	128	137	125	121	114	120	113	105	124	117
9	MCNL-22-9	RGN 534	2114	1660	1948	2147	1788	1336	2015	1446	**1807**	115	138	192	148	117	299	135	129	123	132	118	129	119	111	129	120
10	MCNL-22-10	NPJ 265	2022	1572	1471	1977	1141	1502	2102	1083	**1609**	118	154	197	139	117	297	128	135	118	129	116	122	115	107	128	117
11	MCNL-22-11	KMR(L) 22-6	2279	1486	1693	1955	1573	1465	2051	1662	**1771**	124	152	192	154	117	297	129	136	121	127	119	126	115	111	130	118
12	MCNL-22-12	KMR(L) 22-5	1672	1702	1878	1874	1819	1369	2065	1564	**1743**	122	174	197	152	116	298	136	132	124	130	119	128	118	112	135	119
13	MCNL-22-13	DRMRHT-13-28-13	1698	1669	1548	2368	2004	1688	1877	1888	**1842**	118	142	193	148	117	294	130	141	122	125	117	127	116	109	130	119
14	MCNL-22-14	PRL-2020-5	2042	1996	1888	2448	1896	1544	2218	1436	**1934**	125	167	199	152	118	298	145	143	120	125	117	126	119	110	128	119
15	MCNL-22-15	CS 56 (LR)	1980	1859	1642	2258	2158	1251	1906	1657	**1839**	118	158	197	140	116	295	134	144	119	131	117	124	118	112	133	125
16	MCNL-22-16	BAUM-2022-2	1816	1754	1884	2131	1310	1552	1585	1931	**1745**	120	171	183	152	116	295	127	146	126	126	117	124	115	109	131	123
17	MCNL-22-17	NPJ 260	1723	1711	1506	2758	1264	1721	2575	1776	**1879**	114	147	201	141	119	294	133	141	122	128	115	120	113	103	123	113
18	MCNL-22-18	RH 2199-11	1569	1734	1652	2465	2174	1687	2433	1877	**1949**	125	142	187	155	119	297	129	145	120	123	115	122	116	104	124	114
19	MCNL-22-19	DRMRSJ 294	1672	1879	1758	2804	1742	1558	2332	1514	**1907**	125	155	193	141	116	297	132	143	125	126	117	125	118	107	126	116
20	MCNL-22-20	DRMRCI- 160	1883	1146	1446	2474	1310	1532	2228	1191	**1651**	121	155	191	144	120	297	124	141	118	129	117	122	115	110	131	122
		GM	**1835**	**1730**	**1695**	**2290**	**1571**	**1510**	**2167**	**1642**	**1805**																
		CD (5%)	422	338	352	378	209	246	292	341																	
		CV (%)	13.9	11.8	12.6	10.0	8.1	9.9	8.2	12.6																	
		DOS	20.11.2022	23.11.2022	15.11.2022	15.11.2022	11.11.2022	22.11.2022	15.11.2022	19.11.2022																	

Table 3.14.b. Performance of Indian mustard strains in IVT Late Sown (Irrigated) Zone - III

S.No.	Code	Strain	1000-Seed Wt.(g)								Oil Content (%)								Oil Yield (kg/ha)
			KPR	PNT	VAR	MOR	DOL	SBR	BPR	BND	KPR	PNT	VAR	MOR	DOL	BPR	BND	Mean	
			1	2	3	4	5	6	7	8	1	2	3	4	5	7	8	(1-5,7-8)	
1	MCNL-22-1	NPJ 259	4.0	4.1	3.9	5.3	3.7	5.2	4.3	3.0	35.0	40.1	37.7	39.0	40.8	40.7	37.6	**38.7**	**655**
2	MCNL-22-2	HUJM-21-1	4.3	4.4	4.2	5.2	4.1	5.0	4.0	3.0	37.0	40.2	39.3	39.1	40.2	37.5	38.8	**38.9**	**664**
3	**MCNL-22-3**	**NRCHB- 101 (ZC)**	**4.8**	**4.7**	**4.5**	**5.4**	**3.8**	**4.9**	**4.0**	**3.6**	**35.1**	**41.6**	**34.9**	**36.9**	**40.0**	**37.7**	**38.5**	**37.8**	**713**
4	MCNL-22-4	TM258	4.0	3.9	3.7	4.5	3.2	4.7	3.3	3.2	36.4	36.6	40.0	36.3	39.7	37.5	36.5	**37.6**	**645**
5	MCNL-22-5	RH 1999-22	3.2	3.3	3.7	3.5	3.7	3.7	4.7	4.9	38.3	40.5	42.4	41.4	41.2	40.7	38.1	**40.4**	**756**
6	MCNL-22-6	DRMRIJ 21-51	5.0	5.2	4.5	5.7	3.7	5.7	4.8	4.9	36.2	37.1	41.9	37.7	39.9	39.6	41.3	**39.1**	**706**
7	MCNL-22-7	PRL-2020-8	3.7	4.1	3.8	4.6	3.7	5.1	3.6	3.2	33.5	40.0	40.4	35.7	39.9	38.0	38.4	**38.0**	**740**
8	MCNL-22-8	Kranti (NC)	4.2	3.7	3.8	4.4	3.4	3.8	3.3	2.7	35.9	39.1	39.0	38.4	38.7	38.8	35.8	**38.0**	**679**
9	MCNL-22-9	RGN 534	3.6	3.9	3.8	4.4	3.5	4.4	3.5	2.6	36.9	41.7	41.0	38.6	40.5	37.8	37.2	**39.1**	**706**
10	MCNL-22-10	NPJ 265	4.7	5.0	4.3	5.7	3.5	5.0	4.5	3.6	38.0	40.0	42.2	38.1	39.6	41.2	39.2	**39.8**	**640**
11	MCNL-22-11	KMR(L) 22-6	3.2	4.1	3.7	5.1	3.5	4.4	3.5	3.3	35.7	39.9	39.4	37.6	39.2	37.6	38.2	**38.2**	**677**
12	MCNL-22-12	KMR(L) 22-5	3.9	3.8	3.4	4.2	3.4	4.3	3.4	2.9	37.5	40.2	40.9	36.6	40.6	37.7	39.0	**38.9**	**678**
13	MCNL-22-13	DRMRHT-13-28-13	4.8	5.0	3.7	5.5	3.4	5.4	4.1	3.5	35.6	40.1	41.3	36.0	37.7	37.7	35.3	**37.7**	**694**
14	MCNL-22-14	PRL-2020-5	4.0	3.9	3.7	4.3	3.1	4.5	3.6	4.0	34.6	39.3	37.8	37.2	38.4	37.2	36.7	**37.3**	**721**
15	MCNL-22-15	CS 56 (LR)	4.4	4.3	3.5	5.1	3.5	4.9	3.6	3.4	37.4	37.8	36.3	38.4	38.9	38.4	35.1	**37.5**	**689**
16	MCNL-22-16	BAUM-2022-2	3.7	4.0	3.6	4.9	3.6	4.7	3.6	5.0	35.8	40.0	41.3	38.0	38.5	37.7	38.3	**38.5**	**672**
17	MCNL-22-17	NPJ 260	4.4	3.4	3.7	4.6	3.5	4.4	3.8	4.3	35.9	41.1	39.7	39.0	38.9	39.4	40.0	**39.1**	**736**
18	MCNL-22-18	RH 2199-11	4.0	3.6	3.7	4.5	3.3	4.2	4.3	4.4	37.7	38.7	39.5	38.7	40.0	38.3	37.7	**38.6**	**753**
19	MCNL-22-19	DRMRSJ 294	3.7	3.3	3.4	4.2	3.5	3.6	3.4	3.2	38.1	41.2	39.3	38.8	40.7	39.2	38.6	**39.4**	**752**
20	MCNL-22-20	DRMRCI- 160	3.8	3.7	3.7	4.3	3.0	4.0	3.5	3.7	38.1	39.5	41.6	38.3	40.8	40.0	40.1	**39.8**	**657**

Table 3.15.a. Performance of Indian mustard strains in AVT-1 Late Sown (Irrigated) Zone - II

S.No.	Code	Strain	Seed Yield (Kg/ha)						Plant Stand					Days to Maturity				
			SGN#	HSR	NDH	LDH	ABR$	Mean	SGN	HSR	NDH	LDH	ABR	SGN	HSR	NDH	LDH	ABR
			1	2	3	4	5	(2-4)	1	2	3	4	5	1	2	3	4	5
1	MCNL-22-21	**Radhika (LR)**	**2055**	**1925**	**2248**	**1931**	**2253**	**2034**	**237**	**262**	**237**	**291**	**233**	**134**	**134**	**134**	**137**	**127**
2	MCNL-22-22	Radhika (Filler)	1676	1836	2200	1916	2401	**1984**	231	262	239	290	229	136	136	134	140	127
3	MCNL-22-23	NPJ 250	2096	2173	2608	1789	1705	**2190**	239	261	243	286	233	135	131	133	130	125
4	MCNL-22-24	PM 26	1816	2104	2268	1356	1575	**1909**	231	262	243	291	233	134	133	131	131	123
5	MCNL-22-25	Kranti (NC)	1571	1990	2161	1820	2217	**1990**	235	267	258	284	232	136	132	132	133	125
		GM	**1843**	**2006**	**2297**	**1762**	**2030**	**2022**										
		CD (5%)	290	199	224	301	507											
		CV (%)	10.2	6.4	6.3	11.1	16.2											
		DOS	22.11.2022	15.11.2022	17.11.2022	15.11.2022	18.11.2022											

$ data of ABR excluded from computation of mean due to high CV and also rejection of the trial by monitoring team.

data of SGN excluded from computation of mean due to significant difference between check and filler

Table 3.15.b. Performance of Indian mustard strains in AVT 1 Late Sown (Irrigated) Zone - II

S.No.	Code	Strain	1000-Seed Wt.(g)					Oil Content (%)						Oil yield (Kg/ ha)
			SGN	HSR	NDH	LDH	ABR	SGN	HSR	NDH	LDH	ABR	Mean	
			1	2	3	4	5	1	2	3	4	5	(2-4)	
1	**MCNL-22-21**	**Radhika (LR)**	**4.6**	**4.6**	**2.9**	**4.7**	**6.0**	**37.8**	**39.7**	**37.2**	**41.0**	**39.1**	**39.3**	**799**
2	MCNL-22-22	Radhika (Filler)	4.6	4.7	2.7	5.5	6.7	36.9	40.3	36.1	39.0	39.2	**38.5**	**764**
3	MCNL-22-23	NPJ 250	4.9	4.8	3.3	4.6	6.0	37.9	41.6	35.5	37.7	37.7	**38.3**	**838**
4	MCNL-22-24	PM 26	5.4	4.0	2.2	5.1	5.7	37.5	41.6	36.8	40.7	38.2	**39.7**	**758**
5	MCNL-22-25	Kranti (NC)	4.8	4.6	2.6	4.3	5.1	34.7	41.4	33.1	38.9	37.7	**37.8**	**753**

Table 3.16a. Performance of Indian mustard strains in AVT I+II Late Sown (Irrigated) Zone - III

S.No	Code	Strain	Seed Yield (Kg/ha)									Plant Stand							Days to Maturity						
			KPR	PNT	VAR	MOR#	DOL$	SBR	BPR	Mean		KPR	PNT	VAR	MOR	DOL$	SBR	BPR	KPR	PNT	VAR	MOR	DOL$	SBR	BPR
			1	2	3	4	5	6	7	(1-3,6-7)		1	2	3	4	5	6	7	1	2	3	4	5	6	7
1	MCNL-22-26	DRMR 2018-19$	1976	2161	1950	2271	1924	1626	2577	**2058**		223	280	364	281	335	291	280	124	131	116	124	113	106	122
2	**MCNL-22-27**	**DRMRHJ 430**	**2348**	**1706**	**2044**	**1972**	**2151**	**1873**	**2339**	**2062**	*	**227**	**283**	**378**	**283**	**333**	**299**	**291**	**126**	**134**	**118**	**126**	**118**	**107**	**129**
3	MCNL-22-28	CS 56 (LR)	2149	1459	1751	2140	1831	1629	1849	**1768**		224	267	385	284	337	299	287	123	132	116	127	117	109	132
4	MCNL-22-29	NRCHB- 101 (Filler)	1935	1832	2182	1977	1953	1593	1883	**1885**		222	277	382	284	328	292	283	125	132	117	122	114	106	123
5	MCNL-22-30	NPJ 251	1968	1653	1839	2402	1872	1826	2408	**1939**		214	266	385	287	325	293	279	123	130	115	123	115	107	128
6	MCNL-22-31	Kranti (NC)	1877	1643	1732	2396	1808	1893	2237	**1876**		211	270	382	300	321	294	277	122	130	115	121	112	107	125
7	MCNL-22-32	**NRCHB- 101 (ZC)**	**2025**	**1778**	**2070**	**2207**	**1976**	**1598**	**1932**	**1881**		223	261	382	292	330	295	282	124	130	116	122	115	106	124
		GM	**2040**	**1748**	**1938**	**2195**	**1931**	**1720**	**2175**	**1924**															
		CD (5%)	158	281	237	176	132	171	295																
		CV (%)	5.2	10.8	8.2	5.4	4.6	6.7	9.1																
		DOS	20.11.2022	23.11.2022	15.11.2022	15.11.2022	11.11.2022	23.11.2022	15/11/2022																

$ AVT II strain

$ data of DOL excluded from computation of mean due to low CV.

data of MOR excluded from computation of mean due to significant difference between same genotype used as check and filler

*Strain out yielding the best check by a margin of more than or equal to 10 percent on the basis of oil yield/ seed yield

Table 3.16.b. Performance of Indian mustard strains in AVT I+II Late Sown (Irrigated) Zone - III

S.No	Code	Strain	1000-Seed Wt.(g)							Oil Content (%)							Oil Yield (kg/ha)
			KPR	PNT	VAR	MOR	DOL$	SBR	BPR	KPR	PNT	VAR	MOR	DOL$	BPR	Mean	
			1	2	3	4	5	6	7	1	2	3	4	5	7	(1-3,7)	
1	MCNL-22-26	DRMR 2018-19	4.3	5.0	4.7	5.3	3.2	4.9	4.9	38.2	37.6	39.2	42.0	35.5	40.6	**38.9**	**800**
2	**MCNL-22-27**	**DRMRHJ 430**	**3.8**	**3.6**	**4.0**	**3.8**	**3.2**	**3.4**	**4.2**	**40.3**	**37.9**	**40.8**	**39.8**	**41.2**	**37.9**	**39.2**	**809**
3	MCNL-22-28	CS 56 (LR)	3.9	4.3	3.7	4.8	3.5	2.2	3.5	37.4	36.2	35.0	38.4	36.2	38.3	**36.7**	**649**
4	MCNL-22-29	NRCH- 101 (Filler)	4.4	4.5	3.8	4.7	4.2	4.5	3.5	38.7	37.4	35.6	35.9	38.9	38.4	**37.5**	**707**
5	MCNL-22-30	NPJ 251	3.8	4.1	4.1	4.4	5.0	4.0	4.3	40.6	37.1	37.1	40.0	39.1	40.6	**38.9**	**753**
6	MCNL-22-31	Kranti (NC)	4.0	3.8	4.1	4.6	3.6	3.8	3.3	38.6	38.1	36.7	40.4	36.6	38.9	38.1	**714**
7	**MCNL-22-32**	**NRCHB- 101 (ZC)**	**4.1**	**4.8**	**3.9**	**4.6**	**3.3**	**4.2**	**3.8**	**38.9**	**37.5**	**39.5**	**38.6**	**37.8**	**38.3**	**38.5**	**725**

Table 3.17.a. Performance of Indian mustard hybrids in IHT, Zone-II

S.No.	Code	Strain	Seed Yield (kg/ha)							Plant Stand					Days to Maturity				
			HSR	LDH$	NDH	PAL	MDG	Mean		HSR	LDH$	NDH	PAL	MDG	HSR	LDH$	NDH	PAL	MDG
			1	2	3	4	5	(1,3-5)		1	2	3	4	5	1	2	3	4	5
1	MH 22-01	KGMH- 9783	2876	2120	2969	3661	2876	**3096**		123	141	120	172	133	138	144	138	129	140
2	**MH 22-02**	**RH 0749 (ZC)**	**2596**	**1818**	**2780**	**2737**	**2720**	**2708**		**121**	**138**	**156**	**219**	**132**	**142**	**148**	**143**	**134**	**144**
3	MH 22-03	Pusa MH 111	3152	1759	2899	2507	2757	**2829**		119	140	151	185	133	142	147	141	135	138
4	MH 22-04	PHR 4284	2895	2131	2683	3352	2709	**2910**		119	137	130	207	132	141	148	142	130	145
5	MH 22-05	RHH 2202	3348	1596	2391	2785	3494	**3005**		121	138	161	204	132	140	144	136	127	136
6	MH 22-06	KBH5207	2898	1951	3113	3146	2804	**2990**		122	136	158	208	130	137	144	139	133	140
7	MH 22-07	**45S46 (Check)**	**2510**	**2175**	**3163**	**3827**	**2766**	**3067**		**118**	**147**	**142**	**193**	**131**	**138**	**145**	**140**	**126**	**143**
8	MH 22-08	JH21002	2171	1559	2387	2771	3109	**2609**		119	139	115	203	129	140	145	130	136	142
9	**MH 22-09**	**JKJH11**	**2695**	**2189**	**3056**	**3866**	**3328**	**3236**	*	**118**	**135**	**135**	**217**	**132**	**137**	**145**	**137**	**133**	**143**
10	MH 22-10	DRMRHJ 1419	3199	2006	2651	2796	2299	**2736**		119	139	135	207	132	138	146	143	135	138
11	MH 22-11	DRMRHJ 310	3112	2021	2790	3425	2513	**2960**		124	145	135	223	132	140	147	144	129	141
12	MH 22-12	RHH 2203	3142	1745	2581	2966	3222	**2978**		118	142	145	202	128	141	144	137	138	142
13	MH 22-13	RHH 2201	3302	1569	3134	2873	3263	**3143**		119	139	155	177	131	135	145	136	133	144
14	MH 22-14	DMH- 1 (Check)	2671	2281	2904	3454	2723	**2938**		119	143	137	197	128	139	148	138	133	143
15	MH 22-15	Kranti (NC)	2379	1540	2160	3235	2548	**2581**		116	142	132	212	132	142	144	134	121	140
16	MH 22-16	PMH90V02	3058	2252	2940	3194	2723	**2979**		119	145	150	214	129	140	144	144	127	142
17	MH 22-17	NMH90M01	2706	2227	3157	3246	2964	**3018**		123	131	145	208	130	141	147	141	127	146
18	MH 22-18	DRMRHJ319	3065	1914	2680	2660	2639	**2761**		119	142	142	207	133	140	148	142	138	142
19	**MH 22-19**	**SVJH- 73**	**2922**	**1741**	**2900**	**3810**	**3496**	**3282**	*	**121**	**147**	**143**	**207**	**131**	**141**	**144**	**139**	**125**	**140**
20	MH 22-20	Pusa MH 103	3186	1633	3325	3109	2721	**3085**		121	135	129	210	130	139	146	140	132	143
21	MH 22-21	DRMRHJ 223	2607	1828	2653	3037	3338	**2908**		119	141	148	178	131	140	147	143	137	145
22	MH 22-22	BMH19011	2473	1638	2660	2849	2626	**2652**		124	134	140	213	132	140	145	132	134	138
23	MH 22-23	NAMJH21-04	2493	2248	2843	3610	2930	**2969**		118	129	151	214	130	138	147	135	124	144
24	**MH 22-24**	**Q90007**	**3232**	**1630**	**3080**	**3771**	**2954**	**3259**	*	**122**	**143**	**153**	**192**	**131**	**140**	**144**	**137**	**128**	**145**
25	MH 22-25	SKMH 1901	3178	1792	2409	2449	2638	**2669**		118	139	153	184	128	137	147	147	132	145
26	MH 22-26	4205A252-01	2517	1925	2994	3684	2966	**3040**		116	137	141	171	131	138	144	137	121	142
27	MH 22-27	PHR 33281	2764	2295	2903	3168	2808	**2911**		117	142	148	193	131	141	144	143	129	145
		GM	**2857**	**1910**	**2822**	**3185**	**2886**	**2938**											
		CD (5%)	492	81	387	375	448												
		CV (%)	11	2.6	8.6	7.4	10												
		DOS	15.10.2022	14.10.2022	17.10.2022	14.10.2023	20.10.2022												

$ data of LDH centre excluded from computation of mean due to low CV

* Strain out yielding the best hybrid check by a margin of more than or equal to 5 percent and best varietal check by a margin of more than or equal to 10 percent on the basis of seed yield

Table 3.17.b. Performance of Indian mustard hybrids in IHT, Zone-II

S.No.	Code	Strain	1000-Seed Wt.(g)						Oil Content (%) Zone II						Oil Yield (kg/ha)
			HSR	LDH	NDH	PAL	MDG	Mean	HSR	LDH$	NDH	PAL	MDG	Mean	
			1	2	3	4	5	(1,3-5)	1	2	3	4	5	(1,3-5)	
1	MH 22-01	KGMH- 9783	5.5	5.8	4.4	4.6	5.6	**5.0**	35.2	37.4	35.7	40.2	40.3	**37.9**	**1173**
2	MH 22-02	RH 0749 (ZC)	6.6	5.2	5.5	3.6	6.1	**5.4**	36.6	36.1	35.8	42.4	38.3	**38.3**	**1036**
3	MH 22-03	Pusa MH 111	4.7	4.7	3.4	4.4	4.5	**4.3**	37.1	39.4	36.5	36.0	40.0	**37.4**	**1058**
4	MH 22-04	PHR 4284	4.9	5.6	3.9	4.4	4.9	**4.5**	38.2	35.6	35.2	39.0	39.4	**37.9**	**1104**
5	MH 22-05	RHH 2202	5.3	4.6	3.8	4.0	5.1	**4.6**	38.7	36.2	36.9	39.8	39.5	**38.7**	**1163**
6	MH 22-06	KBH5207	6.3	5.7	4.3	3.6	5.2	**4.9**	37.3	38.9	37.1	39.7	40.0	**38.5**	**1152**
7	**MH 22-07**	**45S46 (Check)**	**6.1**	**6.7**	**4.7**	**4.7**	**5.1**	**5.1**	**40.6**	**39.7**	**38.5**	**40.4**	**40.3**	**39.9**	**1225**
8	MH 22-08	JH21002	7.0	8.0	6.2	5.1	6.2	**6.1**	34.1	34.4	37.9	41.7	34.7	**37.1**	**968**
9	**MH 22-09**	**JKJH11**	**5.8**	**6.9**	**4.8**	**5.3**	**4.9**	**5.2**	**39.2**	**38.6**	**38.9**	**40.8**	**41.9**	**40.2**	**1300**
10	MH 22-10	DRMRHJ 1419	4.8	5.7	3.9	3.9	4.8	**4.3**	40.3	37.0	37.8	41.1	40.5	**39.9**	**1092**
11	MH 22-11	DRMRHJ 310	5.2	6.2	4.0	4.7	5.4	**4.8**	39.7	36.2	36.6	40.1	39.1	**38.9**	**1150**
12	MH 22-12	RHH 2203	5.2	4.4	3.7	5.6	5.2	**4.9**	36.0	35.3	34.5	42.3	37.7	**37.6**	**1119**
13	MH 22-13	RHH 2201	5.4	4.9	3.6	5.0	5.3	**4.8**	37.9	36.0	37.7	40.7	38.4	**38.7**	**1215**
14	MH 22-14	DMH- 1 (Check)	4.3	4.9	3.1	4.0	3.9	**3.8**	36.0	36.3	35.8	40.4	37.5	**37.4**	**1100**
15	MH 22-15	Kranti (NC)	5.8	6.2	3.8	3.5	4.6	**4.4**	34.6	36.3	36.8	40.0	37.6	**37.3**	**962**
16	MH 22-16	PMH90V02	6.4	6.8	4.6	4.8	5.1	**5.2**	38.9	36.0	37.5	40.3	38.8	**38.9**	**1158**
17	MH 22-17	NMH90M01	6.3	6.8	5.1	4.5	5.8	**5.4**	40.7	37.9	36.1	40.3	38.7	**39.0**	**1176**
18	MH 22-18	DRMRHJ 319	5.3	5.6	3.9	4.1	5.2	**4.6**	37.0	37.1	37.8	41.4	42.2	**39.6**	**1094**
19	**MH 22-19**	**SVJH- 73**	**5.4**	**6.3**	**4.2**	**4.4**	**6.2**	**5.0**	**40.2**	**37.5**	**37.4**	**41.2**	**42.3**	**40.3**	**1322**
20	MH 22-20	Pus MH 103	5.0	6.7	4.7	3.6	5.0	**4.6**	40.6	39.2	37.7	39.8	40.9	**39.7**	**1226**
21	MH 22-21	DRMRHJ 223	4.7	5.0	3.3	3.9	5.2	**4.3**	40.6	38.2	36.7	40.2	40.0	**39.4**	**1145**
22	MH 22-22	BMH19011	5.3	4.7	3.6	4.3	5.1	**4.6**	38.9	38.0	39.2	40.0	37.6	**38.9**	**1032**
23	MH 22-23	NAMJH21-04	5.2	5.4	4.1	4.6	5.7	**4.9**	38.4	37.5	40.1	42.9	41.0	**40.6**	**1206**
24	**MH 22-24**	**Q90007**	**5.2**	**6.0**	**3.8**	**4.7**	**4.9**	**4.6**	**39.6**	**36.5**	**34.7**	**42.1**	**41.1**	**39.4**	**1283**
25	MH 22-25	SKMH 1901	5.4	4.8	3.6	5.1	4.9	**4.7**	37.0	36.0	33.1	41.3	41.4	**38.2**	**1019**
26	MH 22-26	4205A252-01	5.2	5.6	4.4	5.3	5.2	**5.0**	38.6	38.7	39.4	39.9	40.8	**39.7**	**1206**
27	MH 22-27	PHR 33281	4.2	4.8	3.2	5.0	5.1	**4.4**	39.3	36.5	38.6	40.8	38.6	**39.3**	**1144**

Table 3.18.a. Performance of Indian mustard hybrids in IHT, Zone-III

S.No	Code	Strain	Seed Yield (kg/ha)									Plant Stand						
			KPR	MOR	KOT	BPR	VAR$	JHS	FZB$	JAI	Mean	KPR	MOR	KOT	BPR	VAR$	JHS	JAI
			1	2	3	4	5	6	7	8	(1-4,6,8)	1	2	3	4	5	6	8
1	MH 22-01	KGMH- 9783	2690	3586	2879	3109	1500	2287	1774	2139	**2782**	121	118	103	120.7	143	147	101
2	MH 22-02	RGN 73 (ZC)	2520	3191	2923	2904	1578	2304	1675	2055	**2650**	122	118	106	134.7	144.3	136	133
3	MH 22-03	Pusa MH 111	2244	2300	2703	2660	1882	2533	1758	1730	**2362**	123	112	101	139.3	145.7	163	134
4	MH 22-04	PHR 4284	2187	2453	2874	3261	1957	3160	1725	2184	**2686**	118	114	102	147.3	147	164	126
5	MH 22-05	RHH 2202	2613	2321	2576	3162	1758	2472	1757	1888	**2505**	121	116	104	137	160.3	159	125
6	MH 22-06	KBH5207	2124	3121	2836	2793	1987	2511	1988	2036	**2570**	122	116	105	136	152	154	131
7	MH 22-07	**45S46 (Check)**	**2562**	**3420**	**3029**	**3338**	**1784**	**3136**	**2029**	**2394**	**2980**	**121**	**115**	**105**	**116.3**	**154**	**160**	**122**
8	MH 22-08	JH21002	2320	2796	2533	2507	1545	2172	1807	2173	**2417**	122	114	100	103.7	141.7	150	96
9	MH 22-09	JKJH11	1640	3330	2949	3307	1865	2667	1675	2063	**2659**	118	113	102	137	151.7	155	128
10	MH 22-10	DRMRHJ 1419	2506	2404	2453	2982	1896	2890	1799	1927	**2527**	122	115	105	137.3	152.7	149	130
11	MH 22-11	DRMRHJ 310	2685	3116	3098	2773	1823	2703	1669	2470	**2807**	122	114	104	124.7	146.7	155	129
12	MH 22-12	RHH 2203	2654	3458	3035	3007	1713	2482	1909	2078	**2786**	120	118	106	134.3	150.3	156	129
13	MH 22-13	RHH 2201	2263	2989	2512	2670	1579	2481	1910	2326	**2540**	122	112	101	129	145	142	130
14	MH 22-14	DMH- 1 (Check)	3066	3681	2403	3138	1724	2687	1720	2334	**2885**	123	118	105	138.3	148	157	132
15	MH 22-15	Kranti (NC)	2453	2557	3176	2319	1509	3151	1741	1834	**2582**	119	115	104	143.7	151.7	148	128
16	MH 22-16	PMH90V02	2161	3508	3013	3288	1818	2123	2045	2186	**2713**	121	115	104	125	150.7	143	132
17	MH 22-17	NMH90M01	2449	3110	2308	2871	1543	2415	1827	2051	**2534**	123	113	105	129	145.3	155	131
18	MH 22-18	DRMRHJ 319	2273	2902	2709	2567	1727	2800	1459	2084	**2556**	120	119	104	140.3	145	155	126
19	MH 22-19	SVJH- 73	2618	3607	2820	3011	2040	2470	1840	2558	**2847**	120	114	105	121.3	145.3	154	130
20	MH 22-20	Pusa MH 103	2707	2952	2797	2627	1752	2933	1662	1877	**2649**	123	117	105	128.7	147.3	165	128
21	MH 22-21	DRMRHJ 223	2330	3414	2868	2521	1800	2154	1809	2187	**2579**	119	116	107	99.67	147.3	136	132
22	MH 22-22	BMH19011	2295	2769	2489	2626	1328	2709	1600	1652	**2423**	120	117	107	137	148.3	158	133
23	MH 22-23	NAMJH21-04	2829	3717	2707	3296	1908	2637	1739	2551	**2956**	121	113	104	128	149.3	147	133
24	MH 22-24	Q90007	2309	3084	2412	3284	1542	2638	1709	2175	**2650**	124	116	108	135.3	152	163	131
25	MH 22-25	SKMH 1901	2597	3035	2830	2653	1458	2056	1535	1948	**2520**	120	116	101	144.3	146	149	131
26	MH 22-26	4205A252-01	2875	3408	2603	3227	1742	2681	1870	2281	**2846**	124	115	106	125	146	171	133
27	MH 22-27	PHR 33281	2552	3557	2708	3074	1866	2121	1748	2213	**2704**	120	117	105	139.3	149.3	142	133
		GM	**2464**	**3103**	**2750**	**2925**	**1727**	**2569**	**1770**	**2126**	**2656**							
		CD (5%)	447	282	344	368	272	448	436	349								
		CV (%)	11.3	5.7	7.8	7.9	9.8	10.9	15.4	10.3								
		DOS	19.10.2022	28.10.2022	18.10.2022	21.10.2022	20.10.2022	31.10.2022	28.10.2022	23.10.2022								

$ data of VAR and FZB centres excluded from computation of mean due to improper experimental design followed and also high CV of FZB.

Table 3.18.b. Performance of Indian mustard hybrids in IHT, Zone-III

S.No	Code	Strain	Days to Maturity								1000-Seed Wt.(g)								
			KPR	MOR	KOT	BPR	VAR	JHS	FZB	JAI	KPR	MOR	KOT	BPR	VAR	JHS	FZB	JAI	Mean
			1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	(2-6,7-8)
1	MH 22-01	KGMH- 9783	135	130	128	129	116	126	124	131	4.7	4.9	4.8	4.9	3.7	4.7	4.5	4.6	4.6
2	MH 22-02	RGN 73 (ZC)	133	133	136	135	114	132	129	137	4.4	3.9	4.5	4.2	4.1	4.4	4.2	4.0	4.2
3	MH 22-03	Pusa MH 111	136	128	135	130	117	131	129	134	4.9	4.0	4.5	4.0	4.0	4.2	4.3	3.9	4.2
4	MH 22-04	PHR 4284	138	138	132	132	114	132	130	137	4.3	4.4	4.4	4.5	3.6	4.4	4.5	4.6	4.3
5	MH 22-05	RHH 2202	135	126	126	124	122	124	128	134	5.2	5.0	4.6	4.8	3.6	4.7	4.4	4.0	4.5
6	MH 22-06	KBH5207	130	128	131	126	117	125	124	134	5.3	4.6	5.0	4.5	3.5	4.8	4.4	4.6	4.6
7	MH 22-07	45S46 (Check)	134	127	125	125	118	130	125	133	4.1	5.0	5.3	5.4	3.6	5.1	4.8	5.4	4.9
8	MH 22-08	JH21002	137	129	130	129	113	128	128	135	5.6	5.1	6.0	5.7	3.7	5.7	5.3	5.7	5.4
9	MH 22-09	JKJH11	133	132	127	128	117	123	125	131	4.9	4.8	4.9	4.7	3.8	4.7	4.4	4.5	4.6
10	MH 22-10	DRMRHJ 1419	132	132	132	132	118	134	128	137	4.4	4.1	5.5	4.3	3.9	4.2	4.4	3.9	4.3
11	MH 22-11	DRMRHJ 310	136	137	134	130	116	125	127	137	4.7	4.7	4.6	5.0	3.6	4.7	4.4	3.9	4.4
12	MH 22-12	RHH 2203	134	128	127	127	115	126	126	135	4.6	4.7	4.6	4.6	3.7	4.8	4.4	4.4	4.5
13	MH 22-13	RHH 2201	135	131	130	126	116	124	124	133	5.0	4.3	4.7	3.7	3.4	4.4	4.1	4.1	4.2
14	MH 22-14	DMH- 1 (Check)	131	128	131	131	118	127	127	136	4.0	3.6	3.7	3.5	3.6	3.7	3.8	3.0	3.6
15	MH 22-15	Kranti (NC)	137	128	125	125	113	125	124	131	4.5	4.3	4.5	4.7	3.6	4.8	4.7	4.5	4.4
16	MH 22-16	PMH90V02	133	134	133	132	114	134	124	136	4.1	5.8	4.6	5.8	3.5	5.8	5.1	5.1	5.0
17	MH 22-17	NMH90M01	130	129	132	135	114	132	124	136	4.8	5.6	5.8	5.9	3.6	5.7	5.0	5.1	5.2
18	MH 22-18	DRMRHJ 319	132	136	135	128	120	132	129	138	4.2	4.3	4.6	4.2	3.7	4.4	4.9	3.8	4.3
19	MH 22-19	SVJH- 73	134	130	124	127	114	126	125	132	4.7	5.1	4.8	5.0	3.7	5.0	4.4	4.7	4.7
20	MH 22-20	Pusa MH 103	130	128	133	133	117	133	130	133	4.3	5.1	5.1	4.5	3.5	5.5	5.1	5.9	4.9
21	MH 22-21	DRMRHJ 223	131	131	132	131	119	126	132	136	4.0	3.8	4.5	3.7	3.9	4.8	4.2	4.4	4.2
22	MH 22-22	BMH19011	134	128	126	123	118	125	126	130	4.0	3.9	4.1	3.7	3.6	4.5	3.8	3.4	3.9
23	MH 22-23	NAMJH21-04	132	127	126	126	111	128	125	133	3.8	4.9	4.6	4.5	3.6	4.8	4.3	4.2	4.3
24	MH 22-24	Q90007	135	129	129	129	120	129	124	134	5.7	4.9	4.7	4.6	3.5	4.6	4.3	3.4	4.5
25	MH 22-25	SKMH 1901	137	137	137	136	116	135	128	136	4.6	4.8	4.8	4.3	3.6	4.6	4.9	4.4	4.5
26	MH 22-26	4205A252-01	130	126	137	128	114	126	124	135	4.9	4.5	4.7	4.5	3.9	4.2	4.1	3.9	4.3
27	MH 22-27	PHR 33281	139	131	136	131	113	127	126	137	4.1	3.8	3.7	4.5	3.7	4.1	3.9	3.7	3.9

Table 3.18.c. Performance of Indian mustard hybrids in IHT, Zone-III

S.No.	Code	Strain	Oil Content (%)									Oil Yield (kg/ha)
			KPR	MOR	KOT	BPR	VAR$	JHS	FZB$	JAI	Mean	
			1	2	3	4	5	6	7	8	(1-4,6,8)	
1	MH 22-01	KGMH- 9783	40.9	42.3	41.2	40.3	39.1	41.0	39.8	38.1	**40.6**	**1130**
2	MH 22-02	RGN 73 (ZC)	43.5	42.8	41.8	42.2	39.1	40.0	41.2	39.0	**41.5**	**1101**
3	MH 22-03	Pusa MH 111	42.8	42.3	40.4	39.2	37.8	39.5	40.5	41.1	**40.9**	**966**
4	MH 22-04	PHR 4284	41.6	41.3	40.2	41.7	39.9	38.9	39.8	37.2	**40.1**	**1079**
5	MH 22-05	RHH 2202	40.6	43.9	42.5	41.5	39.5	40.0	41.3	39.4	**41.3**	**1035**
6	MH 22-06	KBH5207	40.0	40.4	42.3	39.2	40.4	39.1	40.4	39.6	**40.1**	**1031**
7	**MH 22-07**	**45S46 (Check)**	**40.8**	**43.2**	**42.1**	**41.8**	**41.7**	**42.9**	**42.5**	**40.1**	**41.8**	**1246**
8	MH 22-08	JH21002	36.8	45.0	42.0	38.2	38.3	37.5	39.9	36.4	**39.3**	**950**
9	MH 22-09	JKJH11	43.5	42.8	41.8	41.6	39.8	42.9	40.8	39.7	**42.0**	**1118**
10	MH 22-10	DRMRHJ 1419	40.9	44.1	41.8	40.3	42.3	40.1	41.2	36.7	**40.6**	**1027**
11	MH 22-11	DRMRHJ 310	41.1	41.9	43.4	40.4	39.4	40.2	37.9	36.2	**40.5**	**1138**
12	MH 22-12	RHH 2203	39.4	42.7	41.4	38.5	38.2	38.3	35.4	38.2	**39.7**	**1107**
13	MH 22-13	RHH 2201	39.6	44.8	39.6	37.8	38.5	39.7	39.1	38.9	**40.1**	**1017**
14	MH 22-14	DMH- 1 (Check)	40.3	45.1	42.1	40.2	41.0	40.6	40.0	37.1	**40.9**	**1180**
15	MH 22-15	Kranti (NC)	38.7	41.6	39.6	38.5	39.9	39.1	38.0	38.9	**39.4**	**1017**
16	MH 22-16	PMH90V02	41.0	44.9	42.1	39.8	42.8	41.9	39.8	37.5	**41.2**	**1118**
17	MH 22-17	NMH90M01	40.0	42.1	42.4	41.4	41.9	40.3	40.7	39.8	**41.0**	**1039**
18	MH 22-18	DRMRHJ 319	40.3	41.2	42.0	40.8	42.4	41.7	39.5	39.1	**40.8**	**1044**
19	MH 22-19	SVJH- 73	42.1	40.5	43.3	41.7	40.5	42.3	41.4	39.7	**41.6**	**1184**
20	MH 22-20	Pusa MH 103	40.9	43.5	42.1	37.6	42.0	40.7	36.4	40.9	**40.9**	**1085**
21	MH 22-21	DRMRHJ 223	41.6	38.0	42.1	41.0	40.3	41.1	38.9	38.5	**40.4**	**1042**
22	MH 22-22	BMH19011	41.4	40.7	42.8	42.3	39.9	41.7	42.3	39.4	**41.4**	**1003**
23	MH 22-23	NAMJH21-04	39.4	41.6	42.6	40.8	42.5	42.7	41.9	39.0	**41.0**	**1213**
24	MH 22-24	Q90007	41.1	43.6	42.1	40.5	41.8	40.2	38.2	36.5	**40.7**	**1078**
25	MH 22-25	SKMH 1901	41.1	41.6	40.5	40.8	38.6	37.6	37.5	38.1	**39.9**	**1007**
26	MH 22-26	4205A252-01	42.0	42.9	42.8	37.6	42.8	43.1	40.9	41.1	**41.6**	**1183**
27	MH 22-27	PHR 33281	40.7	42.9	40.3	41.8	41.6	40.5	40.6	37.1	**40.6**	**1097**

Table 3.19.a. Performance of Indian mustard hybrids in IHT, Zone-IV

S. No.	Code	Strain	Seed Yield (kg/ha)							Plant Stand					Days to maturity				
			SKN	MDR	PLI$	JAL	NGP	Mean		SKN	MDR	PLI	JAL	NGP	SKN	MDR	PLI	JAL	NGP
			1	2	3	4	5	(1-2,4-5)		1	2	3	4	5	1	2	3	4	5
1	MH 22-01	KGMH- 9783	3581	2819	2026	952	2038	**2348**		121	97	167	122	117	113	121	130	94	99
2	**MH 22-02**	**GDM 4 (ZC)**	**2943**	**2463**	**1843**	**1172**	**1886**	**2116**		**119**	**107**	**162**	**129**	**110**	**115**	**119**	**129**	**93**	**102**
3	MH 22-03	Pusa MH 111	3258	2076	1686	928	1529	**1948**		121	108	162	122	117	120	122	135	97	103
4	MH 22-04	PHR 4284	3325	2626	1859	962	1743	**2164**		119	113	167	123	115	117	124	133	94	104
5	MH 22-05	RHH 2202	2515	2103	1607	973	1784	**1844**		114	112	176	125	112	114	117	125	93	96
6	MH 22-06	KBH5207	3529	2443	2558	1079	1966	**2255**		119	108	178	126	117	116	121	128	88	96
7	MH 22-07	45S46 (Check)	3700	2240	1963	993	1703	**2159**		118	111	181	125	118	112	118	129	92	97
8	MH 22-08	JH21002	2337	1922	1925	940	1509	**1677**		100	108	167	123	115	114	121	134	92	99
9	**MH 22-09**	**JKJH11**	**3733**	**3091**	**1900**	**922**	**1841**	**2397**	*	**118**	**109**	**167**	**121**	**118**	**112**	**116**	**128**	**88**	**101**
10	MH 22-10	DRMRHJ 1419	2889	2503	2333	905	1990	**2072**		116	116	194	120	117	116	120	131	93	104
11	MH 22-11	DRMRHJ 310	3526	2318	2647	1099	1608	**2138**		121	113	186	129	111	118	119	130	92	101
12	MH 22-12	RHH 2203	2880	2251	1936	1165	1657	**1988**		125	108	181	129	118	116	118	128	91	97
13	MH 22-13	RHH 2201	2733	1836	1749	1058	1650	**1819**		115	104	151	127	110	112	116	130	90	101
14	MH 22-14	**DMH- 1 (Check)**	**3626**	**2535**	**2500**	**962**	**1671**	**2199**		**122**	**111**	**224**	**123**	**112**	**118**	**120**	**133**	**95**	**99**
15	MH 22-15	Kranti (NC)	2839	1902	1732	976	1773	**1873**		116	106	151	126	113	113	123	127	93	101
16	MH 22-16	PMH90V02	3689	2621	2361	905	1523	**2184**		123	111	197	119	112	117	124	129	91	99
17	MH 22-17	NMH90M01	3448	2668	2232	968	1501	**2146**		121	115	203	123	123	116	124	131	93	100
18	MH 22-18	DRMRHJ 319	3254	2399	2130	967	1721	**2085**		123	115	186	123	115	118	124	129	94	103
19	**MH 22-19**	**SVJH- 73**	**3699**	**2977**	**2183**	**935**	**1935**	**2386**	*	**122**	**112**	**176**	**121**	**113**	**113**	**119**	**130**	**89**	**100**
20	MH 22-20	Pus MH 103	3558	2520	1544	824	1480	**2096**		115	104	151	119	113	118	125	133	94	101
21	MH 22-21	DRMRHJ 223	3029	2623	2227	995	1846	**2123**		115	107	203	124	114	117	123	128	89	99
22	MH 22-22	BMH19011	2593	2098	1880	1504	1590	**1946**		110	107	173	130	115	110	116	129	92	98
23	MH 22-23	NAMJH21-04	3740	2437	1997	915	1614	**2176**		121	109	176	122	113	112	118	130	93	94
24	MH 22-24	Q90007	3010	2485	2012	933	1580	**2002**		118	111	149	121	116	111	116	131	93	98
25	**MH 22-25**	**SKMH 1901**	**3722**	**3005**	**1918**	**990**	**1897**	**2404**	*	**117**	**109**	**162**	**125**	**118**	**122**	**122**	**130**	**99**	**101**
26	MH 22-26	4205A252-01	3594	2330	1585	912	1982	**2204**		121	105	130	120	124	113	122	126	91	98
27	MH 22-27	PHR 33281	2885	2475	1929	976	2097	**2108**		116	109	170	124	113	116	123	133	90	103
		GM	**3246**	**2436**	**2010**	**997**	**1745**	**2106**											
		CD (5%)	**409**	**319**	**284**	**124**	**331**												
		CV (%)	7.9	8.2	8.8	7.7	11.8												
		DOS	11.10.2022	19.10.2022	18.10.2022	20.10.2022	29.10.2022												

$ data of PLI centre excluded from computation of mean due to rejection of experimental trial by monitoring team.

* strain out yielding the best varietal check by a margin of > 10 % and hybrid check by a margin of > 5 % for Seed yield

Table 3.19.b. Performance of Indian mustard hybrids in IHT, Zone-IV

S. No.	Code	Strain	1000-Seed Wt.(g)						Oil Content (%)				Oil Yield (kg/ha)
			SKN	MDR	PLI	JAL	NGP	Mean	SKN	NGP	JAL	Mean	
			1	2	3	4	5	(1-2,4-5)	1	2	4	(1-2,4)	
1	MH 22-01	KGMH- 9783	5.2	4.8	4.9	4.4	5.5	**5.0**	39.8	33.7	36.8	36.8	**863**
2	**MH 22-02**	**GDM 4 (ZC)**	**5.6**	**5.9**	**4.9**	**4.4**	**5.1**	**5.2**	**41.7**	**32.7**	**39.3**	**37.9**	**802**
3	MH 22-03	Pusa MH 111	4.7	4.6	4.4	4.5	4.3	**4.5**	41.3	30.1	38.5	36.6	**713**
4	MH 22-04	PHR 4284	5.1	4.9	5.8	4.7	4.8	**4.9**	39.2	31.7	40.1	37.0	**801**
5	MH 22-05	RHH 2202	5.1	4.6	4.5	4.3	5.0	**4.7**	41.4	36.1	39.9	39.1	**721**
6	MH 22-06	KBH5207	5.5	5.2	5.0	4.7	5.4	**5.2**	42.4	31.7	38.1	37.4	**843**
7	**MH 22-07**	**45S46 (Check)**	**5.2**	**5.3**	**5.1**	**4.5**	**4.7**	**4.9**	**43.5**	**33.7**	**40.4**	**39.2**	**846**
8	MH 22-08	JH21002	6.4	5.5	5.5	4.3	5.0	**5.3**	38.5	29.6	38.0	35.4	**593**
9	**MH 22-09**	**JKJH11**	**5.6**	**5.3**	**4.5**	**4.3**	**5.0**	**5.0**	**41.2**	**32.5**	**37.0**	**36.9**	**884**
10	MH 22-10	DRMRHJ 1419	4.8	4.4	5.0	4.6	5.3	**4.8**	42.0	33.1	41.2	38.8	**803**
11	MH 22-11	DRMRHJ 310	5.0	4.3	5.9	4.5	5.5	**4.8**	40.0	32.4	36.6	36.4	**777**
12	MH 22-12	RHH 2203	4.7	5.1	5.5	4.1	5.2	**4.7**	41.1	32.6	35.2	36.3	**722**
13	MH 22-13	RHH 2201	4.8	4.7	4.4	4.7	4.1	**4.6**	42.2	32.1	39.2	37.8	**688**
14	**MH 22-14**	**DMH- 1 (Check)**	**3.9**	**3.8**	**5.1**	**4.4**	**4.5**	**4.2**	**39.9**	**30.4**	**39.5**	**36.6**	**805**
15	MH 22-15	Kranti (NC)	5.2	5.2	4.3	5.1	5.0	**5.1**	38.9	31.9	35.6	35.4	**664**
16	MH 22-16	PMH90V02	6.2	5.5	4.6	4.9	5.3	**5.5**	40.7	30.6	38.3	36.6	**798**
17	MH 22-17	NMH90M01	6.2	5.7	5.4	4.3	4.7	**5.2**	40.5	31.2	37.0	36.2	**778**
18	MH 22-18	DRMRHJ 319	5.1	4.6	5.1	4.6	4.4	**4.7**	42.1	32.2	36.8	37.0	**772**
19	**MH 22-19**	**SVJH- 73**	**5.5**	**5.2**	**5.4**	**4.3**	**5.3**	**5.1**	**38.4**	**32.4**	**38.2**	**36.3**	**867**
20	MH 22-20	Pusa MH 103	6.3	5.6	5.3	4.7	4.2	**5.2**	39.9	32.3	36.2	36.1	**757**
21	MH 22-21	DRMRHJ 223	4.4	4.2	4.4	4.4	5.3	**4.6**	41.7	34.3	39.4	38.4	**816**
22	MH 22-22	BMH19011	4.2	4.4	4.4	4.8	4.1	**4.4**	42.4	33.9	40.1	38.8	**755**
23	MH 22-23	NAMJH21-04	5.4	5.4	4.6	4.5	4.6	**5.0**	39.5	33.0	35.4	36.0	**783**
24	MH 22-24	Q90007	4.8	4.9	5.4	4.7	4.7	**4.8**	42.1	34.4	39.8	38.8	**776**
25	**MH 22-25**	**SKMH 1901**	**5.5**	**4.7**	**4.1**	**5.0**	**5.4**	**5.1**	**40.7**	**32.7**	**37.1**	**36.8**	**885**
26	MH 22-26	4205A252-01	5.2	5.2	4.9	4.6	5.6	**5.1**	42.8	34.4	37.5	38.2	**843**
27	MH 22-27	PHR 33281	4.5	4.5	5.8	4.8	5.5	4.8	40.5	34.1	37.0	37.2	**784**

Table 3.19.c. Percent sterile plants in different entries of IHT

S.No	Code	Strain	Sterility (%) Zone II					Sterility (%) Zone III							Sterility (%) Zone IV			Mean
			HSR$	LDH$	NDH$	PAL$	MDG	MOR$	KOT$	BPR	VAR$	JHS$	FZB$	JAI$	SKN$	JAL$	NGP$	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	(5,8)
1	MH 21-01	KGMH- 9783	7	12	9	19	4	0.0	0	35	10	1	18	15	13	3	5	**19**
2	MH 21-02	(ZC)	0	15	0	16	0	0.0	9	0	5	3	16	25	2	7	0	**0**
3	MH 21-03	Pusa MH 111	12	67	14	9	32	0.0	23	100	15	1	17	15	58	3	55	**66**
4	MH 21-04	PHR 4284	18	15	12	6	5	0.0	5	5	15	14	13	25	12	20	4	**5**
5	MH 21-05	RHH 2202	2	10	6	13	4	0.0	9	15	0	7	19	15	25	20	22	**10**
6	MH 21-06	KBH5207	25	18	31	20	19	0.0	0	50	10	14	13	15	18	7	3	**35**
7	MH 21-07	45S46 (Check)	0	12	5	14	0	0.0	5	20	15	8	12	15	13	7	25	**10**
8	MH 21-08	JH21002	7	8	2	13	4	0.0	5	0	5	3	15	25	0	3	4	**2**
9	MH 21-09	JKJH11	19	12	13	15	6	0.0	9	25	15	4	17	15	15	17	8	**16**
10	MH 21-10	DRMRHJ 1419	31	22	12	15	0	0.0	14	0	0	8	16	15	23	10	36	**0**
11	MH 21-11	DRMRHJ 310	27	2	34	19	23	0.0	0	45	15	9	13	15	18	13	7	**34**
12	MH 21-12	RHH 2203	11	13	6	0	4	0.0	0	0	0	0	19	15	18	0	27	**2**
13	MH 21-13	RHH 2201	7	8	12	15	5	0.0	20	25	0	3	16	25	15	0	5	**15**
14	MH 21-14	DMH- 1 (Check)	15	15	8	20	3	0.0	15	5	0	10	11	15	58	37	40	**4**
15	MH 21-15	Kranti (NC)	19	8	11	27	0	0.0	0	0	20	3	16	25	0	10	3	**0**
16	MH 21-16	PMH90V02	21	13	23	10	18	0.0	9	35	10	12	9	25	20	3	5	**27**
17	MH 21-17	NMH90M01	16	23	29	14	25	0.0	5	60	0	11	17	25	23	3	21	**43**
18	MH 21-18	DRMRHJ 319	13	22	21	15	20	0.0	5	25	10	7	7	15	33	7	21	**23**
19	MH 21-19	SVJH- 73	17	0	19	4	4	0.0	9	10	0	11	17	15	25	7	22	**7**
20	MH 21-20	Pus MH 103	5	15	2	16	0	0.0	0	25	5	11	13	15	32	7	35	**13**
21	MH 21-21	DRMRHJ 223	11	18	23	30	24	0.0	5	35	0	13	16	25	25	7	5	**30**
22	MH 21-22	BMH19011	0	13	2	13	10	0.0	0	35	15	4	12	15	15	0	6	**23**
23	MH 21-23	NAMJH21-04	14	15	5	6	3	0.0	0	0	0	7	16	15	12	13	7	**2**
24	MH 21-24	Q90007	17	15	12	19	15	0.0	5	10	0	6	14	25	8	3	24	**13**
25	MH 21-25	SKMH 1901	3	15	2	4	0	0.0	0	0	10	2	13	25	27	17	5	**0**
26	MH 21-26	4205A252-01	0	0	4	6	4	0.0	4	0	15	3	15	25	13	7	5	**2**
27	MH 21-27	PHR 33281	12	12	21	16	15	0	0	30	15	11	19	25	20	0	36	**23**

$ data of HSR,LDH,,NDH,PAL,MOR,KOT,VAR,JHS, FBZ,JAI,SKN,JAL and NGP excluded from computation of mean due to errornous reporting

Table 3.20.a. Performance of Indian mustard hybrids in AHT-I, Zone-II

S.No.	Code	Strain	Seed Yield (kg/ha)							Plant Stand					Days to Maturity				
			LDH	HSR	NDH	SGN	MDG	Mean		LDH	HSR	NDH	SGN	MDG	LDH	HSR	NDH	SGN	MDG
			1	2	3	4	5	(1-5)		1	2	3	4	5	1	2	3	4	5
1	MH 22-28	DRMRHJ 2518	1799	3107	2861	2178	2660	**2521**		284	267	330	228	267	145	140	144	150	141
2	**MH 22-29**	**RH 0749 (ZC)**	**1913**	**2527**	**2888**	**2686**	**2631**	**2529**		**289**	**261**	**311**	**232**	**268**	**142**	**141**	**145**	**149**	**143**
3	MH 22-30	NAMJH 21-01	2140	2695	3182	2520	2587	**2625**		282	266	180	234	260	147	142	143	149	144
4	MH 22-31	SVJH- 70	2012	2897	3107	2430	3348	**2759**		281	260	284	239	265	146	136	141	150	141
5	**MH 22-32**	**45S46 (Hybrid Check)**	**2283**	**2667**	**2868**	**2735**	**2701**	**2651**		**285**	**262**	**297**	**235**	**271**	**144**	**135**	**141**	**151**	**137**
6	MH 22-33	RMX 9922	2043	2764	3125	2530	2915	**2676**		294	263	302	233	270	145	138	142	150	138
7	**MH 22-34**	**RHH 2101**	**2245**	**3406**	**3282**	**2325**	**3412**	**2934**	*	**281**	**262**	**316**	**238**	**266**	**145**	**137**	**142**	**149**	**139**
8	MH 22-35	18J408C	2169	2676	3236	2547	2640	**2654**		285	266	274	232	268	144	136	132	149	140
9	**MH 22-36**	**SVJH- 71**	**2468**	**3378**	**3191**	**2833**	**3453**	**3064**	*	**286**	**263**	**278**	**233**	**269**	**144**	**137**	**142**	**151**	**139**
10	MH 22-37	DMH- 1 (Hybrid Check)	2332	2664	2816	2578	2626	**2603**		289	264	314	230	264	146	137	142	150	142
11	MH 22-38	Kranti (NC)	1662	2348	2739	2294	2575	**2211**		280	263	312	230	266	143	136	138	149	139
12	**MH 22-39**	**IJ 16R1168**	**2501**	**3206**	**3044**	**2597**	**2694**	**2808**	*	**288**	**265**	**314**	**234**	**265**	**146**	**138**	**141**	**150**	**140**
13	MH 22-40	KGMH 9198	2406	3023	3173	2155	2533	**2658**		282	260	283	235	267	145	136	142	149	143
		GM	**2152**	**2874**	**3039**	**2493**	**2829**	**2668**											
		CD (5%)	321	365	324	305	431												
		CV (%)	10.4	8.8	7.4	8.5	10.6												
		DOS	14.10.2022	15.10.2022	17.10.2022	30.10.2022	20.10.2022												

* strain out yielding the best varietal check by a margin of > 10 % and hybrid check by a margin of > 5 % for Seed yield

Table 3.20.b. Performance of Indian mustard hybrids in AHT-I, Zone-II

S.No.	Code	Strain	1000-Seed Wt.(g)							Oil Content (%) Zone II						Oil Yield (kg/ha)
			LDH	HSR	NDH	SGN	MDG	Mean		HSR	LDH	NDH	SGN	MDG	Mean	
			1	2	3	4	5	(1-5)		1	2	3	4	5	(1-5)	
1	MH 22-28	DRMRHJ 2518	4.8	5.0	4.3	5.0	5.0	**4.8**		38.7	40.4	37.8	41.6	37.9	**39.3**	**990**
2	**MH 22-29**	**RH 0749 (ZC)**	**7.1**	**6.6**	**6.0**	**5.7**	**6.1**	**6.3**		**40.4**	**39.2**	**36.3**	**42.3**	**37.0**	**39.0**	**987**
3	MH 22-30	NAMJH 21-01	6.2	4.3	3.8	4.1	5.0	**4.7**		40.9	38.6	37.3	39.3	38.1	**38.8**	**1020**
4	MH 22-31	SVJH- 70	6.3	5.8	5.0	5.4	6.2	**5.7**		39.0	36.7	35.6	39.3	38.9	**37.9**	**1046**
5	**MH 22-32**	**45S46 (Hybrid Check)**	**6.6**	**5.9**	**5.2**	**5.9**	**5.1**	**5.7**		**41.7**	**40.8**	**40.2**	**40.9**	**39.4**	**40.6**	**1076**
6	MH 22-33	RMX 9922	6.0	5.4	4.4	6.3	5.5	**5.5**		38.3	38.9	37.1	39.7	39.7	**38.7**	**1036**
7	**MH 22-34**	**RHH 2101**	**5.7**	**5.9**	**4.6**	**4.2**	**5.5**	**5.2**		**40.2**	**37.5**	**37.9**	**40.5**	**41.4**	**39.5**	**1158**
8	MH 22-35	18J408C	6.5	5.4	4.3	4.6	5.3	**5.2**		41.0	40.0	39.8	41.5	39.8	**40.4**	**1073**
9	**MH 22-36**	**SVJH- 71**	**5.9**	**5.4**	**4.5**	**5.0**	**6.0**	**5.4**		**41.0**	**38.5**	**37.1**	**39.7**	**39.5**	**39.2**	**1200**
10	MH 22-37	DMH- 1 (Hybrid Check)	4.5	4.0	3.4	6.1	4.0	**4.4**		37.2	38.5	36.7	41.2	39.0	**38.5**	**1003**
11	MH 22-38	Kranti (NC)	4.3	4.5	4.7	4.7	4.3	**4.5**		37.4	36.4	36.3	39.6	39.9	**37.9**	**838**
12	**MH 22-39**	**IJ 16R1168**	**5.9**	**5.1**	**4.6**	**5.0**	**5.1**	**5.1**		**41.5**	**40.8**	**37.1**	**41.4**	**40.9**	**40.3**	**1132**
13	MH 22-40	KGMH 9198	6.3	6.4	5.1	5.0	5.4	**5.6**		41.3	41.5	37.8	39.0	39.4	**39.8**	**1058**

Table 3.20c. Percent sterile plants in different entries of AHT-I

S. No.	Code	Strain	Sterility (%) Zone-II				
			LDH$	HSR	NDH	MDG	Mean
			1	2	3	4	(1-10)
1	MH 22-28	DRMRHJ 2518	22	18	19	9	**15.3**
2	MH 22-29	RH 0749 (ZC)	0	0	0	0	**0.0**
3	MH 22-30	NAMJH 21-01	21	10	6	11	**9.0**
4	MH 22-31	SVJH- 70	9	7	4	7	**6.0**
5	MH 22-32	45S46 (Hybrid Check)	4	11	4	6	**7.0**
6	MH 22-33	RMX 9922	14	29	28	19	**25.3**
7	MH 22-34	RHH 2101	22	4	8	4	**5.3**
8	MH 22-35	18J408C	0	5	4	3	**4.0**
9	MH 22-36	SVJH- 71	15	10	15	2	**9.0**
10	MH 22-37	DMH- 1 (Hybrid Check)	31	7	10	0	**5.7**
11	MH 22-38	Kranti (NC)	14	0	0	0	**0.0**
12	MH 22-39	IJ 16R1168	22	20	12	13	**15.0**
13	MH 22-40	KGMH 9198	19	31	25	25	**27.0**

$ data of LDH excluded from computation of mean due to erronous reporting

Table 3.21.a. Performance of Indian mustard hybrids in AHT-I, Zone-IV

S. No.	Code	Strain	Seed Yield (kg/ha)							Plant Stand					Days to maturity				
			SKN	MDR	*PLI	JAL	NGP	Mean		SKN	MDR	PLI	JAL	NGP	SKN	MDR	PLI	JAL	NGP
			1	2	3	4	5	(1-2,4-5)		1	2	3	4	5	1	2	3	4	5
1	MH 22-41	Kranti (NC)	2873	2297	1576	853	1853	**1969**		226	225	142	220	260	112	116	136	88	103
2	MH 22-42	IJ16R1168	2707	2468	1650	1008	1476	**1915**		204	218	182	230	268	115	120	138	94	105
3	**MH 22-43**	**45S46 (Hybrid Check)**	**3287**	**2782**	**1780**	**850**	**1566**	**2121**		**234**	**211**	**211**	**220**	**260**	**111**	**118**	**136**	**93**	**102**
4	MH 22-44	DMH- 1 (Hybrid Check)	3166	2735	2228	800	1468	2042		211	220	203	218	270	118	123	138	96	106
5	**MH 22-45**	**GDM 4 (ZC)**	**3459**	**2542**	**1753**	**928**	**1408**	**2084**		**238**	**225**	**194**	**225**	**271**	**117**	**122**	**134**	**93**	**106**
6	MH 22-46	SVJH- 71	3341	2274	2008	1020	1753	**2097**		222	213	235	232	260	115	119	135	85	104
7	MH 22-47	NAMJH 21-01	3355	2596	1715	1197	1680	**2207**		234	224	182	246	260	118	123	136	88	106
8	**MH 22-48**	**18 J408C**	**3513**	**2936**	**1968**	**1130**	**1947**	**2381**	*	**238**	**211**	**138**	**240**	**269**	**110**	**119**	**134**	**87**	**103**
9	MH 22-49	KGMH 9198	3734	2449	2201	956	1519	**2164**		240	222	178	228	272	114	118	136	87	104
10	MH 22-50	DRMRHJ 2518	2999	2475	2327	885	1488	**1961**		234	218	166	221	260	116	123	135	90	106
		GM	**3243**	**2555**	**1921**	**962**	**1616**	**2094**											
		CD (5%)	447	258	265	148	244												
		CV (%)	9.5	7.0	8.0	10.6	10.4												
		DOS	11.10.2022	19.10.2022	19.10.2022	22.10.2022	30.10.2022												

* data of PLI centre excluded from computation of mean due to conducted the trial under three replications

* strain outyielding the best varietal check by a margin of > 10 % and hybrid check by a margin of > 5 % for Seed yield

Table 3.21.b. Performance of Indian mustard hybrids in AHT-I, Zone-IV

S. No.	Code	Strain	1000-Seed Wt.(g)							Oil Content (%)				Oil Yield (kg/ha)	Sterility (%) Zone- IV	
			SKN	MDR	PLI	JAL	NGP	Mean		SKN	NGP	JAL	Mean		JAL	Mean
			1	2	3	4	5.0	(1-5)		1	2	4	(1-2,4)		1	1
1	MH 22-41	Kranti (NC)	5.2	4.7	5.4	4.5	5.4	**5.0**		40.3	35.6	38.6	**38.2**	**751**	0	0
2	MH 22-42	IJ16R1168	5.1	4.4	5.6	4.2	4.5	**4.8**		42.2	37.6	41.0	**40.3**	**771**	5	5
3	**MH 22-43**	**45S46 (Hybrid Check)**	**5.7**	**5.2**	**4.6**	**4.4**	**5.6**	**5.1**		**42.8**	**35.3**	**36.8**	**38.3**	**812**	10	10
4	MH 22-44	DMH- 1 (Hybrid Check)	3.9	3.8	5.8	4.5	4.3	4.5		41.0	34.8	38.0	37.9	775	0	0
5	**MH 22-45**	**GDM 4 (ZC)**	**5.4**	**5.1**	**4.4**	**4.4**	**5.2**	**4.9**		**40.8**	**35.3**	**38.9**	**38.3**	**799**	3	3
6	MH 22-46	SVJH- 71	5.4	4.7	5.2	4.3	5.6	**5.0**		41.9	37.4	39.3	**39.5**	**829**	0	0
7	MH 22-47	NAMJH 21-01	4.2	3.7	4.5	4.4	4.5	**4.3**		42.6	34.9	40.3	**39.3**	**867**	0	0
8	**MH 22-48**	**18 J408C**	**5.1**	**5.2**	**5.5**	**4.3**	**5.5**	**5.1**		**41.0**	**37.2**	**39.7**	**39.3**	**936**	8	8
9	MH 22-49	KGMH 9198	6.0	5.5	4.8	4.7	5.3	**5.3**		41.4	35.6	40.2	**39.1**	**845**	5	5
10	MH 22-50	DRMRHJ 2518	5.1	5.0	5.4	4.6	4.6	**5.0**		41.2	33.3	39.0	**37.8**	**742**	5	5

Table 3.22.a. Performance of Quality Indian mustard strains in IVT, Zone-II

S.No.	Code	Strain	Seed Yield (kg/ha)							Plant Stand					Days to Maturity					1000-Seed Wt. (g)				
			BAW	NDH	HSR	LDH	SGN	Mean		BAW	NDH	HSR	LDH	SGN	BAW	NDH	HSR	LDH	SGN	BAW	NDH	HSR	LDH	SGN
			1	2	3	4	5	(1-5)		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1	**QM-22-1**	**DRMRCI(Q) 172#**	**2490**	**2798**	**2880**	**2271.67**	**2831**	**2654**	***	**121**	**124**	**117**	**129**	**114**	**144**	**143**	**143**	**143**	**150**	**3.6**	**2.8**	**4.0**	**3.8**	**5.5**
2	**QM-22-2**	**PM 30 (NC Quality)**	**2376**	**2677**	**2565**	**2130**	**2588**	**2467**		**114**	**111**	**114**	**128**	**113**	**149**	**144**	**142**	**141**	**149**	**5.8**	**4.8**	**6.9**	**6.2**	**5.8**
3	QM-22-3	Pusa QMH 1	2206	2203	2955	2337.67	3077	**2556**		120	132	116	126	116	149	145	145	143	150	4.6	4.3	6.6	5.6	5.7
4	QM-22-4	PMAS 11	2455	2676	2522	2230.33	2631	**2503**		116	138	119	125	114	147	142	139	138	149	4.2	3.1	4.1	4.4	5.0
5	**QM-22-5**	**RH 0749 (ZC)**	**2403**	**2356**	**2667**	**2442.33**	**3511**	**2676**		**122**	**139**	**118**	**126**	**111**	**145**	**146**	**143**	**144**	**149**	**5.7**	**5.2**	**6.7**	**6.5**	**6.1**
6	QM-22-6	PDZ 18@	2069	2258	2593	2506	2482	**2381**		118	132	117	129	117	145	143	142	144	150	3.5	2.8	3.8	4.2	3.2
7	QM-22-7	PM 32 (LR)	2837	2608	2730	1978.67	2158	**2462**		116	127	119	128	120	145	144	140	144	150	4.8	3.7	4.7	4.4	4.7
8	QM-22-8	PMAS 7	2778	2753	2675	2266	3096	**2714**		118	132	117	123	115	148	141	140	140	149	3.4	2.7	3.7	4.0	3.8
9	QM-22-9	LES 67#	2719	2710	2604	1847.67	3162	**2609**		115	122	118	125	119	146	143	138	153	149	3.4	2.8	4.3	3.2	4.9
10	QM-22-10	LES 66#	2289	3060	2541	2176	2207	**2455**		120	130	117	125	116	143	141	139	153	150	3.6	3.2	3.9	4.0	3.7
11	**QM-22-11**	**RH(OE) 1708#**	**2959**	**2912**	**3089**	**1769.67**	**3251**	**2796**	*	**119**	**123**	**116**	**125**	**118**	**145**	**143**	**139**	**147**	**150**	**3.8**	**3.7**	**5.3**	**4.6**	**4.5**
12	QM-22-12	PDZ 19@	2561	3185	2608	1858.67	2529	2548		116	137	121	124	113	143	139	138	144	149	3.3	2.8	3.3	4.4	4.8
13	QM-22-13	DRMRQ 29-20	2116	2607	2159	1872.67	2781	**2307**		121	130	114	130	116	143	142	132	143	149	3.8	3.6	4.8	4.2	5.8
14	QM-22-14	RH(OE) 1806#	2325	2863	2927	2030.67	2697	**2569**		115	139	117	125	119	144	142	137	142	150	4.7	3.0	4.2	4.0	5.9
15	**QM-22-15**	**PDZ 11 (Double Low Check)**	**2817**	**2940**	**2561**	**1804.67**	**1838**	**2392**		**118**	**142**	**116**	**126**	**114**	**142**	**142**	**135**	**142**	**150**	**3.5**	**3.2**	**4.0**	**4.1**	**4.9**
16	**QM-22-16**	**DRMRCI(Q) 158@**	**2463**	**2489**	**2821**	**2107.33**	**3239**	**2624**	**	**119**	**124**	**118**	**127**	**114**	**148**	**143**	**142**	**157**	**149**	**4.0**	**3.2**	**4.6**	**4.7**	**4.7**
		GM	**2491**	**2693**	**2661**	**2102**	**2755**	**2540**																
		CD (5%)	447	271	444	316	431																	
		CV (%)	10.8	6.0	9.9	9.0	9.4																	
		DOS	17.10.2022	15.10.2022	16.10.2022	17.10.2022	29.10.2022																	

@ double low strain

single low strain

** double low strain outyielding the best double low quality check by a margin of > 10 % for seed yield and at par in oil yield with best non quality check

* single low strain outyielding the best single low quality check by a margin of > 10 % for seed yield and at par with best non quality check

***Strain possessing low erucic acid content in oil and possessing resistance against white rust and seed yield/ oil yield at par with the best quality and non quality check

Table 3.22.b. Performance of Quality Indian mustard strains in IVT, Zone-II

S.No.	Code	Strain	1000-Seed Wt. (g)					Oil Content (%) Zone II						Oil Yield (kg/ha)
			BAW	NDH	HSR	LDH	SGN	BAW	NDH	HSR	LDH	SGN	Mean	
			1	2	3	4	5	1	2	3	4	5	(1-5)	
1	**QM-22-1**	**DRMRCI(Q) 172#**	**3.6**	**2.8**	**4.0**	**3.8**	**5.5**	**37.7**	**40.3**	**43.5**	**44.7**	**40.5**	**41.3**	**1097**
2	**QM-22-2**	**PM 30 (NC Quality)**	**5.8**	**4.8**	**6.9**	**6.2**	**5.8**	**38.1**	**39.0**	**42.8**	**42.1**	**43.8**	**41.2**	**1016**
3	QM-22-3	Pusa QMH 1	4.6	4.3	6.6	5.6	5.7	35.8	36.0	39.0	39.2	39.5	**37.9**	**968**
4	QM-22-4	PMAS 11	4.2	3.1	4.1	4.4	5.0	36.7	37.1	43.2	39.9	38.0	**39.0**	**976**
5	**QM-22-5**	**RH 0749 (ZC)**	**5.7**	**5.2**	**6.7**	**6.5**	**6.1**	**37.4**	**36.6**	**41.8**	**39.5**	**40.6**	**39.2**	**1049**
6	QM-22-6	PDZ 18@	3.5	2.8	3.8	4.2	3.2	37.6	37.8	42.9	41.9	41.2	**40.3**	**959**
7	QM-22-7	PM 32 (LR)	4.8	3.7	4.7	4.4	4.7	38.3	40.8	42.9	41.7	42.7	**41.3**	**1016**
8	QM-22-8	PMAS 7	**3.4**	**2.7**	**3.7**	**4.0**	**3.8**	**0.0**	**36.8**	**43.4**	**44.3**	**41.5**	**41.5**	**1127**
9	QM-22-9	LES 67#	3.4	2.8	4.3	3.2	4.9	40.4	42.7	42.4	42.5	41.4	**41.9**	**1092**
10	QM-22-10	LES 66#	3.6	3.2	3.9	4.0	3.7	38.7	40.1	42.2	41.2	42.7	**41.0**	**1005**
11	**QM-22-11**	**RH(OE) 1708**	**3.8**	**3.7**	**5.3**	**4.6**	**4.5**	**37.6**	**41.1**	**43.1**	**42.8**	**43.4**	**41.6**	**1163**
12	QM-22-12	PDZ 19@	3.3	2.8	3.3	4.4	4.8	41.2	41.5	44.1	42.8	44.0	42.7	1089
13	QM-22-13	DRMRQ 29-20	3.8	3.6	4.8	4.2	5.8	35.9	38.5	41.1	40.7	38.8	**39.0**	**899**
14	QM-22-14	RH(OE) 1806#	4.7	3.0	4.2	4.0	5.9	38.9	40.0	45.0	43.5	44.4	**42.4**	**1088**
15	**QM-22-15**	**PDZ 11 (Double Low Check)**	**3.5**	**3.2**	**4.0**	**4.1**	**4.9**	**39.9**	**42.6**	**42.2**	**41.7**	**42.1**	**41.7**	**998**
16	**QM-22-16**	**DRMRCI(Q) 158@**	**4.0**	**3.2**	**4.6**	**4.7**	**4.7**	**40.7**	**42.1**	**44.6**	**44.3**	**38.9**	**42.1**	**1105**

Table 3.23.a. Performance of Quality Indian mustard strains in IVT, Zone-III

S.No	Code	Strain	Seed Yield (kg/ha)									Plant Stand							Days to Maturity						
			PNT	KPR	MOR	BPR	DOL##	JHS$	VAR##	Mean		PNT	KPR	MOR	BPR	DOL	JHS	VAR	PNT	KPR	MOR	BPR	DOL	JHS	VAR
			1	2	3	4	5	6	7	(1-4)		1	2	3	4	5	6	7	1	2	3	4	5	6	7
1	**QM-22-1**	**DRMRCI(Q) 172#**	**1828**	**2366**	**3326**	**2394**	**1465**	**1422**	**1459**	**2478**	**	**178**	**124**	**137**	**126**	**163**	**110**	**184**	**136**	**134**	**135**	**127**	**130**	**125**	**122**
2	**QM-22-2**	**PM 30 (NC Quality)**	**1811**	**1903**	**3049**	**2264**	**1465**	**1496**	**1497**	**2257**		**149**	**119**	**144**	**136**	**161**	**126**	**169**	**139**	**137**	**133**	**134**	**130**	**133**	**123**
3	QM-22-3	Pusa QMH 1	2311	2171	2952	2145	910	2322	1205	**2395**		150	121	156	143	171	109	174	141	135	135	135	131	126	125
4	QM-22-4	PMAS 11	1435	2006	3053	1874	987	2188	1271	**2092**		156	118	146	137	164	110	182	136	133	129	132	131	129	120
5	**QM-22-5**	**RGN 73 (ZC)**	**2241**	**2176**	**3599**	**2098**	**1233**	**1965**	**1690**	**2528**		**137**	**122**	**155**	**125**	**164**	**111**	**186**	**140**	**130**	**135**	**137**	**132**	**130**	**125**
6	QM-22-6	PDZ 18@	1605	2443	3231	1980	925	1304	1432	**2315**		157	122	160	115	164	132	166	137	132	134	134	128	127	123
7	QM-22-7	PM 30 (LR)	2018	2099	2949	1933	1218	1278	1667	**2250**		115	119	148	130	168	110	157	140	134	135	137	127	127	121
8	QM-22-8	PMAS 7	1286	2181	2813	2157	925	1418	1131	**2109**		157	122	143	122	166	130	177	131	131	130	132	126	126	118
9	QM-22-9	LES 67#	1648	1847	3447	2683	1002	1696	1369	**2406**		170	120	160	139	166	107	195	140	130	131	132	128	128	121
10	QM-22-10	LES 66#	1890	1790	3436	2596	863	1942	1534	**2428**		147	114	152	131	163	109	187	140	136	126	130	130	129	115
11	QM-22-11	RH(OE) 1708	1616	2006	2866	2204	987	2058	1494	**2173**		155	116	154	123	159	111	181	134	134	128	133	127	131	113
12	QM-22-12	PDZ 19@	1224	2289	3088	2358	863	1541	978	**2240**		153	124	150	141	164	113	176	136	129	126	129	127	131	111
13	QM-22-13	DRMRQ 29-20	1631	2073	2779	1874	1033	1930	969	**2089**		135	120	149	124	165	128	171	133	131	125	131	129	123	111
14	QM-22-14	RH(OE) 1806#	1795	1980	3288	2376	879	1944	1311	**2360**		159	116	155	112	163	112	191	135	133	127	130	130	126	115
15	**QM-22-15**	**PDZ 11 (Double Low Check)**	**1677**	**1852**	**2917**	**2222**	**1203**	**1769**	**1598**	**2167**		**151**	**117**	**150**	**122**	**163**	**114**	**188**	**135**	**134**	**126**	**129**	**127**	**128**	**115**
16	**QM-22-16**	**DRMRCI(Q) 158@**	**1906**	**2150**	**3436**	**2506**	**1125**	**1841**	**1323**	**2499**	**	**135**	**124**	**143**	**123**	**163**	**111**	**183**	**138**	**133**	**135**	**136**	**131**	**131**	**120**
		GM	**1745**	**2083**	**3139**	**2229**	**1068**	**1757**	**1370**	**1939**															
		CD (5%)	290	203	328	325	255	426	238																
		CV (%)	10.0	5.8	6.3	8.8	14.3	14.5	10.4																
		DOS	28.10.2022	19.10.2022	29.10.2022	19.10.2022	18.10.2022	29.10.2022	20.10.2022																

@ double low strain

single low strain

data of DOL and VAR centres excluded from computation of mean due to lower mean of the trial than state mean

$ data of JHS centre excluded from computation of mean due to rejection by monitoring team

** single low strain outyielding the best single low quality check by a margin of or equal to 10 % for seed yield and at par in oil yield with best non quality check

** double low strain outyielding the best double low quality check by a margin of > 10 % for seed yield and at par in oil yield with best non quality check

Table 3.23.b. Performance of Quality Indian mustard strains in IVT, Zone-III

S.No.	Code	Strain	1000-Seed Wt. (g)							Oil Content (%)								Oil Yield (kg/ha)
			PNT	KPR$	MOR	BPR	DOL	JHS	VAR	PNT	KPR	MOR	BPR	DOL##	JHS$	VAR##	Mean	
			1	2	3	4	5	6	7	1	2	3	4	5	6	7	(1-4)	
1	**QM-22-1**	**DRMRCI(Q) 172#**	**2.5**	**3.4**	**3.4**	**3.3**	**3.4**	**3.4**	**3.9**	**44.1**	**43.9**	**43.4**	**45.3**	**41.5**	**41.3**	**43.5**	**44.2**	**1095**
2	**QM-22-2**	**PM 30 (NC Quality)**	**4.9**	**5.3**	**5.7**	**5.9**	**3.0**	**4.8**	**4.9**	**44.1**	**42.0**	**41.2**	**43.2**	**35.7**	**38.8**	**43.5**	**42.6**	**962**
3	QM-22-3	Pusa QMH 1	4.6	4.9	5.4	4.8	3.2	5.2	4.5	42.9	41.3	38.9	41.4	35.0	9.5	41.6	**41.1**	**985**
4	QM-22-4	PMAS 11	3.0	3.6	3.6	3.6	3.1	4.5	3.7	43.4	40.6	40.2	44.1	36.8	40.5	41.2	**42.1**	**880**
5	QM-22-5	**RGN 73 (ZC)**	3.7	4.5	4.7	3.7	3.3	4.7	3.3	40.8	40.4	38.9	41.2	31.8	38.2	40.7	**40.3**	**1019**
6	QM-22-6	PDZ 18@	2.8	3.3	3.3	3.4	3.3	3.9	3.7	44.3	41.5	41.1	44.5	41.7	42.6	42.1	**42.9**	**992**
7	QM-22-7	PM 30 (LR)	4.9	5.2	5.2	5.9	3.8	5.1	5.1	43.0	42.6	41.0	43.7	37.8	41.5	43.6	**42.6**	**958**
8	QM-22-8	PMAS 7	2.7	3.3	3.4	3.0	4.0	3.6	3.1	43.8	41.3	41.8	43.7	39.7	37.3	44.8	**42.7**	**900**
9	QM-22-9	LES 67#	2.8	4.1	3.5	3.6	3.1	3.5	3.0	42.7	41.9	40.9	43.9	35.5	42.9	43.3	**42.3**	**1019**
10	QM-22-10	LES 66#	3.2	5.2	4.0	3.5	3.6	3.6	4.2	41.5	38.5	40.6	43.0	38.4	44.4	41.9	**40.9**	**993**
11	QM-22-11	RH(OE) 1708	3.2	4.2	4.0	3.9	2.6	4.1	4.3	39.2	40.6	41.9	43.6	36.0	41.2	43.5	**41.3**	**898**
12	QM-22-12	PDZ 19@	2.5	5.3	2.8	2.9	2.8	4.3	3.2	42.6	41.8	42.1	44.1	36.7	42.3	43.5	**42.7**	**955**
13	QM-22-13	DRMRQ 29-20	3.4	5.0	3.9	3.9	4.0	4.3	2.9	43.1	39.3	39.5	42.8	35.0	41.5	38.4	**41.2**	**860**
14	QM-22-14	RH(OE) 1806#	2.8	3.8	3.9	3.6	3.0	3.8	4.1	43.3	38.6	43.0	43.0	40.3	41.7	42.2	**42.0**	**990**
15	**QM-22-15**	**PDZ 11 (Double Low Check)**	**3.0**	**4.7**	**3.3**	**3.6**	**3.4**	**4.0**	**3.5**	**43.2**	**41.2**	**42.0**	**44.5**	**40.3**	**42.4**	**42.9**	**42.7**	**926**
16	**QM-22-16**	**DRMRCI(Q) 158@**	**3.4**	**4.8**	**3.9**	**3.9**	**4.3**	**4.5**	**3.3**	**44.2**	**41.4**	**43.9**	**44.0**	**44.2**	**42.9**	**41.4**	**43.4**	**1084**

Table 3.23c. Erucic acid Content (%) of entries being evaluated in IVT/AVT Quality trials

S. No.	Code	Genotypes	Erucic Acid Content (%)						Glucosinolate Content (µmol/ g)					
			BP	PNT	HSR	LDH	NDH	Mean	BP	PNT	HSR	LDH	NDH	Mean
			1	2	3	4	5	(1-5)	1	2	3	4	5	(1-5)
1	QM-22-1	DRMRCI(Q) 172	2.0	1.1	1.0	0.0	0.6	**0.9**	35.7	34.4	30.3	50.2	31.8	**36.5**
2	QM-22-2	PM 30 (NC Quality)	0.8	1.0	1.3	0.9	0.5	**0.9**	49.2	57.9	46.0	59.7	86.7	**59.9**
3	QM-22-3	Pusa QMH 1	5.6	6.1	7.0	9.1	2.8	**6.1**	44.7	42.0	48.3	60.9	127.8	**64.8**
4	QM-22-4	PMAS 11	2.7	5.9	4.7	5.7	1.3	**4.1**	21.8	23.1	21.2	22.7	25.0	**22.7**
5	QM-22-5	RH 0749 (ZC)	46.9	45.8	47.8	50.3		**47.7**	38.9	53.0	35.9	53.8		**45.4**
6	QM-22-6	PDZ 18	0.7	1.8	2.0	0.6	0.8	**1.2**	22.7	23.7	21.8	22.8	24.8	**23.1**
7	QM-22-7	PM 32 (LR)	0.3	0.7	0.4	0.0		**0.4**	47.0	53.8	44.8	50.8	115.9	**62.4**
8	QM-22-8	PMAS 7	3.7	3.3	4.4	4.4	1.4	**3.4**	24.2	24.8	21.5	21.3	23.8	**23.1**
9	QM-22-9	LES 67	0.7	0.7	0.3	0.0	0.2	**0.4**	37.2	36.8	35.6	53.1	52.0	**42.9**
10	QM-22-10	LES 66	0.8	1.2	0.3	0.9	0.3	**0.7**	39.5	35.7	30.2	44.8	71.3	**44.3**
11	QM-22-11	RH(OE) 1708	1.4	4.0	3.7	2.2	1.4	**2.5**	37.6	42.8	38.7	60.7	98.4	**55.6**
12	QM-22-12	PDZ 19	1.3	1.0	0.4	0.0	0.2	**0.6**	22.2	22.3	20.8	23.5	33.8	**24.5**
13	QM-22-13	DRMRQ 29-20	16.5	20.8	19.0	13.4	9.0	**15.7**	80.6	83.3	69.7	60.2	85.3	**75.8**
14	QM-22-14	RH(OE) 1806	0.3	2.7	1.8	0.7	0.8	**1.3**	31.7	36.8	30.6	59.2	97.0	**51.1**
15	QM-22-15	PDZ 11 (Double Low Check)	0.7	1.4	0.5	0.0	0.1	**0.5**	20.8	23.1	24.0	11.4	14.8	**18.8**
16	QM-22-16	DRMRCI(Q) 158	1.3	0.7	0.7	0.0	0.2	**0.6**	23.8	27.3	24.8	22.1	48.7	**29.3**
17	MCN-22-29	DRMRCI(Q)- 47	0.4	1.2	0.9	0.0	0.2	**0.5**	36.0	32.8	23.2	23.5	52.3	**33.6**
18	MCN-22-36	IJ 19R5004	8.2	8.1	6.7	4.6	3.5	**6.2**	22.8	33.5	23.4	15.3	27.8	**24.6**
19	MCN-22-51	PDZ 16	2.0	0.7	0.5	1.0	0.3	**0.9**	18.0	17.5	22.7	18.3	30.4	**21.4**
20	MCN-22-52	PDZ 1	0.4	1.2	1.5	0.0	0.2	**0.7**	21.7	22.7	23.5	18.8	28.4	**23.0**
21	MCN-22-54	PDZ 14	1.1	1.8	1.9	0.8	0.2	**1.2**	20.7	22.7	20.8	14.2	24.8	**20.6**
22	MCN-22-45	PDZ 15	0.7	1.2	0.5	0.0	0.1	**0.5**	23.8	25.7	20.5	15.0	23.3	**21.7**

Table3.24. Performance of Indian mustard strains in AVT-I under saline/alkaline conditions

S.No.	Code	Strain	Seed Yield (kg/ha)							Plant Stand		Days to Maturity	1000- Seed Wt. (g)				Oil Content (%)
			AGR#	HSR#	KAR	FTP	LKW#	BKR#	Mean	KAR	FTP	LKW	KAR	FTP	LKW	BKR	KAR
			1	2	3	4	5	6	(3-4)	3	4	5	3	4	5	6	3
1	CSCN-22-1	CS 54 (Check)	1809	2184	2117	1739	1673	1587	1928	299	230	125	5.5	5.0	5.0	4.7	39.5
2	CSCN-22-2	CS2020-10*	2252	2358	2538	1936	1847	1662	2237	300	235	125	5.7	5.0	5.0	5.2	40.0
3	CSCN-21-3	CS 60 (LR)	1983	1803	1658	1422	1200	1344	1540	238	213	123	4.0	3.3	3.9	4.4	37.9
4	CSCN-21-4	Kranti (NC)	1883	1724	1653	1416	1404	1624	1534	270	221	126	4.8	3.5	4.3	5.9	38.0
		GM	**1982**	**2017**	**1992**	**1628**	**1531**	**1554**	**1810**								
		CD (5%)	233	262	293	285	238	215									
		C.V. (%)	7.4	8.1	9.2	10.9	9.7	8.6									
		ECe/ pH**	12.0 ds/m	10.4 ds/m	9.3	9.4	9.2	13.0 ds/m									
		DOS	28.10.2022	16.10.2022	21.10.2022	21.10.2022	21.10.2022	29.10.2022									

data excluded from computation mean due to non availability of plant stand data (AGR, HSR, LKW & BKR)

Only two valid locations, hence no promotion

Table 3.25.a. Performance of Gobhi Sarson strains in AVT-I

S.No.	Code	Strain	Seed Yield (Kg/ha)								Plant Stand						Days to Maturity					
			KNG	DLK	BJR$	CHT	LDH	ABR	Mean		KNG	DLK	BJR	CHT	LDH	ABR	KNG	DLK	BJR	CHT	LDH	ABR
			1	2	3	4	5	6	(1-2,4-6)		1	2	3	4	5	6	1	2	3	4	5	6
1	NCN-22-1	Kranti (NC)	1374	1525	750	1582	1795	1878	**1631**		244	247	121	310	299	278	153	124	194	142	143	145
2	NCN-22-2	GSC 6 (Filler)	1671	2208	1269	1912	2076	2481	**2070**		243	252	130	340	290	285	158	131	200	150	151	150
3	**NCN-22-3**	**GSH- 2155**	**1985**	**2547**	**1303**	**1914**	**2425**	**2835**	**2341**	**	**244**	**249**	**126**	**322**	**298**	**290**	**159**	**138**	**198**	**156**	**156**	**156**
4	NCN-22-4	GSC 6 (Quality Check)	1723	2175	1271	2021	2091	2366	**2075**		241	250	120	315	302	271	158	132	201	148	151	150
5	NCN-22-5	GSL- 1 (NC)	1800	2412	883	2147	2057	2574	**2198**		245	250	97	305	299	275	163	141	201	157	156	155
6	**NCN-22-6**	**AKMS 8141 (HPGS 1), (LR)**	**1947**	**2413**	**1118**	**2103**	**2275**	**2612**	**2270**		**245**	**253**	**123**	**285**	**280**	**284**	**163**	**141**	**199**	**155**	**155**	**155**
		GM	**1750**	**2213**	**1099**	**1946**	**2120**	**2458**	**2098**													
		CD (5%)	154	171	256	239	334.1	368														
		CV (%)	5.9	5.1	12.8	11.5	10.5	9.9														
		DOS	17.10.2022	28.10.2022	29.10.2022	11.10.2022	14.10.2022	23.10.2022														

$ data of BJR centre excluded from computation of mean due to rejection by monitoring team.

** Strain outyielding the best check by a margin of more than or equal to 10 percent on the basis of oil yield

Table 3.25.b. Performance of Gobhi Sarson strains in AVT-I

S.No.	Code	Strain	1000-seed weight (g)						Oil Content (%)							Oil Yield (kg/ha)
			KNG	DLK	BJR	CHT	LDH	ABR	KNG		BJR$	CHT	LDH	ABR	Mean	
			1	2	3	4	5	6	1		3	4	5	6	(4-6)	
1	NCN-22-1	Kranti (NC)	4.6	4.3	4.4	3.7	4.9	4.2	39.9		38.8	39.18	35.06	35.8	**37.5**	**611**
2	NCN-22-2	GSC 6 (Filler)	3.9	4.1	6.4	3.6	3.6	3.9	43.9		43.6	42.7	41.14	45.2	**43.2**	**895**
3	**NCN-22-3**	**GSH- 2155**	**3.0**	**2.9**	**4.6**	**3.4**	**3.3**	**3.1**	**43.8**		**42.4**	**41.94**	**41.36**	**44.2**	**42.8**	**1003**
4	NCN-22-4	GSC 6 (Quality Check)	3.8	4.2	5.4	3.5	3.4	3.9	42.1		43.4	42.9	39.27	43.5	**41.9**	**870**
5	NCN-22-5	GSL- 1 (NC)	2.9	2.9	4.5	3.6	3.7	3.1	37.6		43.2	38.13	36.41	36.2	**37.1**	**815**
6	**NCN-22-6**	**AKMS 8141 (HPGS 1), (LR)**	**3.0**	**3.1**	**4.8**	**3.7**	**3.5**	**3.0**	**41.3**		**46.3**	**38.84**	**39.95**	**39.7**	**39.9**	**907**

Agronomy

Agronomy

3.1 Long-term fertility experiment on cropping systems involving rapeseed-mustard

The experiment was initiated in 2011-12 and conducted at 6 centres during 2022-23. At Bharatpur, the experiment was initiated from the year 2022-23.

Year 2022-23: Application of 150% NPK recorded the highest seed yield at Kangra (1907 kg/ha), LDH (2058 kg/ha), HSR (2339 kg/ha) and BPR (2381 kg/ha) which was 323, 275, 180 and 24% higher over the control, and 25, 5, 34 and 6% higher over the 100% NPK, respectively. Application of 100% NPK+FYM @ 2.5 t/ha recorded significantly highest seed yield at PNT (2015 kg/ha) and KOT (2225 kg/ha) which was higher by 247 & 81% over the control and 13 & 101% over the 100% NPK, respectively (Table 3.1.1).

Dholi:Pooled data of 10-yearsunder rice-mustard cropping system (Table 3.1.2) revealed thatapplication of 150% NPK recorded maximum mustard seed yield which was higher by 267 and 20% over control and 100% NPK, respectively. Sustainability yield index (SYI), system net return (SNR) and B:C ratio (BCR) were also recorded highest with the application of 150% NPK compared to control and 100% NPK.Application of 150% NPK increased SYI, SNR and BCR by 17, 31 and 27% over 100% NPK, respectively. The soil fertility parameters after 10-years were not influenced significantly except N due to the different fertility treatments.

Shillongani:Pooled data of 5-yearsunder rice-toria cropping system (Table 3.1.3) revealed that application of 150% NPK recorded maximum toria seed yield, system productivity, SYI, SNR and BCR. Application of 150% NPK increased seed yield, system productivity, SYI, SNR and BCR by 86, 45, 209, 168 and 67% over 100% NPK, respectively. After 5-years, soil organic carbon, available NPKZn and B were increased significantly with the application of 100% NPK+2.5 t FYM/ha compared to 100 and 150% NPK, and initial values.

Pantnagar:After 11–years under maize-mustard cropping system (Table 3.1.4),application of 100% NPK+2.5 t FYM/ha recorded markedly higher mustard seed yield (13%) and system productivity (10%) compared to 100% NPK. Whereas, SNR (8%) and BCR (6%) were recorded maximum with the application of 100% NPK+40 kg S/ha compared to 100% NPK. Soil organic carbon and available N were recorded maximum with the use of 100% NPK+2.5 t FYM/ha, and available P & K were higher with the use of 150% NPK. However, available S, Zn & B were not influenced significantly with the different fertility treatments after 11-years.

Kota:pooled data of 6-years under urdbean-mustard cropping system (Table 3.1.5) revealed that application of 100% NPK+2.5 t FYM/ha recorded maximum mustard seed yield (8%), system productivity (7%), SYI (8%), SNR (9%) and BCR (9%) over the 100% NPK. Soil OC and available N, P, K, S and Zn were also increased after 6-years and recorded maximum with the use of 100% NPK+2.5 t FYM/ha.

SK Nagar:Pooled data of 7-years under moong-mustard cropping system (Table 3.1.6) revealed that application of 150% NPK increased mustard seed yield, system productivity, SNR and BCR by 17, 13, 25 and 9% over the 100% NPK, respectively. Soil fertility status (OC, N and P) were not influenced significantly after 7-years of experiment with different fertility treatments.

Table 3.1.1. Seed yield (kg/ha) of rapeseed-mustard under different long term fertility levels (2022-23).

Treatment	KNG	LDH	HSR	PNT	KOT	BPR
Control	451	549	833 (40.0)	580 (46.5)	1229	1917
100% PK	690	1486	844 (40.2)	997 (44.5)	1767	1936
100% NPK	1525	1960	1742 (40.1)	1781(42.1)	2021	2250
150% NPK	1907	2058	2339 (40.1)	1803 (41.1)	2170	2381
100% NPK + 40 kg S/ha	1712	1821	1808 (40.2)	1952 (43.1)	2103	2262
100% NPK + 25 kg $ZnSO_4$/ha	1672	1910	1758 (39.8)	1904 (42.8)	2098	2143
100% NPK + 1 kg B/ha	1698	1896	1764 (40.3)	1896 (42.0)	2068	2083
100% NPK + 2.5 t FYM/ha	1753	1842	2149 (39.9)	2015 (43.1)	2225	2131
100% NP	1352	1734	1667 (39.9)	1456 (42.9)	1827	2155
100% NK	1384	1635	1579 (40.2)	1418 (42.5)	1774	2101
CD (p = 0.05)	193	175	305 (NS)	284	336	185
Date of sowing	Oct. 13	Oct. 28	Oct. 22	Oct. 22	Oct. 16	Oct. 20
Variety	GSC 7	PBR 357	RH 749	NDRE 4	Giriraj	Radhika
RDF (NPK kg/ha)	120:60:60	100:30:15	80:30:20	120:40:20	80:40:30	80:40:40
Year of start	2019-20	2011-12	2011-12	2011-12	2017-18	2022-23
Preceding crop	Maize	Maize	P. millet	Maize	Urdbean	P. millet

*Oil content (%) in parenthesis

Table 3.1.2. Long-term (10-year) effects on productivity, profitability and soil fertility under rice-mustard cropping system at Dholi (at harvest of mustard 2021-22).

Treatments	Mustard seed yield (kg/ha)	SYI	System net return (Rs/ha)	B:C ratio	OC (%)	N (kg/ha)	P (kg/ha)	K (kg/ha)	S (kg/ha)	Zn (mg/kg)	B (mg/kg)
Control	510	0.28	-14638	-0.17	0.32	130	23.9	92	11.4	0.56	0.31
100% PK	1037	0.51	19562	0.22	0.38	137	24.9	94	11.5	0.55	0.31
100% NPK	1558	0.72	107815	1.13	0.34	149	24.2	99	11.7	0.55	0.32
150% NPK	1870	0.84	141578	1.43	0.35	169	24.9	103	11.3	0.56	0.31
100% NPK + 40 kg S/ha	1614	0.76	117671	1.16	0.36	139	25.3	91	13.4	0.56	0.31
100% NPK + 25 kg $ZnSO_4$/ha	1607	0.76	112155	1.1	0.42	144	24.4	94	11.8	0.58	0.32
100% NPK + 1 kg B/ha	1543	0.75	110922	1.15	0.3	107	24.2	93	11.3	0.55	0.34
100% NPK + 2.5 t FYM/ha	1737	0.81	123893	1.17	0.5	128	25.4	102	11.7	0.57	0.33
100% NP	1159	0.51	43233	0.46	0.39	119	23.2	104	11.2	0.55	0.3
100% NK	814	0.31	18616	0.21	0.34	159	24.2	99	10.7	0.55	0.29
CD (p=0.05)	136	-	17315	0.28	NS	25	NS	NS	NS	NS	NS
Initial values	-	-	-	-	0.38	137	27.1	85	12.8	0.55	0.29

Table 3.1.3. Long-term (5-year) effects on productivity, profitability and soil fertility under rice-toria cropping system at Shillongani (at harvest of mustard 2021-22).

Treatments	Toria seed yield (kg/ha)	System productivity (kg/ha)	SYI	System net returns (Rs/ha)	B:C ratio	OC (%)	N (kg/ha)	P (kg/ha)	K (kg/ha)	Zn (mg/kg)	B (mg/kg)
Control	432	3470	0.01	9280	1.49	0.6	242	43	135	0.48	0.53
100% PK	601	4470	0.13	16024	1.7	0.68	248	64.2	139	0.48	0.53
100% NPK	711	5200	0.21	21859	1.9	0.65	267	66	144	0.49	0.64
150% NPK	1322	7540	0.65	58796	3.17	0.67	273	69.3	155	0.49	0.64
100% NPK + 40 kg S/ha	961	6020	0.39	36122	2.37	0.65	271	67	146	0.49	0.65
100% NPK + 25 kg $ZnSO_4$/ha	962	5910	0.39	35187	2.29	0.68	270	66.3	148	0.61	0.64
100% NPK + 1 kg B/ha	1011	6100	0.43	41059	2.67	0.69	264	68	148	0.48	0.77
100% NPK + 2.5 t FYM/ha	1096	6680	0.49	44423	2.65	0.85	286	73.7	158	0.58	0.75
100% NP	778	6170	0.26	28231	2.26	0.69	243	64.6	131	0.47	0.63
100% NK	711	4510	0.21	24109	2.09	0.65	247	44.3	137	0.47	0.64
CD (p=0.05)	110	634	-	7181	0.65	0.04	4.3	3.3	3	0.01	0.01
Initial values	-	-	-	-	-	0.61	215	27.4	111	0.27	0.52

Table 3.1.4. Long-term (11-year) effects on productivity, profitability and soil fertility under maize-mustard cropping system at Pantnagar (at mustard harvest 2022-23).

Treatments	Mustard seed yield (kg/ha)	System productivity (kg/ha)	System net returns (Rs/ha)	B:C ratio	OC (%)	N (kg/ha)	P (kg/ha)	K (kg/ha)	S (kg/ha)	Zn (mg/kg)	B (mg/kg)
Control	580	931	9027	0.22	0.48	172	6.9	149	25.6	0.8	0.55
100% PK	996	1561	31128	0.58	0.53	204	18.3	163	27.3	0.78	0.55
100% NPK	1781	2915	103374	1.86	0.71	256	18	168	29.3	0.78	0.56
150% NPK	1803	2975	100681	1.64	0.65	268	19.3	178	30	0.8	0.56
100% NPK + 40 kg S/ha	1952	3083	111403	1.97	0.75	279	18	174	32.6	0.8	0.55
100% NPK + 25 kg $ZnSO_4$/ha	1904	3031	109186	1.95	0.68	270	17.8	166	30.3	0.87	0.57
100% NPK + 1 kg B/ha	1896	3021	108698	1.94	0.66	266	17.8	173	30.6	0.8	0.61
100% NPK + 2.5 t FYM/ha	2015	3193	110642	1.75	0.92	291	18.8	175	29.3	0.84	0.59
100% NP	1456	2326	72874	1.35	0.73	245	18.7	157	30	0.8	0.57
100% NK	1418	2250	73595	1.5	0.71	242	13.8	159	29.6	0.83	0.58
CD (p=0.05)	284	311	16888	0.31	0.11	34	2	7	NS	NS	NS
Initial values					-	250	20.8	228	-	-	-

Table 3.1.5. Long-term (6-year) effects on productivity, profitability and soil fertility under urdbean-mustard cropping system at Kota (at harvest of mustard 2022-23).

Treatments	Mustard seed yield (kg/ha)	System productivity (kg/ha)	SYI	System net returns (Rs/ha)	B:C ratio	OC (%)	N (kg/ha)	P (kg/ha)	K (kg/ha)	S (kg/ha)	Zn (mg/kg)
Control	1452	2482	0.43	55134	1.29	0.42	215	23.6	338	16	0.55
100% PK	1788	3069	0.55	76169	1.62	0.43	236	53	439	17.1	0.65
100% NPK	2203	3589	0.71	97936	2.11	0.46	283	61	446	18.7	0.74
150% NPK	2395	3757	0.78	105483	2.33	0.47	319	69.3	467	19.7	0.81
100% NPK + 40 kg S/ha	2312	3732	0.75	102869	2.22	0.47	298	59	460	31.1	0.85
100% NPK + 25 kg ZnSO4/ha	2226	3634	0.72	98780	2.08	0.47	291	56.7	454	19.5	1.25
100% NPK + 1 kg B/ha	2257	3639	0.73	98755	2.07	0.44	294	58.3	449	19.7	0.81
100% NPK + 2.5 t FYM/ha	2369	3846	0.77	107216	2.31	0.59	323	71.7	473	30.3	1.2
100% NP	2005	3266	0.63	85412	1.87	0.45	281	51.7	368	18.5	0.66
100% NK	1939	3183	0.61	83334	1.88	0.44	280	28	427	18.8	0.75
CD (p=0.05)	349	511	-	17800	0.7	0.2	30	8.7	33	3	0.13
Initial values	-	-	-	-	-	0.52	280	40.3	400	18.9	0.92

Table 3.1.6.Long-term (7-year) effects on productivity, profitability and soil fertility under moong-mustard cropping system at SK Nagar (at harvest of mustard 2021-22).

Treatments	Mustard seed yield (kg/ha)	System productivity (kg/ha)	System net returns (Rs/ha)	B:C ratio	Available N (kg/ha)	Available P (kg/ha)	Available K (kg/ha)	Organic carbon (%)
Control	1068	1683	19049	1.32	108	54.5	182	0.19
100% PK	1425	2265	40008	1.61	120	49.5	176	0.21
100% NPK	1646	2461	48672	1.74	118	50.1	212	0.2
150% NPK	1924	2788	61000	1.89	120	52.8	185	0.21
100% NPK + 40 kg S/ha	1762	2700	57994	1.86	123	49.2	212	0.21
100% NPK + 25 kg $ZnSO_4$/ha	1686	2485	48317	1.72	118	47	193	0.2
100% NPK + 1 kg B/ha	1644	2528	50172	1.74	117	48.5	175	0.2
100% NPK + 2.5 t FYM/ha	1764	2618	46079	1.61	113	56.9	199	0.2
100% NP	1681	2460	49253	1.76	122	51	216	0.21
100% NK	1495	2205	41008	1.67	108	51.5	208	0.19
CD (p=0.05)	115	145	-	-	NS	NS	20.9	NS

3.2 Evaluation of herbicides for weed management in rapeseed-mustard

The experiment was conducted at six centres during 2022-23 (Table 3.2.1). Pre emergence (PE) application of pendimethalin 1.0 kg a.i./ha recorded significantly higher seed yield at LDH (1985 kg/ha), PNT (1920 kg/ha), SKN (2131 kg/ha), RNT (919 kg/ha) and IMP (1134 kg/ha) which was higher by 26, 61, 18, 49 and 36% over the weedy check. Whereas at HSR, post emergence (PoE) application of fluazifop-p-butyl 0.125 kg a.i./ha at 25-30 DAS found effective and recorded highest seed yield (2510 kg/ha) which was higher by 24% over the weedy check. The weed control efficiency (WCE) was maximum with the pendimethalin 1.0 kg a.i./ha at LDH, PNT, SKN, RNT and IMP (Fig. 3.2.1). Whereas, at HSR the maximum WCE was with PoE of fluazifop-p-butyl 0.125 kg a.i./ha at 25-30 DAS. Application of pendimethalin 1.0 kg a.i./ha (PE) also recorded the lowest WI at PNT, SKN and IMP (Fig. 3.2.2) which refers to less yield loss due to weeds. Net return and B:C ratio were also recorded highest with the application of pendimethalin 1.0 kg a.i./ha (PE) at PNT and IMP (Table 3.2.2).

Table 3.2.1. Seed yield of mustard as influenced by different herbicides.

Treatments	Seed yield (kg/ha)					
	LDH	HSR	PNT	SKN	RNT	IMP
Pendimethalin 1.0 kg a.i./ha (PE)	1985	2313	1920	2131	919	1134
Pendimethalin 0.5 kg a.i./ha (PE)	1952	2230	1778	1903	877	907
Fluazifop-p-butyl 0.125 kg a.i./ha (PoE)	1853	2510	1491	2041	851	928
Quizalofop 0.050 kg a.i./ha (PoE)	1752	2423	1760	2001	802	982
Weedy check	1579	2020	1190	1804	615	832
Weed free	2419	2707	2161	2299	964	1335
CD (p=0.05)	281	336	352	304	163	186
DOS	Oct. 29	Oct. 21	Oct. 29	Oct. 18	Dec. 08	Nov. 23
Variety	PBR 357	RH725	PR 20	GDM-4	NRCHB101	NRCHB 101

PE: Pre-emergence; PoE: Post-emergence

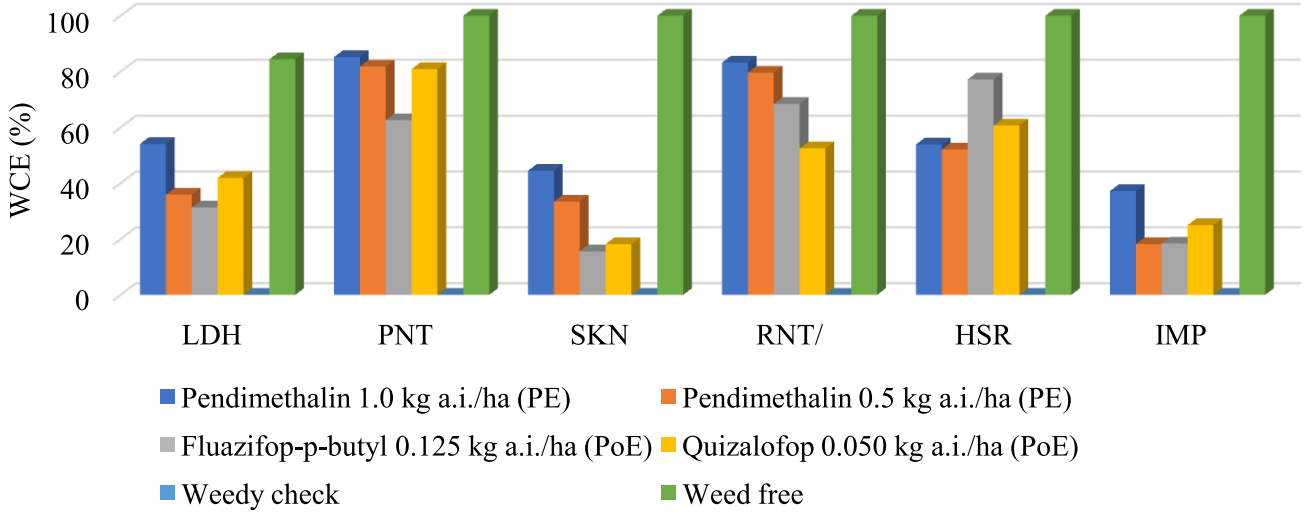

Fig. 3.2.1. Weed control efficiency of different herbicides in mustard.

RNT/BHU-at maturity; LDH-at maturity; IMP-at 80 DAS; HSR-at 45 DAS; SKN-at 45 DAS; PNT-at 80 DAS

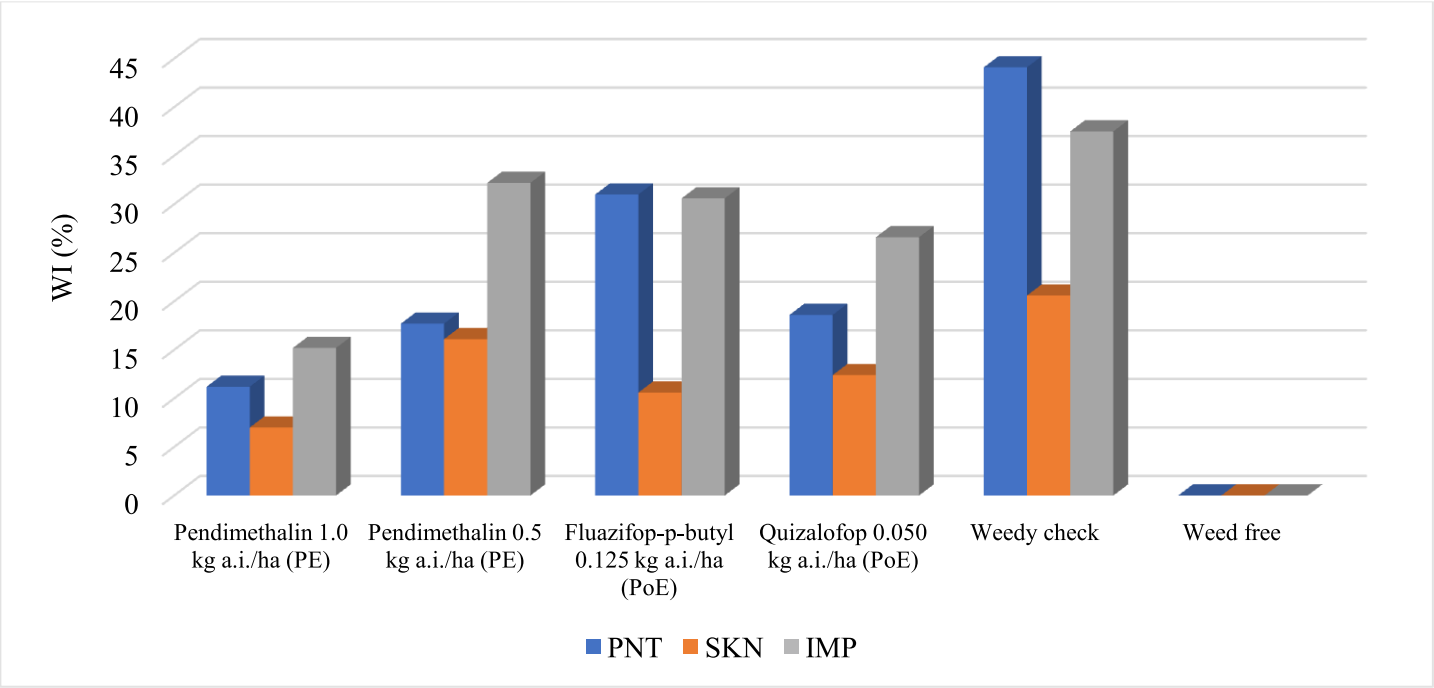

Fig. 3.2.2. Weed index of different herbicides in mustard.

Table: 3.2.2. Economics of mustard as influenced by different herbicides.

Treatments	Net returns (Rs/ha)			B:C ratio		
	PNT	IMP	LDH	PNT	IMP	LDH
Pendimethalin 1.0 kg a.i./ha (PE)	76183	24853	88595	2.68	0.67	3.90
Pendimethalin 0.5 kg a.i./ha (PE)	69443	13682	86985	2.53	0.38	3.94
Fluazifop-p-butyl 0.125 kg a.i./ha (PoE)	53247	14741	80561	1.90	0.41	3.63
Quizalofop 0.050 kg a.i./ha (PoE)	68580	16874	74941	2.51	0.46	3.46
Weedy check	38432	10799	67524	1.45	0.31	3.41
Weed free	85727	23518	105132	2.67	0.48	3.86
CD (p=0.05)	19210	-	14892	-	-	NS

3.3 Agronomic evaluation of promising rapeseed-mustard entries

Timely sown (irrigated) mustard: Two entries of mustard (RH 1975 and RH 1974) were evaluated under timely sown irrigated conditions (Zone II)against the checks (Giriraj, RH 749 and Kranti) at Hisar, Ludhiana, Sriganganagar, New Delhi and Bawal (Table 3.3.1). The entry RH 1975 recorded the maximum seed yield at Bawal, Hisar and Sriganganaga. Entry RH 1975 showed higher seed yield by 17, 1 & 3% at Bawal, 27, 38 & 28% at Hisar, 1, -10 &4% at Ludhiana, 13, 47 & 15% at Sriganganagar, 21, -4 & 6% at New Delhi over the checks RH 749, Kranti and DRMRIJ 31, respectively. Seed yield of RH 1975 increased significantly with the application of 150% RDF at Ludhiana and New Delhi over 100 and 125% RDF, and with125% at Bawal and Hisar over 100% RDF.

Table 3.3.1. Agronomic evaluation (seed yield, kg/ha) of timely sown (irrigated) mustard entries in Zone-II.

Entries/Varieties (E)	Fertility levels (F)			
	100% RDF	125% RDF	150% RDF	Mean
Bawal				
RH1975	2420	2600	2619	2546
RH 1974	1991	2168	2180	2113
RH 749	2063	2224	2241	2176
Kranti	2398	2582	2601	2527
DRMRIJ 31	2342	2520	2531	2464
Mean	2243	2419	2434	
CD (p=0.05)	Entries (E) = 179; Fertility (F) = 143; ExF = NS			
DOS: Oct. 21; Recommended fertility level- 80 kg N, 30 kg P_2O_5, 20 kg K_2O, 40 kg S/ha				
Hisar				
RH1975	2644	3031	3071	2916
RH 1974	2569	2769	3027	2788
RH 749	2116	2316	2476	2302
Kranti	1898	2160	2289	2116
DRMRIJ 31	2018	2307	2498	2274
Mean	2249	2516	2672	
CD (p=0.05)	Entries (E) = 236; Fertility (F) = 215; ExF = NS			
DOS: Oct. 22; Recommended fertility level- 80 kg N, 30 kg P_2O_5, 20 kg K_2O/ha				
Ludhiana				
RH1975	1543	1671	1849	1687
RH 1974	1477	1618	1589	1561
RH 749	1593	1729	1682	1668
Kranti	1696	1902	2064	1887
DRMRIJ 31	1444	1681	1742	1622
Mean	1551	1720	1785	
CD (p=0.05)	Entries (E) = NS; Fertility (F) = 79; ExF = NS			
DOS: Nov. 12; Recommended fertility level- 40kg N, 20 kg P_2O_5/ha				
Sriganganagar				
RH1975	2594	2833	2840	2756
RH 1974	2495	2604	2208	2436
RH 749	2377	2299	2671	2449
Kranti	1898	1594	2123	1872
DRMRIJ 31	2079	2662	2421	2388

Mean	2289	2398	2453	
CD (p=0.05)	Entries (E) = 217; Fertility (F) = NS; ExF = NS			
DOS: Oct. 19; Recommended fertility level- 75 kg N, 40 kg P_2O_5,30 kg K_2O, 20 kg S/ha				
New Delhi				
RH1975	2389	2333	2767	2496
RH 1974	2233	2633	2245	2370
RH 749	1967	2222	2011	2067
Kranti	2478	2529	2800	2602
DRMRIJ 31	2111	2589	2355	2352
Mean	2236	2461	2436	
CD (p=0.05)	Entries (E) = 178; Fertility (F) = 111; E at same level of F = 336; F at same or different level of E = 345			
DOS: Oct 12; Recommended fertility levels NPKS (kg/ha)- 80:40:40:30				

Quality mustard: Two entries of quality mustard (PDZ 14 and PDZ 15) were evaluated in Zone IIIagainst the checks (PM 30, PDZ 1, RGN 73 and Kranti) at Kota, Kanpur, Pantnagar, Morena and Jhansi (Table 3.3.2). Entry PDZ 15 recorded higher seed yield by 7% over PDZ 1 at Jhansi; 36, 8, 21 & 13% over PM 30, RGN 73, Kranti & PDZ 1 at Kanpur; 5 & 8% over PM 30 & PDZ 1 at Kota; 5% over PDZ 1 at Morena; and 8% over PDZ 1 at Pantnagar, respectively. Entry PDZ 14 recorded higher seed yield by 2, 15 & 7% over PM 30, Kranti & PDZ 1 at Jhansi; 11% over PM 30 at Kanpur; 5 & 7% over PM 30 & PDZ 1 at Kota; and 4 & 9% over RGN 73 & PDZ 1 at Morea, respectively.

Table 3.3.2. Agronomic evaluation (seed yield, kg/ha) of quality mustard entries in Zone-III.

Entries/Varieties (E)	Fertility levels (F)			
	100% RDF	125% RDF	150% RDF	Mean
Jhansi				
PDZ 15	1481	1632	1804	1639
PDZ 14	1506	2047	2057	1870
PM 30	1552	2018	1916	1829
RGN 73	1574	2191	2270	2012
Kranti	1299	1722	1879	1633
PDZ 1	1166	1666	1771	1534
Mean	1430	1879	1950	
CD (p=0.05)	Entries (E) = 44; Fertility (F) = 50; ExF = 122			
DOS: Nov. 06; Recommended fertility levels NPKS (kg/ha)- 120:60:60:40				
Kanpur				
PDZ 15	1694	2079	1727	1833
PDZ 14	1463	1481	1551	1498
PM 30	1218	1380	1444	1347
RGN 73	1560	1833	1694	1696
Kranti	1463	1611	1463	1512
PDZ 1	1500	1861	1491	1617
Mean	1483	1708	1562	
CD (p=0.05)	Entries (E) = 175; Fertility (F) = 89; ExF = NS			
DOS: Oct. 21; Recommended fertility levels NPK (kg/ha)- 100:60:60				
Kota				
PDZ 15	2129	2067	2161	2119

PDZ 14	2068	2129	2115	2104
PM 30	1975	2021	2038	2011
RGN 73	2056	2114	2176	2115
Kranti	2098	2144	2502	2248
PDZ 1	1831	2071	1974	1959
Mean	2026	2091	2161	
CD (p=0.05)	Entries (E) = 252; Fertility (F) = 131; ExF = NS			
DOS: Oct. 16; Recommended fertility levels NPK (kg/ha)-100:50:30				
Morena				
PDZ 15	2629	2867	3106	2867
PDZ 14	2653	2967	3317	2979
PM 30	2506	3069	3353	2976
RGN 73	2625	2778	3222	2875
Kranti	2686	3089	3393	3056
PDZ 1	2414	2789	3014	2739
Mean	2586	2927	3234	
CD (p=0.05)	Entries (E) = 79; Fertility (F) = 72; ExF = NS			
DOS: Oct. 31; Recommended fertility levels NPKS (kg/ha)-75:40:30:20				
Pantnagar				
PDZ 15	1515	1602	1800	1639
PDZ 14	1418	1579	1641	1546
PM 30	1981	2175	2291	2149
RGN 73	1915	2175	2325	2138
Kranti	1667	1916	2213	1932
PDZ 1	1343	1570	1623	1512
Mean	1640	1836	1982	
CD (p=0.05)	Entries (E) = 270; Fertility (F) = 63 ExF = NS			
DOS: Oct. 22; Recommended fertility levels NPK (kg/ha)-120:40:20				

Late sown mustard: One entry of mustard (DRMR 2018-19) were evaluated under late sown conditions (Zone III)against the checks (CS 56, NRCHB 101 and Kranti) at Kota, Varanasi, Kanpur, Pantnagar and Jhansi (Table 3.3.3). The entry DRMR 2018-19 recorded the maximum seed yield at Jhansi, Kota and Varanasi. Seed yield of DRMR 2018-19 increased by 15, 5 & 2% at Jhansi, 46, 16 & 41% at Kota, and 37, 30 & 26% at Varanasi over the checks CS 56, Kranti and NRCHB 101, respectively. Data from Pantnagar centre were found non-significant. Application of 150% RDF at Jhansi and Varanasi, and 125% RDF at Kota recorded maximum seed yield of DRMR 2018-19.

Table 3.3.3. Agronomic evaluation (seed yield, kg/ha) of late sown mustard entries in Zone-III.

Entries/Varieties (E)	Fertility levels (F)			
	100% RDF	125% RDF	150% RDF	Mean
Jhansi				
DRMR 2018-19	2789	2988	3295	3024
CS 56	2568	2769	2525	2621
Kranti	2662	2910	3048	2873
NRCHB 101	2144	3153	3580	2959
Mean	2541	2955	3112	
CD (p=0.05)	Entries (E) = 207; Fertility (F) = 101; ExF = 202			

DOS: Nov. 07; Recommended fertility levels NPKS (kg/ha)- 120:60:60:40				
Kanpur				
DRMR 2018-19	1231	1370	1625	1409
CS 56	1486	1611	1421	1506
Kranti	1194	1412	1435	1347
NRCHB 101	1509	1741	1644	1631
Mean	1355	1534	1531	
CD (p=0.05)	Entries (E) = 175; Fertility (F) = 87; ExF = NS			
DOS: Nov. 06; Recommended fertility levels NPK (kg/ha)-100:60:60				
Kota				
DRMR 2018-19	2118	2207	2191	2172
CS 56	1363	1458	1649	1490
Kranti	1739	1944	1953	1879
NRCHB 101	1501	1445	1684	1543
Mean	1680	1764	1869	
CD (p=0.05)	Entries (E) = 153; Fertility (F) = 117; ExF = NS			
DOS: Nov. 15; Recommended fertility levels NPK (kg/ha)-100:50:30				
Pantnagar				
DRMR 2018-19	1089	1187	1307	1194
CS 56	1245	1332	1409	1329
Kranti	1205	1251	1405	1287
NRCHB 101	1243	1377	1428	1349
Mean	1196	1287	1387	
CD (p=0.05)	Entries (E) = NS; Fertility (F) = 59; ExF = NS			
DOS: Nov. 17; Recommended fertility levels NPK (kg/ha)- 120:40:20				
Varanasi				
DRMR 2018-19	1878	2100	2259	2079
CS 56	1321	1543	1702	1522
Kranti	1395	1617	1776	1596
NRCHB 101	1455	1677	1836	1656
Mean	1512	1734	1893	
CD (p=0.05)	Entries (E) = 160; Fertility (F) = 221; ExF = NS			
DOS: Nov. 15; Recommended fertility levels NPKS (kg/ha)-120:60:60				

3.4 Enhancing drought and heat tolerance in rapeseed-mustard through microbes

The experiment was conducted at 13 locations during 2022-23. Seed inoculation with microbes significantly increased seed yield of mustard at all the locations except at Ludhiana and SK Nagar (Table 3.4.1). Irrespective to the irrigation levels, seed inoculation recorded maximum yield with CRIDA MI-II at Chatha (26%), Dholi (29%), Morena (63%), Jobner (25%) and Imphal (50%) over no inoculation.CRIDA MI-I increased seed yield at Sriganganagar (27%) and Varanasi (58%) over no inoculation. Seed inoculation with Biophos and Biophos^{+} recorded maximum seed yield at Bawal (12%) and Banda (12%), whereas, MRD 17 recorded maximum seed yield atJhansi (4%) and Nagpur (52%)over the control. Normal irrigation levels as per location also recorded maximum seed yield over the 50% deficit and no irrigation.The respective microbial inoculants showed significant yield improvement at normal irrigation levels at Jhansi, Dholi, Morena, Varanasi, Jobner, Nagpur and Imphal over the no irrigation and 50% deficit irrigation. Whereas, at 50% deficit irrigation at Chatha, Sriganganagar, Bawal and Banda increased seed yield significantly over the no irrigation.

Leaf relative water content (RWC) increased significantly at Jhansi (MRD 17), Bawal (Biophos and Biophos+), Banda (CRIDA MI-II) and Chatha (CRIDA MI-II) over no inoculation. SPAD reading and membrane stability index (MSI) also increased markedly with the MRD 17 at Jhansi and SK Nagar (Table 3.4.2). The oil content in seed not influenced significantly with the seed inoculations. Irrigation levels also influenced the physiological indices significantly and recorded higher at normal irrigation levels. Across the irrigation levels seed inoculation significantly increased net returns with CRIDA MI-II at Jobner (43%), Morena (116%), Dholi (58%), Imphal (266%) and Chatha (36%); CRIDA MI-I at Varanasi (100%), Bawal (17%) and Banda (17%), and with MRD 17 at Jhansi (3%) and Nagpur (77%) over no inoculation (Table 3.4.3). Inoculation with microbes not influenced soil nutrients and OC significantly except N at Bawal and Imphal; P at Jhansi and Imphal; and K at Imphal (Table 3.4.4).

Pooled data analysis on three years mean seed yield (Table 3.4.5) revealed that seed inoculation with CRIDA MI-I recorded maximum seed yield at four locations; Sriganganagar (22%), Morena (18%), Varanasi (46%) and SK Nagar (9%) over the no inoculation. Seed inoculation with CRIDA MI-II recorded maximum seed yield at three locations; Chatha (30%), Dholi (31%) and Jobner (21%) compared to no inoculation. At Ludhiana and Nagpur seed inoculation with MRD 17 recorded maximum yield 14 & 31% compared to no inoculation. Bawal and Banda reported maximum seed yield with the Biophos and Biophos^{+} seed inoculation which was 12 & 13% higher over the no inoculation. Economic returns were also increased with the seed inoculation of the respective centre-wise microbial inoculants.

Application of Normal irrigation recorded maximum seed yield at all the location compared to one irrigation and no irrigation.

Table 3.4.1. Seed yield (kg/ha) of mustard as influenced by irrigation levels and microbial inoculants.

Irrigation frequency (I)	Microbial inoculants (M)						Mean
	MRD 17	MKS6	Biophos and Biophos^{+}	CRIDA MI-I	CRIDA MI-II	Control	
Chatha							
No Irrigation	982	935	1063	1067	1117	885	1008
50% deficit Irrigation	1452	1497	1623	1647	1670	1340	1538
Normal Irrigations	1508	1550	1747	1793	1805	1425	1638
Mean	1314	1327	1478	1502	1531	1217	

CD (p=0.05)	Irrigation Levels (I) = 165; Microbial consortia (M) = 74; ExF = NS						
DOS: Oct. 25; Recommended fertility levels NPK (kg/ha) - 80:40:20							
Sriganganagar							
No Irrigation	2059	1704	1789	1974	2128	1386	1840
50% deficit Irrigation	2339	2235	2297	2480	2125	1943	2237
Normal Irrigations	2222	2484	2832	2716	2843	2311	2568
Mean	2206	2141	2306	2390	2365	1880	
CD (p=0.05)	Irrigation Levels (I) = 436; Microbial consortia (M) = 144; ExF = 321						
DOS: Oct. 19; Recommended fertility levels NPKS (kg/ha) - 75:40:30:20							
Jhansi							
No Irrigation	1273	1021	1290	749	1200	1308	1140
50% deficit Irrigation	1418	1375	1317	1406	1330	1339	1364
Normal Irrigations	1596	1551	1465	1699	1543	1488	1557
Mean	1429	1316	1357	1285	1358	1378	
CD (p=0.05)	Irrigation Levels (I) = 59; Microbial consortia (M) = 45; ExF = 77						
DOS: Nov. 07; Recommended fertility levels NPKS (kg/ha) - 120:60:60:40							
Ludhiana							
No Irrigation	1911	1873	1979	1936	1932	1760	1899
50% deficit Irrigation	2216	2147	2139	2125	1949	1986	2094
Normal Irrigations	2661	2480	2428	2516	2456	2335	2479
Mean	2263	2167	2182	2192	2112	2027	
CD (p=0.05)	Irrigation Levels (I) = 254; Microbial consortia (M) = NS; ExF = NS						
DOS: Oct. 21; Recommended fertility levels NPK (kg/ha) – 100:30:15							
Bawal							
No Irrigation	2070	2111	2297	2090	2146	2048	2127
50% deficit Irrigation	2261	2278	2509	2265	2330	2246	2315
Normal Irrigations	2296	2304	2536	2292	2365	2282	2345
Mean	2209	2231	2448	2215	2280	2192	
CD (p=0.05)	Irrigation Levels (I) = 143; Microbial consortia (M) = 129; ExF = NS						
DOS: Oct. 22; Recommended fertility levels NPKS (kg/ha) - 80:30:20:40							
Banda							
No Irrigation	1374	1318	1365	1287	1355	1235	1322
50% deficit Irrigation	1771	1754	2040	1900	2003	1798	1878
Normal Irrigations	2260	2073	2275	2160	2279	2041	2181
Mean	1802	1715	1894	1782	1879	1691	
CD (p=0.05)	Irrigation Levels (I) = 255; Microbial consortia (M) = 79; ExF = NS						
DOS: Nov. 05; Recommended fertility levels NPKS (kg/ha) – 90:40:30:30							
Dholi							
No Irrigation	1104	1250	1202	1286	1371	1041	1209
50% deficit Irrigation	1284	1502	1876	1935	1540	1267	1567
Normal Irrigations	1641	1660	1511	1711	2071	1541	1689
Mean	1343	1471	1530	1644	1661	1283	
CD (p=0.05)	Irrigation Levels (I) = 159; Microbial consortia (M) = 170; ExF = 90						
DOS: Nov. 04; Recommended fertility levels NPK (kg/ha) - 80:40:40							
Morena							
No Irrigation	1155	1075	1268	1318	1427	933	1196
50% deficit Irrigation	1539	1493	1754	1825	2022	1343	1663
Normal Irrigations	1764	1631	2319	2350	2611	1450	2021
Mean	1486	1400	1780	1831	2020	1242	

CD (p=0.05)	Irrigation Levels (I) = 124; Microbial consortia (M) = 70; M at same level of I = 138; I at same or different level of M =164						
DOS: Oct. 31; Recommended fertility levels NPK (kg/ha) - 80:40:20							
Varanasi							
No Irrigation	1184	1030	1406	1556	1484	868	1254
50% deficit Irrigation	1507	1354	1730	1879	1807	1191	1578
Normal Irrigations	1795	1641	2018	2167	2095	1479	1866
Mean	1495	1342	1718	1867	1795	1179	
CD (p=0.05)	Irrigation Levels (I) = 82; Microbial consortia (M) = 161; ExF = NS						
DOS: Oct. 21; Recommended fertility levels NPK (kg/ha) - 120:60:60							
Jobner							
No Irrigation	831	855	863	893	913	690	841
50% deficit Irrigation	1133	1188	1212	1290	1327	1035	1197
Normal Irrigations	1472	1499	1524	1587	1614	1371	1511
Mean	1145	1181	1200	1257	1285	1032	
CD (p=0.05)	Irrigation Levels (I) = 107; Microbial consortia (M) = 83; ExF = NS						
DOS: Oct. 27; Recommended fertility levels NPK (kg/ha) - 60:40:00							
Nagpur							
No Irrigation	1207	827	783	836	886	705	874
50% deficit Irrigation	1236	1188	1081	983	940	860	1048
Normal Irrigations	1408	1326	1264	1054	1016	972	1173
Mean	1284	1114	1043	957	947	846	
CD (p=0.05)	Irrigation Levels (I) = 108; Microbial consortia (M) = 91; ExF = NS						
DOS: Oct. 27; Recommended fertility levels NPK (kg/ha) - 80:40:40							
SK Nagar							
No Irrigation	1467	1472	1588	1621	1471	1523	1524
50% deficit Irrigation	2568	2450	2123	2580	2341	2159	2370
Normal Irrigations	2495	2667	2528	2673	2602	2372	2556
Mean	2177	2196	2080	2292	2138	2018	
CD (p=0.05)	Irrigation Levels (I) = 221; Microbial consortia (M) = NS; ExF = NS						
DOS: Oct. 18; Recommended fertility levels NPKS (kg/ha) - 50:50:00:40							
Imphal							
No Irrigation	922	881	910	1012	1076	817	936
50% deficit Irrigation	958	904	921	1002	1278	819	980
Normal Irrigations	957	910	917	1021	1361	849	1002
Mean	946	898	916	1012	1238	828	
CD (p=0.05)	Irrigation Levels (I) = NS; Microbial consortia (M) = 173; ExF = NS						
DOS: Nov. 23; Recommended fertility levels NPK (kg/ha) - 60:30:30							

Table 3.4.2. RWC, SPAD values, MSI and oil contentof mustard as influenced by irrigation and microbial inoculants.

	RWC (%)								SPAD values*			MSI*	Oil content (%)		
	JHS	IMP	JOB	BAW	NGP	BND	SKN	CHT	JHS	SKN	NGP	SKN	SKN	IMP	BND
Irrigation frequency															
No Irrigation	24.4	73.8	55.6	69	55.4	61.5	78.8	57.1	23.1	31.7	30	28.8	38	38	37
50% deficit	42.7	74.8	64.5	81	59.4	66.1	82.2	69.4	25.9	31.3	39	38.1	39	38	39
Normal	71	76	70.7	80	62.2	67.5	79.5	73.9	28.3	32.7	44	30.9	39	39	39
CD (p=0.05)	0.3	NS	4.9	7	NS	2	NS	8.7	1.1	NS	6	4.7	NS	NS	NS
Microbial inoculants															
MRD 17	53.2	75.9	62.9	72	65.1	64.7	82.8	62.2	26.3	33.9	42	34.8	38	39	38
MKS6	47.4	75	63.8	75	63	65.6	80.7	59.2	25.5	31.6	43	33.3	38	38	38
Biophos and Biophos+	40.3	76	64	87	59.9	65.5	81.3	71.9	25.5	29.6	40	31.7	38	38	39
CRIDA MI-I	51.1	73.9	64.6	74	58.4	65.7	77.1	74.6	25.8	33.4	39	31.7	39	40	39
CRIDA MI-II	41.4	75.4	65.3	77	54.3	66.1	80.9	77.4	25.4	31.5	33	38	38	40	39
Control	42.7	73	61	72	53.3	62.6	78.2	55.6	26	31.3	31	26.1	38	36	38
CD (p=0.05)	0.3	NS	NS	6	NS	2.2	NS	6.1	0.5	NS	NS	4.8	NS	NS	NS

*At 80 DAS

Table 3.4.3. Net returns of mustard as influenced by irrigation and microbial inoculants.

Treatments	Net returns (Rs./ha)											
	JOB	MOR	DOL	IMP	JHS	VAR	SKN	NGP	BAW	BND	LDH	CHT
Irrigation frequency												
No Irrigation	22145	39835	35847	14270	30076	45529	46459	27580	81291	44700	75190	36981
50% deficit	40377	66068	55301	16686	40684	60658	90689	36579	89328	78141	86347	64116
Normal	56306	85737	61104	17875	49585	74742	98922	42541	88817	94512	108436	68316
CD (p=0.05)	5858	-	8106	-	3196	2353	12060	4044	5389	13172	14972	8989
Microbial inoculants												
MRD 17	37604	55376	41817	14783	43969	56150	80141	49326	83555	72368	95733	52024
MKS6	39530	50153	49909	12199	37801	47236	81209	40450	84754	68027	90519	52750
Biophos and Biophos^{+}	40376	73190	54213	13158	40072	68789	74855	36922	96544	77890	91186	60956
CRIDA MI-I	43538	76242	59825	18387	36094	77545	86408	32634	83918	72243	91943	62288
CRIDA MI-II	45058	87690	60517	30745	40072	73368	78039	32360	87443	77621	88160	63832
Control	31550	40628	38223	8389	42683	38768	71486	27857	82659	66557	82403	46975
CD (p=0.05)	4514	-	9108	-	2437	4693	NS	5720	6206	4192	NS	4057

Table 3.4.4.Soil OC, available NPKS as influenced by irrigation and microbial inoculantsafter harvest of mustard.

	Organic carbon (%)			N (kg/ha)					P (kg/ha)					K (kg/ha)					S(mg/kg)
	JHS	NGP	SKN	JHS	BAW	NGP	IMP	SKN	JHS	BAW	NGP	IMP	SKN	JHS	BAW	NGP	IMP	SKN	SKN
Irrigation frequency																			
No Irrigation	0.31	0.27	0.24	170	121	243	304	169	8.5	10	23	20.7	55.2	250	175	334	211	201	15.1
50% deficit Irrigation	0.31	0.29	0.26	170	117	258	298	172	8.5	9	25	20	55	251	169	337	207	196	15.3
Normal Irrigations	0.32	0.34	0.25	170	116	283	277	161	8.6	9	27	18.8	50.2	238	169	341	199	192	15.5
CD (p=0.05)	NS	NS	NS	NS	3	NS	NS	NS	0.02	NS	NS	NS	NS	NS	4	NS	NS	NS	NS
Microbial inoculants																			
MRD 17	0.31	0.32	0.26	170	119	290	279	168	8.5	9	27	18.5	55	250	171	345	196	196	15.7
MKS6	0.31	0.31	0.24	170	118	280	304	161	8.6	9	26	20.9	54.5	251	170	342	199	196	15.2
Biophos and Biophos+	0.31	0.3	0.25	170	120	271	318	170	8.6	10	25	21.2	51.5	250	171	338	225	188	15.5
CRIDA MI-I	0.31	0.3	0.25	170	119	256	304	168	8.5	9	24	20	52.8	250	171	336	214	203	14.8
CRIDA MI-II	0.31	0.29	0.24	171	119	235	303	171	8.5	8	24	20.8	54	225	171	333	206	197	15.7
Control	0.32	0.29	0.24	170	113	235	251	168	8.5	9	24	17.4	52.9	251	170	333	194	198	15.2
CD (p=0.05)	NS	NS	NS	NS	4	NS	23	NS	0.03	NS	NS	1.6	NS	NS	NS	NS	14	NS	NS
Initial	0.31	-		168	132	-	-	-	8.2	13	-	-	-	247	181	-	-	-	-

Table 3.4.5. Effect of irrigation and biofertilizer on seed yield of mustard (3-year mean).

Treatment	Chatha	Sriganganagar	Ludhiana	Bawal	Banda	Dholi	Morena	Varanasi	Jobner	Nagpur	SK Nagar
Microbial inoculants											
MRD 17	1303	1868	1901	2005	2012	1360	2118	1414	1193	1013	1704
MKS6	1292	1812	1840	2032	1996	1483	1874	1285	1226	922	1771
Biophos and Biophos+	1428	1931	1813	2233	2108	1539	2096	1611	1240	889	1697
CRIDA MI-I	1450	2056	1810	2016	2052	1663	2178	1701	1285	857	1781
CRIDA MI-II	1479	1970	1826	2073	2077	1678	2141	1683	1320	845	1756
Control	1135	1681	1661	1991	1866	1284	1842	1167	1092	771	1632
Irrigation frequency											
No irrigation	976	1566	1595	1910	1523	1222	1848	1206	904	682	1261
One irrigation	1478	1901	1801	2107	2110	1586	2049	1481	1232	909	1789
Two irrigations	1591	2192	2029	2156	2421	1695	2228	1744	1541	1057	2121

3.5 Response of macro and micro nutrient bio-fertilizers in enhancing rapeseed-mustard productivity and soil health

The experiment was conducted at 16 locations during 2022-23. Seed inoculation with liquid biofertilizers significantly increased seed yield at all the locations except at SK Nagar, Shillongani and Ludhiana (Table 3.5.1). Seed inoculation with NPK consortia+ZSB increased seed yield at Chatha (20%), Pantnagar (41%), Dholi (21%), Kota (17%), Varanasi (40%), Kanke (8%), Bawal (14%), Bharatpur (21%) and Sriganganagar (21%) compared to no culture. Inoculation with *Azotobacter* increased seed yield at Kangra (32%), Morena (27%), Ranital (23%), whereas, seed inoculation with PSMO recorded higher yield at Imphal (58%) over the no culture.Application of 100% RDF significantly increased mustard seed yield at Chatha, Morena, Dholi, Kota, Varanasi, SK Nagar, Kanke, Bharatpur, Shillongani and Ludhiana compared to control and 75% RDF (Table 3.5.1). Whereas, at Kangra, Pantnagar, Ranital, Bawal and Sriganganagar seed yield increased significantly with 75% RDF over control. Seed yield did not influence significantly due to different fertility levels at Imphal. Oil content increased with ZSB, *Azotobacter* and KMB at Imphal, Pantnagar and SK Nagar, respectively (Fig. 3.5.1). Seed inoculation with NPK consortia+ZSB significantly increased net economic returns at all the locations except at Kangra and Morena *(Azotobacter)*(Table 3.5.2). Soil OC at SK Nagar; available N at Dholi, Kota, Pantnagar and Imphal; available P at Kota, Dholi, SK Nagar and Imphal; available K at Kota, Bawal, Dholi, Pantnagar and Imphal; available S at Kota; and Zn at Kota, Dholi and Pantnagar increased significantly compared to no culture (Table 3.5.3 & 4).

Table 3.5.1. Seed yield (kg/ha) of mustard as influenced by different fertility levels and liquid biofertilizers.

Fertility level (F)	Biofertilizers (BF)						Mean
	Azotobacter	PSMO	KMB	ZSB	NPK consortia+ZSB	No culture	
Kangra							
100% RDF	2068	2022	1732	1827	1899	1646	1866
75% RDF	1961	1898	1641	1706	1792	1544	1757
Control	1032	910	753	832	891	632	842
Mean	1687	1610	1375	1455	1527	1274	
CD (p=0.05)	Fertility Levels (F) = 98; Biofertilizers (BF) = 55; FxBF = NS						
DOS: Oct 14; Recommended fertility levels NPK (kg/ha) - 120:60:60							
Chatha							
100% RDF	1675	1642	1592	1475	1717	1487	1598
75% RDF	1375	1358	1292	1275	1392	1150	1307
Control	883	858	817	772	917	725	829
Mean	1311	1286	1233	1174	1342	1121	
CD (p=0.05)	Fertility Levels (F) = 121; Biofertilizers (BF) = 63; FxBF = NS						
DOS: Oct 25 ; Recommended fertility levels NPK (kg/ha) - 80:40:20							
Pantnagar							
100% RDF	1801	1685	1589	1508	1944	1376	1650
75% RDF	1745	1657	1533	1463	1872	1380	1608
Control	1068	9900	9046	8580	1137	7650	9537
Mean	1538	1444	1342	1276	1650	1173	
CD (p=0.05)	Fertility Levels (F) = 131; Biofertilizers (BF) = 108; FxBF = NS						
DOS: Oct. 22; Recommended fertility levels NPK (kg/ha) - 120:40:20							
Morena							

100% RDF	3025	2884	2575	2735	2826	2432	2746
75% RDF	2920	2747	2424	2560	2767	2247	2611
Control	1606	1491	1341	1457	1468	1251	1436
Mean	2517	2374	2113	2251	2354	1977	
CD (p=0.05)	Fertility Levels (F) = 31; Biofertilizers (BF) = 81; FxBF = NS						
DOS: Oct. 30; Recommended fertility levels NPK (kg/ha) - 80:40:20							
Dholi							
100% RDF	1900	1759	1796	1880	2110	1718	1861
75% RDF	1594	1728	1603	1757	1825	1646	1692
Control	1295	1382	1243	1538	1636	1238	1389
Mean	1596	1623	1547	1725	1857	1534	1647
CD (p=0.05)	Fertility Levels (F) = 107; Biofertilizers (BF) = 95; FxBF = NS						
DOS: Nov. 05; Recommended fertility levels NPK (kg/ha) - 80:40:40							
Kota							
100% RDF	2114	2466	2431	2252	2554	2041	2310
75% RDF	1871	1821	1868	1867	1940	1613	1830
Control	1321	1445	1867	1262	1593	1122	1340
Mean	1769	1911	1865	1794	2029	1592	
CD (p=0.05)	Fertility Levels (F) = 198; Biofertilizers (BF) = 197; FxBF = NS						
DOS: Oct 16; Recommended fertility levels NPK (kg/ha) - 100:50:30							
Varanasi							
100% RDF	2125	2209	1896	1815	2249	1676	1995
75% RDF	1937	2020	1707	1626	2060	1487	1806
Control	1559	1642	1329	1248	1682	1109	1428
Mean	1874	1957	1644	1563	1997	1424	
CD (p=0.05)	Fertility Levels (F) = 73; Biofertilizers (BF) = 172; FxBF = NS						
DOS: Oct 19; Recommended fertility levels NPK (kg/ha) - 120:60:60							
SK Nagar							
100% RDF	2564	2425	2358	2108	2175	2313	2324
75% RDF	1845	2057	1910	2123	2102	1745	1964
Control	1661	1576	1705	1654	1592	1696	1647
Mean	2023	2020	1991	1962	1956	1918	
CD (p=0.05)	Fertility Levels (F) = 284; Biofertilizers (BF) = NS; FxBF = 288						
DOS: Oct 18; Recommended fertility levels NPK (kg/ha) - 50:50:00							
Kanke							
100% RDF	1298	1524	1329	1345	1298	1345	1356
75% RDF	1083	1036	1012	1107	1321	1024	1097
Control	526	500	512	600	545	571	542
Mean	969	1020	951	1017	1055	980	
CD (p=0.05)	Fertility Levels (F) = 57; Biofertilizers (BF) = 116; FxBF = --						
DOS: Nov. 16; Recommended fertility levels NPKS (kg/ha) - 80:60:40:20							
Ranital (Previously Bhubaneswar)							
100% RDF	1078	1035	1010	968	1017	911	1003
75% RDF	1047	1015	1003	921	1006	871	977
Control	408	412	356	372	388	278	369
Mean	844	821	790	754	804	687	
CD (p=0.05)	Fertility Levels (F) = 93; Biofertilizers (BF) = 88; FxBF = NS						
DOS: Dec. 05; Recommended fertility levels NPK (kg/ha) - 80:40:40							

Imphal							
100% RDF	1083	1333	1014	913	1222	861	1071
75% RDF	1090	1458	1028	944	1229	882	1105
Control	1076	1257	934	896	1208	826	1033
Mean	1083	1350	992	918	1220	856	
CD (p=0.05)	Fertility Levels (F) = NS; Biofertilizers (BF) = 150; FxBF= NS						
DOS: Nov. 28; Recommended fertility levels NPK (kg/ha) - 60:30:30							
Bawal							
100% RDF	2173	2156	2092	2135	2346	2057	2160
75% RDF	2022	2010	1954	1996	2187	1925	2015
Control	1708	1690	1626	1650	1864	1613	1692
Mean	1967	1952	1890	1929	2132	1865	-
CD (p=0.05)	Fertility Levels (F) = 112; Biofertilizers (BF) = 127; FxBF = NS						
DOS: Oct. 23; Recommended fertility levels NPKS (kg/ha) - 80:30:20:40							
Bharatpur							
100% RDF	2447	2499	2268	2521	2680	2275	2448
75% RDF	2283	2014	2194	2062	2341	1801	2116
Control	1322	1370	1291	1265	1430	1240	1320
Mean	2017	1961	1918	1949	2150	1772	
CD (p=0.05)	Fertility Levels (F) = 197; Biofertilizers (BF) = 121; BF at same level of F = 210; F at same or different level of BF= 271						
DOS: Oct. 20; Recommended fertility levels NPK (kg/ha) - 80:40:40							
Shillongani							
100% RDF	833	779	758	742	814	712	773
75% RDF	570	547	621	678	605	653	613
Control	447	340	378	369	373	458	394
Mean	610	557	586	596	597	608	
CD (p=0.05)	Fertility Levels (F) = 73; Biofertilizers (BF) = NS; FxBF = NS						
DOS: Nov. 28; Recommended fertility levels NPK (kg/ha) - 60:30:30							
Ludhiana							
100% RDF	2037	1929	1857	1955	2037	1884	1950
75% RDF	1778	1876	1791	1828	1844	1749	1811
Control	1302	1370	1442	1455	1346	1291	1368
Mean	1703	1725	1697	1746	1742	1641	
CD (p=0.05)	Fertility Levels (F) = 134; Biofertilizers (BF) = NS; FxBF = NS						
DOS: Nov. 12; Recommended fertility levels NPK (kg/ha) - 100:30:15							
Sriganganagar							
100% RDF	2509	2473	2366	2679	2493	2031	2425
75% RDF	2016	2335	2337	2138	2483	2250	2260
Control	1878	1966	2020	1882	2352	1755	1975
Mean	2134	2258	2241	2233	2442	2012	
CD (p=0.05)	Fertility Levels (F) = 260; Biofertilizers (BF) = 141; FxBF = 316						
DOS: Oct. 19; Recommended fertility levels NPKS (kg/ha) - 75:40:30:20							

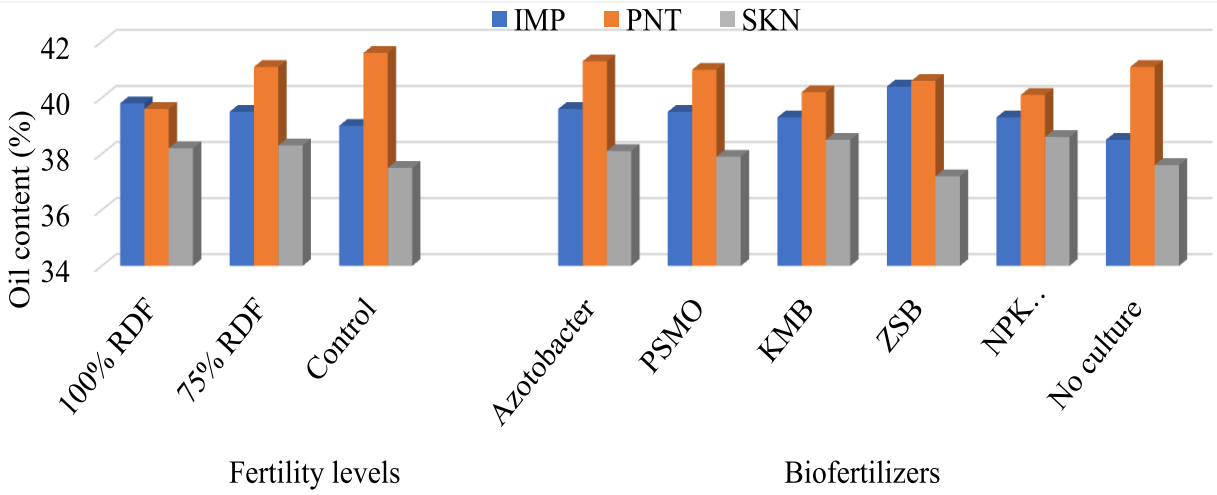

Fig. 3.5.1. Oil content (%) of mustard as influenced by different fertility levels and liquid biofertilizers.

Table 3.5.2. Net returns of mustard as influenced by different fertility levels and liquid biofertilizers.

Treatment	Net returns (Rs/ha)												
	CHT	KOT	VAR	KNK	LDH	BAW	KNG	MOR	BPR	DOL	SHL	PNT	SKN
Fertility levels													
100% RDF	67621	99787	83946	38330	77395	78684	71901	129620	95137	70870	21152	55013	87084
75% RDF	52828	74969	74628	26442	70444	71988	67255	123014	79273	64228	14542	54270	69130
Control	29933	52291	57576	596	44654	59671	22748	56661	41969	50314	5073	23718	57594
CD (p=0.05)	6619	10756	3030	3019	7820	5844	5342	-	11020	6490	4360	7111	15455
Biofertilizers													
Azotobacter	53719	72519	79216	20364	63677	70762	64724	118394	75267	58757	14838	51580	73717
PSMO	52356	80272	83960	22827	64953	69908	60532	109743	72058	60057	11764	46445	73523
KMB	49480	77779	66476	19156	63362	66567	47724	93979	69670	55623	12964	40910	71967
ZSB	46240	73889	61885	22696	66587	68545	52081	102275	71496	66548	13998	37313	70366
NPKconsortia+ZSB	55384	86475	86466	23592	66223	79714	56025	108499	82651	72890	13491	57957	69966
No culture	46584	63159	54296	22101	60185	65188	42721	85697	61615	56950	14478	31799	68079
CD (p=0.05)	3414	10740	7465	6108	NS	6523	2295	-	6578	5795	NS	5873	NS

Table 3.5.3. SoilOC, available NPKS & Znas influenced by different fertility levels and liquid biofertilizersafter harvest of mustard.

Treatment	OC (%)		N (kg/ha)						P (kg/ha)					
	DOL	SKN	KOT	BAW	DOL	PNT	SKN	IMP	KOT	BAW	DOL	PNT	SKN	IMP
Fertility levels														
100% RDF	0.57	0.26	292	127	171	222	185	287	56.9	11	14.3	13.8	55.4	24.2
75% RDF	0.54	0.26	267	119	164	197	184	320	43.2	10	14.1	12.1	53.9	23.6
Control	0.50	0.25	245	105	147	159	167	285	38.3	9	13.9	9.3	48.4	21.6
CD (p=0.05)	NS	NS	9	5	10	4	14	NS	2.8	NS	NS	0.7	3.8	NS
Biofertilizers														
Azotobacter	0.50	0.26	267	121	145	202	186	302	46.3	10	11.8	11.1	52.1	25.1
PSMO	0.49	0.26	269	117	168	192	183	313	47.4	11	14.1	12.4	54.7	27.3
KMB	0.54	0.26	267	115	152	186	178	302	46.9	10	14.4	11.8	54.1	22.3
ZSB	0.57	0.25	265	114	169	180	175	294	45.4	9	15.8	11.8	53.2	20.9
NPK consortia+ZSB	0.56	0.25	277	125	171	211	180	297	49.3	12	14.5	12.3	51.8	23.6
No culture	0.54	0.24	264	110	159	184	172	276	41.4	8	14.1	11.0	49.6	19.7
CD (p=0.05)	NS	0.02	8	3	12	7	NS	21	2.4	NS	2.1	NS	2.7	3.0
Initial value	0.50	-	305	138	150	235	-	-	55.5	15	13.3	20.1	-	-

Table 3.5.4. Soil available K, S and Zn as influenced by different fertility levels and liquid biofertilizers after harvest of mustard.

Treatment	K (kg/ha)						S (mg/kg)				Zn (mg/kg)		
	KOT	BAW	DOL	PNT	SKN	IMP	KOT	DOL	PNT	SKN	KOT	DOL	PNT
Fertility levels													
100% RDF	447	198	136	228	183	273	10.5	11.4	27.9	13.7	0.99	0.50	0.72
75% RDF	425	190	134	208	192	264	9.8	11.3	23.9	12.9	0.91	0.51	0.73
Control	389	179	131	184	202	257	9.0	11.5	14.8	12.7	0.82	0.49	0.50
CD (p=0.05)	22	7	NS	4	NS	NS	0.5	NS	2.4	NS	0.03	NS	0.01
Biofertilizers													
Azotobacter	414	188	116	209	189	263	9.5	11.2	21.8	12.9	0.90	0.44	0.70
PSMO	422	186	129	205	199	272	10.1	11.5	22.4	13.0	0.91	0.50	0.68
KMB	425	196	129	216	194	275	10.0	11.5	22.3	12.7	0.91	0.48	0.71
ZSB	417	186	146	199	194	274	9.6	11.4	22.8	13.3	0.91	0.59	0.82
NPK consortia+ZSB	432	202	144	218	192	267	10.2	11.3	21.4	12.9	0.92	0.55	0.78
No culture	411	176	137	192	186	238	9.4	11.4	22.4	13.8	0.88	0.44	0.69
CD (p=0.05)	11	4	17	3	NS	19	0.4	NS	NS	NS	0.03	0.06	0.02
Initial value	455	218	131	223	-	-	12.5	11.8	-	-	1.04	0.52	-

3.6 Optimization of mineral nutrient management for higher productivity

The experiment was initiated during 2022-23 at 18 locations (Table 3.6.1). Application of secondary (S) and micronutrients (Zn & B) and their enrichment with FYM significantly increased the seed yield of mustard at all the locations except at Ludhiana, Hisar and Shillongani (Table 3.6.1). Application of 20 kg S+2.5 kg Zn+0.5 kg B/ha enriched with 500 kg FYM/hasignificantly increased seed yield at Chatha (18%), Ranital (6%), Imphal (26%), Kanpur (6%), Pantnagar (4%), Sriganganagar (16%) and Dholi (12%) over the recommended dose (40 kg S+5 kg Zn+1 kg B/ha). Whereas, application of 40 kg S+5 kg Zn+1 kg B/ha enriched with 500 kg FYM/ha recorded markedly higher seed yield at Jhansi (6%), Kangra (9%), Morena (19%), Nagpur (7%), SK Nagar (16%), Kanke (2%) and Kota (1%)over recommended dose (40 kg S+5 kg Zn+1 kg B/ha). At Jobner, application of 40 kg S+5 kg Zn+1 kg B/ha recorded significantly higher seed yield over the half of recommended dose (20 kg S+2.5 kg Zn+ 0.5 kg B/ha). Application of higher dose 150% RDF significantly increased seed yield at Ranital, Jhansi, Kangra, Kanpur, Morena, Nagpur, SK Nagar, Sriganganagar and Dholi compared to control and 100% RDF. Whereas, 125% RDF at Chatha, Imphal, Jobner, Pantnagar, Shillongani over control and 100% RDF; and 100% RDF at Kanke, Ludhiana, and Hisar over control. Nutrient enrichment with FYM at recommended levels (40 kg S+5 kg Zn+1 kg B/ha enriched with 500 kg FYM/ha) markedly increased seed oil content at Hisar, Imphal, Pantnagar and SK Nagar over the no enrichment (Fig. 3.6.1). Application of 40 kg S+5 kg Zn+1 kg B/ha enriched with 500 kg FYM/ha increased net returns significantly at Jobner, Kanpur, Kota, Chatha, Jhansi, Morena, Nagpur, Kanke, Kangra and Dholi, however, increased non-significantly at Ludhiana, Pantnagar, Shillongani and SK Nagar (3.6.2). Soil OC, N, P, K, S, Zn and B content were also analysed and found higher with the use of 40 kg S+5 kg Zn+1 kg B/ha enriched with 500 kg FYM/ha compared to no enrichment (Table 3.6.3, 3.6.4 & 3.6.5).

Table 3.6.1. Seed yield of mustard as influenced by different nutrient management options.

Major nutrients (M)	Secondary & micro nutrients (SM)				Mean
	20 kg S+2.5 kg Zn+ 0.5 kg B/ha	40 kg S+5 kg Zn+1 kg B/ha	20 kg S+2.5 kg Zn+0.5 kg B/ha enriched with 500 kg FYM/ha	40 kg S+5 kg Zn+1 kg B/ha enriched with 500 kg FYM/ha	
Chatha					
Control	850	943	1050	1078	980
100% NPK	1225	1287	1650	1702	1466
125% NPK	1400	1450	1763	1820	1608
150% NPK	1492	1620	1812	1867	1698
Mean	1242	1325	1569	1617	
CD (p=0.05)	Major nutrients (M) = 97; Secondary & micro nutrients (SM) = 96; MxSM = NS				
DOS: Oct 24; Recommended fertility levels NPK (kg/ha) - 80:40:20					
Ranital (Previously Bhubaneswar)					
Control	402	408	491	543	461
100% NPK	841	887	939	929	899
125% NPK	964	956	973	989	970
150% NPK	949	992	1036	1093	1017
Mean	789	811	859	888	
CD (p=0.05)	Major nutrients (M) = 95; Secondary & micro nutrients (SM) = 46; MxSM = NS				
DOS: Dec. 02; Recommended fertility levels NPK (kg/ha) – 80:40:40					
Imphal					

Control	806	826	1021	901	889
100% NPK	814	844	1028	958	911
125% NPK	854	1010	1326	1271	1115
150% NPK	813	836	1060	992	925
Mean	821	879	1109	1031	
CD (p=0.05)	Major nutrients (M) = 138; Secondary & micro nutrients (SM) =; 128; MxSM = NS				
DOS: Nov. 28; Recommended fertility levels NPK (kg/ha) – 60:30:30					
Jhansi					
Control	1402	1799	1733	1852	1696
100% NPK	2130	2262	2183	2421	2249
125% NPK	2460	2870	2738	3069	2784
150% NPK	2659	3228	3188	3399	3118
Mean	2163	2540	2460	2685	
CD (p=0.05)	Major nutrients (M) = 381; Secondary & micro nutrients (SM) = 145; MxSM = NS				
DOS: Oct 22; Recommended fertility levels NPK (kg/ha) - 120:60:60					
Jobner					
Control	1173	1325	1201	1348	1262
100% NPK	1558	1696	1594	1724	1643
125% NPK	1732	1861	1761	1886	1810
150% NPK	1795	1921	1816	1954	1871
Mean	1564	1701	1593	1728	
CD (p=0.05)	Major nutrients (M) = 133; Secondary & micro nutrients (SM) = 107; MxSM = NS				
DOS: Oct 22; Recommended fertility levels NPK (kg/ha) – 60:40:00					
Kangra					
Control	421	515	660	810	602
100% NPK	1679	1771	1920	1990	1840
125% NPK	2020	2087	2093	2143	2086
150% NPK	2187	2250	2219	2258	2229
Mean	1577	1656	1723	1800	1689
CD (p=0.05)	Major nutrients (M) = 100; Secondary & micro nutrients (SM) = 48; SM at same level M = 105; M at same or different levels SM = 129				
DOS: Oct 12; Recommended fertility levels NPK (kg/ha) – 120:60:60					
Kanke					
Control	607	635	609	693	636
100% NPK	1270	1395	1254	1365	1321
125% NPK	1307	1340	1304	1386	1334
150% NPK	1404	1412	1342	1421	1395
Mean	1147	1196	1127	1216	
CD (p=0.05)	Major nutrients (M) = 101; Secondary & micro nutrients (SM) = 80; MxSM = --				
DOS: Nov. 17; Recommended fertility levels NPK (kg/ha) – 80:60:40:20					
Kanpur					
Control	1170	1238	1276	1299	1246
100% NPK	1333	1448	1619	1771	1543
125% NPK	2057	2190	2362	2438	2262
150% NPK	2552	2628	2705	2743	2657
Mean	1778	1876	1990	2063	

CD (p=0.05)	Major nutrients (M) = 62; Secondary & micro nutrients (SM) = 81; MxSM = NS				
DOS: Oct 21; Recommended fertility levels NPK (kg/ha) – 100:60:60					
Kota					
Control	1438	1691	1606	1635	1593
100% NPK	2654	2653	2642	2778	2682
125% NPK	2608	2886	2762	2922	2795
150% NPK	2908	2990	2972	3000	2967
Mean	2402	2555	2495	2584	
CD (p=0.05)	Major nutrients (M) = 209; Secondary & micro nutrients (SM) = 173; MxSM = NS				
DOS: Oct 16; Recommended fertility levels NPK (kg/ha) - 100:50:30					
Ludhiana					
Control	1487	1592	1533	1648	1565
100% NPK	2161	2213	2198	2226	2200
125% NPK	2215	2302	2316	2296	2282
150% NPK	2317	2389	2352	2411	2367
Mean	2045	2122	2096	2150	
CD (p=0.05)	Major nutrients (M) = 189; Secondary & micro nutrients (SM) = NS; MxSM = NS				
DOS: Nov 15; Recommended fertility levels NPK (kg/ha) – 100:30:15					
Morena					
Control	1180	1353	1520	1701	1439
100% NPK	1793	1908	2015	2121	1959
125% NPK	2010	2260	2567	2715	2388
150% NPK	2245	2490	2733	2979	2612
Mean	1807	2003	2209	2379	
CD (p=0.05)	Major nutrients (M) = 104; Secondary & micro nutrients (SM) = 55; SM at same level of M = 118; M at same or different level of SM = 140				
DOS: Oct. 30; Recommended fertility levels NPKS (kg/ha) - 80:40:20					
Nagpur					
Control	893	899	910	917	905
100% NPK	974	970	977	989	978
125% NPK	1082	1117	1124	1131	1114
150% NPK	1193	1218	1259	1477	1287
Mean	1036	1051	1068	1128	
CD (p=0.05)	Major nutrients (M) = 79; Secondary & micro nutrients (SM) = 24; MxSM = NS				
DOS: Oct 25; Recommended fertility levels NPKS (kg/ha) - 80:40:40:20					
Pantnagar					
Control	974	989	1047	1019	1007
100% NPK	2028	2047	2092	2102	2068
125% NPK	2168	2225	2222	2230	2211
150% NPK	1961	2072	2024	2103	2040
Mean	1783	1833	1846	1864	
CD (p=0.05)	Major nutrients (M) = 176; Secondary & micro nutrients (SM) = 56; MxSM = NS				
DOS: Oct. 29; Recommended fertility levels NPK (kg/ha) – 120:40:20					
SK Nagar					
Control	1394	1515	1316	1428	1413
100% NPK	1782	1747	1952	1860	1835

125% NPK	2295	1564	1741	2268	1967
150% NPK	2060	2222	2443	2641	2341
Mean	1882	1762	1863	2049	
CD (p=0.05)	Major nutrients (M) = 259; Secondary & micro nutrients (SM) = 194; MxSM = 388				
DOS: Oct 18; Recommended fertility levels NPK (kg/ha) – 50:50:00					
Shillongani					
Control	386	386	486	452	428
100% NPK	613	600	636	681	632
125% NPK	750	825	796	789	790
150% NPK	1001	772	798	817	847
Mean	687	646	679	685	0
CD (p=0.05)	Major nutrients (M) = 142; Secondary & micro nutrients (SM) = NS; MxSM = NS				
DOS: Nov. 13; Recommended fertility levels NPK (kg/ha) - 60-30-30					
Sriganganagar					
Control	1665	1626	1977	2146	1854
100% NPK	2071	2535	2411	2325	2336
125% NPK	2033	2125	2630	2711	2375
150% NPK	2254	2582	2305	2485	2407
Mean	2006	2217	2331	2417	
CD (p=0.05)	Major nutrients (M) = 205; Secondary & micro nutrients (SM) = 181; MxSM = 361				
DOS: Oct. 19; Recommended fertility levels NPK (kg/ha) – 75:40:30					
Dholi					
Control	1144	1122	1209	1220	1174
100% NPK	1694	1745	1808	1909	1789
125% NPK	1769	2081	2281	2349	2120
150% NPK	2228	2319	2330	2345	2306
Mean	1709	1817	1907	1956	
CD (p=0.05)	Major nutrients (M) = 187; Secondary & micro nutrients (SM) = 102; MxSM = 237				
DOS: Nov 03; Recommended fertility levels NPK (kg/ha) – 80:40:40					
Hisar					
Control	1953	1891	2231	1836	1978
100% NPK	2249	2555	2547	2665	2504
125% NPK	2613	2564	2536	2571	2571
150% NPK	2402	2320	2509	2547	2444
Mean	2304	2333	2456	2405	
CD (p=0.05)	Major nutrients (M) = 290; Secondary & micro nutrients (SM) = NS; MxSM = NS				
DOS: Oct. 22; Recommended fertility levels NPK (kg/ha) – 80:30:20					

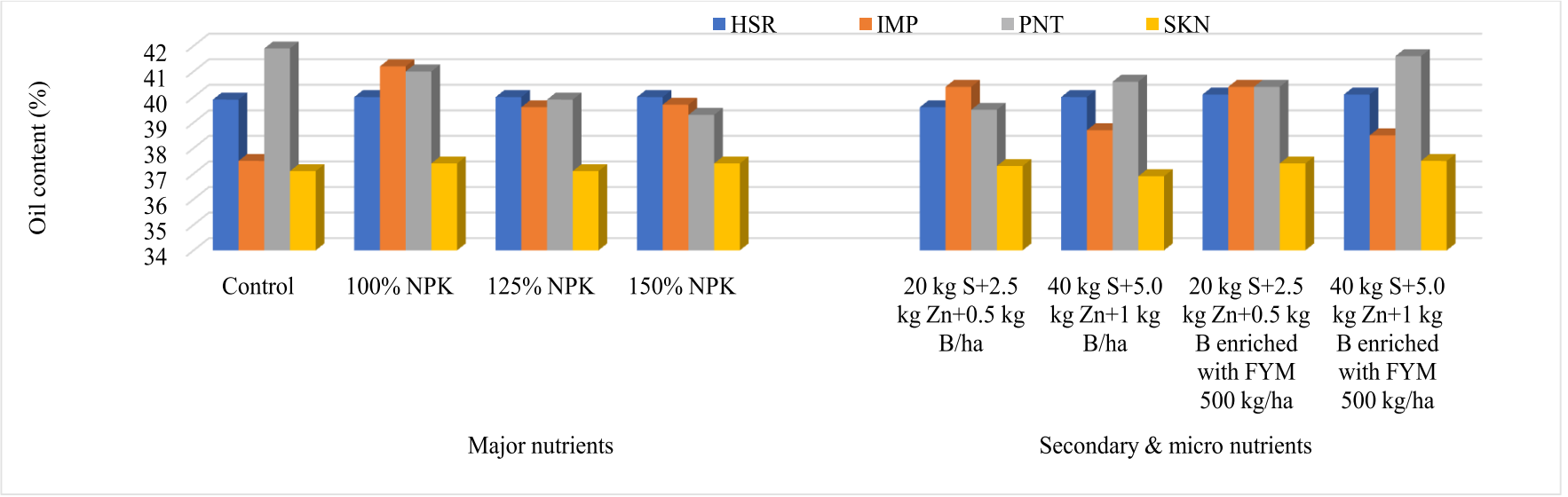

Fig. 3.6.1. Oil content (%) of mustard as influenced by different nutrient management options.

Table 3.6.2. Net returns of mustard as influenced by different nutrient management options.

Treatments	Net return (Rs./ha)													
	JOB	KPR	KOT	CHT	JHS	MOR	NGP	LDH	PNT	KNK	KNG	SHL	SKN	DOL
Major nutrients														
Control	42846	39403	65498	34542	56702	56814	47952	51179	24434	4659	9508	5261	39323	29752
100% NPK	61016	55598	123344	57365	80392	83993	51808	87349	77486	36439	67100	12893	58263	58918
125% NPK	69451	94786	127573	64244	107966	108875	59020	92048	84147	34624	78711	21183	64611	76843
150% NPK	72138	116325	134554	68175	124545	121336	68207	96850	73619	36444	84707	23429	84184	87231
CD (p=0.05)	7270	-	11369	5311	20741	-	4183	10376	9590	5218	5448	8530	14105	9187
Secondary & micro nutrients														
20 kg S +2.5 kg Zn+ 0.5 kg B/ha	57608	70453	106278	47038	77478	73063	54899	80098	64260	27578	55352	18001	63386	57322
40 kg S +5.0 kg Zn+ 1 kg B/ha	63853	74187	112767	49265	95867	82890	55703	82101	64281	29721	57331	13971	53258	60660
20 kg S +2.5 kg Zn+ 0.5 kg B/ha enriched with 500 kg FYM/ha	58911	79257	111111	63864	93080	97118	56582	82163	66471	25448	62732	15981	61574	67458
40 kg S +5.0 kg Zn+ 1 kg B/ha enriched with 500 kg FYM/ha	65079	82214	114112	64160	103180	105388	59802	83064	64675	29418	64611	14811	68164	67304
CD (p=0.05)	5809	-	9408	5247	7895	-	1253	NS	NS	3789	2606	NS	NS	5660

Table 3.6.3. Soil organic carbon and available nitrogen content as influenced by different nutrient management options in mustard at harvest.

Treatment	Soil organic carbon (%)				N (kg/ha)							
	JHS	SKN	NGP	PNT	KOT	IMP	JHS	PNT	SKN	DOL	JOB	NGP
Major nutrients												
Control	0.36	0.21	0.27	0.69	258	329	150	183	149	160	128	215
100% NPK	0.39	0.21	0.31	0.70	295	345	155	200	152	165	130	226
125% NPK	0.41	0.23	0.32	0.70	303	347	166	207	166	165	131	237
150% NPK	0.43	0.24	0.34	0.71	312	351	171	213	169	168	131	248
CD (p=0.05)	0.03	NS	NS	NS	8	NS	4	8	15	NS	NS	NS
Secondary & micro nutrients												
20 kg S +2.5 kg Zn+ 0.5 kg B/ha	0.36	0.21	0.30	0.69	283	310	155	195	153	160	129	224
40 kg S +5.0 kg Zn+ 1 kg B/ha	0.38	0.22	0.31	0.70	293	344	162	197	161	163	130	228
20 kg S +2.5 kg Zn+ 0.5 kg B/ha enriched with 500 kg FYM/ha	0.41	0.23	0.32	0.70	289	358	161	205	162	166	129	234
40 kg S +5.0 kg Zn+ 1 kg B/ha enriched with 500 kg FYM/ha	0.43	0.22	0.33	0.70	296	360	163	206	161	170	130	241
CD (p=0.05)	0.03	NS	NS	NS	8	25	2	3	NS	NS	NS	NS
Initial values	0.34	-	-	0.53	305	-	159	238	-	-	129	-

Table 3.6.4. Soil available phosphorus and potassium as influenced by different nutrient management options in mustard at harvest.

Treatment	P (kg/ha)								K (kg/ha)							
	KOT	IMP	JHS	PNT	SKN	DOL	JOB	NGP	KOT	IMP	JHS	PNT	SKN	DOL	JOB	NGP
Major nutrients																
Control	41.4	23.2	8.3	10.9	57.0	13.9	16.4	20.7	405	214	179	180	211	127	158	348
100% NPK	56.9	24.0	9.0	12.1	55.6	15.8	17.3	21.8	444	222	186	201	219	130	162	353
125% NPK	60.8	24.0	10.1	12.5	58.6	15.9	18.4	22.5	458	228	197	214	208	132	163	361
150% NPK	65.5	24.3	10.6	14.7	57.3	16.4	18.7	23.1	468	225	203	233	222	135	166	364
CD (p=0.05)	2.9	NS	0.4	1.0	NS	NS	1.2	NS	14	NS	4	12	NS	NS	5	NS
Secondary & micro nutrients																
20 kg S +2.5 kg Zn+ 0.5 kg B/ha	50.7	23.0	9.0	12.0	56.0	15.1	17.4	21.8	434	208	186	199	215	130	161	351
40 kg S +5.0 kg Zn+ 1 kg B/ha	57.4	23.5	9.7	12.1	56.5	15.2	17.8	22.1	447	219	192	197	214	131	162	353
20 kg S +2.5 kg Zn+ 0.5 kg B/ha enriched with 500 kg FYM/ha	54.0	24.3	9.4	12.9	57.7	15.8	17.7	22.1	440	226	191	217	221	132	162	358
40 kg S +5.0 kg Zn+ 1 kg B/ha enriched with 500 kg FYM/ha	58.7	24.8	9.8	12.2	58.4	16.0	17.8	22.2	450	235	194	216	209	133	163	364
CD (p=0.05)	2.7	1.4	0.2	0.5	NS	NS	NS	NS	7	11	1	10	NS	NS	NS	NS
Initial values	55.5	-	9.4	20.7	-	-	16.8	-	455	-	188	228	-	-	161	-

Table 3.6.5. Soil available sulphur, zinc and boron as influenced by different nutrient management options in mustard at harvest.

Treatment	S (mg/kg)					Zn (mg/kg)				B (mg/kg)			
	PNT	DOL	SKN	JHS	KOT	PNT	DOL	JHS	KOT	PNT	DOL	JHS	KOT
Major nutrients													
Control	15.2	10.5	12.8	5.8	9.5	0.86	0.52	0.25	0.85	0.59	0.39	1.52	0.44
100% NPK	13.3	10.9	13.7	6.1	11.2	0.84	0.51	0.29	1.04	0.57	0.40	1.56	0.62
125% NPK	12.8	10.5	14.1	6.7	11.5	0.83	0.51	0.35	1.10	0.56	0.39	1.61	0.65
150% NPK	11.8	10.7	14.6	7.0	11.5	0.81	0.51	0.37	1.03	0.54	0.40	1.65	0.66
CD (p=0.05)	0.5	NS	NS	0.1	0.6	0.01	NS	0.02	0.04	0.01	NS	0.02	0.03
Secondary & micro nutrients													
20 kg S +2.5 kg Zn+ 0.5 kg B/ha	12.9	10.9	13.2	6.2	10.0	0.82	0.51	0.29	0.94	0.54	0.40	1.56	0.5
40 kg S +5.0 kg Zn+ 1 kg B/ha	13.3	10.6	14.0	6.5	11.1	0.82	0.51	0.32	1.02	0.56	0.39	1.59	0.59
20 kg S +2.5 kg Zn+ 0.5 kg B/ha enriched with 500 kg FYM/ha	13.1	10.5	14.4	6.4	10.9	0.83	0.52	0.31	1.01	0.57	0.39	1.58	0.59
40 kg S +5.0 kg Zn+ 1 kg B/ha enriched with 500 kg FYM/ha	13.8	10.7	13.7	6.6	11.3	0.85	0.52	0.34	1.03	0.59	0.40	1.61	0.63
CD (p=0.05)	0.4	NS	0.7	0.1	0.5	0.01	NS	0.01	0.04	0.01	NS	0.01	0.04
Initial values	11.6	-	-	5.4	12.5	0.64	-	0.27	1.04	1.71	-	1.49	-

Plant Pathology

4. Plant Pathology

Disease Scenario

During 2022-23, moderate to severe occurrence of Alternaria blight and white rust diseases was recorded at six locations. Low to moderate incidence of downy mildew was observed at the cotyledonary stage at MOR and PNT. Powdery mildew severity was moderate (BPR) to high (SKN, JAG, PNT and MOR). Moderate to severe incidence of Sclerotinia rot was observed at HSR and BPR while low at DOL and MOR. Different trials were sown as per technical program on dates as given below:

Centre	Date of sowing of different trials								
	4.1	**4.2**	**4.3**	**4.4**	**4.5**	**4.6**	**4.7**	**4.9**	**4.10**
PNT	28.10.2022 (A and B)	28.10.2022	29.10.2022	29.10.2022	29.10.2022	29.10.2022	-	21.10.2022	21.10.2022
HSR	13.11.2022 (A and B)	13.11.2022	14.11.2022	14.11.2022	14.11.2022	14.11.2022	-	13.11.2022	13.11.2022
LDH	03.11.2022 (A and B)	03.11.2022	03.11.2022	03.11.2022	03.11.2022	29.10.2022	-	03.11.2022	03.11.2022
NDH	-	07.11.2022	-	-	-	-	-	-	-
MOR	22.11.2022 (A and B)	23.11.2022	-	23.11.2022	-	-	-	23.10.2022	-
SKN	22.11.2022 (A)	22.11.2022	-	-	-	22.11.2022	-	-	22.11.2022
JAG	-	02.11.2022	02.11.2022	-	-	-	02.11.2022	-	-
DOL	20.10.2022 (A and B)	20.10.2022	-	-	20.10.2022	14.11.2022	14.11.2022	17.10.2022	-
SHL	03.11.2022 (A and B)	03.11.2022	04.11.2022	11.11.2022	04.11.2022	05.11.2022	-	15.11.2022	20.11.2022
BPR	29.10.2022 (A) 2.11.2022 (B)	-	-	2.11.2022	29.10.2022	-	-	3.11.2022	29.10.2022
JHS	-	05.11.2022	-	-	05.11.2022	-	-	28.10.2022	28.10.2022
KPR	-	-	-	-	-	23.11.2022	-	-	-
MDR	-	20.10.2022	-	-	-	20.10.2022	-	-	-
NGP	-	22.11.2022	-	-	-	22.11.2022	-	-	-
VAR	-	18.11.2022	-	-	18.11.2022	-	19.11.2022	-	-

4.1. Screening of AVT-1 and AVT-2 *Brassica* breeding material

Natural conditions: DOL, SHL, HSR, MOR, PNT and LDH

Artificial conditions: **AB:** DOL, SHL, PNT, HSR, LDH, BPR;
WR: PNT, HSR, MOR, BPR and LDH; **DM:** MOR, PNT
SR: LDH, HSR, PNT, DOL and BPR

Total 68 breeding lines/checks including 38 Indian mustard, 2 Gobhi Sarson, 16 checks of breeding trials and 12 susceptible and resistant/ tolerant checks were sown in single 3-m row in randomized completely block design (RCBD) with 2 replications. Under artificial conditions, repeated inoculation was done after collecting inoculum from naturally infected plants with AB and WR diseases to facilitate the secondary spread of the pathogen. For SR disease screening, 5 mm disc of 7-days fresh fungal mycelium was placed on third internode of plant at flowering stage.

Observations of DM (20 DAS), WR, AB on leaves (ABL), PM and SR (% incidence) were recorded at 90-100 days after sowing (DAS) depending upon location under natural and artificial conditions. Staghead incidence and Alternaria pod blight (ABP) severity were recorded 15-days before harvest (table 4.1.1-5). Disease severity was < 20% in susceptible or > 20% in resistant checks observed at BPR (ABL, WR), MOR (ABL, ABP), HSR (ABP), MOR, DOL (SR), therefore, data excluded from tables. All disease data recorded in per cent were converted as arc sin transformation value and analysed using ANOVA. None of the entries showed tolerance/resistance to AB, PM and SR.

WR: DRMR 2018-19, DRMRIJ 20-157, IJ 19R5004, PDZ 14, DRMR 2018-37, DRMRCI (Q) 47, PDZ 15, PDZ 16, DRMR 2018-25 entries of *B. juncea* were found resistant to WR under both natural (Rohini 30.5%, NRCHB 101 30.0%) (Table 4.1.2) and artificial conditions (Rohini 32.2%, NRCHB 101 37.6%) (Table 4.1.5) at HSR, MOR, LDH, BPR and PNT locations.

4.2. Uniform Disease Nursery for major diseases

Locations: SHL, MOR, DOL, NDH, PNT, HSR, JAG, LDH, VAR, JHS and SGN.

Total 44 entries of *B. juncea* and 9 checks, were sown in a single 3-m row with two replications in RCBD. Susceptible checks were sown after every two test rows. Observations on AB, WR, DM, PM severity and SR incidence were recorded in UDN under natural conditions (Tables 4.2.1-2).

WR: DRMRDR 2135 (2 years), DRMRSJ 14, DRMRCI 169, DRMRSJ 9, DRMR 2018-26, DRMR 2020-15, DRMRDR 2133, PAB 2017-25, DRMRCI (Q) 57, DRMRCI 153, DRMRCI 170, DRMRSJ 12, PAB 2017-22, DRMRCI 171, and DRMR 2019-15 of *B. juncea* showed resistance reaction to WR under natural conditions with mean disease severity <10%, and the highest WR severity was on check Rohini (31.1%) and NRCHB 101 (25.0%) at HSR, NDH, SKN, JHS locations (Table 4.2.2). Data received from MOR, MDR, PNT and JAG were excluded for WR due to disease severity below 20% in susceptible or above 20% in resistant checks.

AB: PAB 2017-25 (16.9; 10.1%), DRMRSJ 22 (19.8; 19.0), PAB 2017-1 (19.2, 13.9), PRD-2014-26 (16.2; 13.0%), PAB-2017-22 (17.1; 9.6%), and PAB-2017-4 (16.1; 10.9%) showed tolerant reaction to AB both on leaves and silique in comparison to tolerant PHR-2 (16.8%; 16.2%) and susceptible Rohini (27.5; 20.7%), NRCHB 101 (31.0; 25.1%) checks under natural condition at 10 locations.

4.3 National Disease Nursery (NDN) for Alternaria blight

Locations: PNT, DOL, HSR, LDH, MOR, VAR, KPR, JAG and SHL.

Total 27 strains of *B. juncea* including 8 checks were sown in paired row of 3 m length. Observation on AB was recorded on leaves 90/100 DAS and on silique 15-days before harvesting under artificial inoculation conditions at SHL, PNT, LDH, HSR and JAG. Data of JAG and LDH were excluded as the disease severity was <20% on susceptible or higher in tolerant check consecutively for second year. Reaction to AB, WR, DM, PM and SR was recorded from the trial (Table 4.3.1).

AB: DRMR-PMJ 17(16.1; 16.0%) showed tolerance to AB on leaves and silique, respectively. PAB 2017-20 (17.5; 16.7%) also showed tolerant reaction to AB on leaves and silique over check Rohini (36.2; 28.0 %) and NRCHB 101 (24.2; 25.7%) under artificial condition at HSR, PNT, and SHL locations.

WR: Entries of *B. juncea,* DRMR 2018-19 (3 years), DRMRIJWR 20-11, and DRMRSJ 349 were immune to WR. While, PAB 2014-8 (2 years), DRMRIJWR 20-16, RH 1700-3, PAB 2014-7, PAB 2017-15 and DRMR-PMJ-17 were found resistant to WR (Table 4.3.1).

4.4 National Disease Nursery (NDN) for white rust

Locations: PNT, MOR, HSR, BPR and LDH (artificial condition)

Total 58 genotypes of Indian mustard with 9 checks, were sown in paired-row of 3 m length between susceptible checks. Observation for WR on leaves and stag head formation was recorded at 100 DAS under artificial inoculation conditions. Reaction to AB, PM, SR and DM was also recorded under natural conditions (Table 4.4.1-2).

WR: Total 17 Entries of *B. juncea*, DRMR 2018-41 (5 years), RH 1700, RH 1700-1 (4 years), RH 1700-4, DRMRCI 131, DRMRCI 132, DRMRM 18-36-12, DRMRM 18-37-13, DRMR 18-35-11, DRMR 2018-19, (3 years), DRMRCI 139, DRMRDR 2141, DRMRSJ 349, DRMRSJ 206, DRMR 2018-1, PDZ 16, DRMRDR 2195, (2 years) showed immune/ resistant reaction to WR at PNT, HSR, MOR and BPR locations under artificial conditions. Other 28 strains which showed resistance to WR with <10% disease severity were DRMRDR 2155, DRMRDR 2196, DRMRDR 2151, DRMRDR 2152, DRMRIJWR-20-12, DRMRIJWR-20-13, DRMRIJWR-20-14, DRMRIJWR-20-15, DRMRIJWR-20-17, DRMRIJWR-20-18, DRMRIJWR-20-19, DRMRIJWR-20-20, DRMRIJWR-20-21, DRMRIJWR-20-23, DRMRIJWR-20-24, DRMRIJWR-20-26, DRMRIJ-12-44, DRMRIJ-12-37, DRMRDR 2235, DRMRM 163, PMAS A 2010, PAB 14-18, DRMRDR 2135, DRMRDR 2143, PAB 14-8, PAB 14-7, JC 36, DRMRIJ 20-11 at HSR, MOR, PNT, BPR locations (Table 4.4.2).

4.5 National Disease Nursery (NDN) for Sclerotinia rot

Locations: PNT, HSR, LDH, BPR, VAR, SHL, and JHS

Total 12 entries of *B. juncea* and 6 checks were sown in paired rows of 3 m length between susceptible check (Rohini, NRCHB 101 and NRCYS-5-2) and tolerant check NPC 16. Stem inoculation was done to ensure uniform SR infection. Per cent SR incidence was recorded prior to harvest and mean lesion size (cm) was also measured 3-weeks after artificial inoculation. In addition, reaction to AB, WR and PM was also recorded (Table 4.5.1-2).

None of the entries of *B. juncea* showed tolerance to SR, where the disease incidence was lowest in DRMRIS 20-1 (46.9%) with lowest lesion size 14.7 cm compared to maximum incidence and lesion length in checks NRCHB 101 (63.5%; 23.6 cm) and NRCYS-05-2 (72.6%; 27.6 cm). While, DRMRIS 20-11 of *B. juncea* showed resistance to WR (4 location).

4.6 Screening of IVT entries of Brassica against different diseases

Locations: DOL, SHL, PNT, HSR, LDH, KPR, MDR, SKN and NGP

Total 163 strains including 10 susceptible and resistant checks and 25 LR, ZC, NC, hybrid, quality checks were sown in single 3m row in RCBD with 2 replications. Observation on AB, WR, DM, SR and PM was recorded. Staghead incidence and AB severity on pod was recorded 15-days before harvesting. Entries showing resistant/tolerant/susceptible reaction to AB, WR, DM and PM under natural conditions are listed in Table 4.6.1-2. Data from HSR (ABL & ABP), DOL (ABL), PNT (WR & PM), LDH, MDR, KPR (WR) excluded due to disease severity >20% in resistant/tolerant and <20% in susceptible checks. None of the entry was found tolerant/ resistant to AB, SR and PM.

WR: DRMRCI-160 (5.6%), RHH 2202 (6.4%), Q 90007 (6.1%), DRMRCI(Q) 172 (5.9%), PMAS 11 (3.4%), PDZ 18 (1.1%), PDZ 19 (0.6%) of *B. juncea* were found resistant to WR (Table 4.6.2).

4.7 Assessment of yield loss and management of AB in rice-fellow mustard cropping system

An experiment was conducted to asses the yield losses caused by the major diseases of rapesed-mustard under rice-fellow-mustard cropping system at SHL, JAG, DOL and VAR locations using cv. Varuna. Trial failed at SHL due to heavy rains (168.8mm) during third week of October. Among different teatments at VAR, JAG and DOL, the foliar spray of Tebuconazole 50%+ trifloxistrobin 25% WG @ 0.5g/l gave maximum 71.5% reduction of AB disease over check with incrased yield by 57.8, 41.8, and 49.7 % respectively, for third season followed by Iprodione 50WP-FS @ 0.2% which gave 62.4% ABL disease reduction. Seed treatment alonwith foliar spray of garlic bulb extract @ 1% w/v, and *T. harziamum* also found efective in reducing the AB severity by 48.3% and 45.0% respectively, over check (Table 4.7.1). Based on three years data, it is concluded that foliar spray of Tebuconazole 50%+ trifloxistrobin 25% WG @ 0.5g/l at 40 and 70 days after sowing may be beneficial for the management of AB under rice-fellow-mustard cropping system. The seed treatment alonwith foliar spray of garlic bulb extract @ 1% w/v, and *T. harziamum* @ 10g/kg seed was also effective in reducing the AB and could be used as one of the component of natural farming. Based on 3 years data, the average yield losses caused by AB disease was 49.8 per cent in mustard under rice-fellow-mustard cropping system at DOL, JAG and VAR.

4.8 Epidemiology of DM, WR, AB, SR and PM diseases of Indian mustard

Experiment on epidemiological studies of rapeseed-mustard diseases was conducted at HSR, PNT, SHL, SKN, JAG, DOL, and JHS using cv. Varuna and local variety sown on 8 different dates starting from October 01 to November 19 at weekly interval without adopting any protection measures against pest and diseases (Table 4.8.1-8). Data for initial appearance of diseases followed by per cent disease severity/incidence was recorded in each plot twice a week on Tuesday and Friday till harvest.

HSR

Experiment was conducted with 8 dates of sowing using Varuna and RH 30 cultivars of mustard. Initial two dates of sowing on Oct 01 and Oct 08 were failed due to heavy rains in the last week of September. WR appeared first at 38 DAS which was 15 days early than last year (53 DAS) on Nov 19 sown RH 30, which further increased upto 118 DAS on Nov 5 sown crop of both the cultivars (Table 4.8.1A). Staghead formation observed first at 83 DAS on both Varuna and RH 30 on Nov 19 sown crop which was 2 day earlier than last year (Table 4.8.1B). AB appeared first 86 DAS on Nov 19 sown RH 30 (Table 4.8.1C). SR disease initiation was observed 68 DAS in Nov 19 sown RH 30 and 69 DAS in Nov 12 sown Varuna. Maximum incidence was 22.1 % in Oct 29 sown RH 30 which was 46.7% in RH 30 and 44.8% in Varuna sown on Nov 05 (Table 4.8.1D). While, the maximum yield 2612 kg/ha was of Varuna and 2501 kg/ha of RH 30 in Oct 15 sown crop (Table 4.8.1C).

SHL

Experiment was laid out with cv. Varuna and TM 2 sown on 8 dates starting from Oct 01 to Nov 19 at weekly intervals. Due to heavy rains during first week of October, crop was not sown on Oct 01, Oct 08 and Oct 15 dates. Data concluded that the sowing of mustard crop may be delayed in Assam as the rains occurred in first fortnight of October. White rust severity was minimum at SHL. ABL observed first on leaves at 34 DAS and on silique at 83 DAS on Nov 19

sown TM 2, while ABP appeared at 104 DAS on Oct 22 sown crop. Maximum disease severity was 38.9% (100 DAS) on Nov 19 sown cv TM 2 (Table 4.8.3). Maximum yield was recorded in Nov 05 sown cv Varuna (1667 kg/ha) and 1093 kg/ha of TM 2 sown on Nov 05. Yield data revealed that the best sowing time of crop in the region could be last week of October as the yield drastically influenced with sowing time (Table 4.8.4).

SKN

Experiment was laid out with cv. Varuna and GM 2 sown at 8 sowing dates starting from Oct 01 to Nov. 19 at weekly intervals. Powdery mildew disease first appeared at 56 DAS instead of 88, 89 DAS, 79 DAS, 83 DAS, 76 DAS during 2021-22, 2020-21, 2019-20, 2018-19, 2017-18, respectively on Nov 19 sown both Varuna and cv. GM 2. The maximum disease severity was observed in Nov 19 sown cv. Varuna (96.5%) and GM 2 (92.0%), which clearly indicate that late sown crop encountered with higher PM incidence. Consequently, the maximum seed yield reduction was observed in late sown crop (Table 4.8.4B). Highest yield was observed in Oct 01 sown GM 2 (2030kg/ha) and Varuna (1950kg/ha). WR was observed first 57 DAS on Varuna and 56 DAS on GM 2 on Nov 19 sown crop which was maximum (23.5%) on Oct 22 sown crop (Table 4.8.4B).

JAG

Experiment on epidemiological studies of AB and PM was laid out with cvs. Varuna and CG Sarson as per technical programme. Initiation of AB was reported in Nov 12 sown crop of Varuna at 42 DAS and 45 DAS on CG Sarson. Highest ABL severity was 32.5% 100 DAS in Oct 01 sown crop of Varuna. PM appeared first at 75 DAS on Nov 19 sown Varuna (Table 4.8.5). Maximum yield (1700 kg/ha) was recorded in Oct 22 sown Varuna, while Nov 5 sown crop of CG Sarson yielded highest.

PNT

Two cultivars Varuna and Kranti were sown with weekly interval starting from Oct 01 to Nov 19 at eight different dates. Sowing was not done on Oct 15 due to water logged conditions in the field. Downy mildew disease first appeared 11 DAS on Oct 22, 29 sown both Varuna and Kranti cultivars (Table 4.8.6A). WR disease first appeared 46 DAS on Nov 19 sown crop (Table 4.8.6B) which was increased upto 50% on Oct 22 sown crop. AB disease was first noticed at 49 DAS on Nov 19 sown Kranti. Whereas, on Oct 01 sown crop, the disease appeared late i.e. 81 DAS (Table 4.8.2c).

DOL

Experiment was laid out at weekly intervals with 8 dates of sowing starting from Oct 01 to Nov 19 using cv. Varuna and Rajendra Suflam. AB was first observed at 43 DAS and 45 DAS on Varuna and Rajendra Suflam, respectively. The disease continued to progress on leaves up to 120 DAS on both the cultivars (Table 4.8.7).

JHS

Experiment was conducted with 8 sowing dates starting from Oct 01 to Nov 19 at weekly interval using Giriraj and Varuna varieties. WR appeared first at 56 DAS on Nov 19 sown Varuna (Table 4.8.8b) and highest 50% severity was observed in Nov 05 sown Giriraj. AB appeared first on leaves at 42 DAS on Nov 19 sown Varuna and seen on pods at 83 DAS on Nov 19 sown Varuna (Table 4.8.8A). PM initiated at 80 DAS in Nov 19 sown Varuna. Higher seed yield was obtained 2860 kg/ha in Oct 22 sown Giriraj.

4.9 Efficacy of fungicides against major rapeseed-mustard diseases

The experiment was conducted at HSR, JHS, MOR, DOL, BPR and PNT in plot size 3x5m with 30x10 cm spacing using the variety DRMRIJ 31 with three replications. Ten plants from each plot were tagged for recording observations on AB, WR, PM and SR severity/ incidence. Data revealed that AB severity was minimum (12.2% ABL; 13.2% ABP) in Tebuconazole 50% + Trifloxostrobin 25% WG@0.1% with 59.8 and 53.5% ABL & ABP reduction in comparison to control (32.3%) which was 19.1% ABL; 17.6% ABP and 34.5% in check during 2020-21 and 14.0% ABL; 13.4% ABP and 31.5% in check during 2021-22. All tested fungicides were also effective in reducing AB severity over control, both on leaves and pods (Table 4.9.1). Metalaxyl 4% + Mancozeb 64% @ 0.25% was found effective to minimize WR severity on leaf (10.5%) and staghead incidence (5.0%) in comparison to check (32.7%) constantly for three years. PM severity was observed minimum 30.2% in Tebuconazole 50% + Trifloxostrobin 25% WG@ 0.1% over control (50.2%). Both Propiconazole 25% EC @0.1% and Tebuconazole 50% + Trifloxostrobin 25% WG@0.1% were found effective in per cent reduction of SR incidence by 63.4% and 60.5%, respectively as compared to control (25.3% incidence). Consequently, the highest seed yield was 2226 kg/ha and 2108 kg/ha in Propiconazole 25% EC

@0.1% and Tebuconazole 50% + Trifloxostrobin 25%, respectively. Based on three years results, it is concluded that the foliar spray of Tebuconazole 50% + Trifloxostrobin 25% at 40 and 70 DAS could be effective in managing rapeseed-mustard diseases.

4.10 Bio-management of rapeseed-mustard diseases

Location: PNT, HSR, LDH, BPR, JHS, and SKN

The experiment on bio-management of rapeseed-mustard diseases was conducted at PNT, JHS, LDH, SHL, HSR, BPR, SKN centres with 6 treatments and 3 replications on 3x5 m size plots with 30x10 cm spacing using DRMRIJ 31 cultivar. Ten plants from each plot were tagged for recording observations on AB, WR, PM and SR severity/ incidence. Seed treatment (10g/kg) + foliar spray with *T. harzianum* at 60 and 75 DAS was found superior over check in per cent reduction of WR (30.3%), ABL (24.4%; ABP 18.7%), PM (32.9%) and SR (38.0%) (Table 4.10.1-2). Maximum average yield was 1816 kg/ha in seed treatment (10g/kg) + foliar spray with *T. harzianum* at 60 and 75 DAS which was at par with soil incorporation of *T. harzianum* with mustard straw @ 2.5t/ h (1835 kg/ha) which may be due to reduction of WR, PM and SR diseases. Results indicated that seed treatment (10g/kg) + foliar spray with *T. harzianum* at 60 and 75 DAS may be the best option for bio-management of rapeseed-mustard diseases.

Survey of farmer's field for disease outbreak

MOR

Survey was conducted during crop season at adjoining areas of Morena district. During this year disease appeared in late as compared to previous years. AB and WR first appeared in Dec, staghead formation in Feb, powdery mildew in Jan and Sclerotinia rot was first seen in Jan. The weather condition was not much favorable to disease at early stage of the crop growth but winter rains received during the month of Dec and Jan caused sever increase in all the diseases. The staghead and powdery mildew diseases were observed in most of the fields which was sown late.

SKN

Farmer's field survey was conducted to observe the disease outbreak in Moti Bhakhar, Vasda, Marwada and Ranawas villages. Farmer's mainly cultivated GDM 4 and varieties of private seed companies. White rust was observed in moderate form and powdery mildew was observed in severe form on late sown crops. On timely sown crops, White rust disease appeared during second fortnight of December (Dec 18) and 15-20 per cent severity was observed. Powdery mildew disease appeared during first fortnight of January month (Jan 10) and 20-35 per cent severity was observed.

Table 4.1.1: Reaction of AVT-I and AVT-II Brassica germplasm to Alternaria Blight under natural condition

Code No.	PC Unit code	Entry Name	% ABL (100 DAS)*							% ABP (15 days before harvest)*					
			HSR	MOR	PNT	SHL	DOL	Mean	LDH	HSR	PNT	SHL	DOL	LDH	Mean
SBG-22-01	MCN (OD)-22-11	KMR(E) 21-1	20.5	12.0	27.5	29.7	21.0	**22.1**	49.1	14.5	20.0	17.3	13.4	40.4	**21.1**
SBG-22-02	MCN (OD)-22-20	DRMRHT 13-13-5-4	12.8	22.0	20.0	28.7	22.4	**21.2**	56.5	10.6	22.5	15.7	21.4	38.7	**21.8**
SBG-22-03	MCN (OD)-22-50	DRMRHT 13-13-5-5	18.9	22.2	20.0	29.9	23.9	**23.0**	50.5	15.6	30.0	18.3	16.5	37.9	**23.6**
SBG-22-04	MCN (OD)-22-10	RH 1999-42	21.1	21.1	22.5	30.6	22.7	**23.6**	55.0	16.8	27.5	20.1	13.3	41.0	**23.7**
SBG-22-05	MCN (OD)-22-49	ORM 2019-25	20.0	30.0	20.0	30.8	23.6	**24.9**	61.2	13.4	25.0	18.3	14.4	29.9	**20.2**
SBG-22-06	MCN (OD)-22-22	PRE 2018-10	22.2	19.8	20.0	30.1	33.5	**25.1**	60.8	15.6	25.0	16.8	24.1	28.4	**22.0**
SBG-22-07	**TC-AB**	**PHR-2**	27.8	14.9	27.5	32.7	5.2	**21.6**	67.9	20.5	12.5	19.3	3.8	19.0	**15.0**
SBG-22-08	MCN (OD)-22-56	DRMRHJ 1117	31.1	21.1	20.0	27.9	11.4	**22.3**	69.1	24.5	32.5	21.1	9.6	27.1	**23.0**
SBG-22-09	MCN (OD)-22-34	DRMR 2018-19	36.7	10.0	12.5	30.6	32.2	**24.4**	44.6	29.5	37.5	19.7	26.4	35.3	**29.7**
SBG-22-10	MCN (OD)-22-13	DRMRHJ 430	20.5	13.1	25.0	31.1	26.0	**23.1**	59.3	15.6	35.0	19.8	20.1	29.0	**23.9**
SBG-22-11	MCN (OD)-22-16	NPJ 250	23.4	14.9	17.5	31.2	26.3	**22.7**	58.7	17.8	37.5	17.0	17.5	41.4	**26.2**
SBG-22-12	MCN (OD)-22-40	NPJ 251	22.2	16.0	15.0	31.3	25.2	**21.9**	65.6	15.6	27.5	17.9	16.0	41.7	**23.7**
SBG-22-13	**Check**	**NRCHB 101**	21.1	24.2	17.5	29.4	23.0	**23.0**	62.2	16.8	27.5	15.3	16.1	39.3	**23.0**
SBG-22-14	**RC-WR**	**DRMRMJA 35**	34.5	17.1	20.0	29.6	15.2	**23.3**	64.8	24.5	35.0	16.5	15.5	42.7	**26.8**
SBG-22-15	MCN (OD)-22-21	NPJ 253	33.4	18.9	35.0	29.5	21.5	**27.7**	64.6	23.4	42.5	17.2	17.6	32.0	**26.5**
SBG-22-16	MCN (OD)-22-39	RHH 2101	24.5	22.9	32.5	31.4	21.8	**26.6**	53.1	17.8	27.5	18.7	12.7	33.1	**21.9**
SBG-22-17	MCN (OD)-22-45	DRMRHJ 2518	22.2	14.9	22.5	29.5	12.7	**20.3**	54.8	15.6	30.0	19.4	9.5	22.9	**19.5**
SBG-22-18	MCN (OD)-22-55	NAMJH 21-01	26.7	17.1	22.5	31.8	27.1	**25.0**	55.0	18.9	22.5	19.9	27.0	32.0	**24.0**
SBG-22-19	MCN (OD)-22-2	18J408C	25.1	17.1	25.0	31.1	31.6	**26.0**	39.3	16.8	22.5	16.9	26.3	45.5	**25.6**
SBG-22-20	MCN (OD)-22-29	SVJH- 70	24.5	14.9	22.5	30.0	35.4	**25.5**	49.7	17.8	35.0	18.7	32.9	31.3	**27.1**
SBG-22-21	MCN (OD)-22-54	RMX 9922	20.5	11.8	22.5	30.7	40.7	**25.2**	55.2	14.5	35.0	16.9	35.1	36.3	**27.5**
SBG-22-22	MCN (OD)-22-44	SVJH- 71	26.7	11.1	17.5	29.8	33.5	**23.7**	49.4	18.9	35.0	17.2	29.7	41.6	**28.5**
SBG-22-23	MCN (OD)-22-23	IJ 16 R 1168	28.9	12.2	22.5	28.2	34.3	**25.2**	42.8	20.0	32.5	16.0	23.6	32.9	**25.0**
SBG-22-24	**Hybrid check**	**DMH-1**	25.1	22.0	22.5	32.0	30.7	**26.5**	53.6	16.8	30.0	18.8	25.6	31.4	**24.5**
SBG-22-25	MCN (OD)-22-12	PBR 939	28.9	8.0	35.0	28.3	41.7	**28.4**	48.8	20.0	40.0	17.0	29.4	29.1	**27.1**
SBG-22-26	MCN (OD)-22-48	RH 1975	30.0	14.0	25.0	32.5	41.0	**28.5**	61.1	22.2	35.0	19.7	30.3	42.1	**29.9**
SBG-22-27	MCN (OD)-22-17	ACN 237	23.4	7.8	32.5	28.8	42.9	**27.1**	60.0	17.8	30.0	13.3	30.9	23.3	**23.0**
SBG-22-28	MCN (OD)-22-30	NPJ 252	36.7	14.7	32.5	30.8	41.6	**31.3**	67.3	29.5	45.0	18.3	31.0	32.0	**31.1**
SBG-22-29	MCN (OD)-22-41	KMR 21-3	24.5	10.9	27.5	32.5	25.1	**24.1**	59.3	17.8	52.5	19.9	22.9	18.9	**26.4**
SBG-22-30	MCN (OD)-22-47	DRMRIJ 20-157	17.8	6.0	22.5	34.0	43.5	**24.8**	61.6	13.4	50.0	20.1	40.6	20.5	**28.9**
SBG-22-31	MCN (OD)-22-8	IJ 19R5004	30.0	21.1	20.0	30.8	33.6	**27.1**	55.5	22.2	37.5	19.0	29.9	21.7	**26.1**
SBG-22-32	MCN (OD)-22-42	PDZ- 14	26.7	17.1	25.0	31.7	27.2	**25.5**	53.8	20.0	37.5	19.6	21.3	43.1	**28.3**
SBG-22-33	MCN (OD)-22-31	RH 1974	27.8	8.0	25.0	28.5	32.9	**24.4**	60.0	20.5	42.5	20.2	23.1	40.9	**29.4**
SBG-22-34	MCN (OD)-22-14	KGMH 9198	25.1	8.7	30.0	31.9	43.1	**27.8**	57.3	16.8	45.0	20.3	36.1	25.4	**28.7**
SBG-22-35	MCN (OD)-22-19	SKM- 1901	32.2	12.2	37.5	30.3	35.0	**29.4**	77.0	21.1	45.0	18.2	25.5	30.2	**28.0**
SBG-22-36	MCN (OD)-22-33	DRMR 2018-37	31.1	13.1	27.5	28.3	36.1	**27.2**	63.7	24.5	37.5	16.3	27.9	22.1	**25.6**
SBG-22-37	MCN (OD)-22-43	DRMRCI(Q) 47	33.4	30.9	30.0	32.0	27.9	**30.8**	65.6	23.4	20.0	17.8	19.7	20.3	**20.2**
SBG-22-38	MCN (OD)-22-7	PDZ 15	31.7	33.6	30.0	29.7	29.5	**30.9**	69.4	22.2	40.0	17.3	27.2	30.4	**27.4**
SBG-22-39	MCN (OD)-22-32	RH 1934	21.1	21.1	20.0	31.1	16.0	**21.9**	59.5	16.8	37.5	18.5	12.1	28.7	**22.7**
SBG-22-40	MCN (OD)-22-1	RGN 524	30.0	34.0	35.0	32.7	22.6	**30.9**	60.5	25.1	32.5	18.0	16.9	26.7	**23.8**
SBG-22-41	MCN (OD)-22-18	PDZ 16	29.5	34.0	32.5	33.0	22.8	**30.4**	58.6	21.1	40.0	18.9	16.7	44.1	**28.2**
SBG-22-42	MCN (OD)-22-9	DRMR 2018-25	31.7	7.8	25.0	33.3	23.0	**24.1**	52.1	20.5	27.5	21.4	19.5	48.2	**27.4**
SBG-22-43	**SC**	**Rohini**	18.9	14.0	35.0	33.3	30.7	**26.4**	62.4	15.6	27.5	20.3	22.1	35.2	**24.1**
SBG-22-44	**RC-WR**	**BioYSR**	31.2	33.1	27.5	34.8	16.6	**28.6**	64.9	23.4	27.5	21.1	11.2	21.0	**20.8**
SBG-22-45	MCN (OD)-22-3	GSH- 2155	8.4	6.0	15.0	15.6	18.4	**12.7**	58.5	6.7	27.5	7.5	14.5	34.1	**18.1**
SBG-22-46	**Karan rai Check**	**DLSC 1**	7.3	10.0	12.5	17.8	15.1	**12.5**	62.4	5.0	22.5	14.3	10.8	30.1	**16.5**
SBG-22-47	MCN (OD)-22-15	CS2020-10	25.1	10.2	32.5	34.2	5.8	**21.5**	45.5	17.8	47.5	19.4	3.7	27.4	**23.1**
SBG-22-48	**Bn-Check**	**GSL-1**	8.9	16.0	12.5	32.1	22.9	**18.5**	49.1	6.7	27.5	18.2	15.6	33.2	**20.2**
SBG-22-49	MCN (OD)-22-5	Maya (ZC) Zone- III	28.9	30.0	25.0	31.9	4.8	**24.1**	58.6	20.5	47.5	19.7	2.1	42.5	**26.4**
SBG-22-50	MCN (OD)-22-24	Basanti (WRR Check)	33.4	30.9	22.5	34.0	26.8	**29.5**	66.5	21.1	35.0	21.5	28.8	44.2	**30.1**
SBG-22-51	MCN (OD)-22-35	PM 28 (LR)	26.7	13.1	27.5	30.8	16.3	**22.9**	64.3	20.0	40.0	19.7	13.8	35.6	**25.8**
SBG-22-52	MCN (OD)-22-46	RGN 73 (ZC) Z- III	29.5	13.1	22.5	30.7	18.4	**22.8**	71.3	20.5	42.5	17.9	12.7	20.5	**22.8**
SBG-22-53	MCN (OD)-22-37	GSL- 1 (NC)	7.3	22.0	10.0	12.9	25.5	**15.5**	56.3	5.0	37.5	6.8	11.4	29.5	**18.0**
SBG-22-54	MCN (OD)-22-26	Nenoy (ZC) Zone- V	31.7	25.1	47.5	37.9	39.9	**36.4**	65.8	22.2	50.0	21.9	21.8	30.2	**29.2**
SBG-22-55	MCN (OD)-22-27	CS 56 (LR) Zone- III	28.9	10.2	40.0	33.5	43.0	**31.1**	67.8	20.5	40.0	19.3	31.7	33.3	**28.9**
SBG-22-56	MCN (OD)-22-36	DRMR 150-35(LR) Z-V	30.0	21.3	40.0	30.0	22.1	**28.7**	64.1	25.1	32.5	17.0	13.1	39.4	**25.4**
SBG-22-57	MCN (OD)-22-51	AKMS 8141 (LR)	8.9	10.9	15.0	13.7	25.9	**14.9**	42.6	6.7	35.0	8.1	17.1	52.0	**23.8**
SBG-22-58	MCN (OD)-22-25	GSC 6 (QC)	7.8	10.7	17.5	13.9	5.0	**11.0**	42.0	7.3	45.0	5.7	3.0	35.5	**19.3**
SBG-22-59	MCN (OD)-22-38	TS- 38 (LR) Zone- V	32.2	25.1	45.0	31.7	22.1	**31.2**	63.2	22.2	45.0	19.5	17.5	19.8	**24.8**
SBG-22-60	MCN (OD)-22-52	CS 54 (Salinity Check)	30.0	10.9	35.0	31.9	35.4	**28.6**	67.0	23.4	35.0	21.2	24.2	21.4	**25.0**
SBG-22-61	MCN (OD)-22-4	NRCHB-101 (LR) Z-VI	24.5	9.1	32.5	30.9	33.6	**26.1**	66.0	17.8	37.5	18.8	29.1	26.5	**25.9**
SBG-22-62	MCN (OD)-22-53	BIO 902 (ZC) Zone- IV	30.0	30.0	22.5	30.9	25.5	**27.8**	58.3	20.5	35.0	18.0	17.5	38.5	**25.9**
SBG-22-63	MCN (OD)-22-28	PDZ 1 (00 Check)	26.7	33.1	30.0	33.2	33.1	**31.2**	46.8	20.0	30.0	18.5	19.8	29.9	**23.6**
SBG-22-64	MCN (OD)-22-6	CS 60 (Salinity (LR)	23.4	5.1	32.5	31.0	23.1	**23.0**	64.4	17.8	30.0	19.1	16.4	22.7	**21.2**
SBG-22-65	**Quality RC**	**PDZ-1**	30.0	32.0	32.5	32.6	23.6	**30.1**	57.6	20.5	32.5	20.7	15.6	22.1	**22.3**
SBG-22-66	**Toria Check**	**PT-303**	31.2	35.1	57.5	34.2	23.0	**36.2**	68.6	23.4	50.0	20.1	18.9	25.4	**27.5**
SBG-22-67	**Taramira-Check**	**RTM-314**	33.4	30.9	37.5	15.5	43.0	**32.1**	73.1	21.1	32.5	6.8	32.1	50.9	**28.7**
SBG-22-68	**Br-YS-Check**	**NRCYS 05-2**	29.5	16.0	47.5	37.2	36.9	**33.4**	73.0	20.5	47.5	24.4	29.4	30.8	**30.5**
CD(*P*=0.05)			**4.6**	**1.5**	**8.2**	**5.0**	**2.5**		**4.9**	**4.7**	**7.7**	**4.9**	**3.0**	**3.3**	
CV (%)			**7.7**	**3.1**	**-**	**7.5**	**4.1**		**4.9**	**9.4**	**-**	**9.9**	**5.7**	**4.8**	

*Excluded BPR (ABL), MOR (ABP)

Table 4.1.2: Reaction of AVT-I and AVT-II Brassica germplasm to WR under natural condition

Entry Name	% WR severity (100 DAS)*						% Staghead		
	HSR	MOR	PNT	SKN	LDH	Mean	MOR	PNT	Mean
KMR(E) 21-1	26.7	38.0	12.5	21.1	19.9	**23.6**	4.4	0.0	**2.2**
DRMRHT 13-13-5-4	33.4	34.7	20.0	29.4	23.1	**28.1**	7.4	0.0	**3.7**
DRMRHT 13-13-5-5	28.9	36.2	10.0	18.9	22.8	**23.4**	5.6	0.0	**2.8**
RH 1999-42	38.9	34.9	25.0	63.3	36.7	**39.8**	5.3	6.5	**5.9**
ORM 2019-25	25.1	36.0	25.0	30.0	24.5	**28.1**	4.2	0.0	**2.1**
PRE 2018-10	26.7	34.0	10.0	23.9	20.7	**23.1**	4.4	3.5	**4.0**
PHR-2(TC-AB)	24.5	22.0	7.5	12.2	13.0	**15.8**	0.0	12.0	**6.0**
DRMRHJ 1117	20.5	10.9	12.5	4.4	14.3	**12.5**	0.0	0.0	**0.0**
DRMR 2018-19	0.0	1.8	5.0	7.8	0.0	**2.9**	0.0	0.0	**0.0**
DRMRHJ 430	28.4	39.3	20.0	27.2	29.8	**28.9**	8.2	8.0	**8.1**
NPJ 250	23.4	9.1	5.0	7.2	15.4	**12.0**	0.0	0.0	**0.0**
NPJ 251	29.5	36.0	20.0	32.8	26.4	**28.9**	3.5	6.5	**5.0**
NRCHB 101(SC)	30.0	41.1	17.5	30.0	31.5	**30.0**	9.6	4.5	**7.0**
DRMRMJA 35(RC-WR)	10.6	12.9	5.0	7.8	16.2	**10.5**	0.0	3.0	**1.5**
NPJ 253	13.4	6.9	12.5	15.0	20.3	**13.6**	0.0	0.0	**0.0**
RHH 2101	30.0	34.7	20.0	36.7	24.1	**29.1**	4.2	4.5	**4.3**
DRMRHJ 2518	27.2	34.9	12.5	30.0	19.6	**24.8**	4.6	0.0	**2.3**
NAMJH 21-01	25.1	36.0	7.5	9.4	18.5	**19.3**	4.8	0.0	**2.4**
18J408C	26.7	28.0	7.5	28.3	26.4	**23.4**	3.8	2.5	**3.1**
SVJH- 70	24.5	24.0	7.5	18.9	29.8	**20.9**	0.0	0.0	**0.0**
RMX 9922	28.9	18.9	12.5	38.3	29.1	**25.5**	0.0	0.0	**0.0**
SVJH- 71	25.1	20.7	10.0	23.9	22.2	**20.4**	0.0	4.0	**2.0**
IJ 16 R 1168	15.6	15.3	7.5	4.4	15.3	**11.6**	0.0	0.0	**0.0**
DMH-1(Hybrid)	0.0	10.2	15.0	2.2	23.2	**10.1**	0.0	6.5	**3.3**
PBR 939	21.1	34.0	12.5	12.2	31.0	**22.2**	6.0	4.5	**5.3**
RH 1975	28.4	36.2	30.0	15.0	27.1	**27.3**	4.6	12.0	**8.3**
ACN 237	34.5	46.0	25.0	42.2	42.5	**38.0**	9.3	0.0	**4.7**
NPJ 252	27.2	45.8	25.0	17.2	25.5	**28.1**	11.2	8.0	**9.6**
KMR 21-3	31.2	44.2	15.0	23.3	24.7	**27.7**	5.6	0.0	**2.8**
DRMRIJ 20-157	0.0	0.0	7.5	0.6	0.0	**1.6**	0.0	2.5	**1.3**
IJ 19R5004	0.0	0.0	0.0	0.6	0.0	**0.1**	0.0	0.0	**0.0**
PDZ- 14	0.0	9.6	7.5	11.7	4.9	**6.7**	0.0	4.5	**2.3**
RH 1974	22.2	34.0	10.0	22.8	30.7	**23.9**	4.2	13.0	**8.6**
KGMH 9198	24.5	37.1	17.5	13.3	25.7	**23.6**	3.8	0.0	**1.9**
SKM- 1901	14.5	35.8	27.5	14.4	15.4	**21.5**	4.4	5.0	**4.7**
DRMR 2018-37	0.0	0.0	7.5	11.7	17.0	**7.2**	0.0	2.5	**1.3**
DRMRCI(Q) 47	0.0	10.0	7.5	11.7	2.4	**6.3**	0.0	0.0	**0.0**
PDZ 15	0.0	6.0	10.0	1.7	0.0	**3.5**	0.0	6.5	**3.3**
RH 1934	27.2	40.2	17.5	13.9	25.4	**24.8**	6.0	7.0	**6.5**
RGN 524	28.9	34.0	12.5	17.8	32.5	**25.1**	8.2	1.5	**4.8**
PDZ 16	0.0	13.6	12.5	8.3	0.0	**6.9**	0.0	4.5	**2.3**
DRMR 2018-25	0.0	0.0	5.0	5.6	1.5	**2.4**	0.0	0.0	**0.0**
Rohini (SC)	32.2	42.9	22.5	32.8	22.1	**30.5**	10.9	16.5	**13.7**
BioYSR (RC-WR)	0.0	0.0	10.0	2.2	1.3	**2.7**	0.0	0.0	**0.0**
GSH- 2155	0.0	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	**0.0**
DLSC 1 (C)	0.0	0.0	0.0	0.0	2.0	**0.4**	0.0	0.0	**0.0**
CS2020-10	36.7	44.9	17.5	41.1	0.0	**28.0**	0.0	4.0	**2.0**
GSL-1 (Bn)	0.0	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	**0.0**
Maya (ZC) Zone- III	7.8	1.8	12.5	19.4	19.8	**12.3**	0.0	7.5	**3.8**
Basanti (WRR Check)	0.0	0.0	10.0	7.2	8.9	**5.2**	0.0	0.0	**0.0**
PM 28 (LR)	27.2	36.7	15.0	35.6	27.4	**28.4**	6.2	0.0	**3.1**
RGN 73 (ZC) Zine- III	29.5	44.0	37.5	25.6	45.3	**36.4**	7.4	5.5	**6.4**
GSL- 1 (NC)	0.0	8.0	0.0	0.0	0.0	**1.6**	0.0	0.0	**0.0**
Nenoy (ZC) Zone- V	0.0	0.9	3.5	0.0	0.0	**0.9**	0.0	5.0	**2.5**
CS 56 (LR) Zone- III	24.5	17.1	35.0	43.3	28.3	**29.6**	3.6	0.0	**1.8**
DRMR 150-35 (LR) Zone- V	21.1	24.7	35.0	22.2	24.4	**25.5**	4.3	4.0	**4.2**
AKMS 8141 (LR)	0.0	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	**0.0**
GSC 6 (QC)	0.0	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	**0.0**
TS- 38 (LR) Zone- V	0.0	2.9	7.5	0.0	0.0	**2.1**	0.0	0.0	**0.0**
CS 54 (Salinity Check)	31.7	42.0	37.5	39.4	29.5	**36.0**	8.7	8.5	**8.6**
NRCHB- 101 (LR) Zone- VI	33.4	42.9	27.5	23.9	33.2	**32.2**	7.3	0.0	**3.7**
BIO 902 (ZC) Zone- IV	2.8	7.3	15.0	8.3	16.6	**10.0**	0.0	0.0	**0.0**
PDZ 1 (Double Low Check)	0.0	1.6	5.0	0.6	0.0	**1.4**	0.0	4.5	**2.3**
CS 60 (Salinity (LR)	28.4	36.7	35.0	51.1	31.7	**36.6**	3.4	0.0	**1.7**
PDZ-1 (RC)	0.0	0.0	3.5	1.1	0.0	**0.9**	0.0	0.0	**0.0**
PT-303 (C)	0.0	0.7	20.0	1.1	0.0	**4.4**	0.0	0.0	**0.0**
RTM-314 (Es)	0.0	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	**0.0**
NRCYS 05-2 (Br-YS)	0.0	4.0	15.0	10.0	1.3	**6.1**	0.0	3.5	**1.8**
CD(*P*=0.05)	**4.2**	**3.5**	**7.4**	**4.6**	**3.6**		**0.5**	**4.1**	
CV (%)	**11.0**	**7.5**	**-**	**13.7**	**9.0**		**3.7**	**-**	

*Excluded BPR (WR)

Table. 4.1.3: Reaction of AVT-I and AVT-II Brassica germplasm to Powdery mildew, Downy mildew under natural condition

Entry Name	% PM severity (100 DAS)					% DM severity (20 DAS)		
	MOR	PNT	SKN	BPR	Mean	MOR	PNT	Mean
KMR(E) 21-1	68.0	20.0	75.0	15.5	**44.6**	10.9	45.0	**28.0**
DRMRHT 13-13-5-4	84.5	37.5	65.0	20.0	**51.7**	16.0	40.0	**28.0**
DRMRHT 13-13-5-5	51.2	40.0	80.0	22.0	**48.3**	22.2	37.5	**29.9**
RH 1999-42	95.3	35.0	65.0	19.0	**53.6**	22.9	50.0	**36.5**
ORM 2019-25	65.8	32.5	75.0	21.0	**48.6**	18.4	55.0	**36.7**
PRE 2018-10	79.6	20.0	90.0	36.0	**56.4**	20.2	60.0	**40.1**
PHR-2	92.9	65.0	60.0	35.0	**63.2**	9.1	57.5	**33.3**
DRMRHJ 1117	91.3	27.5	80.0	42.0	**60.2**	2.0	42.5	**22.3**
DRMR 2018-19	51.3	27.5	85.0	33.0	**49.2**	0.0	50.0	**25.0**
DRMRHJ 430	87.3	30.0	95.0	43.0	**63.8**	16.0	60.0	**38.0**
NPJ 250	41.1	27.5	65.0	31.0	**41.2**	2.9	45.0	**24.0**
NPJ 251	24.2	37.5	70.0	18.0	**37.4**	16.2	37.5	**26.9**
NRCHB 101	80.9	25.0	65.0	29.0	**50.0**	11.1	32.5	**21.8**
DRMRMJA 35	41.1	20.0	85.0	32.0	**44.5**	2.0	45.0	**23.5**
NPJ 253	25.1	17.5	75.0	31.0	**37.2**	2.2	50.0	**26.1**
RHH 2101	47.8	15.0	75.0	32.0	**42.5**	17.1	42.5	**29.8**
DRMRHJ 2518	81.8	35.0	70.0	-	**62.3**	16.2	37.5	**26.9**
NAMJH 21-01	76.7	22.5	75.0	34.0	**52.1**	8.3	42.5	**25.4**
18J408C	98.0	10.0	75.0	34.0	**54.3**	16.0	57.5	**36.8**
SVJH- 70	83.3	27.5	70.0	37.0	**54.5**	8.0	57.5	**32.8**
RMX 9922	85.3	12.5	80.0	26.0	**51.0**	10.9	70.0	**40.5**
SVJH- 71	62.0	15.0	75.0	40.0	**48.0**	14.9	65.0	**40.0**
IJ 16 R 1168	72.9	10.0	75.0	32.0	**47.5**	6.0	50.0	**28.0**
DMH-1	86.7	40.0	80.0	28.0	**58.7**	0.0	57.5	**28.8**
PBR 939	90.0	35.0	85.0	39.0	**62.3**	22.3	45.0	**33.6**
RH 1975	89.1	27.5	90.0	29.0	**58.9**	24.9	70.0	**47.5**
ACN 237	76.0	27.5	70.0	40.0	**53.4**	28.2	67.5	**47.9**
NPJ 252	94.7	22.5	85.0	39.0	**60.3**	21.1	60.0	**40.6**
KMR 21-3	80.2	37.5	80.0	20.0	**54.4**	15.8	50.0	**32.9**
DRMRIJ 20-157	92.2	37.5	75.0	40.0	**61.2**	2.9	65.0	**34.0**
IJ 19R5004	82.9	45.0	65.0	10.5	**50.9**	0.0	50.0	**25.0**
PDZ- 14	93.3	35.0	75.0	16.7	**55.0**	2.0	55.0	**28.5**
RH 1974	81.8	37.5	65.0	11.5	**49.0**	20.9	42.5	**31.7**
KGMH 9198	68.2	22.5	90.0	23.0	**50.9**	20.7	50.0	**35.4**
SKM- 1901	79.3	30.0	65.0	29.0	**50.8**	21.1	65.0	**43.1**
DRMR 2018-37	90.0	32.5	75.0	38.0	**58.9**	8.0	77.5	**42.8**
DRMRCI(Q) 47	94.0	37.5	85.0	39.0	**63.9**	2.2	40.0	**21.1**
PDZ 15	54.9	20.0	75.0	32.0	**45.5**	2.0	77.5	**39.8**
RH 1934	51.3	12.5	75.0	20.0	**39.7**	20.0	47.5	**33.8**
RGN 524	93.8	40.0	85.0	31.0	**62.5**	10.9	40.0	**25.5**
PDZ 16	95.5	25.0	80.0	31.0	**57.9**	3.8	65.0	**34.4**
DRMR 2018-25	84.2	20.0	85.0	21.0	**52.6**	0.0	60.0	**30.0**
Rohini	66.0	22.5	85.0	14.0	**46.9**	26.0	70.0	**48.0**
BioYSR	68.0	17.5	65.0	34.0	**46.1**	0.0	65.0	**32.5**
GSH- 2155	16.0	0.0	0.0	39.0	**13.8**	0.0	0.0	**0.0**
DLSC 1	5.1	0.0	0.0	10.5	**3.9**	0.0	0.0	**0.0**
CS2020-10	61.1	22.5	80.0	11.0	**43.7**	26.0	42.5	**34.3**
GSL-1	26.7	15.0	45.0	33.0	**29.9**	0.0	0.0	**0.0**
Maya (ZC) Zone- III	81.1	25.0	80.0	38.0	**56.0**	2.0	35.0	**18.5**
Basanti (WRR Check)	85.1	20.0	85.0	32.0	**55.5**	0.0	52.5	**26.3**
PM 28 (LR)	77.3	15.0	75.0	10.5	**44.5**	21.1	70.0	**45.6**
RGN 73 (ZC) Zine- III	30.2	17.5	85.0	37.0	**42.4**	22.2	25.0	**23.6**
GSL- 1 (NC)	26.2	0.0	25.0	28.0	**19.8**	3.8	7.5	**5.7**
Nenoy (ZC) Zone- V	42.2	12.5	-	8.5	**21.1**	0.0	0.0	**0.0**
CS 56 (LR) Zone- III	80.2	5.0	75.0	11.0	**42.8**	21.1	27.5	**24.3**
DRMR 150-35 (LR) Zone- V	82.9	10.0	75.0	32.0	**50.0**	17.3	35.0	**26.2**
AKMS 8141 (LR)	10.9	5.0	0.0	36.0	**13.0**	0.0	0.0	**0.0**
GSC 6 (QC)	12.2	0.0	42.5	11.0	**16.4**	0.0	0.0	**0.0**
TS- 38 (LR) Zone- V	0.0	0.0	-	14.0	**4.7**	0.0	12.5	**6.3**
CS 54 (Salinity Check)	61.8	22.5	85.0	21.0	**47.6**	19.8	35.0	**27.4**
NRCHB- 101 (LR) Zone- VI	93.8	0.0	75.0	44.0	**53.2**	25.1	37.5	**31.3**
BIO 902 (ZC) Zone- IV	93.1	10.0	70.0	37.0	**52.5**	2.0	52.5	**27.3**
PDZ 1 (00 Check)	89.8	10.0	75.0	33.0	**52.0**	0.0	37.5	**18.8**
CS 60 (Salinity (LR)	78.2	7.5	85.0	37.0	**51.9**	21.1	40.0	**30.6**
PDZ-1	89.9	5.0	65.0	10.0	**42.5**	0.0	27.5	**13.8**
PT-303	0.0	0.0	-	37.0	**12.3**	0.0	0.0	**0.0**
RTM-314	34.2	0.0	0.0	11.5	**11.4**	0.0	0.0	**0.0**
NRCYS 05-2	82.0	0.0	60.0	13.0	**38.8**	2.0	0.0	**1.0**
CD (*P*=0.05)	**0.5**	**9.4**	**10.5**	**4.3**		**2.0**	**11.4**	
CV (%)	**3.7**	**-**	**7.5**	**3.4**		**6.6**	**-**	

Table 4.1.4: Reaction of AVT-I and AVT-II Brassica germplasm to Alternaria Leaf Blight under artificial condition

Entry Name	% ABL severity (90 DAS)*							% ABP (15 days before harvest)*				
	HSR	PNT	SHL	DOL	BPR	Mean	LDH	PNT	SHL	DOL	LDH	Mean
KMR(E) 21-1	18.9	40.0	32.8	26.7	20.0	**27.7**	50.3	32.5	22.1	19.5	39.1	**28.3**
DRMRHT 13-13-5-4	12.8	25.0	32.9	25.6	25.0	**24.3**	58.8	40.0	22.2	27.1	38.9	**32.0**
DRMRHT 13-13-5-5	21.1	27.5	35.4	30.0	25.0	**27.8**	50.4	47.5	23.1	24.2	41.5	**34.1**
RH 1999-42	17.8	25.0	37.5	30.9	25.0	**27.2**	54.8	45.0	25.7	17.9	41.9	**32.6**
ORM 2019-25	20.5	32.5	36.2	29.9	30.0	**29.8**	63.5	52.5	23.9	19.4	30.7	**31.6**
PRE 2018-10	21.1	35.0	34.2	41.3	20.0	**30.3**	60.9	50.0	23.2	31.4	30.9	**33.8**
PHR-2	30.0	27.5	36.8	8.7	15.0	**23.6**	67.9	17.5	23.5	7.0	22.0	**17.5**
DRMRHJ 1117	34.5	30.0	32.2	22.3	20.0	**27.8**	69.4	32.5	26.2	13.4	30.9	**25.7**
DRMR 2018-19	40.0	22.5	36.9	39.7	15.0	**30.8**	47.3	40.0	27.6	31.2	40.4	**34.8**
DRMRHJ 430	17.8	27.5	36.4	36.9	15.0	**26.7**	70.2	40.0	24.2	26.4	29.7	**30.1**
NPJ 250	24.5	25.0	35.5	33.6	7.5	**25.2**	60.0	40.0	23.1	22.6	40.5	**31.6**
NPJ 251	20.5	30.0	37.8	31.7	15.0	**27.0**	65.5	45.0	22.6	22.0	40.6	**32.5**
NRCHB 101	22.2	30.0	36.4	29.9	25.0	**28.7**	62.5	42.5	24.0	21.0	30.3	**29.4**
DRMRMJA 35	36.7	22.5	35.7	25.1	15.0	**27.0**	64.2	37.5	20.9	20.1	20.6	**24.8**
NPJ 253	34.5	32.5	37.2	28.6	20.0	**30.5**	61.6	45.0	23.3	22.6	20.5	**27.8**
RHH 2101	25.1	37.5	35.0	26.6	7.5	**26.3**	53.5	50.0	25.3	19.1	20.5	**28.7**
DRMRHJ 2518	20.5	32.5	34.8	16.4	7.5	**22.3**	56.5	32.5	24.6	15.5	31.7	**26.1**
NAMJH 21-01	27.8	27.5	37.7	29.3	15.0	**27.5**	55.2	37.5	25.8	32.8	20.5	**29.1**
18J408C	23.4	27.5	35.3	40.0	15.0	**28.2**	54.5	35.0	24.2	31.9	21.5	**28.1**
SVJH- 70	26.7	35.0	34.9	42.4	7.5	**29.3**	54.4	42.5	26.2	37.1	41.1	**36.7**
RMX 9922	21.1	42.5	39.5	48.1	25.0	**35.2**	63.1	37.5	25.9	39.9	39.3	**35.6**
SVJH- 71	22.2	35.0	34.9	40.9	15.0	**29.6**	57.7	40.0	23.4	39.5	39.8	**35.7**
IJ 16 R 1168	29.5	22.5	32.0	41.0	25.0	**30.0**	46.2	57.5	23.5	27.1	30.1	**34.5**
DMH-1	24.5	27.5	38.6	38.9	7.5	**27.4**	56.7	35.0	27.3	31.1	30.3	**30.9**
PBR 939	27.8	42.5	33.1	47.2	15.0	**33.1**	54.0	40.0	21.2	35.7	30.2	**31.8**
RH 1975	28.9	35.0	38.5	45.0	15.0	**32.5**	62.5	47.5	24.3	34.9	40.1	**36.7**
ACN 237	25.1	40.0	34.2	46.9	25.0	**34.2**	62.4	45.0	22.9	38.5	20.0	**31.6**
NPJ 252	40.0	37.5	37.2	45.9	25.0	**37.1**	70.5	50.0	24.8	37.3	30.3	**35.6**
KMR 21-3	22.2	35.0	34.0	27.8	25.0	**28.8**	62.5	60.0	26.1	26.7	20.1	**33.2**
DRMRIJ 20-157	12.8	27.5	43.7	45.1	20.0	**29.8**	61.6	55.0	25.7	46.9	21.2	**37.2**
IJ 19R5004	27.8	27.5	34.5	37.3	25.0	**30.4**	55.5	42.5	20.8	39.0	20.2	**30.6**
PDZ- 14	28.9	32.5	34.5	28.4	15.0	**27.9**	62.2	52.5	20.9	24.7	40.1	**34.5**
RH 1974	26.7	32.5	31.5	38.6	25.0	**30.8**	62.8	45.0	22.4	27.0	40.5	**33.7**
KGMH 9198	29.5	42.5	35.3	48.8	25.0	**36.2**	67.4	57.5	22.2	42.1	29.4	**37.8**
SKM- 1901	31.1	45.0	34.0	36.9	15.0	**32.4**	76.9	60.0	20.6	31.2	30.5	**35.6**
DRMR 2018-37	33.4	32.5	31.9	41.0	25.0	**32.8**	68.8	40.0	19.0	35.9	20.5	**28.8**
DRMRCI(Q) 47	30.0	37.5	34.4	29.3	25.0	**31.2**	75.6	35.0	21.0	25.7	20.9	**25.6**
PDZ 15	35.6	40.0	32.5	34.9	15.0	**31.6**	74.4	62.5	18.9	31.4	32.5	**36.3**
RH 1934	22.2	37.5	35.9	20.8	25.0	**28.3**	74.3	40.0	21.2	15.6	33.0	**27.4**
RGN 524	27.8	35.0	37.3	25.6	20.0	**29.1**	73.1	45.0	21.0	22.3	18.7	**26.7**
PDZ 16	28.9	37.5	37.0	26.8	20.0	**30.0**	75.0	42.5	20.8	19.3	43.6	**31.6**
DRMR 2018-25	31.1	32.5	36.3	27.1	15.0	**28.4**	72.0	37.5	24.5	22.6	42.8	**31.8**
Rohini	21.1	42.5	37.2	37.9	25.0	**32.7**	72.6	57.5	22.8	26.4	28.0	**33.7**
BioYSR	30.0	40.0	37.7	21.6	15.0	**28.8**	74.3	40.0	24.3	17.6	19.9	**25.4**
GSH- 2155	6.7	22.5	17.6	24.6	20.0	**18.3**	62.2	60.0	9.7	19.1	29.0	**29.4**
DLSC 1	8.9	25.0	20.8	23.4	7.5	**17.1**	62.4	42.5	13.4	15.9	32.4	**26.0**
CS2020-10	24.5	47.5	38.6	8.5	15.0	**26.8**	75.5	62.5	21.8	7.5	33.1	**31.2**
GSL-1	7.8	22.5	35.1	27.6	7.5	**20.1**	71.6	47.5	20.5	26.3	31.3	**31.4**
Maya (ZC) Zone- III	29.5	37.5	35.8	9.4	15.0	**25.4**	73.2	52.5	22.2	5.9	37.5	**29.5**
Basanti (WRR Check)	36.7	57.5	37.0	37.0	15.0	**36.6**	75.0	50.0	24.1	33.2	41.1	**37.1**
PM 28 (LR)	25.1	37.5	34.4	20.9	20.0	**27.6**	63.9	45.0	21.6	17.3	29.9	**28.4**
RGN 73 (ZC) Zine- III	27.8	40.0	35.7	24.4	25.0	**30.6**	74.2	57.5	20.6	19.3	19.8	**29.3**
GSL- 1 (NC)	8.9	20.0	15.3	31.5	7.5	**16.6**	61.8	45.0	9.5	15.5	33.4	**25.8**
Nenoy (ZC) Zone- V	30.0	60.0	41.3	46.8	7.5	**37.1**	72.6	57.5	24.5	26.8	35.8	**36.1**
CS 56 (LR) Zone- III	26.7	45.0	37.1	49.9	15.0	**34.7**	67.7	42.5	22.5	35.5	33.2	**33.4**
DRMR 150-35 (LR) Zone- V	29.5	45.0	36.7	27.2	10.0	**29.7**	64.5	62.5	20.4	16.4	44.3	**35.9**
AKMS 8141 (LR)	7.3	25.0	17.0	30.1	7.5	**17.4**	62.5	65.0	10.4	20.9	52.1	**37.1**
GSC 6 (QC)	8.4	25.0	16.7	9.7	5.0	**13.0**	56.2	57.5	7.1	7.2	32.7	**26.1**
TS- 38 (LR) Zone- V	31.1	50.0	36.8	27.5	7.5	**30.6**	70.3	57.5	23.4	22.0	21.8	**31.2**
CS 54 (Salinity Check)	28.9	47.5	36.6	41.4	25.0	**35.9**	66.1	67.5	24.1	31.9	19.8	**35.8**
NRCHB- 101 (LR) Zone- VI	25.1	45.0	35.5	39.2	25.0	**33.9**	65.7	60.0	22.0	36.9	31.1	**37.5**
BIO 902 (ZC) Zone- IV	32.2	30.0	34.7	30.3	25.0	**30.4**	58.2	70.0	20.7	21.5	39.4	**37.9**
PDZ 1 (00 Check)	27.8	35.0	36.7	37.7	20.0	**31.4**	57.3	45.0	21.6	25.0	30.1	**30.4**
CS 60 (Salinity (LR)	25.1	45.0	37.1	28.6	15.0	**30.2**	69.3	42.5	21.4	20.6	19.3	**25.9**
PDZ-1	33.4	40.0	37.2	30.8	15.0	**31.3**	68.3	40.0	23.5	20.7	20.5	**26.2**
PT-303	30.0	60.0	38.4	29.0	7.5	**33.0**	71.5	57.5	24.7	23.9	30.7	**34.2**
RTM-314	31.2	47.5	18.5	49.3	15.0	**32.3**	74.7	45.0	9.7	37.3	50.9	**35.7**
NRCYS 05-2	31.1	52.5	40.2	48.3	7.5	**35.9**	75.7	57.5	26.4	36.4	31.8	**38.0**
CD(*P*=0.05)	**4.7**	**7.6**	**4.4**	**3.3**	**9.2**		**4.3**	**8.1**	**4.8**	**1.4**	**3.6**	
CV (%)	**7.8**	**-**	**6.1**	**4.7**	**-**		**4.0**	**-**	**8.6**	**2.4**	**5.4**	

Table 4.1.5: Reaction of AVT-I and AVT-II Brassica germplasm to WR, DM, PM and SR under artificial condition

Entry Name	% WR (100 DAS)						% SH			% DM (20 DAS)			% PM			% Sclerotinia rot*				Lesion Size (cm)			Stem Diameter (cm)
	HSR	MOR	PNT	LDH	BPR	Mean	MOR	PNT	Mean	MOR	PNT	Mean	PNT	MOR	Mean	HSR	PNT	BPR	Mean	LDH	BPR	Mean	BPR
KMR(E) 21-1	33.4	42.0	27.5	22.2	15.0	**28.0**	5.1	6.0	**5.6**	12.2	47.5	**29.9**	25.0	69.3	**47.2**	26.2	65.0	26.6	**39.3**	7.5	20.8	**14.2**	2.1
DRMRHT 13-13-5-4	38.9	37.1	25.0	25.3	10.0	**27.3**	8.2	5.0	**6.6**	17.1	40.0	**28.6**	35.0	85.1	**60.1**	40.2	55.0	34.3	**43.2**	7.2	28.2	**17.7**	2.0
DRMRHT 13-13-5-5	36.7	38.9	22.5	23.2	7.5	**25.8**	7.2	0.0	**3.6**	22.0	55.0	**38.5**	37.5	52.2	**44.9**	42.6	45.0	46.4	**44.7**	12.3	19.2	**15.8**	2.2
RH 1999-42	45.6	39.1	35.0	38.0	20.0	**35.5**	5.7	0.0	**2.9**	25.1	60.0	**42.6**	37.5	97.1	**67.3**	27.3	80.0	30.3	**45.9**	13.5	33.2	**23.4**	2.0
ORM 2019-25	30.0	37.1	32.5	25.2	15.0	**28.0**	4.7	5.0	**4.8**	21.1	55.0	**38.1**	30.0	68.9	**49.5**	54.8	85.0	33.5	**57.8**	12.4	19.2	**15.8**	2.0
PRE 2018-10	31.7	36.0	17.5	24.0	7.5	**23.3**	5.1	0.0	**2.6**	21.1	52.5	**36.8**	17.5	83.3	**50.4**	49.9	100.0	68.7	**72.9**	11.0	23.6	**17.3**	1.8
PHR-2	28.9	23.8	20.0	16.0	2.5	**18.2**	0.0	4.0	**2.0**	10.9	35.0	**23.0**	70.0	94.9	**82.5**	57.3	100.0	45.0	**67.4**	3.2	58.8	**31.0**	2.2
DRMRHJ 1117	25.1	11.8	17.5	16.8	15.0	**17.2**	0.0	5.5	**2.8**	3.1	65.0	**34.1**	22.5	93.1	**57.8**	58.9	85.0	28.9	**57.6**	13.9	20.4	**17.2**	2.2
DRMR 2018-19	0.0	2.2	5.0	0.0	0.0	**1.4**	0.0	6.5	**3.3**	0.0	60.0	**30.0**	27.5	51.8	**39.7**	41.7	80.0	76.0	**65.9**	11.0	68.2	**39.6**	1.9
DRMRHJ 430	35.6	42.9	30.0	31.7	12.5	**30.5**	8.9	10.0	**9.4**	17.1	50.0	**33.6**	30.0	90.0	**60.0**	56.3	80.0	67.4	**67.9**	7.5	56.2	**31.9**	2.0
NPJ 250	26.7	11.8	12.5	19.0	0.0	**14.0**	0.0	9.0	**4.5**	3.8	45.0	**24.4**	27.5	46.0	**36.8**	40.7	97.5	27.9	**55.4**	15.7	19.8	**17.7**	2.1
NPJ 251	33.4	38.0	22.5	26.7	25.0	**29.1**	4.3	4.0	**4.1**	18.9	60.0	**39.5**	35.0	26.0	**30.5**	63.9	100.0	54.3	**72.7**	17.1	16.2	**16.7**	2.0
NRCHB 101	40.0	43.2	32.5	32.2	40.0	**37.6**	10.9	7.0	**9.0**	21.3	25.0	**23.2**	22.5	83.8	**53.2**	50.3	85.0	86.6	**74.0**	12.7	66.0	**39.3**	1.9
DRMRMJA 35	6.7	14.9	17.5	15.8	0.0	**11.0**	0.0	0.0	**0.0**	2.9	42.5	**22.7**	12.5	44.7	**28.6**	46.2	100.0	35.2	**60.5**	14.5	34.4	**24.5**	2.1
NPJ 253	17.8	9.1	20.0	20.3	25.0	**18.4**	0.0	7.0	**3.5**	3.8	35.0	**19.4**	15.0	26.0	**20.5**	30.8	80.0	79.2	**63.3**	15.2	8.0	**11.6**	1.8
RHH 2101	35.6	37.1	22.5	23.9	25.0	**28.8**	4.4	4.0	**4.2**	18.0	65.0	**41.5**	15.0	50.0	**32.5**	52.0	85.0	26.5	**54.5**	18.0	9.6	**13.8**	1.9
DRMRHJ 2518	30.0	38.0	22.5	21.7	20.0	**26.4**	5.4	8.0	**6.7**	17.1	45.0	**31.1**	35.0	85.1	**60.1**	46.8	82.5	-	**64.7**	6.7	-	**6.7**	-
NAMJH 21-01	28.4	40.0	15.0	17.9	12.5	**22.8**	5.6	8.0	**6.8**	16.0	42.5	**29.3**	17.5	78.9	**48.2**	55.8	80.0	36.4	**57.4**	16.6	30.6	**23.6**	2.1
18J408C	31.7	32.0	20.0	25.0	25.0	**26.7**	4.4	7.0	**5.7**	16.9	72.5	**44.7**	10.0	98.9	**54.5**	35.0	55.0	80.6	**56.9**	19.5	9.6	**14.6**	2.1
SVJH- 70	27.8	26.9	12.5	28.5	25.0	**24.1**	0.0	4.0	**2.0**	9.1	65.0	**37.1**	27.5	86.0	**56.8**	40.0	95.0	27.2	**54.1**	19.2	22.8	**21.0**	2.0
RMX 9922	30.0	23.1	22.5	28.3	25.0	**25.8**	0.0	0.0	**0.0**	12.2	85.0	**48.6**	15.0	89.8	**52.4**	51.7	80.0	84.5	**72.1**	20.9	46.4	**33.7**	1.8
SVJH- 71	29.5	24.0	10.0	24.5	25.0	**22.6**	0.0	0.0	**0.0**	16.2	57.5	**36.9**	7.5	64.2	**35.9**	48.2	80.0	47.0	**58.4**	13.9	37.2	**25.6**	2.0
IJ 16 R 1168	18.9	18.9	17.5	17.5	7.5	**16.1**	0.0	0.0	**0.0**	7.8	37.5	**22.7**	5.0	76.0	**40.5**	54.8	65.0	32.7	**50.8**	16.7	12.2	**14.5**	2.1
DMH-1	2.8	6.0	22.5	23.5	0.0	**11.0**	0.0	8.0	**4.0**	0.0	57.5	**28.8**	40.0	92.0	**66.0**	32.5	62.5	41.7	**45.6**	20.2	4.0	**12.1**	1.9
PBR 939	25.1	36.0	22.5	29.7	7.5	**24.2**	6.5	9.0	**7.7**	22.9	75.0	**49.0**	37.5	92.0	**64.8**	41.7	80.0	83.3	**68.3**	10.0	50.4	**30.2**	1.9
RH 1975	31.2	40.0	30.0	26.4	25.0	**30.5**	5.1	5.5	**5.3**	26.0	62.5	**44.3**	27.5	90.9	**59.2**	43.8	65.0	31.7	**46.8**	20.0	12.6	**16.3**	2.1
ACN 237	40.0	48.0	30.0	34.3	40.0	**38.5**	8.0	4.5	**6.3**	30.2	50.0	**40.1**	27.5	79.3	**53.4**	45.2	62.5	28.6	**45.4**	18.0	20.8	**19.4**	2.1
NPJ 252	30.0	47.6	32.5	28.1	15.0	**30.6**	11.8	3.0	**7.4**	22.0	47.5	**34.8**	22.5	96.2	**59.4**	54.8	95.0	50.0	**66.6**	20.3	21.4	**20.9**	2.0
KMR 21-3	34.5	46.9	22.5	26.3	20.0	**30.0**	6.5	10.0	**8.2**	17.1	70.0	**43.6**	37.5	82.0	**59.8**	51.3	95.0	87.1	**77.8**	19.1	35.0	**27.1**	2.0
DRMRIJ 20-157	0.0	0.0	12.5	0.0	0.0	**2.5**	0.0	0.0	**0.0**	3.8	80.0	**41.9**	42.5	94.9	**68.7**	34.8	97.5	35.4	**55.9**	19.4	19.8	**19.6**	2.0
IJ 19R5004	0.0	0.0	5.0	0.0	5.0	**2.0**	0.0	0.0	**0.0**	0.0	67.5	**33.8**	52.5	86.0	**69.3**	52.3	97.5	34.4	**61.4**	18.0	20.8	**19.4**	2.0
PDZ- 14	1.7	10.9	12.5	5.4	7.5	**7.6**	0.0	3.5	**1.8**	2.9	62.5	**32.7**	27.5	95.8	**61.7**	41.2	82.5	41.7	**55.1**	16.6	4.0	**10.3**	2.1
RH 1974	28.4	37.1	10.0	31.1	7.5	**22.8**	4.8	4.5	**4.6**	22.0	35.0	**28.5**	35.0	84.0	**59.5**	32.5	97.5	53.3	**61.1**	19.0	47.8	**33.4**	1.8
KGMH 9198	26.7	38.5	32.5	24.6	25.0	**29.4**	4.7	4.0	**4.3**	22.0	42.5	**32.3**	25.0	70.9	**48.0**	36.6	82.5	29.3	**49.5**	15.7	15.0	**15.4**	2.0
SKM- 1901	17.8	37.9	37.5	15.9	25.0	**26.8**	5.0	0.0	**2.5**	22.7	52.5	**37.6**	30.0	82.0	**56.0**	51.7	97.5	33.1	**60.8**	16.0	24.6	**20.3**	2.0
DRMR 2018-37	0.0	0.0	12.5	14.9	0.0	**5.5**	0.0	0.0	**0.0**	10.0	65.0	**37.5**	30.0	93.3	**61.7**	74.9	90.0	36.7	**67.2**	12.8	21.6	**17.2**	2.2
DRMRCI(Q) 47	1.7	11.8	15.0	2.3	15.0	**9.2**	0.0	4.0	**2.0**	3.1	40.0	**21.6**	37.5	95.8	**66.7**	36.6	100.0	88.2	**74.9**	8.9	67.4	**38.2**	1.9
PDZ 15	0.0	9.1	12.5	0.0	7.5	**5.8**	0.0	10.5	**5.3**	2.9	65.0	**34.0**	10.0	58.9	**34.5**	51.5	80.0	36.7	**56.1**	16.0	2.4	**9.2**	2.3

RH 1934	31.2	42.9	20.0	25.6	20.0	**27.9**	6.5	7.5	**7.0**	22.0	40.0	**31.0**	12.5	54.0	**33.3**	46.8	95.0	43.2	**61.7**	12.1	7.6	**9.9**	2.3
RGN 524	35.6	36.0	35.0	33.1	25.0	**32.9**	4.7	6.0	**5.3**	12.2	50.0	**31.1**	40.0	96.0	**68.0**	42.2	90.0	34.5	**55.6**	13.5	11.8	**12.7**	2.3
PDZ 16	4.5	17.8	12.5	0.0	0.0	**7.0**	0.0	0.0	**0.0**	5.1	57.5	**31.3**	27.5	97.1	**62.3**	51.2	70.0	49.0	**56.7**	9.7	37.2	**23.5**	2.0
DRMR 2018-25	0.0	0.0	17.5	1.3	7.5	**5.3**	0.0	10.0	**5.0**	0.0	30.0	**15.0**	25.0	88.0	**56.5**	59.1	75.0	39.0	**57.7**	9.8	25.6	**17.7**	2.2
Rohini	38.9	46.0	27.5	23.5	25.0	**32.2**	11.0	4.0	**7.5**	26.9	55.0	**41.0**	22.5	68.9	**45.7**	61.1	100.0	33.2	**64.8**	14.6	13.4	**14.0**	2.1
BioYSR	0.0	0.0	10.0	7.9	0.0	**3.6**	0.0	6.0	**3.0**	0.0	50.0	**25.0**	22.5	70.9	**46.7**	70.8	100.0	33.3	**68.0**	4.4	7.6	**6.0**	2.1
GSH- 2155	0.0	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	**0.0**	0.0	0.0	**0.0**	0.0	18.0	**9.0**	22.8	55.0	54.1	**44.0**	21.2	32.6	**26.9**	2.2
DLSC 1	0.0	0.0	0.0	23.4	0.0	**4.7**	0.0	0.0	**0.0**	0.0	0.0	**0.0**	0.0	7.8	**3.9**	18.9	80.0	55.0	**51.3**	11.9	7.8	**9.9**	2.5
CS2020-10	40.0	46.0	25.0	23.1	20.0	**30.8**	0.0	11.0	**5.5**	26.9	35.0	**31.0**	20.0	63.8	**41.9**	51.2	92.5	24.4	**56.0**	14.8	13.0	**13.9**	2.4
GSL-1	0.0	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	**0.0**	0.0	0.0	**0.0**	7.5	27.8	**17.7**	20.0	60.0	34.7	**38.2**	1.4	29.4	**15.4**	1.9
Maya (ZC) Zone- III	10.6	3.8	22.5	19.5	7.5	**12.8**	0.0	8.5	**4.3**	2.7	25.0	**13.9**	22.5	84.0	**53.3**	45.7	92.5	59.8	**66.0**	13.3	38.0	**25.7**	2.0
Basanti (WRR Check)	0.0	0.0	17.5	9.7	0.0	**5.4**	0.0	0.0	**0.0**	0.0	52.5	**26.3**	17.5	88.0	**52.8**	52.1	90.0	83.3	**75.1**	14.7	25.8	**20.2**	1.9
PM 28 (LR)	31.1	41.1	30.0	24.9	7.5	**26.9**	7.7	0.0	**3.8**	22.0	50.0	**36.0**	20.0	81.1	**50.6**	55.4	82.5	24.4	**54.1**	13.4	17.0	**15.2**	2.0
RGN 73 (ZC) Zine- III	32.2	46.0	40.0	46.4	15.0	**35.9**	7.5	0.0	**3.8**	23.0	40.0	**31.5**	7.5	32.7	**20.1**	65.8	60.0	36.7	**54.2**	7.5	12.2	**9.9**	1.9
GSL- 1 (NC)	0.0	1.6	0.0	0.0	**0.0**	**0.3**	0.0	0.0	**0.0**	4.0	7.5	**5.8**	0.0	26.0	**13.0**	22.2	60.0	48.2	**43.5**	**10.1**	28.6	**19.4**	1.9
Nenoy (ZC) Zone- V	0.0	1.8	7.5	0.0	**0.0**	**1.9**	0.0	7.0	**3.5**	0.0	0.0	**0.0**	7.5	45.1	**26.3**	83.7	100.0	55.8	**79.8**	**9.5**	29.8	**19.7**	1.9
CS 56 (LR) Zone- III	27.2	32.0	40.0	27.7	25.0	**30.4**	4.3	6.0	**5.1**	17.1	15.0	**16.1**	5.0	82.0	**43.5**	45.0	80.0	85.1	**70.0**	16.3	36.2	**26.3**	2.0
DRMR 150-35 (LR) Z-V	25.1	28.7	37.5	24.3	25.0	**28.1**	4.9	8.0	**6.4**	18.0	35.0	**26.5**	12.5	86.0	**49.3**	50.0	97.5	40.1	**62.5**	15.6	21.2	**18.4**	1.9
AKMS 8141 (LR)	0.0	0.0	3.5	0.0	0.0	**0.7**	0.0	0.0	**0.0**	0.0	0.0	**0.0**	10.0	13.1	**11.6**	19.0	82.5	21.1	**40.9**	15.9	11.4	**13.7**	1.9
GSC 6 (QC)	0.0	0.0	5.0	0.0	0.0	**1.0**	0.0	4.5	**2.3**	0.0	0.0	**0.0**	0.0	14.7	**7.4**	21.1	80.0	46.2	**49.1**	10.7	34.6	**22.7**	1.8
TS- 38 (LR) Zone- V	0.0	3.8	32.5	0.0	0.0	**7.3**	0.0	5.5	**2.8**	0.0	27.5	**13.8**	0.0	0.0	**0.0**	100.0	100.0	64.9	**88.3**	14.9	25.4	**20.2**	1.8
CS 54 (Salinity Check)	36.7	44.0	37.5	29.7	40.0	**37.6**	7.9	6.5	**7.2**	22.0	25.0	**23.5**	12.5	65.8	**39.2**	54.9	100.0	76.7	**77.2**	18.8	49.0	**33.9**	1.8
NRCHB- 101 (LR) Z-V	38.9	44.0	30.0	32.7	30.0	**35.1**	8.0	14.0	**11.0**	25.1	37.5	**31.3**	0.0	96.0	**48.0**	55.8	85.0	37.4	**59.4**	21.8	21.0	**21.4**	2.0
BIO 902 (ZC) Zone- IV	4.5	9.6	20.0	16.6	7.5	**11.6**	0.0	7.0	**3.5**	2.7	50.0	**26.4**	10.0	94.9	**52.5**	41.7	95.0	47.3	**61.3**	12.7	20.2	**16.5**	2.0
PDZ 1 (00 Check)	0.0	2.0	12.5	0.0	7.5	**4.4**	0.0	11.0	**5.5**	0.0	20.0	**10.0**	7.5	92.0	**49.8**	72.0	77.5	46.4	**65.3**	6.4	19.6	**13.0**	2.1
CS 60 (Salinity (LR)	35.6	40.0	37.5	22.5	30.0	**33.1**	3.8	7.0	**5.4**	22.0	40.0	**31.0**	12.5	82.9	**47.7**	74.9	95.0	36.7	**68.9**	17.4	8.4	**12.9**	1.9
PDZ-1	0.0	0.9	7.5	0.0	15.0	**4.7**	0.0	4.0	**2.0**	0.0	37.5	**18.8**	15.0	94.0	**54.5**	45.0	92.5	36.7	**58.1**	15.8	2.4	**9.1**	2.0
PT-303	0.0	1.8	40.0	0.0	0.0	**8.4**	0.0	9.0	**4.5**	0.0	0.0	**0.0**	0.0	0.0	**0.0**	100.0	97.5	30.1	**75.9**	23.8	16.2	**20.0**	1.8
RTM-314	0.0	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	**0.0**	0.0	0.0	**0.0**	0.0	37.1	**18.6**	100.0	100.0	91.7	**97.2**	18.5	67.6	**43.1**	1.4
NRCYS 05-2	0.0	5.3	47.5	1.0	0.0	**10.8**	0.0	6.0	**3.0**	2.9	0.0	**1.5**	0.0	44.0	**22.0**	100.0	100.0	74.6	**91.5**	11.0	61.8	**36.4**	1.3
CD (*P*=0.05)	**4.8**	**1.9**	**8.3**	**3.1**	**6.9**		**1.2**	**4.5**		**4.8**	**10.8**		**8.8**	**15.8**		**10.2**	**11.3**	**6.6**		**6.1**	**-**		**-**
CV (%)	**11.3**	**3.9**	**-**	**7.3**	**-**		**8.9**	**-**		**14.7**	**-**		**-**	**13.8**		**11.1**	**-**	**8.0**		**21.4**	**-**		**-**

Table.4.2.1: Reaction of oilseed *Brassica* germplasm against Alternaria Leaf blight in Uniform Disease Nursery (natural condition)

Code No.	Entries	% ABL (100 DAS)*											% ABP (15 days before harvest)									
		HSR	NDH	MOR	PNT	SHL	VAR	DOL	JHS	JAG	CHT	Mean	HSR	MOR	PNT	SHL	VAR	DOL	LDH	JHS	CHT	Mean
UDN-22-01	DRMRDR 2155	23.4	44.4	22.7	45.0	30.0	50.0	19.4	15.0	20.8	43.3	**31.4**	18.9	10.9	27.5	18.5	20.0	15.2	32.1	5.0	37.5	**20.6**
UDN-22-02	DRMRDR 2203	22.2	27.8	20.2	20.0	28.2	50.0	21.0	10.0	18.5	36.3	**25.4**	15.6	10.0	42.5	16.8	12.5	15.4	31.5	10.0	28.2	**20.3**
UDN-22-03	DRMRDR 2202	31.1	27.8	16.0	25.0	27.0	50.0	17.1	25.0	9.8	41.1	**27.0**	21.1	6.9	32.5	15.4	12.5	12.4	31.3	5.0	36.3	**19.3**
UDN-22-04	DRMRSJ 14	25.1	17.8	19.2	20.0	30.5	50.0	18.4	10.0	3.5	37.7	**23.2**	17.8	11.8	35.0	20.5	17.5	14.1	28.0	10.0	31.1	**20.6**
UDN-22-05	**BioYSR (RC-WR)**	27.8	24.4	30.5	25.0	27.9	50.0	15.8	25.0	21.9	56.0	**30.4**	22.2	10.9	27.5	20.1	10.0	11.1	30.4	5.0	47.3	**20.5**
UDN-22-06	DRMRDR 2116	32.2	17.2	32.0	25.0	30.4	50.0	19.7	10.0	17.0	53.0	**28.6**	23.4	14.0	35.0	21.1	27.5	15.3	33.6	15.0	46.2	**25.7**
UDN-22-07	DRMRDR 2140	16.8	28.3	36.0	25.0	28.9	50.0	16.0	15.0	22.4	44.2	**28.3**	11.7	14.7	32.5	19.2	20.0	9.6	18.9	5.0	38.0	**18.8**
UDN-22-08	DRMRCI 169	21.1	20.0	16.2	30.0	30.1	50.0	18.5	10.0	17.9	52.1	**26.6**	16.8	9.1	40.0	20.3	10.0	13.8	40.7	10.0	46.2	**23.0**
UDN-22-09	DRMRDR 2227	20.0	23.8	36.0	35.0	29.0	50.0	21.1	25.0	19.7	43.6	**30.3**	15.6	14.9	32.5	17.0	17.5	16.7	38.7	5.0	36.3	**21.6**
UDN-22-10	DRMRDR 2133	22.2	21.1	17.1	32.5	31.1	50.0	22.9	25.0	23.7	42.3	**28.8**	13.4	10.9	47.5	18.8	17.5	16.1	37.0	7.5	34.3	**22.5**
UDN-22-11	DRMRSJ 9	12.3	21.6	11.8	32.5	28.3	50.0	35.5	15.0	8.1	33.5	**24.9**	10.6	8.2	40.0	17.0	50.0	27.3	37.6	7.5	25.7	**24.9**
UDN-22-12	DRMRDR 2201	25.1	17.2	14.9	27.5	30.4	50.0	28.2	15.0	9.6	52.3	**27.0**	20.0	9.1	37.5	15.7	15.0	20.9	36.9	7.5	45.2	**23.1**
UDN-22-13	PRD- 2014-7	21.1	38.9	10.9	37.5	25.3	30.0	13.1	10.0	18.7	45.1	**25.1**	17.8	8.0	40.0	17.4	5.0	10.0	19.4	10.0	35.0	**18.1**
UDN-22-14	DRMRDR 2152	11.7	18.9	14.0	40.0	29.1	50.0	24.2	10.0	14.7	37.1	**25.0**	10.6	8.2	40.0	18.1	22.5	17.9	35.4	10.0	29.4	**21.3**
UDN-22-15	DRMRDR 2206	12.8	20.5	36.0	35.0	29.8	50.0	20.7	20.0	25.4	34.3	**28.4**	10.0	14.0	27.5	18.7	22.5	15.2	20.5	5.0	28.1	**17.9**
UDN-22-16	**Rohini (SC)**	23.4	34.4	24.0	25.0	28.7	50.0	26.8	15.0	21.1	26.2	**27.5**	17.8	13.1	32.5	17.0	22.5	18.5	37.1	10.0	17.6	**20.7**
UDN-22-17	DRMR 2018-26	26.7	20.5	22.0	30.0	28.3	50.0	30.4	15.0	17.2	25.0	**26.5**	20.0	12.0	42.5	17.5	50.0	24.5	36.6	5.0	16.0	**24.9**
UDN-22-18	DRMRDR 2195	22.2	35.0	22.2	27.5	29.6	50.0	25.1	20.0	22.0	28.3	**28.2**	15.6	12.0	42.5	16.2	22.5	20.0	32.5	10.0	21.1	**21.4**
UDN-22-19	DRMRDR 2135	28.4	36.1	16.0	35.0	30.8	30.0	29.1	15.0	7.5	24.3	**25.2**	24.5	10.0	27.5	15.8	7.5	23.9	28.5	5.0	18.0	**17.8**
UDN-22-20	DRMRDR 2156	15.6	37.7	12.0	32.5	30.7	30.0	18.0	10.0	17.0	25.0	**22.8**	14.5	9.1	27.5	19.9	10.0	8.1	33.4	10.0	16.3	**16.5**
UDN-22-21	DRMRDR 2203	33.4	34.4	11.6	32.5	32.4	50.0	30.5	20.0	20.2	24.8	**29.0**	23.4	6.9	22.5	21.4	15.0	22.4	28.4	5.0	18.6	**18.2**
UDN-22-22	DRMRDR 2151	20.0	20.0	14.0	27.5	29.7	50.0	30.9	20.0	7.1	47.0	**26.6**	15.6	7.8	37.5	17.3	20.0	30.9	30.5	5.0	38.2	**22.5**
UDN-22-23	**NRCHB 101(SC)**	26.7	21.1	10.9	25.0	28.0	50.0	41.0	25.0	27.6	55.0	**31.0**	20.0	9.1	40.0	15.2	22.5	32.5	38.3	5.0	43.0	**25.1**
UDN-22-24	DRMR 2020-15	33.4	18.9	11.1	25.0	29.3	27.5	41.7	15.0	10.2	44.3	**25.6**	27.2	9.1	45.0	16.6	10.0	32.7	35.6	5.0	35.6	**24.1**
UDN-22-25	DRMRDR 2196	26.7	25.6	21.1	25.0	30.6	30.0	32.4	30.0	20.6	32.0	**27.4**	21.1	12.2	27.5	20.0	12.5	30.7	28.6	5.0	24.2	**20.2**
UDN-22-26	DRMRDR 2141	29.5	20.0	22.0	27.5	31.0	27.5	32.2	15.0	18.4	33.3	**25.6**	24.5	10.9	47.5	20.1	7.5	28.3	29.3	10.0	26.1	**22.7**
UDN-22-27	DRMRCI 143	30.0	16.6	20.0	32.5	32.1	40.0	29.8	10.0	26.2	46.8	**28.4**	23.4	10.9	45.0	18.6	17.5	24.5	28.3	7.5	37.1	**23.6**
UDN-22-28	**GSL-1 (Bn)**	7.3	7.7	10.2	17.5	15.8	27.5	6.9	20.0	6.3	16.3	**13.5**	5.0	6.0	50.0	8.2	7.5	4.8	27.4	1.0	7.0	**13.0**
UDN-22-29	**PT-303 (C)**	33.4	23.3	14.0	60.0	30.7	50.0	28.9	15.0	13.2	43.3	**31.2**	23.4	10.9	40.0	17.9	50.0	28.5	29.2	5.0	32.4	**26.4**
UDN-22-30	DRMRDR 2235	22.2	23.3	20.2	25.0	31.7	50.0	27.6	15.0	24.2	22.5	**26.2**	18.9	12.0	37.5	18.7	12.5	25.4	37.0	10.0	14.1	**20.7**
UDN-22-31	PAB-2017-25	24.5	17.8	14.9	20.0	27.6	17.5	5.9	25.0	2.7	13.3	**16.9**	20.0	6.9	7.5	20.1	0.0	4.8	19.2	5.0	7.2	**10.1**
UDN-22-32	DRMRCI (Q) 57	31.2	23.3	28.0	30.0	29.4	30.0	11.5	15.0	11.3	51.1	**26.1**	26.7	10.9	32.5	17.0	5.0	8.9	33.5	5.0	44.3	**20.4**
UDN-22-33	DRMRCI 153	17.8	20.0	26.0	40.0	29.5	50.0	31.9	20.0	8.1	34.7	**27.8**	12.8	10.9	35.0	20.5	20.0	20.1	35.6	10.0	27.8	**21.4**
UDN-22-34	DRMR 2019-20	13.4	15.0	22.9	27.5	31.2	27.5	16.4	15.0	11.1	22.0	**20.2**	10.6	11.1	42.5	19.6	5.0	16.6	29.2	10.0	11.0	**17.3**
UDN-22-35	**NRCYS 05-2 (Br-YS)**	31.2	6.6	22.0	57.5	30.2	50.0	43.0	25.0	10.7	22.0	**29.8**	26.7	12.0	57.5	18.5	50.0	31.6	38.0	10.0	13.2	**28.6**
UDN-22-36	DRMRSJ 22	21.1	14.4	20.0	12.5	28.9	27.5	26.8	15.0	16.6	15.5	**19.8**	17.8	14.0	42.5	15.6	10.0	19.3	35.4	10.0	6.2	**19.0**
UDN-22-37	DRMRDR 2119	23.4	12.2	14.9	22.5	30.6	27.5	32.3	25.0	11.7	13.1	**21.3**	18.9	10.0	40.0	17.3	17.5	26.1	35.5	10.0	6.5	**20.2**
UDN-22-38	PAB-2017-1	26.7	7.8	15.8	25.0	32.0	22.5	10.0	25.0	8.9	18.3	**19.2**	20.0	10.9	17.5	19.1	0.0	5.8	28.3	15.0	8.2	**13.9**
UDN-22-39	DRMRDR 2236	23.4	11.1	20.9	32.5	30.4	30.0	26.8	20.0	12.3	20.3	**22.8**	17.8	13.1	32.5	18.4	12.5	22.2	35.6	15.0	11.3	**19.8**
UDN-22-40	DRMRCI 170	21.1	14.4	29.1	25.0	30.7	30.0	22.1	10.0	10.8	21.0	**21.4**	16.8	16.0	35.0	18.3	7.5	18.0	28.5	15.0	11.5	**18.5**
UDN-22-41	**DRMRMJA 35(RC-WR)**	30.0	20.0	30.0	20.0	26.7	27.5	31.1	15.0	23.7	22.3	**24.6**	23.4	14.9	37.5	17.5	7.5	22.7	28.1	25.0	10.5	**20.8**
UDN-22-42	PRD-2014-26	27.2	33.3	18.9	15.0	12.8	15.0	5.8	10.0	6.5	17.4	**16.2**	20.5	10.9	27.5	6.3	5.0	3.9	20.4	10.0	12.6	**13.0**
UDN-22-43	**DLSC 1 (C)**	8.4	13.3	16.0	12.5	30.0	17.5	13.5	10.0	13.5	12.3	**14.7**	6.7	9.1	7.5	20.0	0.0	9.0	10.8	10.0	6.0	**8.8**
UDN-22-44	DRMRSJ 12	17.8	17.8	19.1	22.5	30.8	50.0	25.8	20.0	23.1	34.8	**26.2**	13.4	9.1	42.5	18.0	7.5	20.9	37.5	20.0	21.3	**21.1**
UDN-22-45	DRMRDR 2241	23.4	15.5	18.0	27.5	32.0	30.0	23.4	10.0	11.2	34.3	**22.5**	18.9	10.0	40.0	18.8	7.5	21.4	37.9	15.0	24.3	**21.5**
UDN-22-46	PAB-2017-22	26.7	22.7	10.9	15.0	28.7	15.0	6.7	30.0	3.2	12.3	**17.1**	20.0	6.9	7.5	19.5	0.0	4.7	16.8	7.5	3.3	**9.6**
UDN-22-47	RH-1700-3	33.4	21.6	10.9	27.5	30.1	30.0	19.6	20.0	6.3	37.8	**23.7**	27.2	8.0	37.5	18.3	5.0	15.8	39.6	10.0	31.7	**21.4**
UDN-22-48	**PHR-2 (TC-AB)**	25.1	20.5	10.0	12.5	25.9	22.5	11.4	25.0	6.6	8.3	**16.8**	17.8	6.0	35.0	17.7	5.0	8.9	47.2	5.0	2.9	**16.2**
UDN-22-49	DRMRCI 171	27.8	22.2	32.2	25.0	31.2	30.0	24.2	20.0	5.8	15.0	**23.3**	22.2	15.8	37.5	20.4	7.5	18.5	20.3	10.0	5.5	**17.5**
UDN-22-50	DRMR 2019-15	23.4	15.0	21.1	27.5	31.4	17.5	36.9	20.0	14.6	24.0	**23.1**	17.8	11.8	40.0	19.8	12.5	31.0	26.7	5.0	16.0	**20.1**
UDN-22-51	PRD-2014-21	26.7	22.2	33.1	25.0	31.2	17.5	8.8	20.0	4.2	15.7	**20.4**	20.0	14.0	12.5	19.4	0.0	6.0	28.6	5.0	7.8	**12.6**
UDN-22-52	PAB-2017-4	22.2	21.6	20.0	12.5	23.4	17.5	8.9	25.0	2.9	7.3	**16.1**	15.6	13.3	10.0	15.8	5.0	6.2	24.4	5.0	3.1	**10.9**
UDN-22-53	DRMRDR 2242	28.4	25.5	25.1	32.5	31.4	27.5	26.7	20.0	0.0	15.3	**23.2**	24.5	15.2	42.5	20.5	17.5	19.5	30.5	5.0	7.3	**20.3**
CD(*P*=0.05)		**5.3**	**3.1**	**7.0**	**8.6**	**4.2**	**3.0**	**4.7**	**10.4**	**3.9**	**-**		**5.0**	**1.3**	**6.1**	**4.2**	**3.0**	**1.5**	**4.6**	**5.5**	**-**	
CV (%)		**9.1**	**5.6**	**13.2**	**-**	**6.4**	**5.3**	**8.4**	**19.9**	**13.9**	**-**		**9.9**	**3.3**	**-**	**8.4**	**5.4**	**3.1**	**6.9**	**15.1**	**-**	

***LDH and JHS excluded for ABL**

Table 4.2.2: Reaction of oilseed Brassica germplasm to WR, SH, PM and DM under UDN (natural condition)

Entries	% WR (100 DAS)*						% SH**	% Powdery mildew severity (100 DAS)#							% DM			% SR##
	HSR	NDH	SKN	JHS	CHT	Mean	CHT	MOR	PNT	SKN	JAG	JHS	NGP	Mean	MOR	PNT	Mean	CHT
DRMRDR 2155	0.0	15.6	7.2	10.0	0.0	**6.6**	0.0	97.3	27.5	100.0	29.9	20.0	64.4	**56.5**	0.0	50.0	**25.0**	0.0
DRMRDR 2203	8.9	22.8	16.1	20.0	16.9	**16.9**	0.0	96.2	20.0	100.0	29.2	20.0	68.9	**55.7**	0.0	20.0	**10.0**	0.0
DRMRDR 2202	27.8	34.4	35.6	15.0	24.5	**27.5**	1.5	97.1	15.0	95.0	17.8	30.0	64.4	**53.2**	1.6	22.5	**12.0**	0.0
DRMRSJ 14	0.0	11.1	0.6	10.0	0.0	**4.3**	0.0	95.3	20.0	95.0	6.4	15.0	60.0	**48.6**	0.0	25.0	**12.5**	0.0
BioYSR (RC-WR)	7.8	19.5	20.6	7.5	8.2	**12.7**	0.0	96.4	30.0	100.0	32.0	25.0	77.8	**60.2**	4.0	30.0	**17.0**	2.0
DRMRDR 2116	18.9	13.9	15.6	20.0	28.3	**19.3**	2.3	97.1	30.0	100.0	17.9	10.0	64.4	**53.2**	3.6	30.0	**16.8**	0.0
DRMRDR 2140	5.0	34.5	10.0	5.0	23.3	**15.6**	0.5	97.1	57.5	95.0	22.2	20.0	68.9	**60.1**	4.9	37.5	**21.2**	3.1
DRMRCI 169	0.0	12.8	0.6	5.0	12.5	**6.2**	0.0	90.9	30.0	90.0	28.9	15.0	75.6	**55.1**	20.2	30.0	**25.1**	0.0
DRMRDR 2227	25.1	21.1	7.2	3.0	24.5	**16.2**	0.0	94.0	45.0	95.0	21.1	25.0	75.6	**59.3**	6.9	27.5	**17.2**	0.0
DRMRDR 2133	20.5	15.0	19.4	25.0	28.8	**21.7**	2.5	94.9	42.5	100.0	36.9	25.0	60.0	**59.9**	12.2	50.0	**31.1**	0.0
DRMRSJ 9	0.0	0.0	7.8	10.0	0.0	**3.6**	0.0	94.0	30.0	80.0	16.0	25.0	42.2	**47.9**	0.0	37.5	**18.8**	0.0
DRMRDR 2201	2.8	11.1	0.6	25.0	1.5	**8.2**	0.0	94.2	32.5	90.0	24.3	25.0	71.1	**56.2**	0.0	20.0	**10.0**	33.3
PRD- 2014-7	32.2	31.1	26.1	20.0	32.5	**28.4**	3.5	90.9	60.0	80.0	24.5	20.0	73.3	**58.1**	19.8	45.0	**32.4**	2.8
DRMRDR 2152	0.0	0.0	4.4	5.0	12.6	**4.4**	0.0	88.0	57.5	95.0	25.5	30.0	84.4	**63.4**	0.0	32.5	**16.3**	0.0
DRMRDR 2206	26.7	18.3	8.9	10.0	27.7	**18.3**	1.5	78.0	22.5	80.0	34.3	25.0	42.2	**47.0**	2.9	65.0	**34.0**	16.7
Rohini (SC)	40.0	28.9	35.6	20.0	33.3	**31.6**	8.6	94.9	62.5	100.0	12.9	20.0	68.9	**59.9**	20.0	35.0	**27.5**	23.3
DRMR 2018-26	0.0	0.0	1.7	3.0	11.1	**3.2**	0.0	90.0	47.5	95.0	14.2	20.0	57.8	**54.1**	0.0	30.0	**15.0**	10.0
DRMRDR 2195	4.5	23.9	6.1	5.0	8.6	**9.6**	0.0	94.0	65.0	75.0	31.1	30.0	80.0	**62.5**	7.4	55.0	**31.2**	0.0
DRMRDR 2135	0.0	0.0	5.0	3.0	0.0	**1.6**	0.0	90.9	62.5	85.0	12.3	20.0	66.7	**56.2**	0.0	35.0	**17.5**	0.0
DRMRDR 2156	24.5	37.8	18.9	20.0	36.1	**27.5**	6.6	86.9	50.0	85.0	22.7	20.0	91.1	**59.3**	11.1	75.0	**43.1**	4.5
DRMRDR 2203	31.2	40.0	26.1	7.5	37.5	**28.5**	13.9	92.0	60.0	95.0	30.2	25.0	77.8	**63.3**	0.0	37.5	**18.8**	16.7
DRMRDR 2151	17.8	13.3	7.2	7.5	16.4	**12.4**	1.0	81.1	27.5	80.0	12.3	25.0	66.7	**48.8**	0.0	62.5	**31.3**	11.0
NRCHB 101(SC)	41.1	20.6	33.3	5.0	38.3	**27.6**	16.3	78.0	35.0	70.0	35.1	30.0	95.6	**57.3**	1.6	40.0	**20.8**	32.5
DRMR 2020-15	0.0	0.0	5.6	5.0	18.8	**5.9**	0.0	96.0	40.0	95.0	17.5	20.0	82.2	**58.5**	0.0	60.0	**30.0**	13.3
DRMRDR 2196	8.9	12.2	10.6	25.0	25.0	**16.3**	1.5	90.9	22.5	95.0	23.3	25.0	75.6	**55.4**	0.0	57.5	**28.8**	20.0
DRMRDR 2141	10.0	15.6	9.4	10.0	22.3	**13.5**	0.3	94.9	20.0	95.0	27.1	25.0	68.9	**55.1**	3.4	20.0	**11.7**	21.5
DRMRCI 143	28.9	21.1	5.6	20.0	0.0	**15.1**	0.0	93.1	17.5	85.0	25.3	15.0	77.8	**52.3**	2.0	50.0	**26.0**	13.3
GSL-1 (Bn)	0.0	0.0	0.0	5.0	0.0	**1.0**	0.0	25.1	40.0	0.0	0.8	25.0	75.6	**27.7**	0.0	0.0	**0.0**	14.3
PT-303 (C)	0.0	0.0	4.4	1.0	22.7	**5.6**	1.5	12.0	0.0		19.1	25.0	55.6	**22.3**	0.0	0.0	**0.0**	36.6
DRMRDR 2235	4.5	12.2	8.3	5.0	34.2	**12.8**	3.3	95.8	7.5	90.0	27.3	25.0	75.6	**53.5**	2.9	47.5	**25.2**	3.1
PAB-2017-25	5.0	18.9	2.8	5.0	0.0	**6.3**	0.0	98.0	70.0	65.0	17.3	30.0	88.9	**61.5**	0.0	12.5	**6.3**	13.3
DRMRCI (Q) 57	0.0	0.0	4.4	1.0	10.5	**3.2**	0.0	91.8	15.0	90.0	27.1	20.0	64.4	**51.4**	2.9	7.5	**5.2**	14.7
DRMRCI 153	0.0	0.0	1.7	20.0	0.0	**4.3**	0.0	90.0	20.0	80.0	8.3	25.0	62.2	**47.6**	0.0	22.5	**11.3**	37.5
DRMR 2019-20	0.0	16.1	8.3	25.0	1.5	**10.2**	0.0	94.0	25.0	75.0	28.3	25.0	77.8	**54.2**	14.9	60.0	**37.5**	10.0
NRCYS 05-2 (Br-YS)	0.0	0.0	0.6	1.0	0.0	**0.3**	0.0	20.7	0.0	60.0	22.9	30.0	64.4	**33.0**	0.0	0.0	**0.0**	6.8
DRMRSJ 22	4.5	18.9	13.3	10.0	33.3	**16.0**	1.3	68.2	5.0	75.0	29.4	20.0	68.9	**44.4**	1.1	27.5	**14.3**	20.0
DRMRDR 2119	32.2	14.5	15.6	7.5	0.0	**14.0**	0.0	62.2	7.5	95.0	31.3	30.0	80.0	**51.0**	6.0	45.0	**25.5**	10.5
PAB-2017-1	30.0	41.1	21.1	5.0	36.5	**26.7**	6.7	94.0	22.5	65.0	10.5	30.0	66.7	**48.1**	10.2	40.0	**25.1**	20.0
DRMRDR 2236	31.1	31.7	4.4	15.0	2.1	**16.9**	0.0	94.9	5.0	95.0	34.7	30.0	60.0	**53.3**	10.0	50.0	**30.0**	18.8
DRMRCI 170	0.0	0.0	0.0	20.0	0.0	**4.0**	0.0	84.9	0.0	90.0	19.3	15.0	73.3	**47.1**	0.0	22.5	**11.3**	0.0
DRMRMJA 35(RC-WR)	31.2	22.8	14.4	5.0	23.3	**19.3**	1.3	94.0	0.0	95.0	33.2	25.0	68.9	**52.7**	22.0	45.0	**33.5**	13.3
PRD-2014-26	34.5	50.0	34.4	10.0	27.8	**31.3**	1.5	97.3	7.5	90.0	7.3	15.0	84.4	**50.3**	25.3	30.0	**27.7**	5.3
DLSC 1 (C)	0.0	0.0	0.0	5.0	0.0	**1.0**	0.0	6.9	0.0	0.0	23.5	15.0	1.1	**7.8**	0.0	0.0	**0.0**	0.0
DRMRSJ 12	0.0	0.0	1.7	10.0	0.0	**2.3**	0.0	76.9	7.5	65.0	33.6	25.0	73.3	**46.9**	0.0	55.0	**27.5**	0.0
DRMRDR 2241	30.0	27.2	12.8	5.0	14.3	**17.9**	0.0	88.2	5.0	80.0	20.3	30.0	66.7	**48.4**	10.9	30.0	**20.5**	10.0
PAB-2017-22	0.0	18.9	2.8	7.5	4.4	**6.7**	0.0	95.5	27.5	65.0	9.4	10.0	93.3	**50.1**	2.0	50.0	**26.0**	0.0
RH-1700-3	11.7	27.8	4.4	20.0	0.0	**12.8**	0.0	91.8	7.5	85.0	9.6	25.0	82.2	**50.2**	22.2	25.0	**23.6**	5.5
PHR-2 (TC-AB)	25.1	28.4	15.6	15.0	28.2	**22.5**	2.0	88.0	17.5	65.0	7.3	20.0	64.4	**43.7**	0.0	27.5	**13.8**	1.7
DRMRCI 171	0.0	0.0	0.0	15.0	0.0	**3.0**	0.0	94.0	0.0	75.0	9.2	20.0	80.0	**46.4**	0.0	7.5	**3.8**	0.0
DRMR 2019-15	0.0	0.0	1.7	10.0	1.0	**2.5**	0.0	80.0	0.0	75.0	13.4	25.0	64.4	**43.0**	0.0	20.0	**10.0**	10.0
PRD-2014-21	35.6	23.9	25.0	20.0	29.4	**26.8**	0.0	90.9	30.0	75.0	9.1	20.0	84.4	**51.6**	20.0	35.0	**27.5**	0.0
PAB-2017-4	40.0	35.6	21.1	15.0	32.3	**28.8**	8.1	60.0	15.0	65.0	0.0	20.0	66.7	**37.8**	10.0	25.0	**17.5**	0.0
DRMRDR 2242	43.4	13.3	11.7	5.0	13.3	**17.3**	0.0	82.0	5.0	75.0	0.0	25.0	53.3	**40.1**	3.6	45.0	**24.3**	0.0
CD(*P*=0.05)	**4.5**	**3.5**	**5.7**	**5.2**	**-**			**2.1**	**10.2**	**13.0**	**4.2**	**9.2**	**12.0**		**1.4**	**10.5**		**-**
CV (%)	**13.4**	**8.4**	**25.9**	**13.1**	**-**			**1.5**	**-**	**7.9**	**7.8**	**15.2**	**10.4**		**5.9**	**-**		**-**

*MOR, MDR, PNT and JAG excluded for WR;**PNT and JHS excluded for SH;#VAR and MDR excluded for PM;##MOR,PNT and LDH excluded for SR

Table 4.3.1: Reaction of oilseed Brassica germplasm against AB, WR and DM in NDN for Alternaria blight (artificial condition)

Code No.	Entries	% ABL (100 DAS)*				% ABP (15 days before harvest)**			% WR (100 DAS)				%SH	% DM
		HSR	SHL	PNT	Mean	PNT	LDH	Mean	HSR	PNT	LDH	Mean	PNT	PNT
NDN-22-01	**DLSC 1 (C)**	7.3	13.3	22.5	**14.4**	27.5	13.5	**20.5**	0.0	0.0	0.0	**0.0**	0.0	0.0
NDN-22-02	RMM-10-1-1	27.8	30.7	40.0	**32.8**	40.0	16.2	**28.1**	38.9	10.0	16.4	**21.8**	4.0	57.5
NDN-22-03	**Rohini (SC)**	30.0	31.1	47.5	**36.2**	35.0	21.0	**28.0**	48.9	20.0	22.4	**30.4**	6.0	30.0
NDN-22-04	DRMRIJWR 20-15	25.1	31.7	42.5	**33.1**	30.0	16.3	**23.1**	15.6	7.5	8.5	**10.5**	10.0	32.5
NDN-22-05	PAB-2014-4	22.2	25.9	27.5	**25.2**	17.5	14.7	**16.1**	31.1	12.5	39.6	**27.7**	11.0	52.5
NDN-22-06	PAB-2014-18	28.9	25.1	27.5	**27.2**	7.5	17.1	**12.3**	30.0	7.5	13.6	**17.0**	6.0	55.0
NDN-22-07	DRMRIJWR 20-16	30.0	28.5	35.0	**31.2**	35.0	13.2	**24.1**	5.0	10.0	8.3	**7.8**	7.0	40.0
NDN-22-08	**PT-303 (C)**	35.6	31.4	45.0	**37.3**	52.5	21.1	**36.8**	0.0	10.0	0.0	**3.3**	6.0	0.0
NDN-22-09	**NRCHB 101 (SC)**	24.5	28.2	20.0	**24.2**	37.5	13.9	**25.7**	48.9	7.5	27.7	**28.0**	0.0	37.5
NDN-22-10	DRMRIJWR 20-19	34.5	30.0	20.0	**28.2**	25.0	12.0	**18.5**	25.1	5.0	1.3	**10.5**	0.0	7.5
NDN-22-11	DRMRIJWR 20-11	18.9	31.0	22.5	**24.1**	40.0	11.9	**25.9**	0.0	0.0	0.0	**0.0**	0.0	65.0
NDN-22-12	RH-1700-3	32.2	29.2	20.0	**27.1**	30.0	17.9	**23.9**	23.4	5.0	0.0	**9.5**	8.0	22.5
NDN-22-13	DRMR-PMJ-17	6.7	14.1	27.5	**16.1**	20.0	11.9	**16.0**	10.6	10.0	11.9	**10.8**	5.0	12.5
NDN-22-14	PAB-2017-18	33.4	26.7	20.0	**26.7**	7.5	22.7	**15.1**	12.8	22.5	17.5	**17.6**	4.5	35.0
NDN-22-15	PAB- 2014-8	31.7	30.8	22.5	**28.3**	7.5	21.2	**14.4**	0.0	7.5	3.3	**3.6**	7.0	27.5
NDN-22-16	**GSL-1 (Bn)**	7.3	12.4	15.0	**11.6**	50.0	13.9	**31.9**	0.0	0.0	0.0	**0.0**	0.0	0.0
NDN-22-17	DRMRSJ 22	30.0	31.7	17.5	**26.4**	37.5	10.6	**24.0**	27.8	7.5	9.0	**14.8**	6.0	60.0
NDN-22-18	PAB-2017-20	8.9	28.6	15.0	**17.5**	17.5	16.0	**16.7**	31.1	12.5	17.0	**20.2**	4.0	27.5
NDN-22-19	**PHR-2 (TC-AB)**	36.7	31.2	25.0	**31.0**	22.5	17.1	**19.8**	29.5	17.5	12.7	**19.9**	5.0	20.0
NDN-22-20	PAB-2014-1	22.2	29.9	35.0	**29.0**	35.0	14.8	**24.9**	32.2	15.0	17.5	**21.6**	10.0	30.0
NDN-22-21	DRMRMJA 35	40.0	30.0	22.5	**30.8**	40.0	13.8	**26.9**	7.8	7.5	6.8	**7.4**	5.0	25.0
NDN-22-22	DRMRSJ-349	28.9	30.7	25.0	**28.2**	37.5	12.5	**25.0**	0.0	0.0	0.0	**0.0**	0.0	60.0
NDN-22-23	**NRCYS 05-2 (Br-YS)**	36.7	34.3	57.5	**42.8**	57.5	15.9	**36.7**	0.0	35.0	0.0	**11.7**	14.0	0.0
NDN-22-24	PAB- 2014-7	32.2	31.8	30.0	**31.3**	12.5	14.2	**13.3**	0.0	12.5	2.8	**5.1**	3.0	62.5
NDN-22-25	PAB-2017-15	29.5	31.7	15.0	**25.4**	7.5	17.2	**12.3**	4.5	12.5	11.4	**9.5**	7.0	22.5
NDN-22-26	DRMR 2018-19	27.8	30.4	35.0	**31.1**	35.0	12.0	**23.5**	0.0	0.0	0.0	**0.0**	0.0	45.0
NDN-22-27	**BioYSR (RC-WR)**	30.0	35.0	37.5	**34.2**	45.0	22.7	**33.9**	0.0	7.5	10.3	**5.9**	6.0	27.5
CD(*P*=0.05)		**4.3**	**4.7**	**7.4**		**6.6**	**1.8**		**4.2**	**6.7**	**2.4**		**4.6**	**9.5**
CV (%)		**6.8**	**7.1**	**-**		**-**	**3.8**		**11.1**	**-**	**8.1**		**-**	**-**

Table 4.4.1: Reaction of oilseed Brassica germplasm against AB in NDN for White Rust (natural condition)

Code No.	Entries	% AB severity (100 DAS)						% ABP (days before harvest)				
		HSR	MOR	PNT	BPR	Mean	LDH	HSR	MOR	PNT	LDH	Mean
NDN-22-28	DRMR 2018-19	25.1	24.7	17.5	20.0	**21.8**	62.7	20.0	12.0	42.5	21.6	**24.0**
NDN-22-29	DRMRDR 2155	27.8	26.9	30.0	25.0	**27.4**	55.6	21.1	14.0	40.0	18.9	**23.5**
NDN-22-30	RH- 1700	23.4	21.1	25.0	25.0	**23.6**	63.5	17.8	16.1	52.5	19.4	**26.4**
NDN-22-31	DRMRM 18-35-11	22.2	28.6	22.5	5.0	**19.6**	60.6	18.9	16.9	40.0	21.7	**24.4**
NDN-22-32	DRMRSJ-349	17.8	13.1	12.5	20.0	**15.9**	66.9	13.4	9.1	47.5	23.6	**23.4**
NDN-22-33	DRMR 2018-1	36.7	36.0	25.0	7.5	**26.3**	64.7	31.2	15.9	45.0	21.8	**28.5**
NDN-22-34	DRMRDR 2196	24.5	24.0	12.5	10.0	**17.8**	53.7	20.0	10.9	40.0	22.1	**23.3**
NDN-22-35	DRMRDR 2151	30.0	30.9	12.5	10.0	**20.9**	58.3	23.4	16.2	52.5	19.8	**28.0**
NDN-22-36	DRMRIJWR-20-20	21.1	18.9	20.0	15.0	**18.8**	62.6	16.8	10.9	37.5	20.8	**21.5**
NDN-22-37	DRMR 2018-41	25.1	22.2	22.5	15.0	**21.2**	51.0	20.5	15.0	42.5	17.7	**23.9**
NDN-22-38	DRMRCI-131	13.4	18.9	32.5	10.0	**18.7**	55.4	10.6	14.7	40.0	21.3	**21.7**
NDN-22-39	**Rohini (SC)**	18.9	10.9	37.5	30.0	**24.3**	64.1	14.5	10.9	45.0	22.7	**23.3**
NDN-22-40	DRMR 2018-37	35.6	25.1	20.0	25.0	**26.4**	65.5	30.0	10.9	57.5	18.9	**29.3**
NDN-22-41	RH 1400-1	40.0	24.4	27.5	15.0	**26.7**	63.9	28.4	11.6	55.0	21.9	**29.2**
NDN-22-42	DRMRCI-132	24.5	25.3	15.0	15.0	**20.0**	61.0	20.0	14.0	25.0	21.8	**20.2**
NDN-22-43	DRMRIJWR-20-21	28.9	10.5	12.5	7.5	**14.8**	63.3	23.4	8.0	25.0	23.3	**19.9**
NDN-22-44	DRMRIJWR-20-26	25.1	22.7	15.0	15.0	**19.5**	49.9	20.0	10.9	37.5	11.0	**19.9**
NDN-22-45	DRMR 2018-25	20.0	19.5	10.0	15.0	**16.1**	55.5	15.6	11.4	20.0	13.2	**15.0**
NDN-22-46	**PHR-2(TC-AB)**	27.8	6.9	15.0	10.0	**14.9**	68.4	21.1	6.0	15.0	12.5	**13.6**
NDN-22-47	DRMRDR 2156	17.8	6.9	25.0	15.0	**16.2**	69.8	13.4	5.8	27.5	13.6	**15.1**
NDN-22-48	DRMTIJWR 20-18	33.4	24.7	20.0	15.0	**23.3**	58.5	27.2	12.0	32.5	17.6	**22.3**
NDN-22-49	DRMRDR 2152	32.2	26.9	30.0	25.0	**28.5**	58.5	26.7	14.0	30.0	13.3	**21.0**
NDN-22-50	DRMRIJWR 20-12	26.7	21.1	15.0	15.0	**19.5**	49.9	21.1	16.1	32.5	14.9	**21.2**
NDN-22-51	DRMRIJWR-20-19	34.5	28.6	20.0	15.0	**24.5**	60.0	30.0	16.9	30.0	16.9	**23.4**
NDN-22-52	DRMRIJ-12-44	31.7	13.1	10.0	15.0	**17.5**	43.0	25.1	9.1	45.0	18.9	**24.5**
NDN-22-53	**PT-303 (C)**	33.4	9.3	52.5	15.0	**27.6**	72.0	27.2	5.3	40.0	21.3	**23.5**
NDN-22-54	DRMRDR 2195	32.2	9.1	17.5	7.5	**16.6**	63.9	26.7	8.0	35.0	17.8	**21.9**
NDN-22-55	**GSL-1 (Bn)**	7.3	10.0	10.0	7.5	**8.7**	50.4	5.0	9.1	40.0	18.3	**18.1**
NDN-22-56	RH- 1700-1	8.4	33.6	15.0	10.0	**16.7**	63.1	6.7	14.0	35.0	21.0	**19.2**
NDN-22-57	DRMRIJWR-20-10	25.1	6.0	10.0	15.0	**14.0**	58.9	20.5	5.1	40.0	17.7	**20.8**
NDN-22-58	DRMRM 18-36-12	23.4	12.0	17.5	20.0	**18.2**	63.2	17.8	6.0	40.0	21.1	**21.2**
NDN-22-59	DRMRIJ 12-37	26.7	26.7	10.0	15.0	**19.6**	64.7	20.5	12.0	37.5	24.9	**23.7**
NDN-22-60	**NRCHB 101(SC)**	16.8	17.1	17.5	20.0	**17.9**	60.5	11.7	11.2	42.5	22.3	**21.9**
NDN-22-61	DRMRCI-139	33.4	25.1	12.5	7.5	**19.6**	44.3	26.7	10.9	27.5	19.5	**21.1**
NDN-22-62	DRMRIJWR-20-24	24.5	21.1	20.0	15.0	**20.2**	54.7	20.0	10.0	42.5	19.4	**23.0**
NDN-22-63	DRMRDR 2235	28.4	17.1	20.0	15.0	**20.1**	47.3	24.5	9.8	32.5	22.1	**22.2**
NDN-22-64	DRMRIJWR-20-23	20.0	16.2	15.0	7.5	**14.7**	60.5	17.8	10.0	35.0	18.2	**20.2**
NDN-22-65	DRMRM-163	13.4	14.0	17.5	15.0	**15.0**	49.5	11.7	9.1	40.0	20.2	**20.3**
NDN-22-66	PMAS A 2010	21.1	21.1	15.0	15.0	**18.1**	60.2	16.8	7.8	15.0	15.3	**13.7**
NDN-22-67	PAB 14-18	24.5	21.3	15.0	10.0	**17.7**	54.4	20.0	8.0	37.5	20.2	**21.4**
NDN-22-68	DRMRDR 2135	18.9	36.5	17.5	7.5	**20.1**	44.5	15.6	16.0	40.0	19.4	**22.8**
NDN-22-69	DRMRIJWR-20-28	17.8	16.9	17.5	7.5	**14.9**	50.6	14.5	9.1	42.5	22.0	**22.0**
NDN-22-70	DRMRIJWR-20-17	20.0	34.2	15.0	15.0	**21.1**	54.2	16.8	14.9	52.5	18.7	**25.7**
NDN-22-71	DRMRSJ-206	26.7	20.0	17.5	15.0	**19.8**	45.3	22.2	10.0	42.5	18.2	**23.2**
NDN-22-72	DRMRDR 2143	28.4	34.0	17.5	7.5	**21.9**	55.4	24.5	13.1	55.0	20.4	**28.3**
NDN-22-73	DRMRIJWR-20-14	18.9	6.9	15.0	7.5	**12.1**	57.6	12.3	8.0	50.0	15.8	**21.5**
NDN-22-74	RH- 1700-4	22.2	34.0	25.0	15.0	**24.1**	54.9	18.9	17.1	20.0	22.0	**19.5**
NDN-22-75	**DLSC 1 (C)**	8.9	24.7	10.0	15.0	**14.7**	47.6	7.3	12.0	45.0	20.1	**21.1**
NDN-22-76	DRMRIJWR 20-13	16.8	21.1	22.5	7.5	**17.0**	52.0	11.7	10.9	60.0	22.0	**26.1**
NDN-22-77	**NRCYS-05-2 (Br-YS)**	32.2	6.9	52.5	15.0	**26.7**	60.3	27.2	19.8	45.0	15.9	**27.0**
NDN-22-78	DRMRIJWR-20-13	20.5	14.9	20.0	10.0	**16.4**	61.2	16.8	10.9	47.5	15.0	**22.6**
NDN-22-79	DRMRDR 2116	28.4	16.2	20.0	7.5	**18.0**	54.3	23.4	10.9	45.0	24.3	**25.9**
NDN-22-80	DRMRM 18-37-13	23.4	21.1	17.5	7.5	**17.4**	57.9	17.8	14.0	37.5	14.2	**20.9**
NDN-22-81	DRMRIJWR-20-15	26.7	10.9	25.0	10.0	**18.2**	56.3	21.1	10.0	25.0	12.2	**17.1**
NDN-22-82	PAB 14-8	34.5	8.0	17.5	7.5	**16.9**	50.7	30.0	10.2	42.5	14.8	**24.4**
NDN-22-83	DRMRSJ 22	31.7	10.2	17.5	7.5	**16.7**	39.5	25.1	12.0	37.5	19.5	**23.5**
NDN-22-84	DRMRDR 2242	27.8	16.0	12.5	10.0	**16.6**	61.4	21.1	10.9	27.5	12.8	**18.1**
NDN-22-85	DRMRDR 2141	8.4	26.9	15.0	10.0	**15.1**	50.7	6.7	14.0	37.5	14.4	**18.2**
NDN-22-86	RH- 1700-3	20.0	21.1	17.5	15.0	**18.4**	64.4	16.8	14.0	32.5	17.0	**20.1**
NDN-22-87	PAB 14-7	26.7	6.9	15.0	25.0	**18.4**	54.8	22.2	5.1	40.0	21.2	**22.1**
NDN-22-88	DRMRSJ-271	28.4	20.0	12.5	15.0	**19.0**	58.4	24.5	12.0	57.5	23.8	**29.4**
NDN-22-89	**DRMRMJA 35(RC-WR)**	33.4	32.0	15.0	7.5	**22.0**	52.5	20.5	16.0	57.5	21.7	**28.9**
NDN-22-90	**BioYSR (RC-WR)**	32.2	35.8	20.0	15.0	**25.8**	45.3	22.2	17.1	42.5	21.6	**25.9**
NDN-22-91	JC 36	36.7	24.0	20.0	15.0	**23.9**	62.4	24.5	14.9	67.5	21.8	**32.2**
NDN-22-92	DRMRIJ-20-11	28.9	28.2	10.0	15.0	**20.5**	57.3	21.1	16.0	60.0	21.7	**29.7**
NDN-22-93	PDZ 16	23.4	30.2	22.5	7.5	**20.9**	73.8	20.5	15.6	37.5	21.8	**23.9**
NDN-22-94	NPJ 250	33.4	17.3	20.0	10.0	**20.2**	45.6	23.4	10.0	7.7	21.7	**15.7**
CD(*P*=0.05)		**4.6**	**1.6**	**7.2**	**6.3**		**3.6**	**4.9**	**1.2**	**2.7**	**3.6**	
CV (%)		**7.8**	**3.1**	**-**	**-**		**3.7**	**9.3**	**3.1**	**-**	**6.9**	

Table 4.4.2: Reaction of oilseed Brassica germplasm to WR, SR, PM and DM NDN for White Rust under artificial condition

Entries	% WR severity on leaf (100 DAS)*					% Stag head			% SR**	% PM				% DM		
	HSR	MOR	PNT	BPR	Mean	PNT	MOR	Mean	BPR	BPR	PNT	MOR	Mean	MOR	PNT	Mean
DRMR 2018-19	0.0	0.0	5.0	0.0	**1.3**	0.0	0.0	**0.0**	22.9	25.0	12.5	90.9	**42.8**	0.0	45.0	**22.5**
DRMRDR 2155	0.0	0.0	7.5	0.0	**1.9**	3.0	0.0	**1.5**	12.6	40.0	7.5	92.2	**46.6**	6.9	35.0	**21.0**
RH- 1700	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	**0.0**	50.5	40.0	5.0	81.3	**42.1**	0.0	25.0	**12.5**
DRMRM 18-35-11	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	**0.0**	20.2	40.0	7.5	90.9	**46.1**	0.0	55.0	**27.5**
DRMRSJ-349	0.0	0.0	3.5	0.0	**0.9**	3.0	0.0	**1.5**	19.7	30.0	12.5	97.1	**46.5**	0.0	50.0	**25.0**
DRMR 2018-1	0.0	0.0	7.5	0.0	**1.9**	0.0	0.0	**0.0**	16.1	40.0	22.5	94.9	**52.5**	0.0	20.0	**10.0**
DRMRDR 2196	1.7	8.0	10.0	0.0	**4.9**	0.0	0.0	**0.0**	3.8	25.0	30.0	94.0	**49.7**	8.0	15.0	**11.5**
DRMRDR 2151	5.0	6.3	7.5	0.0	**4.7**	5.0	0.0	**2.5**	30.2	40.0	12.5	89.1	**47.2**	26.0	67.5	**46.8**
DRMRIJWR-20-20	4.5	3.1	10.0	0.0	**4.4**	6.0	0.0	**3.0**	31.8	25.0	7.5	97.3	**43.3**	10.9	35.0	**23.0**
DRMR 2018-41	0.0	0.0	5.0	0.0	**1.3**	5.0	0.0	**2.5**	11.7	25.0	20.0	97.1	**47.4**	0.0	55.0	**27.5**
DRMRCI-131	2.8	14.0	2.0	0.0	**4.7**	0.0	0.0	**0.0**	20.2	30.0	20.0	89.1	**46.4**	7.1	35.0	**21.0**
Rohini (SC)	48.9	42.2	17.5	34.2	**35.7**	6.0	7.4	**6.7**	14.8	20.0	25.0	98.0	**47.7**	32.9	37.5	**35.2**
DRMR 2018-37	22.2	14.0	7.5	22.5	**16.6**	3.0	4.8	**3.9**	13.6	40.0	37.5	96.9	**58.1**	10.2	40.0	**25.1**
RH 1400-1	35.6	35.3	7.5	10.4	**22.2**	14.0	9.6	**11.8**	10.3	40.0	32.5	97.8	**56.8**	8.0	65.0	**36.5**
DRMRCI-132	0.0	0.0	7.5	0.0	**1.9**	0.0	0.0	**0.0**	12.0	40.0	35.0	96.0	**57.0**	6.0	60.0	**33.0**
DRMRIJWR-20-21	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	**0.0**	8.6	25.0	45.0	98.0	**56.0**	0.0	57.5	**28.8**
DRMRIJWR-20-26	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	**0.0**	30.5	30.0	57.5	78.9	**55.5**	0.0	52.5	**26.3**
DRMR 2018-25	41.1	7.7	15.0	38.3	**25.5**	7.0	0.0	**3.5**	39.1	25.0	27.5	87.0	**46.5**	5.0	47.5	**26.2**
PHR-2(TC-AB)	31.1	22.0	17.5	15.8	**21.6**	6.0	3.6	**4.8**	18.0	25.0	37.5	84.0	**48.8**	14.7	50.0	**32.4**
DRMRDR 2156	33.4	17.6	20.0	14.2	**21.3**	17.5	0.0	**8.8**	25.3	30.0	50.0	94.9	**58.3**	24.0	52.5	**38.3**
DRMTIJWR 20-18	5.0	16.9	0.0	0.0	**5.5**	0.0	0.0	**0.0**	21.5	50.0	37.5	90.9	**59.5**	0.0	25.0	**12.5**
DRMRDR 2152	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	**0.0**	24.3	40.0	37.5	92.2	**56.6**	6.9	45.0	**26.0**
DRMRIJWR 20-12	0.0	0.0	10.0	0.0	**2.5**	4.5	0.0	**2.3**	36.4	25.0	20.0	81.3	**42.1**	0.0	75.0	**37.5**
DRMRIJWR-20-19	4.5	0.0	2.0	0.0	**1.6**	0.0	0.0	**0.0**	20.0	25.0	7.5	90.9	**41.1**	0.0	30.0	**15.0**
DRMRIJ-12-44	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	**0.0**	81.1	15.0	7.5	97.1	**39.9**	0.0	60.0	**30.0**
PT-303 (C)	0.0	0.0	17.5	0.0	**4.4**	6.0	0.0	**3.0**	43.0	30.0	0.0	24.0	**18.0**	0.0	0.0	**0.0**
DRMRDR 2195	5.0	6.0	22.5	0.0	**8.4**	5.0	0.0	**2.5**	16.9	25.0	22.5	94.9	**47.5**	0.0	25.0	**12.5**
GSL-1 (Bn)	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	**0.0**	6.5	40.0	0.0	30.0	**23.3**	0.0	0.0	**0.0**
RH- 1700-1	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	**0.0**	26.4	25.0	17.5	95.8	**46.1**	0.0	27.5	**13.8**
DRMRIJWR-20-10	50.0	44.0	20.0	34.2	**37.0**	8.0	0.0	**4.0**	11.5	25.0	7.5	92.9	**41.8**	28.0	35.0	**31.5**
DRMRM 18-36-12	0.0	0.0	2.0	0.0	**0.5**	0.0	0.0	**0.0**	59.5	25.0	10.0	94.7	**43.2**	0.0	50.0	**25.0**
DRMRIJ 12-37	0.0	0.0	5.0	0.0	**1.3**	5.0	0.0	**2.5**	25.9	15.0	17.5	91.8	**41.4**	0.0	77.5	**38.8**
NRCHB 101(SC)	51.1	44.7	20.0	34.2	**37.5**	6.0	9.3	**7.6**	22.0	10.0	10.0	90.0	**36.7**	20.0	17.5	**18.8**
DRMRCI-139	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	**0.0**	3.7	15.0	12.5	97.3	**41.6**	0.0	65.0	**32.5**
DRMRIJWR-20-24	0.0	0.0	3.5	2.9	**1.6**	0.0	0.0	**0.0**	24.2	25.0	7.5	82.0	**38.2**	0.0	60.0	**30.0**
DRMRDR 2235	6.7	0.0	3.5	0.0	**2.6**	0.0	0.0	**0.0**	24.6	40.0	12.5	90.9	**47.8**	0.0	47.5	**23.8**
DRMRIJWR-20-23	0.0	0.0	3.5	4.6	**2.0**	4.0	0.0	**2.0**	14.8	25.0	20.0	81.1	**42.0**	0.0	35.0	**17.5**
DRMRM-163	2.8	4.0	2.0	0.0	**2.2**	3.0	0.0	**1.5**	21.4	25.0	25.0	87.8	**45.9**	6.0	17.5	**11.8**
PMAS A 2010	10.6	6.3	12.5	0.0	**7.3**	4.0	0.0	**2.0**	14.5	20.0	25.0	92.0	**45.7**	2.0	60.0	**31.0**
PAB 14-18	6.7	9.1	5.0	2.9	**5.9**	0.0	0.0	**0.0**	15.3	40.0	12.5	96.0	**49.5**	5.1	17.5	**11.3**
DRMRDR 2135	4.5	2.9	0.0	0.0	**1.9**	0.0	0.0	**0.0**	23.3	40.0	0.0	96.7	**45.6**	0.0	55.0	**27.5**
DRMRIJWR-20-28	5.0	18.0	10.0	7.9	**10.2**	0.0	4.1	**2.1**	51.2	25.0	2.5	96.0	**41.2**	12.2	27.5	**19.9**
DRMRIJWR-20-17	1.7	0.0	5.0	0.0	**1.7**	6.0	0.0	**3.0**	20.6	20.0	12.5	90.0	**40.8**	0.0	60.0	**30.0**
DRMRSJ-206	0.0	0.0	3.5	9.2	**3.2**	0.0	0.0	**0.0**	15.4	30.0	12.5	89.8	**44.1**	0.0	42.5	**21.3**
DRMRDR 2143	0.0	0.0	3.5	0.0	**0.9**	0.0	0.0	**0.0**	13.7	10.0	7.5	92.1	**36.5**	0.0	35.0	**17.5**
DRMRIJWR-20-14	0.0	0.0	2.0	0.0	**0.5**	0.0	0.0	**0.0**	17.9	15.0	7.5	81.1	**34.5**	0.0	45.0	**22.5**
RH- 1700-4	0.0	0.0	3.5	0.0	**0.9**	3.0	0.0	**1.5**	35.7	30.0	0.0	90.9	**40.3**	0.0	62.5	**31.3**
DLSC 1 (C)	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	**0.0**	13.9	25.0	7.5	90.9	**41.1**	0.0	15.0	**7.5**
DRMRIJWR 20-13	4.5	0.0	0.0	0.0	**1.1**	0.0	0.0	**0.0**	21.7	15.0	22.5	42.0	**26.5**	0.0	50.0	**25.0**
NRCYS-05-2 (Br-YS)	0.0	0.0	52.5	0.0	**13.1**	20.0	0.0	**10.0**	61.1	20.0	17.5	33.1	**23.5**	0.0	7.5	**3.8**
DRMRIJWR-20-13	5.0	6.0	7.5	0.0	**4.6**	4.0	0.0	**2.0**	6.4	30.0	12.5	96.2	**46.2**	4.0	20.0	**12.0**
DRMRDR 2116	30.0	10.0	20.0	0.0	**15.0**	10.0	0.0	**5.0**	15.6	15.0	15.0	96.0	**42.0**	0.0	15.0	**7.5**
DRMRM 18-37-13	0.0	0.0	12.5	7.9	**5.1**	7.0	0.0	**3.5**	7.6	40.0	12.5	88.0	**46.8**	6.9	45.0	**26.0**
DRMRIJWR-20-15	0.0	20.0	7.5	0.0	**6.9**	4.0	3.4	**3.7**	0.0	25.0	67.5	92.5	**61.7**	0.0	30.0	**15.0**
PAB 14-8	0.0	0.0	5.0	0.0	**1.3**	3.0	0.0	**1.5**	2.8	50.0	0.0	98.9	**49.6**	0.0	55.0	**27.5**
DRMRSJ 22	22.2	0.0	12.5	5.8	**10.1**	0.0	0.0	**0.0**	6.2	30.0	10.0	98.2	**46.1**	0.0	30.0	**15.0**
DRMRDR 2242	31.7	8.0	15.0	0.0	**13.7**	4.0	0.0	**2.0**	0.0	30.0	22.5	78.9	**43.8**	2.0	20.0	**11.0**
DRMRDR 2141	5.0	0.0	7.5	7.9	**5.1**	4.0	0.0	**2.0**	0.0	40.0	12.5	92.2	**48.2**	6.9	65.0	**36.0**
RH- 1700-3	25.1	20.7	7.5	5.8	**14.8**	4.5	4.4	**4.4**	6.8	30.0	12.5	96.0	**46.2**	6.2	25.0	**15.6**
PAB 14-7	4.5	6.0	5.0	0.0	**3.9**	6.0	0.0	**3.0**	0.0	40.0	50.0	98.0	**62.7**	0.0	65.0	**32.5**
DRMRSJ-271	12.8	10.2	12.5	5.8	**10.3**	6.0	0.0	**3.0**	4.1	50.0	47.5	90.9	**62.8**	3.8	17.5	**10.7**
DRMRMJA 35(RC-WR)	28.4	19.8	5.0	13.8	**16.7**	7.0	0.0	**3.5**	42.1	40.0	30.0	92.9	**54.3**	4.5	32.5	**18.5**
BioYSR (RC-WR)	0.0	24.0	7.5	11.7	**10.8**	10.0	4.2	**7.1**	51.3	50.0	37.5	84.2	**57.2**	10.9	35.0	**23.0**
JC 36	0.0	0.0	7.5	0.0	**1.9**	4.0	0.0	**2.0**	37.7	40.0	7.5	94.9	**47.5**	0.0	47.5	**23.8**
DRMRIJ-20-11	0.0	0.0	3.5	0.0	**0.9**	6.0	0.0	**3.0**	68.2	25.0	17.5	78.0	**40.2**	0.0	37.5	**18.8**
PDZ 16	0.0	0.0	22.5	7.9	**7.6**	5.0	0.0	**2.5**	50.5	20.0	10.0	76.9	**35.6**	0.0	30.0	**15.0**
NPJ 250	43.4	0.0	7.5	0.0	**12.7**	4.0	0.0	**2.0**	31.5	30.0	20.0	80.2	**43.4**	0.0	45.0	**22.5**
CD(*P*=0.05)	**5.1**	**3.3**	**6.2**	**2.3**		**3.6**	**0.4**		**6.4**	**10.6**	**9.0**	**3.3**		**2.0**	**10.3**	
CV (%)	**22.9**	**16.3**	**-**	**-**		**-**	**8.2**		**-**	**-**	**-**	**2.3**		**12.8**	**-**	

*SHL and LDH excluded for WR; **MOR, PNT and LDH excluded for SR

Table 4.5.1: Reaction of oilseed Brassica lines against AB, WR and SH in NDN for Sclerotinia rot under natural condition

Code No	Entries	% ABL (100 DAS)*						% ABP(15 days before harvest)							% WR (100 DAS)**					% Staghead		
		HSR	PNT	SHL	VAR	LDH	Mean	HSR	PNT	SHL	VAR	LDH	JHS	Mean	HSR	PNT	LDH	BPR	Mean	PNT	JHS	Mean
NDN-22-95	DRMRDR 2119	30.0	25.0	29.8	50.0	60.6	**39.1**	18.9	32.5	18.0	10.0	18.7	10.0	**18.0**	31.2	12.5	5.6	10.5	**14.9**	5.0	13.7	**9.4**
NDN-22-96	DRMRDR 2237	32.2	20.0	30.7	27.5	42.1	**30.5**	23.4	25.0	15.9	7.5	27.6	8.3	**17.9**	22.2	25.0	11.3	12.5	**17.7**	6.0	9.4	**7.7**
NDN-22-97	DRMRSJ 361	28.4	37.5	29.8	50.0	54.2	**40.0**	16.8	30.0	18.1	12.5	36.0	5.0	**19.7**	38.9	25.0	22.8	29.5	**29.0**	7.0	11.5	**9.3**
NDN-22-98	**NRCHB 101(SC)**	27.8	20.0	30.8	50.0	58.0	**37.3**	15.6	35.0	17.7	17.5	42.8	5.0	**22.3**	45.6	20.0	23.7	21.0	**27.6**	0.0	12.0	**6.0**
NDN-22-99	DRMRIS 20-4	26.7	32.5	32.1	30.0	65.6	**37.4**	17.8	40.0	19.9	7.5	44.3	10.0	**23.2**	40.0	30.0	20.6	8.1	**24.7**	6.0	9.5	**7.8**
NDN-22-100	**BioYSR (RC-WR)**	31.1	15.0	32.5	30.0	70.8	**35.9**	21.1	47.5	21.4	7.5	50.9	8.3	**26.1**	0.0	7.5	25.0	21.3	**13.4**	0.0	12.1	**6.1**
NDN-22-101	DRMRDR 2220	25.1	20.0	31.3	27.5	58.3	**32.4**	14.5	40.0	21.0	10.0	43.2	6.6	**22.5**	20.5	12.5	22.5	11.0	**16.6**	0.0	9.3	**4.7**
NDN-22-102	DRMRIS 20-11	30.0	17.5	29.6	30.0	65.4	**34.5**	16.8	27.5	18.5	7.5	23.7	5.0	**16.5**	0.0	5.0	2.3	22.0	**7.3**	7.0	9.4	**8.2**
NDN-22-103	**NRCYS-05-2 (Br-YS)**	33.4	50.0	31.0	50.0	76.4	**48.2**	20.5	67.5	19.3	50.0	22.0	5.0	**30.7**	0.0	47.5	2.4	6.5	**14.1**	5.0	11.6	**8.3**
NDN-22-104	**Rohini (SC)**	27.8	52.5	32.4	50.0	77.4	**48.0**	15.6	37.5	20.9	17.5	28.0	3.0	**20.4**	45.6	45.0	30.5	39.0	**40.0**	6.5	15.8	**11.2**
NDN-22-105	DRMRDR 2239	29.5	15.0	32.2	27.5	66.3	**34.1**	17.8	40.0	20.3	12.5	50.8	8.3	**25.0**	15.6	27.5	1.8	25.0	**17.5**	0.0	10.9	**5.5**
NDN-22-106	**DRMRMJA 35(RC-WR)**	31.1	15.0	32.1	50.0	73.7	**40.4**	18.9	37.5	20.4	12.5	43.1	5.0	**22.9**	25.1	17.5	22.0	22.0	**21.7**	0.0	9.1	**4.6**
NDN-22-107	DRMRSJ-25	27.8	17.5	31.2	30.0	65.6	**34.4**	20.5	27.5	18.7	10.0	29.8	6.6	**18.8**	30.0	15.0	7.3	42.0	**23.6**	0.0	8.5	**4.3**
NDN-22-108	DRMRIS 20-1	28.4	25.0	30.5	50.0	60.2	**38.8**	18.9	30.0	17.9	15.0	55.1	6.6	**23.9**	40.0	27.5	35.4	30.0	**33.2**	6.0	11.7	**8.9**
NDN-22-109	DRMRDR 2156	30.0	20.0	31.9	27.5	55.3	**32.9**	21.1	32.5	20.3	10.0	52.2	3.0	**23.2**	35.6	12.5	3.7	33.0	**21.2**	7.0	11.2	**9.1**
NDN-22-110	DRMRIS 20-5	27.8	27.5	28.9	50.0	61.9	**39.2**	16.8	57.5	18.1	30.0	59.4	8.3	**31.7**	32.2	17.5	24.9	33.0	**26.9**	8.0	8.4	**8.2**
NDN-22-111	DRMRDR 2238	32.2	25.0	31.0	27.5	43.9	**31.9**	18.9	45.0	19.3	27.5	40.2	5.0	**26.0**	23.4	7.5	13.8	0.0	**11.2**	10.0	11.0	**10.5**
NDN-22-112	**NPC 16 (TC-Bc)**	7.8	10.0	14.2	10.0	40.9	**16.6**	5.0	7.5	10.1	0.0	42.0	5.0	**11.6**	0.0	0.0	0.0	0.0	**0.0**	0.0	13.2	**6.6**
CD(*P*=0.05)		**3.9**	**11.3**	**2.4**	**4.9**	**2.2**		**4.3**	**7.4**	**2.8**	**4.7**	**3.0**	**4.1**		**3.8**	**10.0**	**4.9**	**4.3**		**4.8**	**4.3**	
CV (%)		**5.8**	**-**	**4.4**	**6.2**	**2.0**		**8.3**	**-**	**6.5**	**10.5**	**3.6**	**14.8**		**6.8**	**-**	**11.1**	**7.1**		**-**	**12.3**	

*Excluded BPR, JHS (APL); **JHS (WR)

Table 4.5.2: Reaction of oilseed *Brassica* germplasm to SR, PM and PM under NDN for Sclerotinia rot under artificial condition

Entries	% SR*							SR Lesion length (cm)							Stem diameter (cm)			% DM	% PM*		
	HSR	DOL	JHS	BPR	PNT	SHL	Mean	HSR	PNT	LDH	SHL	JHS	BPR	Mean	BPR	SHL	Mean	PNT	JHS	BPR	Mean
DRMRDR 2119	76.4	30.3	70.7	38.7	75.0	90.0	**63.5**	16.8	33.5	12.7	18.4	11.3	18.6	**18.6**	2.2	5.6	**3.9**	45.0	36.6	16.0	**26.3**
DRMRDR 2237	80.9	16.0	66.6	67.5	65.0	90.0	**64.3**	18.8	20.7	17.6	17.8	8.3	27.4	**18.4**	2.2	5.0	**3.6**	57.5	26.6	18.0	**22.3**
DRMRSJ 361	66.4	41.7	72.0	68.8	95.0	90.0	**72.3**	13.7	39.3	16.2	17.4	14.3	25.8	**21.1**	2.2	4.8	**3.5**	70.0	13.3	30.5	**21.9**
NRCHB 101(SC)	75.9	23.0	82.9	72.1	97.5	96.7	**74.7**	14.1	39.8	20.4	20.0	21.3	26.2	**23.6**	2.2	4.6	**3.4**	65.0	16.6	24.0	**20.3**
DRMRIS 20-4	66.8	32.8	53.1	45.8	87.5	90.0	**62.7**	17.5	44.6	16.4	18.2	7.7	20.2	**20.8**	2.2	5.0	**3.6**	60.0	23.3	13.0	**18.2**
BioYSR (RC-WR)	71.4	22.0	88.8	60.6	67.5	96.7	**67.8**	18.4	35.2	9.2	18.5	22.6	22.8	**21.1**	2.2	5.0	**3.6**	55.0	23.3	24.0	**23.7**
DRMRDR 2220	75.9	18.2	85.4	50.0	65.0	96.7	**65.2**	16.8	38.9	18.5	16.9	21.3	21.0	**22.2**	2.1	4.8	**3.4**	67.5	36.6	14.0	**25.3**
DRMRIS 20-11	61.4	14.7	76.0	58.3	62.5	90.0	**60.5**	12.2	24.2	7.1	18.9	13.6	35.8	**18.6**	2.0	5.1	**3.6**	77.5	16.6	20.0	**18.3**
NRCYS-05-2 (Br-YS)	85.9	55.2	70.3	79.2	95.0	90.0	**79.3**	20.2	37.9	13.0	16.2	11.3	67.0	**27.6**	2.2	4.0	**3.1**	0.0	16.6	10.0	**13.3**
Rohini (SC)	71.4	24.7	72.2	58.3	92.5	93.3	**68.7**	13.9	32.0	13.6	17.5	15.0	29.2	**20.2**	2.2	4.8	**3.5**	67.5	23.3	41.0	**32.2**
DRMRDR 2239	66.8	17.1	67.7	56.8	85.0	90.0	**63.9**	18.2	43.2	13.5	16.6	14.0	22.6	**21.4**	2.1	4.9	**3.5**	80.0	13.3	23.0	**18.2**
DRMRMJA 35(RC-WR)	57.3	11.3	53.4	31.8	97.5	90.0	**56.9**	13.2	39.0	3.5	17.8	9.3	7.6	**15.1**	2.2	5.0	**3.6**	72.5	16.6	25.0	**20.8**
DRMRSJ-25	80.9	30.8	52.2	38.0	95.0	96.7	**65.6**	20.7	42.2	16.5	17.8	10.0	9.4	**19.4**	2.1	4.8	**3.5**	52.5	26.6	30.0	**28.3**
DRMRIS 20-1	71.8	21.3	65.2	29.2	70.0	90.0	**57.9**	16.1	29.2	7.1	15.5	12.0	8.4	**14.7**	2.2	6.0	**4.1**	77.5	23.3	23.0	**23.2**
DRMRDR 2156	81.4	27.3	60.3	38.1	77.5	96.7	**63.6**	11.2	33.0	10.5	16.2	8.7	14.8	**15.7**	1.4	5.9	**3.7**	35.0	20.0	33.0	**26.5**
DRMRIS 20-5	71.4	32.4	53.7	41.0	87.5	93.3	**63.2**	11.1	40.9	15.1	14.9	7.7	7.6	**16.2**	1.3	5.4	**3.3**	47.5	30.0	30.0	**30.0**
DRMRDR 2238	66.8	30.0	51.6	59.0	75.0	93.3	**62.6**	20.2	47.6	29.2	15.9	8.0	14.4	**22.5**	2.1	5.3	**3.7**	67.5	16.6	11.0	**13.8**
NPC 16 (TC-Bc)	57.3	13.5	40.3	58.3	97.5	86.7	**58.9**	9.8	10.5	7.8	9.2	6.3	16.3	**10.0**	2.3	5.8	**4.1**	0.0	16.6	9.4	**13.0**
CD(*P*=0.05)	**10.3**	**6.6**	**3.4**	**5.6**	**12.7**	**-**		**5.2**	**11.1**	**-**	**3.6**	**3.6**	**-**		**-**	**0.9**		**8.3**	**12.5**	**3.5**	
CV (%)	**8.3**	**10.4**	**2.9**	**6.1**	**-**	**15.5**		**14.9**	**-**	**-**	**12.7**	**17.5**	**-**		**-**	**10.2**		**-**	**25.0**	**5.3**	

*Excluded VAR(SR, PM)

Table:4.6.1: Reaction of IVT entries of Brassica against Alternaria blight under natural condition

Code No.	Code No.	Entries	% AB severity (90/100 DAS)*					% ABP (15 days before harvest)*					
			KPR	SHL	Mean	PNT	LDH	KPR	PNT	SHL	DOL	LDH	Mean
SIVT-22-01	TCN-22-9	BAUT-08-09	30.0	30.8	**30.4**	50.0	58.5	27.0	57.5	18.4	13.9	34.9	**30.3**
SIVT-22-02	TCN-22-2	PT- 303 (NC)	30.0	18.1	**24.0**	45.0	62.0	28.0	47.5	12.7	5.1	31.4	**24.9**
SIVT-22-03	TCN-22-5	TKM 21-1	50.0	31.5	**40.7**	42.5	61.9	48.0	45.0	19.6	6.8	37.9	**31.5**
SIVT-22-04	TCN-22-8	PT- 2016-9	50.0	31.0	**40.5**	47.5	69.7	44.0	47.5	20.5	10.0	35.4	**31.5**
SIVT-22-05	TCN-22-6	Azad Chetna (LR)	30.0	32.7	**31.3**	40.0	59.3	26.0	40.0	20.8	10.4	30.5	**25.5**
SIVT-22-06	TCN-22-1	JT-14-9	50.0	29.9	**40.0**	37.5	56.2	43.0	45.0	20.9	25.9	43.2	**35.6**
SIVT-22-07	TCN-22-3	TKM 21-2	30.0	33.1	**31.5**	40.0	58.4	29.0	42.5	20.2	21.9	42.9	**31.3**
SIVT-22-08	TCN-22-7	Bhawani (ZC)	20.0	31.1	**25.6**	32.5	69.0	17.0	42.5	20.0	15.0	28.5	**24.6**
SIVT-22-09	TCN-22-4	PT- 2019-4	50.0	31.8	**40.9**	27.5	60.6	46.0	40.0	19.2	15.8	33.4	**30.9**
SIVT-22-10	**Check-Toria**	**PT-303**	20.0	32.6	**26.3**	45.0	57.9	21.0	57.5	18.6	18.9	37.7	**30.7**
SIVT-22-11	YSCN-22-7	YSKM 21-1	30.0	34.0	**32.0**	62.5	59.2	38.0	70.0	20.2	17.4	41.3	**37.4**
SIVT-22-12	YSCN-22-2	DRMRYS 205	30.0	32.6	**31.3**	42.5	61.2	28.0	62.5	21.6	17.0	32.3	**32.3**
SIVT-22-13	YSCN-22-5	RMYS 4	30.0	33.4	**31.7**	45.0	65.0	32.0	57.5	19.5	14.1	30.6	**30.7**
SIVT-22-14	YSCN-22-10	PYS 2018-4	50.0	32.5	**41.3**	57.5	57.6	30.0	55.0	21.7	13.5	20.2	**28.1**
SIVT-22-15	YSCN-22-3	NRCYS-05-02 (ZC)	50.0	33.9	**42.0**	47.5	60.2	48.0	57.5	19.7	13.3	32.7	**34.2**
SIVT-22-16	YSCN-22-12	YSKM 21-2	30.0	32.9	**31.5**	42.5	68.3	39.0	57.5	19.3	25.5	43.4	**36.9**
SIVT-22-17	YSCN-22-1	AAUJYS 14-2	30.0	36.5	**33.3**	52.5	64.4	34.0	47.5	21.5	18.7	36.5	**31.6**
SIVT-22-18	YSCN-22-11	DRMRYS-18-15	50.0	35.2	**42.6**	52.5	67.1	45.0	57.5	20.3	18.4	51.7	**38.6**
SIVT-22-19	YSCN-22-6	DRMRYS 204	30.0	33.9	**31.9**	50.0	56.7	34.0	62.5	20.5	18.3	34.2	**33.9**
SIVT-22-20	YSCN-22-13	Pitambari (LR)	30.0	35.7	**32.9**	45.0	61.4	29.0	57.5	24.7	18.1	35.8	**33.0**
SIVT-22-21	YSCN-22-9	YSH 401 (NC)	50.0	32.9	**41.5**	52.5	67.1	44.0	57.5	21.6	15.8	38.3	**35.4**
SIVT-22-22	YSCN-22-4	PYS-2018-1	30.0	34.1	**32.0**	42.5	58.9	29.0	60.0	22.5	16.0	29.6	**31.4**
SIVT-22-23	YSCN-22-14	RMYS 5	50.0	34.9	**42.5**	45.0	57.0	36.0	50.0	23.0	14.6	44.1	**33.5**
SIVT-22-24	YSCN-22-8	AAUJYS 15-2	30.0	34.1	**32.0**	42.5	64.6	31.0	45.0	19.6	17.3	33.5	**29.3**
SIVT-22-25	**YS Check**	**NRCYS -5-2**	30.0	35.7	**32.8**	52.5	58.7	26.0	52.5	23.3	21.2	34.5	**31.5**
SIVT-22-26	MCN (E)-22-4	ACN 247	30.0	33.1	**31.5**	17.5	57.4	29.0	30.0	21.2	31.9	45.0	**31.4**
SIVT-22-27	MCN (E)-22-9	NPJ 257	50.0	34.3	**42.1**	12.5	42.4	27.0	25.0	22.4	7.3	50.8	**26.5**
SIVT-22-28	MCN (E)-22-17	DRMRIJ 20-117	30.0	31.4	**30.7**	15.0	40.7	30.0	20.0	18.7	5.5	16.4	**18.1**
SIVT-22-29	MCN (E)-22-21	PRO 5111 (HC)	30.0	31.3	**30.6**	12.5	59.7	31.0	27.5	18.4	6.0	31.9	**23.0**
SIVT-22-30	MCN (E)-22-14	DRMRSJ 272	30.0	30.4	**30.2**	15.0	41.5	30.0	37.5	19.1	10.6	37.6	**26.9**
SIVT-22-31	MCN (E)-22-6	PRE-2018- 1	30.0	31.8	**30.9**	15.0	42.5	33.0	42.5	20.0	8.5	45.7	**29.9**
SIVT-22-32	MCN (E)-22-19	GDM 4 (LR)	20.0	33.7	**26.8**	35.0	50.3	19.5	42.5	22.2	10.0	35.9	**26.0**
SIVT-22-33	MCN (E)-22-23	RH 1999-37	50.0	31.9	**41.0**	20.0	40.3	44.0	35.0	20.9	10.2	44.6	**30.9**
SIVT-22-34	MCN (E)-22-2	BAUM-2022-1	30.0	30.7	**30.4**	20.0	56.1	28.0	37.5	18.8	17.7	40.9	**28.6**
SIVT-22-35	MCN (E)-22-10	TM 314-1	30.0	30.4	**30.2**	20.0	42.4	31.0	35.0	21.2	19.9	35.7	**28.5**
SIVT-22-36	MCN (E)-22-24	SHIVANI PLUS	30.0	31.4	**30.7**	22.5	64.5	27.0	42.5	18.5	10.1	44.9	**28.6**
SIVT-22-37	MCN (E)-22-15	NPJ 58	50.0	30.6	**40.3**	20.0	58.7	44.0	42.5	18.7	11.0	41.5	**31.5**
SIVT-22-38	MCN (E)-22-7	DRMRCI- 156	30.0	32.0	**31.0**	22.5	48.3	30.0	45.0	19.9	14.2	30.2	**27.8**
SIVT-22-39	MCN (E)-22-12	SVJH- 72 (Hybrid)	30.0	31.5	**30.8**	15.0	45.6	30.0	40.0	20.9	5.7	45.1	**28.3**
SIVT-22-40	MCN (E)-22-18	Q80623	30.0	30.5	**30.3**	17.5	36.3	30.0	45.0	17.3	14.3	46.6	**30.6**
SIVT-22-41	MCN (E)-22-3	DRMRHT-1712	30.0	32.4	**31.2**	15.0	48.4	34.0	30.0	20.6	11.3	29.1	**25.0**
SIVT-22-42	MCN (E)-22-11	PM 25 (NC)	50.0	29.7	**39.9**	20.0	38.5	36.0	32.5	20.5	13.3	43.0	**29.0**
SIVT-22-43	MCN (E)-22-1	Pusa MH 126 (Hybrid)	30.0	33.0	**31.5**	27.5	47.2	30.0	32.5	20.9	15.0	30.0	**25.7**
SIVT-22-44	MCN (E)-22-25	PRE-2020-14	20.0	31.6	**25.8**	27.5	50.4	18.0	42.5	19.4	9.6	35.7	**25.0**
SIVT-22-45	MCN (E)-22-22	HUJMI 21-1	20.0	30.5	**25.2**	22.5	40.2	35.0	30.0	17.8	8.1	37.3	**25.6**
SIVT-22-46	MCN (E)-22-5	JD 6 (ZC)	40.0	33.4	**36.7**	20.0	49.9	39.0	35.0	20.0	10.0	30.2	**26.8**
SIVT-22-47	MCN (E)-22-13	RH 2199-11	30.0	32.3	**31.1**	25.0	43.7	31.0	37.5	20.1	11.9	43.3	**28.7**
SIVT-22-48	MCN (E)-22-20	ANDM 14-09	30.0	31.2	**30.6**	30.0	56.7	30.0	40.0	21.4	19.4	28.0	**27.8**
SIVT-22-49	MCN (E)-22-16	KMR(E) 22-1	50.0	33.3	**41.7**	25.0	45.8	46.0	37.5	20.5	16.1	20.7	**28.2**
SIVT-22-50	MCN (E)-22-8	KMR(E) 22-2	30.0	33.0	**31.5**	30.0	44.7	32.0	35.0	20.4	10.0	25.9	**24.6**
SIVT-22-51	MCN (E)-22-26	**PHR-2 (TC-AB)**	30.0	29.3	**29.7**	32.5	45.5	29.0	40.0	21.3	15.3	24.5	**26.0**
SIVT-22-52	MCN-22-3	Kranti (NC)	30.0	33.0	**31.5**	27.5	33.7	29.0	37.5	20.6	13.7	31.0	**26.3**
SIVT-22-53	MCN-22-9	ACNMM- 3	50.0	30.4	**40.2**	30.0	50.8	47.0	32.5	19.9	31.4	25.7	**31.3**
SIVT-22-54	MCN-22-13	DRMR 2020-8	30.0	34.5	**32.3**	25.0	36.8	24.0	42.5	20.5	16.9	40.5	**28.9**
SIVT-22-55	MCN-22-17	GIRIRAJ (LR)	20.0	33.1	**26.5**	12.5	47.2	17.5	40.0	21.2	12.2	48.3	**27.8**

SIVT-22-56	MCN-22-22	KMR 22-3	50.0	30.5	**40.2**	15.0	31.1	44.0	30.0	18.4	12.9	34.4	**27.9**
SIVT-22-57	MCN-22-6	RH 2187	40.0	35.3	**37.7**	20.0	53.6	38.0	37.5	23.1	12.5	31.2	**28.4**
SIVT-22-58	MCN-22-19	RH 2199	50.0	31.4	**40.7**	27.5	52.4	45.0	45.0	19.3	15.9	27.2	**30.5**
SIVT-22-59	MCN-22-25	DTM- 341	50.0	32.7	**41.4**	25.0	36.8	44.0	32.5	20.4	15.5	27.8	**28.0**
SIVT-22-60	MCN-22-15	DM 2020-3	30.0	33.1	**31.5**	20.0	57.0	30.0	42.5	21.1	10.3	30.3	**26.8**
SIVT-22-61	MCN-22-1	RMM-19-12	30.0	34.0	**32.0**	15.0	52.1	28.0	42.5	19.2	9.1	28.1	**25.4**
SIVT-22-62	MCN-22-7	DRMRIJ 21-37	30.0	33.6	**31.8**	20.0	48.9	25.0	50.0	20.8	11.2	40.6	**29.5**
SIVT-22-63	MCN-22-24	TM316	50.0	34.1	**42.1**	17.5	43.2	46.0	40.0	21.1	11.8	44.6	**32.7**
SIVT-22-64	MCN-22-11	RCC 4 (ZC)	30.0	34.6	**32.3**	20.0	39.7	23.5	35.0	19.6	5.9	35.3	**23.9**
SIVT-22-65	MCN-22-20	PR-2020-14	50.0	33.9	**42.0**	25.0	49.3	31.0	32.5	20.9	5.2	26.0	**23.1**
SIVT-22-66	MCN-22-26	PBR 813-2	30.0	30.1	**30.0**	27.5	42.4	28.0	35.0	20.1	9.2	30.3	**24.5**
SIVT-22-67	MCN-22-5	KMR 22-4	50.0	31.5	**40.7**	20.0	55.0	46.0	30.0	19.8	13.8	17.0	**25.3**
SIVT-22-68	MCN-22-14	HUJM-21-4	30.0	32.9	**31.4**	30.0	47.0	22.5	42.5	20.7	12.6	29.5	**25.6**
SIVT-22-69	MCN-22-21	SKM 1924	50.0	33.2	**41.6**	32.5	45.2	46.0	35.0	20.4	14.2	37.5	**30.6**
SIVT-22-70	MCN-22-18	NPJ 261	50.0	32.8	**41.4**	27.5	36.3	46.0	47.5	20.4	11.6	31.6	**31.4**
SIVT-22-71	MCN-22-23	SKM 2012	30.0	33.9	**31.9**	20.0	47.0	25.0	45.0	20.4	12.3	29.5	**26.4**
SIVT-22-72	MCN-22-12	NPJ 262	40.0	33.1	**36.5**	25.0	36.9	31.0	47.5	19.8	10.6	31.8	**28.1**
SIVT-22-73	MCN-22-4	PR-2019-1	50.0	32.4	**41.2**	35.0	38.2	34.0	47.5	19.7	13.6	27.8	**28.5**
SIVT-22-74	MCN-22-16	RAURD 18-1	30.0	31.1	**30.6**	15.0	40.8	28.0	32.5	18.3	13.0	25.8	**23.5**
SIVT-22-75	MCN-22-8	DRMRCI- 154	30.0	33.6	**31.8**	20.0	35.5	24.0	45.0	20.3	13.4	31.5	**26.8**
SIVT-22-76	MCN-22-27	RB- 110	40.0	32.2	**36.1**	27.5	51.0	23.0	40.0	21.6	13.1	44.4	**28.4**
SIVT-22-77	MCN-22-2	DRMRHT 18-141	30.0	31.9	**31.0**	27.5	51.8	27.0	42.5	20.4	15.9	36.7	**28.5**
SIVT-22-78	MCN-22-10	RGN 528	40.0	34.6	**37.3**	22.5	47.0	36.0	50.0	20.3	15.9	41.9	**32.8**
SIVT-22-79	MCN-22-28	**Rohini (SC)**	25.0	33.0	**29.0**	22.5	45.6	29.0	45.0	21.6	18.7	25.8	**28.0**
SIVT-22-80	MCN-22-29	**BIOYSR (RC-WR)**	25.0	30.7	**27.9**	20.0	33.1	20.5	30.0	19.1	15.4	29.7	**22.9**
SIVT-22-81	MCNR-22-4	RH 2199-6	30.0	33.2	**31.6**	27.5	47.1	31.0	40.0	22.2	17.0	44.4	**30.9**
SIVT-22-82	MCNR-22-8	BAUM- 17	40.0	31.5	**35.7**	22.5	43.3	44.0	27.5	19.0	14.4	39.0	**28.8**
SIVT-22-83	MCNR-22-11	RH 2148	30.0	34.5	**32.2**	20.0	49.6	22.0	32.5	19.1	13.3	30.1	**23.4**
SIVT-22-84	MCNR-22-16	RH 761 (LR)	30.0	33.0	**31.5**	27.5	51.9	25.0	42.5	20.1	13.8	39.1	**28.1**
SIVT-22-85	MCNR-22-6	DRMRCI- 155	30.0	32.6	**31.3**	15.0	52.5	25.0	50.0	19.8	13.7	41.4	**30.0**
SIVT-22-86	MCNR-22-1	JM-15-8	30.0	34.0	**32.0**	17.5	42.0	29.0	27.5	21.5	13.3	45.0	**27.3**
SIVT-22-87	MCNR-22-13	RH 725 (ZC)	50.0	33.2	**41.6**	20.0	41.4	46.0	32.5	21.1	13.6	27.5	**28.1**
SIVT-22-88	MCNR-22-18	JKJH12	30.0	34.9	**32.4**	22.5	31.9	29.0	42.5	22.5	17.6	26.9	**27.7**
SIVT-22-89	MCNR-22-5	NPJ 263	30.0	33.8	**31.9**	22.5	40.5	23.0	30.0	21.0	16.0	39.9	**26.0**
SIVT-22-90	MCNR-22-9	DRMR 2020-3	40.0	33.5	**36.8**	17.5	42.8	23.5	42.5	21.7	10.0	29.5	**25.4**
SIVT-22-91	MCNR-22-17	RGN 526	30.0	30.4	**30.2**	20.0	47.4	33.0	32.5	18.6	12.3	30.6	**25.4**
SIVT-22-92	MCNR-22-12	DRMRHT- 17-2	50.0	31.4	**40.7**	25.0	47.4	44.0	37.5	18.5	11.0	29.4	**28.1**
SIVT-22-93	MCNR-22-2	NPJ 264	50.0	34.0	**42.0**	25.0	40.0	46.0	45.0	20.0	11.8	29.9	**30.5**
SIVT-22-94	MCNR-22-15	TM260	50.0	33.4	**41.7**	32.5	48.2	48.0	42.5	24.1	13.1	32.1	**32.0**
SIVT-22-95	MCNR-22-10	DRMRRIL 21-1	20.0	32.7	**26.3**	20.0	50.4	17.0	45.0	22.0	12.1	39.0	**27.0**
SIVT-22-96	MCNR-22-7	RB- 113	50.0	32.8	**41.4**	30.0	50.2	46.0	32.5	20.8	10.5	45.7	**31.1**
SIVT-22-97	MCN(L)-22-2	HUJM-21-1	50.0	34.2	**42.1**	27.5	43.8	44.0	45.0	20.6	14.1	20.1	**28.7**
SIVT-22-98	MCN(L)-22-5	RH 1999-22	30.0	32.9	**31.4**	17.5	39.1	26.0	40.0	20.1	10.8	50.3	**29.4**
SIVT-22-99	MCN(L)-22-9	RGN 534	50.0	31.5	**40.8**	20.0	47.7	45.0	35.0	18.7	13.3	37.0	**29.8**
SIVT-22-100	MCN(L)-22-13	DRMRHT-13-28-13	30.0	32.4	**31.2**	25.0	61.4	25.0	37.5	19.0	15.8	41.2	**27.7**
SIVT-22-101	MCN(L)-22-16	BAUM-2022-2	30.0	32.4	**31.2**	42.5	47.7	26.0	35.0	21.1	11.1	43.3	**27.3**
SIVT-22-102	MCN(L)-22-19	DRMRSJ 294	30.0	31.8	**30.9**	25.0	35.8	26.0	35.0	20.0	10.8	30.9	**24.5**
SIVT-22-103	MCN(L)-22-1	NPJ 259	50.0	33.0	**41.5**	27.5	41.9	48.0	45.0	20.2	11.3	39.9	**32.9**
SIVT-22-104	MCN(L)-22-17	NPJ 260	30.0	33.7	**31.8**	22.5	37.7	32.0	37.5	19.9	12.8	41.0	**28.6**
SIVT-22-105	MCN(L)-22-10	NPJ 265	50.0	34.5	**42.3**	22.5	50.1	48.0	42.5	20.4	12.2	30.0	**30.6**
SIVT-22-106	MCN(L)-22-15	Radhika (LR)	30.0	34.1	**32.0**	17.5	49.3	35.0	52.5	19.1	10.9	35.9	**30.7**
SIVT-22-107	MCN(L)-22-6	DRMRIJ 21-51	30.0	34.4	**32.2**	20.0	36.2	31.0	37.5	19.1	10.6	30.4	**25.7**
SIVT-22-108	MCN(L)-22-12	KMR(L) 22-5	50.0	34.7	**42.4**	30.0	37.2	44.0	22.5	20.8	13.2	26.3	**25.4**
SIVT-22-109	MCN(L)-22-20	DRMRCI- 160	50.0	34.4	**42.2**	45.0	45.5	33.0	42.5	21.1	13.3	43.6	**30.7**
SIVT-22-110	MCN(L)-22-3	PM 26 (ZC)	30.0	33.3	**31.7**	22.5	46.6	31.0	42.5	22.3	10.8	42.2	**29.8**
SIVT-22-111	MCN(L)-22-18	RH 2199-11	30.0	34.4	**32.2**	20.0	34.2	33.0	47.5	20.9	9.3	26.6	**27.5**
SIVT-22-112	MCN(L)-22-14	PRL-2020-5	50.0	33.0	**41.5**	22.5	32.3	42.0	37.5	20.2	8.7	26.8	**27.0**
SIVT-22-113	MCN(L)-22-7	PRL-2020-8	40.0	31.9	**35.9**	35.0	34.8	34.0	52.5	18.6	7.9	19.4	**26.5**

SIVT-22-114	MCN(L)-22-11	KMR(L) 22-6	50.0	33.3	**41.7**	27.5	37.1	46.0	37.5	22.7	10.1	24.4	**28.1**
SIVT-22-115	MCN(L)-22-4	TM258	30.0	33.6	**31.8**	27.5	35.8	28.0	37.5	17.6	10.6	21.0	**22.9**
SIVT-22-116	**SC**	**NRCHB 101**	30.0	33.2	**31.6**	32.5	50.2	26.0	32.5	20.5	11.9	35.5	**25.3**
SIVT-22-117	**RC-WR**	**DRMRMJA 35**	50.0	34.3	**42.2**	30.0	35.3	46.0	42.5	21.0	11.8	21.2	**28.5**
SIVT-22-118	MH-22-10	DRMRHJ 1419	30.0	33.5	**31.7**	42.5	44.0	21.0	25.0	18.7	12.9	32.4	**22.0**
SIVT-22-119	MH-22-4	PHR 4284	30.0	34.8	**32.4**	15.0	48.0	33.0	27.5	19.7	16.4	32.6	**25.8**
SIVT-22-120	MH-22-16	PMH90V02	30.0	32.4	**31.2**	22.5	33.5	31.0	20.0	16.7	10.7	30.7	**21.8**
SIVT-22-121	MH-22-20	Pus MH 103	30.0	34.0	**32.0**	27.5	36.7	30.0	27.5	21.0	15.5	35.1	**25.8**
SIVT-22-122	MH-22-26	4205A252-01	30.0	33.8	**31.9**	25.0	38.3	30.0	25.0	20.5	9.7	38.1	**24.6**
SIVT-22-123	MH-22-18	5TH4122	30.0	35.1	**32.6**	22.5	47.0	31.0	22.5	22.0	10.4	39.6	**25.1**
SIVT-22-124	MH-22-7	45S46 (Check)	30.0	33.7	**31.9**	15.0	46.8	33.0	27.5	20.6	12.5	35.4	**25.8**
SIVT-22-125	MH-22-13	RHH 2201	40.0	33.5	**36.8**	25.0	45.2	37.0	25.0	20.2	14.2	42.7	**27.8**
SIVT-22-126	MH-22-22	BMH19011	50.0	34.0	**42.0**	27.5	48.6	42.0	27.5	22.2	8.9	29.5	**26.0**
SIVT-22-127	MH-22-14	DMH- 1 (Check)	40.0	34.2	**37.1**	20.0	36.1	37.0	25.0	20.5	14.7	25.5	**24.5**
SIVT-22-128	MH-22-5	RHH 2202	30.0	32.8	**31.4**	35.0	32.2	25.0	37.5	22.2	17.4	24.2	**25.2**
SIVT-22-129	MH-22-11	DRMRHJ 310	40.0	33.8	**36.9**	25.0	45.1	37.0	30.0	22.2	15.7	38.9	**28.8**
SIVT-22-130	MH-22-17	NMH90M01	40.0	34.0	**37.0**	27.5	39.8	46.0	35.0	23.2	14.8	31.9	**30.2**
SIVT-22-131	MH-22-1	KGMH- 9783	30.0	33.6	**31.8**	22.5	42.5	24.0	25.0	19.9	16.1	34.4	**23.9**
SIVT-22-132	MH-22-19	SVJH- 73	30.0	34.5	**32.3**	25.0	50.0	33.0	27.5	21.3	12.7	21.3	**23.2**
SIVT-22-133	MH-22-23	NAMJH21-04	50.0	34.0	**42.0**	30.0	39.3	41.0	37.5	19.0	9.2	39.0	**29.1**
SIVT-22-134	MH-22-6	KBH5207	30.0	31.4	**30.7**	27.5	36.2	29.0	35.0	18.5	10.5	32.6	**25.1**
SIVT-22-135	MH-22-21	DRMRHJ 223	30.0	32.9	**31.4**	20.0	38.1	26.0	37.5	20.0	10.2	21.3	**23.0**
SIVT-22-136	MH-22-27	PHR 33281	30.0	34.0	**32.0**	22.5	39.6	31.0	30.0	20.5	9.8	26.0	**23.5**
SIVT-22-137	MH-22-3	Pusa MH 111	50.0	34.6	**42.3**	20.0	47.9	47.0	42.5	21.3	10.7	31.3	**30.5**
SIVT-22-138	MH-22-12	RHH 2203	30.0	34.3	**32.1**	27.5	38.3	28.0	42.5	20.2	9.5	41.1	**28.3**
SIVT-22-139	MH-22-24	Q90007	30.0	33.8	**31.9**	27.5	38.9	27.0	45.0	19.3	10.7	29.2	**26.2**
SIVT-22-140	MH-22-9	JKJH11	30.0	31.4	**30.7**	27.5	33.9	33.5	37.5	20.3	9.2	28.3	**25.7**
SIVT-22-141	MH-22-25	SKMH 1901	50.0	32.6	**41.3**	32.5	38.9	44.0	32.5	18.1	7.1	36.3	**27.6**
SIVT-22-142	MH-22-8	JH21002	50.0	34.9	**42.5**	27.5	27.4	46.0	42.5	23.5	6.6	37.6	**31.2**
SIVT-22-143	MH-22-28	DMH -1	30.0	33.7	**31.8**	25.0	37.9	30.0	37.5	21.7	15.1	23.9	**25.6**
SIVT-22-144	QM-22-2	PM 30 (NC Quality)	50.0	33.0	**41.5**	27.5	40.2	42.0	40.0	22.6	15.5	31.8	**30.4**
SIVT-22-145	QM-22-5	RH 0749 (ZC)	30.0	34.1	**32.1**	22.5	33.6	31.0	45.0	21.5	16.2	30.4	**28.8**
SIVT-22-146	QM-22-8	PMAS 7	30.0	31.5	**30.8**	22.5	32.3	33.0	40.0	18.7	13.3	37.5	**28.5**
SIVT-22-147	QM-22-11	RH(OE) 1708	50.0	32.0	**41.0**	27.5	47.5	43.0	30.0	19.1	24.4	28.8	**29.0**
SIVT-22-148	QM-22-16	DRMRCI(Q) 158	30.0	34.1	**32.1**	37.5	52.6	31.0	35.0	22.1	24.8	29.6	**28.5**
SIVT-22-149	QM-22-13	DRMRQ 29-20	30.0	33.3	**31.7**	30.0	37.7	32.0	47.5	22.0	10.5	33.7	**29.1**
SIVT-22-150	QM-22-1	DRMRCI(Q) 172	30.0	33.3	**31.7**	20.0	43.6	26.0	30.0	20.6	22.8	22.4	**24.4**
SIVT-22-151	QM-22-7	PM 32 (LR)	20.0	34.0	**27.0**	17.5	52.8	20.0	22.5	19.8	25.7	33.5	**24.3**
SIVT-22-152	QM-22-14	RH(OE) 1806	30.0	33.1	**31.5**	17.5	47.4	32.0	32.5	18.8	22.8	41.7	**29.5**
SIVT-22-153	QM-22-9	LES 67	30.0	34.0	**32.0**	25.0	53.9	30.0	42.5	20.2	27.4	35.6	**31.1**
SIVT-22-154	QM-22-4	PMAS 11	50.0	34.5	**42.2**	20.0	38.4	46.0	42.5	21.2	26.5	39.6	**35.2**
SIVT-22-155	QM-22-15	PDZ 11 (00 Check)	30.0	33.5	**31.8**	20.0	35.8	28.0	40.0	18.6	25.1	31.2	**28.6**
SIVT-22-156	QM-22-12	PDZ 19	30.0	34.7	**32.4**	25.0	47.0	28.0	40.0	21.6	45.0	36.0	**34.1**
SIVT-22-157	QM-22-6	PDZ 18	30.0	33.8	**31.9**	22.5	51.8	32.0	42.5	21.4	34.3	38.8	**33.8**
SIVT-22-158	QM-22-10	LES 66	20.0	33.8	**26.9**	12.5	41.3	19.0	32.5	21.7	14.3	42.7	**26.0**
SIVT-22-159	QM-22-3	Pusa QMH 1	50.0	34.1	**42.0**	20.0	40.5	44.0	37.5	20.0	12.8	49.3	**32.7**
SIVT-22-160	**Quality C**	**PDZ-1**	30.0	33.5	**31.7**	12.5	49.2	21.0	32.5	18.8	16.8	30.4	**23.9**
SIVT-22-161	**Bn Check**	**GSL-1**	10.0	15.8	**12.9**	15.0	52.3	13.5	35.0	9.3	7.8	29.8	**19.1**
SIVT-22-162	**Taramira C**	**RTM-314**	30.0	13.3	**21.6**	40.0	56.4	28.5	32.5	7.5	17.6	31.9	**23.6**
SIVT-22-163	**Karenrai C**	**DLSC 1**	20.0	14.2	**17.1**	12.5	47.9	13.5	7.5	8.3	11.0	20.9	**12.2**
CD(*P*=0.05)			**7.4**	**3.8**		**9.6**	**4.6**	**5.4**	**7.6**	**-**	**5.3**	**3.2**	
CV(%)			**-**	**5.5**		**-**	**5.4**	**8.0**	**-**	**9.7**	**12.4**	**4.6**	

*Excluded HSR (ABL & ABP) & DOL for ABL

Table 4.6.2: Reaction of IVT entries of oilseed Brassica to WR, PM, SR and DM

Entries	% WR (90/100 DAS)*			% PM**				% SR	% DM
	HSR	SKN	Mean	PNT	SKN	NGP	Mean	KPR	PNT
BAUT-08-09	0.0	2.2	**1.1**	0.0	-	57.8	**28.9**	10.3	27.5
PT- 303 (NC)	0.0	1.1	**0.6**	0.0	-	66.7	**33.3**	14.1	15.0
TKM 21-1	0.0	1.1	**0.6**	0.0	-	73.3	**36.7**	4.3	0.0
PT- 2016-9	0.0	0.6	**0.3**	0.0	-	68.9	**34.4**	6.2	7.5
Azad Chetna (LR)	0.0	2.8	**1.4**	0.0	-	80.0	**40.0**	4.5	0.0
JT-14-9	0.0	0.0	**0.0**	0.0	-	73.3	**36.7**	11.0	12.5
TKM 21-2	0.0	1.7	**0.9**	0.0	-	71.1	**35.6**	8.7	15.0
Bhawani (ZC)	0.0	2.2	**1.1**	0.0	-	80.0	**40.0**	11.3	7.5
PT- 2019-4	0.0	10.6	**5.3**	0.0	-	84.4	**42.2**	16.6	20.0
PT-303(C)	0.0	3.3	**1.7**	0.0	-	71.1	**35.6**	6.4	0.0
YSKM 21-1	0.0	2.8	**1.4**	0.0	-	62.2	**31.1**	9.2	27.5
DRMRYS 205	0.0	0.0	**0.0**	0.0	-	88.9	**44.4**	4.1	0.0
RMYS 4	0.0	4.4	**2.2**	7.5	-	80.0	**43.8**	0.0	0.0
PYS 2018-4	0.0	2.8	**1.4**	0.0	-	88.9	**44.4**	0.0	10.0
NRCYS-05-02 (ZC)	0.0	4.4	**2.2**	0.0	-	60.0	**30.0**	5.6	15.0
YSKM 21-2	0.0	0.6	**0.3**	0.0	-	88.9	**44.4**	7.7	17.5
AAUJYS 14-2	0.0	0.0	**0.0**	0.0	-	68.9	**34.4**	0.0	22.5
DRMRYS-18-15	0.0	0.6	**0.3**	0.0	-	88.9	**44.4**	6.4	0.0
DRMRYS 204	0.0	0.0	**0.0**	0.0	-	77.8	**38.9**	11.0	0.0
Pitambari (LR)	0.0	1.7	**0.9**	0.0	35.0	73.3	**36.1**	7.7	32.5
YSH 401 (NC)	0.0	5.0	**2.5**	0.0	20.0	66.7	**28.9**	0.0	10.0
PYS-2018-1	0.0	7.2	**3.6**	0.0	25.0	57.8	**27.6**	3.1	27.5
RMYS 5	0.0	5.6	**2.8**	0.0	-	66.7	**33.3**	0.0	30.0
AAUJYS 15-2	0.0	0.0	**0.0**	0.0	-	55.6	**27.8**	0.0	32.5
NRCYS -5-2(C)	0.0	4.4	**2.2**	0.0	25.0	64.4	**29.8**	22.5	0.0
ACN 247	30.0	26.7	**28.4**	22.5	60.0	68.9	**50.5**	10.6	15.0
NPJ 257	20.5	5.6	**13.1**	12.5	60.0	75.6	**49.4**	4.4	17.5
DRMRIJ 20-117	33.4	22.2	**27.8**	12.5	75.0	91.1	**59.5**	4.6	25.0
PRO 5111 (Hybrid Check)	35.6	20.6	**28.1**	12.5	55.0	57.8	**41.8**	0.0	15.0
DRMRSJ 272	31.2	28.9	**30.1**	12.5	60.0	73.3	**48.6**	22.5	25.0
PRE-2018- 1	38.9	38.3	**38.6**	12.5	70.0	88.9	**57.1**	15.3	30.0
GDM 4 (LR)	36.7	45.0	**40.9**	22.5	75.0	80.0	**59.2**	6.1	47.5
RH 1999-37	42.2	35.6	**38.9**	22.5	80.0	62.2	**54.9**	3.8	45.0
BAUM-2022-1	45.6	55.6	**50.6**	27.5	95.0	91.1	**71.2**	3.9	47.5
TM 314-1	34.5	53.3	**43.9**	32.5	80.0	80.0	**64.2**	5.2	30.0
SHIVANI PLUS	30.0	24.4	**27.2**	5.0	75.0	71.1	**50.4**	31.5	27.5
NPJ 58	38.9	25.0	**32.0**	7.5	65.0	64.4	**45.6**	19.3	12.5
DRMRCI- 156	42.2	40.6	**41.4**	32.5	95.0	88.9	**72.1**	0.0	25.0
SVJH- 72 (Hybrid)	43.4	36.7	**40.1**	7.5	65.0	68.9	**47.1**	4.4	22.5
Q80623	30.0	23.3	**26.7**	17.5	65.0	88.9	**57.1**	3.1	15.0
DRMRHT-1712	34.5	32.8	**33.7**	7.5	65.0	64.4	**45.6**	5.8	12.5
PM 25 (NC)	32.2	28.9	**30.6**	7.5	60.0	57.8	**41.8**	6.4	12.5
Pusa MH 126 (Hybrid)	29.5	31.7	**30.6**	5.0	75.0	68.9	**49.6**	4.8	22.5
PRE-2020-14	45.6	42.2	**43.9**	7.5	85.0	80.0	**57.5**	16.7	20.0
HUJMI 21-1	41.1	46.7	**43.9**	12.5	85.0	77.8	**58.4**	10.6	12.5
JD 6 (ZC)	43.4	32.2	**37.8**	17.5	95.0	86.7	**66.4**	10.3	15.0
RH 2199-11	38.9	35.6	**37.3**	7.5	70.0	82.2	**53.2**	3.8	20.0
ANDM 14-09	40.0	27.8	**33.9**	12.5	75.0	73.3	**53.6**	4.7	15.0
KMR(E) 22-1	41.1	27.2	**34.2**	12.5	90.0	93.3	**65.3**	12.5	17.5
KMR(E) 22-2	36.7	32.2	**34.5**	17.5	75.0	73.3	**55.3**	7.0	10.0
PHR-2 (TC-AB)	28.4	33.3	**30.9**	52.5	100.0	82.2	**78.2**	2.5	27.5
Kranti (NC)	35.6	32.8	**34.2**	22.5	90.0	82.2	**64.9**	10.8	10.0
ACNMM- 3	31.2	44.4	**37.8**	27.5	75.0	86.7	**63.1**	0.0	17.5

DRMR 2020-8	40.0	37.8	**38.9**	32.5	80.0	88.9	**67.1**	0.0	17.5
GIRIRAJ (LR)	43.4	45.0	**44.2**	22.5	85.0	88.9	**65.5**	3.9	7.5
KMR 22-3	34.5	40.0	**37.3**	22.5	80.0	80.0	**60.8**	4.3	25.0
RH 2187	33.4	28.3	**30.9**	22.5	75.0	84.4	**60.6**	4.4	12.5
RH 2199	31.7	30.0	**30.9**	32.5	90.0	71.1	**64.5**	0.0	12.5
DTM- 341	32.2	23.3	**27.8**	17.5	60.0	64.4	**47.3**	3.5	7.5
DM 2020-3	42.2	25.0	**33.6**	22.5	65.0	91.1	**59.5**	3.5	22.5
RMM-19-12	35.6	38.9	**37.3**	22.5	80.0	80.0	**60.8**	0.0	47.5
DRMRIJ 21-37	51.1	33.3	**42.2**	17.5	95.0	91.1	**67.9**	5.7	15.0
TM316	36.7	32.2	**34.5**	17.5	95.0	86.7	**66.4**	8.2	15.0
RCC 4 (ZC)	38.9	32.2	**35.6**	32.5	80.0	82.2	**64.9**	8.2	37.5
PR-2020-14	30.0	38.9	**34.5**	7.5	95.0	73.3	**58.6**	3.8	12.5
PBR 813-2	31.2	20.6	**25.9**	27.5	85.0	77.8	**63.4**	0.0	22.5
KMR 22-4	32.2	42.8	**37.5**	7.5	85.0	88.9	**60.5**	0.0	30.0
HUJM-21-4	33.4	40.0	**36.7**	17.5	95.0	66.7	**59.7**	0.0	27.5
SKM 1924	38.9	32.8	**35.9**	7.5	85.0	88.9	**60.5**	4.0	22.5
NPJ 261	34.5	31.1	**32.8**	17.5	95.0	91.1	**67.9**	8.4	25.0
SKM 2012	31.1	33.9	**32.5**	7.5	95.0	88.9	**63.8**	0.0	32.5
NPJ 262	30.0	22.8	**26.4**	32.5	95.0	86.7	**71.4**	3.5	27.5
PR-2019-1	35.6	24.4	**30.0**	5.0	90.0	82.2	**59.1**	5.1	12.5
RAURD 18-1	32.2	51.1	**41.7**	12.5	75.0	84.4	**57.3**	5.2	15.0
DRMRCI- 154	29.5	23.9	**26.7**	12.5	75.0	66.7	**51.4**	8.1	7.5
RB- 110	31.2	45.6	**38.4**	27.5	95.0	62.2	**61.6**	8.1	12.5
DRMRHT 18-141	40.0	33.3	**36.7**	12.5	75.0	66.7	**51.4**	16.4	7.5
RGN 528	27.2	17.2	**22.2**	12.5	75.0	82.2	**56.6**	5.1	12.5
Rohini (SC)	33.4	31.7	**32.6**	12.5	95.0	77.8	**61.8**	0.0	10.0
BIOYSR (RC-WR)	0.0	8.9	**4.5**	27.5	80.0	88.9	**65.5**	4.7	17.5
RH 2199-6	35.6	18.9	**27.3**	22.5	95.0	95.6	**71.0**	4.5	7.5
BAUM- 17	38.9	18.9	**28.9**	22.5	85.0	88.9	**65.5**	8.0	15.0
RH 2148	40.0	22.2	**31.1**	12.5	90.0	75.6	**59.4**	28.9	12.5
RH 761 (LR)	42.2	23.3	**32.8**	22.5	95.0	64.4	**60.6**	0.0	7.5
DRMRCI- 155	45.6	31.7	**38.7**	7.5	75.0	82.2	**54.9**	4.9	15.0
JM-15-8	50.0	35.6	**42.8**	32.5	85.0	64.4	**60.6**	9.3	25.0
RH 725 (ZC)	35.6	30.0	**32.8**	22.5	85.0	88.9	**65.5**	0.0	12.5
JKJH12	29.5	14.4	**22.0**	12.5	85.0	84.4	**60.6**	15.0	70.0
NPJ 263	38.9	23.9	**31.4**	17.5	85.0	73.3	**58.6**	7.2	87.5
DRMR 2020-3	43.4	41.7	**42.6**	12.5	95.0	71.1	**59.5**	14.6	80.0
RGN 526	27.2	24.4	**25.8**	7.5	95.0	84.4	**62.3**	6.2	12.5
DRMRHT- 17-2	40.0	38.9	**39.5**	7.5	85.0	71.1	**54.5**	9.0	45.0
NPJ 264	25.1	18.9	**22.0**	12.5	90.0	91.1	**64.5**	0.0	65.0
TM260	51.1	16.1	**33.6**	22.5	90.0	88.9	**67.1**	4.2	50.0
DRMRRIL 21-1	30.0	22.8	**26.4**	5.0	75.0	68.9	**49.6**	7.3	70.0
RB- 113	38.9	32.8	**35.9**	12.5	95.0	60.0	**55.8**	0.0	80.0
HUJM-21-1	31.1	27.8	**29.5**	12.5	80.0	84.4	**59.0**	9.3	55.0
RH 1999-22	34.5	38.9	**36.7**	7.5	65.0	62.2	**44.9**	10.5	75.0
RGN 534	30.0	31.7	**30.9**	7.5	80.0	80.0	**55.8**	0.0	67.5
DRMRHT-13-28-13	31.2	45.0	**38.1**	17.5	85.0	91.1	**64.5**	5.3	70.0
BAUM-2022-2	45.6	56.7	**51.2**	17.5	90.0	88.9	**65.5**	4.9	42.5
DRMRSJ 294	31.7	18.3	**25.0**	12.5	85.0	80.0	**59.2**	6.1	57.5
NPJ 259	22.2	7.8	**15.0**	22.5	65.0	77.8	**55.1**	0.0	42.5
NPJ 260	36.7	30.0	**33.4**	5.0	65.0	64.4	**44.8**	7.5	55.0
NPJ 265	46.7	34.4	**40.6**	7.5	90.0	62.2	**53.2**	8.9	32.5
Radhika (LR)	38.9	23.3	**31.1**	17.5	90.0	66.7	**58.1**	8.4	40.0
DRMRIJ 21-51	42.2	34.4	**38.3**	12.5	100.0	75.6	**62.7**	0.0	57.5
KMR(L) 22-5	31.1	39.4	**35.3**	32.5	90.0	88.9	**70.5**	0.0	72.5
DRMRCI- 160	5.0	6.1	**5.6**	17.5	80.0	71.1	**56.2**	3.7	80.0
PM 26 (ZC)	30.0	23.3	**26.7**	7.5	70.0	68.9	**48.8**	15.4	25.0
RH 2199-11	33.4	25.6	**29.5**	5.0	65.0	80.0	**50.0**	0.0	35.0

PRL-2020-5	31.2	33.3	**32.3**	32.5	85.0	68.9	**62.1**	7.3	50.0
PRL-2020-8	28.9	28.9	**28.9**	32.5	95.0	86.7	**71.4**	3.5	60.0
KMR(L) 22-6	32.2	31.7	**32.0**	32.5	100.0	91.1	**74.5**	9.0	25.0
TM258	12.8	12.8	**12.8**	32.5	90.0	71.1	**64.5**	17.2	27.5
NRCHB 101(SC)	50.0	36.1	**43.1**	17.5	90.0	66.7	**58.1**	16.4	42.5
DRMRMJA 35(RC-WR)	6.7	10.0	**8.4**	42.5	95.0	68.9	**68.8**	12.8	67.5
DRMRHJ 1419	35.6	9.4	**22.5**	42.5	90.0	71.1	**67.9**	5.4	65.0
PHR 4284	30.0	27.2	**28.6**	47.5	100.0	80.0	**75.8**	0.0	52.5
PMH90V02	34.5	32.2	**33.4**	57.5	95.0	86.7	**79.7**	0.0	40.0
Pus MH 103	38.9	17.2	**28.1**	47.5	95.0	66.7	**69.7**	0.0	67.5
4205A252-01	11.7	10.6	**11.2**	37.5	85.0	82.2	**68.2**	8.3	35.0
5TH4122	31.2	26.7	**29.0**	52.5	95.0	64.4	**70.6**	9.4	60.0
45S46 (Check)	33.4	33.9	**33.7**	32.5	85.0	84.4	**67.3**	16.8	50.0
RHH 2201	40.0	33.3	**36.7**	22.5	70.0	91.1	**61.2**	17.7	25.0
BMH19011	31.1	28.3	**29.7**	12.5	75.0	71.1	**52.9**	13.6	45.0
DMH- 1 (Check)	4.5	6.7	**5.6**	27.5	100.0	82.2	**69.9**	8.1	75.0
RHH 2202	5.0	7.8	**6.4**	27.5	100.0	86.7	**71.4**	0.0	77.5
DRMRHJ 310	25.1	25.0	**25.1**	32.5	100.0	75.6	**69.4**	0.0	67.5
NMH90M01	34.5	43.3	**38.9**	17.5	95.0	64.4	**59.0**	17.3	75.0
KGMH- 9783	36.7	27.2	**32.0**	12.5	90.0	60.0	**54.2**	0.0	77.5
SVJH- 73	30.0	37.2	**33.6**	12.5	85.0	88.9	**62.1**	0.0	60.0
NAMJH21-04	31.2	29.4	**30.3**	7.5	95.0	73.3	**58.6**	0.0	87.5
KBH5207	29.5	35.0	**32.3**	7.5	100.0	82.2	**63.2**	3.8	67.5
DRMRHJ 223	28.4	35.6	**32.0**	7.5	100.0	71.1	**59.5**	4.1	35.0
PHR 33281	35.6	38.9	**37.3**	17.5	90.0	66.7	**58.1**	3.7	82.5
Pusa MH 111	30.0	52.8	**41.4**	7.5	85.0	91.1	**61.2**	4.5	62.5
RHH 2203	31.7	46.7	**39.2**	7.5	85.0	88.9	**60.5**	20.0	47.5
Q90007	0.0	12.2	**6.1**	7.5	75.0	68.9	**50.5**	15.1	70.0
JKJH11	26.7	12.2	**19.5**	5.0	90.0	75.6	**56.9**	13.8	60.0
SKMH 1901	40.0	43.9	**42.0**	12.5	100.0	88.9	**67.1**	12.9	80.0
JH21002	38.9	33.9	**36.4**	7.5	100.0	93.3	**66.9**	15.1	55.0
DMH -1	30.0	2.8	**16.4**	22.5	95.0	88.9	**68.8**	8.4	50.0
PM 30 (NC Quality)	31.2	46.7	**39.0**	17.5	95.0	84.4	**65.6**	0.0	65.0
RH 0749 (ZC)	35.6	30.6	**33.1**	12.5	100.0	75.6	**62.7**	5.0	65.0
PMAS 7	30.0	3.3	**16.7**	7.5	95.0	66.7	**56.4**	84.3	80.0
RH(OE) 1708	34.5	47.8	**41.2**	7.5	80.0	84.4	**57.3**	36.7	90.0
DRMRCI(Q) 158	0.0	26.7	**13.4**	7.5	85.0	68.9	**53.8**	67.9	57.5
DRMRQ 29-20	28.4	27.2	**27.8**	5.0	85.0	62.2	**50.7**	6.7	70.0
DRMRCI(Q) 172	5.0	6.7	**5.9**	7.5	95.0	93.3	**65.3**	30.1	27.5
PM 32 (LR)	36.7	42.8	**39.8**	17.5	90.0	88.9	**65.5**	32.1	67.5
RH(OE) 1806	17.8	23.3	**20.6**	7.5	85.0	88.9	**60.5**	55.2	72.5
LES 67	15.6	21.7	**18.7**	17.5	95.0	66.7	**59.7**	16.2	77.5
PMAS 11	5.0	1.7	**3.4**	7.5	95.0	62.2	**54.9**	16.2	82.5
PDZ 11 (00 Check)	0.0	0.6	**0.3**	12.5	75.0	77.8	**55.1**	12.3	72.5
PDZ 19	0.0	1.1	**0.6**	5.0	75.0	68.9	**49.6**	38.9	60.0
PDZ 18	0.0	2.2	**1.1**	7.5	100.0	91.1	**66.2**	20.3	70.0
LES 66	25.1	35.6	**30.4**	22.5	100.0	66.7	**63.1**	40.0	75.0
Pusa QMH 1	16.8	28.3	**22.6**	22.5	95.0	71.1	**62.9**	0.0	82.5
PDZ-1 (RC)	0.0	2.8	**1.4**	17.5	90.0	77.8	**61.8**	10.1	80.0
GSL-1 (Bn)	0.0	0.0	**0.0**	5.0	0.0	2.2	**2.4**	9.5	0.0
RTM-314 (Es)	0.0	0.0	**0.0**	7.5	0.0	0.0	**2.5**	0.0	0.0
DLSC 1 (C)	0.0	0.0	**0.0**	5.0	0.0	0.0	**1.7**	0.0	0.0
CD(*P*=0.05)	**4.1**	**8.7**		**6.2**	**12.3**	**8.4**		16.9	**10.0**
CV(%)	**7.6**	**18.2**		**-**	**7.6**	**6.9**		-	**-**

*PNT, LDH, MDR and KPR excluded for WR; **PNT and MDR excluded for PM

Table: 4.7.1 Assessment of yield loss and management of Alternaria blight in rice-fellow mustard cropping system.

Treatments:	% AB severity				% AB reduction over check	% ABP severity	Yield (kg/ha)				Yield % increase Over Check	B:C ratio	1000 seed weight(g)
	VAR	JAG	DOL	Mean		JAG	VAR	JAG	DOL	Mean		JAG	JAG
Iprodione 50WP -FS @ 0.2%	25.4	8.5	13.2	**15.7**	**62.4**	9.7	1386	1582	1516	**1495**	**40.1**	2.98	7.3
Tebuconazole 50%+trifloxistrobin 25% WG-FS @ 0.5g/l	20.8	4.7	10.2	**11.9**	**71.5**	7.1	1790	1718	1543	**1683**	**57.8**	3.21	8.0
Soil application of Potash 40 kg/ h	30.5	24.1	26.4	**27.0**	**35.4**	24.1	1222	1402	1235	**1287**	**20.6**	2.65	7.1
ST+FS with Trichoderma harzianum @ 10g/ kg seed	32.7	20.9	15.3	**23.0**	**45.0**	17.7	1189	1524	1461	**1391**	**30.4**	2.93	7.2
Lower three leaf removal at 45 DAS	34.0	28.8	22.4	**28.4**	**32.1**	27.5	1122	1236	1279	**1212**	**13.6**	2.4	6.6
Garlic bulb extract @ 1% w/v (ST+FS)	22.2	27.5	15.2	**21.6**	**48.3**	28.6	1531	1352	1464	**1449**	**5.8**	2.61	6.5
Pseudomonas florescence 10^6c.f.u.	32.9	21.5	23.8	**26.0**	**35.9**	24.6	1209	1448	1272	**1310**	**22.8**	2.79	6.8
Check	47.6	37.2	40.6	**41.8**	**-**	33.6	979	1177	1044	**1067**	**-**	2.29	6.4
CD (5%)	**1.0**	**6.1**	**4.8**		**-**	**7.2**	**118.5**	**95.3**	**216.1**	**-**	**-**	**0.2**	**-**
CV	**1.7**	**15.8**	**13.0**		**-**	**18.7**	**5.2**	**3.8**	**9.0**	**-**	**-**	**3.7**	**6.0**

Note:SHL-Heavy rainfall of 168.8 mm in the month of October 2022 in 3 weeks caused water logging of the rice fields of

Table: 4.8.1: Epidemiology of WR, SH, AB and SR disease at HSR during 2022-23

A. White rust

Date of sowing	First appearance	% White rust (DAS)																						
Varuna	(DAS)	38	41	45	48	52	55	59	62	66	69	73	76	80	83	87	90	94	97	101	104	108	111	115	118
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 15	**69**	-	-	-	-	-	-	-	-	-	0.8	0.9	1.7	4.5	6.7	12.3	15.6	23.4	32.2	33.4	34.5	35.6	36.7	36.7	38.9
Oct. 22	**57**	-	-	-	-	-	-	0.8	0.9	0.9	1.7	8.9	10.0	16.8	20.5	23.4	24.5	33.4	36.7	38.9	40.0	41.1	42.2	42.2	-
Oct. 29	**51**	-	-	-	-	0.8	1.7	2.8	3.3	6.7	8.9	12.8	17.8	18.9	27.2	32.2	36.7	40.0	41.1	42.2	43.4	45.6	-	-	-
Nov. 05	**43**	-	-	0.8	1.7	4.5	6.7	10.6	11.7	12.3	18.9	21.1	29.5	33.4	36.7	40.0	42.2	43.4	45.6	46.7	-	-	-	-	-
Nov.12	**43**	-	-	1.7	2.8	3.3	5.0	8.9	10.6	12.8	15.6	24.5	32.2	38.9	41.1	42.2	43.4	45.6	-	-	-	-	-	-	-
Nov. 19	**39**	-	1.7	2.8	3.3	4.5	6.7	8.9	12.8	22.2	33.4	38.9	40.0	41.1	42.2	43.4	-	-	-	-	-	-	-	-	-
RH 30																									
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
Oct. 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
Oct. 15	**68**	-	-	-	-	-	-	-	-	-	0.8	1.7	2.8	5.0	8.9	15.6	17.8	25.1	34.5	35.6	36.7	38.9	38.9	40.0	41.1
Oct. 22	**57**	-	-	-	-	-	-	0.8	1.7	2.8	4.5	10.6	11.7	17.3	21.1	25.1	31.2	35.6	38.9	40.0	41.1	42.2	43.4	43.4	-
Oct. 29	**50**	-	-	-	-	0.8	0.9	1.7	2.8	5.0	7.3	11.7	16.8	20.5	32.2	34.5	38.9	40.0	41.1	43.4	45.6	46.7	-	-	-
Nov. 05	**43**	-	-	0.8	0.8	0.9	1.7	2.8	5.0	6.8	7.3	11.7	23.4	36.7	38.9	41.1	43.4	45.6	46.7	48.9	-	-	-	-	-
Nov. 12	**42**	-	-	1.7	2.8	5.0	7.8	12.3	13.4	15.6	25.1	34.5	36.7	40.0	42.2	43.4	45.6	46.7	-	-	-	-	-	-	-
Nov. 19	**38**	0.8	0.9	1.7	2.8	5.0	6.7	7.8	10.6	26.7	32.2	38.9	41.1	42.2	43.4	45.6	-	-	-	-	-	-	-	-	-

Note: First two date of sowing i.e., 1 and 8 Oct., 2022 were not done due to heavy rain in the last week of September

B. Staghead

Date of sowing	First appearance (DAS)	% Staghead																
Varuna		**83**	**87**	**90**	**94**	**97**	**101**	**104**	**108**	**111**	**115**	**118**	**122**	**125**	**129**	**132**	**136**	**139**
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 15	**114**	-	-	-	-	-	-	-	-	-	1.6	3.1	4.7	7.8	9.4	10.9	12.5	12.5
Oct. 22	**103**	-	-	-	-	-	-	0.7	2.2	3.7	11.8	15.4	16.2	17.6	18.4	18.4	-	-
Oct. 29	**97**	-	-	-	-	1.4	3.4	4.8	7.5	12.3	19.2	20.5	21.9	23.3	-	-	-	-
Nov. 05	**92**	-	-	-	1.6	3.1	7.0	13.3	15.6	22.7	24.2	25.8	-	-	-	-	-	-
Nov.12	**89**	-	-	1.6	3.9	6.3	9.4	16.5	17.3	18.9	-	-	-	-	-	-	-	-
Nov. 19	**83**	0.8	2.3	4.7	9.3	14.7	16.3	17.1	-	-	-	-	-	-	-	-	-	-
RH 30																		
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 15	**114**	-	-	-	-	-	-	-	-	-	1.0	3.1	5.1	8.2	10.2	11.2	12.2	13.3
Oct. 22	**104**	-	-	-	-	-	-	0.6	2.3	4.6	12.7	17.9	18.5	19.1	19.7	19.7	-	-
Oct. 29	**98**	-	-	-	-	-	2.0	5.4	10.7	18.8	20.1	22.1	23.5	24.2	-	-	-	-
Nov. 05	**92**	-	-	-	1.8	5.3	7.1	11.5	21.2	23.0	25.7	26.5	-	-	-	-	-	-
Nov. 12	**88**	-	-	2.5	4.9	11.5	15.6	17.2	18.9	19.7	-	-	-	-	-	-	-	-
Nov. 19	**83**	0.6	2.6	5.8	8.4	12.3	17.4	18.1	-	-	-	-	-	-	-	-	-	-

C. Alternaria blight

Date of sowing	First appearance (DAS)	% Alternaria leaf blight															Seed Yield (Kg/h)
Varuna		**87**	**90**	**94**	**97**	**101**	**104**	**108**	**111**	**115**	**118**	**122**	**125**	**129**	**132**	**136**	
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 15	**97**	-	-	-	0.8	0.8	1.7	2.8	3.3	4.6	8.9	10.0	10.6	11.1	11.7	12.8	2612
Oct. 22	**91**	-	-	0.8	1.7	3.3	6.7	7.8	8.9	10.6	14.5	15.6	16.8	17.8	-	-	2444
Oct. 29	**88**	-	0.8	1.7	2.8	4.6	8.9	14.5	16.8	18.9	20.5	22.2	-	-	-	-	2060
Nov. 05	**95**	-	-	-	0.8	1.7	5.0	12.8	20.5	24.5	-	-	-	-	-	-	1861
Nov. 12	**89**	-	0.8	1.7	5.0	7.8	15.6	25.1	-	-	-	-	-	-	-	-	1677
Nov. 19	**87**	0.8	1.7	8.9	13.4	21.1	-	-	-	-	-	-	-	-	-	-	1454
RH 30																	
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 15	**96**	-	-	0.0	0.8	1.7	2.8	3.3	4.6	5.0	7.8	11.1	11.7	12.3	13.4	14.5	2501
Oct. 22	**91**	-	-	0.8	1.7	2.8	4.6	8.9	10.6	11.7	15.6	16.8	17.8	18.9	-	-	2255
Oct. 29	**87**	0.8	1.7	2.8	5.0	8.9	13.4	17.8	20.0	21.1	22.2	23.4	-	-	-	-	1911
Nov. 05	**95**	-	0.0	0.0	0.8	1.7	6.7	13.4	21.1	25.1	-	-	-	-	-	-	1609
Nov. 12	**89**	-	0.8	1.7	6.7	8.9	17.8	26.7	-	-	-	-	-	-	-	-	1544
Nov. 19	**86**	1.7	3.3	10.0	15.6	22.2	-	-	-	-	-	-	-	-	-	-	1403

D. Sclerotinia rot

Date of sowing	First appearance (DAS)	% Sclerotinia rot (DAS)																				
Varuna		69	73	76	80	83	87	90	94	97	101	104	108	111	115	118	122	125	129	132	136	139
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 15	**83**	-	-	-	-	1.6	1.6	1.6	3.1	3.1	3.1	3.1	4.7	4.7	7.8	7.8	7.8	9.4	9.4	9.4	9.4	9.4
Oct. 22	**85**	-	-	-	-	-	0.7	1.5	2.9	5.9	8.8	10.3	10.3	12.5	12.5	14.7	14.7	15.4	16.2	16.2	-	-
Oct. 29	**85**	-	-	-	-	-	0.7	2.7	6.2	8.9	14.4	15.1	15.8	15.8	16.4	16.4	17.8	17.8	-	-	-	-
Nov. 05	**72**	-	0.8	1.6	3.1	4.7	7.0	7.0	7.8	7.8	8.6	8.6	10.2	11.7	12.5	12.5	-	-	-	-	-	-
Nov. 12	**73**	-	0.8	1.6	2.4	3.9	6.3	6.3	7.9	7.9	10.2	11.0	11.8	11.8	-	-	-	-	-	-	-	-
Nov. 19	**69**	0.8	0.8	2.3	3.1	4.7	7.0	7.0	7.8	8.5	9.3	9.3	-	-	-	-	-	-	-	-	-	-
RH 30																						
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 15	**79**	-	-	-	1.0	2.0	3.1	3.1	3.1	5.1	5.1	5.1	6.1	7.1	7.1	7.1	8.2	8.2	9.2	10.2	10.2	10.2
Oct. 22	**90**	-	-	-	-	-	-	0.6	1.7	3.5	8.7	12.7	14.5	14.5	15.0	16.2	16.8	17.3	18.5	18.5	-	-
Oct. 29	**85**	-	-	-	-	-	1.3	3.4	5.4	8.1	16.8	18.1	19.5	20.1	21.5	21.5	22.1	22.1	-	-	-	-
Nov. 05	**72**	-	0.9	1.8	4.4	5.3	6.2	7.1	8.8	9.7	9.7	13.3	13.3	13.3	14.2	14.2	-	-	-	-	-	-
Nov. 12	**73**	-	0.8	2.5	4.1	4.9	5.7	6.6	7.4	7.4	10.7	10.7	12.3	12.3	-	-	-	-	-	-	-	-
Nov. 19	**68**	0.6	1.3	2.6	3.9	4.5	5.2	5.8	5.8	9.0	9.7	11.0	-	-	-	-	-	-	-	-	-	-

Table 4.8.2: Epidemiology of Alternaria blight disease on leaves at SHL during 2022-23

A. Alternaria blight and Alternaria pods blight

Date of sowing	First appearance (DAS)	% AB Disease severity on leaf (DAS)									First appearance (DAS)	% AB disease severity on pod (DAS)				Yield (kg/ha)	1000 seed wt (g)
Varuna		40	50	60	70	80	90	100	110	120		90	100	110	120		
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 22	**53**	-	-	2.9	5.6	13.1	17.3	20.1	25.2	29.2	**105**	-	-	5.7	9.5	1467	3.37
Oct. 29	**42**	-	2.5	4.8	12.1	15.8	19.7	25.7	30.8	-	**93**	-	5.9	14.2	18.5	1600	3.65
Nov. 05	**40**	-	3.1	7.9	14.2	18.7	23.5	28.2	36.4	-	**89**	-	8.9	16.1	22.3	1667	3.80
Nov. 12	**36**	2.9	6.5	11.7	16.4	19.7	26.8	32.7	38.9	-	**88**	3.1	9.5	15.3	25.8	1333	3.29
Nov. 19	**35**	3.4	8.7	15.4	18.7	27.8	30.5	36.5	-	-	**85**	5.8	12.2	20.7	0.0	1067	3.20
TM 2																	
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 22	**51**	-	-	3.9	8.7	15.7	18.4	23.5	26.4	33.7	**104**	-	-	6.5	11.3	1000	2.55
Oct. 29	**43**	-	4.8	8.5	14.2	19.6	22.1	27.3	33.1	-	**92**	-	7.3	14.2	18.4	1067	2.61
Nov. 05	**41**	-	4.9	10.3	16.3	20.6	24.2	30.7	36.4	-	**88**	2.1	9.2	16.1	21.8	1093	2.76
Nov. 12	**37**	2.8	6.9	13.2	18.3	23.7	29.7	33.1	38.5	-	**86**	2.9	10.1	19.7	26.2	867	2.40
Nov. 19	**34**	3.1	7.9	14.3	19.2	27.5	33.1	38.9	-	-	**83**	5.4	12.1	23.4	-	733	2.30

*1st, 8th & 15th Oct 2022 sowing couldnot be done due to heavy rainfall

Table 4.8.3: Epidemiology of white rust and Powdery mildew at SKN during 2022-23

A. White Rust

Date of sowing	Date of appearance (DAS)	% White Rust (DAS)															
		59	63	66	70	73	77	80	84	87	91	94	98	101	105	108	112
Varuna																	
Oct. 01	**80**	-	-	-	-	-	-	-	1.9	4.3	6.1	7.6	8.7	9.8	10.9	12.5	14.3
Oct. 08	**78**	-	-	-	-	-	-	1.5	3.5	6.5	9.6	12.2	14.3	16.7	19.9	-	-
Oct. 15	**72**	-	-	-	-	0.6	1.5	3.2	6.1	9.2	12.2	16.4	21.6	-	-	-	-
Oct. 22	**64**	-	-	1.0	2.3	5.0	8.6	12.7	15.8	19.9	23.5	-	-	-	-	-	-
Oct. 29	**60**	-	1.4	4.4	8.4	12.4	16.4	20.2	23.6	-	-	-	-	-	-	-	-
Nov. 05	**61**	-	0.9	4.0	7.7	12.5	19.5	-	-	-	-	-	-	-	-	-	-
Nov. 12	**62**	-	0.4	2.5	7.8	-	-	-	-	-	-	-	-	-	-	-	-
Nov. 19	**57**	1.6	5.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GM 2																	
Oct. 01	**81**	-	-	-	-	-	-	-	1.4	4.3	7.5	9.0	11.2	12.5	14.1	16.6	18.1
Oct. 08	**73**	-	-	-	-	-	1.5	2.6	4.1	7.2	10.0	13.0	16.4	19.4	21.9	-	-
Oct. 15	**71**	-	-	-	-	1.1	2.7	5.3	8.0	10.0	11.6	16.9	21.9	-	-	-	-
Oct. 22	**64**	-	-	1.3	3.7	6.4	9.0	11.2	13.1	18.0	23.0	-	-	-	-	-	-
Oct. 29	**61**	-	1.1	3.4	6.9	10.8	14.4	18.8	24.0	-	-	-	-	-	-	-	-
Nov. 05	**61**	-	1.2	3.4	8.4	13.5	19.2	-	-	-	-	-	-	-	-	-	-
Nov. 12	**60**	-	1.7	5.0	9.5	-	-	-	-	-	-	-	-	-	-	-	-
Nov. 19	**56**	2.6	6.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-

B. Powdery mildew

Date of sowing	Date of appearance (DAS)	% Powdery mildew (DAS)															Yield (kg/ha)
		80	84	87	91	94	98	101	105	108	112	115	119	122	126	129	
Varuna																	
Oct. 01	**116**	-	-	-	-	-	-	-	-	-	-	-	2.4	3.7	6.5	9.1	1950
Oct. 08	**109**	-	-	-	-	-	-	-	-	-	1.8	3.2	6.8	10.8	13.9	17.3	1730
Oct. 15	**106**	-	-	-	-	-	-	-	-	2.7	5.5	8.8	12.9	18.3	22.2	-	1420
Oct. 22	**99**	-	-	-	-	-	-	2.2	4.6	8.2	13.2	18.7	24.5	29.8	-	-	1130
Oct. 29	**93**	-	-	-	-	1.3	2.7	6	10.8	17.5	27.3	37.5	46.6	-	-	-	1010
Nov. 05	**88**	-	-	-	3.3	7.4	12.4	17.8	22.7	28.6	41.5	51.5	65.5	-	-	-	780
Nov. 12	**82**	-	2.3	7.0	12.7	19.3	27.0	34.0	45.5	57.5	71.0	84.0	-	-	-	-	350
Nov. 19	**78**	4.4	8.9	18.0	30.5	42.5	55.0	70.5	80.5	90.5	96.5	-	-	-	-	-	310
GM-2																	
Oct. 01	**118**	-	-	-	-	-	-	-	-	-	-	-	1.4	2.6	5.2	8.4	2030
Oct. 08	**109**	-	-	-	-	-	-	-	-	-	1.6	2.7	5.3	8.4	12.0	16.0	1880
Oct. 15	**107**	-	-	-	-	-	-	-	-	2.4	4.6	7.3	10.2	13.7	18.8	-	1570
Oct. 22	**100**	-	-	-	-	-	-	1.5	3.2	6.4	10.0	14.2	19.8	24.7	-	-	1150
Oct. 29	**93**	-	-	-	-	0.9	2.3	4.6	8.5	13.8	20.5	28.3	39.0	-	-	-	1090
Nov. 05	**89**	-	-	-	1.4	4.1	9.4	16.2	21.0	24.6	33.3	47.5	59.0	-	-	-	830
Nov. 12	**83**	-	1.8	3.7	7.9	14.7	23.8	30.5	40.5	52.0	64.5	79.5	-	-	-	-	380
Nov. 19	**78**	2.2	7.1	12.2	24.0	36.0	49.5	65.0	77.5	86.0	92.0	-	-	-	-	-	330

Table 4.8.4: Epidemiology of Alterneria leaf blight and powdery mildew disease of mustard at JAG during 2022-23

A. Alternaria leaf blight and Powdery mildew

Date of sowing	Disease appearance (DAS)	% Alternaria leaf blight (DAS)							Disease appearance (DAS)	% Powdery mildew (DAS)						Yield (kg./ha)	1000 seed wt. in g.
Varuna		**40**	**50**	**60**	**70**	**80**	**90**	**100**		**70**	**80**	**90**	**100**	**110**	**120**		
Oct. 01	**77**	-	-	-	7.0	18.2	28.7	32.5	**122**	-	-	-	-	-	3.8	1620	4.0
Oct. 08	**73**	-	-	-	4.6	14.0	32.5	28.1	**120**	-	-	-	-	-	8.2	1640	5.91
Oct. 15	**67**	-	-	5.0	14.4	13.0	21.2	24.5	**98**	-	-	6.9	13.4	18.6	18.7	1640	5.22
Oct. 22	**62**	-	-	5.7	26.6	32.1	38.6	-	**92**	-	-	11.4	18.7	28.4	41.6	1700	5.00
Oct. 29	**57**	-	3.5	7.1	31.3	36.7	22.5	-	**83**	-	9.4	17.7	27.4	33.6	48.7	1420	4.57
Nov. 05	**53**	-	4.5	12.8	28.6	22.3	16.7	-	**87**	-	2.7	16.3	22.5	30.5	37.5	1460	4.67
Nov. 12	**42**	5.9	8.5	17.6	30.8	28.1	18.6	-	**77**	6.5	10.0	18.3	27.6	40.7	55.7	1130	4.36
Nov. 19	**46**	9.7	17.7	15.3	6.2	5.4	6.0	-	**75**	8.9	18.5	28.6	32.0	38.2	42.8	950	4.64
CG Saraso																	
Oct. 01	**75**	-	-	-	5.7	11.7	24.7	6.6	**122**	-	-	-	-	-	4.0	1420	4.88
Oct. 08	**73**	-	-	-	8.8	9.3	23.3	-	**120**	-	-	-	-	-	6.5	1600	4.64
Oct. 15	**66**	-	-	3.7	8.4	12.8	14.2	-	**93**	-	-	4.6	8.6	13.5	16.5	1634	4.00
Oct. 22	**62**	-	-	2.6	8.3	26.9	8.8	-	**91**	-	-	8.5	16.3	20.6	32.5	1500	4.68
Oct. 29	**54**	-	2.7	1.9	21.7	25.0	13.6	-	**84**	-	4.7	10.9	17.6	30.4	40.0	1464	4.84
Nov. 05	**58**	-	5.6	4.2	22.0	28.2	7.7	-	**91**	-	0.0	7.6	18.0	25.6	33.9	1680	4.00
Nov. 12	**45**	2.0	6.9	11.3	15.0	11.6	4.4	-	**76**	6.3	11.0	21.6	26.4	34.4	38.7	1480	4.63
Nov. 19	**47**	6.6	11.6	12.7	6.8	3.7	-	-	**122**	-	-	-	-	-	4.0	8680	4.71

Table 4.8.5: Epidemiology of Downy mildew, White rust, Alternaria blight and Powdery Mildew at PNT during 2022-23

A. Downy mildew

Date of sowing	First app. (DAS)	Disease incidene (%) at cotyledonary stage and Disease severity (%) at true leaf to adult plant stage																																		
		Days of observation																																			
Varuna		**11**	**14**	**18**	**21**	**25**	**28**	**32**	**35**	**39**	**42**	**46**	**49**	**53**	**56**	**60**	**63**	**67**	**70**	**74**	**78**	**81**	**84**	**88**	**91**	**95**	**98**	**102**	**105**	**109**	**112**	**116**	**119**	**123**	**126**
Oct-01	**35**	-	-	-	-	-	-	-	80.0	80.0	70.0	50.0	40.0	30.0	30.0	20.0	10.0	30.0	30.0	30.0	40.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	40.0	40.0	40.0	40.0	20.0
Oct-08	**28**	-	-	-	-	-	80.0	80.0	70.0	60.0	60.0	60.0	40.0	20.0	20.0	20.0	20.0	30.0	30.0	30.0	30.0	50.0	50.0	50.0	50.0	50.0	50.0	60.0	60.0	80.0	80.0	90.0	50.0	30.0	30.0	30.0
Oct-15	**Sowing was not done due to water logged conditions**																																			
Oct-22	**11**	80.0	100.0	100.0	80.0	80.0	40.0	30.0	30.0	20.0	20.0	10.0	20.0	20.0	20.0	20.0	40.0	40.0	40.0	40.0	40.0	40.0	50.0	50.0	50.0	60.0	80.0	50.0	50.0	40.0	40.0	30.0	20.0	20.0	10.0
Oct-29	**11**	100.0	100.0	80.0	70.0	40.0	40.0	30.0	20.0	10.0	10.0	-	10.0	10.0	30.0	20.0	20.0	20.0	20.0	20.0	20.0	30.0	30.0	40.0	80.0	60.0	50.0	30.0	30.0	30.0	30.0	30.0	30.0	-	-
Nov-05	**14**	-	100.0	100.0	80.0	40.0	40.0	10.0	20.0	20.0	20.0	30.0	30.0	30.0	30.0	20.0	20.0	10.0	10.0	10.0	0.0	30.0	60.0	80.0	80.0	60.0	60.0	60.0	40.0	10.0	10.0	-	-	-	-
Nov-12	**18**	-	-	100.0	80.0	80.0	40.0	30.0	20.0	20.0	20.0	20.0	20.0	10.0	10.0	10.0	-	-	-	30.0	70.0	70.0	70.0	50.0	50.0	50.0	20.0	10.0	-	-	-	-	-	-	-	-
Nov-19	**14**	-	100.0	100.0	80.0	60.0	50.0	20.0	20.0	20.0	20.0	10.0	-	-	-	-	-	20.0	50.0	50.0	70.0	60.0	60.0	60.0	10.0	-	-	-	-	-	-	-	-	-	-	-
Kranti																																				
Oct-01	**35**	-	-	-	-	-	-	-	80.0	50.0	50.0	40.0	30.0	30.0	20.0	10.0	-	10.0	30.0	30.0	30.0	40.0	40.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	40.0	40.0	40.0	40.0	40.0
Oct-08	**28**	-	-	-	-	-	80.0	60.0	60.0	60.0	60.0	50.0	30.0	20.0	20.0	20.0	30.0	30.0	40.0	40.0	40.0	40.0	40.0	50.0	50.0	60.0	60.0	80.0	80.0	80.0	70.0	60.0	60.0	60.0	30.0
Oct-15	**Sowing was not done due to water logged conditions**																																			
Oct-22	**11**	80.0	100.0	100.0	80.0	80.0	40.0	30.0	30.0	20.0	20.0	10.0	20.0	20.0	30.0	20.0	30.0	40.0	40.0	40.0	40.0	40.0	40.0	50.0	50.0	50.0	60.0	80.0	50.0	40.0	30.0	40.0	30.0	20.0	20.0	-
Oct-29	**11**	100.0	100.0	80.0	70.0	40.0	40.0	30.0	10.0	10.0	20.0	10.0	10.0	20.0	20.0	20.0	20.0	20.0	20.0	30.0	30.0	30.0	40.0	40.0	60.0	60.0	60.0	40.0	30.0	30.0	30.0	30.0	20.0	0.0	-
Nov-05	**14**	-	100.0	100.0	80.0	30.0	20.0	20.0	30.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	10.0	10.0	10.0	0.0	-	50.0	80.0	80.0	80.0	60.0	60.0	60.0	40.0	10.0	-	-	-	-	-	-
Nov-12	**18**	-	-	100.0	80.0	80.0	40.0	30.0	30.0	20.0	20.0	20.0	20.0	10.0	10.0	10.0	10.0	-	-	30.0	60.0	70.0	70.0	50.0	50.0	50.0	20.0	10.0	-	-	-	-	-	-	-	-
Nov-19	**14**	-	100.0	100.0	70.0	50.0	50.0	20.0	20.0	20.0	20.0	10.0	30.0	10.0	10.0	-	-	-	50.0	50.0	60.0	40.0	60.0	60.0	10.0	-	-	-	-	-	-	-	-	-	-	-

B. White rust

Date of sowing	First app. (DAS)	% Disease severity DAS)																												
Varuna		42	46	49	53	56	60	63	67	70	74	78	81	84	88	91	95	98	102	105	109	112	116	119	123	126	130	133	135
Oct-01	60	-	-	-	-	-	1.0	2.0	5.0	10.0	12.0	15.0	25.0	25.0	25.0	25.0	25.0	30.0	30.0	30.0	30.0	30.0	30.0	35.0	35.0	35.0	35.0	35.0	40.0
Oct-08	60	-	-	-	-	-	1.0	3.0	3.0	5.0	10.0	10.0	10.0	15.0	20.0	20.0	20.0	25.0	25.0	30.0	30.0	35.0	35.0	40.0	40.0	40.0	45.0	45.0	45.0
Oct-15	Sowing was not done due to water logged conditions																													
Oct-22	46	-	1.0	1.0	1.0	1.0	2.0	5.0	5.0	5.0	10.0	15.0	15.0	20.0	25.0	25.0	25.0	35.0	35.0	40.0	40.0	45.0	45.0	50.0	50.0	50.0	-	-	-
Oct-29	42	1.0	1.0	1.0	1.0	2.0	2.0	10.0	10.0	15.0	15.0	15.0	20.0	20.0	25.0	30.0	30.0	30.0	35.0	35.0	35.0	40.0	45.0	45.0	-	-	-	-	-
Nov-05	53	-	-	-	2.0	5.0	5.0	5.0	5.0	5.0	5.0	10.0	10.0	15.0	25.0	35.0	35.0	35.0	35.0	35.0	40.0	40.0	-	-	-	-	-	-	-
Nov-12	49	-	-	2.0	2.0	2.0	2.0	2.0	2.0	2.0	10.0	15.0	30.0	35.0	45.0	45.0	45.0	45.0	45.0	45.0	-	-	-	-	-	-	-	-	-
Nov-19	46	-	2.0	2.0	2.0	2.0	2.0	2.0	5.0	15.0	25.0	25.0	30.0	35.0	35.0	35.0	35.0	35.0	-	-	-	-	-	-	-	-	-	-	-
Kranti																														
Oct-01	67	-	-	-	-	-	-	-	1.0	2.0	5.0	5.0	10.0	10.0	15.0	20.0	25.0	30.0	30.0	30.0	30.0	30.0	30.0	35.0	35.0	35.0	35.0	35.0	40.0
Oct-08	60	-	-	-	-	-	1.0	1.0	2.0	2.0	5.0	5.0	10.0	15.0	20.0	20.0	20.0	25.0	25.0	30.0	30.0	35.0	35.0	40.0	40.0	40.0	45.0	45.0	45.0
Oct-15	Sowing was not done due to water logged conditions																													
Oct-22	56	-	-	-	-	1.0	1.0	1.0	10.0	10.0	15.0	15.0	15.0	20.0	25.0	25.0	25.0	35.0	35.0	40.0	40.0	45.0	45.0	50.0	50.0	50.0	-	-	-
Oct-29	53	-	-	-	2.0	2.0	5.0	10.0	10.0	15.0	15.0	15.0	20.0	20.0	25.0	30.0	30.0	30.0	35.0	35.0	35.0	40.0	45.0	45.0	-	-	-	-	-
Nov-05	56	-	-	-	-	2.0	5.0	5.0	5.0	5.0	5.0	10.0	10.0	15.0	25.0	35.0	35.0	35.0	35.0	35.0	40.0	40.0	-	-	-	-	-	-	-
Nov-12	49	-	-	2.0	2.0	2.0	2.0	2.0	2.0	2.0	10.0	15.0	30.0	35.0	45.0	45.0	45.0	45.0	45.0	45.0	-	-	-	-	-	-	-	-	-
Nov-19	46	-	2.0	2.0	2.0	2.0	2.0	2.0	5.0	15.0	25.0	25.0	30.0	35.0	35.0	35.0	35.0	35.0	-	-	-	-	-	-	-	-	-	-	-

C. Alternaria leaf blight

Date of sowing	First app. (DAS)	% Disease incidence (DAS)																												
Varuna		49	53	56	60	63	67	70	74	78	81	84	88	91	95	98	102	105	109	112	116	119	123	126	130	133	135	139	143
Oct-01	88	-	-	-	-	-	-	-	-	-	-	-	2.0	5.0	10.0	15.0	15.0	10.0	10.0	10.0	20.0	25.0	30.0	30.0	35.0	35.0	35.0	35.0	35.0
Oct-08	74	-	-	-	-	-	-	-	2.0	2.0	2.0	5.0	5.0	10.0	10.0	10.0	10.0	10.0	15.0	25.0	30.0	30.0	30.0	35.0	35.0	35.0	40.0	45.0	45.0
Oct-15	Sowing was not done due to water logged conditions																												
Oct-22	60	-	-	-	2.0	1.0	1.0	2.0	5.0	5.0	5.0	10.0	10.0	20.0	25.0	30.0	30.0	30.0	30.0	40.0	40.0	40.0	45.0	50.0	50.0	50.0	40.0	40.0	40.0
Oct-29	53	-	2.0	2.0	2.0	2.0	2.0	5.0	5.0	5.0	10.0	10.0	20.0	25.0	30.0	35.0	40.0	45.0	45.0	45.0	35.0	45.0	45.0	45.0	35.0	35.0	35.0	35.0	-
Nov-05	56	-	0.0	2.0	2.0	2.0	2.0	2.0	5.0	5.0	15.0	15.0	25.0	40.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	35.0	40.0	40.0	40.0	-	-	-
Nov-12	53	-	2.0	2.0	2.0	2.0	2.0	2.0	10.0	15.0	25.0	25.0	45.0	45.0	45.0	45.0	40.0	45.0	45.0	45.0	40.0	40.0	40.0	40.0	-	-	-	-	-
Nov-19	56	-	-	2.0	2.0	2.0	5.0	5.0	15.0	20.0	40.0	40.0	45.0	45.0	40.0	40.0	40.0	40.0	40.0	40.0	35.0	35.0	-	-	-	-	-	-	-
Kranti																													
Oct-01	81	-	-	-	-	-	-	-	-	-	2.0	2.0	2.0	10.0	15.0	15.0	15.0	15.0	15.0	15.0	25.0	30.0	30.0	30.0	35.0	35.0	35.0	35.0	35.0
Oct-08	60	-	-	-	-	-	-	-	2.0	2.0	2.0	5.0	10.0	10.0	10.0	10.0	10.0	10.0	25.0	30.0	30.0	30.0	35.0	35.0	35.0	35.0	40.0	45.0	45.0
Oct-15	Sowing was not done due to water logged conditions																												
Oct-22	60	-	-	-	1.0	1.0	5.0	5.0	5.0	5.0	10.0	1.0	1.0	10.0	15.0	25.0	25.0	25.0	30.0	30.0	30.0	35.0	45.0	45.0	45.0	50.0	50.0	45.0	40.0
Oct-29	60	-	-	-	2.0	5.0	5.0	5.0	5.0	5.0	5.0	10.0	15.0	20.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	45.0	45.0	45.0	40.0	40.0	35.0	35.0	-
Nov-05	56	-	-	2.0	2.0	2.0	5.0	5.0	5.0	5.0	10.0	20.0	30.0	35.0	45.0	45.0	45.0	45.0	45.0	50.0	50.0	45.0	45.0	45.0	40.0	40.0	-	-	-
Nov-12	53	-	2.0	2.0	2.0	2.0	2.0	2.0	5.0	10.0	20.0	25.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	40.0	40.0	-	-	-	-	-
Nov-19	49	2.0	2.0	2.0	2.0	2.0	5.0	5.0	10.0	10.0	20.0	20.0	35.0	35.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	-	-	-	-	-	-	-

Table: 4.8.6: Epidemiology of Alternaria blight at DOL during 2022-23

A. Alternaria Blight

Date of sowing	Disease appearance	% Disease severity Days after sowing								Yield(kg/ha)
Varuna	**(DAS)**	**50**	**60**	**70**	**80**	**90**	**100**	**110**	**120**	
Oct. 01	**70**	-	-	1.2	4.5	14.2	22.6	35.0	39.3	1515
Oct. 08	**68**	-	-	1.5	5.2	18.2	25.7	35.2	40.0	1544
Oct. 15	**63**	-	-	2.5	5.5	20.3	26.5	30.5	36.0	1563
Oct. 22	**56**	-	1.4	2.4	4.1	14.5	21.3	28.4	30.0	1561
Oct. 29	**56**	-	1.6	2.0	3.0	12.3	20.3	24.5	27.5	1499
Nov. 05	**52**	-	1.2	1.5	2.5	10.5	20.3	23.4	25.3	1435
Nov. 12	**45**	1.2	1.8	2.6	3.6	12.3	18.4	22.4	24.5	1374
Nov. 19	**43**	1.5	2.3	3.0	3.8	13.4	20.0	22.0	24.4	1343
RajendraSuflam										
Oct. 01	**74**	-	-	-	3.2	12.4	19.5	26.2	30.0	1535
Oct. 08	**70**	-	-	1.3	4.8	15.3	21.8	28.5	32.0	1551
Oct. 15	**65**	-	-	1.5	4.5	18.2	22.4	28.9	31.8	1582
Oct. 22	**60**	-	1.1	1.9	3.6	13.7	20.8	26.4	27.9	1580
Oct. 29	**56**	-	1.3	2.0	3.1	11.6	18.6	25.2	26.2	1520
Nov. 05	**52**	-	1.2	1.8	2.1	10.0	16.5	22.8	23.7	1488
Nov. 12	**52**	-	1.4	2.1	2.8	10.6	16.8	20.5	22.4	1412
Nov. 19	**45**	1.5	2.0	2.5	3.0	11.5	15.2	20.0	22.5	1408

Table 4.8.7: Epidemiology of Alternaria blight, white rust and powdery mildew at JHS during 2022-23

A. Alternaria blight

Date of Sowing	Disease Appearance (DAS)	% AB on leaves (DAS)							Disease Appearance (DAS)	% AB on siliqua (DAS)			
Giriraj		**50**	**60**	**70**	**80**	**90**	**100**	**110**		**80**	**90**	**100**	**110**
Oct. 01	**91**	-	-	-	-	-	5.0	5.0	**-**	-	-	-	-
Oct. 08	**85**	-	-	-	-	5.0	5.0	10.0	**-**	-	-	-	-
Oct. 15	**78**	-	-	-	5.0	10.0	10.0	10.0	**-**	-	-	-	-
Oct. 22	**68**	-	-	5.0	10.0	10.0	20.0	20.0	**-**	-	-	-	-
Oct. 29	**61**	-	-	10.0	20.0	20.0	30.0	30.0	**97**	-	-	5.0	10.0
Nov. 05	**54**	-	10.0	10.0	30.0	30.0	50.0	-	**92**	-	-	10.0	20.0
Nov. 12	**49**	5.0	20.0	30.0	30.0	50.0	50.0	-	**90**	-	10.0	20.0	30.0
Nov. 19	**47**	5.0	10.0	20.0	20.0	30.0	50.0	-	**88**	10.0	20.0	20.0	30.0
Varuna													
Oct. 01	**90**	**-**	**-**	**-**	**-**	**5.0**	**5.0**	**5.0**	**-**	**-**	**-**	**-**	**-**
Oct. 08	**82**	-	-	-	-	5.0	10.0	10.0	-	-	-	-	-
Oct. 15	**75**	-	-	-	5.0	10.0	20.0	20.0	-	-	-	-	-
Oct. 22	**64**	-	-	5.0	10.0	20.0	20.0	30.0	-	-	-	-	-
Oct. 29	**55**	-	-	10.0	20.0	30.0	50.0	-	94	-	-	10.0	20.0
Nov. 05	**50**	-	10.0	20.0	30.0	30.0	50.0	-	90	-	20.0	20.0	30.0
Nov. 12	**45**	10.0	20.0	30.0	30.0	50.0	50.0	-	89	30.0	50.0	-	-
Nov. 19	**42**	10.0	10.0	30.0	30.0	50.0	50.0	-	83	-	30.0	50.0	-

B. White rust

Date of Sowing	Disease App.(DAS)	% WR severity (DAS)						Disease App.(DAS)	% Staghead (DAS)					Disease App.(DAS)	%Powdery mildew (DAS)						Yield(kg/ha)
Giriraj		**60**	**70**	**80**	**90**	**100**	**110**		**90**	**100**	**110**	**120**	**130**		**80**	**90**	**100**	**110**	**120**	**130**	
Oct. 01	**104**	-	-	-	-	-	12.5	-	-	-	-	-	-	**123**	-	-	-	-	-	40.0	1840
Oct. 08	**95**	-	-	-	-	15.0	27.0	-	-	-	-	-	-	**115**	-	-	-	-	30.0	-	1910
Oct. 15	**88**	-	-	-	20.0	25.5	27.5	**114**	-	-	23.0	30.3	35.2	**110**	-	-	-	-	30.0	-	2390
Oct. 22	**80**	-	-	-	25.0	30.0	35.2	**110**	-	-	24.3	25.8	32.1	**103**	-	-	-	30.0	-	-	2860
Oct. 29	**77**	-	-	20.0	25.0	32.5	40.0	**100**	-	23.0	25.0	28.8	30.0	**97**	-	-	50.0	-	-	-	1980
Nov. 05	**68**	-	26.0	32.0	34.2	40.0	50.0	**99**	-	25.6	27.0	30.0	32.0	**90**	-	50.0	-	-	-	-	1960
Nov. 12	**62**	20.0	22.5	28.0	29.0	32.2	35.0	**98**	-	26.0	27.4	28.0	30.0	**90**	-	50.0	-	-	-	-	1850
Nov. 19	**58**	17.0	20.2	26.9	27.4	28.0	30.0	**93**	-	20.2	22.5	25.0	25.4	**84**	-	26.0	-	-	-		190
Varuna																					
Oct. 01	**101**	-	-	-	-	-	22.0	-	-	-	-	-	-	**123**	-	-	-	-	-	50.0	770
Oct. 08	**93**	-	-	-	-	18.0	29.2	-	-	-	-	-	-	**115**	-	-	-	-	50.0	-	890
Oct. 15	**87**	-	-	-	23.40	25.8	29.4	**108**	-	-	25.0	32.0	35.0	**110**	-	-	-	-	50.0	-	1580
Oct. 22	**82**	-	-	-	27.30	33.0	37.1	**102**	-	-	22.0	25.0	30.0	**103**	-	-	-	30.0	-	-	1820
Oct. 29	**75**	-	-	22.0	28.00	34.0	40.0	**100**	-	20.0	23.0	26.8	28.0	**89**	-	-	50.0	-	-	-	1680
Nov. 05	**67**	-	26.0	32.9	34.80	40.0	50.0	**98**	-	25.6	27.0	30.0	32.0	**90**	-	50.0	-	-	-	-	1150
Nov. 12	**60**	22.0	25.0	28.3	30.00	33.9	35.0	**97**	-	25.0	26.9	29.2	30.0	**84**	-	50.0	-	-	-	-	1360
Nov. 19	**56**	18.5	20.8	27.0	27.40	28.9	32.0	**90**	19.8	20.2	22.0	23.0	26.0	**80**	30.0	-	-	-	-	-	1350

Table: 4.9.1 Efficacy of fungicides against major diseases of rapeseed mustard 2022-23.

A. Alternaria leaf blight

TREATMENTS	% AB (100 DAS)									% Reduction over Check	% AB Pod (15 days before harvest)							% Reduction over Check
	HSR	**MOR**	**PNT**	**DOL**	**JHS**	**BPR**	**LDH**	**SHL**	**Mean**		**HSR**	**MOR**	**PNT**	**JHS**	**LDH**	**SHL**	**Mean**	
Tebuconazole 50%+ Trifloxystrobin 25% @ 0.1%	16.5	11.4	3.7	10.2	14.2	6.7	21.3	14.0	12.2	**59.8**	8.7	6.7	21.7	13.1	13.0	15.9	**13.2**	**53.5**
Propiconazole 25% @ 0.1%	20.8	14.8	16.3	13.6	18.0	13.3	21.9	17.7	17.1	**49.3**	13.9	7.8	40.0	13.7	15.6	23.1	**19.0**	**32.5**
Metalaxyl 4% + mancozeb 64% @ 0.25%	20.9	7.7	11.7	20.7	19.3	23.3	22.1	21.6	18.4	**38.4**	14.3	6.0	38.3	17.5	16.0	23.9	**19.3**	**30.0**
Hexaconazole 5% @ 0.1%	21.1	14.4	18.7	18.5	13.4	23.3	22.4	19.7	18.9	**43.7**	13.7	6.2	48.3	10.9	14.4	24.6	**19.7**	**28.2**
Tebuconazole 25.9% @ 0.1%	21.5	16.5	17.7	16.8	22.2	8.3	21.5	17.3	17.7	**50.4**	15.9	10.4	41.7	18.1	14.3	24.7	**20.8**	**27.9**
Azoxystrobin 23% @ 0.1%	16.6	12.6	6.7	19.2	14.5	16.7	20.4	17.2	15.5	**50.8**	11.3	5.3	36.7	12.8	8.7	19.4	**15.7**	**43.4**
Mancozeb 40% + Azoxystrobin 7% @ 0.3%	-	-	-	-	-	26.7	-	26.7	26.7	**23.7**	-	-	-	-	-	34.2	**34.2**	**0.0**
Control	32.6	21.6	25.0	39.6	33.8	36.7	34.5	35.0	32.3	**-**	17.4	16.4	53.2	28.7	20.7	34.2	**28.4**	**-**
CD 0.05 %	**3.5**	**1.8**	**4.5**	**4.0**	**2.0**	**7.9**	**1.6**	**1.9**			**2.9**	**22.2**	**5.3**	**1.5**	**1.8**	**2.7**		
CV %	**7.2**	**4.6**	**17.7**	**11.3**	**18.0**	**-**	**3.1**	**3.9**			**7.6**	**7.5**	**7.4**	**15.4**	**4.6**	**6.7**		

B. White Rust

TREATMENTS	% WR (90/100 DAS)							% Reduction over Check	% Staghead				% Reduction over Check
	HSR	**MOR**	**PNT**	**JHS**	**BPR**	**LDH**	**Mean**		**MOR**	**PNT**	**JHS**	**Mean**	
Tebuconazole 50%+ Trifloxystrobin 25% @ 0.1%	25.9	14.4	12.4	12.2	20.0	22.2	**17.0**	**48.1**	4.7	3.9	10.1	**6.2**	**64.0**
Propiconazole 25% @ 0.1%	32.6	24.6	14.6	16.4	22.0	30.8	**22.0**	**32.7**	8.6	4.0	12.9	**8.5**	**51.1**
Metalaxyl 4% + mancozeb 64% @ 0.25%	6.7	12.6	11.6	14.9	6.7	4.1	**10.5**	**67.9**	0.0	3.5	11.4	**5.0**	**71.3**
Hexaconazole 5% @ 0.1%	30.0	24.6	18.7	15.3	16.7	34.7	**21.1**	**35.6**	0.0	4.7	12.3	**5.7**	**67.4**
Tebuconazole 25.9% @ 0.1%	33.0	34.4	10.9	13.2	26.7	33.7	**23.6**	**27.8**	5.7	3.4	11.1	**6.8**	**61.1**
Azoxystrobin 23% @ 0.1%	5.8	25.6	16.7	11.1	5.0	7.9	**12.8**	**60.8**	9.1	4.3	9.8	**7.8**	**55.3**
Mancozeb 40% + Azoxystrobin 7% @ 0.3%	-	-	-	-	6.7	-	**6.7**	**79.6**	-	-	-	-	**-**
Control	40.0	45.5	23.3	31.5	23.3	40.6	**32.7**	**-**	27.2	7.1	17.8	**17.4**	-
CD 0.05 %	**3.8**	**1.2**	**4.7**	**1.3**	**7.0**	**3.5**			**2.1**	**1.8**	**1.6**		
CV %	**7.4**	**2.3**	**16.9**	**14.1**	**-**	**1.6**			**8.8**	**22.9**	**23.2**		

Table 4.9.2: Efficacy of fungicides against Sclerotinia rot major diseases

TREATMENTS	% PM				% Reduction over Check	% DM	% SR							% Reduction over Check
	MOR	JHS	BPR	Mean		MOR	HSR	MOR	PNT	DOL	BPR	LDH	Mean	
Tebuconazole 50%+ Trifloxystrobin 25% @ 0.1%	58.4	12.8	19.3	**30.2**	**39.9**	7.1	7.1	13.3	18.5	6.3	9.7	5.1	**10.0**	**60.5**
Propiconazole 25% @ 0.1%	78.1	20.4	16.0	**38.2**	**24.0**	11.6	8.4	15.0	14.5	5.5	8.7	3.5	**9.3**	**63.4**
Metalaxyl 4% + mancozeb 64% @ 0.25%	91.2	14.2	26.0	**43.8**	**12.7**	6.7	12.5	45.0	24.4	14.7	8.3	9.7	**19.1**	**24.6**
Hexaconazole 5% @ 0.1%	90.7	18.8	15.7	**41.7**	**16.9**	12.6	6.6	21.7	22.9	13.2	8.2	7.2	**13.3**	**47.6**
Tebuconazole 25.9% @ 0.1%	89.6	14.7	20.3	**41.6**	**17.2**	15.7	7.4	36.7	23.1	9.5	10.6	4.5	**15.3**	**39.5**
Azoxystrobin 23% @ 0.1%	60.6	15.8	14.3	**30.2**	**39.7**	11.7	8.0	26.7	22.4	10.4	7.8	8.7	**14.0**	**44.7**
Mancozeb 40% + Azoxystrobin 7% @ 0.3%	-	-	6.7	**6.7**	**86.7**	-	-	-	-	-	5.9	-	**5.9**	**76.7**
Control	91.9	**38.7**	20.0	**50.2**	-	21.9	17.3	60.0	25.2	21.2	17.3	11.0	**25.3**	-
CD 0.05 %	**1.7**	**1.2**	**4.3**			**1.2**	**2.5**	**5.0**	**4.2**	**4.9**	**4.5**	2.1		
CV %	**1.4**	**11.1**				**3.4**	**7.8**	**8.3**	**10.8**	**23.7**	-	7.4		

TREATMENTS	Yield (kg/ha)								% Increment over Check	B:C ratio		IBCR	
	HSR	MOR	PNT	DOL	BPR	LDH	SHL	Mean		HSR	BPR	PNT	BPR
Tebuconazole 50%+ Trifloxystrobin 25% @ 0.1%	2097	2958	1800	1876	2522	2104	2168	2218	**26.2**	1.38	1:0.45	1:0.76	3.53
Propiconazole 25% @ 0.1%	1926	2558	1600	1764	2833	1967	2188	2119	**26.9**	1.44	1:0.89	1:0.55	3.99
Metalaxyl 4% + mancozeb 64% @ 0.25%	2068	2717	1473	1381	2322	2469	2057	2070	**22.3**	1.47	1:0.17	1:0.30	3.26
Hexaconazole 5% @ 0.1%	2130	2460	1330	1426	2133	1816	1792	1869	**10.8**	1.62	1:0.05	1:0.10	3.14
Tebuconazole 25.9% @ 0.1%	2083	2653	1400	1663	2489	1893	2015	2028	**20.7**	1.52	1:0.41	1:0.19	3.50
Azoxystrobin 23% @ 0.1%	2246	2524	1670	1589	2633	2360	2194	2174	**27.1**	1.57	1:0.61	1:0.64	3.70
Mancozeb 40% + Azoxystrobin 7% @ 0.3%	-	-	-	-	2478	-	2478	2478	**35.5**	-	1:0.39	-	3.49
Control	1808	2224	1267	954	2200	1642	1599	1671	-	-		-	
CD 0.05 %	**125.0**	**234**	**320.0**	**107.0**	**363.0**	**342.0**	**245.4**			-		-	
CV %	**3.4**	**5.0**	-	**3.9**	-	**9.3**	**12.0**			-		-	

Table 10.1: Bio-management of rapeseed-mustard diseases during 2022-23

Treatments	% AB (90 DAS)					% Reduction over Check	% AB Pod (15 DBH)					% Reduction over Check
	PNT	JHS	LDH	SHL	Mean		PNT	JHS	LDH	SHL	Mean	
Seed treatment with Trichoderma harzianum @10g/ kg of seed	33.3	20.0	34.0	27.2	**28.6**	**24.3**	36.7	5.0	21.1	20.4	**20.8**	**25.9**
Soil incorporation of T. harzianum with mustard straw @ 2.5t/ h	28.3	10.0	27.6	24.0	**22.5**	**33.4**	33.3	10.0	17.9	15.9	**19.3**	**31.4**
T_1 + Foliar spray with T. harzianum at 60 and 75 DAS	36.7	10.0	29.5	21.4	**24.4**	**40.6**	40.0	5.0	16.2	13.7	**18.7**	**33.3**
Soil incorporation of FYM T. harzianum @ 1 kg/ q FYM	30.0	20.0	30.0	24.1	**26.0**	**32.9**	35.0	10.0	20.4	18.4	**20.9**	**25.4**
Foliar spray with Bacillus subtilis 10^6c.f.u.	31.7	20.0	28.8	23.4	**26.0**	**34.9**	36.7	10.0	19.5	15.0	**20.3**	**27.7**
Control	38.3	50.0	39.9	36.0	**41.0**	**-**	43.3	20.0	24.8	24.2	**28.1**	**-**
CD 0.05 %	**6.4**	**4.7**	**1.7**	**2.4**			**6.1**	**2.3**	**1.7**	**2.8**		
CV %	**10.6**	**12.2**	**2.7**	**4.3**			**8.8**	**12.7**	**3.5**	**6.2**		

Treatments	% WR (75 DAS)							% Reduction over Check
	HSR	PNT	SKN	JHS	BPR	LDH	Mean	
Seed treatment with Trichoderma harzianum @10g/ kg of seed	34.5	30.0	29.3	20.0	26.7	21.3	**27.0**	**20.1**
Soil incorporation of T. harzianum with mustard straw @ 2.5t/ h	36.3	23.3	27.2	10.0	30.7	14.3	**23.6**	**30.0**
T_1 + Foliar spray with T. harzianum at 60 and 75 DAS	32.2	26.7	28.7	10.0	25.3	18.3	**23.5**	**30.3**
Soil incorporation of FYM T. harzianum @ 1 kg/ q FYM	35.2	28.3	26.7	10.0	27.3	19.4	**24.5**	**27.5**
Foliar spray with Bacillus subtilis 10^6c.f.u.	33.3	31.7	25.6	20.0	26.0	13.5	**25.0**	**25.9**
Control	40.0	40.0	30.2	30.0	36.0	26.4	**33.8**	**-**
CD 0.05 %	**-**	**7.3**	**-**	**4.8**	**4.2**	**5.8**		
CV %	**5.5**	**13.3**	**8.7**	**15.9**	**7.0**	**12.5**		

Table 10.2: Bio-management of rapeseed-mustard diseases during 2022-23

Treatments	% PM				% Reduction over Check	% SR					% Reduction over Check
	SKN	JHS	BPR	Mean		HSR	PNT	BPR	LDH	Mean	
Seed treatment with Trichoderma harzianum @10g/ kg of seed	70.0	20.0	22.0	**37.3**	**28.1**	10.3	24.5	19.6	6.8	**15.3**	**24.0**
Soil incorporation of T. harzianum with mustard straw @ 2.5t/ h	73.3	20.0	24.0	**39.1**	**24.7**	7.1	23.0	16.8	5.1	**13.0**	**35.4**
T_1 + Foliar spray with T. harzianum at 60 and 75 DAS	71.7	10.0	22.7	**34.8**	**32.9**	4.8	26.9	14.9	3.3	**12.5**	**38.0**
Soil incorporation of FYM T. harzianum @ 1 kg/ q FYM	73.3	10.0	26.0	**36.4**	**29.8**	6.0	21.5	18.5	6.1	**13.0**	**35.2**
Foliar spray with Bacillus subtilis 10^6c.f.u.	75.0	10.0	24.0	**36.3**	**30.0**	8.2	31.8	19.2	4.8	**16.0**	**20.4**
Control	75.0	50.0	30.7	**51.9**	**0.0**	16.1	29.1	24.3	10.9	**20.1**	**0.0**
CD 0.05 %	**-**	**4.2**	**2.4**			**2.1**	**5.2**	**3.0**	**2.3**		
CV %	**9.8**	**11.8**	**4.3**			**6.7**	**10.7**	**6.4**	**8.9**		

Treatments	Seed yield (kg/ha)							% Incremental over Check	1000 Seed weight		B:C Ratio
	HSR	PNT	BPR	SKN	LDH	SHL	Mean		PNT	BPR	BPR
Seed treatment with Trichoderma harzianum @10g/ kg of seed	1832	1300	2520	882	1692	1698	**1645**	**9.1**	5.4	4.2	2.52
Soil incorporation of T. harzianum with mustard straw @ 2.5t/ h	1998	1533	2613	909	2124	1882	**1835**	**18.5**	5.6	4.7	1.92
T_1 + Foliar spray with T. harzianum at 60 and 75 DAS	2143	1353	2793	882	1911	1862	**1816**	**17.7**	5.3	4.3	2.86
Soil incorporation of FYM T. harzianum @ 1 kg/ q FYM	2037	1400	2515	873	1711	1700	**1707**	**12.4**	5.1	5.4	2.12
Foliar spray with Bacillus subtilis 10^6c.f.u.	1915	1280	2500	863	2156	1840	**1743**	**14.2**	5.6	5.3	2.49
Control	1723	1253	2348	875	1278	1500	**1495**	**0.0**	4.9	4.6	2.38
CD 0.05 %	**190.5**	**69.0**	**320.0**	**-**	**315.5**	**312.9**			**0.2**	**0.4**	**-**
CV %	**5.3**	**27.7**	**9.7**	**5.49**	**9.4**	**14.6**			**2.5**	**4.4**	**-**

ENTOMOLOGY

5. ENTOMOLOGY

The 2022-23 crop season witnessed moderate to high population development of mustard aphid on different Brassica species.

5.1 Screening of advanced breeding germplasm against mustard aphid

One hundred seventy strains (IVT) were evaluated against mustard aphid including susceptible/tolerant checks. Aphid pressure was low at **KAN** centre and moderate to severe at **MOR, HSR, SKN, PTN, NDH, LDH, DHO and SHIL** centres. Out of 170 IVT entries, none was found resistant. However, the minimum aphid infestation index (AII) of 1.6 was reported in PRE-2020-14 and DTM-341 (Table 5.1A). Among the 63 entries (AVT I and AVT II) screened against mustard aphid, none was found resistant. However, one entry AKMS 8141 recorded the minimum AII of 1.5 (Table 5.1B).

5.2 Assessment of yield losses due to insect pests in Brassica crops

The highest yield losses were observed in Brijraj (84.0%), GDM-4 (82.3%) and Radhika (80.9%) at **SK Nagar** followed by PBR 357 (33.12%), Brijraj (30.11) and Radhika (27.20%) at **Ludhiana** and RH 725 (24.8%) at **Hisar** (Table 5.2). It was followed by 23.0% yield losses in PM 27 at **Shillongani** and 22.9% in Radhika at **Hisar**. The highest yield loss among the entries evaluated in other centres was 20.0% in Brijraj at **New Delhi** and 18.4% in Radhika at **Dholi and Morena,** respectively; 8.3% and 8.0 in Brijraj at **Pantnagar** and **Kanpur,** respectively**.**

5.3 Population dynamics of various insect-pests on *Brassica* crops

Incidence of various insect-pests on *Brassica* crops

At **Hisar**, aphid population was observed from 5th to 13th std week with peak during 9th and 10th std week. The aphid population was observed till 13th std week after which it disappeared from the crop. Low to moderate population of painted bug (0.1-0.5 bugs/ mrl) was observed from 48th – 1st std. week on DRMR IJ 31, T 27, GSC 6 and BSH 1 under timely sown conditions. Similarly, low activity of flea beetle was recorded from 45th-50th SMW under timely sown conditions. Low activity of cutworm was observed during 46th std week under timely sown conditions and during 51st and 52nd std week under late sown conditions along with low activity of cabbage caterpillar during 50th-51st std week under timely sown conditions and 52nd and 1st std week under late sown conditions. The activity of coccinellid predators was observed from 47th to 13th std week (Table 5.3.1A-D). At **Dholi**, moderate to high population of mustard aphid was recorded. It remained active from 2nd to 12th SMW with peak activity during 6th-7th SMW (Table 5.3.2). At **Pant Nagar,** low to moderate population of mustard aphid was recorded on DRMR IJ 31, T 27, GSC 6, BSH 1, YST 151, *B. nigra, B. alba* and Varuna during 5th to 12th std week (Table 5.3.3A,B). Under late sown conditions, the peak activity of mustard aphid was observed from 7th-8th SMW. At **Ludhiana**, activity of both mustard aphid and cabbage aphid was recorded with low to moderate activity both under timely and late sown conditions. Under timely sown conditions first appearance of mustard aphid was recorded during 5th standard week on DRMR IJ 31 and

BSH 1 which remained active till 10th std week on DRMR IJ 31, and under late sown conditions also it remained active from 5th to 10th std. week (Table 5.3.4 A,B). Cabbage aphid remained active from 6th to 13th std week under late sown conditions. Low to moderate activity of cabbage caterpillar was recorded both under timely and late sown conditions. Cabbage caterpillar appeared on 8th std week under both timely and late sown conditions and remained active till 12th std week. Very low activity of flea beetle and sawfly was reported during 45th and 46th std week under timely sown conditions (Table 5.3.4A-C). At **SK Nagar**, population of mustard aphid was recorded from 50th to 8th std week in timely and late sown crop (Table 5.3.5). At **Shillongani,** peak population of mustard aphid was recorded in 3rd to 5th std week, sawfly during 52nd to 3rd std week, flea beetle activity from 49th to 12th std week and coccinellid predators' activity during 52nd and 13th std week (Table 5.3.7A-D). At **Morena**, mustard aphid remained active from 49th to 13th std week, while the activity of coccinellid beetles was observed from 50th to 13th std week. Some activity of painted bug was also recorded from 47th to 51st std week. (Table 5.3.8A-D).

5.3 (B) Monitoring of alate mustard aphids on yellow sticky traps

The alate aphid population was recorded by seven centres. At **Hisar**, the alate population appeared during 52nd std week, peaked (147.3 aphids/ trap) during 11th std week and disappeared after 13th std week. At **S.K. Nagar**, alate mustard aphid population appeared during 50th std week, reached its peak (1545.4 aphids/ trap) during 8th std week and disappeared after 12th std week. At **Ludhiana**, alate aphid appeared as early as 43rd std week and remained active upto 15th std week with peak (236.2 aphids/ trap) during 11th std week. At **Pant Nagar**, the alate aphid appeared in 3rd std week and peaked (255.4 aphids/ trap) during 10th std week while it disappeared after 12th std week. At **Kanpur**, it appeared during 9th std week and disappeared after 10th std week. At **Morena**, it appeared during 47th std week, peaked (142.2 aphids/ trap) during 7th std week and disappeared after 13th std week. At **Dholi**, its first appearance was recorded during 2nd std week with peak activity (101.0 aphids/ trap) during 10th std week and disappeared after 12th std week (Table 5.3.8).

5.4 Effect of host plant diversity on abundance of mustard aphid and associated specialist and generalist natural enemies (Pooled data of three years)

At **Hisar**, aphid population in the three intercrop treatments was lower than the mustard alone treatment during 10th and 11th week while lower activity of lady bird beetles was observed on mustard alone treatment during 8th, 9th, 12th, 13th and 14th std week. And significantly high activity of syrphid flies and honey bees was observed in the intercrop treatments over mustard alone. Maximum activity of syrphid fly (9.5 visits/ minute) was recorded in mustard+fennel treatment. Similarly, maximum mummified aphids were also recorded in this treatment. The maximum mustard equivalent yield of 2378.6 kg/ha was also recorded in mustard+fennel treatment (Tables 5.4.1A-C). At **Dholi** also, the population of mustard aphid in the mustard alone treatment remained higher than all the other intercrop treatments throughout crop season. Minimum population of mustard aphid was recorded in mustard+coriander followed by mustard+fennel and mustard+chickpea (Table 5.4.2A). The

maximum activity of aphid parasitoid *Diaeretiella rapae*, lady bird beetles, syrphid fly larvae and Spiders was recorded in mustard+coriander followed by mustard+fennel and mustard+chickpea (Table 5.4.2B). Similarly, maximum yield of 1018.3 kg/ha was recorded in mustard+coriander followed by mustard+fennel (985.3 kg/ha), mustard+chickpeak (868.3 kg/ha) while minimum yield (745.3 kg/ha) was obtained in mustard alone (Table 5.4.2C). At **Pantnagar**, the minimum aphid population was observed in the mustard+chickpea treatment followed by mustard+coriander (Table 5.4.3A). The maximum mustard equivalent yield was recorded in mustard+fennel (1673.3 kg/ha) followed by mustard alone (1650.1 kg/ha) (Table 5.4.3B). At **Ludhiana**, the population of mustard aphid, cabbage aphid and cabbage caterpillar in the three intercrop treatments remained significantly lower than that in mustard alone. The population of the three pests remained minimum in the mustard+coriander treatment followed by mustard+chickpea and mustard+fennel (Table 5.4.4A). However, no significant differences in relative population of natural enemies were observed among the treatments. The maximum mustard equivalent yield 3406.6 kg/ha was obtained in mustard+chickpea followed by mustard+fennel (2870.6 kg/ha), mustard+coriander (2451.4 kg/ha) as against 1450.5 kg/ha in mustard alone which was significantly lower than the three intercrop treatments (Table 5.4.4C). At **SK Nagar**, the population of mustard aphid in all the four treatments remained comparable at all the observation intervals with no effect of intercropping observed on yield as well (Table 5.4.5A-B). At **Shillongani**, the minimum mean aphid activity at both flowering and siliqua formation stage (25.0 and 15.9 aphids/ plant) was observed in mustard+coriander treatment. It was followed by mustard+fennel treatment (38.8 and 25.7 aphids/plant at flowering and pod formation) and mustard+chickpea (41.8 and 29.6 aphids/plant) as against 68.7 and 51.3 aphids/plant in mustard alone. Almost similar trend was reflected in yield in different treatments (Table 5.4.6). Thus, it can be inferred from this experiment that intercropping of mustard with coriander/chickpea/fennel results in reduction in mustard aphid population with increased activity of natural enemies.

5.5 Effect of aphid herbivory on changes in biochemical parameters of Brassica plants

Aphid feeding on host plants resulted in changes in their biochemical parameters. At **Hisar**, there was 31.0 to 40.0% increase in enzymatic activity of peroxidase on infested plants over uninfested. The induction in peroxidase activity, though not very high, was higher in conventional (non canola) cultivars (40.0 and 39.0% in GSL 1 and DRMR IJ 31, respectively) than quality cultivars (32.4 and 31.9%, respectively) (Table 5.5.1). On the other hand, induction in myrosinase activity was higher in quality cultivars (46.8 and 45.9% in PM 30 and GSC 6, respectively) compared to conventional cultivars (32.4 and 25.7% in GSL 1 and DRMR IJ 31, respectively). Opposite trend was observed for total glucosinolate content with higher induction observed in conventional cultivars (39.4 and 31.4% in GSL 1 and DRMR IJ 31, respectively) than quality cultivars (29.1 and 28.1% in GSC 6 and PM 30, respectively). At **Ludhiana**, the induction in peroxidase activity after aphid infestation varied from 11.22% in DRMR IJ 31 to 269.92% in GSC 6. In general, conventional cultivars of both *B. juncea* and *B. napus* witnessed lower induction compared to quality cultivars. For

myrosinase, the induction in activity ranged from 86.54 to 150.10% after infestation in different varieties (Table 5.5.2). Among the four varieties, only PM 30 witnessed minimum induction in myrosinase activity (86.54%). Further, this variety recorded maximum reduction in total glucosinolates (-22.84%) after aphid infestation among the three varieties while GSL 1 recorded as slight increase in glucosinolates content (4.9%) in aphid infested plants. For total phenols, the induction in quality cultivars (37.57 and 29.47% in PM 30 and GSC6, respectively) was higher than conventional cultivars (26.60 and 14.11% in DRMR IJ 31 and GSL 1, respectively). However, no specific trend was observed for ortho-dihydroxy phenols except for general induction in all the varieties. For flavonols, the increase in content after aphid feeding was higher in conventional cultivars (30.73 and 20.96% in DRMR IJ 31 and GSL 1, respectively) compared to quality cultivars. Further, a reduction in flavonols content (-12.86%) was observed in PM 30 while a slight increase (2.99%) was observed in GSC 6 after aphid infestation. At **Pantnagar,** a general trend of increase in all the biochemicals after aphid infestation was observed in all the varieties. The increase in myrosinase activity in quality cultivars (55.79 and 42.32% in PM 30 and GSC 6, respectively) was more than that observed in conventional cultivars (21.51 and 37.44% in DRMR IJ-31 and GSL-1, respectively). Opposite trend was observed for total glucosinolate content with higher induction in conventional cultivars (48.88 and 25.29% in DRMR IJ 31and GSL 1, respectively) compared to quality cultivars (20.67 and 15.39% in GSC 6 and PM 30, respectively).

Table 5.1 (A): Reaction of IVT entries against mustard aphid

S. No.	Code No.	Breeding Code	Entry Name	MOR	HSR	KAN	SKN	PTN	NDH	LDH	DHO	SHIL	Mean
1	SBG 22-1	TCN 22-09	BAUT-08-09	3.2	1.1	0.0	3.6	1.7	3.5	1.7	3.2	2.9	**2.6**
2	SBG 22-2	TCN 22-02	PT- 303 (NC)	3.8	1.2	0.1	3.6	1.5	3.8	1.9	3.6	3.0	**2.8**
3	SBG 22-3	TCN 22-05	TKM 21-1	3.3	1.4	0.8	3.6	1.6	3.8	2.3	2.9	2.9	**2.7**
4	SBG 22-4	TCN 22-08	PT- 2016-9	3.0	1.2	0.1	3.6	1.6	3.8	2.1	2.2	2.8	**2.5**
5	SBG 22-5	TCN 22-06	Azad Chetna (LR)	3.6	1.0	0.1	3.6	0.9	3.7	1.4	3.6	2.8	**2.6**
6	SBG 22-6	**BSH-1 (CHECK)**	**BSH-1 (CHECK)**	3.9	2.1	0.2	3.6	1.7	3.0	3.2	3.1	2.9	**2.9**
7	SBG 22-7	TCN 22-01	JT-14-9	3.0	1.1	0.1	3.6	1.6	2.8	1.8	2.4	2.9	**2.4**
8	SBG 22-8	TCN 22-03	TKM 21-2	3.5	1.4	0.1	3.6	1.0	2.5	2.1	2.8	2.9	**2.5**
9	SBG 22-9	TCN 22-07	**Bhawani (ZC)**	3.0	1.0	0.2	3.5	0.9	2.8	2.8	3.4	2.8	**2.5**
10	SBG 22-10	TCN 22-04	PT- 2019-4	3.2	2.0	0.2	3.5	1.0	2.7	2.5	2.5	2.9	**2.5**
11	SBG 22-11	**PT- 303 (CHECK)**	**PT- 303 (CHECK)**	3.3	1.3	0.1	3.5	2.6	2.7	2.9	3.2	2.9	**2.8**
12	SBG 22-12	YSCN 22-7	YSKM 21-1	1.2	1.6	0.1	3.3	2.4	2.2	2.9	2.2	2.8	**2.3**
13	SBG 22-13	YSCN 22-2	DRMRYS 205	1.5	1.0	0.2	3.3	2.2	1.8	1.0	2.9	2.8	**2.1**
14	SBG 22-14	YSCN 22-5	RMYS 4	3.2	1.2	0.1	3.3	2.4	2.3	1.4	3.1	2.8	**2.5**
15	SBG 22-15	YSCN 22-10	PYS 2018-4	2.0	1.1	0.2	3.3	1.9	2.0	2.9	3.8	2.9	**2.5**
16	SBG 22-16	YSCN 22-3	NRCYS-05-02ZC	3.3	0.9	0.3	3.3	1.7	2.2	2.2	2.4	2.9	**2.4**
17	SBG 22-17	YSCN 22-12	YSKM 21-2	1.2	1.4	0.1	3.3	2.0	2.7	2.5	3.2	3.0	**2.4**
18	SBG 22-18	YSCN 22-1	AAUJYS 14-2	3.5	1.0	0.1	3.2	1.9	2.7	2.7	2.2	2.9	**2.5**
19	SBG 22-19	**NRCYS 05-02 (CHECK)**	**NRCYS 05-02 (CHECK)**	2.9	1.1	0.3	3.2	1.8	2.3	3.6	2.5	2.9	**2.5**
20	SBG 22-20	YSCN 22-11	DRMRYS-18-15	1.6	1.4	0.1	3.3	1.9	2.3	3.3	3.8	3.1	**2.6**
21	SBG 22-21	YSCN 22-6	DRMRYS 204	1.1	1.2	0.1	3.3	1.9	2.7	2.8	2.4	2.8	**2.3**
22	SBG 22-22	YSCN 22-13	**Pitambari (LR)**	2.1	1.2	0.6	3.3	1.7	2.8	2.5	2.7	2.9	**2.4**
23	SBG 22-23	YSCN 22-9	YSH 401 (NC)	1.2	1.9	0.0	3.3	1.7	2.7	2.9	2.4	2.9	**2.4**
24	SBG 22-24	YSCN 22-4	PYS-2018-1	3.4	1.8	0.6	3.3	1.8	2.3	2.9	3.5	2.8	**2.7**
25	SBG 22-25	YSCN 22-14	RMYS 5	2.1	1.2	0.2	3.3	1.6	3.3	1.8	2.2	2.9	**2.3**
26	SBG 22-26	YSCN 22-8	**AAUJYS 15-2***	1.8	1.0	0.2	3.2	2.0	2.7	1.6	3.2	3.0	**2.3**
27	SBG 22-27	**NRCYS 05-02 (CHECK)**	**NRCYS 05-02 (CHECK)**	1.0	0.8	0.5	3.2	1.8	2.7	2.8	2.6	2.9	**2.2**
28	SBG 22-28	MCN (E) 22-4	ACN 247	2.6	0.8	0.3	3.3	1.8	2.3	1.8	3.2	2.9	**2.3**
29	SBG 22-29	MCN (E) 22-9	NPJ 257	3.0	1.5	0.2	3.5	1.8	3.3	0.5	3.1	2.9	**2.5**
30	SBG 22-30	MCN (E) 22-17	DRMRIJ 20-117	3.6	0.9	0.3	3.3	1.8	2.0	1.0	3.2	3.0	**2.4**
31	SBG 22-31	MCN (E) 22-21	**PRO 5111 (Hybrid Check)**	0.8	1.0	0.1	3.3	1.9	2.0	0.9	2.9	2.9	**2.0**
32	SBG 22-32	MCN (E) 22-14	DRMRSJ 272	1.0	1.2	0.2	3.2	1.7	2.0	1.4	2.2	2.9	**2.0**
33	SBG 22-33	MCN (E) 22-6	PRE-2018- 1	1.0	1.0	0.1	3.3	1.8	2.0	0.4	3.4	2.8	**2.0**
34	SBG 22-34	MCN (E) 22-19	**GDM 4 (LR)**	0.8	2.6	0.2	3.3	1.7	2.2	0.3	3.2	2.9	**2.1**
35	SBG 22-35	MCN (E) 22-23	RH 1999-37	2.0	1.1	0.3	3.3	1.8	2.2	0.1	2.4	2.9	**2.0**
36	SBG 22-36	**RH -725 (CHECK)**	**RH -725 (CHECK)**	2.4	1.8	0.1	3.3	2.1	2.0	2.6	2.1	3.0	**2.4**
37	SBG 22-37	MCN (E) 22-2	BAUM-2022-1	1.9	1.2	0.4	3.4	1.7	2.0	0.1	2.5	3.0	**2.0**
38	SBG 22-38	MCN (E) 22-10	TM 314-1	1.4	1.3	0.6	3.3	2.2	2.7	0.9	3.3	2.8	**2.2**
39	SBG 22-39	MCN (E) 22-24	SHIVANI PLUS	2.5	1.3	0.5	3.3	0.9	2.5	1.6	2.8	2.8	**2.2**
40	SBG 22-40	MCN (E) 22-15	NPJ 58	1.6	1.3	0.0	3.2	1.9	2.3	0.4	3.1	2.9	**2.1**
41	SBG 22-41	MCN (E) 22-7	DRMRCI- 156	1.0	0.8	0.8	3.3	2.2	2.0	2.1	2.4	2.9	**2.1**
42	SBG 22-42	MCN (E) 22-12	SVJH- 72 (Hybrid)	2.1	1.2	0.1	3.3	1.8	2.2	2.6	2.6	3.0	**2.4**
43	SBG 22-43	MCN (E) 22-18	Q80623	1.0	0.9	0.3	3.2	1.8	2.0	0.6	3.1	3.0	**2.0**
44	SBG 22-44	MCN (E) 22-3	DRMRHT-1712	1.2	1.0	0.2	3.3	1.9	2.0	2.6	2.4	3.0	**2.2**
45	SBG 22-45	**KRANTI (CHECK)**	**KRANTI (CHECK)**	1.0	1.3	0.3	3.3	2.0	2.5	0.2	2.9	1.8	**1.9**
46	SBG 22-46	MCN (E) 22-11	PM 25 (NC)	2.4	0.9	0.3	3.3	1.7	2.7	0.4	2.7	2.9	**2.1**
47	SBG 22-47	MCN (E) 22-1	Pusa MH 126 (Hybrid)	0.5	0.7	0.0	3.3	1.8	1.8	0.3	2.1	3.0	**1.7**
48	SBG 22-48	MCN (E) 22-25	PRE-2020-14	1.0	0.7	0.1	3.4	1.6	1.5	0.4	2.3	2.0	**1.6**
49	SBG 22-49	MCN (E) 22-22	HUJMI 21-1	1.7	0.8	0.2	3.4	1.9	1.5	0.0	2.2	2.9	**1.8**
50	SBG 22-50	MCN (E) 22-5	JD 6 (ZC)	1.2	0.7	0.1	3.2	1.7	2.2	0.4	2.5	3.0	**1.9**
51	SBG 22-51	MCN (E) 22-13	RH 2199-11	1.0	0.8	0.1	3.5	1.5	2.2	0.4	2.9	3.0	**1.9**
52	SBG 22-52	MCN (E) 22-20	ANDM 14-09	0.6	1.0	0.1	3.3	0.9	2.2	0.2	3.3	1.8	**1.7**
53	SBG 22-53	MCN (E) 22-16	KMR(E) 22-1	1.2	0.9	0.1	3.3	1.9	2.3	0.5	2.8	3.0	**2.0**
54	SBG 22-54	MCN (E) 22-8	KMR(E) 22-2	1.0	0.8	0.1	3.3	1.8	2.0	0.2	2.4	3.0	**1.8**
55	SBG 22-55	**PM-30 (CHECK)**	**PM-30 (CHECK)**	2.2	1.6	0.0	3.3	1.9	2.0	0.2	2.1	2.9	**2.0**
56	SBG 22-56	MCN 22-3	Kranti (NC)	1.4	1.0	0.1	3.2	1.7	1.7	0.7	3.1	1.8	**1.8**
57	SBG 22-57	MCN 22-9	ACNMM- 3	4.0	1.1	0.1	3.2	1.7	1.8	2.0	2.8	3.0	**2.5**

58	SBG 22-58	MCN 22-13	DRMR 2020-8	0.6	1.7	0.1	3.2	1.5	2.0	0.6	2.4	3.0	**1.9**
59	SBG 22-59	MCN 22-17	GIRIRAJ (LR)	1.2	1.3	0.1	3.2	1.8	2.2	0.8	2.5	2.9	**2.0**
60	SBG 22-60	MCN 22-22	KMR 22-3	1.0	1.1	0.1	3.3	1.5	2.0	2.3	2.7	1.9	**2.0**
61	SBG 22-61	MCN 22-6	RH 2187	1.2	1.1	0.5	3.3	1.8	1.5	2.4	2.9	3.0	**2.2**
62	SBG 22-62	MCN 22-19	RH 2199	2.8	1.2	0.0	3.3	1.6	1.7	0.5	3.3	3.0	**2.2**
63	SBG 22-63	MCN 22-25	DTM- 341	0.8	1.2	0.1	3.2	1.7	1.5	0.5	2.4	1.7	**1.6**
64	SBG 22-64	MCN 22-15	DM 2020-3	1.0	1.3	0.1	3.3	1.7	2.0	0.2	3.1	3.0	**2.0**
65	SBG 22-65	**RH -725 (CHECK)**	**RH -725 (CHECK)**	2.4	0.8	0.1	3.3	2.5	2.0	1.2	3.2	3.0	**2.3**
66	SBG 22-66	MCN 22-1	RMM-19-12	2.1	0.7	0.1	3.2	1.8	2.0	1.8	3.4	3.0	**2.3**
67	SBG 22-67	MCN 22-7	DRMRIJ 21-37	2.4	1.4	0.1	3.2	1.7	2.0	0.2	2.7	2.9	**2.1**
68	SBG 22-68	MCN 22-24	TM316	3.5	1.2	0.1	3.3	1.6	2.0	0.1	2.9	2.9	**2.2**
69	SBG 22-69	MCN 22-11	**RCC 4 (ZC)**	1.2	1.0	0.1	3.3	1.5	2.0	1.1	3.4	2.8	**2.0**
70	SBG 22-70	MCN 22-20	PR-2020-14	0.6	0.9	0.0	3.2	1.6	2.0	1.2	2.8	2.9	**1.9**
71	SBG 22-71	MCN 22-26	**PBR 813-2**	1.3	2.3	0.2	3.2	1.6	2.0	0.3	2.8	3.0	**2.1**
72	SBG 22-72	MCN 22-5	KMR 22-4	0.4	0.9	0.4	3.2	1.6	2.0	0.5	2.7	2.8	**1.8**
73	SBG 22-73	MCN 22-14	HUJM-21-4	0.8	1.0	0.4	3.3	1.7	2.0	0.2	2.6	2.9	**1.8**
74	SBG 22-74	MCN 22-21	SKM 1924	1.0	1.0	0.0	3.3	1.7	2.0	0.4	2.8	2.9	**1.9**
75	SBG 22-75	**KRANTI (CHECK)**	**KRANTI (CHECK)**	2.8	0.8	0.1	3.3	1.8	2.0	0.1	2.3	3.0	**2.0**
76	SBG 22-76	MCN 22-18	**NPJ 261**	1.0	0.9	0.2	3.2	2.0	2.0	0.0	2.8	3.0	**1.9**
77	SBG 22-77	MCN 22-23	SKM 2012	1.0	0.9	0.1	3.3	1.7	2.0	0.1	2.9	3.0	**1.9**
78	SBG 22-78	MCN 22-12	**NPJ 262**	2.0	2.5	0.3	3.3	2.2	2.0	1.5	2.1	2.9	**2.3**
79	SBG 22-79	MCN 22-4	PR-2019-1	2.2	0.7	0.1	3.3	2.2	2.0	2.4	2.5	2.9	**2.3**
80	SBG 22-80	MCN 22-16	RAURD 18-1	2.4	0.9	0.1	3.3	1.9	2.7	0.3	2.8	2.8	**2.1**
81	SBG 22-81	MCN 22-8	DRMRCI- 154	1.6	0.8	0.1	3.1	2.0	2.0	0.2	3.4	2.9	**2.0**
82	SBG 22-82	MCN 22-27	RB- 110	1.2	0.8	0.1	3.2	2.0	2.0	1.2	2.9	2.9	**2.0**
83	SBG 22-83	MCN 22-2	DRMRHT 18-141	1.2	1.5	0.1	3.2	1.8	2.7	1.8	2.1	3.0	**2.2**
84	SBG 22-84	MCN 22-10	RGN 528	1.0	1.3	0.1	3.3	2.1	2.0	2.3	2.7	3.0	**2.2**
85	SBG 22-85	**PM-30 (CHECK)**	**PM-30 (CHECK)**	1.2	0.8	0.1	3.3	1.8	2.0	0.2	2.6	3.0	**1.9**
86	SBG 22-86	MCNR 22-4	RH 2199-6	1.0	0.9	0.6	3.2	2.0	2.0	2.4	2.9	3.0	**2.2**
87	SBG 22-87	MCNR 22-8	BAUM- 17	2.2	0.7	0.2	3.2	1.9	2.2	1.2	2.5	3.0	**2.1**
88	SBG 22-88	MCNR 22-11	RH 2148	3.0	2.7	0.1	3.2	1.8	2.2	0.7	2.3	3.0	**2.4**
89	SBG 22-89	MCNR 22-16	RH 761 (LR)	2.2	0.7	0.1	3.3	1.8	1.5	0.9	3.4	3.0	**2.1**
90	SBG 22-90	MCNR 22-6	DRMRCI- 155	2.0	2.2	0.0	3.2	1.9	1.5	0.6	3.2	3.0	**2.2**
91	SBG 22-91	MCNR 22-1	JM-15-8	1.6	0.7	0.2	3.3	2.0	2.0	1.3	3.1	3.0	**2.1**
92	SBG 22-92	MCNR 22-13	**RH 725 (ZC)**	3.4	2.4	0.1	3.2	1.9	2.5	0.3	2.8	3.0	**2.4**
93	SBG 22-93	MCNR 22-18	JKJH12	1.4	1.5	0.1	3.3	1.9	2.0	1.5	2.4	3.0	**2.1**
94	SBG 22-94	**RH -725 (CHECK)**	**RH -725 (CHECK)**	2.4	1.2	0.1	3.2	1.8	2.0	0.5	3.5	3.0	**2.2**
95	SBG 22-95	MCNR 22-5	NPJ 263	0.8	0.7	0.1	3.3	1.9	2.0	0.1	3.1	3.0	**1.9**
96	SBG 22-96	MCNR 22-9	DRMR 2020-3	2.9	2.1	0.1	3.2	1.8	2.0	0.2	3.5	3.0	**2.3**
97	SBG 22-97	MCNR 22-17	RGN 526	2.0	0.8	0.2	3.2	2.1	2.0	1.6	2.1	3.0	**2.1**
98	SBG 22-98	MCNR 22-12	DRMRHT- 17-2	1.2	0.7	0.1	3.3	2.1	2.7	1.3	2.5	3.0	**2.1**
99	SBG 22-99	MCNR 22-2	NPJ 264	1.4	0.8	0.1	3.2	2.2	2.8	0.4	2.8	3.0	**2.1**
100	SBG 22-100	MCNR 22-15	TM260	1.4	0.6	0.1	3.3	1.9	3.2	0.1	2.6	3.0	**2.0**
101	SBG 22-101	MCNR 22-10	DRMRRIL 21-1	0.8	0.7	0.2	3.3	2.3	2.0	0.3	2.5	3.0	**1.9**
102	SBG 22-102	MCNR 22-7	RB- 113	1.2	0.8	0.3	3.2	2.0	2.7	0.5	2.5	3.0	**2.0**
103	SBG 22-103	**KRANTI (CHECK)**	**KRANTI (CHECK)**	1.0	0.7	0.1	3.3	1.8	2.5	0.3	3.5	3.0	**2.0**
104	SBG 22-104	MCN (L) 22-2	HUJM-21-1	1.8	0.6	0.1	3.3	2.0	3.2	0.2	3.1	3.0	**2.2**
105	SBG 22-105	MCN (L) 22-5	RH 1999-22	1.0	0.7	0.2	3.3	1.7	2.0	0.1	2.5	3.0	**1.8**
106	SBG 22-106	MCN (L) 22-9	RGN 534	1.0	0.0	1.0	3.3	2.0	2.0	0.6	2.6	3.0	**1.8**
107	SBG 22-107	MCN (L) 22-13	DRMRHT-13-28-13	0.9	0.8	0.2	3.2	2.1	2.2	2.0	2.9	3.0	**2.1**
108	SBG 22-108	MCN (L) 22-16	BAUM-2022-2	2.2	1.5	0.1	3.3	1.8	2.0	0.8	2.8	2.9	**2.2**
109	SBG 22-109	MCN (L) 22-19	DRMRSJ 294	2.1	1.4	0.1	3.2	2.1	2.0	1.7	3.2	2.9	**2.3**
110	SBG 22-110	MCN (L) 22-1	NPJ 259	0.6	2.9	0.1	3.3	1.7	1.5	0.2	3.5	2.9	**2.1**
111	SBG 22-111	MCN (L) 22-17	NPJ 260	1.0	0.8	0.1	3.1	1.8	1.5	0.2	3.4	2.9	**1.8**
112	SBG 22-112	MCN (L) 22-10	NPJ 265	1.0	0.9	0.5	3.2	1.7	2.5	0.0	2.8	2.9	**1.9**
113	SBG 22-113	**RH -725 (CHECK)**	**RH -725 (CHECK)**	1.6	3.0	0.3	3.3	2.1	2.0	0.3	2.4	2.9	**2.2**
114	SBG 22-114	MCN (L) 22-15	**Radhika (LR)**	1.0	0.7	0.1	3.2	1.9	2.7	0.2	2.8	2.9	**1.9**
115	SBG 22-115	MCN (L) 22-6	DRMRIJ 21-51	1.4	2.8	0.1	3.3	1.8	2.7	0.5	2.5	2.9	**2.2**
116	SBG 22-116	MCN (L) 22-12	KMR(L) 22-5	0.8	0.6	0.1	3.2	2.4	2.5	0.4	2.6	3.0	**1.9**
117	SBG 22-117	MCN (L) 22-20	DRMRCI- 160	0.8	0.8	0.4	3.2	1.9	2.0	1.3	2.9	3.0	**2.0**
118	SBG 22-118	MCN (L) 22-3	PM 26 (ZC)	2.1	0.9	0.2	3.3	2.0	2.0	0.4	2.2	3.0	**2.0**
119	SBG 22-119	MCN (L) 22-18	RH 2199-11	1.0	1.0	0.2	3.3	2.2	2.0	0.1	2.4	3.0	**1.9**
120	SBG 22-120	MCN (L) 22-14	PRL-2020-5	2.2	0.7	0.1	3.3	1.7	2.0	0.3	2.8	3.0	**2.0**
121	SBG 22-121	MCN (L) 22-7	PRL-2020-8	3.1	0.7	0.3	3.2	1.8	2.0	1.8	2.3	3.0	**2.2**

122	SBG 22-122	MCN (L) 22-11	KMR(L) 22-6	3.0	0.9	0.2	3.3	1.6	2.2	1.4	2.4	3.0	**2.2**
123	SBG 22-123	MCN (L) 22-4	TM258	2.1	0.8	0.1	3.2	1.0	2.0	1.2	2.7	3.0	**2.0**
124	SBG 22-124	**PM-30 (CHECK)**	**PM-30 (CHECK)**	1.0	0.7	0.1	3.3	1.9	2.5	2.7	2.8	3.0	**2.2**
125	SBG 22-125	MH 22-10	DRMRHJ 1419	0.8	0.7	0.1	3.2	2.3	2.0	2.7	3.3	3.0	**2.3**
126	SBG 22-126	MH 22-4	PHR 4284	1.6	1.0	0.1	3.3	1.8	2.0	1.4	2.9	3.0	**2.1**
127	SBG 22-127	MH 22-16	PMH90V02	1.8	2.9	0.1	3.5	1.8	2.7	0.2	2.7	3.0	**2.3**
128	SBG 22-128	MH 22-20	Pus MH 103	1.6	2.2	0.1	3.3	2.0	2.5	1.2	2.5	3.0	**2.3**
129	SBG 22-129	MH 22-26	4205A252-01	1.4	0.7	0.5	3.3	3.3	2.5	0.1	2.4	3.0	**2.1**
130	SBG 22-130	MH 22-18	DRMRHJ319	1.6	2.0	0.1	3.3	1.6	2.5	0.8	2.1	3.0	**2.1**
131	SBG 22-131	MH 22-7	**45S46 (Check)**	0.2	1.3	0.1	3.3	2.1	2.0	0.2	2.4	3.0	**1.8**
132	SBG 22-132	MH 22-13	RHH 2201	1.0	1.1	0.1	3.3	2.1	2.2	0.4	3.2	3.0	**2.0**
133	SBG 22-133	**DMH-1 (CHECK)**	**DMH-1 (CHECK)**	1.0	1.3	0.0	3.2	1.9	2.5	0.0	3.1	3.0	**2.0**
134	SBG 22-134	MH 22-22	BMH19011	1.0	1.8	0.1	3.3	2.4	2.0	0.2	3.5	3.0	**2.2**
135	SBG 22-135	MH 22-14	DMH- 1 (Check)	1.0	2.6	0.1	3.2	1.8	2.0	0.2	2.6	3.0	**2.1**
136	SBG 22-136	MH 22-5	RHH 2202	1.4	1.2	0.2	3.2	2.1	2.0	0.0	2.4	3.0	**1.9**
137	SBG 22-137	MH 22-11	DRMRHJ 310	0.8	2.1	0.1	3.5	1.9	2.0	0.0	2.7	3.0	**2.0**
138	SBG 22-138	MH 22-17	NMH90M01	1.0	1.1	0.1	3.4	2.0	2.0	0.0	2.5	3.0	**1.9**
139	SBG 22-139	MH 22-1	KGMH- 9783	1.0	0.9	0.4	3.2	2.1	2.2	0.0	2.3	3.0	**1.8**
140	SBG 22-140	MH 22-19	**SVJH- 73**	1.2	3.1	0.1	3.2	1.7	1.7	0.1	2.4	3.0	**2.1**
141	SBG 22-141	MH 22-23	NAMJH21-04	0.8	2.5	0.1	3.2	2.4	1.5	0.4	2.2	3.0	**2.0**
142	SBG 22-142	**KRANTI (CHECK)**	**KRANTI (CHECK)**	1.2	1.0	0.2	3.3	1.8	1.8	0.3	2.8	3.0	**1.9**
143	SBG 22-143	MH 22-6	KBH5207	1.0	1.9	0.3	3.2	1.8	2.5	1.6	2.8	3.0	**2.2**
144	SBG 22-144	MH 22-21	DRMRHJ 223	0.6	1.9	0.2	3.2	2.2	2.7	2.7	3.1	3.0	**2.4**
145	SBG 22-145	MH 22-27	PHR 33281	1.0	0.9	0.1	3.1	1.0	2.5	2.3	3.5	3.0	**2.2**
146	SBG 22-146	MH 22-3	Pusa MH 111	2.2	1.0	0.1	3.2	1.6	2.2	3.1	3.1	3.0	**2.4**
147	SBG 22-147	MH 22-12	RHH 2203	1.6	1.6	0.3	3.5	1.9	2.0	2.5	2.8	3.0	**2.4**
148	SBG 22-148	MH 22-24	**Q90007**	1.0	1.0	0.2	3.2	1.9	2.0	1.7	2.4	3.0	**2.0**
149	SBG 22-149	MH 22-9	**JKJH11**	2.5	1.0	0.4	3.7	1.7	1.8	0.7	2.6	3.0	**2.1**
150	SBG 22-150	MH 22-25	SKMH 1901	2.8	0.7	0.3	3.1	2.0	1.8	0.8	2.8	3.0	**2.1**
151	SBG 22-151	MH 22-8	JH21002	0.8	1.0	0.1	3.2	1.8	1.7	1.1	2.9	3.0	**1.9**
152	SBG 22-152	**45S46 (HC)**	**45S46 (HC)**	2.2	1.4	0.1	3.2	0.9	1.5	0.3	2.5	3.0	**1.9**
153	SBG 22-153	QM 22-2	**PM 30 (NC Quality)**	1.4	3.1	0.2	3.2	0.9	1.5	0.0	2.2	3.0	**1.9**
154	SBG 22-154	QM 22-5	**RH 0749 (ZC)**	0.8	1.1	0.1	3.3	1.8	2.5	0.0	2.1	3.0	**1.8**
155	SBG 22-155	QM 22-8	PMAS 7	1.9	0.8	0.1	3.2	2.6	3.0	0.7	3.1	3.0	**2.3**
156	SBG 22-156	QM 22-11	**RH(OE) 1708#**	2.8	1.0	0.1	3.2	1.9	2.0	0.3	3.0	3.0	**2.2**
157	SBG 22-157	QM 22-16	DRMRCI(Q) 158#	2.0	2.0	0.1	3.2	1.7	2.0	0.3	2.8	3.0	**2.1**
158	SBG 22-158	QM 22-13	DRMRQ 29-20	1.4	1.9	0.1	3.3	1.9	2.7	0.4	3.4	2.9	**2.2**
159	SBG 22-159	QM 22-1	**DRMRCI(Q) 172@**	1.2	1.8	0.2	3.3	2.6	2.0	3.3	2.7	3.0	**2.5**
160	SBG 22-160	QM 22-7	PM 32 (LR)	1.0	2.3	0.0	3.3	2.2	2.7	2.4	2.9	3.0	**2.5**
161	SBG 22-161	**PM-30 (CHECK)**	**PM-30 (CHECK)**	1.5	1.7	0.3	3.2	2.6	2.0	4.4	3.1	2.9	**2.7**
162	SBG 22-162	QM 22-14	RH(OE) 1806#	1.5	0.7	0.1	3.3	0.9	2.5	3.8	2.8	3.0	**2.3**
163	SBG 22-163	QM 22-9	LES 67#	2.1	0.8	0.1	3.3	0.9	2.0	4.2	2.9	3.0	**2.4**
164	SBG 22-164	QM 22-4	PMAS 11	2.2	0.8	0.0	3.4	0.8	2.5	4.3	2.7	2.9	**2.5**
165	SBG 22-165	QM 22-15	**PDZ 11 (Double Low Check)**	2.6	0.8	0.1	3.2	1.9	2.5	1.8	2.8	3.0	**2.3**
166	SBG 22-166	QM 22-12	**PDZ 19@**	1.2	0.7	0.1	3.2	1.8	2.8	1.1	2.4	3.0	**2.0**
167	SBG 22-167	QM 22-6	PDZ 18@	1.5	0.7	0.1	3.2	1.6	2.3	0.2	2.8	2.9	**1.9**
168	SBG 22-168	QM 22-10	LES 66#	1.0	0.8	0.1	3.2	1.6	2.5	2.2	3.1	3.0	**2.2**
169	SBG 22-169	QM 22-3	Pusa QMH 1	1.0	0.8	0.2	3.2	1.0	2.5	0.5	2.5	3.5	**1.9**
170	SBG 22-170	**PDZM 31 (CHECK)**	**PDZM 31 (CHECK)**	1.2	1.9	0.1	3.2	1.0	2.8	0.4	2.7	3.5	**2.1**
Mean				**1.7**	**1.2**	**0.2**	**3.3**	**1.8**	**2.2**	**1.2**	**2.8**	**2.9**	**2.1**

Note: Kanpur data not included for mean calculation due to very low aphid pressure

Table 5.1 (B): Reaction of AVT I and AVT II entries of *Brassica* to mustard aphid infestation

S. No	Code No.	Breeding Code	Entry Name	MOR	HSR	KAN	SKN	PTN	NDH	LDH	DHO	SHIL	Mean
1	SAG 22-1	MCN (OD) 22-11	KMR(E) 21-1	1.5	1.2	0.0	3.2	2.4	1.8	0.4	2.9	2.8	**2.0**
2	SAG 22-2	MCN (OD) 22-20	DRMRHT 13-13-5-4	1.4	2.0	0.0	3.2	0.9	2.3	2.2	2.7	2.9	**2.2**
3	SAG 22-3	MCN (OD) 22-50	DRMRHT 13-13-5-5	2.1	1.2	0.1	3.1	1.7	2.2	0.6	2.5	2.8	**2.0**
4	SAG 22-4	MCN (OD) 22-10	RH 1999-42	2.0	1.3	0.0	3.2	0.9	2.7	2.1	3.3	2.6	**2.3**
5	SAG 22-5	MCN (OD) 22-49	ORM 2019-25	1.0	1.4	0.1	3.2	2.0	3.0	0.6	2.8	2.7	**2.1**
6	SAG 22-6	MCN (OD) 22-22	PRE 2018-10	1.0	1.1	0.1	3.2	2.0	1.5	1.2	3.2	2.7	**2.0**
7	SAG 22-7	**RH- 725 (C.check)**	**RH- 725 (C.check)**	2.1	1.3	0.1	3.2	1.6	2.5	1.3	2.8	1.4	**2.0**
8	SAG 22-8	MCN (OD) 22-56	DRMRHJ 1117	1.0	1.3	0.1	3.2	1.0	3.2	2.6	3.1	2.7	**2.3**
9	SAG 22-9	MCN (OD) 22-34	DRMR 2018-19$	1.5	1.1	0.0	3.2	0.6	2.0	0.3	2.9	2.7	**1.8**
10	SAG 22-10	MCN (OD) 22-13	DRMRHJ 430	2.5	0.9	0.2	3.2	0.9	2.2	1.2	3.1	1.9	**2.0**
11	SAG 22-11	MCN (OD) 22-16	NPJ 250	1.5	1.1	0.0	3.2	1.6	1.6	1.0	2.8	2.8	**2.0**
12	SAG 22-12	MCN (OD) 22-40	NPJ 251	2.1	1.1	0.2	3.2	2.2	2.5	2.0	3.4	2.7	**2.4**
13	SAG 22-13	**BSH-1 (S.Check)**	**BSH-1 (S.Check)**	1.6	2.3	0.1	3.2	2.0	2.3	2.5	3.2	2.6	**2.5**
14	SAG 22-14	MCN (OD) 22-21	NPJ 253	2.1	1.3	0.2	3.2	1.6	1.5	0.9	2.8	2.7	**2.0**
15	SAG 22-15	MCN (OD) 22-39	RHH 2101	2.1	1.1	0.2	3.2	1.6	1.8	0.5	2.9	2.7	**2.0**
16	SAG 22-16	MCN (OD) 22-45	DRMRHJ 2518	1.8	1.3	0.1	3.2	1.8	3.0	0.1	3.1	2.8	**2.1**
17	SAG 22-17	MCN (OD) 22-55	NAMJH 21-01	1.0	2.1	0.0	3.2	1.8	2.2	0.3	2.8	2.9	**2.0**
18	SAG 22-18	MCN (OD) 22-2	18J408C	0.8	1.1	0.1	3.2	1.7	3.0	0.5	3.0	2.8	**2.0**
19	SAG 22-19	MCN (OD) 22-29	SVJH-70	0.8	1.0	0.1	3.2	1.7	2.7	2.2	2.9	2.7	**2.2**
20	SAG 22-20	MCN (OD) 22-54	RMX 9922	1.0	1.2	0.1	3.2	1.8	2.8	0.1	3.1	3.0	**2.0**
21	SAG 22-21	MCN (OD) 22-44	SVJH-71	0.2	2.9	0.1	3.2	1.6	2.0	0.7	2.1	2.7	**1.9**
22	SAG 22-22	MCN (OD) 22-23	IJ16R1168	1.6	1.2	0.1	3.2	1.9	2.0	0.3	2.5	2.8	**1.9**
23	SAG 22-23	**45 S 46 (Check)**	**46 S 46 (Check)**	1.2	1.1	0.1	3.2	1.0	2.5	0.5	3.4	2.8	**2.0**
24	SAG 22-24	MCN (OD) 22-12	PBR 939	1.6	2.6	0.1	3.2	1.7	2.8	1.3	2.5	2.7	**2.3**
25	SAG 22-25	MCN (OD) 22-48	RH 1975	1.2	1.3	0.0	3.2	2.3	2.5	1.3	3.1	2.7	**2.2**
26	SAG 22-26	MCN (OD) 22-17	ACN 237	1.4	1.1	0.0	3.2	2.1	2.7	0.0	2.9	2.9	**2.0**
27	SAG 22-27	MCN (OD) 22-30	NPJ 252	1.2	2.4	0.0	3.2	1.0	2.7	1.3	2.8	1.8	**2.1**
28	SAG 22-28	MCN (OD) 22-41	KMR 21-3	2.0	1.3	0.1	3.2	2.1	2.2	0.7	2.7	2.7	**2.1**
29	SAG 22-29	MCN (OD) 22-47	DRMRIJ 20-157	1.0	1.2	0.1	3.7	1.9	2.3	0.6	2.2	2.7	**2.0**
30	SAG 22-30	MCN (OD) 22-08	IJ19R5004	1.0	1.1	0.1	3.2	1.6	2.2	0.4	3.2	2.8	**1.9**
31	SAG 22-31	MCN (OD) 22-42	PDZ-14	1.0	0.9	0.0	3.2	1.7	2.0	1.7	2.6	2.8	**2.0**
32	SAG 22-32	**KANTI (NC)**	**KANTI (NC)**	1.0	1.1	0.1	3.2	1.7	1.8	0.7	2.2	2.7	**1.8**
33	SAG 22-33	MCN (OD) 22-31	RH 1974	1.2	1.1	0.0	3.2	2.2	1.8	0.3	3.0	2.7	**1.9**
34	SAG 22-34	MCN (OD) 22-14	KGMH 9198	0.8	1.0	0.1	3.2	1.6	2.5	0.9	3.6	2.7	**2.0**
35	SAG 22-35	MCN (OD) 22-19	SKM-1801	0.8	2.2	0.1	3.2	1.0	2.5	0.9	2.8	2.8	**2.0**
36	SAG 22-36	MCN (OD) 22-33	DRMR 2018-37	2.0	1.2	0.1	3.2	1.7	3.2	0.5	2.6	2.8	**2.2**
37	SAG 22-37	MCN (OD) 22-43	DRMRCI(Q) 47	1.8	1.4	0.1	3.2	1.6	2.7	1.3	3.1	2.9	**2.3**
38	SAG 22-38	MCN (OD) 22-07	PDZ-15	1.4	1.0	0.6	3.2	1.6	3.0	1.5	2.2	2.6	**2.1**
39	SAG 22-39	MCN (OD) 22-32	RH 1934	1.4	0.9	0.1	3.2	0.9	2.5	1.7	2.8	1.9	**1.9**
40	SAG 22-40	MCN (OD) 22-01	RGN 524	1.6	1.6	0.3	3.2	1.6	2.0	0.3	2.9	2.7	**2.0**
41	SAG 22-41	MCN (OD) 22-18	PDZ-16	2.1	1.1	0.1	3.2	0.8	3.0	0.4	2.4	2.8	**2.0**
42	SAG 22-42	MCN (OD) 22-09	DRMR 2018-25	2.2	1.2	0.1	3.1	1.8	1.9	1.1	2.6	2.8	**2.1**
43	SAG 22-43	**PM-30 (Check)**	**PM-30 (Check)**	1.5	1.0	0.1	3.2	1.9	3.0	0.5	2.2	2.9	**2.0**
44	SAG 22-44	MCN (OD) 22-03	GSH-2155	2.1	1.2	0.0	3.2	0.6	3.0	1.2	2.5	3.7	**2.2**
45	SAG 22-45	MCN (OD) 22-15	CS 2020-10	1.2	1.2	0.1	3.1	0.6	2.0	0.5	2.2	1.7	**1.6**
46	SAG 22-46	**GSL-1 (Check)**	**GSL-1 (Check)**	1.4	1.1	0.0	1.6	0.8	1.5	1.1	2.1	3.9	**1.7**
47	SAG 22-47	MCN (OD) 22-05	Maya	2.0	1.2	0.1	3.2	1.9	3.2	1.2	3.1	2.9	**2.3**
48	SAG 22-48	MCN (OD) 22-24	Basanti	0.8	1.8	0.1	3.2	2.2	3.2	0.2	3.0	1.8	**2.0**
49	SAG 22-49	MCN (OD) 22-35	PM 28 (LR)	1.0	1.2	0.0	3.2	1.6	2.0	0.7	2.8	2.8	**1.9**
50	SAG 22-50	MCN (OD) 22-46	RGN 73	1.0	1.1	0.0	3.2	0.9	2.0	0.3	3.4	2.9	**1.9**
51	SAG 22-51	MCN (OD) 22-37	GSL-1 (Check)	1.2	1.2	0.0	2.2	1.8	1.5	0.7	2.1	3.5	**1.8**
52	SAG 22-52	MCN (OD) 22-26	Binoy	1.2	2.0	0.0	3.2	1.5	2.5	1.6	2.7	1.7	**2.1**
53	SAG 22-53	MCN (OD) 22-27	CS 56	1.8	1.3	0.1	3.2	1.6	2.3	0.2	2.4	2.8	**2.0**
54	SAG 22-54	MCN (OD) 22-36	DRMR 150-35	1.4	1.2	0.2	3.2	1.6	2.0	0.5	3.2	2.9	**2.0**
55	SAG 22-55	MCN (OD) 22-51	AKMS 8141	0.8	1.2	0.0	1.4	0.8	2.0	0.9	2.2	2.8	**1.5**
56	SAG 22-56	MCN (OD) 22-25	GSC 6	1.2	2.9	0.0	3.2	1.8	2.2	0.3	2.9	1.6	**2.0**
57	SAG 22-57	MCN (OD) 22-38	TS-38	1.0	1.0	0.0	3.2	1.7	2.3	0.7	2.5	2.8	**1.9**
58	SAG 22-58	MCN (OD) 22-52	CS 54	1.0	1.1	0.3	3.2	1.9	2.5	0.4	2.9	2.9	**2.0**
59	SAG 22-59	MCN (OD) 22-04	NRCHB-101	0.8	1.8	0.1	3.2	0.8	1.6	0.7	2.6	1.8	**1.7**
60	SAG 22-60	MCN (OD) 22-53	BIO-902	0.6	1.1	0.1	3.2	1.5	3.0	0.5	2.4	1.8	**1.8**
61	SAG 22-61	MCN (OD) 22-28	PDZ-1	1.0	1.5	0.0	3.2	1.6	3.2	0.0	3.0	2.8	**2.0**
62	SAG 22-62	MCN (OD) 22-06	CS 60	0.8	1.1	0.1	3.2	0.9	2.0	0.0	2.8	1.6	**1.6**
63	SAG 22-63	**PDZM 31 (CHECK)**	**PDZM 31 (CHECK)**	0.9	1.0	0.2	3.2	0.9	2.8	0.1	2.1	2.9	**1.7**
Mean				**1.4**	**1.4**	**0.1**	**3.1**	**1.5**	**2.4**	**0.8**	**2.8**	**2.6**	**2.0**

Note: Kanpur data not included for mean calculation due to very low aphid pressure

Table 5.2: Assessment of avoidable yield losses due to insect pests in *Brassicas*

Centre	Mustard aphid population in unprotected plot		Yield (kg/ha)		Avoidable yield losses (%)
			Protected	Unprotected	
Hisar					
Radhika	81.6		2254.0	1738.2	22.9
Brijraj	104.8		2142.9	1918.7	10.5
RH 725	95.1		2650.8	1994.0	24.8
CD (p=0.05)	**NS**		**164.3**	**132.9**	**--**
Dholi					
Radhika	22.6		1326.0	1106.0	19.8
Brijraj	36.4		1262.0	1068.0	18.1
Rajendra Sufalam	48.6		1036.0	918.0	12.8
CD (p=0.05)	**-**		**78.2**	**61.2**	--
Ludhiana	**Aphids/ plant**	**Cabbage caterpillars/ plant**			
Radhika	52.7	22.8	2152.1	1566.7	27.20
Brijraj	83.5	24.9	2068.8	1445.8	30.11
PBR 357	98.8	28.1	1987.5	1329.2	33.12
CD (p=0.05)	**21.65**	**5.77**	**70.32**	**66.80**	**-**
S.K.Nagar					
Radhika	297.1		1169.0	218.0	80.9
Brijraj	299.3		811.0	134.0	84.0
GDM-4	300.5		1044.0	181.0	82.3
CD (p=0.05)	**NS**		**157.6**	**37.0**	**-**
Morena					
Radhika	128.6		2091.0	1704.0	18.4
Brijraj	96.9		2245.0	1881.0	16.2
RVM-3	110.2		1995.0	1760.0	11.7
CD (p=0.05)	**13.0**		**54.9**	**121.9**	**-**
New Delhi					
Radhika	485.0		2537.0	2296.9	9.5
Brijraj	620.0		2201.8	1761.8	20.0
PM 30	463.0		1819.2	1600.6	12.0
Pant Nagar					
Radhika	114.2		1822.0	1679.0	7.8
Brijraj	94.3		1904.0	1746.0	8.3
Varuna	87.9		1620.0	1531.0	5.5
CD (p=0.005)	**26.4**		**132.0**	**320.0**	--
Kanpur					
Radhika	6.8		1786.0	1769.0	0.9
Brijraj	4.9		1984.0	1825.0	8.0
Varuna	5.7		2007.0	1849.0	7.8
CD (p=0.05)	NS		NS	NS	--
Shillongani					
Radhika	98.2		1736.7	1370.0	21.1
Brijraj	125.8		1828.0	1454.2	20.4
PM 27	110.1		1256.7	967.7	23.0
CD (p=0.05)	**14.9**		**90.8**	**84.9**	**--**

Table 5.3.1(A): Population dynamics of painted bug on *Brassicas* varieties at Hisar

Population dynamics of painted bug on *Brassica* varieties														
Std Week	Meteorological observations						No. of painted bugs/ m row length (mrl)							
							Timely Sown				Late Sown			
	Temperature (°C)		RH (%)		Sunshine hours	Rainfall (mm)	*B. juncea*	*Eruca sativa*	*B. napus*	*B. rapa*	*B. juncea*	*Eruca sativa*	*B. napus*	*B. rapa*
	Max.	Min.	Morn.	Even.			DRMR IJ 31	T 27	GSC 6	BSH 1	DRMR IJ 31	T 27	GSC 6	BSH 1
45	29.9	16.5	94.0	61.0	3.9	4.2	0.0	0.0	0.0	0.0	-	-	-	-
46	26.6	12.0	88.0	48.0	6.8	0.0	0.0	0.0	0.0	0.0	-	-	-	-
47	25.8	8.0	85.0	48.0	7.8	0.0	0.0	0.0	0.0	0.0	-	-	-	-
48	26.0	7.2	94.0	53.0	6.9	0.0	0.1	0.1	0.0	0.1	-	-	-	-
49	23.5	7.4	94.0	67.0	6.4	0.0	0.3	0.0	0.3	0.2	-	-	-	-
50	24.6	6.9	92.0	46.0	7.8	0.0	0.0	0.4	0.5	0.1	-	-	-	-
51	19.3	5.6	98.0	76.0	5.5	0.0	0.3	0.2	0.3	0.1	0.0	0.0	0.0	0.0
52	15.7	5.7	98.0	76.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	14.6	4.4	100.0	85.0	2.6	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	15.2	6.3	100.0	84.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	18.0	3.6	91.0	52.0	6.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	19.2	7.4	98.0	71.0	4.5	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: Weather data provided by the Department of Agricultural Meteorology, CCS HAU, Hisar

Table 5.3.1(B). Population dynamics of flea beetle on *Brassica* varieties at Hisar

Std Week	Meteorological observations						No. of insects/ plant							
							Timely Sown				Late Sown			
	Temperature (°C)		RH (%)		Sunshine hours	Rainfall (mm)	*B. juncea*	*Eruca sativa*	*B. napus*	*B. rapa*	*B. juncea*	*Eruca sativa*	*B. napus*	*B. rapa*
	Max.	Min.	Morn.	Even.			DRMR IJ 31	T 27	GGSC 6	BSH 1	DRMR IJ 31	T 27	GSC 6	BSH 1
45	29.9	16.5	94.0	61.0	3.9	4.2	0.0	0.0	0.0	0.3	-	-	-	-
46	26.6	12.0	88.0	48.0	6.8	0.0	0.2	0.0	0.0	0.0	-	-	-	-
47	25.8	8.0	85.0	48.0	7.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	26.0	7.2	94.0	53.0	6.9	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
49	23.5	7.4	94.0	67.0	6.4	0.0	0.2	0.0	0.0	0.	0.0	0.0	0.0	0.0
50	24.6	6.9	92.0	46.0	7.8	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0
51	19.3	5.6	98.0	76.0	5.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	15.7	5.7	98.0	76.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	14.6	4.4	100.0	85.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	15.2	6.3	100.0	84.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	18.0	3.6	91.0	52.0	6.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 5.3.1 (C): Population dynamics of cutworm (MCW) and cabbage caterpillar (CC) on *Brassica* varieties at Hisar

Population dynamics of cutworm and cabbage caterpillar on *Brassica* varieties														
Std Week	Meteorological observations						No. of larvae/ 10plants							
							Timely Sown				Late Sown			
	Temperature (°C)		RH (%)		Sunshine hours	Rain fall (mm)	*B. juncea*	*Eruca sativa*	*B. napus*	*B. rapa*	*B. juncea*	*Eruca sativa*	*B. napus*	*B. rapa*
	Max.	Min.	Morn	Even			DRMRIJ 31	T 27	GSC 6	BSH 1	DRMRIJ 31	T 27	GSC 6	BSH 1
45	29.9	16.5	94.0	61.0	3.9	4.2	0.0	0.0	0.0	0.0	-	-	-	-
46	26.6	12.0	88.0	48.0	6.8	0.0	0.4 (CW)	0.0	0.0	0.0	-	-	-	-
47	25.8	8.0	85.0	48.0	7.8	0.0	0.0	0.0	0.0	0.0	-	-	-	-
48	26.0	7.2	94.0	53.0	6.9	0.0	0.0	0.0	0.0	0.0	-	-	-	-
49	23.5	7.4	94.0	67.0	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	24.6	6.9	92.0	46.0	7.8	0.0	**0.2 (CC)**	0.0	0.0	0.0	0.0	0.0	0.0	0.1(CW)
51	19.3	5.6	98.0	76.0	5.5	0.0	1.1 (CC)	0.0	0.0	0.0	0.0	0.0	0.0	0.2 (CW)
52	15.7	5.7	98.0	76.0	3.5	0.0	0.0	0.0	0.0	0.0	2.8 (CC)	0.0	0.0	0.1 (CW)
1	14.6	4.4	100.0	85.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	15.2	6.3	100.0	84.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	18.0	3.6	91.0	52.0	6.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	19.2	7.4	98.0	71.0	4.5	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	20.5	6.6	97.0	66.0	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	25.3	9.2	93.0	56.0	8.2	0.0	0.0	0.0	0.0	0.0	1.9 (CC)	0.0	0.0	0.0
7	25.3	7.4	95.0	54.0	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	28.1	11.1	95.0	61.0	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	28.5	12.3	93.0	58.0	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	28.1	11.1	89.0	53.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7 (CC)	0.0

Note: Weather data provided by the Department of Agricultural Meteorology, CCS HAU, Hisar.

Table 5.3.1(D): Population dynamics of mustard aphid on *Brassica* varieties at Hisar

Population dynamics of mustard aphid on *Brassica* varieties														
Std. Week	Meteorological observations						No. of aphids / top 10 cm central twig							
							Timely Sown				Late Sown			
	Temp.(°C)		RH (%)		Sunshine hours	Rainfall (mm)	*B. juncea*	*E. sativa*	*B. napus*	*B. rapa*	*B. juncea*	*E. sativa*	*B. napus*	*B. rapa*
	Max.	Min.	Morn.	Even.			DRMR IJ 31	T 27	GSC 6	BSH 1	DRMR IJ-31	T 27	GSC 6	BSH 1
52	15.7	5.7	98.0	76.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	14.6	4.4	100.0	85.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	15.2	6.3	100.0	84.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	18.0	3.6	91.0	52.0	6.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
4	19.2	7.4	98.0	71.0	4.5	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
5	20.5	6.6	97.0	66.0	5.9	0.0	0.0	0.0	0.0	0.0	9.1	0.0	0.0	0.0

6	25.3	9.2	93.0	56.0	8.2	0.0	0.0	0.0	0.0	0.0	25.3	0.0	11.2	7.0
7	25.3	7.4	95.0	54.0	7.2	0.0	0.0	0.0	0.0	0.0	73.4	5.1	18.8	15.5
8	28.1	11.1	95.0	61.0	6.5	0.0	0.0	0.0	0.0	0.0	210.8	20.3	32.4	21.2
9	28.5	12.3	93.0	58.0	7.5	0.0	0.0	0.0	0.0	0.0	320.6	24.1	205.1	280.8
10	28.1	11.1	89.0	53.0	6.0	0.0	0.0	0.0	0.0	0.0	185.5	120.4	130.6	205.9
11	31.7	15.1	88.0	55.0	6.0	5.4	Harvest	Harvested	Harvested	Harvested	29.7	75.5	62.5	85.4
12	26.7	14.7	92.0	65.0	4.3	3.6					3.8	0.0	7.5	3.9
13	29.3	15.3	86.0	53.0	5.2	3.8					0.0	0.0	3.1	0.0
14	29.2	15.3	84.0	51.0	5.7	3.8					0.0	0.0	0.0	0.0

Note: Weather data provided by the department of Agricultural Meteorology, CCS HAU, Hisar.

Table 5.3.1(E): Population dynamics of various natural enemies on *Brassica* varieties at Hisar

Population dynamics of natural enemies on *Brassica* varieties														
Std. Week	**Meteorological observations**						**Coccinellids (Grubs + Beetles)/ Plant**							
							Timely Sown				**Late Sown**			
	Temp. (°C)		**RH (%)**		**Sunshine hours**	**Rainfall (mm)**	***B. juncea***	***E. sativa***	***B. napus***	***B. rapa***	***B. juncea***	***E. sativa***	***B. napus***	***B. Rapa***
	Max.	**Min.**	**Morn.**	**Even.**			**DRMR IJ 31**	**T 27**	**GSC 6**	**BSH 1**	**DRMR IJ-31**	**T 27**	**GSC 6**	**BSH 1**
47	25.8	8.0	85.0	48.0	7.8	0.0	0.3 (DF) 0.3 (LB)	0.0	0.0	0.1 (LB)	0.0	0.0	0.0	0.0
48	26.0	7.2	94.0	53.0	6.9	0.0	0.0	0.0	0.1 (LB)	0.0	0.0	0.0	0.0	0.0
49	23.5	7.4	94.0	67.0	6.4	0.0	0.2 (SF)	0.0	0.0	0.2 (LB)	0.0	0.0	0.0	0.0
50	24.6	6.9	92.0	46.0	7.8	0.0	0.0	0.0	0.0	0.2 (LB)	0.0	0.0	0.0	0.0
51	19.3	5.6	98.0	76.0	5.5	0.0	0.0	0.0	0.0	0.1 (SF)	0.0	0.0	0.0	0.0
52	15.7	5.7	98.0	76.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	14.6	4.4	100.0	85.0	2.6	0.0	0.0	0.0	0.0	0.1 (LB)	0.0	0.0	0.0	0.1
2	15.2	6.3	100.0	84.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	18.0	3.6	91.0	52.0	6.5	0.7	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
4	19.2	7.4	98.0	71.0	4.5	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	20.5	6.6	97.0	66.0	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	25.3	9.2	93.0	56.0	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.5
7	25.3	7.4	95.0	54.0	7.2	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.3	1.0
8	28.1	11.1	95.0	61.0	6.5	0.0	0.0	0.0	0.0	0.4	0.6	1.1	1.3	1.5
9	28.5	12.3	93.0	58.0	7.5	0.0	0.0	0.0	0.0	0.0	1.8	2.0	2.2	2.8
10	28.1	11.1	89.0	53.0	6.0	0.0	0.0	0.0	0.0	0.0	3.2	2.8	3.3	4.2
11	31.7	15.1	88.0	55.0	6.0	5.4	Harvested	Harvested	Harvested	Harvested	2.7	1.8	3.1	2.1
12	26.7	14.7	92.0	65.0	4.3	3.6					2.2	0.9	1.4	1.7
13	29.3	15.3	86.0	53.0	5.2	3.8					1.0	0.0	0.3	0.6

DF: Damselfly, LB: Lady beetle, SF: Syrphid fly

Note: Weather data provided by the department of Agricultural Meteorology, CCS HAU, Hisar.

Table 5.3.2: Population dynamics of mustard aphid on *Brassica* crops (Late Sown) at Dholi

Std. Week	Weather parameters				Rainfall (mm)	Aphid population/10 cm twig on				
	Temperature (°C)		RH (%)			DRMR IJ 31	BSH 1	GSC 6	T 27	Rajendra Suflam
	Max.	Min.	Morn.	Even.						
51	10.2	24.6	100.0	91.5	-	0.0	0.0	0.0	0.0	0.0
52	8.7	22.2	96.8	86.6	-	0.0	0.0	0.0	0.0	0.0
1	9.3	15.7	99.0	93.4	-	0.0	0.0	0.0	0.0	0.0
2	6.7	14.6	99.2	90.7	-	21.6	31.6	23.2	19.2	38.6
3	6.2	20.6	99.1	80.1	-	44.2	58.6	37.6	31.8	51.8
4	11.2	24.5	99.7	80.7	-	56.6	72.8	44.4	38.2	64.7
5	10.6	23.5	100.0	81.4	-	81.4	102.6	59.8	44.6	92.2
6	9.9	25.1	99.0	78.4	-	89.2	114.8	72.4	56.2	107.2
7	10.3	26.1	97.7	77.1	-	96.4	135.6	79.0	68.2	114.8
8	12.8	29.2	99.7	78.7	-	72.6	106.8	61.0	56.8	92.6
9	13.3	30.4	98.5	75.1	-	66.2	72.6	56.8	41.6	62.8
10	13.4	31.3	99.1	74.8	-	51.6	62.4	38.2	33.4	54.6
11	16.2	31.6	99.7	78.5	-	22.6	34.2	20.0	16.2	28.2
12	16.6	28.4	100	83.8	14.4	6.2	14.6	3.2	1.8	12.8
13	16.9	32.9	98.5	74.0	-	0.0	0.0	0.0	0.0	0.0

Table 5.3.3(A): Population dynamics of mustard aphid on *Brassicas* at Pant Nagar (Timely sown)

Std. Week	Temperature		Rain fall (mm)	R.H. %		Sun- Shine (Hrs)	Number of aphids/ top 10 cm central twig							
	Max	Min.		Max.	Min.		DRMR IJ 31	T 27	GSC 6	BSH 1	YST 151	*B. nigra*	*B. alba*	Varuna
5	19.1	9.1	92.4	72.0	1.2	2.9	8.23	0.00	11.27	3.60	5.43	0.00	80.00	0.50
6	24.2	9.1	92.6	46.7	0.0	7.2	19.30	2.47	25.90	10.57	5.03	1.97	144.33	5.33
7	25.1	8.9	84.9	35.7	0.0	7.5	32.33	4.43	41.07	19.83	13.40	3.90	170.50	11.13
8	28.1	11.0	88.7	42.9	8.4	8.6	46.83	13.17	29.00	30.03	23.93	12.67	175.83	15.30
9	29.3	12.2	87.1	36.4	**0.0**	8.5	59.73	24.80	18.90	42.73	37.20	25.60	148.83	8.77
10	29.5	12.3	88.4	32.4	0.0	8.5	41.27	16.67	11.97	29.90	52.07	27.40	127.67	4.47
11	30.5	14.3	85.1	42.3	0.0	8.2	24.73	9.20	6.20	13.10	23.67	16.10	98.50	1.23
12	25.7	13.8	89.7	53.6	69.0	4.9	12.77	5.23	5.00	1.13	5.07	6.17	69.00	0.00

Table 5.3.3(B): Population dynamics of mustard aphid on *Brassicas* at Pant Nagar (Late sown)

Std. Week	Temperature		Rainfall (mm)	R.H. %		Sunshine Hours	Number of aphids/ top 10 cm central twig					
	Max.	Min.		Max.	Min.		DRMR IJ 31	T 27	GSC 6	BSH 1	YST 151	*B. alba*
5	19.1	9.1	92.4	72.0	1.2	2.9	55.53	2.57	8.00	43.20	29.80	72.83
6	24.2	9.1	92.6	46.7	0.0	7.2	94.23	2.87	16.53	71.67	56.60	132.17
7	25.1	8.9	84.9	35.7	0.0	7.5	155.83	6.10	29.40	118.00	89.17	192.27
8	28.1	11.0	88.7	42.9	8.4	8.6	191.33	17.23	51.83	149.17	120.40	251.63
9	29.3	12.2	87.1	36.4	0.0	8.5	194.33	36.23	76.40	165.33	146.67	120.20
10	29.5	12.3	88.4	32.4	0.0	8.5	140.00	22.53	50.23	130.90	107.00	123.83
11	30.5	14.3	85.1	42.3	0.0	8.2	101.97	12.20	33.10	98.33	77.10	89.57
12	25.7	13.8	89.7	53.6	69.0	4.9	61.00	3.70	17.53	69.50	53.23	64.13

Table 5.3.3(C): Population dynamics of Coccinellids (grubs and adults/ plant) on *Brassicas* at Pant Nagar (Timely sown)

Standard Week	Temperature		R.H. %		Rainfall (mm)	Wind speed Kmph	Sunshine (Hrs)	BSH 1	YST 151	GSC 6	T 27	DRMRIJ 31	*B. nigra*	*B. alba*	Varuna
	Max.	Min.	Max.	Min.											
1	13.0	6.6	92.7	87.6	0.0	0	1.3	0.00	0.00	0.00	0.00	0.00	0.00	1.00	3.00
2	14.8	7.1	90.1	69.7	3.8	**1**	2.3	0.00	0.67	0.00	2.00	0.00	0.00	1.33	5.67
3	18.6	6.5	88.3	49.3	0.0	0	4.1	3.00	1.00	2.00	1.00	4.33	0.00	1.00	2.00
4	22.6	9.9	91.3	60.7	10.7	**2**	5.2	1.00	1.00	0.67	5.67	2.00	2.00	1.67	3.33
5	19.1	9.1	92.4	72.0	1.2	0	2.9	3.67	1.67	2.67	10.67	2.33	6.67	2.67	8.33
6	24.2	9.1	92.6	46.7	0.0	0	7.2	5.33	3.00	7.33	10.33	8.33	4.00	9.33	2.67
7	25.1	8.9	84.9	35.7	0.0	0	7.5	3.33	5.00	12.00	12.67	5.33	9.33	6.00	7.33
8	28.1	11.0	88.7	42.9	8.4	**1**	8.6	8.00	11.00	9.33	8.67	4.33	4.00	16.00	6.00
9	29.3	12.2	87.1	36.4	0.0	0	8.5	5.00	9.33	11.67	11.00	6.00	7.33	7.00	10.33
10	29.5	12.3	88.4	32.4	0.0	0	8.5	6.00	2.67	4.00	7.67	2.00	7.67	8.67	7.33
11	30.5	14.3	85.1	42.3	0.0	0	8.2	2.00	4.00	3.67	5.00	0.00	4.67	6.33	3.00
12	25.7	13.8	89.7	53.6	69.0	3	4.9	1.00	0.00	2.33	2.00	1.33	1.00	2.33	0.00

Table 5.3.3(D): Population dynamics of Coccinellids (grubs and adults/ plant) on *Brassicas* at Pant Nagar (Late sown)

Standard Week.	Temperature		R.H. %		Rain fall (mm)	Wind speed Kmph	Sunshine (Hrs)	BSH 1	YST 151	GSC 6	T 27	DRMRIJ 31	*B. nigra*	*B. alba*	Varuna
	Max.	Min.	Max.	Min.											
4	22.6	9.9	91.3	60.7	10.7	**2**	5.2	0.00	1.67	2.00	2.33	0.00	0.33	1.00	1.00
5	19.1	9.1	92.4	72.0	1.2	0	2.9	1.00	2.00	3.67	3.00	0.67	3.67	1.33	0.00
6	24.2	9.1	92.6	46.7	0.0	0	7.2	2.67	4.33	3.00	4.33	1.00	3.33	2.67	2.00
7	25.1	8.9	84.9	35.7	0.0	0	7.5	5.00	8.00	7.00	6.00	0.67	2.00	6.67	3.67
8	28.1	11.0	88.7	42.9	8.4	**1**	8.6	8.67	5.67	9.33	7.33	4.33	7.33	5.00	7.00
9	29.3	12.2	87.1	36.4	**0.0**	0	8.5	9.00	9.67	13.33	5.00	6.67	11.33	8.33	4.67
10	29.5	12.3	88.4	32.4	0.0	0	8.5	11.00	12.00	10.00	8.00	9.00	14.00	7.67	3.00
11	30.5	14.3	85.1	42.3	0.0	0	8.2	8.67	9.33	7.33	4.33	6.67	8.33	6.00	2.00
12	25.7	13.8	89.7	53.6	69.0	3	4.9	7.67	3.00	5.00	1.33	3.00	4.67	2.67	1.67
13	29.6	14.0	85.4	36.3	32.4	2	8.9	3.00	2.00	3.33	0.00	1.67	2.33	0.33	2.67
14	29.9	13.5	80.1	28.3	9.2	1	9.6	2.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00
15	34.9	14.8	80.4	18.7	**0.0**	0	10.7	0.00	0.00	0.00	0.00	0.67	1.00	0.00	0.00

Table 5.3.4 (A): Population dynamics of mustard aphid, cabbage aphid and cabbage caterpillar on *Brassicas* at Ludhiana (Timely sown)

SMW*	Weather Parameters						No of aphids/ top 10 cm central twig								Cabbage caterpillars/ plant			
	Temp. (^{0}C)		R.H. (%)		Rainfall (mm)	Sunshine (hrs)	GSC 6		DRMR-IJ 31		BSH 1		T27		GSC 6	DRMR-IJ 31	BSH 1	T27
	Max.	Min.	M	E			MA	CA	MA	CA	MA	CA	MA	CA				
51	17.3	7.5	97	72	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	15.6	6.6	95	67	0.6	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	13.3	5.5	93	70	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	14.8	7.9	95	72	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	18.1	4.3	89	37	0.0	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	19.4	7.6	90	56	18.1	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	20.3	8.6	93	57	14.0	6.7	0.0	0.0	4.2	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	23.0	10.0	87	45	0.0	6.9	1.5	0.0	8.4	11.1	23.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	24.6	9.2	87	38	0.0	7.8	29.4	8.5	4.8	41.7	9.0	5.1	0.0	0.0	0.0	0.0	0.0	0.0
8	27.5	12.1	90	43	0.0	8.4	16.7	14.5	12.2	29.5	3.1	5.2	0.0	0.0	3.4	1.5	0.0	1.3
9	26.8	13.7	88	43	2.8	8.1	1.3	4.3	6.7	9.0	0.0	0.0	0.0	0.0	7.5	8.2	0.9	2.3
10	28.5	13.6	89	40	0.0	10.3	0.5	8.3	10.3	27.0	0.0	0.0	0.0	0.0	1.5	2.0	8.6	10.7
11	28.2	15.8	87	46	19.2	7.5	0.0	3.3	0.0	0.7	-	-	0.0	0.0	0.0	0.0	0.0	9.8
12	25.5	14.7	88	53	33.0	6.8	0.0	0.0	0.0	0.0	-	-	-	-	-	0.0	0.0	0.0
13	26.5	15.7	87	49	10.4	7.4	0.0	0.0	0.0	0.0	-	-	-	-	-	--	--	0.0
14	28.0	14.4	81	41	14.6	10.4	0.0	0.0	0.0	0.0	-	-	-	-	-	--	--	0.0

*** SMW: Standard Meteorological Week; MA: Mustard aphid, CA: Cabbage aphid**

Table 5.3.4(B): Population dynamics of mustard aphid, cabbage aphid and cabbage caterpillar on *Brassicas* at Ludhiana (late sown)

SMW*	Weather Parameters						No of aphids/ top 10 cm central twig								Cabbage caterpillars/ plant			
	Temp. (^{0}C)		R.H. (%)		Rainfall (mm)	Sunshine (hrs)	GSC 6		DRMR-IJ 31		BSH 1		T27		GSC 6	DRMR-IJ 31	BSH 1	T27
	Max.	Min.	M	E			MA	CA	MA	CA	MA	CA	MA	CA				
52	15.6	6.6	95	67	0.6	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	13.3	5.5	93	70	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	14.8	7.9	95	72	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	18.1	4.3	89	37	0.0	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	19.4	7.6	90	56	18.1	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	20.3	8.6	93	57	14.0	6.7	0.0	0.0	18.3	0.0	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	23.0	10.0	87	45	0.0	6.9	11.0	3.5	26.6	34.5	28.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	24.6	9.2	87	38	0.0	7.8	32.0	45.5	29.6	61.8	36.0	66.8	0.0	0.0	0.0	0.0	0.0	0.0
8	27.5	12.1	90	43	0.0	8.4	25.0	76.5	54.1	102.1	10.2	147.6	0.0	0.0	0.7	0.2	0.1	0.0
9	26.8	13.7	88	43	2.8	8.1	39.7	71.4	20.1	140.2	17.2	125.5	0.0	0.0	3.2	2.6	1.4	0.0
10	28.5	13.6	89	40	0.0	10.3	2.2	102.5	9.8	170.3	0.0	76.4	0.0	0.0	10.5	9.6	4.3	0.0
11	28.2	15.8	87	46	19.2	7.5	0.0	36.0	0.0	62.3	0.0	33.5	0.0	0.0	7.3	6.7	2.2	0.0
12	25.5	14.7	88	53	33.0	6.8	0.0	10.7	0.0	31.3	0.0	11.2	0.0	0.0	2.0	1.5	0.0	0.0
13	26.5	15.7	87	49	10.4	7.4	0.0	4.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	28.0	14.4	81	41	14.6	10.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*** SMW: Standard Meteorological Week; MA: Mustard aphid, CA: Cabbage aphid**

Table 5.3.4 (C): Population dynamics of flea beetle and sawfly larvae on *Brassicas* at Ludhiana (Timely sown)

SMW*	Weather Parameters						No of flea beetles/ plant				Sawfly larvae/ plant			
	Temp. (^{0}C)		R.H. (%)		Rainfall (mm)	Sunshine (hrs)	GSC 6	DRMR-IJ 31	BSH 1	T27	GSC 6	DRMR-IJ 31	BSH 1	T27
	Max.	Min.	M	E										
45	28.2	16.7	85	45	0.0	1.6	0.4	0.3	0.2	0.0	0.0	0.2	0.0	0.0
46	25.6	11.5	89	35	0.0	6.8	0.2	0.2	0.3	0.0	0.5	0.4	0.0	0.0
47	26.2	8.7	93	27	0.0	8.7	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0
48	25.1	8.5	94	35	0.0	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	23.8	8.2	93	37	0.0	7.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	23.6	7.9	91	33	0.0	8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
51	17.3	7.5	97	72	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	15.6	6.6	95	67	0.6	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	13.3	5.5	93	70	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	14.8	7.9	95	72	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	18.1	4.3	89	37	0.0	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	19.4	7.6	90	56	18.1	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	20.3	8.6	93	57	14.0	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	23.0	10.0	87	45	0.0	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	24.6	9.2	87	38	0.0	7.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	27.5	12.1	90	43	0.0	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	26.8	13.7	88	43	2.8	8.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	28.5	13.6	89	40	0.0	10.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	28.2	15.8	87	46	19.2	7.5	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
12	25.5	14.7	88	53	33.0	6.8	0.0	0.0	-	-	-	0.0	0.0	0.0
13	26.5	15.7	87	49	10.4	7.4	0.0	0.0	-	-	-	--	--	0.0
14	28.0	14.4	81	41	14.6	10.4	0.0	0.0	-	-	-	--	--	0.0

*** SMW: Standard Meteorological Week; MA: Mustard aphid, CA: Cabbage aphid**

Table 5.3.5: Population dynamic of mustard aphid on *Brassicas* crops at SK Nagar

Std. week	Weather Parameters						Aphids/ top 10 cm central twig									
	Temp. (°C)		RH (%)		Rain fall (mm)	Sun Shine (hrs)	DRMR IJ 31		T 27		GSC 6		BSH 1		GDM-4	
	Max.	Min.	Morn	Even			Timely sown	Late sown	Timely sown	Late sown	Timely sown	Late sown	Timely sown	Late sown	Timely sown	Late sown
50	29.3	9.9	64	49	0.00	-	5.50	-	0.00	-	1.43	-	3.81	-	2.77	-
51	30.1	8.6	68	45	0.00	-	7.90	-	0,00	-	1.03	-	4.00	-	3.60	-
52	26.8	6.6	63	48	0.00	-	11.90	-	0.00	-	3.73	-	7,60	-	6.57	-
1	25.4	5.6	65	41	0.00	-	20.03	13.27	0.00	0.00	10.00	15.63	16,47	12.37	8.80	7.07
2	27.3	8.6	66	41	0.00	-	28.73	19.20	0.00	0.00	30.01	18.23	30.07	28.17	18.47	12.10
3	26.1	4.9	57	42	0.00	-	35.20	37.53	7.03	10.13	55.53	39.93	42.30	41.30	28.90	24.00
4	24.6	8.7	67	43	0.00	-	57.23	183.93	41.90	45.13	84.90	207.50	99.03	218.00	55.70	210.27
5	25.5	9.8	74	47	28.5	-	72.60	374.00	72.60	68.77	76.13	385.53	83.13	394.17	73.80	372.33
6	30.0	11.2	70	38	0.00	-	33.67	274.27	80.37	149.03	38.83	294.53	45.80	309.33	31.77	318.23
7	33.5	11.1	60	33	0.00	-	0.00	112.53	15.13	139.37	0.00	144.20	0.00	147.67	0.00	101.20
8	34.6	13.0	65	47	0.00	-	-	0.00	-	59.03	-	0.00	-	0.00	-	0.00

Table 5.3.6(A): Population dynamics of mustard sawfly larvae in *Brassicas* at Shillongani

Std. Week	Weather parameters					Sawfly larvae/ plant							
						DRMR IJ 31		T 27		GSC 6		BSH 1	
	Temp. (°C)		RH (%)		Rain fall (mm)	Timely	Late	Timely	Late	Timely	Late	Timely	Late
	Max	Min	Morn	Even									
47	28.9	14.9	88	65	0.0	0	-	0	-	0	-	0	-
48	28.2	14.5	88	63	0.0	0	-	0	-	0	-	0	-
49	28.0	14.2	88	62	0.0	0.20	-	0	-	0	-	0	-
50	27.1	13.8	86	65	0.0	0.45	-	0.30	-	0	-	0.25	-
51	26.4	13.7	87	67	0.0	0.55	0	0.55	0	0.70	0.70	0.60	0.70
52	22.8	12.4	89	74	2.5	1.30	0	0.65	0	1.45	1.45	0.70	1.45
1	24.6	9.9	93	58	0.0	1.05	1.10	1.35	1.35	1.20	1.20	1.45	1.20
2	25.8	10.9	88	55	0.0	1.50	1.55	1.15	1.20	1.65	1.65	1.20	1.65
3	22.3	11.4	93	57	0.0	0.65	0.70	1.55	1.50	0.85	0.80	1.65	0.80
4	25.2	11.1	87	49	0.0	0.25	0	0.75	0.80	0.35	0.40	0.80	0.40
5	26.9	14.6	91	55	0.0	0	0	0	0.25	0.30	1.00	0.40	0.70
6	24.7	14.9	89	59	0.1	0	0	0	0	0.55	0	1.60	1.45
7	26.6	14.6	86	55	0.0	0	0	0	0	0	0	1.25	1.15
8	26.6	16.4	94	69	21.2	0	0	0	0	0	0	0	0
9	28.6	15.9	85	60	0.0	0	0	0	0	0	0	0	0
10	29.9	18.1	88	53	0.0	0	0	0	0	0	0	0	0
11	28.8	17.6	90	60	6.6	0	0	0	0	0	0	0	0
12	24.8	17.6	91	67	42.4	0	0	0	0	0	0	0	0
13	27.8	18.6	85	58	12.6	0	0	0	0	0	0	0	0

Table 5.3.6 (B): Population dynamics of mustard flea beetles in *Brassicas* at Shillongani

Std. Week	Weather parameters					Flea beetles/ plant							
						DRMR IJ 31		T 27		GSC 6		BSH 1	
	Temp. (^{0}C)		RH (%)		Rain fall (mm)	Timely	Late	Timely	Late	Timely	Late	Timely	Late
	Max	Min	Morn	Even									
47	28.9	14.9	88	65	0.0	0	-	0	-	0	-	0	-
48	28.2	14.5	88	63	0.0	0	-	0	-	0	-	0	-
49	28.0	14.2	88	62	0.0	0.5	-	0.7	-	0.8	-	0	-
50	27.1	13.8	86	65	0.0	0.9	-	1.2	-	1.8	-	0.5	-
51	26.4	13.7	87	67	0.0	1.1	0	1.1	0	1.5	0	0.8	0
52	22.8	12.4	89	74	2.5	1.6	0	1.8	0.9	2	1.4	1.6	0
1	24.6	9.9	93	58	0.0	1.3	0	1.6	1.7	1.1	1.1	1.3	1.4
2	25.8	10.9	88	55	0.0	1.8	0	1.8	1.6	0.7	1.6	1.9	1.6
3	22.3	11.4	93	57	0.0	1.1	0.6	1.2	1.8	0.6	0.7	1.1	1.7
4	25.2	11.1	87	49	0.0	0.8	1.3	1.1	1.2	0.9	0.3	0.6	0.8
5	26.9	14.6	91	55	0.0	1.1	1.2	1.8	0.5	0.6	0.3	1.9	1.6
6	24.7	14.9	89	59	0.1	0.4	1.7	1.6	1.8	0.9	1.6	1.1	1.2
7	26.6	14.6	86	55	0.0	0.4	1.4	1.8	2	0.9	0.7	0.6	0.7
8	26.6	16.4	94	69	21.2	0.4	1.9	0.9	1.4	0.6	0.5	0.5	1.6
9	28.6	15.9	85	60	0.0	0	0.9	0	1.1	0.5	0.4	1.8	1.3
10	29.9	18.1	88	53	0.0	0	0	0	0	0	0.3	0.9	1.1
11	28.8	17.6	90	60	6.6	0	0	0	0	0	0	0.3	0.9
12	24.8	17.6	91	67	42.4	0	0	0	0	0	0	0	1.4
13	27.8	18.6	85	58	12.6	0	0	0	0	0	0	0	0

Table 5.3.6(C): Population dynamics of mustard aphid in *Brassicas* at Shillongani

Std. Week	Weather parameters					No of aphids/ top 10 cm central twig							
						DRMR IJ 31		T 27		GSC 6		BSH 1	
	Temp. (^{0}C)		RH (%)		Rain fall (mm)	Timely	Late	Timely	Late	Timely	Late	Timely	Late
	Max	Min	Morn	Even									
47	28.9	14.9	88	65	0.0	0	-	0	-	0	-	0	-
48	28.2	14.5	88	63	0.0	0	-	0	-	0	-	0	-
49	28.0	14.2	88	62	0.0	0	-	0	-	0	-	0	-
50	27.1	13.8	86	65	0.0	0	-	0	-	0	-	0	-
51	26.4	13.7	87	67	0.0	0	0	0	0.98	0	0	0	0
52	22.8	12.4	89	74	2.5	5.45	0.88	0	2.00	0.95	1.90	0.98	0.80
1	24.6	9.9	93	58	0.0	7.38	2.65	0	13.25	6.50	4.73	11.20	8.20
2	25.8	10.9	88	55	0.0	17.65	16.65	0.98	17.90	19.35	20.93	16.88	29.20
3	22.3	11.4	93	57	0.0	29.90	48.73	4.43	44.95	32.30	47.93	40.58	49.33
4	25.2	11.1	87	49	0.0	24.90	58.70	16.08	51.08	24.93	57.83	27.08	56.33
5	26.9	14.6	91	55	0.0	17.05	35.48	35.00	28.35	23.10	38.93	41.73	38.83
6	24.7	14.9	89	59	0.1	10.68	18.10	29.70	17.93	12.85	16.45	25.28	16.95
7	26.6	14.6	86	55	0.0	8.00	26.98	19.30	20.78	15.53	17.35	13.08	17.83
8	26.6	16.4	94	69	21.2	7.08	13.15	15.35	9.43	6.50	11.05	4.78	12.58
9	28.6	15.9	85	60	0.0	3.58	12.13	10.35	6.58	7.38	8.35	5.68	10.83
10	29.9	18.1	88	53	0.0	0.93	8.83	8.23	3.90	2.83	4.68	6.55	4.60
11	28.8	17.6	90	60	6.6	0	1.80	7.63	1.18	1.03	1.98	2.03	2.83
12	24.8	17.6	91	67	42.4	0	1.18	1.73	1.15	0.98	0.95	1.00	1.88
13	27.8	18.6	85	58	12.6	0	0.83	1.03	0	0.13	0.90	0.03	0.83

Table 5.3.6(D): Population dynamics of coccinellids (adults+grubs) in *Brassicas* at Shillongani

Std. Week	Weather parameters					Coccinellids (Adults+Grubs)/ plant							
						DRMR IJ 31		T 27		GSC 6		BSH 1	
	Temp. (^{0}C)		RH (%)		Rain fall (mm)	Timely	Late	Timely	Late	Timely	Late	Timely	Late
	Max	Min	Morn	Even									
47	28.9	14.9	88	65	0.0	0	-	0	-	0	-	0	-
48	28.2	14.5	88	63	0.0	0	-	0	-	0	-	0	-
49	28.0	14.2	88	62	0.0	0	-	0	-	0	-	0	-
50	27.1	13.8	86	65	0.0	0	-	0	-	0	-	0	-
51	26.4	13.7	87	67	0.0	0	0	0	0	0	0	0	0
52	22.8	12.4	89	74	2.5	0	0	0	0	0	0	0	0.9
1	24.6	9.9	93	58	0.0	0.8	1.1	1.1	0	0	0.5	0	1.1
2	25.8	10.9	88	55	0.0	1.9	1.9	1.9	1.6	0.9	0.9	0.9	0.9
3	22.3	11.4	93	57	0.0	1.2	1.6	1.6	1.8	1.1	1.2	1.3	1.2
4	25.2	11.1	87	49	0.0	0.9	0.9	1.1	1.7	1.2	0.7	1.4	2.1
5	26.9	14.6	91	55	0.0	1.1	1.3	1.2	2.1	0.9	1.2	1.1	1.9
6	24.7	14.9	89	59	0.1	0.5	0.8	0.7	1.8	1.2	1.2	1.4	1.6
7	26.6	14.6	86	55	0.0	0.5	0.8	0.7	2.2	1.2	0.7	1.3	1.5
8	26.6	16.4	94	69	21.2	0.6	0.9	0.8	1.4	0.9	0.6	1	1
9	28.6	15.9	85	60	0.0	1.1	1.4	1.3	1.1	0.8	0.6	0.9	1.7
10	29.9	18.1	88	53	0.0	1.2	1.5	1.4	1.4	1.1	1.5	1.2	1.4
11	28.8	17.6	90	60	6.6	1.7	2	1.2	1.2	2.1	1.1	2.1	1.2
12	24.8	17.6	91	67	42.4	0	1.6	0	0.9	1.8	1.5	1.9	0
13	27.8	18.6	85	58	12.6	0	0.3	0	1.7	2.1	0.8	0.9	0.9

Table 5.3.7 (A) Population dynamics of mustard aphid on *Brassicas* crops at Morena

Std. Week	Weather parameters				Rainfall (mm)	Aphid population/ top 10 cm central twig							
						Timely sown				Late sown			
	Temperature (^{o}C)		RH (%)			*B. juncea*	*E. sativa*	*B. napus*	*B. rapa*	*B. juncea*	*E. sativa*	*B. napus*	*B. rapa*
	Max.	Min.	Morn.	Even.		DRMR IJ 31	T 27	GSC 6	BSH 1	DRMR IJ 31	T 27	GSC 6	BSH 1
45	31.2	15.3	79.2	51.8	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	29.0	14.0	60.2	46.7	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47	27.1	10.8	54.1	46.8	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	27.2	9.6	55.7	44.1	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	26.1	9.0	56.5	46.7	-	0.0	1.2	1.0	1.4	0.0	0.0	0.0	1.6
50	27.8	9.5	55.9	48.0	-	1.2	1.0	1.2	2.0	2.8	3.0	2.8	3.4
51	26.2	8.2	56.5	45.5	-	1.4	1.0	1.4	2.4	1.6	1.0	1.6	2.8
52	23.1	7.0	53.7	45.9	-	1.2	1.2	1.4	1.0	1.2	1.8	2.4	0.7
1	17.6	4.5	64.3	46.7	-	2.6	1.2	0.8	2.4	1.8	1.4	1.7	2.4
2	20.2	6.6	71.0	45.7	-	1.0	1.4	1.2	1.6	1.2	2.8	2.7	3..9
3	19.2	5.3	73.2	48.0	-	1.2	1.0	1.9	1.8	1.0	2.8	3.4	2.8
4	21.4	9.9	78.9	64.9	11.5	1.0	1.6	1.4	2.4	1.6	1.6	3.6	2.9
5	21.0	9.9	75.4	51.3	10.0	1.6	1.2	0.6	1.4	1.7	1.9	3..2	2.6
6	27.4	11.3	61.7	52.3	-	2.4	1.9	2.8	2.4	1.8	2.9	2.9	3.0
7	28.5	12.2	59.5	41.8	-	2.6	2.0	3.2	2.6	2.0	2.5	2.6	2.4
8	31.4	14.3	61.4	36.6	-	2.0	2.8	2.4	1.4	2.6	1.6	2.8	2.4
9	32.8	14.6	57.7	38.7	-	1.0	2.4	1.6	2.4	2.4	2.1	2.0	2.0
10	32.9	15.4	58.1	39.1	-	0.8	2.4	3.8	1.6	2.2	3.1	2.6	1.4
11	33.4	15.1	54.6	35.6	-	0.0	0.8	1.0	2.1	1.0	2.0	1.4	2.1

12	33.5	15.3	53.5	35.4	-	0.0	0.2	1.0	0.8	1.0	0.2	1.4	1.6
13	32.6	14.4	53.1	35.6	3.5	0.0	0.2	0.2	0.4	0.8	0.0	1.2	1.2

Note: - Weather data provided by Gramin Mausam Krishi Sewa, ZARS, Morena M.P

Table 5.3.7 (B) Population dynamics of painted bug on *Brassicas* crops at Morena

Std. Week	Weather parameters				Rainfall (mm)	Number of painted bugs/ metre row length (mrl)							
	Temperature (°C)		RH (%)			Timely sown				Late sown			
	Max.	Min.	Morn.	Even.		*B. juncea*	*E. sativa*	*B. napus*	*B. rapa*	*B. juncea*	*E. sativa*	*B. napus*	*B. rapa*
						DRMR IJ 31	T 27	GSC 6	BSH 1	DRMR IJ 31	T 27	GSC 6	BSH 1
45	31.2	15.3	79.2	51.8	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	29.0	14.0	60.2	46.7	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47	27.1	10.8	54.1	46.8	-	0.8	0.4	0.2	0.8	0.8	0.2	0.4	0.8
48	27.2	9.6	55.7	44.1	-	0.2	0.8	1.0	1.0	0.8	1.0	0.8	0.8
49	26.1	9.0	56.5	46.7	-	0.4	0.4	0.6	0.8	1.0	0.8	1.0	1.0
50	27.8	9.5	55.9	48.0	-	0.8	0.0	0.4	1.0	0.6	0.6	0.0	1.0
51	26.2	8.2	56.5	45.5	-	0.0	0.0	1.0	0.8	1.0	0.8	0.0	0.6
52	23.1	7.0	53.7	45.9	-	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0
1	17.6	4.5	64.3	46.7	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	20.2	6.6	71.0	45.7	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	19.2	5.3	73.2	48.0	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	21.4	9.9	78.9	64.9	11.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	21.0	9.9	75.4	51.3	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	27.4	11.3	61.7	52.3	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	28.5	12.2	59.5	41.8	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	31.4	14.3	61.4	36.6	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	32.8	14.6	57.7	38.7	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	32.9	15.4	58.1	39.1	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	33.4	15.1	54.6	35.6	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	33.5	15.3	53.5	35.4	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	32.6	14.4	53.1	35.6	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: - Weather data provided by Gramin Mausam Krishi Sewa, ZARS , Morena M.P

Table 5.3.7 (C): Population dynamic of Coccinellids on *Brassicas* crops at Morena

Std. Week	Weather parameters				Rainfall (mm)	Number of cocinellids (Adults+Grubs)/ plant							
	Temperature (°C)		RH (%)			Timely sown				Late sown			
	Max.	Min.	Morn.	Even.		*B. juncea*	*E. sativa*	*B. napus*	*B. rapa*	*B. juncea*	*E. sativa*	*B. napus*	*B. rapa*
						DRMR IJ 31	T 27	GSC 6	BSH 1	DRMR IJ 31	T 27	GSC 6	BSH 1
45	31.2	15.3	79.2	51.8	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	29.0	14.0	60.2	46.7	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47	27.1	10.8	54.1	46.8	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	27.2	9.6	55.7	44.1	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	26.1	9.0	56.5	46.7	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	27.8	9.5	55.9	48.0	-	0.1	0.1	0.4	0.8	0.1	0.8	1.4	1.2
51	26.2	8.2	56.5	45.5	-	0.6	0.4	1.2	1.0	0.7	1.2	0.6	1.2
52	23.1	7.0	53.7	45.9	-	1.2	1.0	1.0	1.2	1.0	1.2	1.2	1.4
1	17.6	4.5	64.3	46.7	-	1.2	0.2	0.3	1.0	1.8	0.8	1.0	1.6
2	20.2	6.6	71.0	45.7	-	0.0	1.2	0.4	0.2	1.4	1.0	0.1	0.1
3	19.2	5.3	73.2	48.0	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	21.4	9.9	78.9	64.9	11.5	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
5	21.0	9.9	75.4	51.3	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	27.4	11.3	61.7	52.3	-	0.0	0.6	0.6	0.0	0.0	0.0	0.4	0.0
7	28.5	12.2	59.5	41.8	-	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.8
8	31.4	14.3	61.4	36.6	-	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.8
9	32.8	14.6	57.7	38.7	-	0.0	0.0	0.0	0.4	1.2	2.4	3.2	2.8
10	32.9	15.4	58.1	39.1	-	0.0	0.0	0.0	0.4	1.0	1.2	2.8	2.0
11	33.4	15.1	54.6	35.6	-	0.0	0.0	0.0	0.0	2.4	1.6	1.8	1.4
12	33.5	15.3	53.5	35.4	-	0.0	0.0	0.0	0.0	0.8	1.0	0.6	1.0
13	32.6	14.4	53.1	35.6	3.5	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0

Note: - Weather data provided by Gramin Mausam Krishi Sewa, ZARS , Morena M.P

Table 5.3.7 (D): Activity of honey bees on *Brassicas* at Morena

Std. Week	Weather parameters				Rainfall (mm)	Number of honey bee visits/ min/ plant							
	Temperature (°C)		RH (%)			Timely sown				Late sown			
	Max.	Min.	Morn.	Even.		*B. juncea*	*E. sativa*	*B. napus*	*B. rapa*	*B. juncea*	*E. sativa*	*B. napus*	*B. rapa*
						DRMR IJ 31	T 27	GSC 6	BSH 1	DRMR IJ 31	T 27	GSC 6	BSH 1
45	31.2	15.3	79.2	51.8	-	1.4	1.6	2.4	1.4	1.4	1.6	2.6	3.4
46	29.0	14.0	60.2	46.7	-	1.2	2.6	1.5	1.6	1.6	1.2	1.8	2.8
47	27.1	10.8	54.1	46.8	-	2.6	2.1	2.8	1.8	2.4	1.8	1.1	1.2
48	27.2	9.6	55.7	44.1	-	1.2	3.0	1.5	1.0	0.6	2.4	1.0	1.0
49	26.1	9.0	56.5	46.7	-	3.2	2.4	1.9	2.0	2.5	2.5	2.1	1.6
50	27.8	9.5	55.9	48.0	-	2.0	1.4	1.6	1.6	1.1	1.2	1.8	1.1
51	26.2	8.2	56.5	45.5	-	2.6	1.4	1.9	1.3	1.2	1.2	1.2	1.2
52	23.1	7.0	53.7	45.9	-	2.5	2.5	1.6	1.0	3.1	1.2	2.1	1.0
1	17.6	4.5	64.3	46.7	-	2.1	1.5	2.8	1.6	2.4	1.8	1.6	1.3
2	20.2	6.6	71.0	45.7	-	1.0	2.0	2.5	1.2	1.6	2.0	1.4	1.2
3	19.2	5.3	73.2	48.0	-	2.8	1.0	1.8	1.2	2.5	2.1	3.6	1.4
4	21.4	9.9	78.9	64.9	11.5	1.2	2.0	1.0	1.4	1.0	3.2	1.6	1.0
5	21.0	9.9	75.4	51.3	10.0	2.0	0.0	2.7	1.0	1.0	1.0	2.4	1.6
6	27.4	11.3	61.7	52.3	-	2.4	0.0	2.4	1.2	1.8	1.0	2.1	3.2
7	28.5	12.2	59.5	41.8	-	2.8	0.0	1.4	1.5	0.0	2.1	2.1	3.8
8	31.4	14.3	61.4	36.6	-	2.4	0.0	1.4	2.6	0.0	1.0	1.4	0.0
9	32.8	14.6	57.7	38.7	-	1.0	0.0	0.8	0.4	0.0	0.4	1.2	1.6
10	32.9	15.4	58.1	39.1	-	0.4	0.0	0.0	0.4	0.0	0.4	1.0	1.0
11	33.4	15.1	54.6	35.6	-	0.0	0.0	0.0	0.2	0.0	0.1	0.4	0.0
12	33.5	15.3	53.5	35.4	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	32.6	14.4	53.1	35.6	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: - Weather data provided by Gramin Mausam Krishi Sewa , ZARS, Morena M.P

Table 5.3.8: Monitoring of alate mustard aphid on sticky traps

Std. week	Mean mustard aphid (alate) population per trap						
	HSR	SKN	LDH	PTN	KAN	MOR	DHO
40	-	-	0.0	-	-	0.0	0.0
41	-	-	0.0	-	-	0.0	0.0
42	-	-	0.0	-	-	0.0	0.0
43	-	-	1.0	-	0.0	0.0	0.0
44	-	-	91.6	-	0.0	0.0	0.0
45	-	-	71.0	-	0.0	0.0	0.0
46	-	-	26.6	-	0.0	0.0	0.0
47	0.0	-	11.8	-	0.0	3.2	0.0
48	0.0	-	9.4	-	0.0	4.8	0.0
49	0.0	0.0	9.6	-	0.0	6.0	0.0
50	0.0	8.8	7.6	-	0.0	6.4	0.0
51	0.0	17.2	8.8	-	0.0	6.4	0.0
52	3.0	49.8	5.2	-	0.0	10.4	0.0
1	3.8	86.4	2.8	-	0.0	16.2	0.0
2	0.0	123.4	2.8	-	0.0	28.8	10.6
3	0.0	147.4	3.8	8.8	0.0	45.2	12.2
4	0.0	295.8	5.4	49.8	0.0	26.2	14.5
5	0.0	502.6	10.8	66.8	0.0	16.8	19.6
6	7.8	728.8	49.2	84.6	0.0	36.9	22.3
7	16.8	1315.4	62.2	110.0	0.0	142.2	41.5
8	71.5	1545.4	118.6	142.4	0.0	112.2	55.6
9	117.8	320.8	202.8	205.2	3.6	98.5	88.7
10	129.8	157.8	216.2	255.4	4.8	87.4	101.0
11	147.3	95.6	236.2	179.2	0.0	42.2	26.7
12	121.0	20.8	162.2	183.6	0.0	32.2	9.8
13	4.8	-	145.4	-	0.0	6.2	0.0
14	0.0	-	95.0	-	-	0.0	-
15	-	-	4.4	-	-	0.0	-
16	-	-	0.0	-	-	0.0	-
17	-	-	0.0	-	-	0.0	-

Table 5.4.1(A) Effect of host plant diversity on abundance of mustard aphid and the associated specialist and generalist natural enemies at Hisar (Pooled data of three years)

Std. Week	No of aphids / plant						NE: Ladybird beetle (adult + larvae)/plant					
	T1	T2	T3	T4	Mean	CD (p=0.05)	T1	T2	T3	T4	Mean	CD (p=0.05)
4	0.0	0.0	0.0	0.0	**0.0**	NS	0.0	0.0	0.0	0.0	0.0	NS
5	0.2	0.1	0.1	0.1	**0.1**	NS	0.0	0.0	0.0	0.0	0.0	NS
6	1.7	2.0	1.9	1.7	**1.8**	NS	0.1	0.0	0.0	0.0	0.02	NS
7	8.7	8.8	9.5	8.8	**9.0**	1.0	0.2	0.2	0.2	0.3	0.2	NS
8	15.5	15.0	15.9	14.6	**15.3**	NS	0.2	0.7	0.6	0.8	0.6	0.25
9	23.3	22.3	22.4	22.6	**22.7**	NS	0.2	0.6	1.0	0.6	0.6	031
10	34.8	30.3	29.8	29.9	**31.2**	2.1	0.6	0.9	0.4	0.7	0.6	NS
11	38.4	34.0	35.5	35.7	**35.9**	3.1	1.8	2.9	1.8	2.3	2.2	NS
12	29.5	24.6	26.4	27.7	**27.1**	NS	6.1	10.3	7.5	10.7	8.7	2.1
13	29.1	25.3	28.5	32.1	**28.7**	1.5	6.5	11.9	10.0	12.8	10.3	2.3
14	16.6	14.4	14.7	14.6	**15.1**	NS	2.9	4.8	2.9	4.5	3.8	1.4
15	6.0	5.4	6.0	5.9	**5.8**	NS	0.4	0.5	0.5	0.5	0.5	NS
16	1.2	0.3	1.6	1.5	**1.1**	NS	0.1	0.1	0.2	0.2	0.2	NS
Mean	**15.8**	**14.0**	**14.8**	**15.0**			**1.5**	**2.5**	**1.3**	**2.6**		

T1: Mustard alone; T2: Mustard + Fennel; T3: Mustard + Chickpea, T4: Mustard + Coriander

Table 5.4.1(B) Seasonal mean of honey bees, syrphid flies and mummified aphids in mustard with intercrop at Hisar (Pooled data of three years)

Tr. No.	Intercrop combination	Honey bee/minute	Syrphid fly adult/minute	Mummified adults of aphid/5cm axis
1	Mustard alone	5.6	3.5	10.9
2	Mustard + Fennel	10.8	9.5	18.2
3	Mustard + Chickpea	6.6	4.8	13.6
4	Mustard + Coriander	9.2	8.8	15.0
	Mean	**8.0**	**6.7**	**14.4**
	CD (p=0.05)	1.8	0.9	2.1

Table 5.4.1(C) Economics of effect of host plant diversity on abundance of mustard aphid and the associated specialist and generalist natural enemies at Hisar (Pooled data of three years)

Tr. No.	Treatments	Mustard equivalent yield (kg/ha)	Gross return (Rs/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	BCR
1	**2**	**3**	**4**	**5**	**6**	**7**
T_1	Mustard alone	1809.2	89650	31885	57765	2.7
T_2	Mustard + fennel	2378.6	117178	33135	84043	3.4
T_3	Mustard + chickpea	1764.5	86999	33516	53482	2.5
T_4	Mustard + coriander	1911.2	94134	32588	61545	2.8
	CD (p=0.05)	243.1				

MSP/Sale price: Mustard =54.50 Rs /Kg, Gram =52.30 Rs /Kg, Fennel =100.00 Rs /Kg, Coriander =65.00 Rs /Kg

5.4.2(A) Effect of host plant diversity on abundance of mustard aphid at Dholi (Pooled data of three years)

Std. Week	No of aphids /10 cm of inflorescence					
	Mustard alone	Mustard + chickpea	Mustard + coriander	Mustard + fennel	Mean	CD (p=0.05)
51	0.00	0.00	0.00	0.00	0.00	NS
52	13.27	9.48	5.6	6.37	8.68	2.03
1	60.86	18.85	13.7	15.82	27.30	8.21
2	73.74	45.00	33.99	37.31	47.51	10.94
3	89.48	59.95	41.28	46.28	59.24	13.52
4	87.71	72.16	48.80	55.36	66.00	14.7
5	110.71	70.69	53.21	61.19	73.95	16.59
6	130.65	83.12	60.72	68.35	85.71	19.53
7	161.41	91.01	72.12	78.53	100.76	23.58
8	114.21	110.69	85.99	98.83	102.43	19.76
9	88.51	88.49	67.74	80.74	81.37	15.50
10	64.33	60.42	39.51	47.56	52.95	10.80
11	18.18	32.85	22.4	26.08	24.87	4.41
12	18.18	11.49	4.11	6.2	9.99	2.67
13	0.00	0.00	0.00	0.00	0.00	NS
Mean	**68.74**	**50.28**	**36.61**	**41.90**		

Table 5.4.2 (B) Effect of host plant diversity on abundance of specialist and generalist natural enemies (peak population) at Dholi (Pooled data of three years)

Treatments	Mummified aphids (parasitized by *Diaeretiella rapae*)	Lady bird beetles (Adults+Grubs)/ plant	Syrphid fly larvae	Spiders	Others (Rove beetle, dragon flies etc)
Mustard alone	5.76	5.60	5.49	4.70	9.78
Mustard+Chickpea	7.58	7.23	7.15	5.92	14.40
Mustard+Coriander	11.66	11.39	9.59	8.68	23.15
Mustard+Fennel	10.55	9.70	8.86	7.74	19.87

Table 5.4.2 (C). Economics of host plant diversity on abundance of mustard aphid and natural enemies at Dholi (Pooled data of three years)

Treatments	Mustard equivalent yield (kg/ha)	Gross return (Rs/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	BCR
T1 Mustard alone	745.33	37639.16	25182	12457.16	1.49
T2 Mustard+Chickpea	868.33	43850.66	25472	20378.66	1.72
T3 Mustard+Coriander	1018.33	51425.66	25152	27273.66	2.04
T4 Mustard+Fennel	985.33	49759.16	25153	23771.16	1.97
CD (p≤0.05)	153.01				

MSP/Sale price: Mustard =54.50 Rs /Kg, Gram =52.30 Rs /Kg, Fennel =100.00 Rs /Kg, Coriander =65.00 Rs /Kg

Table 5.4.3(A) Effect of host plant diversity on abundance of mustard aphid and the associated specialist and generalist natural enemies at Pantnagar (Pooled data of three years)

Std. Week	No of aphids / plant					Natural enemies (*Coccinella* spp.)					Number of mummified aphids (*Diaeretiella rapae*)/10plants				
	T1	T2	T3	T4	CD (p=0.05)	T1	T2	T3	T4	CD (p=0.05)	T1	T2	T3	T4	CD (p=0.05)
5	9.76	6.11	6.81	7.53	**NS**	0.88	0.88	0.55	1.00	**NS**	0.66	0.11	0.00	0.11	**NS**
6	19.67	12.43	15.33	16.5	**2.50**	1.33	0.77	0.88	1.11	**NS**	2.11	0.55	0.88	1.00	**NS**
7	26.01	19.13	22.27	23.91	**2.73**	2.11	1.11	1.44	1.88	**0.74**	2.77	1.44	2.00	2.00	**NS**
8	33.20	27.16	30.95	30.52	**NS**	1.66	1.88	1.55	2.00	**NS**	4.00	2.77	3.00	3.33	**NS**
9	38.98	29.85	33.93	34.81	**NS**	2.55	2.22	1.66	2.33	**NS**	5.77	4.00	4.55	4.77	**0.57**
10	37.94	27.60	32.72	32.91	**NS**	2.77	2.33	2.00	2.77	**NS**	9.66	7.22	8.00	7.44	**NS**
11	34.30	21.33	26.95	28.62	**NS**	2.11	1.11	1.22	1.88	**NS**	9.33	6.55	7.88	7.66	**NS**
12	30.57	18.43	22.36	26.10	**NS**	1.55	0.88	0.88	1.33	**NS**	10.22	7.11	7.22	8.22	**2.07**
13	22.17	9.35	13.44	16.78	**8.12**	1.22	0.77	0.88	0.88	**NS**	7.44	4.55	5.77	6.11	**1.91**
14	22.68	10.03	12.21	17.88	**1.59**	1.33	0.50	0.83	1.33	**NS**	8.50	4.50	6.00	7.00	**1.81**

T1: Mustard alone, T2: Mustard+Chickpea, T3: Mustard+Coriander, T4: Mustard+Fennel

Table 5.4.3(B) Economics of effect of host plant diversity on abundance of mustard aphid and the associated specialist and generalist natural enemies at Pantnagar (Pooled data of three years)

Tr. No.	Treatments	Mustard equivalent yield (kg/ha)	Gross return (Rs/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	BCR
1	**2**	**3**	**4**	**5**	**6**	**7**
T_1	Mustard alone	1650.17	89934.26	27000	62934.26	3.33
T_2	Mustard + chickpea	865.60	47175.20	28100	19075.20	1.68
T_3	Mustard + coriander	814.66	44398.97	27800	16598.97	1.60
T_4	Mustard + Fennel	1673.30	91194.85	27500	63694.85	3.32
	C.D. at 5%	**488.56**				

MSP: Mustard = Rs 54.50/Kg, Gram =52.30 Rs /Kg

Fennel =120.00 Rs /Kg, Coriander =100.18 Rs /Kg

$$\text{Mustard equivalent yield} = \text{Mustard seed yield (kg/ha)} + \frac{\text{(seed yield of intercrop (kg/ha)} \times \text{(Price of intercrop (Rs/kg))}}{\text{Price of Mustard (Rs/kg)}}$$

Table 5.4.4(A): Effect of host plant diversity on abundance of mustard aphid at Ludhiana (Pooled data of three years)

Std. Week	Mustard aphid (no/plant)					Cabbage aphid (no/ plant)					Cabbage caterpillar (no of larvae/plant)				
	T1	T2	T3	T4	CD (p=0.05)	T1	T2	T3	T4	CD (p=0.05)	T1	T2	T3	T4	CD (p=0.05)
1	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-
2	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-
3	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-
4	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-
5	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-
6	27.4	14.7	9.0	10.1	**17.9**	9.2	7.1	8.5	7.0	**0.8**	0.0	0.0	0.0	0.0	-
7	42.4	25.1	24.9	15.0	**5.9**	16.4	12.6	11.8	7.5	**5.2**	0.0	0.0	0.0	0.0	-
8	66.3	46.2	33.4	20.9	**15.7**	39.2	34.7	23.0	9.5	**10.4**	51.8	35.3	23.9	4.7	**1.4**
9	109.6	44.2	37.7	15.0	**25.6**	102.6	60.2	46.0	21.1	**50.1**	53.0	36.1	28.7	13.0	**3.1**
10	89.5	58.8	49.1	18.2	**19.9**	105.7	83.1	81.8	21.4	**33.0**	39.7	34.5	20.6	11.9	**14.2**
11	35.6	24.6	19.0	7.1	**14.6**	121.5	77.7	77.5	22.4	**35.3**	15.2	7.0	7.6	1.6	**7.6**
12	18.7	8.1	12.5	2.0	**14.7**	73.9	55.1	50.6	12.9	**32.9**	0.0	0.0	0.0	0.0	-
13	1.9	0.6	3.4	0.0	**NS**	32.5	15.4	14.1	3.4	**9.0**	0.0	0.0	0.0	0.0	-
Overall mean	**48.9**	**27.9**	**23.4**	**11.3**	**17.4**	**62.6**	**43.2**	**39.2**	**13.1**	**14.7**	**39.9**	**28.2**	**20.2**	**7.8**	**4.7**

T1: Mustard alone, T2: Mustard+fennel, T3: Mustard+chickpea, T4: Mustard+coriander

Table 5.4.4(B) Comparative mean population of different natural enemies in different treatments (2022-23)

Tr. No.	Treatments	Coccinellid adults/ plant	Coccinellid grubs/ plant	Syrphid fly larvae/ plant	Chrysoperla larvae/ plant
1	**2**	**3**	**4**	**5**	**6**
T_1	Mustard alone	1.3	0.2	1.1	1.0
T_2	Mustard + fennel	1.6	0.3	0.8	0.6
T_3	Mustard + chickpea	1.7	0.2	1.1	0.8
T_4	Mustard + coriander	1.5	0.3	1.1	1.1
	C.D. (p=0.05)	**NS**	NS	NS	0.34

Table 5.4.4(C) Economics of effect of host plant diversity on abundance of mustard aphid and the associated specialist and generalist natural enemies at Ludhiana (Pooled data of three years)

Tr. No.	Treatments	Mustard equivalent yield (kg/ha)	Gross return (Rs/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	BCR
1	**2**	**3**	**4**	**5**	**6**	**7**
T_1	Mustard alone	1450.5	73258.1	30166.7	43091.4	2.4
T_2	Mustard + fennel	2870.6	144631.0	30666.7	113964.3	4.7
T_3	Mustard + chickpea	3406.6	171973.6	32166.7	139806.9	5.3
T_4	Mustard + coriander	2451.4	123772.4	31916.7	91855.7	3.9
	C.D. (p=0.05)	**130.5**				

MSP: Mustard = Rs 54.50/Kg, Gram =52.30 Rs /Kg

Fennel =100.00 Rs /Kg, Coriander =65.00 Rs /Kg

Mustard equivalent yield = Mustard seed yield (kg/ha) + $\frac{\text{seed yield of intercrop (kg/ha)} \times \text{(Price of intercrop (Rs/kg))}}{\text{Price of Mustard (Rs/kg)}}$

Table 5.4.5 (A) Effect of host plant diversity on abundance of mustard aphid and the associated specialist and generalist natural enemies at SK Nagar (Pooled data of three years)

Std. Week	Aphids/10cm top twig of *Brassica*				
	Mustard alone	**Mustard+chickpea**	**Mustard+coriander**	**Mustard+fennel**	**CD (p≤0.05)**
50	0.0	0.0	0.0	0.0	-
51	0.0	0.0	0.0	0.0	-
52	0.0	0.0	0.0	0.0	-
1	12.0	11.3	11.1	12.8	NS
2	16.9	18.5	14.7	13.9	NS
3	18.9	21.8	17.9	16.8	NS
4	258.3	254.2	261.3	259.9	NS
5	415.00	382.6	395.7	382.3	NS
6	363.0	363.0	363.2	360.2	NS
7	214.6	219.2	211.3	221.0	NS
8	39.9	50.3	41.1	50.8	NS
9	17.2	25.4	22.7	21.1	NS
10	0.0	0.0	0.0	0.0	-
11	0.0	0.0	0.0	0.0	-
12	0.0	0.0	0.0	0.0	-
13	0.0	0.0	0.0	0.0	-

Table 5.4.5 (B) Economics of effect of host plant diversity on abundance of mustard aphid and the associated specialist and generalist natural enemies at SK Nagar (Pooled data of thee years)

Tr. No.	**Treatments**	**Mustard equivalent yield (kg/ha)**	**Gross return (Rs/ha)**	**Cost of cultivation (Rs/ha)**	**Net return (Rs/ha)**	**BCR**
1	**2**	**3**	**4**	**5**	**6**	**7**
T_1	Mustard alone	1102.2	60071.0	29611.0	30460.0	1.45
T_2	Mustard + fennel	1188.4	64770.0	30837.0	33933.0	1.49
T_3	Mustard + chickpea	1125.1	61318.0	29858.0	31460.0	1.65
T_4	Mustard + coriander	1100.3	59968.0	30944.0	29024.0	2.12
CD (p=0.05)		**269.05**				

Price: Mustard =54.50 Rs /Kg, Gram =52.30 Rs /Kg
Fennel =100.00 Rs /Kg, Coriander =65.00 Rs /Kg

$$\text{Mustard equivalent yield} = \text{Mustard seed yield (kg/ha)} + \frac{\text{(seed yield of intercrop (kg/ha)} \times \text{(Price of intercrop (Rs/kg))}}{\text{Price of Mustard (Rs/kg)}}$$

Table 5.4.6 Effect of plant diversity on abundance of mustard aphid and the associated specialist and generalist natural enemies at Shillongani (Pooled data of three years)

Treatments	**Mean aphid population (no/plant)**		**Mean no. of cocinella (G+A)/plant**		**Yield (kg/ha)**
	Flowering Stage	**Siliqua formation Stage**	**Flowering Stage**	**Siliqua formation Stage**	
T1 (Mustard alone)	68.72	51.39	1.73	1.58	586.89
T2 (Mustard + chickpea)	41.87	29.68	2.21	2.00	660.44.33+ (156.00 Chickpea)
T3 (Mustard + coriander)	25.08	15.98	2.52	2.22	702.11+ (171.77 corrinder)
T4 (Mustard + fennel)	38.84	25.77	2.73	2.01	677.44+ (172.89 fennel)
Sem(±)	1.18	0.90	-	-	16.10
CD (5%)	**2.44**	**1.80**	**NS**	**NS**	**36.54**

Table 5.4.7 Economics of intercropping different crops with mustard at Shillongani (Pooled data of three years)

Sr. No.	Treatments	Yield (kg/ha)	Gross return (Rs/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	BCR
T_1	Mustard alone	586.89	29637.95	11000	18637.95	1.69
T_2	Mustard + chickpea	660.44+(156.00 Chickpea)	41308.39	15000	26308.39	1.75
T_3	Mustard + coriander	702.11+(171.77coriander)	46622.10	15000	31622.1	2.10
T_4	Mustard + fennel	677.44+(172.89 fennel)	51499.89	15000	36499.89	2.43
	CD (p=0.05)	16.10				

MSP/Sale price: Mustard =54.50 Rs /Kg, Gram =52.30 Rs /Kg, Fennel =100.00 Rs /Kg, Coriander =65.00 Rs /Kg

Table 5.5.1. Biochemical components in mustard genotypes in relation to aphid infestation (Hisar)

Sr. No.	Variety	Biochemical parameters							Yield (kg/ha)
		No of aphids/ top 10 cm central twig	Peroxidase (µmole/min/mg protein)	Myrosinase (U/g)	Total glucosinolates (µmole/g)	Total phenols* (%)	Ortho-dihydroxy phenols (mg/g)	Flavonols (mg/g)	
1	DRMRIJ 31 **(Uninfested)**	2.3	0.41	3.92	53.4	3.8 (11.15)	0.63	0.82	2489.4
2	GSL 1 **(Uninfested)**	4.5	0.30	2.19	56.1	4.2 (11.82)	0.59	0.87	2481.5
3	PM 30 **(Uninfested)**	4.1	0.47	1.28	55.5	5.1 (13.03)	0.71	0.75	2531.7
4	GSC 6 **(Uninfested)**	3.2	0.37	1.98	16.8	6.8 (15.11)	0.67	1.22	2677.2
	Mean	**3.6**	**0.38**	**2.34**	**45.4**	**5.0**	**0.65**	**0.92**	**2544.9**
1	DRMRIJ 31 **(Infested)**	116.6	0.57	4.93	70.2	4.8 (12.70)	0.90	0.99	1875.7
2	GSL 1 **(Infested)**	134.5	0.42	2.90	78.2	5.8 (13.96)	0.74	1.11	1949.7
3	PM 30 **(Infested)**	119.0	0.62	1.88	71.1	6.8 (15.12)	1.09	0.88	2119.0
4	GSC 6 **(Infested)**	132.1	0.49	2.89	21.7	9.4 (17.80)	1.08	1.53	2193.1
	Mean	**125.5**	**0.53**	**3.15**	**60.3**	**6.7**	**0.95**	**1.12**	**2034.3**
	CD (p=0.05)	13.02	0.02	0.58	5.29	1.53	0.19	0.22	346.5
	Increase/Decrease (%) over uninfested								
1	DRMR IJ 31	-	**+39.0**	+25.7	**+31.4**	+26.3	+42.8	+20.7	-24.7
2	GSL 1	-	**+40.0**	+32.4	**+39.4**	+38.1	+25.4	+27.5	-21.4
3	PM 30	-	+31.9	**+46.8**	+28.1	+33.3	+53.5	+17.3	-16.3
4	GSC 6	-	+32.4	**+45.9**	+29.1	+38.2	+41.0	+25.4	-18.1

*Figures in parenthesis is angular transformed values in total phenols

Table 5.5.2. Biochemical components in mustard genotypes in relation to aphid infestation (Ludhiana)

Sr. No.	Variety	Biochemical parameters							Yield (kg/ha)
		No of aphids/ top 10 cm central twig	Peroxidase (ΔA/min/mg protein)	Myrosinase (U/g)	Total glucosinolates (µmole/g DW)	Total phenols (mg/g DW)	Ortho-dihydroxy phenols (mg/g DW)	Flavonols (mg/g DW)	
1	DRMRIJ 31 **(Uninfested)**	1.3	0.27	0.69	27.75	8.43	0.32	4.06	1822.22
2	GSL 1 **(Uninfested)**	1.4	0.28	0.36	28.50	10.47	0.37	4.90	1661.11
3	PM 30 **(Uninfested)**	1.9	0.26	0.99	27.46	7.35	0.30	5.61	1872.22
4	GSC 6 **(Uninfested)**	1.6	0.21	0.86	13.15	7.62	0.31	4.78	1516.67
	Mean	**1.5**	**0.26**	**0.73**	**24.21**	**8.47**	**0.33**	**4.84**	**1718.06**
1	DRMRIJ 31 **(Infested)**	145.1	0.30	1.72	25.10	10.67	0.43	5.30	1536.11
2	GSL 1 **(Infested)**	168.4	0.51	0.87	29.90	11.95	0.50	5.93	1263.89
3	PM 30 **(Infested)**	145.2	0.55	1.85	21.18	10.11	0.42	4.89	1408.33
4	GSC 6 **(Infested)**	161.3	0.79	1.97	12.25	9.87	0.40	4.92	1188.89
	Mean	**155.0**	**0.54**	**1.60**	**22.11**	**10.62**	**0.44**	**5.26**	**1349.31**
	CD (p=0.05)								
	Genotypes	6.8	0.07	0.46	1.27	0.89	0.05	NS	45.81
	Infestation	4.8	0.05	8.32	0.9	0.62	0.03	NS	32.39
	G x I	9.7	0.10	NS	1.8	NS	NS	NS	64.78
	Increase/Decrease (%) over uninfested								
1	DRMR IJ 31	-	+11.22	**+150.10**	-9.52	+26.60	+34.41	**+30.73**	-15.70
2	GSL 1	-	**+86.45**	**+138.58**	+4.90	+14.11	+35.37	**+20.96**	-23.91
3	PM 30	-	+110.54	+86.54	**-22.84**	**+37.57**	+39.72	-12.86	-24.77
4	GSC 6	-	**+269.92**	**+129.74**	-6.83	**+29.47**	+28.51	+2.99	-21.61

Table 5.5.3 Biochemical components in mustard genotypes in relation to aphid infestation (Pantnagar)

Sr. No.	Variety	Biochemical parameters						
		No of aphids/ top 10 cm central twig	Peroxidase (µmole/min/mg protein)	Myrosinase (U/g)	Total glucosinolates (µmole/g)	Total phenols* (mg/g)	Ortho-dihydroxy phenols (mg/g)	Flavonols (mg/g)
1	DRMRIJ 31 **(Uninfested)**	1.06	0.41	4.09	57.33	4.69	0.51	0.74
2	GSL 1 **(Uninfested)**	0.98	0.30	2.27	51.43	4.48	0.47	0.82
3	PM 30 **(Uninfested)**	2.10	0.47	1.38	66.18	4.37	0.58	0.78
4	**GSC 6 (Uninfested)**	1.90	0.37	2.16	20.56	5.71	0.65	0.97
	Mean	**1.51**	**0.38**	**2.47**	**48.87**	**4.81**	**0.55**	**0.82**
1	DRMRIJ 31 **(Infested)**	65.67	0.63	4.97	71.83	6.25	0.73	0.86
2	GSL 1 **(Infested)**	53.16	0.54	3.12	76.57	6.38	0.62	0.95
3	PM 30 **(Infested)**	80.81	0.78	2.15	76.37	6.47	0.84	0.89
4	GSC 6 **(Infested)**	97.26	0.56	3.07	24.81	8.12	0.86	1.16
	Mean	**74.22**	**0.62**	**3.32**	**62.39**	**6.80**	**0.76**	**0.96**
	CD (p=0.05)	8.78	0.014	0.045	4.37	0.011	0.018	0.021
	Increase/Decrease (%) over uninfested							
1	DRMR IJ 31	-	21.15	21.51	**25.29**	33.26	43.13	16.21
2	GSL 1	-	31.70	37.44	**48.88**	42.41	31.91	15.85
3	PM 30	-	25.80	**55.79**	15.39	48.05	44.82	14.10
4	GSC 6	-	16.66	**42.32**	20.67	42.20	32.30	19.58

Plant Physiology

6. Plant Physiology

6.1: Screening of genotypes from different agro-climatic zones for high-temperature tolerance at seedling stage.

Twenty-six genotypes of Indian mustard (*Brassica juncea*) were evaluated for high-temperature tolerance at seedlings stage in laboratory and field conditions at Bharatpur, Hisar and Ludhiana centres. Higher seedling mortality indicated more susceptibility of the genotypes to high temperature and vice-versa.

For laboratory experiment, a set of 26 genotypes was sown in plastic trays filled with 5 kg of soil at optimum moisture conditions and kept in the seed germinator at 25°C ± 1°C. After 4-5 days (when seedlings had about 2.5 cm height), the seedlings were exposed to high temperatures (45°C ± 1°C) with 30-40 % relative humidity for four hours daily for 4 days. Seedling mortality and dry weight of 10 seedlings were recorded at Hisar and Ludhiana (Table 6.1.1). Only one genotype DRMRCI 125 registered seedling mortality ≤20% at Hisar while none of the genotypes at Ludhiana. All the test genotypes at Hisar had dry weight/10 seedlings ≥35 mg under laboratory conditions except JD6. The highest dry matter per 10 seedlings was 63.3 mg in Kranti and ORM 2019-25 followed by 58.4 mg in DRMRCI 145 and PM 25. Dry matter was ≥35 mg in all the genotypes at Ludhiana, maximum in Kranti (57.5 mg) trailed by PM 25 (57.2 mg) and DRMRCI 167 (55.4 mg). Seedling mortality ≤20% and dry weight/10 seedlings ≥35 mg rated genotypes tolerant under controlled conditions. None of the genotypes was found tolerant to high-temperature at seedling stage under laboratory conditions.

The same set of genotypes was field planted at Bharatpur and Ludhiana. The 100-counted seeds of each genotype were sown in 2 m row length. After 30 days of crop growth, seedling mortality and dry weight of 10 plants were recorded (Table 6.1.2). Sixteen genotypes recorded ≤20% seedling mortality at the two locations. Dry matter of 10 plants was 41.1g in DRMR 20-33 at Ludhiana only. Selection criteria of seedling mortality ≤20% and dry weight/10 plants ≥35g rated none of the genotypes tolerant for high-temperature under field conditions.

6.2 Screening of genotypes for drought tolerance

Twenty-three genotypes of *Brassica juncea* were evaluated for drought tolerance under field conditions at Bharatpur, Dholi, Hisar and Ludhiana centres. The test genotypes were sown in 5 rows with 2.5 m row length at 30 cm row spacing after pre-sowing irrigation. Treatments were replicated 3 times under RBD factorial design. The main treatment consisted of i) two post-sowing irrigations at 35 and 65 DAS (IR) and ii) no post-sowing irrigation (RF). Analysis of variance revealed significant genotypic differences for RWC, SPAD values, photosynthetic pigments, canopy temperature, yield components and seed yield (Table 6.2.1 to 6.2.11).

Moisture stress reduced seed yield by ≤20% only in one genotype DRMRSJ 276 at three locations(Bharatpur, Dholi and Ludhiana),DRMRCI 162 and RGN 229 at Hisar and Ludhiana,DRMRCI 163 at Bharatpur and Ludhiana while DRMR 2020-3 and DRMRCI163 at Dholi and Ludhiana rating these genotypes highly tolerant to drought. Genotype DRMRCI 161was rated moderately tolerant at all the studied locations with seed yield reduction ≤30%. These genotypes maintained higher SPAD values, chlorophyll content and RWC with a relatively low reduction in total siliquae per plant, seeds/siliqua, 1000 seed weight and YSI ≥0.5. Seed yield reduction was ≤20% in RH725 (check) at Dholi, Hisar and Ludhiana while RGN 229 only at Hisar and Ludhiana

6.3 Screening of genotypes for high-temperature tolerance at terminal stage

Twenty-seven mustard genotypes were sown in the field at two dates i.e. optimum/normal sowing (NS) in the third week of October and late sown in the last week of November (LS). Genotypes were sown in paired rows in RBD. Late sown (LS) crop faced high-temperature (≥30°C) at the pod filling stage. The per cent reduction was computed under late sown over normal sown.

Environmental differences due to planting dates (NS and LS) significantly influenced canopy temperature, canopy temperature depression, membrane stability and yield attributes *viz.*, number of seeds per siliqua, 1000 seed weight and seed yield. However, environment x genotypes (ExG) interaction effects were non-significant for CT at Hisar and MS at Bharatpur (Table 6.3.1 to 6.3.6).

DRMR 2019-19 and DRMR 2018-19 showed tolerance to terminal heat stress with seed yield reduction ≤20% at 3 locations (Bharatpur, Dholi and Ludhiana) and only two genotypes(JC32 and Radhika) at Bharatpur and Ludhiana. CS 56 at Hisar and Ludhiana; while DRMRCI 166 at Bharatpur and Hisar were also thermo tolerant with yield reduction ≤20% with heat and yield stability indices ≥0.5.Yield reduction was≤ 30% in DRMR2017-27 at all the 4 locations while PM26 (check) at Bharatpur, Dholi and Ludhiana and BPR543-2(check) at Dholi and Ludhiana were rated as moderately tolerant to terminal heat stress.

6.4 Effect PGRs to mitigate drought stress

The foliar application was given at the initiation of flowering and 50% flowering at 3 locations under rainfed conditions. Two foliar sprays of trehalose (Tre) @10 and 20 mM, urea @1 and 2% and potassium nitrate (KNO_3) @1 and 2% were tested to mitigate moisture stress in the rainfed varieties. The local variety of centres *viz.*, DRMR 1165-40 (Bharatpur), RH 725 (Hisar) and PBR97 (Ludhiana) was selected to test the efficacy of growth regulating substances (Table 6.4.1 to 6.4.4).

.Foliar application of trehalose @10mM improved seed yield at Bharatpur and Ludhiana while foliar sprays of potassium nitrate @2% at Hisar. PGRs were effective in improving yield with increased RWC,total siliquae/plant, seeds per siliqua , seed weight and CSI.

6.5: Enhancing productivity of rapeseed mustard through microbes under moisture stress (Physiologists will be associated with AGRONOMY trail for recording data)

Physiological traits (Chlorophyll, SPAD and RWC) and osmoprotectants (Proline and total sugar) increased with the microbial treatments under moisture stress at Ludhiana center (Table 6.5.1 to 6.5.2).

Maximum increase in total Chlorophyll, carotenoids and SPAD with Biophos and Biophos^{+}, RWC with CRIDA MI I, proline with CRIDA MI II and total sugar was recorded with MKS 6 at Ludhiana centre.

6.6: Microbes for mitigating high temperature at terminal stage in mustard

The efficiency of stress adaptive consortium, Pusa Sanjeevni (IARI, New Delhi) and microbial formulation (CSIR-Luck now) were tested under field conditions in three mustard varieties at Bharatpur, Dholi, Hisar and Ludhiana centers (Table 6.6.1 to 6.6.10).

Variation existed in the three varieties for the studied traits with microbial formulation and Pusa Sanjeevni under normal and late-sown conditions.

The RWC and membrane stability improved with both microbial inoculations in normal and late-sown varieties. Chlorophyll content improved with both microbial inoculations in normal

and late-sown varieties at Bharatpur and Ludhiana centers. CT was higher in late-sown inoculated varieties at Hisar and Ludhiana centers. Total siliquae per plant and biomass increased with microbial formulation and Pusa Sanjeevni inoculated 3 varieties at Dholi and Ludhiana centers. Seed yield improved with both the inoculations under normal and late sown varieties at all 4 locations except for PBR 357 and RH725 inoculated with microbial formulation, all the 3 varieties with pusa sanjeevani under late sown condition at Bharatpur centre, Giriraj inoculated with microbial formulation (normal & late sown) and also with pusa sanjeevani only under the normal sown condition at Hisar centre over non-inoculated control.

6.7. Evaluation of germplasm /breeding lines for remobilization efficiency

130 germplasm/breeding lines were evaluated for remobilization efficiency in paired rows in one replication under timely sown conditions. Only six breeding lines (JA245, JT1, NR3350, PM67, DJ33 and IM46) reported efficient uptake or mobilization (Table 6.7.1). Remobilization efficiency was higher in nineteen lines at two locations (Hisar and Ludhiana)

Table 6.1.1: Screening of genotypes from different agro climatic zones for high temperature tolerance under laboratory condition.

Laboratory conditions							
		Seedling mortality (%)			DW/10 seedlings (mg)		
Code	Entries	Hisar	Ludhiana	Avg	Hisar	Ludhiana	Avg
Phy-22-1	DRMRSJ 272	52.9	47.2	50.1	40.6	42.5	41.5
Phy-22-2	DRMR 1167	42.7	39.5	41.1	45.6	40.1	42.8
Phy-22-3	JD-6 (Check)	50.9	44.8	47.9	34.8	38.4	36.6
Phy-22-4	DRMRCI 125	16.7	25.9	21.3	55.8	48.7	52.2
Phy-22-5	DRMRCI 128	33.0	23.6	28.3	39.6	35.8	37.7
Phy-22-6	Kranti	20.6	25.4	23.0	63.3	57.5	60.4
Phy-22-7	DRMRHT 1712	38.1	33.1	35.6	48.6	52.2	50.4
Phy-22-8	DRMRHT 13-13-5-4	37.7	31.7	34.7	58.3	49.8	54.0
Phy-22-9	KMR(E) 21-1	43.1	48.2	45.7	37.3	35.2	36.2
Phy-22-10	DRMR 1188	47.2	38.1	42.7	42.9	52.9	47.9
Phy-22-11	DRMR 19-5	52.6	45.5	49.1	40.6	37.7	39.1
Phy-22-12	ORM2019-25	20.6	30.9	25.8	63.3	46.9	55.1
Phy-22-13	DRMRCI 133	50.2	45.2	47.7	38.0	39.6	38.8
Phy-22-14	DRMRCI 145	20.8	24.0	22.4	58.4	46.3	52.3
Phy-22-15	PM25 (Check)	20.8	25.5	23.2	58.4	57.2	57.8
Phy-22-16	DRMRHT 13-13-5-5	23.7	28.8	26.3	57.6	49.1	53.3
Phy-22-17	DRMR 19-21	53.1	45.3	49.2	44.4	42.8	43.6
Phy-22-18	Pro5111	50.4	45.4	47.9	53.1	48.6	50.8
Phy-22-19	DRMRCI 165	33.3	38.2	35.8	54.2	48.5	51.3
Phy-22-20	DRMRCI 166	27.7	30.5	29.1	45.1	51.8	48.4
Phy-22-21	PRE2018-10	32.7	37.5	35.1	42.9	45.4	44.1
Phy-22-22	DRMR 2019-19	37.8	40.8	39.3	58.1	54.1	56.1
Phy-22-23	DRMR 20-33	33.2	32.1	32.7	42.4	40.6	41.5
Phy-22-24	RH1999-42	54.9	48.2	51.6	49.4	54.2	51.8
Phy-22-25	RMX 9310	50.2	42.6	46.4	50.4	48.5	49.4
Phy-22-26	DRMRCI 167	50.2	46.1	48.2	35.1	55.4	45.2
Mean		38.3	37.1		48.4	46.9	
CD=(p=0.05)		2.7	1.2		2.6	3.8	

Table 6.1.2: Screening of genotypes from different agroclimatic zones for high temperature at seedling stage

Code	Entries	Field conditions													
		Seedling mortality (%)			DW/10 plants (g)			CT (^{0}C)			MS (%)			STI	SSTI
		Bharatpur	Ludhiana	Avg	Bharatpur	Ludhiana	Avg	Bharatpur	Ludhiana	Avg	Bharatpur	Ludhiana	Avg	Ludhiana	
Phy-22-1	DRMRSJ 272	9.7	18.0	13.8	21.6	21.9	21.8	18.8	22.4	20.6	48.3	45.2	46.7	50.6	63.2
Phy-22-2	DRMR 1167	16.0	20.6	18.3	15.4	25.1	20.2	19.2	22.1	20.7	44.0	37.9	40.9	62.9	69.6
Phy-22-3	JD-6 (Check)	19.3	24.7	22.0	17.1	27.5	22.3	17.9	22.4	20.2	56.0	35.8	45.9	83.7	59.8
Phy-22-4	DRMRCI 125	8.0	16.4	12.2	16.1	25.0	20.6	19.6	23.2	21.4	59.2	40.8	50.0	72.4	59.0
Phy-22-5	DRMRCI 128	19.7	21.3	20.5	23.7	26.6	25.1	18.0	21.5	19.8	53.8	35.0	44.4	46.6	55.7
Phy-22-6	Kranti	23.7	28.7	26.2	14.9	17.4	16.2	18.6	22.7	20.7	57.5	34.7	46.1	63.7	54.8
Phy-22-7	DRMRHT 1712	20.3	14.1	17.2	15.2	26.4	20.8	18.5	22.3	20.4	54.2	33.9	44.0	51.9	60.3
Phy-22-8	DRMRHT 13-13-5-4	16.3	24.6	20.5	18.3	27.2	22.8	18.8	22.4	20.6	64.0	27.3	45.7	62.3	55.0
Phy-22-9	KMR(E) 21-1	28.7	14.9	21.8	18.5	33.9	26.2	18.4	21.8	20.1	54.9	28.0	41.4	47.7	56.5
Phy-22-10	DRMR 1188	18.7	17.9	18.3	16.4	33.2	24.8	18.7	22.2	20.5	55.1	22.8	38.9	64.0	63.1
Phy-22-11	DRMR 19-5	22.3	17.9	20.1	12.7	22.3	17.5	18.6	21.3	20.0	63.6	28.9	46.2	56.5	58.3
Phy-22-12	ORM2019-25	26.0	10.3	18.2	19.0	31.4	25.2	18.4	21.6	20.0	47.1	38.7	42.9	41.8	63.4
Phy-22-13	DRMRCI 133	17.7	17.0	17.3	15.1	25.8	20.4	19.4	20.7	20.0	46.8	26.6	36.7	45.9	61.4
Phy-22-14	DRMRCI 145	10.3	29.2	19.8	12.4	27.3	19.8	18.2	21.6	19.9	44.5	40.7	42.6	50.4	55.1
Phy-22-15	PM25 (Check)	14.3	35.2	24.8	18.6	27.6	23.1	18.1	21.8	19.9	56.9	47.9	52.4	61.6	62.9
Phy-22-16	DRMRHT 13-13-5-5	19.3	5.8	12.6	12.3	27.9	20.1	18.1	21.5	19.8	40.2	50.6	45.4	54.0	64.3
Phy-22-17	DRMR 19-21	11.3	39.8	25.6	12.8	19.8	16.3	18.0	20.7	19.3	56.3	49.3	52.8	46.1	49.8
Phy-22-18	Pro5111	32.0	17.3	24.6	10.3	34.8	22.5	17.7	21.7	19.7	46.0	44.6	45.3	67.9	58.0
Phy-22-19	DRMRCI 165	15.7	14.5	15.1	12.3	23.8	18.1	17.5	21.4	19.4	65.6	36.8	51.2	50.2	60.7
Phy-22-20	DRMRCI 166	17.3	29.7	23.5	17.4	23.3	20.3	17.9	22.3	20.1	58.6	35.1	46.9	37.3	53.9
Phy-22-21	PRE2018-10	24.7	19.1	21.9	22.1	27.5	24.8	18.6	21.2	19.9	57.1	41.6	49.3	43.8	59.4
Phy-22-22	DRMR 2019-19	11.3	11.8	11.6	20.3	25.9	23.1	18.1	21.4	19.8	57.7	39.1	48.4	57.8	63.5
Phy-22-23	DRMR 20-33	20.3	33.6	26.9	15.1	41.1	28.1	20.1	22.1	21.1	58.0	32.4	45.2	55.1	50.6
Phy-22-24	RH1999-42	22.3	17.0	19.7	21.0	29.0	25.0	19.1	21.7	20.4	61.3	37.1	49.2	73.9	57.8
Phy-22-25	RMX 9310	25.0	14.0	19.5	18.8	19.7	19.3	18.3	21.6	20.0	42.0	36.1	39.0	52.1	67.7
Phy-22-26	DRMRCI 167	19.7	13.6	16.6	23.3	26.5	24.9	19.0	21.4	20.2	40.0	36.2	38.1	61.6	59.2
Mean		18.8	20.3		17.0	26.8		18.5	21.8		53.4	37.0		56.2	59.3
CD=(p=0.05)		6.3	3.0		6.9	3.7		NS	NS		10.7	4.1		4.0	3.2

Table 6.2.1: Effect of moisture stress on relative water content (RWC) and canopy temperature (CT ^{0}C)

Code	Entries	RWC (%)												CT (^{0}C)	
		Bharatpur			Dholi			Hisar			Ludhiana			Ludhiana	
		IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)	IR	RF
Phy-22-27	DRMR 1167	79.8	73.8	7.5	85.8	67.5	21.2	83.2	70.2	15.7	90.1	86.5	4.0	21.0	22.5
Phy-22-28	DRMR 1188	77.7	73.1	5.9	85.4	69.2	19.0	81.0	72.1	10.9	91.0	90.1	1.0	21.5	24.8
Phy-22-29	JC36	73.7	73.0	0.9	89.4	67.0	25.1	82.0	70.6	13.9	91.5	85.6	6.4	19.6	20.1
Phy-22-30	DRMR1222	78.6	72.4	7.9	94.4	69.1	26.8	82.6	72.9	11.8	91.3	85.5	6.3	20.8	23.5
Phy-22-31	DRMR 19-5	75.2	71.6	4.8	95.4	74.2	22.2	75.4	65.6	13.0	92.5	87.6	5.2	22.9	23.5
Phy-22-32	Kranti	75.4	72.7	3.6	91.0	63.1	30.7	73.5	63.7	13.3	91.0	90.9	0.1	18.0	23.6
Phy-22-33	DRMRCI 148	76.1	75.4	0.9	86.6	68.0	21.5	63.9	54.0	15.5	92.3	86.9	5.8	17.6	23.7
Phy-22-34	DRMRCI 161	77.5	73.8	4.8	94.3	65.6	30.5	82.7	75.2	9.1	93.0	89.8	3.5	16.3	19.8
Phy-22-35	NPJ210	77.0	75.6	1.8	84.7	65.2	23.0	75.9	65.7	13.4	92.9	91.1	1.9	19.4	20.3
Phy-22-36	DRMR 19-21	80.9	73.6	9.0	95.5	62.3	34.8	86.2	76.1	11.7	90.4	87.1	3.7	17.4	20.3
Phy-22-37	DRMR 20-33	77.0	76.7	0.3	87.5	67.8	22.6	86.4	76.2	11.7	91.7	86.5	5.7	16.9	18.5
Phy-22-38	NPJ214	84.8	75.7	10.7	90.3	66.9	25.9	84.4	74.2	12.0	88.2	78.9	10.5	19.3	20.0
Phy-22-39	DRMRCI 162	77.6	76.5	1.4	97.5	68.7	29.5	80.3	72.3	10.0	90.2	86.2	4.4	17.6	19.1
Phy-22-40	DRMRCI 163	76.7	75.7	1.2	99.8	63.7	36.2	75.3	60.4	19.8	90.9	88.5	2.6	16.1	22.4
Phy-22-41	RGN 229 (Check)	76.3	75.8	0.6	97.6	65.4	33.0	79.9	71.3	10.8	90.4	86.7	4.0	19.0	20.9
Phy-22-42	DRMR 2019-7	78.6	73.5	6.5	89.5	63.4	29.2	82.3	71.9	12.6	91.2	85.5	6.2	18.1	19.4
Phy-22-43	DRMR 2019-19	80.7	74.5	7.6	92.1	70.3	23.7	85.7	75.7	11.7	90.4	81.1	10.2	18.3	21.1
Phy-22-44	DRMR 2020-3	77.1	76.6	0.7	89.3	74.2	16.9	74.0	63.4	14.4	86.4	85.3	1.2	16.1	18.1
Phy-22-45	DRMRSJ 276	79.0	72.4	8.4	99.7	72.6	27.2	74.2	64.4	13.2	91.6	90.5	1.2	20.1	21.6
Phy-22-46	DRMRHJ 1117	76.5	71.7	6.3	99.6	63.3	36.5	84.9	75.2	11.4	90.1	86.1	4.5	21.1	21.2
Phy-22-47	RH 725 (Check)	79.1	72.4	8.5	89.9	71.5	20.4	77.1	69.7	9.6	90.9	86.7	4.6	17.4	21.0
Phy-22-48	DRMRCI 128	77.8	73.2	5.9	92.2	67.7	26.6	83.8	71.3	14.9	90.8	84.8	6.6	18.1	20.2
Phy-22-49	DRMRCI 146	77.3	75.3	2.6	97.5	66.1	32.2	81.3	71.4	12.2	92.3	85.1	7.8	18.1	24.7
Mean		77.8	74.1		92.4	67.5		79.8	69.7		90.9	86.7		18.7	21.3
CD (p=0.05)	I	1.0			1.7			0.5			0.9			0.2	
	G	NS			0.5			1.6			3.3			0.7	
	IxG	NS			2.4			2.3			4.7			1.0	

IR=Irrigated RF= Rainfed

Table 6.2.2: Effect of moisture stress on chlorophyll la and chlorophyll b (mg/gFW) at Bharatpur and Ludhiana

Code	Entries	Chl a						Chl b					
		Bharatpur			Ludhiana			Bharatpur			Ludhiana		
		IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)
Phy-22-27	DRMR 1167	0.631	0.625	0.9	1.450	1.274	12.1	0.152	0.145	4.4	0.406	0.379	6.5
Phy-22-28	DRMR 1188	0.668	0.627	6.1	1.381	1.299	6.0	0.164	0.130	20.5	0.739	0.306	58.6
Phy-22-29	JC36	0.709	0.670	5.6	1.410	1.304	7.5	0.185	0.152	17.9	0.318	0.297	6.6
Phy-22-30	DRMR1222	0.665	0.648	2.5	1.311	1.045	20.3	0.188	0.180	4.3	0.503	0.244	51.5
Phy-22-31	DRMR 19-5	0.742	0.680	8.4	1.483	1.386	6.6	0.213	0.183	14.1	0.511	0.192	62.4
Phy-22-32	Kranti	0.640	0.635	0.8	1.456	1.250	14.1	0.168	0.163	3.0	0.309	0.302	2.4
Phy-22-33	DRMRCI 148	0.594	0.590	0.7	1.373	1.279	6.8	0.144	0.132	8.4	0.382	0.290	24.0
Phy-22-34	DRMRCI 161	0.664	0.631	5.1	1.420	1.380	2.8	0.206	0.166	19.2	0.368	0.352	4.4
Phy-22-35	NPJ210	0.750	0.647	13.7	1.450	1.029	29.0	0.159	0.146	7.9	0.341	0.311	8.8
Phy-22-36	DRMR 19-21	0.716	0.518	27.7	1.547	1.028	33.5	0.122	0.120	2.1	0.408	0.240	41.2
Phy-22-37	DRMR 20-33	0.801	0.796	0.6	1.680	1.650	1.8	0.187	0.179	4.5	0.560	0.311	44.5
Phy-22-38	NPJ214	0.846	0.707	16.5	1.517	1.370	9.7	0.202	0.194	3.8	0.378	0.337	10.9
Phy-22-39	DRMRCI 162	0.663	0.632	4.7	1.600	1.033	35.4	0.165	0.150	9.4	0.506	0.258	48.9
Phy-22-40	DRMRCI 163	0.788	0.700	11.2	1.548	1.487	4.0	0.171	0.167	2.2	0.491	0.410	16.5
Phy-22-41	RGN 229 (Check)	0.889	0.800	10.1	1.567	1.335	14.8	0.215	0.209	3.0	0.543	0.281	48.2
Phy-22-42	DRMR 2019-7	0.657	0.647	1.6	1.641	1.335	18.7	0.201	0.195	3.2	0.392	0.283	27.8
Phy-22-43	DRMR 2019-19	0.755	0.664	12.0	1.739	1.353	22.2	0.166	0.150	9.6	0.333	0.237	28.8
Phy-22-44	DRMR 2020-3	0.644	0.614	4.7	1.727	1.390	19.5	0.159	0.153	3.3	0.419	0.377	10.1
Phy-22-45	DRMRSJ 276	0.688	0.649	5.7	1.783	1.371	23.1	0.256	0.146	43.0	0.473	0.278	41.2
Phy-22-46	DRMRHJ 1117	0.633	0.561	11.4	1.762	1.519	13.8	0.167	0.166	0.2	0.425	0.265	37.7
Phy-22-47	RH 725 (Check)	0.644	0.627	2.7	1.817	1.264	30.4	0.168	0.148	11.6	0.354	0.249	29.6
Phy-22-48	DRMRCI 128	0.772	0.679	12.1	1.767	1.316	25.5	0.173	0.158	8.5	0.350	0.330	5.8
Phy-22-49	DRMRCI 146	0.678	0.629	7.2	1.911	1.124	41.2	0.172	0.143	16.9	0.443	0.343	22.6
Mean		0.706	0.651		1.580	1.297		0.178	0.160		0.433	0.299	
CD (p=0.05)	I	0.048			0.078			0.015			0.028		
	G	NS			0.271			0.049			0.095		
	IxG	NS			NS			NS			0.135		

IR=Irrigated RF= Rainfed

Table 6.2.3: Effect of moisture stress on total chlorophyll at 4 centers

Code	Entries	Total chlorophyll (mg/g FW)											
		Bharatpur			Dholi			Hisar			Ludhiana		
		IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)
Phy-22-27	DRMR 1167	0.78	0.77	1.6	2.52	2.09	17.0	1.75	1.21	31.21	1.83	1.63	10.9
Phy-22-28	DRMR 1188	0.83	0.76	8.9	2.93	2.56	12.5	1.97	1.81	8.37	1.99	1.69	15.3
Phy-22-29	JC36	0.89	0.82	8.2	2.35	2.09	10.9	2.81	1.74	38.17	1.85	1.60	13.7
Phy-22-30	DRMR1222	0.85	0.83	2.9	2.57	1.98	22.8	2.68	1.83	31.78	1.65	1.29	22.0
Phy-22-31	DRMR 19-5	0.95	0.86	9.7	2.70	2.43	9.9	2.63	2.35	10.32	1.90	1.56	17.9
Phy-22-32	Kranti	0.81	0.80	1.3	1.40	1.19	14.9	2.47	2.18	11.77	1.73	1.56	9.8
Phy-22-33	DRMRCI 148	0.74	0.72	2.2	1.24	1.03	16.6	2.17	2.00	7.99	1.57	1.50	4.1
Phy-22-34	DRMRCI 161	0.87	0.80	8.4	1.44	1.28	10.7	2.30	2.05	10.98	1.79	1.55	13.5
Phy-22-35	NPJ210	0.91	0.79	12.7	1.17	1.03	11.7	2.44	1.74	28.68	1.56	1.34	14.2
Phy-22-36	DRMR 19-21	0.84	0.64	24.0	2.62	2.32	11.4	2.12	1.82	14.09	1.63	1.27	22.4
Phy-22-37	DRMR 20-33	0.99	0.97	1.4	2.49	2.15	13.8	2.34	2.14	8.47	2.24	1.59	28.9
Phy-22-38	NPJ214	1.05	0.90	14.1	2.95	2.62	11.1	2.69	2.09	22.31	1.71	1.57	7.8
Phy-22-39	DRMRCI 162	0.83	0.78	5.6	1.27	1.07	16.3	2.47	2.12	14.26	1.78	1.29	27.3
Phy-22-40	DRMRCI 163	0.96	0.87	9.6	2.54	2.20	13.7	2.10	1.94	7.29	1.98	1.64	17.2
Phy-22-41	RGN 229 (Check)	1.10	1.01	8.7	1.30	1.16	10.3	1.71	1.39	18.80	1.63	1.62	0.6
Phy-22-42	DRMR 2019-7	0.86	0.84	1.9	2.34	1.96	16.1	2.86	2.59	9.30	1.68	1.62	3.6
Phy-22-43	DRMR 2019-19	0.92	0.81	11.6	2.59	2.37	8.5	2.07	1.41	31.90	1.59	1.58	0.6
Phy-22-44	DRMR 2020-3	0.80	0.77	4.4	2.83	2.62	7.1	2.70	2.31	14.63	1.77	1.62	8.5
Phy-22-45	DRMRSJ 276	0.94	0.80	15.8	2.63	2.39	9.0	1.93	1.34	30.63	1.82	1.65	9.3
Phy-22-46	DRMRHJ 1117	0.80	0.73	9.1	1.38	1.21	11.9	2.39	1.89	20.96	1.94	1.55	20.1
Phy-22-47	RH 725 (Check)	0.81	0.78	4.6	2.72	2.40	11.8	2.43	2.20	9.37	1.56	1.51	3.2
Phy-22-48	DRMRCI 128	0.94	0.84	11.4	1.28	1.09	14.3	3.18	2.78	12.52	1.65	1.44	12.7
Phy-22-49	DRMRCI 146	0.85	0.77	9.2	1.42	1.17	17.1	2.67	2.41	9.97	1.92	1.47	23.5
Mean		0.88	0.81		1.42	1.17		2.39	1.97		1.77	1.53	
CD (p=0.05)	I	0.06			0.02			0.06			NS		
	G	NS			0.01			0.21			0.16		
	IxG	NS			0.03			0.29			0.22		

IR=Irrigated RF= Rainfed

Table 6.2.4: Effect of moisture stress on SPAD and carotenoids at 2 locations

Code	Entries	SPAD						Carotenoids (mg/gF.W.)					
		Hisar			Ludhiana			Bharatpur			Ludhiana		
		IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)
Phy-22-27	DRMR 1167	39.1	33.4	14.6	58.7	39.2	33.2	0.037	0.033	10.5	0.439	0.378	13.9
Phy-22-28	DRMR 1188	40.1	34.0	15.1	51.6	46.5	9.8	0.036	0.033	8.7	0.439	0.438	0.4
Phy-22-29	JC36	33.4	28.2	15.6	53.4	45.5	14.9	0.040	0.039	3.9	0.469	0.402	14.3
Phy-22-30	DRMR1222	34.8	31.4	9.8	49.9	44.8	10.2	0.034	0.032	4.9	0.423	0.332	21.5
Phy-22-31	DRMR 19-5	50.9	34.6	32.0	55.7	46.5	16.6	0.041	0.039	2.9	0.441	0.407	7.7
Phy-22-32	Kranti	43.6	32.2	26.2	48.1	46.6	3.2	0.035	0.034	2.4	0.495	0.369	25.5
Phy-22-33	DRMRCI 148	30.2	27.2	10.0	51.2	47.8	6.6	0.030	0.027	11.0	0.394	0.360	8.7
Phy-22-34	DRMRCI 161	36.2	31.2	13.7	56.5	52.8	6.6	0.036	0.034	7.0	0.431	0.422	2.1
Phy-22-35	NPJ210	38.5	32.5	15.6	50.6	39.3	22.2	0.040	0.033	16.3	0.441	0.289	34.4
Phy-22-36	DRMR 19-21	39.1	35.7	8.7	44.6	41.5	7.0	0.027	0.022	20.0	0.423	0.293	30.8
Phy-22-37	DRMR 20-33	38.2	27.8	27.4	47.0	45.8	2.5	0.051	0.048	4.7	0.555	0.425	23.4
Phy-22-38	NPJ214	46.2	30.9	33.2	48.5	46.7	3.9	0.042	0.041	3.7	0.431	0.410	4.9
Phy-22-39	DRMRCI 162	41.1	33.4	18.6	44.5	44.1	0.9	0.035	0.033	4.0	0.448	0.320	28.7
Phy-22-40	DRMRCI 163	43.3	40.0	7.6	41.9	38.6	8.0	0.045	0.041	8.0	0.467	0.445	4.8
Phy-22-41	RGN 229 (Check)	48.3	40.0	17.2	57.8	57.3	0.7	0.059	0.054	8.8	0.394	0.376	4.8
Phy-22-42	DRMR 2019-7	42.8	39.0	8.8	52.5	51.5	2.0	0.035	0.033	5.4	0.460	0.361	21.5
Phy-22-43	DRMR 2019-19	39.5	34.4	12.8	49.1	43.1	12.3	0.036	0.036	0.7	0.444	0.400	9.9
Phy-22-44	DRMR 2020-3	40.5	33.0	18.5	51.3	46.7	8.9	0.034	0.033	3.7	0.420	0.391	6.8
Phy-22-45	DRMRSJ 276	44.1	36.0	18.3	44.2	41.8	5.5	0.033	0.031	7.9	0.470	0.382	18.8
Phy-22-46	DRMRHJ 1117	37.6	26.1	30.5	46.9	42.6	9.3	0.029	0.028	2.5	0.489	0.461	5.7
Phy-22-47	RH 725 (Check)	38.6	35.9	7.0	52.3	48.1	8.1	0.032	0.030	3.8	0.423	0.383	9.5
Phy-22-48	DRMRCI 128	46.4	37.4	19.4	47.9	46.2	3.6	0.041	0.035	15.9	0.381	0.360	5.5
Phy-22-49	DRMRCI 146	47.8	41.3	13.5	47.0	44.0	6.4	0.037	0.032	12.7	0.540	0.380	29.6
Mean		40.8	33.7		50.0	45.5		0.038	0.035		0.449	0.382	
CD (p=0.05)	I	1.2			NS			NS			0.011		
	G	4.0			1.7			NS			0.039		
	IxG	5.6			2.4			NS			0.055		

IR=Irrigated RF= Rainfed

Table 6.2.5: Effect of moisture stress on siliquae on main shoot (SMS) at 4 locations

Code	Entries	Siliquae on main shoot											
		Bharatpur			Dholi			Hisar			Ludhiana		
		IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)
Phy-22-27	DRMR 1167	53.8	49.4	8.1	30.4	25.8	15.0	52.9	41.9	20.7	41.7	33.8	19.0
Phy-22-28	DRMR 1188	47.0	42.1	10.4	32.4	25.6	21.1	47.0	44.1	6.2	42.6	34.8	18.3
Phy-22-29	JC36	52.7	45.8	13.0	35.9	24.3	32.4	46.7	41.0	12.3	38.9	38.7	0.5
Phy-22-30	DRMR1222	50.3	46.0	8.6	36.5	29.9	18.2	54.1	45.9	15.2	43.9	34.2	22.2
Phy-22-31	DRMR 19-5	49.9	46.1	7.5	44.6	37.4	16.2	45.3	41.8	7.8	46.1	39.5	14.3
Phy-22-32	Kranti	46.7	40.7	12.7	28.1	21.6	23.2	55.0	43.8	20.4	42.8	34.4	19.6
Phy-22-33	DRMRCI 148	47.9	40.5	15.4	31.8	26.7	16.1	54.6	44.6	18.5	41.9	34.0	18.8
Phy-22-34	DRMRCI 161	44.4	42.1	5.2	32.8	26.5	19.2	43.8	41.7	4.9	43.3	32.1	25.8
Phy-22-35	NPJ210	51.8	47.1	9.1	32.9	26.6	19.1	49.1	43.1	12.3	40.3	36.2	10.2
Phy-22-36	DRMR 19-21	54.4	47.0	13.7	33.9	27.3	19.4	45.3	39.5	12.7	43.9	33.0	24.9
Phy-22-37	DRMR 20-33	51.7	46.4	10.1	31.3	25.5	18.6	44.1	39.9	9.5	42.9	41.6	3.0
Phy-22-38	NPJ214	52.4	47.1	10.2	32.6	25.6	21.7	44.3	37.7	15.0	39.7	33.8	14.8
Phy-22-39	DRMRCI 162	49.3	44.8	9.3	30.8	22.5	26.8	47.0	40.7	13.4	41.9	32.3	22.9
Phy-22-40	DRMRCI 163	51.9	46.4	10.5	37.9	31.1	17.8	57.2	51.0	10.8	43.9	39.9	9.3
Phy-22-41	RGN 229 (Check)	51.3	44.4	13.4	31.6	22.8	27.7	53.8	44.7	17.0	47.1	36.9	21.6
Phy-22-42	DRMR 2019-7	50.0	45.0	10.1	35.9	31.1	13.2	57.2	39.8	30.5	48.1	36.9	23.2
Phy-22-43	DRMR 2019-19	51.1	45.2	11.6	38.6	32.8	15.2	54.4	41.4	23.8	40.7	33.7	17.3
Phy-22-44	DRMR 2020-3	49.8	46.0	7.5	37.1	32.2	13.1	49.9	42.2	15.4	41.9	36.1	13.9
Phy-22-45	DRMRSJ 276	48.9	45.5	6.9	44.0	38.2	13.2	56.3	43.7	22.3	48.6	40.7	16.2
Phy-22-46	DRMRHJ 1117	45.9	40.2	12.4	36.2	31.3	13.6	46.0	41.4	10.1	42.7	33.7	21.1
Phy-22-47	RH 725 (Check)	50.8	44.9	11.7	34.8	28.4	18.5	52.7	42.2	19.9	47.3	38.3	19.0
Phy-22-48	DRMRCI 128	45.7	41.7	8.7	31.8	26.0	18.2	53.6	41.3	23.0	44.0	36.0	18.2
Phy-22-49	DRMRCI 146	52.8	48.1	8.8	35.2	29.9	15.2	54.3	47.0	13.5	41.6	35.7	14.3
Mean		50	44.9		34.7	28.2		50.6	42.6		43.3	35.9	
CD (p=0.05)	I	1.9			2.1			1.3			0.3		
	G	NS			0.6			4.6			2.1		
	IxG	NS			NS			NS			2.4		

IR=Irrigated RF= Rainfed

Table 6.2.6: Effect of moisture stress on seeds/siliqua at 4 centers

Code	Entries	Seeds per siliqua											
		Bharatpur			Dholi			Hisar			Ludhiana		
		IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)
Phy-22-27	DRMR 1167	14.9	13.6	8.8	11.3	9.5	15.5	15.7	13.0	16.8	15.3	12.4	18.8
Phy-22-28	DRMR 1188	15.6	14.6	6.2	10.5	9.5	9.8	15.0	13.7	8.7	15.3	14.3	6.5
Phy-22-29	JC36	15.5	14.4	7.0	10.0	8.5	15.2	14.6	11.4	21.4	13.4	13.2	1.9
Phy-22-30	DRMR1222	15.3	12.7	17.0	10.9	9.5	12.6	13.5	11.1	17.5	13.4	12.1	9.2
Phy-22-31	DRMR 19-5	16.7	14.3	14.5	11.7	10.5	10.4	14.1	12.6	10.3	14.0	12.2	12.9
Phy-22-32	Kranti	17.0	14.9	12.1	10.5	9.0	14.2	14.4	13.1	9.5	15.0	11.3	24.8
Phy-22-33	DRMRCI 148	17.7	16.0	10.0	11.0	9.3	15.2	16.7	13.5	19.1	11.9	11.3	4.8
Phy-22-34	DRMRCI 161	17.1	16.2	5.7	12.6	10.4	17.9	15.4	13.6	11.5	14.5	14.1	2.8
Phy-22-35	NPJ210	15.5	14.6	5.8	11.6	9.7	16.3	14.0	11.5	17.5	11.9	11.5	3.4
Phy-22-36	DRMR 19-21	14.7	13.5	8.0	14.3	12.0	16.0	16.5	13.1	20.3	13.3	13.1	1.6
Phy-22-37	DRMR 20-33	15.5	14.0	9.9	11.1	10.0	10.1	16.0	13.0	18.7	12.9	9.5	26.0
Phy-22-38	NPJ214	15.4	14.3	7.5	11.8	10.1	14.3	14.4	11.2	22.4	13.7	12.1	11.7
Phy-22-39	DRMRCI 162	15.2	14.2	6.7	11.6	10.4	10.9	14.6	12.7	12.9	13.3	13.2	0.9
Phy-22-40	DRMRCI 163	15.2	14.0	7.9	9.8	8.7	11.2	13.3	11.7	12.0	12.0	11.2	7.0
Phy-22-41	RGN 229 (Check)	15.7	13.6	13.5	10.9	9.5	12.2	16.5	12.7	22.9	14.0	12.3	12.4
Phy-22-42	DRMR 2019-7	16.8	14.8	12.2	10.4	9.0	13.2	15.5	10.9	29.5	14.6	13.9	4.4
Phy-22-43	DRMR 2019-19	15.8	13.9	11.8	11.4	10.6	7.6	13.5	12.4	8.8	13.3	10.2	23.4
Phy-22-44	DRMR 2020-3	15.3	13.9	9.1	12.0	11.5	4.3	14.6	11.7	19.8	17.4	12.0	31.2
Phy-22-45	DRMRSJ 276	15.9	14.6	8.6	12.5	11.2	10.8	13.8	10.2	26.2	13.1	10.7	18.4
Phy-22-46	DRMRHJ 1117	16.0	14.3	10.5	12.5	11.5	7.8	15.5	14.1	9.4	13.5	11.9	11.8
Phy-22-47	RH 725 (Check)	15.3	13.2	13.7	11.6	10.6	8.0	15.4	13.3	14.1	13.6	12.9	5.1
Phy-22-48	DRMRCI 128	15.3	13.9	9.1	11.7	10.5	10.4	14.2	11.9	16.3	13.7	12.9	5.7
Phy-22-49	DRMRCI 146	15.7	13.6	13.9	11.7	9.8	16.0	13.9	11.7	15.7	14.4	14.2	1.5
Mean		15.8	14.2		11.5	10.1		14.8	12.4	16.6	13.8	12.3	
CD (p=0.05)	I	0.43			0.40			0.45			0.37		
	G	1.44			0.12			1.53			1.29		
	IxG	NS			0.56			NS			1.82		

IR=Irrigated RF= Rainfed

Table 6.2.7: Effect of moisture stress on 1000 seed weight at 3 locations

Code	Entries	1000 seed weight (g)							
		Bharatpur		Hisar			Ludhiana		
		IR	RF	IR	RF	Red (%)	IR	RF	Red (%)
Phy-22-27	DRMR 1167	5.29	5.94	3.41	2.70	21.0	6.38	4.74	25.8
Phy-22-28	DRMR 1188	5.82	5.85	3.44	3.17	8.0	6.22	5.46	12.2
Phy-22-29	JC36	3.52	4.33	3.21	2.81	12.5	4.70	3.46	26.5
Phy-22-30	DRMR1222	4.40	5.50	4.44	3.62	18.5	5.80	5.70	1.7
Phy-22-31	DRMR 19-5	6.43	6.98	3.57	2.79	21.9	7.63	7.05	7.6
Phy-22-32	Kranti	4.78	5.09	4.16	3.75	9.9	6.69	5.24	21.8
Phy-22-33	DRMRCI 148	5.04	5.30	3.90	3.21	17.7	6.65	5.00	24.9
Phy-22-34	DRMRCI 161	5.05	5.51	4.28	3.66	14.4	7.26	5.42	25.2
Phy-22-35	NPJ210	5.15	5.26	3.64	2.81	22.9	6.05	5.52	8.8
Phy-22-36	DRMR 19-21	5.96	6.48	3.93	3.22	18.0	6.48	5.30	18.3
Phy-22-37	DRMR 20-33	8.50	8.59	4.45	3.58	19.7	8.81	7.54	14.3
Phy-22-38	NPJ214	5.64	6.62	4.27	3.36	21.4	6.86	6.27	8.6
Phy-22-39	DRMRCI 162	5.62	5.99	4.59	4.16	9.5	6.67	5.67	15.0
Phy-22-40	DRMRCI 163	5.60	5.96	4.01	3.11	22.4	8.26	5.82	29.6
Phy-22-41	RGN 229 (Check)	4.18	4.21	3.66	3.14	14.2	6.42	5.18	19.3
Phy-22-42	DRMR 2019-7	5.62	7.06	4.33	3.55	18.0	7.79	5.90	24.2
Phy-22-43	DRMR 2019-19	5.78	6.28	3.68	2.96	19.7	9.02	7.21	20.1
Phy-22-44	DRMR 2020-3	6.42	6.73	4.26	3.42	19.7	8.07	5.18	35.9
Phy-22-45	DRMRSJ 276	6.49	7.57	4.07	3.27	19.8	7.79	5.77	25.9
Phy-22-46	DRMRHJ 1117	4.88	4.89	4.02	3.32	17.3	6.69	5.85	12.6
Phy-22-47	RH 725 (Check)	5.46	5.73	3.28	3.09	5.9	6.80	6.40	5.9
Phy-22-48	DRMRCI 128	5.04	5.65	3.85	3.04	21.2	6.85	6.34	7.5
Phy-22-49	DRMRCI 146	6.24	6.85	3.83	3.10	19.1	6.90	5.00	27.5
Mean		5.52	6.02	3.92	3.25	17.1	6.99	5.70	
CD (p=0.05)	I		0.07		0.09			0.09	
	G		0.25		0.30			0.30	
	IxG		0.35		NS			0.42	

IR=Irrigated RF= Rainfed

Table 6.2.8: Effect of moisture stress on biological yield at 4 centers

Code	Entries	Biological yield											
		Bharatpur (kg/ha)			Dholi (kg/ha)			Hisar (g/plant)			Ludhiana (kg/ha)		
		IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)
Phy-22-27	DRMR 1167	10968	9267	15.5	2278	1923	15.6	124	105	15.6	7467	4667	37.5
Phy-22-28	DRMR 1188	12379	8253	33.3	2500	1900	24.0	106	94	11.5	7644	4800	37.2
Phy-22-29	JC36	10087	7427	26.4	2258	1817	19.6	99	83	15.8	8622	3733	56.7
Phy-22-30	DRMR1222	11031	6600	40.2	3053	2517	17.6	100	87	13.5	8178	5867	28.3
Phy-22-31	DRMR 19-5	9394	6760	28.0	3137	2883	8.1	90	82	9.3	8267	5244	36.6
Phy-22-32	Kranti	8324	7067	15.1	2753	2400	12.8	95	85	11.5	6489	4578	29.5
Phy-22-33	DRMRCI 148	10515	8267	21.4	2830	2497	11.8	103	77	25.6	7733	4978	35.6
Phy-22-34	DRMRCI 161	9860	6400	35.1	2660	2383	10.4	87	84	4.4	7467	3956	47.0
Phy-22-35	NPJ210	8374	7333	12.4	2750	2117	23.0	92	73	20.3	5867	4444	24.2
Phy-22-36	DRMR 19-21	11019	8800	20.1	2378	2137	10.2	103	77	24.9	9182	5111	44.3
Phy-22-37	DRMR 20-33	13436	8800	34.5	2400	1857	22.6	91	77	16.2	8400	5467	34.9
Phy-22-38	NPJ214	11371	6800	40.2	2497	2003	19.8	89	71	20.2	8222	4356	47.0
Phy-22-39	DRMRCI 162	7984	7440	6.8	2537	2260	10.9	92	82	10.6	6844	4356	36.4
Phy-22-40	DRMRCI 163	10993	8267	24.8	3090	2693	12.8	80	73	9.7	9022	5067	43.8
Phy-22-41	RGN 229 (Check)	10981	7867	28.4	2463	1997	18.9	79	69	12.1	8533	6311	26.0
Phy-22-42	DRMR 2019-7	8916	7333	17.8	2750	2133	22.4	89	63	28.7	9289	3422	63.2
Phy-22-43	DRMR 2019-19	8450	8400	0.6	3150	2860	9.2	85	74	12.9	7022	2933	58.2
Phy-22-44	DRMR 2020-3	9016	8267	8.3	3083	2850	7.6	105	77	26.9	7556	5289	30.0
Phy-22-45	DRMRSJ 276	8701	8667	0.4	3275	2960	9.6	97	76	22.1	8178	5422	33.7
Phy-22-46	DRMRHJ 1117	9873	9600	2.8	2383	1900	20.3	84	76	9.3	9556	3822	60.0
Phy-22-47	RH 725 (Check)	11296	7067	37.4	3353	3020	9.9	94	81	13.5	6533	4000	38.8
Phy-22-48	DRMRCI 128	10779	8267	23.3	2500	1883	24.7	96	77	19.3	9156	5244	42.7
Phy-22-49	DRMRCI 146	11333	7707	32.0	2770	2323	16.1	115	89	22.0	8178	4444	45.7
Mean		10221	7854		2733	2318		95	80		7974	4674	
CD (p=0.05)	I	654.29			176.78			1.76			48.08		
	G	NS			52.13			5.96			16.65		
	IxG	NS			NS			8.43			235.57		

IR=Irrigated RF= Rainfed

Table 6.2.9: Effect of moisture stress on seed yield at 4 centers

Code	Entries	Seed yield											
		Bharatpur (kg/ha)			Dholi (q/ha)			Hisar (g/plant)			Ludhiana (kg/ha)		
		IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)
Phy-22-27	DRMR 1167	2820	1892	32.9	12.81	9.85	23.1	22.27	17.60	21.0	1208	1145	5.2
Phy-22-28	DRMR 1188	3120	2173	30.4	11.44	9.02	21.1	20.60	16.87	18.1	2126	1318	38.0
Phy-22-29	JC36	2620	1824	30.4	11.49	8.63	24.9	20.73	16.27	21.5	1654	968	41.5
Phy-22-30	DRMR1222	2848	1875	34.2	11.40	8.81	22.7	20.03	14.47	27.8	2129	1424	33.1
Phy-22-31	DRMR 19-5	2467	1528	38.1	13.96	11.62	16.7	20.20	15.07	25.4	1668	1212	27.3
Phy-22-32	Kranti	2729	1835	32.8	11.76	8.99	23.6	20.60	14.47	29.8	1599	1251	21.8
Phy-22-33	DRMRCI 148	2727	2156	20.9	12.16	9.52	21.7	22.67	15.60	31.2	1809	1452	19.7
Phy-22-34	DRMRCI 161	2633	2077	21.1	11.80	8.87	24.8	20.00	16.67	16.7	1674	1179	29.6
Phy-22-35	NPJ210	2613	1818	30.4	12.04	9.22	23.4	16.93	12.33	27.2	1263	1050	16.9
Phy-22-36	DRMR 19-21	2613	2083	20.3	12.98	10.17	21.6	20.37	13.60	33.2	1960	1579	19.5
Phy-22-37	DRMR 20-33	3113	2342	24.8	11.79	8.83	25.1	19.47	14.07	27.7	1515	1446	4.6
Phy-22-38	NPJ214	2829	2156	23.8	12.72	9.99	21.5	22.60	14.83	34.4	1206	1133	6.0
Phy-22-39	DRMRCI 162	2141	1554	27.4	12.94	10.22	21.0	21.10	17.87	15.3	1180	1171	0.8
Phy-22-40	DRMRCI 163	2831	2344	17.2	10.88	8.54	21.5	18.00	13.27	26.3	1636	1586	3.1
Phy-22-41	RGN 229 (Check)	2523	1830	27.5	12.52	9.77	22.0	14.27	12.13	15.0	1491	1373	7.9
Phy-22-42	DRMR 2019-7	2887	2218	23.2	12.75	9.71	23.9	17.13	11.80	31.1	2340	1142	51.2
Phy-22-43	DRMR 2019-19	2840	2268	20.2	14.52	12.44	14.3	21.20	16.27	23.3	1334	904	32.3
Phy-22-44	DRMR 2020-3	2680	2083	22.3	13.82	12.09	12.5	24.13	16.23	32.7	1780	1476	17.1
Phy-22-45	DRMRSJ 276	2629	2173	17.4	14.12	12.24	13.3	18.93	13.93	26.4	1745	1499	14.1
Phy-22-46	DRMRHJ 1117	2591	2105	18.7	11.52	9.10	20.9	19.47	13.67	29.8	2080	1212	41.7
Phy-22-47	RH 725 (Check)	3285	2229	32.1	13.63	11.88	12.8	20.47	16.40	19.9	1378	896	35.0
Phy-22-48	DRMRCI 128	2720	1942	28.6	12.16	9.13	25.0	16.80	12.67	24.6	1485	1408	5.2
Phy-22-49	DRMRCI 146	2951	2449	17.0	13.15	10.35	21.3	23.37	14.80	36.7	2089	1060	49.3
Mean		2748	2041		12.54	9.96		20.06	14.82		1667	1256	
CD (p=0.05)	I	127.32			0.04			0.62			54.54		
	G	431.75			0.01			2.10			186.90		
	IxG	NS			0.06			NS			267.20		

IR=Irrigated RF= Rainfed

Table 6.2.10: Effect of moisture stress on harvest index and oil content

Code	Entries	HI (%)						Oil content (%)			
		Bharatpur		Hisar		Ludhiana		Hisar		Ludhiana	
		IR	RF	IR	RF	IR	RF	IR	RF	IR	RF
Phy-22-27	DRMR 1167	26.1	21.3	18.0	16.8	25.7	15.6	39.5	39.4	37.0	37.6
Phy-22-28	DRMR 1188	25.6	26.3	19.5	18.0	28.8	27.6	39.3	39.2	38.6	37.5
Phy-22-29	JC36	26.3	24.7	21.1	19.5	20.2	19.8	39.1	39.0	38.1	37.4
Phy-22-30	DRMR1222	26.0	28.8	20.0	16.7	26.5	24.4	39.2	38.9	37.7	37.6
Phy-22-31	DRMR 19-5	26.7	22.8	22.5	18.5	23.4	20.2	39.2	39.1	37.3	36.8
Phy-22-32	Kranti	32.8	26.2	21.7	17.1	26.7	24.4	39.2	38.9	37.3	37.1
Phy-22-33	DRMRCI 148	26.1	26.9	22.0	20.5	29.8	23.0	39.0	38.9	38.0	36.8
Phy-22-34	DRMRCI 161	26.9	33.1	22.9	20.0	29.9	22.8	38.9	38.7	38.8	37.0
Phy-22-35	NPJ210	31.2	25.1	18.5	16.8	27.2	17.9	38.9	38.6	37.2	37.2
Phy-22-36	DRMR 19-21	24.4	24.3	19.8	17.6	30.8	22.0	39.1	38.7	37.4	37.1
Phy-22-37	DRMR 20-33	23.8	26.8	21.3	18.4	28.0	19.3	39.0	38.8	38.0	38.0
Phy-22-38	NPJ214	25.1	35.6	25.6	21.1	26.1	14.2	39.2	38.8	38.3	37.4
Phy-22-39	DRMRCI 162	26.9	22.8	22.9	21.7	27.8	16.5	39.4	39.0	37.2	37.5
Phy-22-40	DRMRCI 163	26.2	29.3	22.2	18.3	31.0	18.5	39.0	38.9	37.0	37.2
Phy-22-41	RGN 229 (Check)	23.5	24.5	18.2	17.5	23.5	16.0	39.2	39.1	37.2	38.7
Phy-22-42	DRMR 2019-7	32.3	31.6	19.3	18.6	27.3	25.2	39.0	38.8	38.3	36.0
Phy-22-43	DRMR 2019-19	33.7	26.7	24.9	22.0	21.2	18.4	38.7	38.4	38.0	37.4
Phy-22-44	DRMR 2020-3	29.8	25.8	22.9	21.1	28.2	23.5	38.8	38.5	38.5	37.5
Phy-22-45	DRMRSJ 276	30.2	25.3	19.4	18.4	28.2	20.8	38.7	38.3	38.5	37.8
Phy-22-46	DRMRHJ 1117	26.3	22.7	23.3	17.9	32.0	21.8	38.7	38.1	39.0	37.2
Phy-22-47	RH 725 (Check)	29.9	32.8	21.9	20.2	22.3	21.6	38.7	38.2	38.1	37.6
Phy-22-48	DRMRCI 128	25.2	24.2	17.8	16.4	26.2	16.7	38.9	38.5	37.9	38.0
Phy-22-49	DRMRCI 146	26.3	32.8	20.4	16.6	25.8	23.9	38.9	38.8	39.3	37.0
Mean		27.5	27.0	21.1	18.7	26.8	20.6	39.0	38.8	37.9	37.4
CD (p=0.05)	I	NS		0.67		0.53		0.10		0.17	
	G	NS		2.27		1.85		0.35		0.60	
	IxG	NS		NS		2.61		NS		0.85	

IR=Irrigated RF= Rainfed

Table 6.2.11: Effect of moisture stress on drought susceptibility and yield stability indices at 4 centers

Code	Entries	Drought stability index (DSI)				Yield stability index (YSI)			
		Bharatpur	Dholi	Hisar	Ludhiana	Bharatpur	Dholi	Hisar	Ludhiana
Phy-22-27	DRMR 1167	1.27	0.77	0.80	0.21	0.67	0.53	0.79	0.95
Phy-22-28	DRMR 1188	1.17	0.79	0.69	1.50	0.70	0.48	0.82	0.62
Phy-22-29	JC36	1.17	0.86	0.83	1.64	0.70	0.33	0.78	0.59
Phy-22-30	DRMR1222	1.31	0.77	1.06	1.31	0.66	0.52	0.72	0.67
Phy-22-31	DRMR 19-5	1.46	0.83	0.97	1.08	0.62	0.38	0.75	0.73
Phy-22-32	Kranti	1.26	0.76	1.14	0.86	0.67	0.54	0.70	0.78
Phy-22-33	DRMRCI 148	0.80	0.78	1.19	0.78	0.79	0.50	0.69	0.80
Phy-22-34	DRMRCI 161	0.81	0.75	0.64	1.17	0.79	0.57	0.83	0.70
Phy-22-35	NPJ210	1.17	0.77	1.04	0.67	0.70	0.54	0.73	0.83
Phy-22-36	DRMR 19-21	0.78	0.78	1.27	0.77	0.80	0.49	0.67	0.81
Phy-22-37	DRMR 20-33	0.95	0.75	1.06	0.18	0.75	0.57	0.72	0.95
Phy-22-38	NPJ214	0.92	0.79	1.32	0.24	0.76	0.49	0.66	0.94
Phy-22-39	DRMRCI 162	1.06	0.79	0.59	0.13	0.73	0.48	0.85	0.99
Phy-22-40	DRMRCI 163	0.66	0.79	1.01	0.12	0.83	0.49	0.74	0.97
Phy-22-41	RGN 229 (Check)	1.06	0.78	0.57	0.31	0.73	0.50	0.85	0.92
Phy-22-42	DRMR 2019-7	0.89	0.76	1.19	2.36	0.77	0.55	0.69	0.40
Phy-22-43	DRMR 2019-19	0.78	0.86	0.89	2.17	0.80	0.33	0.77	0.45
Phy-22-44	DRMR 2020-3	0.86	0.88	1.25	0.68	0.78	0.29	0.67	0.83
Phy-22-45	DRMRSJ 276	0.67	0.87	1.01	0.56	0.83	0.30	0.74	0.86
Phy-22-46	DRMRHJ 1117	0.72	0.79	1.14	1.65	0.81	0.48	0.70	0.58
Phy-22-47	RH 725 (Check)	1.24	0.87	0.76	1.38	0.68	0.29	0.80	0.65
Phy-22-48	DRMRCI 128	1.10	0.75	0.94	0.21	0.71	0.57	0.75	0.95
Phy-22-49	DRMRCI 146	0.65	0.79	1.40	1.95	0.83	0.49	0.63	0.51
Mean		0.99	0.80	0.99	0.95	0.74	0.47	0.74	0.76

Table 6.3.1: Effect of terminal heat stress on membrane stability at 4 centers

Code	Entries	Membrane stability (%)											
		Bharatpur			Dholi			Hisar			Ludhiana		
		NS	LS	Red (%)	NS	LS	Red (%)	NS	LS	Red (%)	NS	LS	Red (%)
Phy-22-50	DRMRCI 128	61.0	48.7	20.3	66.1	57.4	13.2	74.6	53.8	27.9	78.2	76.2	2.6
Phy-22-51	DRMRCI 145	71.9	52.0	27.7	68.6	59.0	14.0	74.4	56.2	24.4	82.3	76.5	7.1
Phy-22-52	BPR 543-2 (Check)	67.6	61.0	9.8	73.4	63.7	13.2	64.3	51.8	19.3	81.0	77.2	4.8
Phy-22-53	DRMR 1167	76.4	64.0	16.2	62.7	55.3	11.9	62.5	50.9	18.6	70.6	63.8	9.6
Phy-22-54	DRMR 1188	62.1	58.9	5.0	75.3	68.0	9.6	67.2	52.2	22.4	76.2	74.7	2.0
Phy-22-55	CS56	75.1	58.3	22.3	70.8	59.5	15.9	78.8	71.4	9.5	76.6	68.7	10.3
Phy-22-56	DRMRCI 165	67.5	58.8	12.9	70.8	56.8	19.8	63.1	53.1	15.9	76.4	72.5	5.1
Phy-22-57	DRMRCI 166	67.8	63.6	6.2	78.6	62.2	20.8	64.8	55.4	14.5	80.4	80.2	0.3
Phy-22-58	DRMR 2017-27	67.2	60.2	10.4	78.6	62.2	20.8	69.9	59.2	15.3	86.5	77.2	10.8
Phy-22-59	DRMR 19-5	64.0	59.5	7.1	79.1	67.7	14.4	75.3	54.7	27.4	76.6	71.3	6.9
Phy-22-60	DRMR 19-21	67.7	48.9	27.7	63.3	55.3	12.7	83.8	64.9	22.5	84.7	74.4	12.2
Phy-22-61	JC1	76.7	64.7	15.6	74.7	59.2	20.7	60.7	50.5	16.8	76.4	69.2	9.4
Phy-22-62	DRMRCI 167	61.8	55.8	9.8	65.0	57.1	12.2	58.8	46.5	20.8	81.2	77.5	4.6
Phy-22-63	DRMRHT 1712	72.0	63.6	11.6	69.2	58.0	16.1	83.7	61.2	26.9	87.9	81.5	7.2
Phy-22-64	JC32	68.2	58.1	14.8	80.5	73.1	9.2	58.2	42.8	26.5	76.9	73.7	4.2
Phy-22-65	DRMR 20-33	69.5	61.1	12.2	72.8	67.2	7.7	62.2	58.4	6.0	73.3	71.8	1.9
Phy-22-66	DRMR 2018-19	78.0	74.5	4.5	76.3	70.8	7.2	77.3	50.9	34.2	81.7	72.2	11.7
Phy-22-67	Kranti	55.5	43.7	21.3	82.0	75.4	8.1	67.7	56.7	16.2	76.3	70.8	7.2
Phy-22-68	DRMR 2019-7	72.3	60.0	17.1	71.8	66.1	7.9	64.4	55.7	13.4	79.7	73.2	8.1
Phy-22-69	DRMR 2019-19	67.5	61.9	8.3	80.4	74.7	7.1	72.4	56.0	22.7	79.7	76.9	3.5
Phy-22-70	NPJ 250	68.8	63.8	7.2	69.0	63.8	7.4	74.9	48.3	35.5	80.4	74.7	7.1
Phy-22-71	DRMRHJ 430	73.7	58.5	20.7	77.6	62.0	20.1	72.2	59.0	18.3	83.0	79.4	4.4
Phy-22-72	Radhika	64.7	54.3	16.0	79.5	73.9	7.1	62.2	47.9	23.0	87.3	72.0	17.5
Phy-22-73	NPJ 251	66.2	56.3	14.8	62.9	57.9	8.0	62.2	48.0	22.9	87.9	82.2	6.5
Phy-22-74	NRCHB 101	59.1	45.7	22.6	74.0	61.6	16.8	68.0	54.3	20.0	83.4	81.7	2.1
Phy-22-75	PM26 (Check)	84.1	76.1	9.5	75.7	65.6	13.4	79.8	42.0	47.3	76.8	65.1	15.2
Phy-22-76	DRMRSJ 294	80.5	65.1	19.2	76.4	69.7	8.8	71.8	56.6	21.2	83.0	76.4	7.9
Mean		69.1	59.2		73.2	63.8		69.5	54.0		80.2	74.5	
CD (p=0.05)	E	NS			2.34			1.23			0.61		
	G	NS			0.64			4.52			2.26		
	E×G	NS			3.31			6.40			3.21		

NS- Normal Sown; LS- Late Sown

Table 6.3.2: Effect of terminal heat stress on canopy temperature (^{0}C) and canopy temperature depression (^{0}C) in Indian mustard at Hisar and Ludhiana

Code	Entries	CT (^{0}C)				CTD (^{0}C)			
		Hisar		Ludhiana		Hisar		Ludhiana	
		NS	LS	NS	LS	NS	LS	NS	LS
Phy-22-50	DRMRCI 128	27.0	28.6	21.1	22.5	-6.5	-5.4	-7.8	-4.3
Phy-22-51	DRMRCI 145	27.0	29.6	23.3	20.0	-6.3	-5.0	-5.6	-6.7
Phy-22-52	BPR 543-2 (Check)	25.1	28.1	22.1	22.1	-6.0	-4.7	-6.8	-4.6
Phy-22-53	DRMR 1167	25.7	28.2	19.0	20.8	-6.9	-6.0	-9.9	-5.9
Phy-22-54	DRMR 1188	27.1	29.3	18.1	21.8	-5.0	-4.2	-10.9	-9.4
Phy-22-55	CS56	26.2	29.0	19.9	20.0	-5.6	-4.9	-9.0	-6.7
Phy-22-56	DRMRCI 165	28.0	28.8	19.8	21.6	-5.9	-4.9	-9.2	-5.1
Phy-22-57	DRMRCI 166	26.4	32.3	18.4	21.7	-6.6	-5.5	-10.6	-9.5
Phy-22-58	DRMR 2017-27	26.9	30.7	18.4	20.6	-5.4	-4.5	-10.5	-6.2
Phy-22-59	DRMR 19-5	28.9	32.1	19.5	20.1	-5.3	-4.3	-9.4	-6.7
Phy-22-60	DRMR 19-21	30.4	33.1	19.6	19.5	-6.2	-5.1	-9.3	-7.2
Phy-22-61	JC1	29.1	32.3	22.1	19.6	-5.1	-4.8	-6.8	-7.2
Phy-22-62	DRMRCI 167	27.9	32.0	19.7	20.2	-7.3	-6.0	-9.2	-6.5
Phy-22-63	DRMRHT 1712	27.7	32.6	16.5	25.2	-6.9	-6.7	-12.5	-7.4
Phy-22-64	JC32	27.9	34.8	21.9	22.1	-6.6	-4.2	-7.0	-4.6
Phy-22-65	DRMR 20-33	28.7	30.4	23.1	19.4	-6.7	-5.7	-5.8	-7.3
Phy-22-66	DRMR 2018-19	26.8	33.6	21.8	20.5	-5.3	-4.5	-7.1	-6.3
Phy-22-67	Kranti	26.9	32.7	18.6	20.4	-4.9	-3.3	-10.4	-6.3
Phy-22-68	DRMR 2019-7	27.0	29.9	20.7	23.2	-6.8	-3.5	-8.2	-3.5
Phy-22-69	DRMR 2019-19	26.8	30.4	23.6	19.5	-7.3	-5.4	-5.4	-7.3
Phy-22-70	NPJ 250	24.4	30.7	25.5	21.5	-7.2	-5.6	-3.5	-5.3
Phy-22-71	DRMRHJ 430	26.2	30.4	24.1	22.1	-7.3	-5.3	-4.8	-4.7
Phy-22-72	Radhika	25.4	30.3	18.8	20.4	-6.9	-5.4	-10.1	-6.4
Phy-22-73	NPJ 251	26.9	29.4	19.4	21.6	-6.3	-4.6	-9.6	-5.2
Phy-22-74	NRCHB 101	26.5	29.4	22.9	22.4	-7.4	-5.5	-6.0	-4.4
Phy-22-75	PM26 (Check)	24.0	30.0	19.6	23.2	-6.0	-4.9	-9.4	-3.6
Phy-22-76	DRMRSJ 294	24.3	31.4	20.1	19.4	-6.7	-5.2	-8.8	-7.4
Mean		26.8	30.7	20.6	21.1	-6.3	-5.0	-8.3	-6.1
CD (p=0.05)	E	0.62		0.54		0.21		0.81	
	G	2.29		2.01		0.75		1.93	
	E×G	NS		2.84		NS		2.74	

NS- Normal Sown; LS- Late Sown

Table 6.3.3: Effect of terminal heat stress on seeds per siliqua at 4 locations

Code	Entries	Seeds per siliqua											
		Bharatpur			Dholi			Hisar			Ludhiana		
		NS	LS	Red (%)	NS	LS	Red (%)	NS	LS	Red (%)	NS	LS	Red (%)
Phy-22-50	DRMRCI 128	18.3	15.3	16.4	11.6	10.1	12.5	14.8	13.2	10.8	12.4	12.1	2.4
Phy-22-51	DRMRCI 145	15.9	14.7	7.5	10.9	9.2	15.9	12.4	11.5	7.2	13.3	12.5	6.1
Phy-22-52	BPR 543-2 (Check)	16.2	14.1	12.8	12.0	9.4	21.4	14.5	12.3	15.5	12.8	12.2	4.7
Phy-22-53	DRMR 1167	15.3	15.1	1.3	10.9	10.2	6.7	12.5	11.5	7.7	14.1	13.2	6.4
Phy-22-54	DRMR 1188	15.8	14.7	6.8	11.4	10.2	10.2	11.5	9.3	19.2	14.0	11.9	14.7
Phy-22-55	CS56	14.6	11.9	18.7	11.6	9.8	15.6	10.5	9.8	6.7	12.5	11.8	5.6
Phy-22-56	DRMRCI 165	16.6	15.6	6.0	12.1	10.7	11.3	12.5	11.1	11.2	13.6	13.0	4.6
Phy-22-57	DRMRCI 166	16.3	14.9	8.6	11.4	8.3	27.5	12.7	10.6	16.3	14.7	12.2	17.4
Phy-22-58	DRMR 2017-27	17.1	16.3	5.1	10.8	9.4	12.7	13.4	10.4	22.2	14.1	11.6	17.9
Phy-22-59	DRMR 19-5	17.1	16.9	1.2	11.3	8.5	25.3	13.5	12.1	10.4	13.3	12.8	3.8
Phy-22-60	DRMR 19-21	15.7	13.6	13.2	11.8	10.6	10.1	14.6	12.6	13.3	13.1	13.0	0.3
Phy-22-61	JC1	16.2	14.9	8.2	11.0	10.2	7.9	13.6	12.0	11.7	14.9	12.3	17.3
Phy-22-62	DRMRCI 167	16.0	15.9	0.8	10.9	9.9	9.2	12.7	11.1	12.4	15.7	13.3	15.2
Phy-22-63	DRMRHT 1712	14.9	12.6	15.2	10.8	10.0	7.5	12.0	10.6	11.6	13.5	13.0	3.7
Phy-22-64	JC32	16.7	15.1	9.6	10.8	10.1	6.7	13.4	11.7	12.9	12.9	11.6	10.7
Phy-22-65	DRMR 20-33	13.9	12.3	12.0	12.0	11.2	6.9	14.7	9.4	35.9	13.4	9.8	26.9
Phy-22-66	DRMR 2018-19	17.4	16.3	6.5	10.3	9.6	6.6	16.0	11.4	28.6	13.1	12.7	3.3
Phy-22-67	Kranti	17.0	13.7	19.6	10.9	9.6	11.9	14.1	11.4	18.9	12.7	12.4	2.3
Phy-22-68	DRMR 2019-7	17.5	16.2	7.3	10.5	10.0	4.9	13.3	11.3	14.7	14.5	11.4	21.7
Phy-22-69	DRMR 2019-19	18.9	17.9	4.9	10.2	9.4	7.8	13.9	12.6	9.2	15.1	10.7	29.2
Phy-22-70	NPJ 250	15.9	15.7	0.8	11.0	9.9	9.7	16.0	14.9	6.8	12.8	11.3	11.7
Phy-22-71	DRMRHJ 430	16.2	15.3	5.8	9.8	8.9	9.2	12.7	11.2	12.2	13.3	13.1	1.5
Phy-22-72	Radhika	16.3	16.2	0.4	10.3	9.0	12.7	15.5	12.5	19.4	13.9	13.3	4.3
Phy-22-73	NPJ 251	14.5	14.2	1.8	11.0	10.3	6.7	12.7	9.9	21.6	13.9	13.1	5.7
Phy-22-74	NRCHB 101	16.7	13.8	17.2	11.2	10.2	9.2	14.3	13.4	6.5	13.3	12.6	5.1
Phy-22-75	PM26 (Check)	15.3	13.2	13.9	10.3	9.1	12.1	16.4	13.6	16.8	11.2	10.8	3.2
Phy-22-76	DRMRSJ 294	17.0	16.7	2.0	11.8	9.6	19.2	14.8	12.6	15.1	12.0	11.3	5.8
Mean		16.3	14.9		11.1	9.8		13.7	11.6		13.5	12.2	
CD (p=0.05)	E	0.34			0.62			0.39			0.30		
	G	1.26			0.18			1.42			1.12		
	E×G	NS			0.88			NS			1.59		

NS- Normal Sown; LS- Late Sown

Table 6.3.4: Effect of terminal heat stress on test weight at 4 locations

Code	Entries	1000 seed weight (g)											
		Bharatpur			Dholi			Hisar			Ludhiana		
		NS	LS	Red (%)	NS	LS	Red (%)	NS	LS	Red (%)	NS	LS	Red (%)
Phy-22-50	DRMRCI 128	5.0	4.4	11.0	5.3	4.4	16.4	3.5	2.6	26.6	6.2	6.0	2.6
Phy-22-51	DRMRCI 145	5.3	3.8	26.9	4.9	3.9	19.3	3.9	2.8	27.5	6.2	5.7	8.4
Phy-22-52	BPR 543-2 (Check)	5.0	2.8	44.7	6.0	5.0	16.9	3.1	2.0	34.3	5.6	5.5	1.9
Phy-22-53	DRMR 1167	5.4	3.6	32.4	6.1	5.1	17.1	3.6	2.6	28.3	5.7	3.9	31.3
Phy-22-54	DRMR 1188	5.2	3.7	28.0	6.6	5.7	13.3	3.3	2.6	23.2	5.4	4.4	18.5
Phy-22-55	CS56	5.5	3.6	34.2	6.5	5.3	18.9	3.4	2.8	18.9	7.1	4.9	31.6
Phy-22-56	DRMRCI 165	6.2	4.2	32.7	5.4	4.4	18.8	3.6	2.5	29.6	5.4	5.1	5.0
Phy-22-57	DRMRCI 166	6.2	4.2	32.7	6.5	4.7	28.2	4.2	3.5	15.5	5.9	5.2	11.7
Phy-22-58	DRMR 2017-27	4.7	4.0	14.2	7.2	5.1	29.2	4.0	3.2	21.3	6.2	6.1	1.6
Phy-22-59	DRMR 19-5	5.9	4.7	19.6	5.4	4.5	18.2	4.3	3.3	23.6	6.4	5.9	8.5
Phy-22-60	DRMR 19-21	6.0	5.2	14.1	5.1	3.3	35.1	4.3	3.1	27.5	6.6	5.3	19.6
Phy-22-61	JC1	3.5	2.2	37.9	5.6	4.2	24.7	3.3	1.6	49.4	4.4	3.7	16.2
Phy-22-62	DRMRCI 167	6.2	4.9	21.9	6.1	4.9	19.4	3.4	2.4	28.7	5.1	4.6	10.4
Phy-22-63	DRMRHT 1712	4.5	3.0	33.4	6.1	4.0	35.7	3.5	2.4	31.3	5.0	4.5	10.2
Phy-22-64	JC32	3.8	2.7	30.2	6.9	5.5	20.3	3.1	1.8	42.5	5.1	4.8	5.9
Phy-22-65	DRMR 20-33	7.0	5.0	28.5	6.3	5.2	16.5	4.4	3.5	20.4	7.3	4.9	32.8
Phy-22-66	DRMR 2018-19	5.3	4.6	14.0	7.7	6.3	18.6	4.9	2.8	42.2	6.4	5.5	14.7
Phy-22-67	Kranti	5.9	3.2	45.8	5.6	4.8	13.2	3.7	2.5	32.8	5.6	5.3	5.3
Phy-22-68	DRMR 2019-7	6.0	4.7	21.1	5.9	5.2	12.1	4.1	3.3	19.6	6.5	5.8	11.3
Phy-22-69	DRMR 2019-19	5.9	4.8	19.1	4.9	4.4	10.9	3.7	2.8	23.8	5.8	5.2	11.4
Phy-22-70	NPJ 250	5.9	3.7	37.6	6.2	5.1	17.1	3.7	2.6	30.7	5.6	4.8	15.1
Phy-22-71	DRMRHJ 430	4.6	3.6	21.1	5.8	4.7	20.3	2.9	2.1	27.3	6.1	4.2	30.8
Phy-22-72	Radhika	5.7	4.2	26.6	7.0	5.0	29.1	3.5	2.4	31.3	6.0	4.9	19.3
Phy-22-73	NPJ 251	4.9	3.6	27.1	5.6	4.0	28.9	3.2	2.5	22.4	4.9	4.8	1.2
Phy-22-74	NRCHB 101	5.7	3.5	38.6	6.2	5.3	14.6	3.4	2.3	33.2	6.1	5.4	11.5
Phy-22-75	PM26 (Check)	4.8	3.2	34.8	6.1	4.6	25.2	2.9	2.1	27.9	5.2	5.0	3.2
Phy-22-76	DRMRSJ 294	4.2	3.1	24.9	5.4	4.3	19.4	2.8	2.1	25.8	6.2	4.8	22.6
Mean		5.3	3.9		6.0	4.8		3.6	2.6		5.9	5.0	
CD (p=0.05)	E	0.14			0.27			0.12			0.09		
	G	0.51			0.08			0.45			0.34		
	E×G	0.72			0.38			NS			0.48		

NS- Normal Sown; LS- Late Sown

Table 6.3.5: Effect of terminal heat stress on seed yield at Bharatpur, Dholi, Hisar and Ludhiana

Code	Entries	Seed yield											
		Bharatpur (kg/ha)			Dholi (kg/ha)			Hisar (g/ plant)			Ludhiana (kg/ha)		
		NS	LS	Red (%)	NS	LS	Red (%)	NS	LS	Red (%)	NS	LS	Red (%)
Phy-22-50	DRMRCI 128	1983	1533	22.7	1277	857	32.9	21.16	12.30	41.9	1637	1143	30.1
Phy-22-51	DRMRCI 145	2406	1756	27.0	1084	783	27.8	22.00	14.45	34.3	1966	1366	30.5
Phy-22-52	BPR 543-2 (Check)	2150	1156	46.3	1122	804	28.4	20.40	11.95	41.4	1354	1227	9.4
Phy-22-53	DRMR 1167	2222	1644	26.0	1081	815	24.6	22.95	11.28	50.9	1448	1113	23.1
Phy-22-54	DRMR 1188	2156	1350	37.4	1183	849	28.3	18.30	10.30	43.7	1483	1021	31.2
Phy-22-55	CS56	2389	1622	32.1	1068	772	27.7	17.90	14.70	17.9	1377	1156	16.1
Phy-22-56	DRMRCI 165	2300	1411	38.7	1302	875	32.8	19.40	12.80	34.0	1290	1123	12.9
Phy-22-57	DRMRCI 166	1711	1456	14.9	1255	950	24.3	16.00	13.00	18.8	1351	990	26.7
Phy-22-58	DRMR 2017-27	2089	1689	19.2	1280	1019	20.4	15.40	11.54	25.1	1308	1018	22.2
Phy-22-59	DRMR 19-5	2378	1656	30.4	1252	976	22.1	20.60	11.90	42.2	1641	1199	27.0
Phy-22-60	DRMR 19-21	2289	1489	35.0	1122	881	21.4	20.40	9.80	52.0	1722	868	49.6
Phy-22-61	JC1	2039	1178	42.2	1117	861	22.9	20.60	9.50	53.9	1628	1109	31.9
Phy-22-62	DRMRCI 167	2361	1978	16.2	1073	794	26.1	23.80	14.10	40.8	1444	1132	21.6
Phy-22-63	DRMRHT 1712	1628	944	42.0	1059	845	20.2	24.60	13.40	45.5	1352	1061	21.5
Phy-22-64	JC32	2122	1728	18.6	1150	911	20.8	24.00	11.80	50.8	1058	1003	5.2
Phy-22-65	DRMR 20-33	1489	911	38.8	1344	1074	20.0	20.40	15.80	22.6	1361	940	30.9
Phy-22-66	DRMR 2018-19	2122	1822	14.1	1248	1028	17.7	19.00	13.40	29.5	1074	1049	2.4
Phy-22-67	Kranti	2361	1644	30.4	1303	1036	20.5	19.80	10.90	45.0	1691	1090	35.6
Phy-22-68	DRMR 2019-7	3011	2311	23.3	1361	1138	16.4	21.20	16.40	22.6	1634	1040	36.4
Phy-22-69	DRMR 2019-19	2089	1878	10.1	1291	1136	12.0	20.40	13.40	34.3	1411	1144	18.9
Phy-22-70	NPJ 250	1706	1233	27.7	1340	1048	21.8	22.00	10.40	52.7	1643	1099	33.1
Phy-22-71	DRMRHJ 430	2911	2144	26.3	1209	824	31.9	24.65	13.80	44.0	1353	1072	20.8
Phy-22-72	Radhika	2667	2356	11.7	1157	800	30.9	19.60	12.00	38.8	1379	1131	18.0
Phy-22-73	NPJ 251	1567	1189	24.1	1181	867	26.6	24.20	12.60	47.9	1732	933	46.1
Phy-22-74	NRCHB 101	2333	1644	29.5	1141	913	20.0	22.20	11.60	47.8	1653	1110	32.9
Phy-22-75	PM26 (Check)	1767	1300	26.4	1086	806	25.8	20.10	13.50	32.8	1240	1068	13.9
Phy-22-76	DRMRSJ 294	2972	2222	25.2	1051	788	32.9	20.65	12.76	38.2	1514	1089	28.1
Mean		2193	1602		1190	906		20.80	12.57		1472	1085	
CD (p=0.05)	E	118.88			56.05			0.64			31.82		
	G	436.78			16.53			2.35			119.07		
	E×G	NS			79.27			3.33			168.39		

NS- Normal Sown; LS- Late Sown

Table 6.3.6: Effect of terminal heat stress on heat and yield stability indices at 4 locations

Code	Entries	Heat stability index (HSI)				Yield stability index (YSI)			
		Bharatpur	Dholi	Hisar	Ludhiana	Bharatpur	Dholi	Hisar	Ludhiana
Phy-22-50	DRMRCI 128	0.84	0.67	1.06	0.87	0.77	0.75	0.58	0.70
Phy-22-51	DRMRCI 145	1.00	0.72	0.87	1.25	0.73	0.63	0.66	0.69
Phy-22-52	BPR 543-2 (Check)	1.71	0.72	1.05	0.78	0.54	0.65	0.59	0.91
Phy-22-53	DRMR 1167	0.96	0.75	1.28	0.75	0.74	0.56	0.49	0.77
Phy-22-54	DRMR 1188	1.38	0.72	1.10	0.71	0.63	0.65	0.56	0.69
Phy-22-55	CS56	1.19	0.72	0.45	0.74	0.68	0.63	0.82	0.84
Phy-22-56	DRMRCI 165	1.43	0.67	0.86	0.68	0.61	0.75	0.66	0.87
Phy-22-57	DRMRCI 166	0.55	0.76	0.47	0.62	0.85	0.55	0.81	0.73
Phy-22-58	DRMR 2017-27	0.71	0.80	0.63	0.62	0.81	0.47	0.75	0.78
Phy-22-59	DRMR 19-5	1.12	0.78	1.07	0.92	0.70	0.50	0.58	0.73
Phy-22-60	DRMR 19-21	1.29	0.79	1.31	0.70	0.65	0.49	0.48	0.50
Phy-22-61	JC1	1.56	0.77	1.36	0.84	0.58	0.52	0.46	0.68
Phy-22-62	DRMRCI 167	0.60	0.74	1.03	0.76	0.84	0.60	0.59	0.78
Phy-22-63	DRMRHT 1712	1.55	0.80	1.15	0.67	0.58	0.46	0.54	0.78
Phy-22-64	JC32	0.69	0.79	1.28	0.50	0.81	0.47	0.49	0.95
Phy-22-65	DRMR 20-33	1.44	0.80	0.57	0.60	0.61	0.46	0.77	0.69
Phy-22-66	DRMR 2018-19	0.52	0.82	0.74	0.53	0.86	0.40	0.71	0.98
Phy-22-67	Kranti	1.12	0.80	1.14	0.86	0.70	0.47	0.55	0.64
Phy-22-68	DRMR 2019-7	0.86	0.84	0.57	0.79	0.77	0.38	0.77	0.64
Phy-22-69	DRMR 2019-19	0.37	0.88	0.87	0.75	0.90	0.27	0.66	0.81
Phy-22-70	NPJ 250	1.03	0.78	1.33	0.84	0.72	0.50	0.47	0.67
Phy-22-71	DRMRHJ 430	0.98	0.68	1.11	0.68	0.74	0.73	0.56	0.79
Phy-22-72	Radhika	0.43	0.69	0.98	0.73	0.88	0.71	0.61	0.82
Phy-22-73	NPJ 251	0.89	0.73	1.21	0.75	0.76	0.61	0.52	0.54
Phy-22-74	NRCHB 101	1.09	0.80	1.21	0.86	0.70	0.46	0.52	0.67
Phy-22-75	PM26 (Check)	0.98	0.74	0.83	0.62	0.74	0.59	0.67	0.86
Phy-22-76	DRMRSJ 294	0.93	0.75	0.97	0.77	0.75	0.57	0.62	0.72
	Mean	1.01	0.76	0.98	0.75	0.73	0.55	0.61	0.75

Table 6.4.1: Effect of PGRs on relative water content and leaf water retention in Indian mustard

	RWC (%)			LWR (%)
Treatments	Bharatpur	Hisar	Ludhiana	Ludhiana
Control (No spray)	79.4	75.8	83.6	65.4
Water spray	78.3	84.9	85.3	66.5
Urea @1%	74.7	78.9	86.6	68.0
Urea @2%	77.8	81.3	89.8	67.2
Trehalose @10mM	76.9	83.2	89.1	69.5
Trehalose @20mm	75.2	88.0	90.2	71.1
Pot. nitrate @1%	78.3	82.2	88.8	73.7
Pot. nitrate @2%	77.4	91.8	87.5	71.8
CD (p=0.05)	2.9	3.7	1.2	5.2

Table 6.4.2: Effect of PGRs on photosynthetic pigments (mg/g FW) and chlorophyll stability index at 2 locations

	Chl a		Chl b		Total Chl		Carotenoids		CSI	
Treatments	Bharatpur	Ludhiana	Bharatpur	Ludhiana	Bharatpur	Ludhiana	Bharatpur	Ludhiana	Bharatpur	Ludhiana
Control (No spray)	0.666	1.046	0.144	0.199	0.810	1.245	0.034	0.291		
Water spray	0.547	1.246	0.131	0.222	0.678	1.468	0.023	0.330	0.837	1.184
Urea @1%	0.511	1.281	0.125	0.233	0.636	1.514	0.020	0.336	0.785	1.221
Urea @2%	0.583	1.119	0.129	0.215	0.712	1.334	0.024	0.295	0.880	1.075
Trehalose @10mM	0.719	1.203	0.183	0.226	0.902	1.429	0.041	0.323	1.113	1.152
Trehalose @20mm	0.604	1.070	0.159	0.199	0.763	1.265	0.028	0.281	0.942	1.020
Pot. nitrae @1%	0.530	1.282	0.130	0.264	0.661	1.545	0.020	0.347	0.816	1.246
Pot. nitrate @2%	0.506	1.362	0.122	0.268	0.627	1.630	0.022	0.338	0.774	1.314
CD (p=0.05)	NS	0.060	NS	0.017	NS	0.062	NS	0.347		

Table 6.4.3: Effect of PGRs on siliquae on main shoot (SMS), total siliquae and seeds per siliqua at 3 locations under moisture stress

Treatments	Siliquae on main shoot			Total siliquae/plant			Seeds/siliqua		
	Bharatpur	Hisar	Ludhiana	Bharatpur	Hisar	Ludhiana	Bharatpur	Hisar	Ludhiana
Control (No spray)	45.2	57.5	38.1	197.0	151.0	238.9	15.4	14.5	10.2
Water spray	45.6	65.0	39.9	192.2	186.0	298.9	15.7	14.6	10.7
Urea @1%	45.0	67.0	47.5	193.8	222.0	357.3	13.3	14.6	10.9
Urea @2%	43.2	70.0	40.1	199.4	239.0	338.4	14.7	14.6	11.8
Trehalose @10mM	44.7	56.5	42.5	236.8	219.0	304.0	14.3	14.8	12.2
Trehalose @20mm	47.0	75.0	42.7	211.9	238.0	347.3	15.8	14.6	12.9
Pot. nitrate @1%	54.1	52.0	44.3	257.7	248.0	333.0	14.9	14.6	12.5
Pot. nitrate @2%	46.7	55.0	40.6	203.2	230.0	331.9	14.7	14.6	13.8
CD (p=0.05)	NS	0.01	4.43	NS	0.47	33.10	NS	0.01	1.63

Table 6.4.4: Effect of PGRs on 1000 seed weight ,biomass and seed yield at 3 locations

Treatments	1000 seed weight (g)			Biomass yield			Seeds yield		
	Bharatpur	Hisar	Ludhiana	Bharatpur (kg/ha)	Hisar (g/plant)	Ludhiana (kg/ha)	Bharatpur (kg/ha)	Hisar (g/plant)	Ludhiana (kg/ha)
Control (No spray)	5.9	4.9	4.6	8593	130	4778	2415	27	997
Water spray	5.7	4.9	4.9	8963	170	4800	2485	33	1155
Urea @1%	5.9	4.8	5.6	9259	147	5142	2741	29	1200
Urea @2%	5.9	5.2	6.2	8593	143	5600	2681	29	1355
Trehalose @10mM	5.1	5.1	5.1	8667	141	5333	2783	31	1403
Trehalose @20mm	5.9	4.6	6.7	8000	146	5600	2608	30	1221
Pot. nitrate @1%	5.6	4.8	5.2	8148	149	4933	2528	33	1228
Pot. nitrate @2%	5.7	3.7	5.6	8593	175	5200	2767	39	1326
CD (p=0.05)	NS	-	0.45	NS	0.01	387.80	NS	0.567	98.67

Table 6.5.1: Influence of microbes on photosynthetic pigments (mg/g FW) under moisture stress at Ludhiana

	Chl a				Chl b				Total Chl				Carotenoids			
Treatment	Io	I1	I2	Mean	Io	I1	I2	Mean	Io	I1	I2	Mean	Io	I1	I2	Mean
Control	1.04	1.12	1.24	1.13	0.24	0.25	0.32	0.27	1.28	1.37	1.56	1.40	0.33	0.37	0.40	0.36
Biophos and Biophos+	1.25	1.31	1.41	1.32	0.27	0.34	0.44	0.35	1.52	1.65	1.85	1.67	0.36	0.40	0.46	0.41
CRIDA MI I	1.22	1.32	1.33	1.29	0.33	0.36	0.41	0.37	1.56	1.68	1.74	1.66	0.37	0.40	0.41	0.39
CRIDA MI II	1.12	1.17	1.29	1.19	0.28	0.33	0.46	0.36	1.40	1.50	1.75	1.55	0.34	0.37	0.44	0.39
MKS 6	1.13	1.30	1.32	1.25	0.33	0.36	0.37	0.36	1.46	1.67	1.69	1.61	0.35	0.41	0.41	0.39
MRD 17	1.20	1.25	1.27	1.24	0.32	0.40	0.44	0.39	1.52	1.64	1.71	1.63	0.37	0.39	0.41	0.39
Mean	1.16	1.25	1.31		0.30	0.34	0.41		1.46	1.58	1.72		0.35	0.39	0.42	
CD(p=0.05)	I= 0.0157				I= 0.0336				I= 0.0307				I= 0.00619			
	T= 0.222				T= 0.0475				T= 0.0434				T= 0.0081			
	IxT= 0.396				IxT= 0.0824				IxT= 0.075				IxT=0.0151			

Table 6. 5.2: Influence of microbes on physiological traits under moisture stress at Ludhiana

	SPAD				RWC (%)				Proline (mg/gDW)				Total sugars (mg/DW)			
Treatment	Io	I1	I2	Mean	Io	I1	I2	Mean	Io	I1	I2	Mean	Io	I1	I2	Mean
Control	37.2	38.4	39.9	38.5	84.4	85.7	88.1	86.1	11.7	10.8	10.0	10.8	199.9	222.6	232.0	218.2
Biophos and Biophos+	41.3	41.4	41.7	41.5	85.4	86.4	87.3	86.4	12.3	11.1	11.1	11.5	257.8	262.0	277.0	265.6
CRIDA MI I	40.1	40.6	44.0	41.6	86.6	88.8	90.6	88.7	12.1	11.4	10.4	11.3	217.6	242.3	336.5	265.5
CRIDA MI II	41.4	41.7	42.1	41.7	87.8	88.1	88.3	88.1	12.4	12.0	10.8	11.7	263.2	269.3	338.9	290.5
MKS 6	41.5	41.7	42.3	41.8	85.3	88.2	90.7	88.1	12.0	11.2	10.9	11.4	291.2	293.2	295.5	293.3
MRD 17	40.7	40.9	43.1	41.6	85.6	86.3	89.8	87.2	11.8	11.1	11.1	11.3	237.3	247.2	290.8	258.4
Mean	40.4	40.8	42.2		85.8	87.3	89.1		12.0	11.3	10.7		244.5	256.1	295.1	
CD(p=0.05)	I= 0.082				I= 0.401				I= 0.0251				I= 1.11			
	T= 1.11				T= 0.688				T= 0.0354				T= 1.57			
	IxT= 1.92				IxT= 1.19				IxT= 0.0615				IxT=2.72			

Table 6.6.1: Relative water content as influenced by microbes in Indian mustard at 4 locations

Culture	Varieties	Relative water content (%)											
		Bharatpur			Dholi			Hisar			Ludhiana		
		NS	LS	Mean	NS	LS	Mean	NS	LS	Mean	NS	LS	Mean
No Culture	PBR 357	93.5	86.1	89.8	79.2	68.2	73.7	75.2	55.6	65.4	89.0	84.7	86.9
	RH 725	94.5	89.5	92.0	74.8	64.2	69.5	78.6	57.2	67.9	88.4	84.9	86.7
	Giriraj	92.5	88.4	90.5	78.7	67.5	73.1	79.1	56.5	67.8	88.8	87.0	87.9
	Mean	93.5	88.0		77.6	66.6		77.6	56.4		88.7	85.5	
Microbial Formulation	PBR 357	93.4	89.3	91.4	94.9	82.0	88.5	82.5	67.4	75.0	89.1	86.0	87.6
	RH 725	95.8	91.1	93.5	89.1	75.8	82.5	83.5	64.0	73.8	89.8	89.0	89.4
	Giriraj	94.0	89.3	91.7	92.3	77.8	85.1	76.2	54.2	65.2	89.4	88.4	88.9
	Mean	94.4	89.9		92.1	78.5		80.7	61.9		89.4	87.8	
Pusa Sanjeevani	PBR 357	95.3	88.8	92.1	88.4	77.3	82.9	84.9	66.0	75.5	89.6	88.0	88.8
	RH 725	94.8	90.1	92.5	84.7	73.0	78.9	82.4	63.8	73.1	90.8	89.1	90.0
	Giriraj	92.6	90.3	91.5	85.8	75.1	80.5	90.4	61.4	75.9	90.7	89.4	90.1
	Mean	94.2	89.7		86.3	75.1		85.9	63.7		90.4	88.8	
	Overall Mean	94.0	89.2		85.3	73.4		81.4	60.7		89.5	87.4	
CD (p=0.05)	E	1.01			1.01			0.61			0.41		
	T	NS			1.81			0.53			0.33		
	G	1.23			1.81			0.57			0.33		
	ExT	NS			NS			0.63			0.46		
	ExG	NS			NS			0.72			0.47		
	TxG	NS			NS			0.58			0.58		
	ExTxG	NS			NS			0.72			0.82		

Table 6.6.1: Relative water content as influenced by microbes in Indian mustard at 4 locations

Culture	Varieties	Relative water content (%)											
		Bharatpur			Dholi			Hisar			Ludhiana		
		NS	LS	Mean	NS	LS	Mean	NS	LS	Mean	NS	LS	Mean
No Culture	PBR 357	93.5	86.1	89.8	79.2	68.2	73.7	75.2	55.6	65.4	89.0	84.7	86.9
	RH 725	94.5	89.5	92.0	74.8	64.2	69.5	78.6	57.2	67.9	88.4	84.9	86.7
	Giriraj	92.5	88.4	90.5	78.7	67.5	73.1	79.1	56.5	67.8	88.8	87.0	87.9
	Mean	93.5	88.0		77.6	66.6		77.6	56.4		88.7	85.5	
Microbial Formulation	PBR 357	93.4	89.3	91.4	94.9	82.0	88.5	82.5	67.4	75.0	89.1	86.0	87.6
	RH 725	95.8	91.1	93.5	89.1	75.8	82.5	83.5	64.0	73.8	89.8	89.0	89.4
	Giriraj	94.0	89.3	91.7	92.3	77.8	85.1	76.2	54.2	65.2	89.4	88.4	88.9
	Mean	94.4	89.9		92.1	78.5		80.7	61.9		89.4	87.8	
Pusa Sanjeevani	PBR 357	95.3	88.8	92.1	88.4	77.3	82.9	84.9	66.0	75.5	89.6	88.0	88.8
	RH 725	94.8	90.1	92.5	84.7	73.0	78.9	82.4	63.8	73.1	90.8	89.1	90.0
	Giriraj	92.6	90.3	91.5	85.8	75.1	80.5	90.4	61.4	75.9	90.7	89.4	90.1
	Mean	94.2	89.7		86.3	75.1		85.9	63.7		90.4	88.8	
	Overall Mean	94.0	89.2		85.3	73.4		81.4	60.7		89.5	87.4	
CD (p=0.05)	E	1.01			1.01			0.61			0.41		
	T	NS			1.81			0.53			0.33		
	G	1.23			1.81			0.57			0.33		
	ExT	NS			NS			0.63			0.46		
	ExG	NS			NS			0.72			0.47		
	TxG	NS			NS			0.58			0.58		
	ExTxG	NS			NS			0.72			0.82		

Table 6.6.2: Membrane stability and total chlorophyll as influenced by microbes

Culture	Varieties	Membrane stability									Total chl (mg/g F.W.)		
		Dholi			Hisar			Ludhiana			Dholi		
		NS	LS	Mean	NS	LS	Mean	NS	LS	Mean	NS	LS	Mean
No Culture	PBR 357	70.7	65.0	67.9	70.6	62.8	66.7	80.6	72.8	76.7	2.0	1.6	1.8
	RH 725	66.2	60.2	63.2	70.9	64.2	67.6	80.9	74.2	77.6	1.1	0.9	1.0
	Giriraj	69.0	63.5	66.3	70.2	67.7	69.0	80.2	77.7	79.0	1.1	1.0	1.1
	Mean	68.6	62.9		70.6	64.9		80.6	74.9		1.4	1.2	
Microbial Formulation	PBR 357	83.4	78.7	81.1	73.1	64.2	68.7	83.1	74.2	78.7	2.4	2.2	2.3
	RH 725	77.0	74.1	75.6	71.2	68.4	69.8	81.2	78.4	79.8	2.3	2.0	2.2
	Giriraj	80.2	76.2	78.2	71.3	67.9	69.6	81.3	77.9	79.6	2.3	2.1	2.2
	Mean	80.2	76.3		71.9	66.8		81.9	76.8		2.3	2.1	
Pusa Sanjeevani	PBR 357	77.5	73.6	75.6	72.2	67.9	70.1	82.2	77.9	80.1	2.2	2.0	2.1
	RH 725	74.5	67.9	71.2	71.7	70.2	71.0	81.7	80.2	81.0	2.2	1.8	2.0
	Giriraj	75.1	69.8	72.5	70.3	70.1	70.2	80.3	80.1	80.2	2.2	1.9	2.1
	Mean	75.7	70.4		71.4	69.4		81.4	79.4		2.2	1.9	
	Overall Mean	74.8	69.9		71.3	67.0		81.3	77.0		2.0	1.7	
CD (p=0.05)	E	NS			1.156			2.18			0.09		
	T	2.10			0.85			0.70			0.04		
	G	2.10			0.89			0.99			0.04		
	ExT	NS			0.427			0.43			0.06		
	ExG	NS			0.504			0.60			NS		
	TxG	NS			0.69			0.74			0.075		
	ExTxG	NS			1.021			1.05			0.106		

NS- Normal Sown; LS- Late Sown

Table 6.6.3: Photosynthetic pigments as influenced by microbes in Indian mustard at Bharatpur

Culture	Varieties	Photosynthetic pigments (mg/g F.W.)											
		Chl a			Chl b			Total Chl			Carotenoids		
		NS	LS	Mean	NS	LS	Mean	NS	LS	Mean	NS	LS	Mean
No Culture	PBR 357	0.543	0.383	0.463	0.130	0.090	0.110	0.673	0.473	0.573	0.020	0.009	0.015
	RH 725	0.526	0.505	0.516	0.134	0.113	0.124	0.660	0.619	0.639	0.020	0.022	0.021
	Giriraj	0.447	0.370	0.409	0.132	0.085	0.108	0.579	0.455	0.517	0.021	0.006	0.013
	Mean	0.506	0.420		0.132	0.096		0.638	0.516		0.020	0.012	
Microbial Formulation	PBR 357	0.572	0.438	0.505	0.129	0.110	0.119	0.700	0.548	0.624	0.021	0.012	0.017
	RH 725	0.586	0.478	0.532	0.148	0.107	0.128	0.734	0.585	0.659	0.025	0.017	0.021
	Giriraj	0.509	0.487	0.498	0.113	0.117	0.115	0.622	0.604	0.613	0.019	0.018	0.018
	Mean	0.555	0.468		0.130	0.111		0.685	0.579		0.022	0.016	
Pusa Sanjeevani	PBR 357	0.544	0.522	0.533	0.137	0.128	0.133	0.680	0.651	0.666	0.023	0.021	0.022
	RH 725	0.631	0.492	0.562	0.145	0.112	0.129	0.776	0.604	0.690	0.027	0.019	0.023
	Giriraj	0.477	0.438	0.457	0.111	0.111	0.111	0.588	0.549	0.569	0.016	0.013	0.014
	Mean	0.551	0.484		0.131	0.117		0.682	0.601		0.022	0.018	
	Overall Mean	0.537	0.457		0.131	0.108		0.668	0.565		0.021	0.015	
CD (p=0.05)	E	0.055			0.013			0.067			0.005		
	T	NS			NS			NS			NS		
	G	NS			NS			NS			NS		
	ExT	NS			NS			NS			NS		
	ExG	NS			NS			NS			NS		
	TxG	NS			NS			NS			NS		
	ExTxG	NS			NS			NS			NS		

Table 6.6.4: Photosynthetic pigments as influenced by microbes in Indian mustard at Hisar

Culture	Varieties	Photosynthetic pigments (mg/gF.W.)											
		Chl a			Chl b			Total Chl			Carotenoids		
		NS	LS	Mean	NS	LS	Mean	NS	LS	Mean	NS	LS	Mean
No Culture	PBR 357	2.12	1.84	1.98	0.36	0.37	0.37	2.48	2.21	2.35	0.56	0.49	0.53
	RH 725	2.07	1.94	2.01	0.34	0.34	0.34	2.42	2.28	2.35	0.55	0.50	0.53
	Giriraj	2.35	1.87	2.11	0.28	0.34	0.31	2.63	2.21	2.42	0.57	0.47	0.52
	Mean	2.18	1.88		0.33	0.35		2.51	2.24		0.56	0.49	
Microbial Formulation	PBR 357	2.19	1.97	2.08	0.60	0.52	0.56	2.80	2.49	2.64	0.57	0.50	0.53
	RH 725	2.24	1.99	2.12	0.52	0.51	0.52	2.77	2.50	2.64	0.58	0.48	0.53
	Giriraj	2.24	1.98	2.11	0.50	0.43	0.46	2.74	2.41	2.57	0.45	0.44	0.45
	Mean	2.22	1.98		0.54	0.49		2.77	2.47		0.53	0.47	
Pusa Sanjeevani	PBR 357	1.87	1.75	1.81	0.55	0.49	0.52	2.42	2.24	2.33	0.58	0.54	0.56
	RH 725	1.89	1.57	1.73	0.53	0.42	0.47	2.42	1.99	2.20	0.59	0.47	0.53
	Giriraj	1.89	1.56	1.72	0.48	0.45	0.47	2.37	2.00	2.19	0.54	0.51	0.53
	Mean	1.88	1.63		0.52	0.45		2.40	2.08		0.57	0.51	
	Overall Mean	2.093	1.830		0.463	0.430		2.560	2.263		0.553	0.490	
CD (p=0.05)	E	0.026			0.0087			0.0069			0.0059		
	T	0.010			0.0059			0.00368			0.0054		
	G	0.0054			0.0046			0.0051			0.0041		
	ExT	0.009			0.0088			0.0075			0.0064		
	ExG	0.0070			0.007			0.0054			0.0055		
	TxG	0.0078			0.0088			0.0079			0.0063		
	ExTxG	0.021			0.0112			0.0100			0.0089		

NS- Normal Sown; LS- Late Sown

Table 6.6.5: Photosynthetic pigmentsas influenced by microbes in Indian mustard at Ludhiana

Culture	Varieties	Photosynthetic pigments (mg/g F.W.)											
		Chl a			Chl b			Total Chl			Carotenoids		
		NS	LS	Mean	NS	LS	Mean	NS	LS	Mean	NS	LS	Mean
No Culture	PBR 357	1.47	1.19	1.33	0.40	0.38	0.39	1.85	1.59	1.72	0.46	0.39	0.43
	RH 725	1.42	1.29	1.36	0.36	0.36	0.36	1.78	1.64	1.71	0.45	0.40	0.43
	Giriraj	1.40	1.22	1.31	0.42	0.29	0.36	1.83	1.52	1.67	0.47	0.37	0.42
	Mean	1.43	1.23		0.39	0.34		1.82	1.58		0.46	0.39	
Microbial Formulation	PBR 357	1.48	1.26	1.37	0.45	0.37	0.41	1.94	1.64	1.79	0.47	0.40	0.43
	RH 725	1.53	1.28	1.41	0.37	0.36	0.37	1.91	1.66	1.79	0.48	0.38	0.43
	Giriraj	1.45	1.27	1.36	0.35	0.28	0.31	1.80	1.44	1.62	0.35	0.34	0.35
	Mean	1.49	1.27		0.39	0.34		1.88	1.58		0.43	0.37	
Pusa Sanjeevani	PBR 357	1.47	1.35	1.41	0.45	0.39	0.42	1.92	1.74	1.83	0.48	0.44	0.46
	RH 725	1.49	1.17	1.33	0.43	0.32	0.37	1.85	1.49	1.67	0.49	0.37	0.43
	Giriraj	1.39	1.16	1.27	0.38	0.35	0.37	1.75	1.66	1.70	0.44	0.41	0.43
	Mean	1.45	1.23		0.42	0.35		1.84	1.63		0.47	0.41	
	Overall Mean	1.46	1.24		0.40	0.34		1.85	1.59		0.45	0.39	
CD (p=0.05)	E	0.016			0.010			0.007			0.006		
	T	0.007			0.007			0.004			0.005		
	G	0.005			0.005			0.004			0.004		
	ExT	0.009			0.010			0.006			0.007		
	ExG	0.006			0.007			0.006			0.005		
	TxG	0.008			0.009			0.007			0.006		
	ExTxG	0.011			0.013			0.010			0.009		

Table 6.6.6: Canopy temperature (^{0}C) and CTD (^{0}C) as influenced by microbes

Culture	Varieties	CT (^{0}C)						CTD (^{0}C)					
		Hisar			Ludhiana			Hisar			Ludhiana		
		NS	LS	Mean	NS	LS	Mean	NS	LS	Mean	NS	LS	Mean
No Culture	PBR 357	22.7	25.7	24.2	23.9	25.2	24.6	-4.9	-4.7	-4.8	-6.4	-5.7	-6.1
	RH 725	25.0	28.0	26.5	26.2	29.0	27.6	-3.0	-2.7	-2.9	-4.5	-3.7	-4.1
	Giriraj	24.0	27.0	25.5	25.2	26.9	26.1	-3.8	-3.1	-3.4	-5.3	-4.6	-4.9
	Mean	23.9	26.9		25.1	27.0		-3.9	-3.5		-5.4	-4.7	
Microbial Formulation	PBR 357	19.0	21.4	20.2	20.2	23.8	22.0	-5.5	-4.3	-4.9	-7.5	-6.3	-6.9
	RH 725	19.6	22.0	20.8	20.8	23.1	21.9	-5.6	-2.4	-4.0	-7.6	-4.4	-6.0
	Giriraj	24.4	26.8	25.6	25.6	27.8	26.7	-3.3	-3.1	-3.2	-5.3	-5.2	-5.3
	Mean	21.0	23.4		22.2	24.9		-4.8	-3.3		-6.8	-5.3	
Pusa Sanjeevani	PBR 357	22.7	25.5	24.1	23.9	24.8	24.4	-5.1	-4.2	-4.7	-7.1	-5.7	-6.4
	RH 725	22.7	25.5	24.1	23.9	25.4	24.7	-4.3	-3.5	-3.9	-6.3	-5.0	-5.7
	Giriraj	22.0	24.8	23.4	23.2	28.6	25.9	-4.5	-4.8	-4.7	-6.5	-6.3	-6.4
	Mean	22.5	25.3		23.7	26.3		-4.7	-4.2		-6.7	-5.7	
	Overall Mean	22.5	25.2		23.7	26.1		-4.4	-3.6		-6.3	-5.2	
CD (p=0.05)	E	0.869			0.869			0.0867			0.09		
	T	0.231			0.231			0.0539			0.05		
	G	0.382			0.382			0.0370			0.04		
	ExT	0.327			0.327			0.0762			0.08		
	ExG	0.540			0.540			0.0523			0.05		
	TxG	0.661			0.661			0.0641			0.06		
	ExTxG	0.935			0.935			0.0907			0.09		

NS- Normal Sown; LS- Late Sown

Table 6.6.7: Total siliquae per plant as influenced by microbes at 4 locations in Indian mustard

Culture	Varieties	Total siliquae per plant											
		Bharatpur			Dholi			Hisar			Ludhiana		
		NS	LS	Mean	NS	LS	Mean	NS	LS	Mean	NS	LS	Mean
No Culture	PBR 357	330.8	177.7	254.2	235.2	190.4	212.8	271.5	209.3	240.4	128.1	127.9	128.0
	RH 725	320.1	188.7	254.4	230.7	177.8	204.3	314.5	224.4	269.5	162.9	119.3	141.1
	Giriraj	288.2	179.8	234.0	232.0	179.0	205.5	237.6	170.1	203.9	144.3	111.5	127.9
	Mean	313.0	182.0		232.6	182.4		274.5	201.3		145.1	119.6	
Microbial Formulation	PBR 357	348.1	169.2	258.7	259.5	232.7	246.1	203.0	163.3	183.2	136.1	128.4	132.3
	RH 725	293.9	168.8	231.3	254.8	228.5	241.7	325.7	271.8	298.8	165.7	121.2	143.5
	Giriraj	245.1	193.4	219.3	256.0	230.8	243.4	282.9	222.7	252.8	154.3	113.1	133.7
	Mean	295.7	177.1		256.8	230.7		270.5	219.3		152.0	120.9	
Pusa Sanjeevani	PBR 357	302.7	211.7	257.2	249.3	222.8	236.1	297.7	224.0	260.9	141.9	129.9	135.9
	RH 725	305.8	171.7	238.7	243.7	217.2	230.5	302.2	232.0	267.1	166.5	128.4	147.4
	Giriraj	292.0	206.0	249.0	246.9	221.0	234.0	346.7	254.0	300.4	168.1	119.5	143.8
	Mean	300.1	196.4		246.6	220.4		315.5	236.7		158.8	125.9	
	Overall Mean	302.9	185.2		245.3	211.2		286.8	219.1		152.0	122.1	
CD (p=0.05)	E	27.06			6.19			3.79			1.69		
	T	NS			1.73			0.68			0.566		
	G	NS			1.78			2.65			0.485		
	ExT	NS			2.45			1.69			0.801		
	ExG	NS			NS			0.879			0.687		
	TxG	NS			NS			0.841			0.841		
	ExTxG	NS			NS			1.954			1.190		

Table 6.6.8: Test weight as influenced by microbes at 3 locations in Indian mustard

Culture	Varieties	1000 seed weight (g)								
		Bharatpur			Hisar			Ludhiana		
		NS	LS	Mean	NS	LS	Mean	NS	LS	Mean
No Culture	PBR 357	5.0	3.3	4.2	4.8	3.8	4.3	5.4	4.5	5.0
	RH 725	5.9	3.5	4.7	4.6	3.0	3.8	5.6	4.0	4.8
	Giriraj	6.3	4.3	5.3	4.6	2.8	3.7	6.5	5.1	6.5
	Mean	5.7	3.7		4.7	3.2		5.9	4.6	
Microbial Formulation	PBR 357	5.2	3.5	4.4	4.5	3.5	4.0	5.7	4.9	4.9
	RH 725	5.7	3.7	4.7	4.5	2.9	3.7	5.8	4.4	4.0
	Giriraj	6.7	4.7	5.7	4.7	3.4	4.0	6.8	6.5	5.1
	Mean	5.9	4.0		4.6	3.2		6.1	5.3	
Pusa Sanjeevani	PBR 357	5.3	3.8	4.5	4.3	3.2	3.7	5.9	5.2	5.2
	RH 725	5.9	3.8	4.9	4.5	2.8	3.7	6.2	5.2	4.4
	Giriraj	5.9	4.6	5.3	4.8	3.0	3.9	6.9	6.5	6.5
	Mean	5.7	4.1		4.5	3.0		6.3	5.6	
	Overall Mean	5.8	3.9		4.6	3.1		6.1	5.1	
CD (p=0.05)	E	0.168			0.035			0.026		
	T	NS			0.018			0.029		
	G	0.206			0.0288			0.029		
	ExT	NS			0.0504			0.040		
	ExG	0.291			0.061			0.041		
	TxG	NS			0.071			0.050		
	ExTxG	NS			0.069			0.071		

NS- Normal Sown; LS- Late Sown

Table 6.6.9: Biological yield as influenced by microbes in Indian mustard

Culture	Varieties	Biological yield (kg/ha)											
		Bharatpur			Dholi			Hisar			Ludhiana		
		NS	LS	Mean	NS	LS	Mean	NS	LS	Mean	NS	LS	Mean
No Culture	PBR 357	12753	7786	10269	2338	1672	2005	9708	6226	7967	7778	3148	5463
	RH 725	10481	7127	8804	2279	1650	1965	9650	6083	7867	7407	2037	4722
	Giriraj	9617	7778	8698	2287	1628	1957	9859	5929	7894	7963	2685	5324
	Mean	10951	7564		2301	1650		9739	6079		7716	2623	
Microbial Formulation	PBR 357	13852	8194	11023	2775	2442	2609	9813	6732	8273	8148	4074	6111
	RH 725	10086	7117	8602	2708	2324	2516	11168	7623	9396	7593	2500	5047
	Giriraj	9877	8693	9285	2731	2383	2557	9414	8129	8771	8148	2698	5423
	Mean	11272	8001		2738	2383		10132	7495		7963	3091	
Pusa Sanjeevani	PBR 357	12074	8422	10248	2605	2213	2409	9714	5709	7711	8889	4444	6666
	RH 725	12074	8164	10119	2538	2128	2333	10797	6985	8891	7778	3333	5556
	Giriraj	11136	7859	9497	2579	2165	2372	9347	7601	8474	8704	3140	5922
	Mean	11761	8148		2574	2168		9952	6765		8457	3639	
	Overall Mean	11328	7904		2538	2067		9941	6780		8045	3118	
CD (p=0.05)	E	653.79			20.71			66.75			66.75		
	T	NS			45.27			74.94			74.94		
	G	800.73			45.27			77.805			77.805		
	ExT	NS			64.03			105.97			105.97		
	ExG	1132.40			NS			110.03			110.03		
	TxG	NS			NS			134.76			134.76		
	ExTxG	NS			NS			190.58			190.58		

Table 6.6.10: Seed yield as influenced by microbes in Indian mustard at 4 locations

Culture	Varieties	Seed yield (kg/ha)											
		Bharatpur			Dholi			Hisar			Ludhiana		
		NS	LS	Mean	NS	LS	Mean	NS	LS	Mean	NS	LS	Mean
No Culture	PBR 357	3173	1710	2441	1160	856	1008	2750	2113	2431	1885	1067	1476
	RH 725	2716	1556	2136	1141	829	985	2838	2000	2419	1475	1038	1257
	Giriraj	2525	1802	2164	1144	832	988	3163	2225	2694	1984	1104	1544
	Mean	2805	1689	2247	1149	839	994	2917	2113		1781	1070	
Microbial Formulation	PBR 357	3562	1667	2614	1450	1135	1293	2900	2363	2631	1961	1286	1623
	RH 725	2932	1500	2216	1423	1132	1278	3887	3175	3531	1630	1061	1346
	Giriraj	2759	1879	2319	1433	1120	1277	2813	2150	2481	1990	1156	1573
	Mean	3084	1682	2383	1435	1129	1282	3200	2563		1860	1168	
Pusa Sanjeevani	PBR 357	3154	1457	2306	1414	1097	1256	2850	2338	2594	2001	1373	1687
	RH 725	3272	1407	2340	1383	1078	1231	3100	2388	2744	1850	1084	1467
	Giriraj	3080	1673	2377	1406	1086	1246	2917	2300	2609	2130	1208	1669
	Mean	3169	1512	2341	1401	1087	1244	2956	2342		1994	1222	
	Overall Mean	3019	1628		1397	1018	1240	3024	2339		1880	1153	
CD (p=0.05)	E	170.08			10.01			21.24			21.24		
	T	NS			5.50			12.27			12.27		
	G	NS			5.50			13.346			13.346		
	ExT	294.59			NS			17.35			17.35		
	ExG	294.59			NS			18.87			18.87		
	TxG	NS			NS			23.116			23.116		
	ExTxG	NS			NS			32.69			32.69		

NS- Normal Sown; LS- Late Sown

Expt 6.7.1: Evaluation of germplasm for remobilization efficiency

Code	Entries	REE (%)		Wilting time (hrs)		Main shoot length (cm)			Siliquae on main shoot			Seed yield	
		Hisar	Ludhiana	Hisar	Ludhiana	Bharatpur	Hisar	Ludhiana	Bharatpur	Hisar	Ludhiana	Hisar (g/plant)	Ludhiana (g/plot)
80	IC 597881	71.7	69.8	53.0	41.0	68.4	75.7	54.0	64.4	48.3	54.0	6.0	0.270
81	IC 597883	69.1	26.7	49.0	66.0	64.4	65.0	70.8	47.3	55.0	60.0	6.3	0.350
82	IC 597885	71.2	61.8	50.8	50.0	45.9	52.0	66.6	33.8	52.7	58.6	5.3	0.312
83	IC 597889	67.9	67.9	91.3	95.0	53.6	75.7	70.2	45.9	59.0	55.2	5.8	0.358
84	IC 597895	67.0	78.0	74.8	68.0	58.5	75.0	69.4	46.4	55.7	54.0	4.9	0.268
85	IC 597910	67.6	78.2	90.3	82.0	59.4	73.3	62.0	42.3	51.3	37.2	6.4	0.229
86	IC 766097	67.4	83.4	110.5	55.0	59.0	45.0	58.4	56.7	35.3	40.6	4.3	0.249
87	IC 766272	67.0	70.7	112.5	101.0	42.8	90.0	76.2	44.6	55.0	60.8	5.8	0.303
88	IM 108	68.0	41.6	108.0	80.0	53.1	86.0	64.0	40.1	55.0	49.8	5.3	0.259
89	IM 110	66.6	73.3	94.3	88.0	46.4	86.3	77.6	50.9	53.3	53.4	6.3	0.273
90	IM 120	66.7	65.3	49.3	40.0	67.1	71.7	71.4	58.5	52.7	55.6	5.6	0.231
91	IM 152	65.5	25.9	71.3	50.0	53.6	75.0	72.8	58.5	55.7	58.4	4.9	0.217
92	IM 170	64.0	62.3	53.8	40.0	40.5	82.3	60.8	43.7	52.7	50.6	5.6	0.175
93	IM 24	64.5	15.2	108.0	66.0	50.4	75.3	62.2	39.6	48.0	53.4	3.8	0.244
94	IM 46	64.9	19.1	27.7	27.0	60.8	63.3	63.6	61.2	39.7	44.0	6.0	0.154
95	IM 59	65.3	32.1	30.7	52.0	63.5	62.7	69.6	38.3	37.7	57.2	6.0	0.193
96	IM 68	65.1	11.9	71.3	73.0	47.3	68.7	64.4	45.5	38.3	48.8	4.0	0.168
97	IM 76	65.5	30.5	73.3	67.0	63.5	62.7	70.2	58.1	43.7	46.0	6.3	0.199
98	IM 87	64.5	56.0	73.3	75.0	51.3	83.3	69.2	46.4	50.7	47.8	6.3	0.253
99	IM 97	62.9	29.6	48.3	48.0	52.2	64.7	59.6	39.6	49.3	38.6	6.0	0.161
100	RH 781	63.9	15.7	60.0	60.0	58.5	77.7	73.2	60.3	38.3	47.8	5.6	0.131
101	RH 819	61.8	28.4	55.9	81.0	54.5	74.0	62.6	43.7	53.0	47.6	6.6	0.151
102	RH 904	64.6	30.9	61.7	69.0	64.8	71.3	58.2	54.0	47.3	55.8	5.1	0.259
103	RH 749	63.4	32.4	54.3	52.0	47.7	67.3	67.2	54.5	40.7	46.2	5.6	0.513
104	RL 1359	64.2	56.9	57.8	57.0	67.1	73.0	71.0	63.0	46.3	61.6	5.8	0.189
105	RLM 619	64.4	66.3	88.8	92.0	60.8	69.0	72.2	53.6	53.0	50.4	4.9	0.243
106	RM 51	63.5	22.5	53.3	89.0	59.0	67.7	63.2	44.6	42.7	44.6	6.0	0.214
107	RNN 443-2	63.2	50.6	75.3	99.0	62.1	62.3	62.2	45.0	45.0	43.0	4.4	0.235
108	Rohini	63.9	80.8	114.0	151.0	48.2	56.7	61.6	41.4	42.0	39.6	3.1	0.227
109	RRN 443	64.0	56.9	78.8	69.0	46.8	76.0	84.8	44.6	47.3	63.2	6.5	0.357
110	RVM 2	62.0	41.0	95.8	64.0	68.9	74.3	72.2	47.3	49.0	52.0	4.0	0.295
111	RW 571-2	61.3	74.9	100.3	88.0	70.7	55.3	65.8	46.8	41.3	50.2	6.0	0.270
112	Shivalik	64.0	55.3	77.3	86.0	43.7	81.0	63.4	47.3	48.0	40.6	3.3	0.209
113	Shivani	62.0	54.6	67.2	53.0	64.8	80.3	81.2	55.4	48.7	51.4	4.0	0.282
114	SitaraSagar	63.0	71.6	48.2	38.0	53.6	67.3	76.0	63.9	40.7	55.6	6.0	0.208
115	SKM 0904	62.2	32.5	60.8	48.0	57.6	64.7	68.2	38.7	37.0	50.4	4.0	0.344
116	SM 2	62.2	14.8	91.3	65.0	56.3	79.7	73.6	39.2	45.3	43.4	3.1	0.456
117	TC 27-2	60.2	62.9	76.3	45.0	54.5	77.3	77.4	63.9	46.7	50.4	5.6	0.410
118	TM 2	60.4	31.2	79.8	63.0	59.9	82.7	61.2	43.2	40.3	46.4	6.4	0.341
119	Vasundhara	61.6	17.6	80.3	93.0	59.4	57.0	65.8	50.9	47.3	43.2	4.2	0.311
120	Aashirwad	59.4	32.8	53.1	59.0	50.4	75.0	73.2	42.3	43.7	46.6	2.9	0.280
121	AJ 11	60.5	20.9	59.8	31.0	46.8	57.0	65.2	41.4	47.3	45.6	6.0	0.240
122	AJ 2	61.0	44.6	129.8	133.0	60.3	58.3	62.6	53.1	38.7	43.2	3.7	0.339
123	Albeli	59.9	66.5	58.9	40.0	72.6	53.0	59.0	51.7	47.3	43.2	5.1	0.255
124	BR 40	58.5	53.1	100.3	112.0	72.1	61.7	67.8	69.3	52.7	48.2	6.4	0.248
125	CN 101813	56.3	27.4	81.8	98.0	52.3	55.7	63.8	54.5	38.3	44.2	3.0	0.177

126	CN 101834	57.9	25.0	97.8	116.0	64.9	66.7	60.6	49.0	43.0	39.8	6.5	0.126
127	CN 101845	58.5	76.1	96.3	100.0	56.7	62.0	67.6	62.2	48.0	40.8	5.1	0.135
128	CN 101849	57.7	32.7	96.8	110.0	82.0	66.3	57.0	71.5	46.0	42.6	5.3	0.143
129	CN 105309	54.6	6.4	96.8	100.0	65.5	56.7	75.4	71.5	46.3	51.4	5.8	0.152
130	CN 105311	55.1	28.7	48.8	33.0	49.5	73.3	68.4	53.4	45.7	46.8	6.5	0.225
131	CN 105313	50.3	46.7	79.3	78.5	61.6	47.0	70.6	48.4	52.3	47.4	3.8	0.140
132	CN 105364	55.0	49.2	34.7	39.0	68.8	65.3	62.0	51.2	58.7	39.6	4.4	0.170
133	CN 112920	57.1	68.8	90.0	85.0	85.8	56.3	55.2	58.9	35.3	48.0	3.3	0.238
134	CN 34005	56.8	20.0	79.5	75.0	66.0	72.0	62.4	62.7	48.7	40.4	2.7	0.115
135	DJ 109	56.1	70.7	78.0	91.0	76.5	76.3	65.2	66.0	59.7	37.2	4.9	0.271
136	DJ 33	56.1	24.6	29.5	32.0	73.7	81.7	50.8	68.2	45.0	37.2	5.1	0.325
137	DJ 5	52.1	33.4	34.6	48.0	88.0	71.7	62.2	65.5	41.7	41.4	6.3	0.223
138	DRMRIJ 17-39	50.6	36.0	38.5	57.0	77.0	74.3	74.8	49.5	36.0	42.8	5.3	0.297
139	DRMRIJ 17-42	54.6	37.8	60.2	54.0	56.3	72.3	63.2	41.9	42.0	41.8	5.8	0.272
140	RC 1217	52.1	44.7	51.4	55.0	70.2	71.7	67.8	48.2	63.7	53.6	3.8	0.260
141	RC 1261	53.2	25.8	50.5	56.0	54.0	74.7	81.2	51.3	36.7	50.6	4.9	0.180
142	RC 1271	47.9	45.4	52.5	60.0	62.6	82.3	73.0	54.0	44.7	49.6	3.3	0.156
143	RC 1626	46.6	28.1	106.5	115.0	60.3	79.7	69.8	55.8	47.7	52.2	2.7	0.190
144	RC 2025	47.8	22.3	59.4	62.0	72.0	81.7	76.0	53.6	45.3	48.4	4.2	0.195
145	RC 571	47.2	10.4	50.5	57.0	63.0	76.0	77.4	40.5	45.7	49.0	5.6	0.200
146	RC 891	49.6	72.4	167.5	179.0	65.3	79.0	71.8	44.1	53.0	44.6	3.8	0.174
147	RC 915	49.6	59.5	169.5	152.0	72.0	63.3	79.8	46.8	57.0	52.8	4.4	0.181
148	RCQR 9901	44.3	51.1	143.5	149.0	72.5	77.0	74.2	49.1	45.7	41.8	4.7	0.345
149	RCR 9403	58.5	77.6	116.5	80.0	52.7	91.0	77.6	45.0	46.7	43.6	3.3	0.438
150	NRCDR 2	58.2	49.3	145.5	144.0	58.1	84.0	84.2	54.0	50.0	50.0	3.8	0.285
151	NRCDR 2-2	58.1	17.1	71.5	83.0	54.9	75.3	74.0	39.2	41.0	42.6	4.7	0.268
152	PBR 210	57.6	49.4	29.5	34.0	51.3	100.3	78.0	45.5	59.3	50.8	4.7	0.322
153	PBR 378	57.5	66.2	49.5	66.0	67.5	92.7	85.4	68.0	49.3	48.2	4.4	0.327
154	PCR 7	57.2	43.3	50.6	54.0	70.5	67.3	80.8	42.5	47.0	54.2	3.3	0.348
155	PM 28	57.1	70.5	59.2	42.0	52.5	86.3	89.0	50.5	44.0	51.6	6.2	0.241
156	PM 67	56.9	48.6	31.0	37.7	70.5	78.0	69.4	64.5	54.0	42.0	5.1	0.340
157	PR 2001-41	56.8	70.8	41.0	39.0	57.0	80.7	74.0	51.5	48.7	48.4	6.4	0.299
158	PR 2006	56.7	27.9	58.0	48.8	58.0	84.3	78.4	44.0	53.0	46.2	5.6	0.290
159	PR 2008-1	56.6	51.4	73.5	31.7	65.0	51.0	77.8	67.0	48.3	50.4	3.6	0.300
160	PTJ 3-89	56.2	69.0	64.0	43.0	60.5	86.3	78.0	48.5	57.0	48.0	6.6	0.312
161	Purbi Raya 1	56.2	59.0	59.0	65.0	72.0	60.7	65.8	60.0	42.0	37.2	3.0	0.355
162	Purbi Raya 2	55.9	67.0	80.0	66.0	53.0	72.0	71.4	60.5	45.3	38.4	3.6	0.313
163	Pusa Bold	55.8	49.4	60.0	52.2	74.5	75.7	65.2	70.0	48.3	44.8	6.0	0.218
164	PusaBahar	55.4	76.0	116.0	111.0	67.5	63.7	84.2	59.5	53.0	53.8	4.7	0.488
165	PusaMahak	55.4	31.0	82.0	84.0	76.0	89.3	87.4	71.5	49.0	42.0	3.3	0.331
166	RB 50	55.0	58.7	70.4	76.0	71.5	80.7	81.6	52.5	58.0	55.0	4.9	0.372
167	RB 60	55.0	45.2	52.0	31.0	51.0	80.0	74.2	37.5	55.3	54.2	2.7	0.211
168	RC 1149	53.5	13.7	50.0	49.3	59.5	80.3	76.2	51.0	57.0	50.4	2.7	0.188
169	RC 1213	52.4	54.2	82.0	83.0	65.0	71.7	73.6	51.5	41.0	44.2	6.2	0.268
170	JA 159	52.0	52.3	50.0	59.0	66.0	76.0	81.6	47.0	45.7	50.8	4.9	0.290
171	JA 245	51.2	67.4	38.0	33.0	65.5	60.0	71.4	63.0	38.7	44.6	3.1	0.182
172	JA 75	50.1	66.6	41.0	45.9	47.5	64.0	75.5	49.5	56.7	41.6	5.1	0.418
173	Jagannath	49.9	65.8	81.0	89.0	59.0	75.0	87.3	44.5	56.3	61.5	4.7	0.254
174	JM 2	49.9	59.0	67.0	86.0	51.5	71.0	86.0	56.5	51.3	44.2	6.3	0.301
175	JT 1	49.5	52.0	42.0	47.2	74.5	76.0	78.4	65.0	49.3	41.4	4.9	0.170

176	JT 149	49.4	55.2	51.0	52.0	59.5	65.3	69.2	65.0	39.0	40.4	6.3	0.190
177	JT 260	48.4	72.1	31.0	45.7	45.0	76.0	74.0	48.5	44.7	42.6	4.9	0.263
178	Kanti	48.2	73.9	61.0	62.0	56.0	69.3	91.2	44.0	44.7	54.4	6.5	0.218
179	KDM 1049	48.1	45.9	55.0	50.9	62.5	61.0	74.0	46.5	52.3	44.6	3.3	0.316
180	Kranti	47.0	73.7	60.0	61.0	78.0	73.3	84.4	53.5	41.3	41.0	6.2	0.265
181	Krishna	46.7	90.0	50.0	40.7	60.0	56.0	70.4	57.0	41.7	52.8	6.7	0.272
182	Navgold	46.1	22.1	44.0	43.5	69.5	79.3	66.8	60.0	48.3	41.2	5.8	0.184
183	NBR 03-1	44.4	63.3	63.0	40.9	67.0	79.7	76.4	62.0	48.3	52.4	6.4	0.252
184	NC 533728	44.4	7.9	50.0	53.0	80.0	75.3	71.0	59.5	46.3	47.2	6.4	0.280
185	NPJ 161	43.5	28.2	40.0	48.7	70.0	79.3	81.0	45.0	42.7	53.8	4.9	0.210
186	NPJ 190	42.6	54.1	54.0	57.5	72.5	73.3	79.0	49.0	36.7	44.2	6.7	0.306
187	NPJ 206	41.6	23.7	61.0	51.1	80.0	73.7	83.0	52.0	45.3	45.6	6.7	0.301
188	NPJ 28	41.1	44.0	50.0	60.4	80.5	78.3	59.8	54.5	47.3	46.0	6.5	0.286
189	NR 3350	40.0	19.5	31.0	31.0	58.5	80.0	64.0	50.0	50.3	41.8	3.8	0.281
190	DRMRIJ 17-44	39.9	55.5	42.6	52.6	64.5	76.7	68.8	60.0	44.0	46.4	2.9	0.231
191	DRMRIJ 17-52	39.8	46.7	74.5	67.0	61.0	76.0	67.0	43.5	42.3	38.8	6.3	0.195
192	DTM 25	39.7	32.8	50.6	36.6	57.0	80.7	61.0	50.5	45.3	29.6	2.9	0.212
193	DTM 4	39.6	53.0	50.0	52.5	65.5	64.3	61.0	49.5	37.0	43.2	2.9	0.242
194	EC 564544	37.9	35.9	80.5	62.0	69.0	53.0	66.2	50.0	30.0	36.0	6.3	0.368
195	EC 564949	33.1	69.6	62.5	66.0	53.5	62.7	68.0	46.0	46.3	39.6	3.8	0.506
196	EC 61-3-1	33.0	39.0	70.4	61.0	52.0	76.7	73.2	49.5	44.0	45.0	6.6	0.320
197	EJ 20	31.9	58.9	85.5	78.0	76.5	71.0	60.4	52.5	49.3	43.6	6.4	0.370
198	Giriraj	31.4	22.2	91.0	98.0	78.5	86.3	79.8	52.0	52.3	45.8	5.3	0.297
199	GM 1	30.6	69.7	60.3	36.0	48.5	91.0	80.4	52.5	52.3	47.0	4.2	0.313
200	GM 2	29.3	16.1	73.6	44.0	72.0	78.0	75.8	61.5	43.0	42.8	5.6	0.329
201	GM 3	29.1	39.2	40.9	48.0	59.5	66.0	71.0	71.0	45.0	35.8	4.2	0.280
202	GR 325	25.9	67.7	31.8	38.4	64.0	76.3	67.4	43.0	47.7	36.0	3.8	0.212
203	GS 54	24.7	66.1	40.6	42.0	62.5	84.0	78.6	43.5	44.3	42.6	3.6	0.300
204	IC 597810	24.4	15.7	82.5	65.0	60.5	68.7	59.0	71.0	43.7	40.0	5.8	0.315
205	IC 597867	22.7	68.1	54.9	31.0	66.5	70.7	66.4	48.0	51.0	43.8	2.9	0.225
206	IC 597869	22.1	60.3	61.4	75.0	66.0	72.0	65.8	56.5	36.7	42.4	2.7	0.324
207	IC 597870	18.7	17.6	60.5	53.0	56.0	67.7	69.0	47.0	43.7	43.6	4.2	0.246
208	IC 597873	14.1	53.6	72.4	68.0	52.0	70.7	43.8	46.0	43.3	29.6	5.6	0.168
209	IC 597876	22.0	51.8	78.5	76.0	67.0	73.3	70.8	59.0	45.3	44.6	4.7	0.194
Mean		52.8	47.1	68.8	66.4	61.9	72.3	70.6	52.3	47.0	46.6	4.9	0.263

Biochemistry

7. Biochemistry

7.1 Evaluation of important breeding materials for nutritional quality index (NQI) of oil.

Parameters: Oil percent, Fatty acid profile(palmitic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, eicosenoic acid, erucic acid), ω6/ω3, oil stability index, SFA: MUFA: PUFA, saturated and unsaturated ratio.

Centres: Bharatpur, Ludhiana, Pantnagar and Hisar

PM-30 andPDZ-1(Quality check)

7.1.1. Oil percent

Oil percentage of seventeen genotypes was analysed at four centers i.e.Bharatpur, Ludhiana, Pantnagar and Hisar. It ranged from 33% (Pusa QMH-1) to 41% (DRMRC1Q 47)(CV ≤ 0.05). (Table 1)

7.1.2 Oil stability index of quality

Oil stability index which is the ratio of MUFA: PUFA, was analyzed at four centres (Bharatpur, Pantnagar, Hisarand Ludhiana). On the basis of mean estimates, it ranged from 0.67 in NPJ 253to 1.64 in PM-30 (CV ≤ 0.25).(Table 2).

7.1.3 Fatty acid profile

Entries of IVT/AVT quality trials were analysed for fatty acid profile at Bharatpur, Pantnagar, Hisar and Ludhiana. Entries were DRMRC1(Q)172, PM 30(NC), PusaQMH 1, PMAS 11, RH 0749 (ZC), PDZ 18, PM 32(LR), PMAS 7, LES67, LES66, RH(OE)1708, PDZ 19, DRMRQ 29-20, RH(OE)1806. PDZ 11, DRMR CIQ 158, PDZ 15, IJ19R5004, PDZ 16, NPJ 253, PDZ 1, NPJ 252, PM 28, PDZ 14, DRMRCIQ 47 and Released variety.

Palmitic acid: 2.22% (Released Variety) to 4.77 % (LES 67). (CV ≤ 0.19).

Stearic acid: 0.85% (Released Variety) to 2.60% (PDZ 1). (CV ≤ 0.27).

Oleic acid: 11.74 % (NPJ 253) to 49.17 % (PDZ 1).(CV ≤ 0.34).

Linoleic acid: 14.93 % (RH 0749) to 40.48 % (LES 67). (CV ≤ 0.26).

Linolenic acid: 7.98 % (PDZ 1) to 19.11 % (RH 0749). (CV ≤ 0.27).

Eicosanoic acid: 0.34 % (DRMRC1Q 47) to 1.15 % (NPJ 253). (CV ≤ 32).

Erucic acid: 0.37 % (PM-32) to 47.82 % (NPJ 253). (CV ≤ 1.63)

ω6:ω3 ratio ranged from 0.80 (RH 0749) to 4.54 (LES 67). (CV ≤ 0.45).

Saturated Fatty Acid ranged from 2.65 (RH 0749) to 8.54 (LES 67). (CV≤0.22)

SFA: MUFA: PUFA ratio ranged between 1:06:06 to 1:21:11.

Saturated and unsaturated ratio ranged between 1:12 to 1:36.(Table 3-13)

7.2. Value addition screening in seed meal of promising breeding materials

Parameters: Seed meal-protein content, total antioxidant activity, β-carotenecontent and total sinapic acid content

Centres: Bharatpur, Pantnagar, Hisar, Ludhiana

PM-30 andPDZ-1(Quality check)

- **Total protein:**29.43 (RH(OE)1806) to 32.95% (PDZ 16)(CV ≤ 0.04).
- **Total antioxidant capacity** ranged from 14.21 (DRMRC1Q 47) to 20.87 (PM 30) mg/g (CV ≤ 0.11).
- **β-carotene** ranged from 3.49% (PDZ 14) to 5.44% (RH(OE)1806) (CV ≤ 0.14).
- **Total sinapic acid content** ranged from 1.65% (PDZ 18) to 2.40% (PM 32) (CV ≤ 0.11).

7.3 Screening of anti-nutritional factors in quality breeding materials.

Parameters: Total glucosinolates and phytic acid

Centres: Bharatpur, Pantnagar, Hisar, Ludhiana

Entries of IVT/AVT quality trials were evaluated.

Total glucosinolate mean values for fourcentres (Bharatpur, Pantnagar, Ludhiana, Hisar) were <30 µmol/g in PMAS 11, PDZ 18, PMAS 7, PDZ 19, DRMRQ 29-20, PDZ 11, DRMR C1Q158, PDZ 15, IJ19R5004, PDZ 16, PDZ 1, PDZ 14, DRMRCIQ 47genotypes. **Glucosinolate**ranged from 19.11% (PDZ-16) to 73.45% (DRMRQ 29-20) (CV ≤ 0.42).

Phytic acid content mean values were < 2.60% in PDZ 18, Rh(OE)1708, PDZ 1, NPJ 252, PDZ 14 and Released variety (Table 18-19(CV ≤ 0.15).

7.4 Screening of different types of glucosinolates::

Glucosinolate profiling was carried out by UPLC/HPLC at Bharatpur centers. Aliphatic glucosinolates were identified as sinigrin, tropeolingluconapin and few unknown peaks were unidentified. (Table: 20)

7.5 Biochemical basis of resistance will also be evaluated for entomology trials:

Hisar, Pantnagar and Ludhiana participated in the analysis of myrosinase, peroxidases, total glucosinolates, total phenols, ortho-dihydroxy phenols and flavonols. (Data is shown in entomology section)

7.6 Statistical analysis:

Data was statistically analysed using SPSS 2.0 software.

Table 1: Oil Percent

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH	Mean	CV
1.	DRMRC1(Q)172	Biochem-22-1	39.32	39.82	40.68	37.74	39.39	0.03
2.	PM 30(NC)	Biochem-22-2	38.23	38.5	39.77	36.87	38.34	0.03
3.	PusaQMH 1	Biochem-22-3	31.62	35.67	34.44	31.57	33.33	0.05
4.	PMAS 11	Biochem-22-4	36.19	37.7	37.27	35.38	36.64	0.02
5.	RH 0749 (ZC)	Biochem-22-5	40.29	39.99	41.71	41.94	40.98	0.02
6.	PDZ 18	Biochem-22-6	39.15	38.11	39.97	34.25	37.87	0.06
7.	PM 32(LR)	Biochem-22-7	37.29	38.91	38.59	36.14	37.73	0.03
8.	PMAS 7	Biochem-22-8	40.80	40.11	39.85	37.04	39.45	0.04
9.	LES67	Biochem-22-9	36.04	38.71	38.35	34.41	36.88	0.05
10.	LES66	Biochem-22-10	35.65	38.12	36.76	33.45	36.00	0.05
11.	RH(OE)1708	Biochem-22-11	38.55	38.71	39.75	37.08	38.52	0.02
12.	PDZ 19	Biochem-22-12	38.66	38.8	38.47	36.28	38.05	0.03
13.	DRMRQ 29-20	Biochem-22-13	41.52	41.2	41.14	39.92	40.95	0.01
14.	RH(OE)1806	Biochem-22-14	40.75	38.86	41.86	38.08	39.89	0.04
15.	PDZ 11	Biochem-22-15	40.01	40.69	39.69	37.66	39.51	0.03
16.	DRMR CIQ 158	Biochem-22-16	38.62	39.73	39.73	37.28	38.84	0.03
17.	PDZ 15	Biochem-22-17	38.04	39.1	37.86	34.29	37.32	0.05
18.	IJ19R5004	Biochem-22-18	38.07	39	39.78	37.05	38.48	0.03
19.	PDZ 16	Biochem-22-19	37.12	36.48	37.19	34.82	36.40	0.03
20.	NPJ 253	Biochem-22-20	40.13	40.83	41.09	40.85	40.73	0.01
21.	PDZ 1	Biochem-22-21	40.98	39.1	40.32	38.49	39.72	0.02
22.	NPJ 252	Biochem-22-22	40.06	40.74	41.49	39.04	40.33	0.02
23.	PM 28	Biochem-22-23	39.80	39.78	40.17	38.03	39.45	0.02
24.	PDZ 14	Biochem-22-24	40.09	40.78	39.68	35.61	39.04	0.05
25.	DRMRCIQ 47	Biochem-22-25	40.59	42.38	42.87	38.30	41.04	0.04
26.	RV	Biochem-22-26	38.89	39.45	39.42	39.15	39.23	0.01

Table 2: Oil Stability Index (OSI)

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH	Mean	CV
1.	DRMRC1(Q)172	Biochem-22-1	1.23	1.28	1.23	1.20	1.24	0.03
2.	PM 30(NC)	Biochem-22-2	1.70	1.65	1.64	1.58	1.64	0.03
3.	PusaQMH 1	Biochem-22-3	1.14	1.25	1.15	1.07	1.15	0.07
4.	PMAS 11	Biochem-22-4	1.21	1.27	1.27	1.21	1.24	0.03
5.	RH 0749 (ZC)	Biochem-22-5	0.64	1.21	0.79	0.76	0.85	0.29
6.	PDZ 18	Biochem-22-6	0.90	1.00	0.95	0.84	0.92	0.08
7.	PM 32(LR)	Biochem-22-7	1.25	1.34	1.35	1.37	1.33	0.04
8.	PMAS 7	Biochem-22-8	1.32	1.23	1.19	1.19	1.23	0.05
9.	LES67	Biochem-22-9	1.01	1.10	1.06	1.02	1.05	0.04
10.	LES66	Biochem-22-10	1.19	1.27	1.14	1.07	1.17	0.07
11.	RH(OE)1708	Biochem-22-11	1.14	1.16	1.36	1.40	1.26	0.10
12.	PDZ 19	Biochem-22-12	1.35	1.32	1.31	1.35	1.33	0.02
13.	DRMRQ 29-20	Biochem-22-13	1.10	1.13	1.13	1.22	1.14	0.05
14.	RH(OE)1806	Biochem-22-14	1.02	1.27	1.32	1.28	1.22	0.11
15.	PDZ 11	Biochem-22-15	1.10	1.09	1.08	1.05	1.08	0.02
16.	DRMR CIQ 158	Biochem-22-16	1.02	1.23	1.17	1.25	1.17	0.09
17.	PDZ 15	Biochem-22-17	1.00	1.02	1.02	0.98	1.01	0.02
18.	IJ19R5004	Biochem-22-18	1.59	1.42	1.64	1.56	1.55	0.06
19.	PDZ 16	Biochem-22-19	1.06	1.14	1.11	1.09	1.10	0.03
20.	NPJ 253	Biochem-22-20	0.71	0.65	0.66	0.67	0.67	0.03
21.	PDZ 1	Biochem-22-21	1.29	1.37	1.54	1.55	1.44	0.09
22.	NPJ 252	Biochem-22-22	0.68	0.80	0.68	0.65	0.70	0.09
23.	PM 28	Biochem-22-23	0.79	0.90	0.79	0.80	0.82	0.07
24.	PDZ 14	Biochem-22-24	1.19	1.09	1.22	1.23	1.18	0.05
25.	DRMRCIQ 47	Biochem-22-25	1.23	1.16	1.31	1.32	1.25	0.06
26.	RV	Biochem-22-26	0.88	0.85	0.79	0.79	0.83	0.05

Table 3: Palmitic acid (%)

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH	Mean	STD EV	CV
1.	DRMRC1(Q)172	Biochem-22-1	3.62	3.91	3.82	3.51	3.71	0.18	0.05
2.	PM 30(NC)	Biochem-22-2	3.36	2.81	3.51	3.75	3.36	0.40	0.12
3.	PusaQMH 1	Biochem-22-3	3.35	3.57	3.69	3.82	3.61	0.20	0.05
4.	PMAS 11	Biochem-22-4	3.98	2.86	4.11	5.19	4.04	0.95	0.24
5.	RH 0749 (ZC)	Biochem-22-5	2.62	2.82	2.01	2.02	2.37	0.42	0.18
6.	PDZ 18	Biochem-22-6	4.36	3.27	4.82	5.45	4.47	0.92	0.21
7.	PM 32(LR)	Biochem-22-7	3.4	3.21	3.77	4.01	3.60	0.36	0.10
8.	PMAS 7	Biochem-22-8	4.32	3.51	4.44	4.83	4.28	0.55	0.13
9.	LES67	Biochem-22-9	4.98	3.34	5.24	5.52	4.77	0.98	0.20
10.	LES66	Biochem-22-10	4.65	4.19	5.18	4.96	4.75	0.43	0.09
11.	RH(OE)1708	Biochem-22-11	3.31	4.11	3.36	3.68	3.61	0.37	0.10
12.	PDZ 19	Biochem-22-12	4.62	3.96	4.91	5.02	4.63	0.47	0.10
13.	DRMRQ 29-20	Biochem-22-13	3.15	2.73	3.04	3.41	3.08	0.28	0.09
14.	RH(OE)1806	Biochem-22-14	3.48	3.08	3.46	3.89	3.48	0.33	0.10
15.	PDZ 11	Biochem-22-15	3.98	3.51	4.29	4.70	4.12	0.50	0.12
16.	DRMR CIQ 158	Biochem-22-16	4.38	3.47	4.48	4.63	4.24	0.52	0.12
17.	PDZ 15	Biochem-22-17	4.1	4.12	4.62	4.69	4.38	0.31	0.07
18.	IJ19R5004	Biochem-22-18	3.45	3.65	3.87	4.15	3.78	0.30	0.08
19.	PDZ 16	Biochem-22-19	3.87	3.19	4.66	4.64	4.09	0.70	0.17
20.	NPJ 253	Biochem-22-20	3.41	3.78	2.02	2.04	2.81	0.92	0.33
21.	PDZ 1	Biochem-22-21	4.62	4.13	3.78	4.50	4.26	0.38	0.09
22.	NPJ 252	Biochem-22-22	2.59	3.16	2.13	2.38	2.57	0.44	0.17
23.	PM 28	Biochem-22-23	3.18	3.45	2.34	2.33	2.83	0.58	0.20
24.	PDZ 14	Biochem-22-24	3.56	3.77	4.14	4.22	3.92	0.31	0.08
25.	DRMRCIQ 47	Biochem-22-25	3.68	3.92	3.97	4.35	3.98	0.28	0.07
26.	RV	Biochem-22-26	2.16	2.27	2.11	2.34	2.22	0.10	0.05

Table 4: Stearic acid (%)

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH	Mean	STD EV	CV
1.	DRMRC1(Q)172	Biochem-22-1	2.06	2.06	2.61	2.23	2.24	0.26	0.12
2.	PM 30(NC)	Biochem-22-2	2.26	1.81	2.96	3.23	2.56	0.65	0.25
3.	PusaQMH 1	Biochem-22-3	1.92	1.74	2.19	2.00	1.96	0.19	0.09
4.	PMAS 11	Biochem-22-4	1.46	1.52	2.02	2.39	1.85	0.44	0.24
5.	RH 0749 (ZC)	Biochem-22-5	0.73	1.56	1.02	0.63	0.98	0.42	0.43
6.	PDZ 18	Biochem-22-6	1.28	2.10	1.72	1.67	1.69	0.34	0.20
7.	PM 32(LR)	Biochem-22-7	1.49	1.30	1.94	1.86	1.65	0.30	0.18
8.	PMAS 7	Biochem-22-8	1.35	2.44	2.07	2.33	2.05	0.49	0.24
9.	LES67	Biochem-22-9	2.48	2.04	2.87	3.02	2.60	0.44	0.17
10.	LES66	Biochem-22-10	2.38	2.22	2.43	2.67	2.42	0.18	0.08
11.	RH(OE)1708	Biochem-22-11	1.35	1.17	2.32	2.14	1.74	0.57	0.33
12.	PDZ 19	Biochem-22-12	2.05	1.92	2.21	2.56	2.19	0.28	0.13
13.	DRMRQ 29-20	Biochem-22-13	1.39	1.33	1.68	1.56	1.49	0.16	0.11
14.	RH(OE)1806	Biochem-22-14	1.44	1.21	1.91	2.35	1.73	0.51	0.29
15.	PDZ 11	Biochem-22-15	1.73	1.10	1.96	2.37	1.79	0.53	0.30
16.	DRMR CIQ 158	Biochem-22-16	2.68	1.02	2.18	2.66	2.13	0.78	0.36
17.	PDZ 15	Biochem-22-17	1.91	1.87	2.38	2.77	2.23	0.42	0.19
18.	IJ19R5004	Biochem-22-18	2.25	1.21	2.40	2.59	2.11	0.62	0.29
19.	PDZ 16	Biochem-22-19	1.97	2.66	2.24	2.52	2.35	0.31	0.13
20.	NPJ 253	Biochem-22-20	1.22	1.32	1.21	1.11	1.22	0.09	0.07
21.	PDZ 1	Biochem-22-21	2.26	2.41	2.82	2.89	2.60	0.31	0.12
22.	NPJ 252	Biochem-22-22	0.77	0.98	1.12	1.20	1.02	0.19	0.19
23.	PM 28	Biochem-22-23	1.22	1.52	1.12	1.15	1.25	0.18	0.15
24.	PDZ 14	Biochem-22-24	2.09	2.47	2.55	2.77	2.47	0.28	0.11
25.	DRMRCIQ 47	Biochem-22-25	1.9	1.48	2.44	2.73	2.14	0.56	0.26
26.	RV	Biochem-22-26	0.51	0.81	0.95	1.15	0.85	0.27	0.31

Table 5: Oleic acid (%)

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH	Mean	STD EV	CV
1.	DRMRC1(Q)172	Biochem-22-1	42.91	45.03	44.53	45.02	44.37	1.00	0.02
2.	PM 30(NC)	Biochem-22-2	48.82	48.79	45.61	44.50	46.93	2.21	0.05
3.	PusaQMH 1	Biochem-22-3	37.93	38.97	35.83	32.60	36.33	2.81	0.08
4.	PMAS 11	Biochem-22-4	41.76	43.64	42.16	40.61	42.04	1.25	0.03
5.	RH 0749 (ZC)	Biochem-22-5	9.28	18.94	11.94	10.94	12.78	4.25	0.33
6.	PDZ 18	Biochem-22-6	34.53	38.10	37.15	35.62	36.35	1.59	0.04
7.	PM 32(LR)	Biochem-22-7	42.05	45.21	42.45	43.05	43.19	1.41	0.03
8.	PMAS 7	Biochem-22-8	42.86	43.28	41.61	41.66	42.35	0.85	0.02
9.	LES67	Biochem-22-9	42.13	44.01	41.96	41.74	42.46	1.05	0.02
10.	LES66	Biochem-22-10	43.95	46.10	43.81	42.40	44.06	1.53	0.03
11.	RH(OE)1708	Biochem-22-11	42.35	42.57	43.47	44.90	43.32	1.16	0.03
12.	PDZ 19	Biochem-22-12	46.72	46.24	46.06	47.83	46.71	0.79	0.02
13.	DRMRQ 29-20	Biochem-22-13	27.95	30.01	27.41	32.14	29.38	2.16	0.07
14.	RH(OE)1806	Biochem-22-14	40.33	45.67	44.61	44.61	43.81	2.37	0.05
15.	PDZ 11	Biochem-22-15	42.91	41.71	40.19	40.23	41.26	1.31	0.03
16.	DRMR CIQ 158	Biochem-22-16	42.36	47.14	43.65	45.51	44.66	2.10	0.05
17.	PDZ 15	Biochem-22-17	41.8	40.16	40.21	40.40	40.64	0.78	0.02
18.	IJ19R5004	Biochem-22-18	46.4	43.60	44.37	44.88	44.81	1.18	0.03
19.	PDZ 16	Biochem-22-19	40.38	43.48	41.71	40.85	41.60	1.37	0.03
20.	NPJ 253	Biochem-22-20	11.93	11.82	11.74	11.47	11.74	0.20	0.02
21.	PDZ 1	Biochem-22-21	47.86	47.15	49.76	51.93	49.17	2.14	0.04
22.	NPJ 252	Biochem-22-22	11.23	14.85	12.04	11.55	12.42	1.66	0.13
23.	PM 28	Biochem-22-23	14.88	15.59	14.87	13.58	14.73	0.84	0.06
24.	PDZ 14	Biochem-22-24	44.39	42.31	44.23	44.72	43.91	1.09	0.02
25.	DRMRCIQ 47	Biochem-22-25	46.14	44.01	45.47	46.58	45.55	1.12	0.02
26.	RV	Biochem-22-26	12.55	14.32	13.52	12.61	13.25	0.84	0.06

Table 6: Linoleic acid (%)

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH	Mean	STD EV	CV
1.	DRMRC1(Q)172	Biochem-22-1	34.97	35.16	36.17	37.41	35.93	1.12	0.03
2.	PM 30(NC)	Biochem-22-2	28.71	29.55	27.84	28.11	28.55	0.76	0.03
3.	PusaQMH 1	Biochem-22-3	33.26	30.97	31.05	30.58	31.46	1.22	0.04
4.	PMAS 11	Biochem-22-4	34.44	34.33	33.14	33.63	33.88	0.61	0.02
5.	RH 0749 (ZC)	Biochem-22-5	14.52	15.64	15.09	14.46	14.93	0.55	0.04
6.	PDZ 18	Biochem-22-6	38.58	37.86	39.14	42.68	39.56	2.14	0.05
7.	PM 32(LR)	Biochem-22-7	33.75	33.51	31.41	31.46	32.53	1.27	0.04
8.	PMAS 7	Biochem-22-8	32.41	35.11	34.92	34.93	34.34	1.29	0.04
9.	LES67	Biochem-22-9	41.59	39.88	39.51	40.92	40.48	0.95	0.02
10.	LES66	Biochem-22-10	37.01	36.22	38.33	39.78	37.84	1.56	0.04
11.	RH(OE)1708	Biochem-22-11	37.12	36.56	32.04	32.16	34.47	2.75	0.08
12.	PDZ 19	Biochem-22-12	34.61	34.93	35.24	35.51	35.07	0.39	0.01
13.	DRMRQ 29-20	Biochem-22-13	25.52	26.49	24.35	26.36	25.68	0.99	0.04
14.	RH(OE)1806	Biochem-22-14	39.48	35.77	33.74	34.91	35.98	2.48	0.07
15.	PDZ 11	Biochem-22-15	39.02	38.18	37.17	38.51	38.22	0.78	0.02
16.	DRMR CIQ 158	Biochem-22-16	41.36	38.10	37.21	36.46	38.28	2.16	0.06
17.	PDZ 15	Biochem-22-17	41.98	39.28	39.32	41.08	40.42	1.34	0.03
18.	IJ19R5004	Biochem-22-18	29.18	30.52	27.11	28.80	28.90	1.40	0.05
19.	PDZ 16	Biochem-22-19	38.1	38.01	37.71	37.57	37.85	0.25	0.01
20.	NPJ 253	Biochem-22-20	16.92	18.16	17.68	17.09	17.46	0.57	0.03
21.	PDZ 1	Biochem-22-21	37.11	34.30	32.25	33.55	34.30	2.05	0.06
22.	NPJ 252	Biochem-22-22	16.47	18.37	17.78	17.68	17.58	0.80	0.05
23.	PM 28	Biochem-22-23	18.84	17.14	18.81	17.05	17.96	1.00	0.06
24.	PDZ 14	Biochem-22-24	37.35	38.50	36.12	36.49	37.11	1.06	0.03
25.	DRMRCIQ 47	Biochem-22-25	37.6	37.66	34.73	35.27	36.31	1.54	0.04
26.	RV	Biochem-22-26	14.3	16.83	17.02	16.15	16.07	1.24	0.08

Table 7: Linolenic acid (%)

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH	Mean	STD EV	CV
1.	DRMRC1(Q)172	Biochem - 22-1	11.01	11.76	11.32	11.84	11.48	0.39	0.03
2.	PM 30(NC)	Biochem - 22-2	15.78	15.81	18.22	19.11	17.23	1.70	0.10
3.	PusaQMH 1	Biochem - 22-3	19.58	17.37	19.52	21.26	19.43	1.59	0.08
4.	PMAS 11	Biochem - 22-4	10.63	10.95	13.14	12.25	11.74	1.17	0.10
5.	RH 0749 (ZC)	Biochem - 22-5	19.98	14.33	21.35	20.79	19.11	3.24	0.17
6.	PDZ 18	Biochem - 22-6	13.63	15.16	14.28	13.95	14.25	0.66	0.05
7.	PM 32(LR)	Biochem - 22-7	16.28	15.18	19.32	19.63	17.60	2.21	0.13
8.	PMAS 7	Biochem - 22-8	12.32	11.07	12.11	11.58	11.77	0.56	0.05
9.	LES67	Biochem - 22-9	8.08	9.73	9.34	8.81	8.99	0.71	0.08
10.	LES66	Biochem - 22-10	9.35	9.18	9.44	9.22	9.30	0.12	0.01
11.	RH(OE)1708	Biochem - 22-11	13.56	11.19	14.68	14.77	13.55	1.67	0.12
12.	PDZ 19	Biochem - 22-12	9.43	10.51	10.31	9.10	9.84	0.68	0.07
13.	DRMRQ 29-20	Biochem - 22-13	19.86	19.35	23.69	22.46	21.34	2.07	0.10
14.	RH(OE)1806	Biochem - 22-14	12.27	11.06	13.97	13.35	12.66	1.28	0.10
15.	PDZ 11	Biochem - 22-15	12.4	12.78	15.21	14.20	13.65	1.30	0.10
16.	DRMR CIQ 158	Biochem - 22-16	10.21	9.64	11.08	10.76	10.42	0.63	0.06
17.	PDZ 15	Biochem - 22-17	10.18	12.16	12.24	11.07	11.41	0.98	0.09
18.	IJ19R5004	Biochem - 22-18	13.15	12.40	14.75	14.56	13.72	1.13	0.08
19.	PDZ 16	Biochem - 22-19	12.05	10.73	12.42	13.32	12.13	1.07	0.09
20.	NPJ 253	Biochem - 22-20	17.22	16.26	19.23	19.17	17.97	1.47	0.08
21.	PDZ 1	Biochem - 22-21	6.01	9.41	9.35	7.14	7.98	1.68	0.21
22.	NPJ 252	Biochem - 22-22	18.33	16.01	18.87	17.49	17.68	1.25	0.07
23.	PM 28	Biochem - 22-23	17.92	15.51	18.24	18.43	17.53	1.36	0.08
24.	PDZ 14	Biochem - 22-24	9.82	10.14	10.51	10.92	10.35	0.47	0.05
25.	DRMRCIQ 47	Biochem - 22-25	10.95	11.16	12.17	11.08	11.34	0.56	0.05
26.	RV	Biochem - 22-26	17.99	16.17	19.44	19.07	18.17	1.47	0.08

Table 8: Eicosanoic acid (%)

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH	Mean	STD EV	CV
1.	DRMRC1(Q)172	Biochem-22-1	0.87	0.54	0.58	0.00	0.50	0.36	0.73
2.	PM 30(NC)	Biochem-22-2	0.35	0.77	0.57	0.40	0.52	0.19	0.37
3.	PusaQMH 1	Biochem-22-3	1.04	1.25	0.71	0.67	0.92	0.28	0.30
4.	PMAS 11	Biochem-22-4	1.09	1.37	0.75	0.24	0.86	0.49	0.56
5.	RH 0749 (ZC)	Biochem-22-5	0.65	0.82	0.82	0.91	0.80	0.11	0.13
6.	PDZ 18	Biochem-22-6	0.68	0.59	0.89	0.08	0.56	0.34	0.61
7.	PM 32(LR)	Biochem-22-7	0.42	1.15	0.68	0.00	0.56	0.48	0.86
8.	PMAS 7	Biochem-22-8	0.63	1.06	0.43	0.29	0.60	0.34	0.56
9.	LES67	Biochem-22-9	0.32	0.87	0.77	0.00	0.49	0.40	0.83
10.	LES66	Biochem-22-10	0.62	0.65	0.55	0.13	0.49	0.24	0.50
11.	RH(OE)1708	Biochem-22-11	0.33	0.74	0.42	0.19	0.42	0.23	0.56
12.	PDZ 19	Biochem-22-12	0.94	0.87	0.83	0.00	0.66	0.44	0.67
13.	DRMRQ 29-20	Biochem-22-13	0.59	0.41	0.82	0.70	0.63	0.17	0.28
14.	RH(OE)1806	Biochem-22-14	0.65	0.73	0.47	0.16	0.50	0.25	0.50
15.	PDZ 11	Biochem-22-15	0.31	1.21	0.65	0.00	0.54	0.52	0.96
16.	DRMR CIQ 158	Biochem-22-16	0.45	0.68	0.72	0.00	0.46	0.33	0.71
17.	PDZ 15	Biochem-22-17	0.35	0.67	0.69	0.00	0.43	0.32	0.76
18.	IJ19R5004	Biochem-22-18	0.52	0.92	0.79	0.41	0.66	0.24	0.36
19.	PDZ 16	Biochem-22-19	0.74	0.61	0.81	0.13	0.57	0.31	0.54
20.	NPJ 253	Biochem-22-20	1.05	1.39	0.85	1.31	1.15	0.25	0.21
21.	PDZ 1	Biochem-22-21	0.32	1.16	0.53	0.00	0.50	0.49	0.97
22.	NPJ 252	Biochem-22-22	1.04	0.95	0.75	0.62	0.84	0.19	0.23
23.	PM 28	Biochem-22-23	1.18	0.77	0.79	1.25	1.00	0.25	0.25
24.	PDZ 14	Biochem-22-24	0.68	1.16	0.53	0.07	0.61	0.45	0.74
25.	DRMRCIQ 47	Biochem-22-25	0.3	0.71	0.33	0.00	0.34	0.29	0.87
26.	RV	Biochem-22-26	0.95	1.12	0.71	0.83	0.90	0.18	0.19

Table 9: Erucic acid (%)

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH	Mean	STD EV	CV
1.	DRMRC1(Q)172	Biochem-22-1	2.04	1.13	0.97	0.00	1.04	0.84	0.81
2.	PM 30(NC)	Biochem-22-2	0.81	1.02	1.29	0.92	1.01	0.21	0.20
3.	PusaQMH 1	Biochem-22-3	5.61	6.13	7.01	9.10	6.96	1.54	0.22
4.	PMAS 11	Biochem-22-4	2.71	5.88	4.68	5.70	4.74	1.45	0.31
5.	RH 0749 (ZC)	Biochem-22-5	46.94	45.77	47.77	50.26	47.69	1.90	0.04
6.	PDZ 18	Biochem-22-6	0.65	1.78	2.00	0.57	1.25	0.75	0.60
7.	PM 32(LR)	Biochem-22-7	0.32	0.72	0.43	0.00	0.37	0.30	0.81
8.	PMAS 7	Biochem-22-8	3.65	3.31	4.42	4.39	3.94	0.55	0.14
9.	LES67	Biochem-22-9	0.65	0.67	0.31	0.00	0.41	0.32	0.78
10.	LES66	Biochem-22-10	0.8	1.19	0.26	0.85	0.78	0.38	0.50
11.	RH(OE)1708	Biochem-22-11	1.36	4.02	3.71	2.19	2.82	1.26	0.45
12.	PDZ 19	Biochem-22-12	1.32	1.04	0.44	0.00	0.70	0.59	0.85
13.	DRMRQ 29-20	Biochem-22-13	16.54	20.78	19.01	13.39	17.43	3.21	0.18
14.	RH(OE)1806	Biochem-22-14	0.34	2.69	1.84	0.74	1.40	1.07	0.76
15.	PDZ 11	Biochem-22-15	0.65	1.36	0.53	0.00	0.64	0.56	0.88
16.	DRMR CIQ 158	Biochem-22-16	1.3	0.71	0.68	0.00	0.67	0.53	0.79
17.	PDZ 15	Biochem-22-17	0.65	1.22	0.54	0.00	0.60	0.50	0.83
18.	IJ19R5004	Biochem-22-18	8.2	8.11	6.71	4.64	6.91	1.67	0.24
19.	PDZ 16	Biochem-22-19	1.95	0.74	0.45	1.00	1.03	0.65	0.63
20.	NPJ 253	Biochem-22-20	52.11	48.16	47.27	47.82	48.84	2.21	0.05
21.	PDZ 1	Biochem-22-21	0.35	1.22	1.51	0.00	0.77	0.71	0.92
22.	NPJ 252	Biochem-22-22	45.42	45.56	47.31	49.09	46.84	1.72	0.04
23.	PM 28	Biochem-22-23	46.64	46.20	43.83	46.22	45.72	1.28	0.03
24.	PDZ 14	Biochem-22-24	1.06	1.84	1.92	0.83	1.41	0.55	0.39
25.	DRMRCIQ 47	Biochem-22-25	0.39	1.19	0.89	0.00	0.62	0.53	0.85
26.	RV	Biochem-22-26	49.82	49.16	46.25	47.87	48.28	1.57	0.03

Table 10: ω6 and ω3 ratio

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH	Mean	STD EV	CV
1.	DRMRC1(Q)172	Biochem-22-1	3.18	2.98	3.20	3.17	3.13	0.10	0.03
2.	PM 30(NC)	Biochem-22-2	1.82	1.86	1.53	1.47	1.67	0.20	0.12
3.	PusaQMH 1	Biochem-22-3	1.70	1.78	1.59	1.44	1.63	0.15	0.09
4.	PMAS 11	Biochem-22-4	3.24	3.13	2.52	2.79	2.92	0.33	0.11
5.	RH 0749 (ZC)	Biochem-22-5	0.73	1.09	0.71	0.70	0.80	0.19	0.24
6.	PDZ 18	Biochem-22-6	2.83	2.49	2.74	3.06	2.78	0.24	0.09
7.	PM 32(LR)	Biochem-22-7	2.07	2.2	1.63	1.60	1.88	0.31	0.16
8.	PMAS 7	Biochem-22-8	2.63	3.17	2.88	3.05	2.93	0.23	0.08
9.	LES67	Biochem-22-9	5.15	4.09	4.23	4.68	4.54	0.48	0.11
10.	LES66	Biochem-22-10	3.96	3.94	4.06	4.40	4.09	0.21	0.05
11.	RH(OE)1708	Biochem-22-11	2.74	3.26	2.18	2.18	2.59	0.52	0.20
12.	PDZ 19	Biochem-22-12	3.67	3.32	3.42	3.94	3.59	0.28	0.08
13.	DRMRQ 29-20	Biochem-22-13	1.28	1.36	1.03	1.17	1.21	0.14	0.12
14.	RH(OE)1806	Biochem-22-14	3.22	3.23	2.42	2.67	2.88	0.41	0.14
15.	PDZ 11	Biochem-22-15	3.15	2.98	2.44	2.73	2.82	0.31	0.11
16.	DRMR CIQ 158	Biochem-22-16	4.05	3.95	3.36	3.42	3.69	0.36	0.10
17.	PDZ 15	Biochem-22-17	4.12	3.23	3.21	3.72	3.57	0.44	0.12
18.	IJ19R5004	Biochem-22-18	2.22	2.46	1.84	1.98	2.12	0.27	0.13
19.	PDZ 16	Biochem-22-19	3.16	3.54	3.04	2.83	3.14	0.30	0.09
20.	NPJ 253	Biochem-22-20	0.98	1.11	0.92	0.90	0.98	0.10	0.10
21.	PDZ 1	Biochem-22-21	6.17	3.64	3.45	4.75	4.50	1.25	0.28
22.	NPJ 252	Biochem-22-22	0.90	1.14	0.94	1.01	1.00	0.11	0.11
23.	PM 28	Biochem-22-23	1.05	1.1	1.03	0.92	1.03	0.07	0.07
24.	PDZ 14	Biochem-22-24	3.80	3.79	3.44	3.38	3.60	0.23	0.06
25.	DRMRCIQ 47	Biochem-22-25	3.43	3.37	2.85	3.25	3.23	0.26	0.08
26.	RV	Biochem-22-26	0.79	1.04	0.88	0.85	0.89	0.11	0.12

Table 11: Saturated Fatty Acid

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH	Mean	STD	CV
								EV	
1.	DRMRC1(Q)172	Biochem-22-1	5.68	5.97	6.43	5.74	5.95	0.34	0.06
2.	PM 30(NC)	Biochem-22-2	5.62	4.62	6.47	6.97	5.92	1.03	0.17
3.	PusaQMH 1	Biochem-22-3	5.27	5.31	5.88	5.81	5.57	0.32	0.06
4.	PMAS 11	Biochem-22-4	5.44	4.38	6.13	7.58	5.88	1.34	0.23
5.	RH 0749 (ZC)	Biochem-22-5	3.35	4.38	3.03	2.65	3.35	0.74	0.22
6.	PDZ 18	Biochem-22-6	5.64	5.37	6.54	7.11	6.17	0.80	0.13
7.	PM 32(LR)	Biochem-22-7	4.89	4.51	5.71	5.87	5.24	0.65	0.12
8.	PMAS 7	Biochem-22-8	5.67	5.95	6.51	7.16	6.32	0.66	0.10
9.	LES67	Biochem-22-9	7.46	5.38	8.11	8.54	7.37	1.40	0.19
10.	LES66	Biochem-22-10	7.03	6.41	7.61	7.63	7.17	0.58	0.08
11.	RH(OE)1708	Biochem-22-11	4.66	5.28	5.68	5.81	5.36	0.52	0.10
12.	PDZ 19	Biochem-22-12	6.67	5.88	7.12	7.58	6.81	0.72	0.11
13.	DRMRQ 29-20	Biochem-22-13	4.54	4.06	4.72	4.96	4.57	0.38	0.08
14.	RH(OE)1806	Biochem-22-14	4.92	4.29	5.37	6.24	5.21	0.82	0.16
15.	PDZ 11	Biochem-22-15	5.71	4.61	6.25	7.07	5.91	1.03	0.17
16.	DRMR CIQ 158	Biochem-22-16	7.06	4.49	6.66	7.28	6.37	1.28	0.20
17.	PDZ 15	Biochem-22-17	6.01	5.99	7.00	7.45	6.61	0.73	0.11
18.	IJ19R5004	Biochem-22-18	5.7	4.86	6.27	6.74	5.89	0.81	0.14
19.	PDZ 16	Biochem-22-19	5.84	5.85	6.90	7.16	6.44	0.69	0.11
20.	NPJ 253	Biochem-22-20	4.63	5.10	3.23	3.15	4.03	0.99	0.24
21.	PDZ 1	Biochem-22-21	6.88	6.54	6.60	7.39	6.85	0.39	0.06
22.	NPJ 252	Biochem-22-22	3.36	4.14	3.25	3.58	3.58	0.40	0.11
23.	PM 28	Biochem-22-23	4.4	4.97	3.46	3.48	4.08	0.74	0.18
24.	PDZ 14	Biochem-22-24	5.65	6.24	6.69	6.98	6.39	0.58	0.09
25.	DRMRCIQ 47	Biochem-22-25	5.58	5.40	6.41	7.08	6.12	0.78	0.13
26.	RV	Biochem-22-26	2.67	3.08	3.06	3.49	3.07	0.33	0.11

Table 12: Unsaturated: Saturated fatty acid ratio

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH	Mean	STD EV	CV
1.	DRMRC1(Q)172	Biochem-22-1	16.16	15.68	14.55	16.44	15.71	0.83	0.05
2.	PM 30(NC)	Biochem-22-2	16.81	20.75	14.46	13.35	16.34	3.27	0.20
3.	PusaQMH 1	Biochem-22-3	18.49	17.83	16.01	16.21	17.13	1.22	0.07
4.	PMAS 11	Biochem-22-4	16.66	21.95	15.31	12.19	16.53	4.07	0.25
5.	RH 0749 (ZC)	Biochem-22-5	27.27	21.80	32.00	36.81	29.47	6.43	0.22
6.	PDZ 18	Biochem-22-6	15.62	17.59	14.29	13.06	15.14	1.94	0.13
7.	PM 32(LR)	Biochem-22-7	18.98	21.23	16.51	16.05	18.19	2.40	0.13
8.	PMAS 7	Biochem-22-8	16.20	15.76	14.36	12.97	14.82	1.46	0.10
9.	LES67	Biochem-22-9	12.44	17.68	11.33	10.72	13.04	3.17	0.24
10.	LES66	Biochem-22-10	13.05	14.56	12.14	12.11	12.97	1.15	0.09
11.	RH(OE)1708	Biochem-22-11	20.33	18.00	16.61	16.21	17.79	1.86	0.10
12.	PDZ 19	Biochem-22-12	13.95	15.91	13.04	12.20	13.78	1.59	0.12
13.	DRMRQ 29-20	Biochem-22-13	19.93	23.80	20.19	19.16	20.77	2.07	0.10
14.	RH(OE)1806	Biochem-22-14	18.92	22.35	17.62	15.03	18.48	3.05	0.16
15.	PDZ 11	Biochem-22-15	16.69	20.65	15.00	13.15	16.37	3.20	0.20
16.	DRMR CIQ 158	Biochem-22-16	13.55	21.44	14.02	12.74	15.44	4.04	0.26
17.	PDZ 15	Biochem-22-17	15.80	15.60	13.29	12.42	14.28	1.68	0.12
18.	IJ19R5004	Biochem-22-18	17.10	19.66	14.95	13.85	16.39	2.56	0.16
19.	PDZ 16	Biochem-22-19	15.96	15.99	13.49	12.98	14.61	1.60	0.11
20.	NPJ 253	Biochem-22-20	21.43	18.78	29.96	30.75	25.23	6.02	0.24
21.	PDZ 1	Biochem-22-21	13.32	14.25	14.15	12.53	13.56	0.80	0.06
22.	NPJ 252	Biochem-22-22	27.53	23.12	29.77	26.93	26.84	2.76	0.10
23.	PM 28	Biochem-22-23	22.60	19.15	27.90	27.74	24.35	4.25	0.17
24.	PDZ 14	Biochem-22-24	16.51	15.06	13.95	13.33	14.71	1.40	0.10
25.	DRMRCIQ 47	Biochem-22-25	17.09	17.54	14.60	13.12	15.59	2.09	0.13
26.	RV	Biochem-22-26	35.81	31.68	31.68	27.69	31.72	3.31	0.10

Table 13: SFA: MUFA: PUFA ratio

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH
1.	DRMRC1(Q)172	Biochem-22-1	1:07:07	1:08:08	1:07:06	1:08:09
2.	PM 30(NC)	Biochem-22-2	1:08:07	1:11:10	1:07:07	1:07:07
3.	PusaQMH 1	Biochem-22-3	1:09:10	1:09:09	1:07:09	1:07:09
4.	PMAS 11	Biochem-22-4	1:09:09	1:12:10	1:08:08	1:06:06
5.	RH 0749 (ZC)	Biochem-22-5	1:19:11	1:15:07	1:19:12	1:23:13
6.	PDZ 18	Biochem-22-6	1:06:08	1:08:10	1:06:08	1:05:08
7.	PM 32(LR)	Biochem-22-7	1:08:10	1:10:11	1:08:09	1:07:09
8.	PMAS 7	Biochem-22-8	1:07:07	1:08:08	1:07:07	1:06:07
9.	LES67	Biochem-22-9	1:06:07	1:09:09	1:05:06	1:05:06
10.	LES66	Biochem-22-10	1:06:06	1:08:07	1:06:06	1:06:06
11.	RH(OE)1708	Biochem-22-11	1:09:10	1:09:09	1:08:08	1:08:08
12.	PDZ 19	Biochem-22-12	1:07:06	1:08:08	1:07:06	1:06:06
13.	DRMRQ 29-20	Biochem-22-13	1:09:09	1:13:11	1:10:10	1:09:10
14.	RH(OE)1806	Biochem-22-14	1:08:10	1:11:11	1:09:09	1:07:08
15.	PDZ 11	Biochem-22-15	1:07:08	1:10:11	1:07:08	1:06:07
16.	DRMR CIQ 158	Biochem-22-16	1:06:07	1:11:11	1:07:07	1:06:06
17.	PDZ 15	Biochem-22-17	1:07:08	1:07:09	1:06:07	1:05:07
18.	IJ19R5004	Biochem-22-18	1:09:07	1:11:09	1:08:07	1:07:06
19.	PDZ 16	Biochem-22-19	1:07:08	1:08:08	1:06:07	1:06:07
20.	NPJ 253	Biochem-22-20	1:13:07	1:12:07	1:18:11	1:19:12
21.	PDZ 1	Biochem-22-21	1:07:06	1:08:07	1:08:06	1:07:06
22.	NPJ 252	Biochem-22-22	1:19:11	1:15:08	1:18:11	1:17:10
23.	PM 28	Biochem-22-23	1:15:09	1:13:07	1:17:11	1:17:10
24.	PDZ 14	Biochem-22-24	1:07:08	1:07:08	1:07:07	1:07:07
25.	DRMRCIQ 47	Biochem-22-25	1:08:08	1:09:09	1:07:07	1:07:07
26.	RV	Biochem-22-26	1:21:10	1:21:11	1:19:12	1:17:10

Table 14: Protein content (%)

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH	Mean	STD EV	CV
1.	DRMRC1(Q)172	Biochem -22-1	27.08	30.63	29.65	32.08	29.86	2.11	0.07
2.	PM 30(NC)	Biochem -22-2	28.19	29.63	29.34	30.92	29.52	1.12	0.04
3.	PusaQMH 1	Biochem -22-3	30.19	30.75	30.47	32.67	31.02	1.12	0.04
4.	PMAS 11	Biochem -22-4	31.22	30.83	31.22	31.50	31.19	0.28	0.01
5.	RH 0749 (ZC)	Biochem -22-5	29.42	31.58	30.63	29.17	30.20	1.12	0.04
6.	PDZ 18	Biochem -22-6	30.22	32.01	31.44	30.33	31.00	0.87	0.03
7.	PM 32(LR)	Biochem -22-7	31.65	32.5	32.34	32.08	32.14	0.37	0.01
8.	PMAS 7	Biochem -22-8	30.01	32.89	29.88	29.75	30.63	1.51	0.05
9.	LES67	Biochem -22-9	29.14	29.07	29.37	30.33	29.48	0.58	0.02
10.	LES66	Biochem -22-10	30.34	28.98	31.15	30.92	30.35	0.97	0.03
11.	RH(OE)1708	Biochem -22-11	31.97	32.24	32.84	33.83	32.72	0.83	0.03
12.	PDZ 19	Biochem -22-12	30.11	30.71	31.47	31.50	30.95	0.67	0.02
13.	DRMRQ 29-20	Biochem -22-13	29.31	29.44	30.58	31.50	30.21	1.03	0.03
14.	RH(OE)1806	Biochem -22-14	29.42	30.34	29.95	28.00	29.43	1.02	0.03
15.	PDZ 11	Biochem -22-15	31.02	32.59	31.87	30.92	31.60	0.79	0.02
16.	DRMR CIQ 158	Biochem -22-16	31.65	31.16	29.89	32.08	31.20	0.95	0.03
17.	PDZ 15	Biochem -22-17	32.55	32.98	33.75	31.50	32.69	0.94	0.03
18.	IJ19R5004	Biochem -22-18	31.78	31.99	32.71	32.08	32.14	0.40	0.01
19.	PDZ 16	Biochem -22-19	33.16	33.21	33.34	32.08	32.95	0.58	0.02
20.	NPJ 253	Biochem -22-20	31.73	32.95	32.77	32.67	32.53	0.55	0.02
21.	PDZ 1	Biochem -22-21	32.35	30.11	31.89	30.92	31.32	1.00	0.03
22.	NPJ 252	Biochem -22-22	31.38	32.76	32.11	33.25	32.38	0.81	0.03
23.	PM 28	Biochem -22-23	32.04	31.58	32.05	32.08	31.94	0.24	0.01
24.	PDZ 14	Biochem -22-24	30.24	28.9	29.59	30.92	29.91	0.87	0.03
25.	DRMRCIQ 47	Biochem -22-25	29.52	32.8	29.78	32.08	31.05	1.64	0.05
26.	RV	Biochem -22-26	31.37	30.16	29.86	28.00	29.85	1.39	0.05

Table 15: Total antioxidant capacity (mg/g AAE)

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH	Mean	STD EV	CV
1.	DRMRC1(Q)172	Biochem-22-1	17.93	19.85	18.27	18.27	18.58	0.86	0.05
2.	PM 30(NC)	Biochem-22-2	21.30	20.43	20.38	21.36	20.87	0.54	0.03
3.	PusaQMH 1	Biochem-22-3	17.93	18.97	17.91	16.11	17.73	1.19	0.07
4.	PMAS 11	Biochem-22-4	14.15	15.29	14.89	14.34	14.67	0.52	0.04
5.	RH 0749 (ZC)	Biochem-22-5	18.23	17.37	18.13	19.37	18.27	0.82	0.05
6.	PDZ 18	Biochem-22-6	16.99	18.07	17.87	16.00	17.23	0.95	0.05
7.	PM 32(LR)	Biochem-22-7	18.32	14.87	16.97	19.42	17.39	1.96	0.11
8.	PMAS 7	Biochem-22-8	17.57	17.78	18.05	17.24	17.66	0.34	0.02
9.	LES67	Biochem-22-9	15.03	15.28	15.37	15.21	15.22	0.15	0.01
10.	LES66	Biochem-22-10	16.88	19.13	18.92	15.01	17.49	1.94	0.11
11.	RH(OE)1708	Biochem-22-11	19.59	20.97	21.42	18.48	20.11	1.34	0.07
12.	PDZ 19	Biochem-22-12	17.24	18.07	16.94	17.47	17.43	0.48	0.03
13.	DRMRQ 29-20	Biochem-22-13	16.77	19.76	17.53	17.01	17.77	1.37	0.08
14.	RH(OE)1806	Biochem-22-14	16.81	17.92	17.55	17.00	17.32	0.51	0.03
15.	PDZ 11	Biochem-22-15	15.73	15.09	15.48	14.84	15.29	0.40	0.03
16.	DRMR CIQ 158	Biochem-22-16	13.80	15.47	15.07	13.39	14.43	1.00	0.07
17.	PDZ 15	Biochem-22-17	18.75	18.74	19.13	17.36	18.50	0.78	0.04
18.	IJ19R5004	Biochem-22-18	17.71	17.07	17.57	17.42	17.44	0.28	0.02
19.	PDZ 16	Biochem-22-19	18.57	19.79	19.94	17.15	18.86	1.29	0.07
20.	NPJ 253	Biochem-22-20	19.39	20.3	20.35	18.14	19.54	1.04	0.05
21.	PDZ 1	Biochem-22-21	14.19	14.95	13.75	13.99	14.22	0.52	0.04
22.	NPJ 252	Biochem-22-22	18.03	19.01	19.81	16.22	18.27	1.55	0.08
23.	PM 28	Biochem-22-23	16.85	17.19	18.09	15.63	16.94	1.02	0.06
24.	PDZ 14	Biochem-22-24	14.53	14.89	14.26	14.20	14.47	0.31	0.02
25.	DRMRCIQ 47	Biochem-22-25	14.39	14.95	14.46	13.04	14.21	0.82	0.06
26.	RV	Biochem-22-26	16.65	17.9	17.66	15.21	16.86	1.22	0.07

Table 16: β-carotene (ppm)

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH	Mean	STD EV	CV
1.	DRMRC1(Q)172	Biochem-22-1	3.39	3.66	3.26	3.62	3.48	0.19	0.05
2.	PM 30(NC)	Biochem-22-2	3.54	3.4	3.58	3.14	3.42	0.20	0.06
3.	PusaQMH 1	Biochem-22-3	4.12	4.12	3.95	3.81	4.00	0.15	0.04
4.	PMAS 11	Biochem-22-4	3.08	3.29	3.08	3.49	3.23	0.20	0.06
5.	RH 0749 (ZC)	Biochem-22-5	4.19	4.35	4.16	3.94	4.16	0.17	0.04
6.	PDZ 18	Biochem-22-6	3.73	3.43	3.86	3.97	3.74	0.23	0.06
7.	PM 32(LR)	Biochem-22-7	4.79	4.96	4.69	4.28	4.68	0.29	0.06
8.	PMAS 7	Biochem-22-8	4.84	4.94	4.81	4.54	4.78	0.17	0.04
9.	LES67	Biochem-22-9	4.42	4.51	4.33	4.37	4.41	0.08	0.02
10.	LES66	Biochem-22-10	3.69	3.36	3.68	3.45	3.54	0.16	0.05
11.	RH(OE)1708	Biochem-22-11	4.60	4.76	4.62	4.15	4.53	0.27	0.06
12.	PDZ 19	Biochem-22-12	4.35	4.49	4.16	4.25	4.31	0.14	0.03
13.	DRMRQ 29-20	Biochem-22-13	5.08	4.95	4.92	4.65	4.90	0.18	0.04
14.	RH(OE)1806	Biochem-22-14	5.64	5.9	5.59	4.62	5.44	0.56	0.10
15.	PDZ 11	Biochem-22-15	4.24	4.38	4.19	4.23	4.26	0.08	0.02
16.	DRMR CIQ 158	Biochem-22-16	4.83	4.83	4.78	4.13	4.64	0.34	0.07
17.	PDZ 15	Biochem-22-17	4.24	4.4	4.18	4.15	4.24	0.11	0.03
18.	IJ19R5004	Biochem-22-18	4.46	4.93	4.33	4.26	4.50	0.30	0.07
19.	PDZ 16	Biochem-22-19	4.88	4.97	4.75	4.67	4.82	0.13	0.03
20.	NPJ 253	Biochem-22-20	3.49	3.72	3.28	3.67	3.54	0.20	0.06
21.	PDZ 1	Biochem-22-21	4.90	4.98	4.96	4.51	4.84	0.22	0.05
22.	NPJ 252	Biochem-22-22	5.27	5.21	5.27	4.57	5.08	0.34	0.07
23.	PM 28	Biochem-22-23	4.67	4.72	4.66	4.67	4.68	0.03	0.01
24.	PDZ 14	Biochem-22-24	3.32	3.37	3.48	3.78	3.49	0.21	0.06
25.	DRMRCIQ 47	Biochem-22-25	4.39	4.41	4.36	4.07	4.31	0.16	0.04
26.	RV	Biochem-22-26	3.45	3.75	3.46	3.59	3.56	0.14	0.04

Table 17: Total sinapine content (%)

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH	Mean	STD EV	CV
1.	DRMRC1(Q)172	Biochem-22-1	2.01	1.90	2.04	2.08	2.01	0.08	0.04
2.	PM 30(NC)	Biochem-22-2	2.04	1.65	1.78	2.58	2.01	0.41	0.21
3.	PusaQMH 1	Biochem-22-3	1.91	2.39	1.88	1.70	1.97	0.30	0.15
4.	PMAS 11	Biochem-22-4	1.76	1.87	2.01	1.46	1.77	0.24	0.13
5.	RH 0749 (ZC)	Biochem-22-5	2.04	1.78	1.69	2.54	2.01	0.38	0.19
6.	PDZ 18	Biochem-22-6	1.58	1.24	2.44	1.34	1.65	0.55	0.33
7.	PM 32(LR)	Biochem-22-7	2.39	1.96	2.08	3.17	2.40	0.55	0.23
8.	PMAS 7	Biochem-22-8	1.51	1.42	1.27	2.01	1.55	0.32	0.21
9.	LES67	Biochem-22-9	1.80	1.76	1.96	1.67	1.80	0.12	0.07
10.	LES66	Biochem-22-10	1.55	1.19	1.99	1.61	1.58	0.33	0.21
11.	RH(OE)1708	Biochem-22-11	2.05	1.14	2.16	2.79	2.03	0.68	0.33
12.	PDZ 19	Biochem-22-12	2.15	1.50	2.55	2.35	2.14	0.46	0.21
13.	DRMRQ 29-20	Biochem-22-13	2.19	2.10	2.33	2.13	2.19	0.10	0.05
14.	RH(OE)1806	Biochem-22-14	2.20	1.83	1.98	2.75	2.19	0.41	0.19
15.	PDZ 11	Biochem-22-15	2.29	1.88	2.16	2.74	2.27	0.36	0.16
16.	DRMR CIQ 158	Biochem-22-16	1.85	1.94	1.87	2.00	1.92	0.07	0.04
17.	PDZ 15	Biochem-22-17	1.85	1.62	1.71	1.96	1.79	0.15	0.08
18.	IJ19R5004	Biochem-22-18	1.88	1.99	1.96	1.74	1.89	0.11	0.06
19.	PDZ 16	Biochem-22-19	1.93	1.78	2.09	1.88	1.92	0.13	0.07
20.	NPJ 253	Biochem-22-20	2.22	1.80	2.13	2.70	2.21	0.37	0.17
21.	PDZ 1	Biochem-22-21	2.28	1.88	2.27	2.67	2.27	0.32	0.14
22.	NPJ 252	Biochem-22-22	2.17	2.06	1.62	2.69	2.14	0.44	0.21
23.	PM 28	Biochem-22-23	1.66	1.69	1.59	1.85	1.70	0.11	0.07
24.	PDZ 14	Biochem-22-24	1.89	1.85	2.08	1.77	1.89	0.13	0.07
25.	DRMRCIQ 47	Biochem-22-25	1.90	1.90	2.02	1.75	1.89	0.11	0.06
26.	RV	Biochem-22-26	1.83	1.11	1.78	2.83	1.89	0.71	0.38

Table 18: Total glucosinolate (µmole/g)

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH	Mean	STDE V	CV
1.	DRMRC1(Q)172	Biochem-22-1	35.67	34.38	30.32	50.15	37.63	8.65	0.23
2.	PM 30(NC)	Biochem-22-2	49.20	57.87	45.96	59.72	53.19	6.65	0.13
3.	PusaQMH 1	Biochem-22-3	44.67	42.02	48.34	60.91	48.98	8.36	0.17
4.	PMAS 11	Biochem-22-4	21.78	23.09	21.22	22.69	22.20	0.85	0.04
5.	RH 0749 (ZC)	Biochem-22-5	38.92	52.96	35.91	53.79	45.40	9.30	0.20
6.	PDZ 18	Biochem-22-6	22.67	23.73	21.78	22.77	22.74	0.80	0.04
7.	PM 32(LR)	Biochem-22-7	47.02	53.75	44.82	50.75	49.08	3.96	0.08
8.	PMAS 7	Biochem-22-8	24.21	24.78	21.46	21.33	22.94	1.81	0.08
9.	LES67	Biochem-22-9	37.21	36.81	35.64	53.11	40.69	8.30	0.20
10.	LES66	Biochem-22-10	39.48	35.69	30.17	44.80	37.53	6.17	0.16
11.	RH(OE)1708	Biochem-22-11	37.61	42.78	38.71	60.71	44.95	10.74	0.24
12.	PDZ 19	Biochem-22-12	22.15	22.32	20.82	23.45	22.18	1.08	0.05
13.	DRMRQ 29-20	Biochem-22-13	80.60	83.26	69.71	60.23	73.45	10.58	0.14
14.	RH(OE)1806	Biochem-22-14	31.66	36.84	30.57	59.20	39.57	13.37	0.34
15.	PDZ 11	Biochem-22-15	20.81	23.08	23.98	11.43	19.82	5.76	0.29
16.	DRMR CIQ 158	Biochem-22-16	23.81	27.34	24.76	22.14	24.51	2.17	0.09
17.	PDZ 15	Biochem-22-17	23.81	25.66	20.54	14.99	21.25	4.68	0.22
18.	IJ19R5004	Biochem-22-18	22.81	33.50	23.35	15.29	23.74	7.48	0.31
19.	PDZ 16	Biochem-22-19	17.98	17.46	22.71	18.29	19.11	2.42	0.13
20.	NPJ 253	Biochem-22-20	30.38	38.20	31.46	58.07	39.53	12.84	0.32
21.	PDZ 1	Biochem-22-21	21.67	22.72	23.52	18.78	21.67	2.07	0.10
22.	NPJ 252	Biochem-22-22	48.67	75.88	27.22	58.46	52.56	20.30	0.39
23.	PM 28	Biochem-22-23	46.89	75.07	44.58	54.73	55.32	13.87	0.25
24.	PDZ 14	Biochem-22-24	20.67	22.73	20.78	14.20	19.59	3.72	0.19
25.	DRMRCIQ 47	Biochem-22-25	35.97	32.84	23.19	23.47	28.87	6.52	0.23
26.	RV	Biochem-22-26	71.93	77.81	45.55	60.67	63.99	14.20	0.22

Table 19: Phytic acid (%)

S.NO.	Code	Genotypes	BPR	PNT	HSR	LDH	Mean	STDEV	CV
1.	DRMRC1(Q)172	Biochem-22-1	3.13	2.51	2.43	3.73	2.95	8.65	0.23
2.	PM 30(NC)	Biochem-22-2	3.20	2.26	2.11	4.46	3.01	6.65	0.13
3.	PusaQMH 1	Biochem-22-3	3.39	2.20	2.09	4.39	3.02	8.36	0.17
4.	PMAS 11	Biochem-22-4	2.14	1.28	1.28	3.07	1.94	0.85	0.04
5.	RH 0749 (ZC)	Biochem-22-5	2.77	2.66	2.67	3.03	2.78	9.30	0.20
6.	PDZ 18	Biochem-22-6	2.68	1.49	1.31	4.60	2.52	0.80	0.04
7.	PM 32(LR)	Biochem-22-7	2.99	2.60	2.72	3.13	2.86	3.96	0.08
8.	PMAS 7	Biochem-22-8	3.15	3.38	3.14	3.17	3.21	1.81	0.08
9.	LES67	Biochem-22-9	3.16	2.24	2.19	3.84	2.86	8.30	0.20
10.	LES66	Biochem-22-10	2.81	1.56	1.75	4.40	2.63	6.17	0.16
11.	RH(OE)1708	Biochem-22-11	3.15	1.31	1.38	4.45	2.57	10.74	0.24
12.	PDZ 19	Biochem-22-12	3.35	2.71	2.97	4.25	3.32	1.08	0.05
13.	DRMRQ 29-20	Biochem-22-13	3.71	2.17	2.57	4.92	3.34	10.58	0.14
14.	RH(OE)1806	Biochem-22-14	3.52	2.88	3.17	4.03	3.40	13.37	0.34
15.	PDZ 11	Biochem-22-15	2.99	2.29	2.26	3.90	2.86	5.76	0.29
16.	DRMR CIQ 158	Biochem-22-16	3.61	1.42	2.29	5.00	3.08	2.17	0.09
17.	PDZ 15	Biochem-22-17	2.86	2.47	2.25	3.50	2.77	4.68	0.22
18.	IJ19R5004	Biochem-22-18	2.90	2.42	2.57	3.72	2.90	7.48	0.31
19.	PDZ 16	Biochem-22-19	2.78	2.21	2.62	3.03	2.66	2.42	0.13
20.	NPJ 253	Biochem-22-20	2.85	2.71	2.41	3.44	2.85	12.84	0.32
21.	PDZ 1	Biochem-22-21	2.66	2.21	2.19	3.29	2.59	2.07	0.10
22.	NPJ 252	Biochem-22-22	2.26	1.73	1.72	3.30	2.26	20.30	0.39
23.	PM 28	Biochem-22-23	3.18	2.39	2.44	4.01	3.01	13.87	0.25
24.	PDZ 14	Biochem-22-24	2.28	1.31	1.38	3.37	2.09	3.72	0.19
25.	DRMRCIQ 47	Biochem-22-25	3.61	2.15	2.28	5.08	3.28	6.52	0.23
26.	RV	Biochem-22-26	2.04	1.56	1.41	2.70	1.93	14.20	0.22

Table 20: Profile of different glucosinolates (µmole/g defatted seed meal)by UPLC in promising breeding materials
(Centre: BPR)

			Sinigrin		Gluconapin		Glucobrassicanapin		Nasturtin		Total	
S.No	Code	Genotypes	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
1.	DRMRC1(Q)172	Biochem-22-1	5.53	0.10	29.27	0.09	7.62	0.15	0.86	0.17	47.54	0.10
2.	PM 30(NC)	Biochem-22-2	76.45	0.27	59.31	0.08	0.23	0.19	0.04	0.78	139.88	0.18
3.	PusaQMH 1	Biochem-22-3	101.58	0.17	78.69	0.04	0.08	0.92	0.06	0.37	183.66	0.09
4.	PMAS 11	Biochem-22-4	4.51	0.61	18.48	0.28	1.26	0.10	0.11	0.12	28.83	0.28
5.	RH 0749 (ZC)	Biochem-22-5	15.31	0.11	91.62	0.11	1.64	0.21	0.08	0.17	112.18	0.11
6.	PDZ 18	Biochem-22-6	6.98	0.20	21.58	0.09	2.74	0.21	0.26	0.17	35.71	0.07
7.	PM 32(LR)	Biochem-22-7	20.47	0.07	90.21	0.05	2.30	0.39	0.23	0.24	116.99	0.05
8.	PMAS 7	Biochem-22-8	4.31	0.17	17.64	0.19	1.39	0.24	0.11	0.24	38.77	0.50
9.	LES67	Biochem-22-9	26.94	0.07	37.11	0.15	2.33	0.33	0.21	0.20	71.48	0.11
10	LES66	Biochem-22-10	26.99	0.03	45.79	0.08	0.21	0.13	0.02	0.15	75.77	0.05
11	RH(OE)1708	Biochem-22-11	48.27	0.07	63.47	0.07	0.37	0.05	0.06	0.46	114.57	0.06
12	PDZ 19	Biochem-22-12	0.72	1.19	28.39	0.15	3.65	0.85	0.15	1.18	37.05	0.20
13	DRMRQ 29-20	Biochem-22-13	39.89	0.34	51.33	0.55	0.05	0.87	0.04	0.58	95.20	0.16
14	RH(OE)1806	Biochem-22-14	38.10	0.18	65.51	0.16	0.29	1.31	0.06	0.11	106.72	0.05
15	PDZ 11	Biochem-22-15	3.10	0.42	11.72	0.31	0.09	0.09	0.03	0.30	18.18	0.26
16	DRMR CIQ 158	Biochem-22-16	19.82	0.21	40.80	0.24	2.48	0.19	0.04	0.22	66.10	0.22
17	PDZ 15	Biochem-22-17	3.48	0.27	13.49	0.34	0.92	0.22	0.09	0.25	21.44	0.29
18	IJ19R5004	Biochem-22-18	5.98	0.40	12.96	0.23	1.91	0.25	0.27	0.41	26.01	0.22
19	PDZ 16	Biochem-22-19	5.95	0.26	27.96	0.16	0.78	0.59	0.04	0.43	37.98	0.17
20	NPJ 253	Biochem-22-20	21.86	0.26	95.46	0.25	1.24	0.24	0.17	0.18	122.93	0.25
21	PDZ 1	Biochem-22-21	5.16	0.03	23.74	0.02	3.18	0.03	0.16	0.13	36.28	0.03
22	NPJ 252	Biochem-22-22	22.77	0.30	86.11	0.02	1.41	0.29	0.13	0.07	115.57	0.06
23	PM 28	Biochem-22-23	36.73	0.07	98.85	0.05	1.11	0.25	0.17	0.31	141.57	0.05
24	PDZ 14	Biochem-22-24	3.35	0.36	14.62	0.18	1.67	0.35	0.10	0.48	22.94	0.19
25	DRMRCIQ 47	Biochem-22-25	19.72	0.13	42.18	0.08	3.35	0.12	0.07	0.37	68.53	0.08
26	RV	Biochem-22-26	20.63	0.10	107.30	0.08	1.64	0.13	0.11	0.18	133.04	0.07

Forntline Demonstrations

8.Frontline demonstrations

8.1 Distribution of frontline demonstrations

Under the scheme “Frontline demonstrations and other related activities of Oilseeds” funded under the NFSM-Oilseed by DAC&FW, Ministry of Agriculture and Farmers’ Welfare, Govt. of India, 6462 frontline demonstrations (FLDs) were conducted against the allocation of 6000 FLDs under irrigated as well as rainfed conditions on rapeseed (toria, yellow sarson, brown sarson, gobhi sarson and taramira) and mustard (Indian mustard) in 172 districts across 20 states during 2022-23 through 46 cooperating centres of AICRPRM/ ICAR institutes/ Ag. Universities/NGOs/FPOs. The maximum FLDs were conducted in Rajasthan (1651) followed by Uttar Pradesh (1178), Assam (703) and Madhya Pradesh (550). Out of 46 FLDs conducting centres, 14 were in Uttar Pradesh, 10 in Rajasthan, 5 in Madhya Pradesh, 3 in Jharkhand, 2 each in Assam, Haryana, Punjab, Jammu & Kashmir, Himachal Pradesh and Maharashtra and one each in rest of the 10 states. The maximum districts (41) were covered in Uttar Pradesh followed by Rajasthan (20), Assam (14), Madhya Pradesh (13), Maharashtra (11), 10 each in Jammu & Kashmir, Haryana and Punjab, 8 in Odisha, 6 each in Himachal Pradesh and Telangana, 5 each in Uttrakhand and Jharkhand, 4 in Manipur, 3 each in Gujarat and Arunachal Pradesh, one each in Tripura, Meghalaya, Bihar and West Bengal (Table 8.1). The sowing time spread from Sept. 9, 2022 (Uttarakhand) for toria to Dec 16, 2022 (Assam) for toria.

8.2 Types of demonstrations

The 1472 FLDs on rapeseed and 4990 on mustard were conducted. The maximum 4990 FLDs were conducted on Indian mustard followed by toria (1015), gobhi sarson (218), yellow sarson (139), brown sarson (50) and taramira (50). All the demonstrations were conducted under whole package, varietal and component demonstrations in two different situations viz., irrigated (4649) and rainfed (1813). Variety-wise analysis was also done to see the performance of demonstrated improved varieties. There were 18 varieties of Indian mustard followed by 7 of toria and 5 of yellow sarson and 2 of gobhi sarson under irrigated condition. The 8 varieties each of Indian mustard and toria, 4 of yellow sarson, 3 of taramira, 2 of gobhi sarson and one of brown sarson were demonstrated under rainfed condition (Table 8.2). The results included the mean seed yield (kg/ha) for both the improved plot (IP) with improved technology and the farmers’ plot (FP) with farmers’ practice, besides yield superiority of improved technology (%), cost of cultivation (CoC), gross monetary return (GMR) and additional net monetary return (ANMR) in Rs./ha from the IP and benefit: cost (B:C) ratio for both the IP and FP.

8.3 Whole package FLDs of rapeseed-mustard under rainfed condition

Jobner centre (Rajasthan); AAU, Jorhat & Shillongani (Assam); Pantnagar (Uttarakhand); Chatta and Khudwani (J&K); CAU, Imphal (Manipur), Tripura, Meghalaya, Arunachal Pradesh; Kangra, CPU (Himachal Pradesh); MASS and Kanke (Jharkhand) and Bhubaneswar (Odisha) conducted 1649 FLDs on WP of rapeseed-mustard under rainfed condition (Table 8.3). The maximum demonstrations (554) were conducted in Assam on toria (377) and Indian mustard (177) under rainfed condition with mean seed yield of 974 kg/ha in IP and 705 kg/ha in FP. IP had a yield advantage of 34.3% and ANMR of Rs 10,703/ha under rainfed condition in Assam. 220 demonstrations were conducted in Jharkhand on Indian mustard which had shown yield advantage of 48.5% and ANMR of Rs. 17,726/ha. The maximum yield improvement of 75% was recorded in Tripura (TR) followed by Odisha that recorded 59.4 % yield improvement in 30 FLDs on toria with 719 kg/ha average seed yield in IP and ANMR of Rs. 7,606/ha under rainfed condition.

Himachal Pradesh with average mean seed yield of 1,848 kg/ha in 196 FLDs on gobhi sarson(163) and Indian Mustard (33) recorded yield advantage of 51.8% from IP with maximum ANMR of Rs. 30,959/ha.

The minimum (635 kg/ha) mean seed yield from IP with 42.4 % yield improvement were observed in Meghalaya. The cost of cultivation of IP ranged from Rs. 13,049 /ha in Arunachal Pradesh to Rs 33,500 /ha in Himachal Pradesh under rainfed condition. In rainfed condition, the IP also had higher B:C ratio in all states than that of FP. The highest B:C ratio for IP (5.64) in Rajasthan and lowest (1.39) in Odisha were recorded.

8.4 Whole package FLDs of rapeseed-mustard under irrigated condition

The whole package technology demonstration included use of improved variety, balanced use of fertilizers, proper spacing, use of micronutrients and need based plant protection and scientific cultural practices in comparison to farmers' practices of crop cultivation. Bharatpur, KVK (Bansur), Jodhpur, Kota, Sri Ganganagar, KVK (CAZRI), Manzari foundation, Solidaridad and VMFPCL centres/NGOs in Rajasthan; Varanasi, Kanpur, Banda, Jhansi, Agrimitta, Amity University (Noida), Biozone, MB Trust, Ishani, Azamgarh APCL, Mirjapur FPC, Sathiyon FPC, Saili FPC, Kalpvriksh FPC in Uttar Pradesh; KVK Morena, ZARS Morena, Solidaridad, Agrimitra and Jhansi centre in Madhya Pradesh; Bawal in Haryana; AAU, Jorhat and Shillongani in Assam; Ludhiana and Solidaridad in Punjab; GNSU in Bihar; MASS and SISU in Jharkhand; Chatha in J&K; Pantnagar in Uttarakhand; Nagpur in Maharashtra; Kalyani in West Bengal; Bhubaneswar in Odisha and Jagtial in Telengana conducted 4332 FLDs on whole package of rapeseed-mustard under irrigated condition (Table 8.4).

The maximum FLDs (1524) were conducted in Rajasthan where improved plot recorded average yield of 1,946 kg/ha with yield superiority of 14.8% and ANMR of Rs 14,449/ha.

Under irrigated condition, mean seed yield from IP ranged from 989 in Maharashtra to 2,197kg/ha in Punjab, whereas from FP ranged from 625 in Odisha to 2,005 kg/ha in Haryana. The yield increase due to IP ranged from 4.8% in Punjab to 67.8% in J&K.

For IP, Haryana had the highest cost of cultivation (Rs 39,005./ha), while Jharkhand had the lowest cost of cultivation (Rs 16,985/ha).

The maximum ANMR (Rs 25,001 /ha) was reported due to the improved WP of Indian mustard in Jammu & Kashmir, while minimum was in Maharashtra (Rs 7,045 /ha). All IP had positive ANMR. The higher B:C ratio for the improved WP under irrigated condition in all the states. The highest B:C ratio of IP (4.16) was realized in Punjab (Table 8.4).

8.5 Varietal performance in Whole package FLDs of rapeseed-mustard under irrigated condition

An effort was also made to see the performance of demonstrated varieties in whole package demonstrations in different states under irrigated and rainfed condition.

8.5.1 Indian mustard

A total of 18 improved varieties of Indian mustard namely Giriraj, RH 725, NRCHB 101, RH 749, CS 60, DRMR 1165-40, Radhika, Brajraj, PM-30, PM-31, PR 20, Surekha, Azad Mahak, GDM 4, TAM 108-1, RCH 1, PHR 126 and PR-19 were used in WP covering 14 states under irrigated condition (Table 8.5). Improved variety RH 749 demonstrated in 99 FLDs in Uttar Pradesh recorded highest average yield of 2,510 kg/ha with a yield improvement of 30.9% over local (FP) practice and ANMR of Rs 28,542 /ha followed by Surekha demonstrated in 75 FLDs in Uttar Pradesh with average seed yield of 2,442 kg/ha. The maximum yield improvement 68.5% was recorded in Jammu & Kashmir with Brajraj variety. The minimum yield improvement of 2.13% was reported from PHR-126 variety in Punjab, while minimum average seed yield of 663 kg/ha was reported from DRMR 150-35 variety in Assam.

The Giriraj variety was demonstrated in 5 states which recorded highest mean seed yield of 2,288 kg/ha with 8.8% yield improvement in Punjab (50 FLDs) followed by 2,262 kg/ha with 31.4% yield improvement in Uttar Pradesh (336 FLDs), 2,108 kg/ha with 15.6% yield improvement in Madhya Pradesh (318 FLDs), 2,063 kg/ha with 17.2% yield improvement in Bihar (50 FLDs) and 1,909 kg/ha with yield improvement of 16.0% in Rajasthan (693 FLDs) over FP.

The RH 725 variety was also demonstrated in 4 states which recorded highest mean seed yield of 2,200 kg/ha in Haryana (10 FLDs) with yield improvement of 9.7%, followed by 1,880 kg/ha with yield improvement of 7.2% in Rajasthan (49 FLDs), 1,749 kg/ha with yield improvement of 20.1% in Madhya Pradesh (15 FLDs) and 1,211 kg/ha with yield improvement of 17.6% in Uttar Pradesh (80 FLDs) over FP.

The variety NRCHB 101 was demonstrated in 4 states which recorded highest mean seed yield of 2,155 kg/ha with yield improvement of 24.9% in West Bengal (24 FLDs), followed by 1,667 kg/ha mean seed yield with 9.5% yield improvement in Rajasthan (150 FLDs), 1,052 kg/ha mean seed yield with 15.1% yield improvement in Telengana (50 FLDs) and 993 kg/ha mean seed yield with 58.9% yield improvement in Odisha (100 FLDs) over FP.

The improved variety Radhika was demonstrated in 4 states which recorded highest mean seed yield of 1,902 kg/ha with yield improvement of 7.8% in Rajasthan (92 FLDs), followed by 1,691 kg/ha mean seed yield with 20.7% yield improvement in Madhya Pradesh (17 FLDs), 1,257 kg/ha mean seed yield with 22.6% yield improvement in Uttar Pradesh (23 FLDs) and 884 kg/ha mean seed yield with 67.5% yield improvement in Jammu & Kashmir (63FLDs) over FP.

The improved variety RH 749 was demonstrated in 2 states which recorded highest yield improvement of 30.9% with mean seed yield of 2,510 kg/ha in Uttar Pradesh (99 FLDs) followed by 8.5% with mean seed yield of 1,810 kg/ha in Rajasthan (19 FLDs) over FP.

In Rajasthan, 10 improved varieties viz. Giriraj, RH 725, NRCHB 101, RH 749, CS 60, DRMR 1165-40, Radhika, Brajraj, PM 30 and PM 31 were demonstrated in 1524 FLDs by 9 centres under irrigated condition. Out of which, improved variety DRMR 1165-40 demonstrated in 320 FLDs in Rajasthan recorded highest yield of 2,190 kg/ha with yield improvement of 19.9% over FP. In Rajasthan, the improved variety Giriraj was used in maximum demonstrations (653 FLDs), which recorded average seed yield of 1,909 kg/ha with yield improvement of 16.0%. The improved variety Brajraj was demonstrated in 30 FLDs, which recorded average seed yield of 2,021 kg/ha with yield improvement of 7.5%. The improved variety CS 60 was demonstrated in 65 FLDs, which recorded average seed yield of 1,945 kg/ha with yield improvement of 14.2%. The improved varieties Radhika (92 FLDs), PM-30 (89 FLDs), PM 31 (17 FLDs), RH 725 (49) and RH 749 (19 FLDs) recorded average seed yield of 1,902; 1,911; 1,903; 1,880 and 1,810 kg/ha, respectively in Rajasthan.

In Uttar Pradesh, 9 improved varieties viz. DRMR 1165-40, Giriraj, Radhika, RH 725, PR 20, RH 749, PM 30, Surekha, and Azad Mahak were demonstrated in 1052 FLDs by 14 centres/FPOs under irrigated condition. Out of which, improved variety RH 749 demonstrated in 99 FLDs in Uttar Pradesh recorded highest yield of 2,510 kg/ha with yield improvement of 30.9% over FP. The improved variety Surekha was demonstrated in 75 FLDs, which recorded average seed yield of 2,442 kg/ha with yield improvement of 54.4%. In Uttar Pradesh, the improved variety Giriraj was used in maximum demonstrations (336 FLDs), which recorded average seed yield of 2,262 kg/ha with yield improvement of 31.4%. The improved variety Azad Mahak was demonstrated in 63 FLDs, which recorded average seed yield of 2,187 kg/ha with yield improvement of 35.6%. The improved varieties PR 20 (5 FLDs), PM 30 (315 FLDs), DRMR 1165-40 (126 FLDs), and Radhika (23 FLDs) recorded average seed yield of 2,040; 1,896; 1,523; and 1,257 kg/ha, respectively in Uttar Pradesh.

The 4 improved varieties viz. Giriraj, DRMR 1165-40, Radhika and RH 725 were demonstrated in 550 FLDs by 4 centres/FPOs in Madhya Pradesh under irrigated condition. Out of which, improved variety Giriraj was demonstrated in maximum demonstrations (318 FLDs) which recorded highest average yield of 2,108 kg/ha with yield improvement of 15.6% followed by DRMR 1165-40 (200 FLDs), which recorded average seed yield of 2,024 kg/ha with yield improvement of 16.0% over FP. The improved variety RH 725 demonstrated in 15 FLDs, recorded 1,749 kg/ha average seed yield under IP with yield improvement of 20.1%. The improved variety Radhika demonstrated in 17 FLDs, recorded 1,691 kg/ha average seed yield under IP with yield improvement of 20.7% in Madhya Pradesh.

The 3 improved varieties viz. Giriraj, RCH 1 and PHR 126 were demonstrated in 105 FLDs by Ludhiana centre and Solidaridad in Punjab under irrigated condition. Out of which, improved variety Giriraj was demonstrated in maximum demonstrations (50 FLDs) which recorded highest average yield of 2,288 kg/ha with yield improvement of 8.8% followed by RCH 1 (28 FLDs), which recorded average seed yield of 2,147 kg/ha with yield improvement of 3.8% over FP. The improved variety PHR 126 demonstrated in 27 FLDs, recorded 2,111kg/ha average seed yield under IP with yield improvement of 2.1% in Punjab

In Jammu & Kashmir, the improved variety Radhika demonstrated in 63 FLDs recorded highest mean seed yield of 1,455 kg/ha with yield improvement of 67.6%, while Brijraj demonstrated in 28 FLDs recorded mean seed yield of 1336 kg/ha with yield improvement of 68.5%.

The improved variety DRMR 1165-40 (50 FLDs) recorded 1,912 kg/ha average seed yield under IP with yield improvement of 16.0% in Bihar.

The improved variety RH 725 (10 FLDs) recorded 2,200 kg/ha average seed yield under IP with yield improvement of 9.7% in Haryana. The improved variety PM 30 (218 FLDs) recorded 1,132 kg/ha average seed yield under IP with yield improvement of 25.4% in Jharkhand. In Maharashtra, the improved varieties TAM 108-1 (100 FLDs) recorded 989 kg/ha average seed yield with 18.4% yield improvement, over FP.

The PR 19 variety demonstrated in one FLDs in Uttarakhand recorded 1,850 kg/ha average seed yield under IP with yield improvement of 12.1% while DRMR 150-35 variety demonstrated in 25 FLDs in Assam recorded 663 kg/ha average seed yield under IP with yield improvement of 15.7%

The maximum ANMR (Rs. 42,712 /ha) was reported from Surekha variety in Uttar Pradesh, while minimum (Rs. 3,986/ha) was from PHR 126 variety in Punjab. All IP had positive ANMR. The B:C ratio for all improved varieties under irrigated condition was higher. However, highest B:C ratio of IP (4.74) was realized from PHR 126 variety in Punjab. (Table 8.5).

8.5.2 Yellow sarson

Pantnagar centre conducted 30 FLDs with PPS 1, Pant Sweta, NRCYS 05-02, YSH 401 and Pitambari varieties of yellow sarson. Out of which, PPS 1 variety was demonstrated in maximum demonstrations (12 FLDs) which recorded highest average yield of 1,520 kg/ha with yield improvement of 14.5% followed by NRCYS 05-02 (5 FLDs), which recorded average seed yield of 1,508 kg/ha with yield improvement of 13.8% over FP. The improved variety YSH 401 demonstrated in 3 FLDs, recorded 1,433 kg/ha average seed yield under IP with yield improvement of 24.6%. The improved variety Pant Sweta demonstrated in 8 FLDs, recorded 1,406 kg/ha average seed yield under IP with yield improvement of 14.7%. The Pitambari variety in 2 FLDs recorded 1,370 kg/ha average seed yield under IP against the 1,371 kg/ha under FP in Uttarakhand.

Kanpur centre conducted 52 FLDs with Pitambari variety which recorded highest average yield of 2,080 kg/ha with maximum yield improvement of 27.8% and maximum ANMR of Rs. 20,541/ha from IP in Uttar Pradesh. The improved variety Pant Sweta demonstrated in 5 FLDs by Kanpur centre, recorded 1,900 kg/ha average seed yield under IP with yield improvement of 21.8%. (Table 8.5).

8.5.3 Gobhi sarson

Ludhiana conducted 28 FLDs with PGSH 1707 and 27 FLDs with GSC 7 varieties of gobhi sarson. The IP with PGSH 1707 and GSC 7 had the average yield of 2,181 kg/ha and 2,180 kg/ha, with yield improvement of 3.2% and 2.5%, respectively.

8.5.4 Toria

Pantnagar centre in Punjab conducted 12 FLDs with Uttara, 6 FLDs with PT 508 and 2 FLDs with Tapeshwari varieties of toria. The maximum average seed yield of 1,480 kg/ha was recorded with PT 508 variety, followed by 1,475 and 1,336 kg/ha with Tapeshwari and Uttara variety with yield improvement of 15.6%, 15.7% and 17.5%, respectively in Uttarakhand.

Shillongani centre in Assam conducted 124 FLDs with TS 38, TS 36, TS 46, and TS 67 varieties of toria. Out of which, TS 38 variety was demonstrated in maximum demonstrations (54 FLDs) which recorded highest average yield of 1,356 kg/ha with yield improvement of 66.1% followed by TS 67 (37 FLDs), which recorded average seed yield of 1,332 kg/ha with yield improvement of 62.0% over FP. The variety TS 36 demonstrated in 20 FLDs, recorded 1,209 kg/ha average seed yield under IP with yield improvement of 50.2%. The variety TS 46 demonstrated in 13 FLDs, recorded 1,199 kg/ha average seed yield under IP with yield improvement of 36.1% in Assam. (Table 8.5).

8.6 Varietal performance in Whole package FLDs of rapeseed-mustard under rainfed condition

8.6.1 Indian mustard

A total of 8 improved varieties of Indian mustard namely DRMR 150-35, NRCHB 101, Radhika, Brajraj, PM 30, BBM 1, RCC 4 and PR 19 were used in WP covering 7 states under rainfed condition (Table 8.6).

The improved variety Radhika (31 FLDs) and Brajraj (54 FLDs) was demonstrated in Jammu & Kashmir under rainfed situations, where highest mean seed yield with yield improvement of 60.2% with Radhika was recorded followed by 1,382 kg/ha mean seed yield (1,429 kg/ha) with maximum yield improvement of 67.5% with Brajraj. The PM 30 variety demonstrated in 155 FLDs in Jharkhand recorded average seed yield of 1,177 kg/ha with yield improvement of 41.3%, while BBM 1 variety (65) recorded average seed yield of 1,093 kg/ha with yield improvement of 70.8%.

The DRMR 150-35 variety was demonstrated in maximum FLDs (177) in Assam, which recorded average seed yield of 782 kg/ha with yield improvement of 16.0%. The NRCHB 101 variety in 21 FLDs recorded average seed yield of 749 kg/ha with yield improvement of 26.7% in Manipur over FP.

The RCC 4 variety (33 FLDs) in Himachal Pradesh recorded average seed yield of 782 kg/ha with yield improvement of 55.8%. The PR 19 variety in 3 FLDs recorded average seed yield of 1,343 kg/ha with yield improvement of 17.5% in Uttarakhand over FP.

The maximum ANMR (Rs 24,129 /ha) was reported in Jammu & Kashmir from Brajraj variety, while minimum (Rs. 5,263 /ha) was in Assam from DRMR 150-35 variety. All IP had positive ANMR. The higher B:C ratio for all improved varieties under rainfed condition in all the states under IP was realized. The highest B:C ratio of IP (4.03) was realized from PM 30 variety in Jharkhand. (Table 8.6).

8.6.2 Toria

The improved variety TS 38 of toria was demonstrated (515 FLDs) in 4 states under rainfed situations, which recorded highest mean seed yield of 1,064 kg/ha with yield improvement of 35.0% in Assam (262 FLDs) followed by 1,041 kg/ha mean seed yield with highest yield improvement of 75.0% in Tripura (125 FLDs) over FP. TS 38 variety in Arunachal Pradesh (92 FLDs) recorded mean seed yield of 826 kg/ha with yield improvement of 14.9%, while the same variety in Manipur (36 FLDs) recorded mean seed yield of 635 kg/ha with yield improvement of 37.7%

The improved variety TS 67 was demonstrated in Assam (112 FLDs) and Arunachal Pradesh (22 FLDs), which recorded highest mean seed yield of 927 kg/ha with maximum yield improvement of 67.3% in Assam followed by 824 kg/ha mean seed yield with yield improvement of 14.1% over FP in Arunachal Pradesh. Pantnagar conducted 5 FLDs with PT 508, 2 FLDs with Tapeshwari and 13 FLDs with PHT 1 varieties of toria under rainfed situation in Uttarakhand. The IP with PT 508, Tapeshwari and PHT 1 had the average yield of 796 kg/ha; 750 kg/ha and 743 kg/ha, respectively with yield improvement of 21%; 21% and 17.4%, respectively. Bhubaneswar centre conducted 30 FLDs with Sushree variety, which recorded seed yield of 719 kg/ha with yield improvement of 59.4%.

TS 36 variety in Meghalaya (125 FLDs) recorded mean seed yield of 635 kg/ha with yield improvement of 42.4%, while TS 46 variety in Assam (3 FLDs) recorded mean seed yield of 1,190 kg/ha with yield improvement of 25.3%

The maximum ANMR (Rs 18,901 /ha) from TS 38 variety was reported in Tripura, while minimum (Rs. 2,741 /ha) from TS 67 variety was in Arunachal Pradesh. All IP had positive ANMR. (Table 8.6).

8.6.3 Yellow sarson

Pantnagar centre conducted 17 FLDs with PPS 1, Pant Sweta and Pitambari varieties of yellow sarson in rainfed situation of Uttarakhand. Out of which, PPS 1 variety demonstrated in 5 FLDs, recorded highest average yield of 1,236 kg/ha with yield improvement of 16.6% followed by Pant Sweta (10 FLDs), which recorded average seed yield of 759 kg/ha with yield improvement of 17.9% over FP. The improved variety Pitambari demonstrated in 2 FLDs, recorded 710 kg/ha average seed yield under IP with yield improvement of 29.1%.

The improved variety NRCYS 05-02 demonstrated in 3 FLDs, recorded 815 kg/ha average seed yield under IP with yield improvement of 39.7% over FP in Manipur. The maximum ANMR (Rs. 11,244 /ha) from NRCYS 05-02 variety was reported in Manipur, while minimum (Rs. 5,268 /ha) from Pant Sweta variety was in Uttarakhand. All IP had positive ANMR. (Table 8.6).

8.6.4 Gobhi sarson

The improved variety GSC 7 of gobhi sarson was demonstrated in 145 FLDs in Himachal Pradesh under rainfed condition, which recorded an average seed yield of 1,073 kg/ha in IP against 700 kg/ha in FP with a yield improvement of 53.3% and ANMR of Rs.18,239 /ha. Kangra centre conducted 18 FLDs with AKMS 8141 variety of gobhi sarson in rainfed situation of Himachal Pradesh which recorded an average seed yield of 1,277 kg/ha with 31.2% yield improvement in IP. All IP had positive ANMR (Table 8.6).

8.6.5 Brown sarson

Khudwani centre conducted 50 FLDs with Shalimar sarson 2 variety of brown sarson in rainfed situation of Jammu & Kashmir which recorded an average seed yield of 1,093 kg/ha with 17.8% yield improvement in IP. The demonstrated variety had higher B:C ratio than that of FP. (Table 8.6).

8.6.6 Taramira

Jobner centre conducted 50 FLDs using RTM 1355, RTM 1351 and RTM 1624 varieties of taramira under rainfed situation of Rajasthan (Table 8.6). The demonstrations with RTM 1624 (13 FLDs) recorded maximum average seed yield of 1,218 kg/ha with maximum yield improvement of 22.2% and maximum ANMR of Rs 9,450 /ha, while demonstrations with RTM 1355 (16 FLDs) and RTM-1351 (21 FLDs) recorded an average seed yield of 1,187 kg/ha and 1,168 kg/ha, with a yield improvement of 21.2% and 19.7%, respectively. The B:C ratio for all improved varieties under of taramira under rainfed situation was higher.

8.7 Other component technology FLDs

8.7.1 Indian mustard

A total of 431 FLDs with 11 component technologies for Indian mustard were carried out by Bawal and Hisar (Haryana), SK Nagar (Gujarat), Bhubaneswar (Odisha), Bansur (Rajasthan) and CAU (Manipur). (Table 8.7).

Weeding Bawal centre conducted 10 demonstrations and reported yield increase of 23.1% with additional cost (Rs 5,000/ha) and additional net return (13,257/ha).

Thinning: Bawal centre conducted 10 demonstrations on this component. The seed yield increase was up to 14.3% with additional cost of Rs 3,000/ha and additional net return of Rs 10,897/ha. The B:C ratio was 2.84 (IP) and 2.69 (FP).

Sclerotinia rot disease management: Hisar conducted 42 demonstrations on Seed treatment with carbendazim @ 2 g/kg seed and two foliar sprays of 0.1% carbendazim at 45 and 60 DAS using RH 725 variety and 8 demonstrations using RH 1424 variety. This component with RH 725 variety showed an increase of 13.0% in seed yield, additional net return of Rs 14,964/ha with an additional cost of Rs 1,822/ha. The B:C ratio for IP (3.70) was higher than that of the FP (3.44). This component with RH 1424 variety which showed an increase of 16.0% in seed yield, additional net return of Rs 17,865 /ha with an additional cost of Rs 2,137/ha

KVK, Bansur conducted 46 demonstrations on seed treatment with carbandazim 50 WP @ 2 gm/kg of seed and one foliar spray of the same @ 0.2% at 60-70 DA spray to control sclerotinia rot disease using DRMR 1165-40 variety, showing an increase of 24.7% in seed yield, additional net return of Rs 20,772/ha with an additional cost of Rs 1900/ha. The B:C ratio for IP (3.19) was higher than that of the FP (2.70).

Micro nutrient application: KVK, Bansur conducted 31 demonstrations on this component using DRMR 1165-40 variety with micronutrient (Recommended dose of Sulphur+Zinc sulphate+ Borax) application. The seed yield increase was up to 22.0% with additional cost of Rs 1,700/ha and net additional return of Rs 16,612/ha. The B:C ratio was 2.85 (IP) and 2.45 (FP).

Sulphur/ Ferrous sulphate and Zinc sulphate/ Azadirachtin 1500 ppm application: The SK Nagar centre used three components namely application of 40kg sulphur/ ha, application of micronutrients (Ferrous sulphate (15 kg/ha) and zinc sulphate (8 kg/ha)) & spray of Azadirachtin 1500 ppm for plant protection using GDM 4 variety and conducted 100 FLDs in Gujarat with GDM 4

variety of Indian mustard. Among the three, the application of sulphur had the maximum average yield of 2,241 kg/ha and also the maximum increase of 12.2% over FP with ANMR of Rs. 9,921/ha in response to additional expenditure of Rs. 3,323/ha. There was 9.1% yield improvement using micronutrient component with ANMR of Rs 7,214/ha in response to additional expenditure of Rs. 2,378/ha followed by 8.8% yield improvement using application of spray of Azadirachtin (1500 ppm) component with ANMR of Rs 8,016/ha in response to additional expenditure of Rs. 1,304/ha . The IP with all three components had the higher B:C ratio than the FP.

Boron with plant protection measures/ plant protection measures in timely sown and late sown irrigated condition: The Bhubneswar centre had conducted 50 FLDs with three combinations of technological components of Indian mustard in Orissa (Table 7). The centre conducted 20 FLDs on application of recommended dose of boron with plant protection measures and 20 FLDs on plant protection measures in timely sown irrigated condition, 10 FLDs on plant protection measures in late sown irrigated condition with variety NRCHB 101. All three component had an average yield of 962 to 998 kg/ha with yield improvement of 58 to 59.5%. However, the maximum ANMR of Rs. 14,960/ha was recorded from the combination of application of boron with plant protection measures. The IP with three combinations had the higher B:C ratio than the FP.

Sowing method and seed rate: The Imphal centre conducted 14 FLDs on the technological component of proper sowing method and seed rate with variety NRCHB 101 of Indian mustard in rainfed condition of Manipur (Table 7). The IP with an average yield of 891 kg/ha and a yield improvement of 19.1% over FP had an ANMR of Rs 5,054/ha and B:C ratio of 2.22, which was higher than that of the FP.

The KVK Kolhapur conducted 100 FLDs on this component with NRCHB 101 variety in Maharashtra, which gave an average yield of 780 kg/ha with 22.8% yield improvement over FP and ANMR of Rs. 6599/ha. The IP had B:C ratio of 2.48 which was higher than FP (2.18).

8.7.2 Toria

Plant protection in late sown irrigated condition: The Bhubaneswar centre conducted 20 FLDs on component of plant protection in late sown irrigated condition with variety Sushree of toria in irrigated condition of Odisha (Table 7). The seed yield increase was up to 61.3% with additional cost of Rs 4,000/ha and net additional return of Rs 13,658/ha. The B:C ratio was 1.64 (IP) and 1.19 (FP).

Sowing method and seed rate: The Imphal centre conducted 35 FLDs on the technological component of proper sowing method and seed rate with variety TS 38 of toria in rainfed condition of Manipur (Table 7). The IP with an average yield of 717 kg/ha and a yield improvement of 45.1% over FP had an ANMR of Rs 8,930/ha and B:C ratio of 1.83, which was higher than that of the FP.

Varietal in late sown rainfed condition: Imphal centre in Manipur conducted 9 FLDs on the varietal component of toria in the late sown-rainfed condition with CAU-Toria 1 and TS 38 varieties (Table 7). Out of both components, maximum yield increase of 42.4% over the FP was recorded from IP with TS 38 variety. The package with CAU-Toria 1 variety had the maximum average yield of 652 kg/ha and also the maximum ANMR of Rs 7,874 /ha. Both package also had higher B:C ratio than that of the FP.

8.7.3 Yellow sarson

Sowing method and seed rate: The Imphal centre conducted 2 FLDs on the technological component of proper sowing method and seed rate with variety NRCYS 05-02 of yellow sarson in rainfed condition of Manipur (Table 7). The IP with an average yield of 800 kg/ha and a yield improvement of 13.8% over FP had an ANMR of Rs. 3,887,/ha and B:C ratio of 2.04, which was higher than that of the FP.

Varietal in late sown rainfed condition: Imphal centre in Manipur conducted 4 FLDs on the varietal component of yellow sarson in the late sown-rainfed condition with NRCYS 05-02 (Table 7). The component recorded an average yield of 785 kg/ha with 26.6% yield improvement over FP and ANMR of Rs. 7,192/ha. The IP had B:C ratio of 2.16 which was higher than FP (1.87).

8.8 Exploitable yield reservoir in rapeseed-mustard

It is evident from the productivity potentials and profitability of improved rapeseed-mustard production technologies that there exists vast potential to improve the rapeseed-mustard productivity under real farm situations. An attempt was made to estimate the extent of such yield reservoir available for exploitation (Table 8.8). Yield gap-I as a result of demonstration of improved technology over farmers practices was ranging from 5.0% in Punjab to 75% in Tripura, whereas, the yield gap-II (between IP and three year from 2018-19 to 2020-21 state average productivity) was ranging from 14.3% in Gujarat to as high as 230.3% in Odisha.

Exploitable production-1 (EP-I is the sum of 3 year State average production and production increased over State average production by bridging yield gap-I) and exploitable production-II (EP-II is the sum of 3 year State average production and production increased over State average production by bridging gap-II) were also worked out as indicated in Table 8.8.

It can be understood from the Table 8.8 that rapeseed-mustard productivity at national level could be improved by 23.1 and 11.45% by bridging the yield gaps-I and II, respectively. Similarly, the national rapeseed-mustard production could be increased from 95.29 to 117.31 and 106.20 lakh tonnes by bridging yield gaps I and II, respectively. This indicates the presence of significant yield reservoir which can be exploited through spread of appropriate technology among the farmers. Therefore, there is an urgent need for effective transfer of improved rapeseed-mustard production technologies to the rapeseed-mustard growers in order to convince them to adopt such technologies so that yield gaps can be bridged and rapeseed-mustard production in the country can be stepped up.

Table 8.1 State wise FLDs on rapeseed-mustard conducted during 2022-23

State	Centre(s)	Total FLDs	Districts covered	Crops	Period of Sowing 2022
Assam (ASM)	DoR, (AAU)	503	Golaghat, Majuli, Karbi anglong, Baksha, Kokrajhar, Lakhimpur, Jorhat	Indian mustard Toria	Oct 30-Dec 16
	Shillongani (SHL)	200	Nagaon, Morigaon, Hojai, Karbi Anglong, West Karbi Anglong, Biswanath Sonitpur, Darang	Toria	Nov10 -Nov 21
Bihar	GNSU	100	Rohtas	Indian Mustard	Oct 20-Nov 10
Odisha	Bhubaneswar (BHU)	200	Mayurbhanja, Koraput, Sundergarh, Jharsuguda, Deogarh, Balasore, Bhadrak, Keonjhar	Indian mustard Toria	Oct 15-Dec 15
Gujarat (GUJ)	S K Nagar (SKN)	100	Banaskanta, Mehsana, Gandhinagar	Indian mustard	Oct 05-Nov 05
Haryana (HAR)	Hisar (HSR)	50	Bhiwani, Hisar, Sirsa, Rewari Charkhi Dadri, Jhajjar, Mahendragarh, Fatehabad, ,	Indian mustard	Oct 08-30
	Bawal (BAW)	30	Rewari, Mahendragarh	Indian mustard	Oct 15-Nov 05
Himachal Pradesh (HP)	Kangra (KNG)	100	Kangra, Hamirpur	Gobhi sarson	Oct 10- Nov 05
	CPU, Hamirpur	96	Bilaspur, Hamirpur, Mandi, Solan	Gobhi sarson Indian mustard	Oct 15-31
Jammu & Kashmir (J&K)	Chatha (CHT)	176	Jammu, Sambha, Kathua, Reasi	Indian Mustard	nov 01-Nov 20
	Khudwani (KHD)	50	Anantnag, Kulgam, Kupwara, Budgam,Bandipora, Pulwama,	Brown sarson	Oct 01-25
Jharkhand	MASS	273	Ranchi	Indian Mustard	Oct 20- Nov 15
	SISU	100	Ranchi	Indian Mustard	Oct 20- Nov 15
	KANKE	65	Ranchi , Khuti, Lohardaga	Indian Mustard	Nov 10- Dec 6
Madhya Pradesh (MP)	ZARS (MOR)	200	Morena, Bhind, Datia and Gwalior	Indian mustard	Oct 15-Nov 18
	Solidaridad	150	Agar Malwa, Mandsaur, Shajapur, Ujjain, Neemuch, Ratlam	Indian mustard	Oct 05-25
	KVK (MOR)	100	Morena,	Indian mustard	Oct 15-Nov 18
	Agrimitra	50	Singrauli	Indian mustard	Oct 25-Nov 10
	JHI	50	Niwari	Indian mustard	Oct 15-Nov 18
Maharashtra (MH)	Nagpur (NGP)	100	Nagpur, Wardha, Washim, Buldana, Chandrapur, Ahmednagar, Gondia, Yavatmal, Latur, Jalana	Indian mustard	Oct 15-Nov 15
	KLP (100)	100	Kolhapur	Indian mustard	Nov 15-Dec1
Manipur (MAN)	CAU (IMP)	124	Imphal West, Imphal East, Ukhrul, Bishnupur	Indian mustard Toria	Nov 05 -Dec 05
Tripura (TR)	CAU (IMP)	125	Khowai	Toria	Nov 05-25
Arunachal Pradesh (AP)	CAU (IMP)	114	East Siang, Lower Dibang Valley, Siang	Toria	Nov 21-25
Meghalaya (ML)	CAU (IMP)	125	West Garo Hills	Toria	Oct 15-20
Punjab (PUN)	Ludhiana (LDH)	110	Amritsar, Barnala, Bathinda, Fatehgarh Sahib, Jalandhar, Ludhiana, Ropar, Sangrur, Sri Muktsar Sahib	Gobhi sarson Indian mustard	Oct 15-Dec 5
	Solidaridad	50	Sangrur	Indian mustard	Oct 17- Nov 25
Rajasthan (RAJ)	Bharatpur (BPR)	802	Bharatpur	Indian mustard	Oct 20-Nov 20
	Bansur (BAN)	120	Alwar	Indian mustard	Oct 08-28
	Jodhpur (JDH)	150	Jodhpur, Nagaur, Pali	Indian mustard	Oct 24-Nov 8

	Kota (KOT)	100	Kota,Bundi, Jhalawar, Baran	Indian mustard	Sep 25 Oct 10
	Jobner (JOB)	50	Jaipur	Taramira	Oct 10-31
	KVK CAZRI	10	Jodhpur	Indian Mustard	Oct 21-23
	Sriganganagar (SGN)	19	Sriganganagar	Indian mustard	Oct 15-25
	Manjari	100	Dholpur	Indian mustard	Oct 22-28
	Solidaridad	200	Bundi, Baran, Jhalawar, Kota, Tonk ,Sawaimadhopur	Indian mustard	Oct 15-31
	VMFPCL	100	Bharatpur	Indian mustard	Oct 10-31
Telangana (TS)	Jagtial (JGT)	50	Jagtial, Mancherial, KB Asifabad, Rajanna Sirichilla, karim Nagar, Nirmal	Indian mustard	Nov 15-Dec 15
Uttar Pradesh (UP)	Banda (BND)	100	Banda	Indian mustard	Oct 25-Nov 11
	Jhansi (JHI)	150	Jhansi , Lalitpur	Indian mustard	Oct 25-Nov 10
	Kanpur (KPR)	200	Unnao, Fatehpur, Kanpur Dehat, Kanpur Nagar, Auraiya, Etawah, Pratapgarh, Jalaun, Hamirpur, Kannauj, Gonda, Hardoi, Lucknow, Sahjahanpur, Basti, Aligarh, Farrukhabad, Jaunpur	Indian mustard,	Oct 03 - Nov 02
	Varanasi (VAR)	214	Chandauli, Mirzapur, Jaunpur,Azamgarh,Ghazipur, Bhadohi Varanasi,	Indian mustard	Oct 15-Nov 10
	Amity University (AMT)	50	Gautam Budh Nagar Bulandshahar	Indian mustard	Oct 17-27
	Agrimitra	50	Mirzapur	Indian mustard	Oct 15-28
	Biozone	50	Deoria and Maharajganj	Indian mustard	Oct 20-Nov 22
	Azamgarh FPC	50	Azamgarh	Indian Mustard	Nov 15-20
	Ishani FPC	50	Chandauli	Indian Mustard	Nov 15-25
	Kalvriksh FPC	15	Basti	Indian Mustard	Nov 16-20
	Mirzapur FPC	50	Mirzapur	Indian Mustard	Nov 16-25
	Sathiyaon FPC	50	Azamgarh	Indian Mustard	Nov 16-30
	Saili FPC	100	Lucknow, Unnao	Indian Mustard	Oct 16-Nov 15
	MB Trust	50	Sant Kabeer Nagar	Indian mustard	Oct 26- Nov 24
Uttarakhand (UK)	Pantnagar (PNT)	91	Nainital,Haridwar, Rudraprayag, Pauri Garhwal Udham Singh Nagar,	Toria, Yellow sarson, Indian Mustard	Sept 9-Oct.28
West Bengal (WB)	Kalyani (KLN)	50	Nadia	Indian mustard Yellow Mustard	Oct 25- Nov 11
20	**46**	**6462**	**172**	**6**	**Sept 9-Dec 15**

***Jhansi centre conducted FLDs in two states, viz. Uttar Pradesh and Madhya Pradesh**

*** Some centre distributed one FLD to two or more farmers due to small land holdings**

Table 8.2 Frontline demonstrations conducted on rapeseed-mustard during 2022-23

Crop	FLDs (No)	Distribution of FLDs					
		Whole package		Varietal distribution (total No. of Varieties)		Component	
		Irrigated	Rainfed	Irrigated	Rainfed	Irrigated	Rainfed
Toria	1015	144	827	07	08	00	44
Gobhi sarson	218	55	163	02	02	00	00
Yellow sarson	139	113	20	05	04	00	06
Brown sarson	50	00	50	00	01	00	00
Taramira	50	00	50	00	03	00	00
Indian mustard	4990	4020	539	18	08	317	114
Total	**6462**	**4332**	**1649**	**32**	**26**	**317**	**164**

Abbreviations used in the text and table: WP: whole package; IR: Irrigated; RF: Rainfed; YIOFP: Yield increase over farmer's practice; CoC: Cost of cultivation; GMR: Gross monetary return; ANMR: Additional Net Monetary Return; IP: Improved practices; FP: Farmers' Practices; B:C : Benefit : Cost;

Table 8.3 Performance of whole package FLDs on rapeseed-mustard under rainfed condition during 2022-23

State	Centre	Crops	FLDs	Mean yield (kg /ha)		YIOFP (%)	COC (Rs/ha)		GMR (Rs/ha)		ANMR (Rs/ha)	B: C Ratio	
				IP	FP		IP	FP	IP	FP		IP	FP
ASM	DoR, AAU (478) SHL (76)	Indian Mustard (177) Toria (377)	554	947 (645-1350)	705 (350-950)	34.3	24020	21534	51612	38423	10703	2.14	1.78
JH	MASS (155) KANKE (65)	Indian Mustard (220)	220	1152 (878-1750)	776 (500-1050)	48.5	17900	15134	62784	42292	17726	3.5	2.79
HP	Kangra (100) CPU (96)	Gobhi sarson (163) Indian mustard (33)	196	1848 (705-1518)	1217 (407-1196)	51.8	33500	30069	100716	66326	30959	3.0	2.20
J&K	Chatta (85) KHWN(50)	Indian Mustard (85) Brown Mustard (50)	135	1286 (920-1700)	879 (700-1020)	46.3	28037	23287	70087	47905	17432	2.50	2.06
TR	CAU (125)	Toria (125)	125	1041 (773-1284)	595 (319-946)	75.0	21750	16344	56734	32427	18901	2.6	1.98
ML	CAU (125)	Toria (125)	125	635 (280-1100)	446 (185-890)	42.4	15493	13442	34607	24307	8249	2.23	1.8
AP	CAU (114)	Toria (114)	114	825 (620-1080)	719 (520-980)	14.7	13049	11510	44962	39185	4238	3.44	3.4
MAN	CAU (60)	Toria (36) Indian mustard (21) Yellow mustard (03)	60	684 (400-1140)	513 (300-890)	33.3	20188	18554	37278	27958	7686	1.85	1.51
RAJ	JOB (50)	Taramira (50)	50	1187 (1037--1276)	982 (832-1037)	20.9	10309	8935	58163	48118	8671	5.64	5.39
UK	PNT (40)	Toria (20) Yellow mustard (17) Indian Mustard (3)	40	859 (620-1480)	726 (480-1280)	18.3	16017	14779	46815.5	39567	6010.5	2.92	2.68
ODH	BHU (30)	Toria (30)	30	719 (667-788)	451 (399-495)	59.4	28275	21275	39185	24579	7606	1.39	1.16

Figure in parenthesis is the number of FLDs conducted by the centre

Table 8.4 Performance of whole package FLDs on rapeseed-mustard under irrigated condition during 2022-23

State	Centre	Crops	FLDs	Mean yield (kg /ha)		YIOFP (%)	COC (Rs/ha)		GMR (Rs/ha)		ANMR (Rs/ha)	B: C Ratio	
				IP	FP		IP	FP	IP	FP		IP	FP
RAJ	BPR (802) BAN (43) JDH (150) KOT (100) MNZR (100) Solidaridad (200) VMFPCL (100) SGN (19) CAZRI (10)	Indian mustard (1524)	1524	1946 (1200-3000)	1695 (1250-2500)	14.8	34304	35093	106057	92377	14449	3.09	2.63
UP	VAR (214) KPR (200) BND (100) Agrimitra (50) AMTI (50) JHI (150) Biozone (50) MB Trust (50) Ishani (50) Azamgarh (50) Mirjapur (50) Sathiyon (50) Saili (100) Kalpvriksh (15)	Indian mustard (1122) Yellow sarson (57)	1179	2012 (750-2850)	1582 (700-2300)	27.2	34308	31099	109654	86219	20226	3.20	2.77
HAR	Bawal (10)	Indian mustard (10)	10	2200 (1900-2500)	2005 (1700-2250)	9.7	39005	41255	119900	109272	12877	3.07	2.65

MP	ZRAS (200) Solidaridad (150) MOR KVK (100) Agrimitra (50) JHI (50)	Indian mustard (550)	550	2055 (1320-2690)	1772 (1210-2150)	16.0	31423	29893	111997	96574	13893	3.56	3.23
Bihar	GNSU (100)	Indian Mustard (100)	100	1999 (1870-2370)	1696 (1570-1980)	17.9	38784	33967	108945	92432	11696	2.80	2.72
ASM	DoR, AAU (25) SHL (124)	Indian mustard (25) Toria (124)	149	1201 (895-1534)	781 (530-1020)	53.8	25736	22353	65454	42564	19507	2.54	1.9
PUN	LDH (110) Solidaridad (50)	Gobhi Sarson (55) Indian mustard (105)	160	2197 (1425-2775)	2097 (1300-2500)	4.8	28796	31688	119737	114287	8342	4.16	3.61
JH	MASS(118) SISU (100)	Indian Mustard (218)	218	1132 (732-1540)	903 (710-980)	25.4	16985	17231	61694	49214	12726	3.63	2.85
J&K	CHT (91)	Indian mustard (91)	91	1418 (1100-1750)	845 (600-1200)	67.8	20328	14100	77281	46052	25001	3.8	3.26
UK	PNT (51)	Indian Mustard (01) Yellow Sarson (30) Toria (20)	51	1447 (1200-1850)	1257 (1050-1650)	15.1	28562	26855	78861	68506	8648	2.76	2.55
MH	NGP (100)	Indian mustard (100)	100	989 (600-1400)	835 (350-1182)	18.4	19155	17807	53900	45507	7045	2.81	2.56
WB	KLN (50)	Indian mustard (24) Yellow Mustard (26)	50	2052 (1560-2480)	1652 (1352-1984)	24.2	35650	33420	111834	90034	19570	3.14	2.69
ODH	BHU (100)	Indian mustard (100)	100	993 (888-1116)	625 (584-704)	58.9	31315	25196	54118	34062	13937	1.73	1.35
TS	JGT (50)	Indian mustard (50)	50	1052 (625-1425)	914 (620-1253)	15.1	24011	25378	57334	49813	8888	2.38	1.96

Table 8.5 Variety-wise performance in whole package FLDs on rapeseed-mustard under Irrigated conditions during 2022-23

State	Centre	Varieties	FLDs	Mean yield (kg /ha)		YIOF P (%)	COC (Rs./ha)		GMR (Rs./ha)		ANMR (Rs./ha)	B: C Ratio	
				IP	FP		IP	FP	IP	FP		IP	FP
Indian mustard													
RAJ	BPR (443) MNZR (100) Solidaridad (65) VMFPCL (50) KOT (25) CAZRI (10)	Giriraj	693	1909 (1500-2750)	1645 (1250-2500)	16.0	33995	35211	104040	89652	15604	3.06	2.55
RAJ	BAN (03) KOT (46)	RH 725	49	1880 (1400-2250)	1754 (1300-2080)	7.2	30264	28645	102460	95593	5248	3.38	3.33
RAJ	JDH (150)	NRCHB 101	150	1667 (1120-1968)	1522 (1025-1800)	9.5	26643	25836	90851	82949	7095	3.41	3.21
RAJ	SGN (19)	RH 749	19	1810 (1500-2200)	1668 (1400-2000)	8.5	28000	28000	98645	90906	7739	3.52	3.25
RAJ	BPR (65)	CS 60	65	1945 (1750-2110)	1703 (1500-1820)	14.2	36574	37697	106002	92813	14312	2.9	2.46
RAJ	BPR (95) Solidaridad (135) VMFPCL (50) BAN (40)	DRMR 1165-40	320	2190 (1365-3000)	1826 (1250-2565)	19.9	36936	37363	119355	99517	20265	3.23	2.66
RAJ	BPR (63) KOT (29)	Radhika	92	1902 (1500-2750)	1765 (1400-2375)	7.8	38694	40540	103659	96192	9313	2.68	2.37
RAJ	BPR (30)	Brajraj	30	2021 (1500-2375)	1880 (1400-2150)	7.5	34527	36470	110144	102460	9627	3.19	2.8
RAJ	BPR (89)	PM 30	89	1911 (1250-2500)	1727 (1200-2200)	10.7	37097	38415	104149	94121	7392	2.8	2.45
RAJ	BPR (17)	PM 31	17	1903 (1750-2100)	1685 (1640-1900)	12.9	35512	36818	103713	91832	13187	2.9	2.49
UP	MB Trust (26) BUAT (100)	DRMR 1165-40	126	1523 (1175-3064)	1045 (1369-2067)	45.7	28626	22473	83003	56952	19898	2.8	2.5

UP	VAR (115) JHI (47) Amity (50) Agrimitra (50) Biozone (50) MB Trust (24)	Giriraj	336	2262 (750-3202)	1722 (1359-2050)	31.4	31827	29237	123279	93849	26840	3.87	3.21
UP	JHI (23)	Radhika	23	1257 (900-1780)	1025 (745-1400)	22.6	31288	28529	68506	55862	9895	2.19	1.96
UP	JHI (80)	RH 725	80	1211 (750-1750)	1030 (700-1400)	17.6	31747	28434	66000	56135	6552	2.08	1.97
UP	KPR (05)	PR-20	05	2040 (1850-2400)	1540 (1500-1700)	32.5	37049	32909	111180	83930	23110	3	2.55
UP	VAR (99)	RH749	99	2510 (1750-2850)	1918 (1302-2401)	30.8	37429	33707	136795	104531	28542	3.65	3.1
UP	AFPCL (50) ISHANI (50) Kalpvriksh (15) Mirjapur (50) Sathiyon (50) Saili (100)	PM 30	315	1896 (1359-2717)	1713 (1235-2371)	10.7	37256	35301	103332	93358	8019	2.77	2.64
UP	KPR (75)	Surekha	75	2442 (2200-2500)	1582 (1500-1800)	54.4	37452	33294	133089	86219	42712	3.55	2.59
UP	KPR (63)	Azad Mahak	63	2187 (2000-2300)	1613 (1400-1900)	35.6	37507	33347	119191	87908	27123	3.18	2.64
HAR	BAW (10)	RH 725	10	2200 (1900-2500)	2005 (1700-2250)	9.7	39005	41255	119900	109272	12877	3.07	2.65
MP	MOR KVK (100) ZRAS (100) Agrimitra (50) Solidaridad (50) JHI (18)	Giriraj	318	2108 (1350-2580)	1824 (1250-2200)	15.6	31505	29718	114886	99408	13691	3.65	3.35
MP	ZRAS (100) Solidaridad (100)	DRMR 1165-40	200	2024 (1450-2690)	1745 (1250-2250)	16.0	31305	30313	110308	95103	14213	3.52	3.13
MP	JHI (17)	Radhika	17	1691 (1600-1920)	1401 (1320-1500)	20.7	31294	28941	92159	76354	13452	2.94	2.63
MP	JHI (15)	RH 725	15	1749 (1600-2000)	1456 (1350-1680)	20.1	31400	29100	95320	79352	13668	3.03	2.72
BIH	GNSU (50)	Giriraj	50	2063 (1730-2370)	1760 (1500-1980)	17.2	39706	35060	112433	95920	11867	2.83	2.74

BIH	GNSU (50)	DRMR 1165-40	50	1912 (1700-2170)	1648 (1520-1850)	16.0	39891	35597	104204	89816	10094	2.61	2.52
J&K	CHT (63)	Radhika	63	1455 (1200-1700)	868 (710-1200)	67.6	20328	14100	79297	47306	25763	3.90	3.35
J&K	CHT (28)	Brajraj	28	1336 (1100-1500)	793 (675-940)	68.5	20328	14100	72812	43218	23365	3.58	3.07
JH	MASS (118) SISU (100)	PM-30	218	1132 (732-1540)	903 (710-980)	25.4	16985	17231	61694	49214	12726	3.63	2.85
MS	NAG (100)	TAM 108-1	100	989 (600-1400)	835 (350-1182)	18.4	19155	17807	53900	45507	7045	2.81	2.56
ODH	BHU (100)	NRCHB 101	100	993 (888-1116)	625 (584-704)	58.9	31315	25196	54118	34062	13937	1.73	1.35
WB	KLN 24)	NRCHB 101	24	2155 (1765-2530)	1725 (1450-1980)	24.9	35650	33420	117448	94013	21205	3.29	2.81
TS	JGT (50)	NRCHB 101	50	1052 (625-1490)	914 (620-1253)	15.1	24011	25378	57334	49813	8888	2.38	1.96
PUN	LDH (28)	RCH 1	28	2147 (1750-2625)	2069 (1740-2375)	3.8	25120	26710	117012	112761	5841	4.66	4.22
PUN	LDH (27)	PHR 126	27	2111 (1725-2300)	2067 (1750-2288)	2.1	24268	25856	115050	112652	3986	4.74	4.36
PUN	Solidaridad (50)	Giriraj	50	2288 (1400-2775)	2103 (1300-2684)	8.8	37930	43493	124696	114614	15646	3.29	2.64
UK	PNT (1)	PR 19	01	1850	1650	12.1	38850	36900	100825	89925	8950	2.60	2.44
ASM	DoR, AAU (25)	DRMR 150-35	25	663 (300-1500)	573 (250-900)	15.7	25000	24600	36133	31229	4504	1.44	1.26
Yellow sarson													
UP	KPR (52)	Pitambari	52	2080 (2000-2100)	1627 (1400-1750)	27.8	37204	33057	113360	88671	20541	3.05	2.68
UP	KPR (5)	Pant Sweta	5	1900 (1800-2000)	1560 (1400-1750)	21.8	37048	32909	103550	85020	14391	2.8	2.58
UK	PNT (02)	Pitambari	02	1371 (1250-1490)	1370 (1251-1490)	0.07	13730	13740	74665	74719.5	-44.5	5.44	5.44
UK	PNT (05)	NRCYS 05-02	05	1508 (1400-1800)	1328 (1220-1620)	13.8	30746	28796	82186	72376	7860	2.67	2.51
UK	PNT (3)	YSH-0401	03	1433 (1400-1480)	1150 (1050-1200)	24.6	29982	26967	78098.5	62675	12409	2.60	2.32
UK	PNT (08)	Pant Sweta	08	1406 (1300-1500)	1226 (1120-1320)	14.7	28323	26373	76627	66817	7860	2.71	2.53

UK	PNT (12)	PPS 1	12	1520 (1200-1740)	1327 (1200-1540)	14.5	31810	30810	82840	72321.5	9518.5	2.60	2.35
WB	KLN 26)	NRCYS 05-02	26	1958 (1598-2490)	1584 (1120-2103)	23.6	35650	33420	106711	86328	18153	2.99	2.58
Gobhi sarson													
PUN	LDH (28)	PGSH 1707	28	2181 (1813-2500)	2113 (1750-2325)	3.2	23397	24518	118865	115159	4827	5.08	4.70
PUN	LDH (27)	GSC 7	27	2180 (1700-2625)	2126 (1600-2500)	2.5	25819	28259	118810	115867	5383	4.60	4.10
Toria													
UK	PNT (12)	Uttara	12	1336 (1200-1380)	1137 (1050-1280)	17.5	24398	22467	72812	61966.5	8914.5	2.98	2.76
UK	PNT (06)	PT 508	06	1480 (1380-1550)	1280 (1180-1350)	15.6	30869	28919	80660	69760	8950	2.61	2.41
UK	PNT (02)	Tapeshwari	02	1475 (1400-1550)	1275 (1200-1350)	15.7	30200	28250	80388	69488	8950	2.66	2.46
ASM	SHL (54)	TS 38	54	1356 (1190-1550)	816 (720-990)	66.2	25885	21900	73902	44472	26445	2.86	2.03
	SHL (20)	TS 36	20	1209 (895-1450)	805 (530-1020)	50.2	25885	21900	65891	43873	18033	2.55	2.00
	SHL(13)	TS 46	13	1199 (1070-1330)	881 (720-950)	36.1	25885	21900	65346	48015	13346	2.52	2.19
	SHL(37)	TS 67	37	1332 (1014-1630)	822 (653-990)	62.0	25885	21900	72594	44799	23810	2.80	2.04

Table 8.6 Varietal performance in Whole package FLDs of rapeseed-mustard under rainfed condition during 2022-23

State	Centre	Varieties	FLDs	Mean yield (kg /ha)		YIOFP (%)	COC (Rs/ha)		GMR (Rs/ha)		ANMR (Rs/ha)	B: C Ratio	
				IP	FP		IP	FP	IP	FP		IP	FP
Indian mustard													
ASM	DoR, AAU (177)	DRMR 150-35	177	782 (300-1200)	674 (300-910)	16.0	20970	20347	42619	36733	5263	2.03	1.8
MAN	CAU (21)	NRCHB 101	21	749 (300-1140)	591 (189-888)	26.7	21413	19607	40820	32209	6805	1.91	1.64
J&K	CHT (31)	Radhika	31	1429 (1290-1700)	892 (775-1020)	60.2	20328	14100	77880	48614	23038	3.83	3.45
J&K	CHT (54)	Brajraj	54	1382 (1100-1550)	825 (700-1060)	67.5	20328	14100	75319	44962	24129	3.71	3.19
JH	MASS (155)	PM 30	155	1177 (878-1558)	833 (700-997)	41.3	15900	14800	64147	45399	17648	4.03	3.07
JH	KANKE (65)	BBM 1	65	1093 (900-1750)	640 (500-1050)	70.8	22670	15930	59568	34880	17948	2.62	2.18
HP	CPU (33)	RCC 4	33	782 (705-810)	502 (407-507)	55.8	11839	11869	42619	27359	15290	3.60	2.31
UK	PNT (03)	PR 19	03	1343 (1250-1480)	1143 (1050-1280)	17.5	25338	23388	73194	62294	8950	2.89	2.66
Toria													
ASM	DoR, AAU (201) SHL (61)	TS 38	262	1064 (754-1350)	788 (610-950)	35.1	29695	26494	57988	42946	11841	1.95	1.62
ASM	SHL(03)	TS 46	03	1190	950	25.3	25885	21900	64855	51775	9095	2.51	2.36
ASM	DoR, AAU (100) SHL (12)	TS 67	112	927 (700-1150)	554 (510-950)	67.3	15515	11795	50521	30193	16608	3.25	2.55
MAN	CAU (36)	TS 38	36	635 (400-1100)	461 (190-890)	37.7	19373	17820	34607	25124	7930	1.79	1.41
TR	CAU (125)	TS 38	125	1041 (773-1284)	595 (319-946)	75.0	21750	16344	56734	32427	18901	2.6	1.98
AP	CAU (92)	TS 38	92	826 (620-1080)	719 (520-960)	14.9	13101	11868	45017	39185	4599	3.44	3.30
AP	CAU (22)	TS 67	22	824 (640-1070)	722 (540-980)	14.1	12833	10015	44908	39349	2741	3.49	3.92
ML	CAU (125)	TS 36	125	635 (280-1100)	446 (185-890)	42.4	15493	13442	34607	24307	8249	2.23	1.8
UK	PNT (05)	PT508	05	796 (700-980)	658 (570-830)	21.0	15185	13235	43382	35861	5571	2.86	2.71
UK	PNT (02)	Tapeshwari	02	750	620	21.0	14215	12265	40875	33790	5135	2.88	2.75

UK	PNT (13)	PHT 1	13	743 (620-950)	633 (520-835)	17.4	13557	12557	40494	34499	4995	2.99	2.75
ODH	BHU (30)	Sushree	30	719 (667-788)	451 (399-495)	59.4	28275	21275	39185	24579	7606	1.39	1.16
Yellow Mustard													
UK	PNT(2)	Pitambari	2	710	550	29.1	13778	12778	38695	29975	7720	2.81	2.35
UK	PNT(10)	Pant Sweta	10	759 (650-950)	644 (535-835)	17.9	13789	12789	41365.5	35098	5268	3.00	2.74
UK	PNT(5)	PPS 1	05	1236 (1100-1450)	1060 (980-1250)	16.6	23723	22723	67362	57770	8592	2.84	2.54
MAN	CAU (3)	NRCYS 05-02	3	815 (789-850)	583 (400-700)	39.7	21400	20000	44417	31773	11244	2.08	1.59
Gobhi sarson													
HP	Kangra (82) CPU (63)	GSC 7	145	1073 (785-1472)	700 (487-1072)	53.3	19579	17490	58478	38150	18239	2.98	2.18
HP	Kangra (18)	AKMS 8141	18	1277 (930-1518)	973 (607-1196)	31.2	25573	21990	69596	53028	12985	2.72	2.41
Brown sarson													
J&K	KHD (50)	Shalimar sarson -2	50	1093 (957-1298)	928 (799-1073)	17.8	41142	38904	59568	50576	6754	1.45	1.30
Taramira													
RAJ	JOB (16)	RTM 1355	16	1187 (1037-1251)	992 (937-1037)	19.7	10323	8935	58163	48608	8167	5.63	5.44
RAJ	JOB (21)	RTM 1351	21	1168 (1096-1261	964 (832-1032)	21.2	10323	8962	57232	47236	8635	5.54	5.27
RAJ	JOB (13)	RTM 1624	13	1218 (1123-1276)	997 (938-1035)	22.2	10269	8890	59682	48853	9450	5.81	5.5

Table 8.7 Component performance in FLDs of rapeseed-mustard condition during 2022-23

State	Name of centre	Component	FLDs	Situation Irrigated/ Rainfed	Varieties	Mean yield (kg /ha)		YIOFP (%)	COC (Rs/ha)	GMR (Rs/ha)			ANMR (Rs/ha)	B: C Ratio	
						IP	FP	(%)	IP	FP	IP	FP	(Rs./ha)	IP	FP
Indian mustard															
HAR	Bawal	Weeding	10	Irrigated	RH 725	1955 (1650-2550)	1620 (1300-2100)	23.1	39005	34005	106547	88290	13257	2.73	2.59
HAR	Bawal	Thinning	10	Irrigated	RH 725	2035 (1650-2400)	1780 (1400-2150)	14.3	39005	36005	110907	97010	10897	2.84	2.69
HAR	HSR	Varietal and Sclerotinia stem rot	42	Irrigated	RH 725	2678 (2300-3200)	2370 (2150-2680)	13.0	39412	37590	145951	129165	14964	3.70	3.44
HAR	HSR	Varietal and Sclerotinia stem rot management	08	Irrigated	RH 1424	2662 (2400-2900)	2295 (2110-2540)	16.0	38287	36150	145079	125078	17865	3.79	3.46
RAJ	BAN	Varietal and Sclerotinia stem rot management	46	Irrigated	DRMR11 65-40	2101 (1950-2250)	1685 (1600-1750)	24.7	35850	33950	114504	91832	20772	3.19	2.70
RAJ	BAN	Varietal + Micronutrient (SA of Sulphur 90 % + Zinc sulphate + Borax)	31	Irrigated	DRMR11 65-40	1862 (1790-1950)	1526 (1470-1570)	22.0	35650	33950	101479	83167	16612	2.85	2.45
GUJ	SKN	Varietal and Sulphur Application	40	Irrigated	GDM 4	2241 (2194-2639)	1998 (1784-2249)	12.2	36970	33647	122135	108891	9921	3.30	3.24
GUJ	SKN	Varietal and Ferrous Sulphate	30	Irrigated	GDM 4	2115 (1745-2375)	1939 (1554-2338)	9.0	36530	34152	115268	105676	7214	3.16	3.09
GUJ	SKN	Varietal and Azadirachtin 1500 ppm	30	Irrigated	GDM 4	2126 (1878-2372)	1955 (1717-2272)	8.8	34814	33510	115867	106548	8016	3.33	3.18
ODH	BHU	Boron application and Plant protection in late sown irrigated	20	Irrigated	NRCHB 101	987 (889-1041)	621 (587-646)	58.0	32275	25275	59220	37260	14960	1.83	1.47
ODH	BHU	Plant protection in timely sown irrigated	20	Irrigated	NRCHB 101	962 (806-1036)	603 (558-645)	59.5	32275	24500	52429	32863	11791	1.62	1.34
ODH	BHU	Plant protection in late sown irrigated	10	Irrigated	NRCHB 101	998 (945-1056)	628 (588-686)	58.9	32375	25465	54391	34226	13255	1.68	1.34

MAN	CAU	Sowing Method and seed rate	14	Rainfed	NRCHB101	891 (770-1002)	748 (650-853)	19.1	21826	19087	48559	40766	5054	2.22	2.14
MH	KLP	Sowing Method and seed rate	100	Rainfed	NRCHB 101	780 (600-1100)	635 (450-1000)	22.8	17110	15807	42510	34608	6599	2.48	2.18
Toria															
ODH	BHU	Plant protection in late sown irrigated	20	Irrigated	Sushree	853 (722-996)	529 (487-588)	61.3	28275	24275	46488	28830	13658	1.64	1.19
MAN	CAU	Sowing Method and seed rate	35	Rainfed	TS 38	717 (400-1100)	494 (300-800)	45.1	21327	18104	39076	26923	8930	1.83	1.48
MAN	CAU	Varietal in late sown	5	Rainfed	CAU-Toria 1	652 (400-800)	480 (300-600)	35.8	19000	17500	35534	26160	7874	1.87	1.49
MAN	CAU	Varietal in late sown	4	Rainfed	TS 38	537 (400-750)	377 (300-687)	42.4	19653	17996	29266	20546	7063	1.49	1.14
Yellow sarson															
MAN	CAU	Sowing Method and seed rate	2	Rainfed	NRCYS 05-02	800	703	13.8	21400	20000	43600	38313	3887	2.04	1.92
MAN	CAU	Varietal in late sown	4	Rainfed	NRCYS 05-02	785 (678-900)	620 (498-709)	26.6	19800	18000	42782	33790	7192	2.16	1.87

Table 8.8 Exploitable yield reservoir of rapeseed-mustard in major states during 2022-23

State	No. of FLDs	FLDs Mean yield (kg /ha)		Yield gap- I (%)	Three year State average yield (Kg/ha) (2018-19 to 2020-21)	Yield gap- II (%)	Three year State average production (000 tonnes) (2018-19 to 2020-21)	Expected production (000 tonnes)	
		IP	FP					EP-I	EP-II
RAJ	1651	1922	1675	15.0	1583	21.4	4268.41	4908.67	5182
HAR	80	2446	2149	13.8	1960	24.7	1238.90	1410.11	1545
MP	550	2055	1772	16.0	1585	29.6	1128.33	1309	1462.3
UP	1178	2012	1582	21.2	1394	44.3	1027.15	1245	1482.17
WB	50	2052	1652	24.2	1210	69.5	729.21	906	1236.01
Bihar	100	1987	1704	17.0	1249	59.0	96.12	112.4	153
GUJ	100	2169	1967	10.3	1897	14.3	368.42	406.2	421.1
ASM	703	1000	721	39.0	636	57.2	182.12	253.14	286.2
PUN	160	2197	2097	5.0	1534	43.2	47.61	50	68.17
J&K	226	1339	865	55.0	902	48.4	42.23	64.45	62.22
UK	91	1204	1032	16.7	928	29.7	14.84	17.31	19.2
HP	196	1848	1217	52.0	646	186.0	5.45	8.2	15.587
TR	125	1041	595	75.0	842	23.6	6.46	11.3	8
JH	438	1142	840	36.0	762	49.8	246.63	335.41	369.4
MH	200	651	550	18.4	352	84.9	5.00	5.19	9.24
ODH	200	935	586	59.6	283	230.3	1.87	2.9	6.17
All India	**6048**	**1621**	**1317**	**23.1**	**1455**	**11.45**	**9529.77**	**11731.1**	**10620.9**

Appendices

Achievements of AICRP-RM coordinating centers (2022-23)

Varieties notified by SVRC of respective states:

Centre	Crop	Variety	Year of notification	State	Condition
S K Nagar	Mustard	Gujarat Mustard 7 (Banas Anmol)	2022	Gujarat	Early maturing and suitable for irrigated conditions
Kanpur	Mustard	Surekha (KMR16-2)	2022	Uttar Pradesh	Early sown, tolerance to high temperature
	Mustard	Azad Mahak (KMR (E)15-2)	2021	Uttar Pradesh	Early sown, tolerance to high temperature
	Toria	Azad Chetna (TKM 14-2)	2021	Uttar Pradesh	Early sown

Publications of AICRP-RM coordinating centers:
Research paper published:

Bharatpur

Chaudhary R, Chand S, Alam BK, Yadav P, Meena VK, Patel MK, Vasudev S. (2022). Codon Usage Bias for Fatty Acid Genes FAE1 and FAD2 in Oilseed Brassica Species. *Sustainability*. 14(17): 11035.

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74. Dr. A.L. Jat, Assistant Research Scientist (Agronomy), SKDAU, S.K. Nagar 385 506

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SHERE-E-KASHMIR UNIVERSITY OF AGRICULTURAL SCIENCES & TECHNOLOGY, CHATHA (Jammu & Kashmir)

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79. Dr. Rajeev Bharat, Jr.Scientist (Agronomy), SKUAST-Jammu, FOA, Main Campus, Chatha, Jammu 180 002

UNIVERSITY OF AGRICULTURE SCIENCES, DHARWAD

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BANDA UNIVERSITYOF AGRICULTUREL & TECHNOLOGY, BANDA (U.P)

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83. Dr. Dharmendra Kumar, Associate Professor, (Pl. Pathology), BUAT , Banda- 210 001
84. Dr. Hitesh Kumar, Pl. Breeder, BUAT, Banda- 210 001

BHABHA ATOMIC RESEARCH CENTER, MUMBAI

85. Dr. Archana N.Rai, scientist Officer,F, BARC, Mumbai 400 085

ICAR INSTITUTES

ICAR-DIRECTORATE OF RAPESEED-MUSTARD RESEARCH, BHARATPUR (RAJASTHAN)

86. Dr. P.K. Rai, Director, Pr. Scientist, (Pl. Pathology), DRMR, Bharatpur 321 303
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95. Dr.Anubhuti Sharma, Pr. Scientist, (Biochemistry), DRMR, Bharatpur 321 303
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98. Dr.Mukesh Kumar Meena, Senior Scientist, (Soil Science) , DRMR, Bharatpur 321 303
99. Dr. Bhiru Lal Meena, Senior Scientist, (Genetics & Plant Breeding), DRMR, Bharatpur 321 303
100. Dr. Murlidhar Meena, Senior Scientist,(Soil Science), DRMR, Bharatpur 321 303
101. Dr. M.L.Dotaniya, Senior Scientist,(Soil Science), DRMR, Bharatpur 321 303
102. Dr. Vasudev Meena, Senior Scientist,(Soil Science), DRMR, Bharatpur 321 303
103. Dr. R.K. Yogi, Senior Scientist, (Ag. Economics), DRMR, Bharatpur 321 303
104. Dr.Ibandalin Mawlong, Scientist, (Biochemistry), DRMR, Bharatpur 321 303
105. Dr.Sujith Kumar, Scientist, (Biochemistry), DRMR, Bharatpur 321 303
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107. Mr. Prashant Kumar, Scientist,(Biotechnology), DRMR, Bharatpur 321 303
108. Sh. Harveer Singh, Scientist, (Agronomy), DRMR, Bharatpur 321 303
109. Dr. L.K. Meena, Scientist, (Plant Physiology), DRMR, Bharatpur 321 303
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111. Dr. S.K.Sharma, Senior Scientist, & Head, KVK- DRMR, Bharatpur 321 303
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ICAR-INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI

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114. Dr.S.S Rathore, Pr. Scientist, Division of Agronomy, IARI, New Delhi 110 012
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116. Dr. Navinder Saini, Pr. Scientst, Division of Genetics, IARI, New Delhi 110 012
117. Dr. (Mrs.) Sujata Vasudev, Pr. Scientist (Genetics & Plant Breeding.), IARI, New Delhi 110 012
118. Dr. Laxman Prasad.Sr. Scientist, (Genetics & Plant Breeding.), IARI, New Delhi 110 012
119. Dr.J.Nanjundan, Sr.Scientst, (Genetics & Plant Breeding.), IARI, Wellington

ICAR- NATIONAL BUREAU OF PLANT GENETIC RESOURCES, NEW DELHI

120. Dr. Jameel Akhtar, Pr. Scientist, NBPGR, New Delhi 110 012
121. Dr. Rashmi yadav, Sr. Scientist, NBPGR, New Delhi 110 012

CENTRAL ARID ZONE RESEARCH INSITITUE, JODHPUR (RAJASTHAN)

122. Dr. A.K. Shukla, Head, Regional Research Station, ICAR-CAZRI, Pali-Marwar, Jodhpur 342 003
123. Dr. Kamla K. Choudhary, Scientist, Soil Science, ICAR-CAZRI, Pali-Marwar, Jodhpur 342 003

ICAR - NATIONAL CENTRE FOR INTEGRATED PEST MANAGEMENT, NEW DELHI

124. Dr. M.S. Yadav, Pr. Scientist (Plant. Pathology.), NCIPM, New Delhi 110 012

ICAR- CENTRAL SOIL SALINITY RESEARCH INSTITUTE, KARNAL (HARYANA)

125. Dr. Joginder Singh, Sr.Scientist, CSSRI, Karnal 132 001

ICAR- INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE, NEW DELHI

126. Dr. Rajendera Prasad, Director, IASRI, Library Avenue, Pusa, New Delhi-110 012

ICAR-VIVEKANANDA PARVATIYA KRISHI ANUSANDHAN SANSTHAN, ALMORA (UTTARAKHAND)

127. Dr. Lakshmi Kant, Head, Crop Improvement Division, VPKAS, Almora 263 601

PRIVATE ORGANISATIONS

128. Dr. Bhupesh Vaid, Corteva, Gahlot Farm AJJ01 ning Sector -47 opp house No.525 Gurgaon (U.P.)
129. Dr.Nilasis Ghosh Dastidar, Namdhari Seed Pvt. Ltd., 104, Ist Floor, Block 5, Erose Garden, Faridabad (Haryana)
130. Dr.M.C.Gupta, Sr.Breeder (Mustard), Rasi Seeds (P) Ltd., Plot No. 126, Sector-8, IMT Manesar, Dist.Gurgaon-122 051 Haryana
131. Dr. R.K. Arora, Director, Mustard & Millet Research, Tierra Agrotech.Pvt. Ltd, Gurugram
132. Mr. S.U. Baig, Breeder, Nath Seeds Ltd., P B No.318, Nath House, Nath Road, Aurangabad
133. Dr. Siddiqui S.A, Breeder, Nath Seeds Ltd., P B No.318, Nath House, Nath Road, Aurangabad
134. Mr. C.H.Mruthunjaya, Pr. Scientist, Mustard Crop, Hytech Seed India Pvt. Ltd. Alwar (Raj.)
135. Dr. Vijay P. Hande, Plant Breeder, Nirmal Seeds Pvt. Ltd, Pachora, Dist. Jalgaon 424201 (MS)
136. Dr. Shailesh Kumar, Breeder, Advanta Seeds Pvt. Ltd
137. Dr. E. Selvarani, Advanta Seeds Pvt. Ltd
138. Dr. S.K.Yadav, Mustard Breeder, Crystal crop Protection Ltd., F-1/104, South end Apartment, Charmood Village, Erose Garden, Faridabad-121001 (Harayana)
139. Dr. Arun kantode, Mustard Breeder, Crystal crop Protection Ltd., F-1/104, South end Apartment, Charmood Village, Erose Garden, Faridabad-121001 (Harayana)
140. Dr. Sambhaji Y Shedage, Mustard Breeder, Crystal Crop Prodection Ltd., Khasra No 763-768, Maheshwas Kalan, Jalsu, Jaipur (Raj.) 303701
141. Dr. R.S.S.Gurjar, Res. Scientist, J.K. Seeds, Jaipur (Rajasthan)
142. Dr. Ved Prakash, M.D., Shakti Vardhak Hybrid Seeds Pvt. Ltd. Tilak Bazar, Hisar
143. Dr. Raj bahadur, Breeder, Shakti Vardhak Hybrid Seeds Pvt. Ltd. Tilak Bazar, Hisar
144. Dr. Bhojraj Singh, Breeder,-Mustard, Kaveri Seeds, Alwar, Rajasthan
145. Dr. M.K.Singh, Res. Scientist (PB),Bioseed Research India Plot No. 234, B Blick, Kaveri Hills, Phase II, Hyderabad- 500 033
146. Dr. R.S.Mahala, Director, Mustard & Millet Research, Seed Works Pvt. Ltd. Shri Krishana house,3 rd Floor, Banjara Hills, Hyderabad -500 034 (Telangana)
147. Dr. Shankar Yadav,Sr. Breeder(Mustard) Seed Works International Pvt. Ltd.8-2-626/2,Road No 10 Shri Krishana house,3 rd Floor, Banjara Hills, Hyderabad -500 034 (Telangana)
148. Dr. Saurabh Goyal, Breeder, Co. Office Kamadgiri Crop Science Pvt. Ltd. B-66, Kamla Nagar, Agra-282005
149. Dr. Rajarshi Kundu, Managing Director, Mali Agri Tech Pvt Ltd, Subhas Avenue, Ranaghat-741201, Dist. Nadia, West Bengal
150. Dr. Avanesh Kumar Singh, Dept. Gen. Manager Dayal Seeds (P) Ltd. Delhi Road, Partapur, Meerut - 250103 (UP)
151. Dr. Rajarshi Kundu, Managing Director, Mali Agri Tech Pvt Ltd, Subhas Avenue, Ranaghat-741201, Dist. Nadia, West Bengal
152. Dr. U.S. Singh, Breeder (Wheat & Mustard), Nuziveedu Seeds Limited, 905, 9th Floor, Kanchan Junga Bulding, Barakhambha Road, Connaught Place, New Delhi
153. Dr. Pramod kumar, MR Seeds Pvt. Ltd. 82-A, Old Dhan Mandi, Sriganganagar- 335001, Rajasthan

Zone-wise research centres for multi-location testing

Zone I		
Himachal Pradesh	**:**	**Kangra, Dhaula Kuan*, Bajaura*, Una***
Zone II		
Jammu & Kashmir	**:**	**Chatha**
Punjab	**:**	**Ludhiana, Abohar***
Haryana	**:**	**Hisar, Bawal, Karnal*, Palwal (Sohna)*, Mahendragarh***
Uttar Pradesh	**:**	**Modipuram***
Rajasthan	**:**	**Sriganganagar, Alwar***
Delhi	**:**	**IARI New Delhi***
Zone III		
Uttar Pradesh	**:**	**Kanpur, Jhanshi, Varanasi, Lucknow*, Agra*, Faizabad*, Tikamgarh*, Banda***
Uttarakhand	**:**	**Pantnagar**
Madhya Pradesh	**:**	**Morena**
Rajasthan	**:**	**Kota, Bharatpur, Bikaner*, Fatehpur Shekhawati***
Bihar	**:**	**Dholi , Sabour***
Zone IV		
Rajasthan	**:**	**Mandor*, Pali***
Gujarat	**:**	**S.K. Nagar, Junagarh***
Maharashtra	**:**	**Nagpur, Washim***
Zone V		
Chhattisgarh	**:**	**Jagdalpur**
Jharkhand	**:**	**Kanke**
West Bengal	**:**	**Kalyani***
Odisha	**:**	**Bhubaneswar**
Asom	**:**	**Shillongani**
Manipur	**:**	**Imphal**
Zone VI		
Karnataka	**:**	**Raichur*, Dharwad***
Telangana	**:**	**Hyderabad* Jagtial***

*** Voluntary Centre :**

Abbreviations used in the report

Zone I		**Zone III**		**Zone IV**	
KNG	**Kangra**	**BPR**	**Bharatpur**	**WSM**	**Washim**
DLK	**Dhaula Kuan**	**KOT**	**Kota**	**SKN**	**S.K. Nagar**
UNA	**Una**	**DOL**	**Dholi**	**NGP**	**Nagpur**
BJR	**Bajaura**	**BKR**	**Bikaner**	**MDR**	**Mandore**
		TKM	**Tikamgarh**	**PLI**	**Pali**
Zone II					
CHT	**Chatha**	**VAR**	**Varanasi**	**Zone V**	
MOD	**Modipuram**				
MDG	**Mahendragarh**	**LKW**	**Lucknow**	**KLN**	**Kalyani**
LDH	**Ludhiana**			**KNK**	**Kanke**
		PNT	**Pantnagar**		
ABR	**Abohar**	**MOR**	**Morena**	**BHU**	**Bhubaneswar**
HSR	**Hisar**	**SBR**	**Sabour**	**JAG**	**Jagdalpur**
		AGR	**Agra**	**IMP**	**Imphal**
BAW	**Bawal**	**KPR**	**Kanpur**	**SHL**	**Shillongani**
KAR	**Karnal**	**JHS**	**Jhanshi**	**Zone VI**	
NDH	**New Delhi**	**FTP**	**Fatehpur Shekhawati**	**RAI**	**Raichur**
PAL	**Palwal**	**FZB**	**Faizabad**	**DWD**	**Dharwad**
SGN	**Sriganganagar**	**ALW**	**Alwar**	**JGT**	**Jagtial**
				HYD	**Hyderabad**
		JAI	**Jaipur**		

Zone wise FLD's Centres

1. Biozone	: Biozone Research Foundation, Gorakhpur, UP
2. Azamgarh FPC	: Azamgarh Agro Producer Company Ltd., Azamgarh, UP
3. Ishani FPC	: Ishani Farmer Producer Company Ltd., Chandauli, UP
4. Kalpvriksh FPC	: Kalpvriksh Bio Energy Farmer Producer LTD.
5. Mirzapur FPC	: Mirzapur Jaivurja Producer Company Ltd. Mirzapur, UP
6. Agrimitra FPC	: Agrimitra Farmer Producer Company Ltd. Mirzapur, UP
7. Sathiyaon FPC	: Sathiyaon Farmer Producer Company Ltd. Aazamgarh, UP
8. M.B. Trust	: M.B. Integrated Development Foundation /Trust, UP
9. SAILI FPC	: Sustainable Agriculture Integrated Livelihood Institute (SAILI), UP
10. Manjari	: Manjari Foundation, Dholpur, Rajasthan
11. MASS	: Mobile Agricultural School & Services (MASS), Ranchi, Jharkhand
12. SISU	: Society for Integrated Social Upliftment, (SISU) Ranchi, Jharkhand
13. GNSU	: Gopal Narayan Singh University, Sasaram, Bihar
14. VMFPCL	: Veeresh Multipurpose Farmers Producer Company Limited
15. CPU	: Career Point University, Hamirpur, H.P
16. AMT	: Amity University, Noida
17. Solidaridad	: Solidaridad Regional Expertise Centre, New Delhi