



31st Annual Group Meeting
All India Coordinated Research Project on Rapeseed-Mustard
ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur



(AUGUST 20-22, 2024)

Venue: Khanapara Campus, Guwahati (AAU, Assam)

AGENDA

20 AUGUST 2024 (TUESDAY)		
08.00-09.30hrs.	REGISTRATION	
09.30-10.35hrs.	INAUGURAL SESSION	
	Chairman	Dr. T.R. Sharma, Deputy Director General, (CS), ICAR, New Delhi
	Chief Guest	Dr. B.C. Deka, Vice-Chancellor, AAU, Jorhat, Assam
	Guest of honor	Dr. Sanjeev Gupta, ADG (O&P), ICAR, New Delhi
	Rapporteurs	Prof. Kartikeya Srivastava, I.A.Sc., B.H.U., Varanasi Dr. Hariom Kumar Sharma, Senior Scientist, ICAR-DRMR, Bharatpur
09.30-09.35 hrs.	Lightning of lamp	
09.35-09.45 hrs.	Welcome address	Prof. Sanjay Kumar Chetia, Director Research, AAU, Jorhat
09.45-10.00 hrs.	Presentation of Research highlights and Action Taken Report	Dr. P.K. Rai, Director, ICAR-DRMR, Bharatpur
10.00-10.10hrs.	Remarks (Guest of honor)	Dr. Sanjeev Gupta, ADG (O&P), ICAR, New Delhi
10.10-10.20 hrs.	Remarks (Chief Guest)	Dr. B.C. Deka, Vice-Chancellor, AAU, Jorhat, Assam
10.20-10.25hrs.	Release of publications	Guests on the dies
10.25- 10.40hrs.	Chairman's Remarks	Dr. T. R. Sharma, DDG (CS), ICAR, New Delhi
10.40-10.45hrs.	Vote of thanks	Dr. H. K. Borah, Chief Scientist, ZRS, Shillongani
10.45-11.00hrs.	HIGH TEA	
11.00-12.30 hrs.	PRESENTATION OF REPORTS (2023-24)	
	Chairman	Dr. T.R. Sharma, DDG (CS), ICAR, New Delhi
	Co-Chairman	Dr. Sanjeev Gupta, ADG (OP), ICAR, New Delhi
	Rapporteurs	Drs. Bhagirath Ram, Principal Scientist, ICAR-DRMR Dr. Kartikeya Srivastava, B.H.U., Varanasi
	Plant Breeding	Dr. V.V. Singh, PI Plant Breeding, AICRP-RM
	Agronomy	Dr. R.S. Jat, PI Agronomy, AICRP-RM
	Plant Physiology	Dr. Lalit Krishna Meena, PI Plant Physiology, AICRP-RM
	Plant Pathology	Dr. P.D. Meena, PI Plant Pathology, AICRP-RM
	Entomology	Dr. Sarwan Kuamr, PI Entomology, AICRP-RM
	Biochemistry	Dr. Anubhuti Sharma, PI Biochemistry, AICRP-RM
12.30-13.10 hrs.	INVITED LECTURE	
	Breeding the ideal Canola quality mustard using genome editing	Dr. N.C. Bisht, Staff Scientist VI, National Institute of Plant Genome Research (NIPGR)
	Role of biotechnology in brassica improvement	Dr. R.C. Bhattacharya, Director, ICAR-NIPB, New Delhi
	Rapporteurs	Dr. Bhagirath Ram, Principal scientist, ICAR-DRMR Dr. Hariom Kumar Sharma, Senior Scientist, ICAR-DRMR, Bharatpur
13.10-14.00 hrs.	LUNCH BREAK	
	Centers Presentation (10 minutes each)	
14.00-17.30 hrs.	PAU, Ludhiana	PIs of respective centers
	CCSHAU, Hisar	
	CCSHAU, RRS, Bawal	

	GBPUA&T, Pantnagar CSAUA&T, Kanpur BHU, Varanasi RLBCAU, Jhansi SDAU, SK Nagar RARS,AAU, Shillongani RRS, Jagdalpur SAREC, Kangra RPCAU, Dholi BAU, Kanke, Ranchi SKUAS&T, Chatha, Jammu ARS, Sriganaganagar AU, Kota SKNAU, Jobner RRTTS, Ranital (Bhubaneswar) ZARS, Morena CAU, Imphal PDKV, COA, Nagpur	
17.30-18.30 hrs.	Varietal Identification Committee Meeting	
	Chairman Co-Chairman Members	Dr. T.R. Sharma, DDG (CS), ICAR, New Delhi Dr. Sanjeev Gupta, ADG (OP), ICAR, New Delhi Nominated by DDG (CS)
21 AUGUST, 2024 (WEDNESDAY)		
9.30-13.00 hrs.	CONCURRENT SESSIONS	
PLANT BREEDING	Chairman	Dr. Sanjeev Gupta, ADG (OP), ICAR, New Delhi
	Subject Expert	Dr. S.R. Bhatt, Former Professor, ICAR-NRCPB, New Delhi
	Rapporteurs	Dr. H.S. Meena, Principal Scientist, ICAR-DRMR Dr. Hariom Kumar Sharma, Senior Scientist, ICAR-DRMR
AGRONOMY	Chairman	Dr. L.M. Garnayak, Director Research, CAU, Imphal
	Co-Chairman	Dr. Kalyan Pathak, Head Department, of Agronomy, AAU, Jorhat Dr. O.P. Premi, Principal Scientist (Agronomy), ICAR- IISWC, Regional Station Chandigarh
	Subject Expert	Dr. N. Ravishanker, Incharge IFS, ICAR-IIFSR, Meerut
	Rapporteurs	Dr. Rajiv Bharat, Jr. Scientist, Agronomy, SKUAS&T, Jammu Dr. Harvir Singh, Scientist, ICAR-DRMR
PLANT PATHOLOGY	Chairman & Subject Expert	Dr. R.P. Awasthi, Ex-Prof. Plant Pathology, GBPUA&T, Pantnagar
	Co-Chairman	Dr. Pankaj Sharma, Joint Director (School of Crop Health Biology Research), ICAR-NIBSM, Raipur
	Rapporteurs	Prof. A.K. Tiwari, Plant Pathology, GBPUA&T, Pantnagar Dr. Ashish Kumar Gupta, Principal Scientist, ICAR-NIPB, New Delhi
11.00-11.15 hrs.	Tea Break	
ENTOMOLOGY	Chairman and Subject Expert	Dr. Badal Bhattacharya, Head Entomology, AAU, Jorhat
	Co-Chairman	Dr. Mukesh Kumar Dhillon, Head Entomology, IARI, New Delhi
	Rapporteurs	Prof. M.S. Khan, Dept. of Entomology, GBPUA&T, Pantnagar Dr. Sarwan Kumar, Scientist, Entomology, PAU, Ludhiana
BIOCHEMISTRY & PLANT PHISIOLOGY	Chairman and Subject Expert	Dr. Samindra Baishya, Head Biochemistry, AAU, Jorhat
	Co-Chairman	Dr. Priyanka Das, Professor, Biochemistry, AAU, Jorhat
	Rapporteurs	Dr. Anubhuti Sharma, Principal Scientist, Biochemistry,

		ICAR-DRMR, Bharatpur Dr. Pushp Sharma, Prof. Plant Physiology, PAU, Ludhiana
13.00-14.00 hrs.	LUNCH	
14.00-15.00 hrs.	PLANNING AND TECHNICAL PROGRAMME FORMULATION (JOINT SESSION)	
	Chairman	Dr. Sanjeev Gupta, ADG (OP), ICAR, New Delhi
	Co-Chairman	Dr. P. K. Rai, Director, ICAR-DRMR, Bharatpur Dr. Sanjay Kumar, Director, ICAR-IISS, Mau
	Rapporteurs	Dr. H.S. Meena, Principal Scientist, ICAR-DRMR Dr. Hariom Kumar Sharma, Sr. Scientist, ICAR-DRMR
15.00-16.00 hrs.	BREEDER SEED PRODUCTION	
	Chairman & Subject Expert	Dr. Sanjay Kumar, Director, ICAR-IISS, Mau
	Co-Chairman	Dr. Sanjeev Gupta, ADG (OP), ICAR, New Delhi
	Rapporteurs	Dr. Arun Kumar, Principal Scientist, ICAR-DRMR Dr. H.S. Meena, Principal Scientist, ICAR-DRMR
16.00-16.15 hrs.	Tea Break	
16.15-17.30 hrs.	TECHNOLOGY DISSEMINATION, MANAGEMENT	
	Chairman	Dr. Sanjeev Gupta, ADG (OP), ICAR, New Delhi
	Co-Chairman	Dr. S.K. Jha, PS (O&P), ICAR, New Delhi
	Rapporteurs	Dr. Ashok Kumar Sharma, Principal Scientist, ICAR-DRMR, Bharatpur Dr. S.K. Sharma, Head, KVK, ICAR-DRMR
22 AUGUST, 2024 (THURSDAY)		
9.30-11.30 hrs.	BRAIN STORMING SESSION	
	Chairman	Dr. Sanjeev Gupta, ADG (OP), ICAR, New Delhi
	Co-Chairman	Dr. S.R. Bhatt, Former Professor, ICAR-NRCPB, New Delhi
	Rapporteurs	Dr. Ashok Kumar Sharma, Principal Scientist, ICAR-DRMR, Bharatpur Dr. S.K. Sharma, Head, KVK, ICAR-DRMR
	“Current status of Rapeseed-mustard cultivation in eastern and north eastern region and way forward”	
11.30-13.00 hrs.	PLENARY SESSION	
	Chairman	Dr. Sanjeev Gupta, ADG (OP), ICAR, New Delhi
	Co-Chairman	Dr. S.R. Bhatt, Former Professor, ICAR-NRCPB, New Delhi
	Convener	Dr. P. K. Rai, Director, ICAR-DRMR, Bharatpur
	Rapporteurs	Dr. V.V. Singh, Principal Scientist, ICAR-DRMR, Bharatpur Dr. S.K. Rai, Prof. SKUAS&T- Jammu
	Presentation of Recommendations	
	Plant Breeding	Dr. V.V. Singh, Principal Scientist, ICAR-DRMR
	Agronomy	Dr. R.S. Jat, Principal Scientist, ICAR-DRMR
	Plant Physiology	Dr. Lalit Krishan Meena, Scientist, ICAR-DRMR
	Biochemistry	Dr. Anubhuti Sharma, Principal Scientist, ICAR-DRMR
	Entomology	Dr. Sarwan Kumar, Professor, PAU, Ludhiana
	Plant Pathology	Dr. P.D. Meena, Principal Scientist, ICAR-DRMR
	Breeder Seed	Dr. B.L. Meena, Senior Scientist, ICAR-DRMR
	FLD's	Dr. A.K. Sharma, Principal Scientist, ICAR-DRMR
	Recommendations of Varietal Identification Committee	Dr. P. K. Rai, Director, ICAR-DRMR, Bharatpur
	Concluding remarks	Dr. Sanjeev Gupta, ADG (OP), ICAR, New Delhi
	Vote of thanks	Dr. P. K. Rai, Director, ICAR-DRMR, Bharatpur
13.00-14.00 hrs.	LUNCH	

**XXXI Annual Group Meeting of AICRP Rapeseed-Mustard
August 20-22, 2024 at AAU, Khanapara, Guwahati, Assam**

Session: Inaugural

Chairman	: Dr. T. R. Sharma, Deputy Director General, (CS), ICAR, New Delhi
Chief Guest	: Dr. B.C. Deka, Vice-Chancellor, AAU, Jorhat, Assam
Guest of Honour	: Dr. Sanjeev Gupta, ADG (O&P), ICAR, New Delhi
Convener	: Dr. P.K. RAI, Director, ICAR-DRMR, Bharatpur
Rapporteurs	: Prof. Kartikeya Srivastava, I.A.Sc., B.H.U., Varanasi : Dr. Hariom Kumar Sharma, Senior Scientist, ICAR-DRMR

The session started with the welcome address by Prof. Sanjay Kumar Chetia, Director Research, AAU, Jorhat. He said that oilseed demand is rising in the country. Palm oil is imported to meet this demand, So there is a need to increase oilseed production of our country. Dr. P.K. Rai, Director, ICAR-DRMR, Bharatpur presented research highlights and ATR of 30th AGM. He further apprised the house that as per third advance estimates the rapeseed-mustard now stood first with 13.16 million tonnes in terms of oilseed production in country which is over and above soybean production. Dr. Sanjeev Gupta, ADG (OP), ICAR, New Delhi said that we import about 55% of total oilseed demand in country so we have to be Atmanirbhar in oilseed production till 2047. Govt. of India launched National Mission on Oilplam and further National Mission on Edible Oilseed is to be launched by Govt. of India to become Atmanirbhar in oilseed production. He congratulated all rapeseed-mustard fraternity for becoming number one contributors in total oilseed production in the country. He urged scientist to improve the national productivity of rapeseed-mustard upto 2 tonnes /ha. He told that there is great demand for toria in North eastern states, Assam, Odisha, Jharkhand, West Bengal. The demand for canola quality gobhi sarson is there so, we should continue research in this direction. We need to address the issues of pest (aphid, painted bug) and diseases (WR, stem rot, Alternaria). Further, he suggested to increase the oil content *per se* using new approaches. There is a need to launch 3M (maize-mung-mustard) campaign, suitable intercrop for crop diversification. Area in Gujarat, Maharashtra is declining we need to take it into account. We have already done re-zonalization for effective testing of entries. Hot spot for key diseases needs to be identified, breeding hubs and pre-breeding centres should be developed for focused breeding programmes.

Dr. P.K. Singh, Commissioner Agriculture, Govt. of India, urged to break yield plateau by infusing fresh high yielding varieties and hybrids. Rice fallow area should be tapped for rapeseed-mustard area expansion. He further suggested to use genome editing tools for increasing production. Dr. B.C. Deka, Vice Chancellor, AAU, Jorhat said that we need to be Atmanirbhar in oilseed production. Rice fallow area (about 7.5 lakh ha) in Assam can be captured to further increase rapeseed-mustard area in the state. For this we need to breed short duration mustard varieties and high yielding toria varieties which can fit well in rice- mustard- rice cropping system. He further told that under mission double cropping, we need medium duration rice varieties along with medium short duration mustard varieties.

Dr. T.R. Sharma, DDG (CS), ICAR, New Delhi congratulated rapeseed-mustard group for their contribution in enhancing rapeseed-mustard production in country. He apprised the group that rapeseed-mustard varieties of DRMR, IARI and other centres are being recognized at various plateforms at national level. He reminded that the problems which were prevailing 30 years before are still there in the crop. So we need to address these issues. To address these issues innovative technologies, need to be explored by employing vast set of germplasm and genomic resources. He told that very less entries are promoted in the AVT trials only upto 10-15% yield improvement is there. So, there is a need to broaden the genetic base by pre-breeding approaches since there is less limitation for wide hybridization in Brassica.

Protoplast fusion, embryo rescue should be followed for successful wide hybridization. Wild species like *Camelina sativa*, *Diplotaxis*, *Eruca sativa* should be used to incorporate genes for tolerance to various biotic stresses (WR, Sclerotinia rot, Alternaria blight, aphid). Further there is a need to develop climate resilient, short duration, biofortified varieties with high yield for rice fallow area. Genome editing approach should be followed for Orobanche tolerance. He emphasized to develop varieties with high water and nutrient use efficiency and seedling drought tolerance. Furthermore, MAS based varieties can be developed with resistance to white rust disease. Further, we need to identify genes and QTLs for seed size, plant type and anti-nutritional compounds. We need to develop product profile for different regions of mustard. So, identify traits (resistant to WR, SR, AB, PM, Aphids, Painted bug, Orobanche; tolerance to drought, high temperature, salinity, cold; low GLS, EA; early maturity; tolerance to shattering, amenable to mechanical harvesting; high WUE, NUE; ideal plant type) and donors for product profile of the varieties.

He said that there is 30-35% yield gap in crop which needs to be filled by different crop production and protection technologies. We need to develop conservation agriculture technologies. Advanced technologies like use of sensors, IoT, drones can be adopted for irrigation, fertilizer and pesticide application. Further a comprehensive study on natural farming and organic farming is required as desired by Govt. of India. He suggested to understand the population dynamics of pest and pathogens; epidemiology of insect- pests and diseases. Social scientist should develop linkages with farmers for technology transfer. Economist should do impact analysis of developed technologies. Finally, he urged scientist to discuss these issues in this AGM to get fruitful recommendations. The session ended with the vote of thanks by Dr. H.K. Borah, Chief Scientist, ZRS, Shillongani.

**XXXI Annual Group Meeting of AICRP Rapeseed-Mustard
August 20-22, 2024 at Khanapara Campus, AAU, Guwahati (Assam)**

Presentation of Reports (2023-2024)

- Chairman** : Dr. Sanjeev Gupta, ADG (O&P), ICAR, New Delhi
Co- Chairman : Dr P K Singh, Agriculture Commissioner, GOI, New Delhi
Subject Expert : Dr Prassanna Kr. Pathak, Dean, College of Agriculture, AAU, Jorhat
Rapporteurs : Dr. Bhagirath Ram, Principal Scientist, ICAR-DRMR, Bharatpur
: Prof. Kartikeya Srivastava, I. A. Sc., BHU, Varanasi

Session started with the opening remarks of the Chairman Dr Sanjeev Gupta, ADG (O&P). Dr V.V. Singh, PI (Plant Breeding) made a presentation on crop improvement programme. He informed the house that a total of 8229 accessions comprising toria (1293), Indian mustard (5783), yellow sarson (429), gobhi sarson (277), brown sarson (56), karan rai (262), taramira (46) and other *wild sp* (10) were maintained through appropriate mating system at Bhubaneshwar, Dholi, Hisar, Pantnagar, Ludhiana, Kanpur, Hisar, IARI, New Delhi, Jobner, Morena, Pantnagar, Chatha-Jammu, Jagdalpur and SK Nagar.

In addition, 480 new accessions comprising toria (20), Indian mustard (391), yellow Sarson (05), gobhi sarson (07), Brown Sarson (08), Taramira (40) and Karan rai (09) were collected. He mentioned that advanced breeding lines were also evaluated under different station/state /preliminary yield trials at various centres *i.e.* strains of toria were tested at Kanpur, Bhubaneshwar, Chatha-Jammu, Dholi, Jagdalpur and Pantnagar. In Indian mustard, 1227 strains were evaluated at 10 centres; Chatha, Imphal, Hisar, Kanpur, Ludhiana, Pantnagar, Dholi, SK Nagar, Imphal and Bhubaneshwar in 37 trials. Seed yield superiority up to 20.89 % over the check Maya was recorded at Pantnagar. He raised certain issues for discussion in the house such as: rejection of trials due to different reasons *i.e.* low CV (%), high CV (%), mean seed yield of trial at few centre lower than state average yield.

Subsequently, Dr. R. S. Jat, PI (Agronomy) made a presentation on zone-wise agronomic trials and informed the house about details of experiments and findings on long-term fertility experiment on cropping systems, evaluation of herbicides for weed management, agronomic evaluation of promising RM entries, response of macro- and micro-nutrient, bio-fertilizers in enhancing productivity and soil health, optimization of mineral nutrient management for higher productivity and effect of nano-fertilizers on yield & quality of mustard. Thereafter, Dr. P.D. Meena, PI (Plant Pathology) made a presentation on plant pathology programme mentioning the *Brassica* lines resistant to white rust under various trials, management of rapeseed-mustard diseases using novel bio-formulations and bio-management of rapeseed-mustard diseases. He informed the house that based on 3 year results it was concluded that ST (10gm/kg) + FS (6g/l) with *T. harzianum* at 60 & 75 DAS @ 6g/l reduced ABL (35%), ABP (33%), WR (31%), PM (25%) and SR (39%) as well as increased seed yield (19.9%) over control. Similarly, Dr Sarwan Kumar, PI (Entomology) made a presentation on screening of IVT and AVT entries of *Brassica* for resistance against mustard aphid, assessment of yield losses due to insect-pests, trends of population variation of mustard aphid at different locations, and effect of host plant diversity on mustard aphid population. An experiment of planting of 4 rows of mustard+coriander which resulted in significant reduction in aphid population than mustard alone was concluded. Dr. L. K. Meena, PI (Plant Physiology) made a presentation on Screening of genotypes for high-temperature at seedling stage, drought tolerance, terminal heat stress, PGRs to mitigate drought stress, and microbes for mitigating high temperature. He appraised the house about findings/promising entries for targeted traits. Dr. Anubhuti Sharma, PI (Plant Biochemistry) made a presentation on evaluation of IVT/AVT for nutritional quality index, estimation of total glucosinolate in IVT/AVT materials and in "00" genotypes. She told the house about promising genotypes for erucic acid (%) (<2%), glucosinolate ($\mu\text{mol/g}$ defatted seed meal) (< 30 $\mu\text{mol/g}$), phytic acid (%) (Range: 2.00-5.00), oleic acid (%) (> 45%) and linoleic acid (%) (>30%).

Dr. Ashok Kumar Sharma PI (Extension Education) made a presentation on frontline demonstrations of R-M conducted during 2023-24. He presented crop-wise and situation-wise distribution of FLDs, state-wise performance of FLDs under irrigated conditions, state-wise performance of FLDs under rainfed conditions and performance of components in FLDs of rapeseed-mustard during 2023-24. He presented details of different varieties found suitable in different zones with climatic conditions and benefit cost ratio. Subsequently, AICRP-RM centre-wise presentations were invited and Following decisions were taken.

- It was decided that objective/ trait wise crosses should be attempted as per mandate of the centre.
- The interspecific crossing programme for specific traits should be strengthened at ICAR-DRMR, Bharatpur, PAU Ludhiana, HAU, Hisar and ICAR-IARI, New Delhi.

- In addition, already developed pre-breeding material of Alternaria leaf blight at various entries *i.e.* ICAR-IARI New Delhi, ICAR-NIPB, New Delhi, GBPUAT, Pantnagar (UK) may be shared to selected centres *i.e.* GBPUAT, Pantnagar (UK), BHU, Varanasi, RAU, Dholi, Morena and PAU, Ludhiana to initiate crossing programme.
- Similarly, already developed pre-breeding material of Sclerotinia stem at various entries *i.e.* ICAR-IARI New Delhi, HAU, Hisar and ICAR-DRMR Bharatpur may be shared to selected centres *i.e.* BHU, Varanasi, HAU, Hisar, RLBCAU, Jhansi, Morena and PAU, Ludhiana to initiate crossing programme.
- It was decided that the lines showing tolerance to sclerotinia stem rot/powdery mildew/alternaria blight constantly for three years may be registered with NBPGR, New Delhi.
- Looking to the climate change the trial on survey and surveillance of insect pest and diseases may be initiated at few selected centres.
- In physiology trial, microbial consortia word should be used instead of microbial stimulants.
- The breeding material generated by lead centres *i.e.* ICAR-IARI New Delhi, HAU, Hisar, ICAR-DRMR Bharatpur and PAU, Ludhiana may be shared to other interested centres.

**XXXI Annual Group Meeting of AICRP Rapeseed-Mustard
August 20-22, 2024 at Khanapara Campus, AAU, Guwahati, Assam**

Session I: Planning and Technical Programme Formulation: Genetics & Plant Breeding

Chairman : Dr. Sanjeev Gupta, ADG (OP), ICAR, New Delhi
Subject Expert : Dr. S.R. Bhatt, Former Professor, ICAR-NRCPB, New Delhi
Rapporteurs : Dr. H.S. Meena, Principal Scientist, ICAR-DRMR, Bharatpur
: Dr. H.K. Sharma, Sr. Scientist, ICAR-DRMR, Bharatpur

Session started with the opening remarks of Dr. Sanjeev Gupta, ADG (O&P), Chairman of the session. He stressed upon proper conduction of the trials and invited suggestions from the scientists for improvement of the programme. Dr. S R Bhat, Subject expert welcomed the participants and emphasized on pre-breeding programme. Following recommendations were made.

- Trait specific pre-breeding programme shall be undertaken at HAU, PAU, IARI, DRMR.
- Sterility data of hybrid entries shall be recorded only at HAU, Hisar; PAU, Ludhiana, ICAR-DRMR, Bharatpur and IARI, New Delhi.
- Sterility data of hybrid entries other than IHT shall also be recorded.
- Essentially derived lines (EDVs) through genome editing shall be evaluated in AVT-I trial of quality entries after obtaining IBSC certificate regarding absence of transgene duly authenticated by RCGM, DBT, New Delhi.
- Hybrid trials shall not be allocated to private companies.
- Sharing of segregating material to different AICRP-RM centres shall be done as per need of the centre.
- National Crossing Programme (NCP) shall be formulated and be the part of technical program.
- Cut-off date for sowing of Yellow sarson trial in Zone-I shall be 10th October this year.
- Pantnagar shall be added as one of the location in Yellow sarson evaluation trial (Zone V)
- Toria trial will be conducted at Pantnagar, Chatha and three voluntary centres i.e. Udampur, Kashipur and Dhanauri in Zone I

Later on after in-depth deliberations, different crop wise trials were constituted and presented by Dr. V.V. Singh, PI, Plant Breeding.

1. IVT Toria

SN	Entry	Pedigree	Method of breeding	Centre
1.	TKM 24-1	Bhawani X ORT-11	Mass Selection	CSAUA&T, Kanpur
2.	TKM 24-2	Tapeshwari X Anuradha	Mass Selection	CSAUA&T, Kanpur
3.	PTC-2021-1	Composite population	Composite breeding	GBPUAT, Pantnagar
4.	PTC-2021-2	Composite population	Recurrent Selection	GBPUAT, Pantnagar
5.	CG Toria-02	Indira Toria-1 x T-9	Bulk method	SGCARS, Jagdalpur Chhattisgarh
6.	JT-17-1	Composite population	Composite population	SKUAST, Chatha, Jammu
7.	BAUT-08-12	Composite	Composite	BAU, Ranchi
8.	Zonal Check			
9.	PT-303 (NC)			
10.	LR			

Zonal check: ZoneI- Uttara, Zone V – Bhawani, Zone VI – Bhawani, Zone VII - Bhawani

Latest Release: ZoneI-RSPT-6, Zone V – TS 38, Zone VI – TS 38 Zone VII – TS 38

Locations:

Zone I : Pantnagar, Chatha, Udampur, Kashipur, Dhanauri

Zone V : Kanke, Shillongani, Dholi, Kalyani, Varanasi

Zone VI : Imphal, Pasighat, Tripura (COA), Medziphema (Nagaland), Bermiok (Sikkim)

Zone VII : Jagdalpur, Bhubneshwar (Ranital), Kanker, Ambikapur

2. IVT Yellow Sarson

S. No.	Entry	Pedigree	Method of breeding	Centre
1	DRMRYS-24-3	DRMR 235 X DRMR 2381	Pedigree selection	ICAR-DRMR, Bharatpur
2	DRMRYS 202	YSH 401 X SKJ-2	Pedigree selection	ICAR-DRMR, Bharatpur
3	YSKM 24-1	YSK-28 X YSK-2	Pedigree selection	CSAUA&T, Kanpur
4	YSKM 24-2	YSK-42 X YSK-4	Pedigree selection	CSAUA&T, Kanpur
5	PYS-2020-3	PYSC-11-20 X B-9-7-1	Pedigree selection	GBPUAT, Pantnagar
6	PYS-2021-21	PYSC-70-7-14 X PYSC-11-47	Pedigree selection	GBPUAT, Pantnagar
7	RMYS 6	Mutant of MYS 26	Mutation breeding	ARS, Mandor
8	BRYS 2	Swarna X Pitambari	Pedigree selection	BAU, Sabour
9	BYS-24	PYSC-13-7 X PYSC-2013-20	Pedigree selection	BCKV, Kalyani
10	YSH-0401 (NC)			
11	Zonal Check			
12	Pitambari (LR)			

Zonal check: Zone V – Benoy, Zone VI – Benoy, Zone VII - Benoy

Locations

Zone V : Kanke, Shillongani, Dholi, Kalyani, Varanasi, Pantnagar

Zone VI : Imphal, Pasighat, Tripura (COA), Medziphema (Nagaland), Bermiok (Sikkim)

Zone VII : Jagdalpur, Bhubneshwar(Ranital), Kanker, Ambikapur

2.1. AVT-I Yellow Sarson (Repeat)

Zone-V

Entries: PYS 2018-1, YSH-401 (NC), Benoy, (ZC), Pitambari (LR), Filler

Locations: Shillongani, Imphal, Kanke, Kalyani, Bhubaneswar

3. Mustard

3.1. IVT Early Mustard

SN	Entry	Pedigree	Method of breeding	Centre
1	KMR (E) 24-1	Maya X Urvashi	Pedigree selection	CSAUA&T, Kanpur
2	KMR (E) 24-2	Rohini X Mathura Rai	Pedigree selection	CSAUA&T, Kanpur
3	RH 1999-18	NPJ 227 X T 6342	Pedigree selection	CCS HAU, Hisar
4	RH 2399-2	RH 1599-44 X RH 1402 A	Pedigree selection	CCS HAU, Hisar
5	PRE-2022-6	PRE-2011-15 X Maya	Bulk selection	GBPUA&T, Pantnagar
6	PRE-2022-12	PRE-2011-15 X NPJ-112	Bulk selection	GBPUA&T, Pantnagar
7	DRMRHT 13-2	GM-2 X BPR 549-9	Pedigree selection	ICAR-DRMR, Bharatpur
8	DRMRHT-22125	DRMRIJ-31 X PM-28	Pedigree selection	ICAR-DRMR, Bharatpur
9	NPJ 274	PM 25/ (LES-1-27/ EC-597325)	Pedigree selection	IARI, New Delhi
10	NPJ 275	PM 27/ TS6014 (NPJ 112/ BCEF 17-20-1)	Pedigree selection	IARI, New Delhi
11	DRMRCI-206	BPR 141 X NPJ-112	Pedigree selection	ICAR-DRMR, Bharatpur
12	NJI24-401	NJA21-105X NJR21-406	<i>Ogura CMS</i>	Namdhari Seeds Pvt. Ltd.
13	Kesari 5113	PA1IJ119 x PR 1IJ292	<i>Ogura CMS</i>	Crystal Crop Protection Ltd.
14	HUJM(E)-23-7	NDRE-4 X Pusa Bold	Pedigree selection	BHU, Varanasi
15	Pusa Mustard 25			
16	JD 6 (ZC)			
17	LR			
18	Pro 5111 (Hy. check)			

Zonal check/Latest Release: Zone IV : GDM 4 Zone V: NRCHB 101
Zone VI: NRCHB 101 Zone VII: NRCHB 101

Locations:

Zone IV : S. K. Nagar, Nagpur, Mandore, Junagarh

Zone V : Kanke, Shillongani, Kalyani, Dholi, Varanashi

Zone VI : Imphal, Pasighat, Tripura (COA), Medziphema (Nagaland), Bermiok (Sikkim)

Zone VII : Jagdalpur, Bhubaneswar(Ranital), Kanker, Ambikapur

3.2. AVT I Early Indian mustard

Zone V

Entries : 4205B296-01, KMR(E) 23-1, KMR(E) 22-2@, PM 25 (NC), NRCHB 101 (LR), JD 6 (ZC), Pro 5111 (Hybrid Check), Filler

Locations: Kanke, Shillongani, Kalyani, Dholi, Varanashi

@ Repeat entry

3.3. AVT I Early Indian mustard

Zone VI

Entries : DRMRHT 18-65, 4205B296-01, PM 25 (NC), NRCHB 101 (LR), JD 6 (ZC), Pro 5111 (Hybrid Check), Filler

Locations: Imphal, Pasighat, Tripura (COA), Barapani (Umiam), Bermiok (Sikkim)

3.4. AVT I Early Indian mustard

Zone VII

Entries : KMR(E) 23-1, PM 25 (NC), NRCHB 101 (LR), JD 6 (ZC), Filler

Locations: Jagdalpur, Bhubaneswar(Ranital), Kanker, Bilaspur, Ambikapur

3.5. IVT Timely Sown, Irrigated

(To be conducted in Alpha Lattice Design, layout is given in last section of plant breeding technical programme)

SN	Entry	Pedigree	Method of breeding	Centre
1	DRMR 2022-4	NRCHB-101 X DRMRIJ-31	Pedigree selection	ICAR-DRMR, Bharatpur
2	DRMRCI 195	RH 749 X DRMRIJ-31	Pedigree selection	ICAR-DRMR, Bharatpur
3	DRMRIJ 21-57	MJB 9 X RGN 73	Pedigree selection	ICAR-DRMR, Bharatpur
4	SKM 2206	PM 25 X TM 108	Pedigree selection	SDAU, SK Nagar
5	SKM 2209	NRCDR 2 X PM 28	Pedigree selection	SDAU, SK Nagar
6	RH 2263	RH 1209 X RH 7846	Pedigree selection	CCS HAU, Hisar
7	RH 2399-6	RH 30 X Urvashi	Pedigree selection	CCS HAU, Hisar
8	KMR 24-3	Maya X Urvashi	Pedigree selection	CSAUA&T, Kanpur
9	KMR 24-4	Pusa Bold X Arawali	Pedigree selection	CSAUA&T, Kanpur
10	NPJ 278	DRMRIJ 31/ MST-II-14-21 (NPJ-112/ NPJ 176)	Pedigree selection	IARI, New Delhi
11	NPJ 279	TS 6041 (Pusa Agrani/ TERI M 21// NPJ 176)/ Pusa Jagannath	Pedigree selection	IARI, New Delhi
12	PR-2020-16	PR-2018-6 X RB-57-1	Bulk selection	GBPUA&T, Pantnagar
13	PYR-2018-1	PYR-2009-16 X Pro-306	Bulk selection	GBPUA&T, Pantnagar
14	HUJM-23-12	SEJ-2 X HUJM-9964	Pedigree selection	BHU, Varanasi
15	AKMS-1003-50	AKMS 3745 X Neelam	Inter-specific hybridization	SAREC, Kangra
16	ACN -231	Vardhan X Bio YSR	Pedigree selection	CoA, Nagpur
17	TM 416	Mutant of TM 135	Pedigree selection	BARC, Mumbai
18	RB-118	RH 803 X RH 401 B	Pedigree selection	RRS, Bawal
19	RGN 593	RGN 430 X RGN 749	Pedigree selection	SKRAU, Sriganaganagar
20	RL-19-162	Giriraj x RLM 619	Pedigree selection	PAU, Ludhiana
21	RL-19-237	PBR 357 X RH 749	Pedigree selection	PAU Ludhiana

22	CS 2009-219	CS 54 X Krishna	Pedigree selection	CSSRI, Karnal
23	ORM 2019-31	PM-25 x ORM-5-19-2	Pedigree selection	OUAT, Bhuwaneshwar
24	18-52	(Varuna X GM 1) X (Pusa Bold X Pusa Jaikisan) X (IM-2004 X Rohini) X (Kranti X NRCDCR-2)	DH method	DUSC, New Delhi
25	RKM 460	DRMRIJ 31 x RGN 73	Pedigree selection	ARS, Kota
26	Kranti (NC)			
27	Zonal Check			
28	Latest Release			

Zonal Checks: Zone I: RCC 4 Zone- II- RH 749 Zone- III – Maya Zone- IV – Bio 902

Latest Release: Zone I- RH 1975 Zone- II- RH 1975 Zone- III: RGN 73 Zone- IV-GDM-4

Locations :

Zone I: Kangra, Chatha, Pantnagar, Dhaulakuan, Una

Zone II: Abohar, Bawal, Ludhiana, Hisar, New Delhi, Modipuram, Navgaon

Zone III: Kanpur, Morena, Kota, Jhansi, Banda, Jaipur (RARI), Tikamgarh

Zone IV: S.K. Nagar, Nagpur, Jalgaon, Mandore, Sumerpur (Pali)

3.6. AVT-I Mustard, Timely Sown (Irrigated)

Zone I

Entries: RH 2299-63, SKM 2104, Giriraj (LR), RCC 4 (ZC), Kranti (NC), Filler

Locations : Kangra, Chatha, Pantnagar, Bajaura, Dhaulakuan, Una

3.7. AVT-I+II (Timely Sown, Irrigated/Quality/ WRR)

Zone II

Entries: PBR 813-2@, NPJ 271***, DRMRCI(Q) 179**, DRMRCI(Q) 181**, RH (OE) 1710, DRMR 2018-25***#, NPJ 261#, Giriraj (LR), RH 749 (ZC), Kranti (NC), PM 30 (NC), PM 32 (Quality LR), Basanti (WRR C), PDZ 11 (DLC), GED1\$, GED2\$, Varuna, Filler

Locations: Abohar, Bawal, Ludhiana, Hisar, New Delhi, Modipuram, Navgaon

#AVT II strain, @ repeat strain, **quality strain, * white rust resistant strain**

\$Genome edited lines contributed by NIPGR, New Delhi in AVT-I

3.8. AVT-I+ II (Timely sown irrigated/Quality)

Zone III

Entries: DRMRCI (Q) 172***#, LES 68** PM 30 (NCQ), PM 30 (Quality LR), PDZ 11 (DLC), RGN 73 (ZC), GED1\$, GED2\$, Varuna, Filler

Locations: Pantnagar, Kanpur, Morena, Bharatpur, Varanasi, Dholi, Jhansi, Kota

****quality strain, *** white rust resistant strain, # AVT-II strain**

\$Genome edited lines contributed by NIPGR, New Delhi in AVT-I

3.9. IVT Mustard, Timely sown (Rainfed)

SN	Entry	Pedigree	Method of breeding	Centre
1	DRMR 2019-16	DRMR 2019 X NRCDCR 2	Pedigree selection	ICAR-DRMR, Bharatpur
2	DRMRCI 196	RH 725 X DRMR 150-35	Pedigree selection	ICAR-DRMR, Bharatpur
3	DRMRIJ- 138	MJR 3 X Pusa Swarnim	Pedigree selection	ICAR-DRMR, Bharatpur
4	DRMRHT-2090	DRMR 2206 X Pusa Agrani	Pedigree selection	ICAR-DRMR, Bharatpur
5	NPJ 280	Pusa Mustard 30/ BCI-4//SEJ 8	Pedigree selection	IARI, New Delhi
6	NPJ 281	Pusa Mustard 30/ BCI-4	Pedigree selection	IARI, New Delhi
7	RH 2265	RH 749 X TM 143	Pedigree selection	CCS HAU, Hisar
8	RH 2299-64	RH 749 X T-6342	Pedigree selection	CCS HAU, Hisar
9	RGN 599	RGN 433 X TM 172	Pedigree selection	SKRAU, Sriganaganagar
10	CAURM 4-1S	Local Yella X Kranti	Pedigree selection	CAU, Imphal

11	RKM 588	PM 27 X (NPJ 124 X RB 50)	Pedigree selection	ARS, Kota
12	RMM 19-06	JM-2 X JMM-927	Pedigree selection	ZARS, Morena
13	HUJM-23-1	RGN x Vardan	Pedigree selection	BHU, Varanasi
14	RAURD 14-18	Gamma Ray mutant of Rajandra Sufalam	Mutation Breeding	TCA, Dholi
15	BAUM-13-6	RH 305 x Shivani	Pedigree selection	BAU, Ranchi
16	Kranti (NC)			
17	Zonal Check			
18	Latest Release			

Zonal Check - Zone II : RH 725 Zone V: NRCHB 101
Latest Release – Zone II : RH 1424 Zone V : DRMR 150-35

Locations:

Zone II : Sriganganagar, Hisar, Bawal, Ludhiana, Abohar
Zone V : Kanke, Shillongini, Dholi, Varanashi,

3.10. IVT- Mustard Late sown

SN	Entry	Pedigree	Method of breeding	Centre
1	DRMR 2022-16	RH 555 X NPJ 112	Pedigree selection	ICAR-DRMR, Bharatpur
2	DRMRDR 2141	RH 749 X DRMR 2019	Pedigree selection	ICAR-DRMR, Bharatpur
3	DRMRIJ 22-2	IJ 31 X LET 36	Pedigree selection	ICAR-DRMR, Bharatpur
4	RH 2370	RH 1428 X IC- 520747	Pedigree selection	CCS HAU, Hisar
5	RH 2374	NPJ-198 X RH 1403	Pedigree selection	CCS HAU, Hisar
6	KMR (L) 24-5	Vaibhav X Jawahar Mustard-1	Pedigree selection	CSAUA&T, Kanpur
7	KMR (L) 24-6	Vardan X Kranti	Pedigree selection	CSAUA&T, Kanpur
8	NPJ 276	PM 26/ (NPJ 102/PJ// NPJ 102)	Pedigree selection	IARI, New Delhi
9	NPJ 277	PM 27/ MSTL VI-15-10 (Varuna/BEC-144// Varuna)	Pedigree selection	IARI, New Delhi
10	Pusa MH 218	Pusa MS 5-1/ EC 62-1R	Hybrid Breeding	IARI, New Delhi
11	TM132-1	TM102 X RB9901	Pedigree selection	BARC, Mumbai
12	PRL-2022-1	PRB-2013-7 x NRCHB 101	Bulk selection	GBPUA&T, Pantnagar
13	PRL-2022-5	PRL-2012-13 x NRCHB 101	Bulk selection	GBPUA&T, Pantnagar
14	HUJM-23-4	Giriraj X RH-406	Pedigree selection	BHU, Varanasi
15	RGN 592	RGN 429 X DRMRIJ 31	Pedigree selection	SKRAU, Sriganganagar
16	SVJH- 78	SVJA-14 X SVJR-10	Hybrid Breeding	Shakti Vardhak Hybrid Seeds Pvt. Ltd.
17	ORM 2019-30	NRCHB101 x ORM 9-7-2	Pedigree method	OUAT, Bhubaneshwar
18	RKM 599	PM 28 x Bio 902	Pedigree method	ARS, Kota
19	RMWR 19-01	JM-2 X RK-02-4	Pedigree selection	ZARS, Morena
20	Kranti (NC)			
21	Zonal Check			
22	Latest Release			

Zonal check: Zone-II - Pusa Mustard 26 (NPJ 113) Zone-III- NRCHB-101 Zone-V- NRCHB-101

Latest Release : Zone-II – Radhika (DRMR 2017-15) Zone-III- BPM- 11 Zone-V- CS 56

Locations :

Zone II : Sriganganagar, Hisar, New Delhi, Ludhiana, Abohar
Zone III : Kanpur, Morena, Kota, Jhansi, Banda,
Zone V : Kanke, Shillongini, Dholi, Varanashi, Sabour

3.11. AVT-I Mustard,Late Sown (Irrigated)

Zone – II

Entries: NPJ 267, NPJ 268, Kranti (NC), Radhika (LR), PM 26 (ZC), Filler

Locations: Hisar, New Delhi, Ludhiana, Abohar

3.12. AVT-I Mustard, Late Sown (Irrigated)

Zone – III

Entries: DRMR 2018-1***, NPJ 268***, Kranti (NC), CS 56 (LR), NRCHB 101 (ZC), Filler

Locations: Kanpur, Morena, Kota, Bharatpur, Banda

*** White rust resistant strain

3.13. AVT-I Mustard, Late Sown (Irrigated)

Zone – V

Entries: DRMR 2018-1*** Kranti (NC), CS 56 (LR), NRCHB 101 (ZC), Filler

Locations: Kanke, Shillongini, Dholi, Varanashi, Kalyani, Sabour

*** White rust resistant strain

3.14. IHT, Hybrid Mustard

SN	Entry	Pedigree	CMS system used	Centre
1	RHH 2401	RH 406-OA X Ogura 111	<i>Ogura CMS</i>	CCS HAU, Hisar
2	RHH 2402	RH 1401-OA X Ogura 111	<i>Ogura CMS</i>	CCS HAU, Hisar
3	PHR 10143	CMS- M 54 X FR-208	<i>Ogura CMS</i>	PAU Ludhiana
4	PHR 10265	CMS-M 170 x FR-208	<i>Ogura CMS</i>	PAU Ludhiana
5	DRMRHJ 410	OJA4 (A) X OJR 10 (R)	<i>Ogura CMS</i>	ICAR-DRMR, Bharatpur
6	DRMRHJ 520	MJA 5 (A) X MJR 20 (R) Mori	<i>mori CMS</i>	ICAR-DRMR, Bharatpur
7	DRMRHJ 2420	MJA 24 (A) X MJR 20 (R)	<i>mori CMS</i>	ICAR-DRMR, Bharatpur
8	Pusa MH 194	Pusa MS 4-1/ NPJ 93R	<i>Diplotaxis berthautii</i>	IARI, New Delhi
9	Pusa MH 226	Pusa MS 4-1/ EC 62-67-1R	<i>Diplotaxis berthautii</i>	IARI, New Delhi
10	SVJH- 77	SVJA-06 X SVJR-10	<i>Ogura CMS</i>	Shakti Vardhak Hybrid Seeds Pvt. Ltd.
11	NMH90M03	GRU163/GRU164 X GRU472/GRU483	<i>Ogura CMS</i>	Nuziveedu Seeds Ltd.
12	NJH-24-101	NJA21-125X NJR21-403	<i>Ogura CMS</i>	Namdhari Seeds Pvt. Ltd.
13	4205D300-01	4PHHW64A/4PVEV13R	<i>Ogura CMS</i>	Corteva Agriscience
14	KBH 5256	KB22SA 15 X KB22SR016	<i>Ogura CMS</i>	Kaveri Seed Copmany Ltd
15	US 8787	SWJ05A X SWJ52R	<i>Ogura CMS</i>	Seed Works International Pvt. Ltd.
16	NIMOH-02	NMOA-5 X NMOR-7	<i>Ogura CMS</i>	Nirmal Seeds Pvt. Ltd. Jalgaon (M.S.)
17	AMH-511	2011A X 2219R	<i>Ogura CMS</i>	Ajeet Seeds Pvt. Ltd. Aurangabad
18	HT 7262	HRH30A x HRH 15R	<i>Ogura CMS</i>	Hytech Seed India Pvt. Ltd.
19	SBH 618	SMA-4 (A-line) and SMR-4-1 (R line)	<i>Ogura CMS</i>	Super Seeds Pvt. Ltd., Hisar
20	NRCHB-506 (Hybrid Check)			
21	PA 5235	PA1IJ209 x PR 1IJ668	<i>Ogura CMS</i>	Crystal Crop Protection Ltd.
22	Kranti (NC)			
23	Zonal Check			
24	DMH-1 (Hybrid Check)			

Observations on number of sterile/fertile plants are to be recorded on 30 plants in separate trial by covering main raceme at bud stage and recording observation on seed set at maturity in hybrid trial only at selected centres.

Zonal check: Zone-II : RH 749 Zone-III : RGN 73 Zone IV : GDM 4

Locations:

Zone II : Hisar, Ludhiana, New Delhi, Navgaon, Bawal

Zone III : Kanpur, Morena, Kota, Jhansi, Bharatpur

Zone IV: SK Nagar, Mandore, Pali (Sumerpur) , Jalgaon, Nagpur

3.15. AHT-I Hybrid Mustard

Zone – II

Entries: 4205B284-01, Q90033, HRH191290, Kranti(NC), DMH-1(HybridCheck), RH 0749 (ZC), Filler

Locations: Ludhiana, Hisar, New Delhi, Navgaon,

3.16. AHT-I Hybrid Mustard

Zone – III

Entries: : 4205B284-01, Kranti (NC), DMH- 1 (Hybrid Check), RGN 73 (ZC), Filler

Locations: Kanpur, Morena, Kota, Bharatpur, Jhansi,

3.17. AHT-I+II Hybrid Mustard (Repeat)

Zone – IV

Entries: : JKJH 11, SVJH 73, SKMH 1901, 18J408C#, Kranti (NC), DMH- 1 (Hybrid Check), GDM-4 (ZC), 45S46 (Hybrid Check), Filler

Locations: SK Nagar, Mandore, Pali, Jalgaon, Nagpur

3.18. IVT, Quality Mustard

SN	Entry	Pedigree	Method of breeding	Centre
1	LES-70	PM 30/ Donskaja// PM 30*3	MABC	IARI, New Delhi
2	LES-71	PDZ 6/ LES 52	Pedigree selection	IARI, New Delhi
3	PDZ-22#	PM 30/ RLC 3	Pedigree selection	IARI, New Delhi
4	PDZ-23#	PM 30/ RLC 3	Pedigree selection	IARI, New Delhi
5	PMAS 1602	PBR 357/ RLC 3//PBR 357	MABC	PAU Ludhiana
6	PMAS 1604	PBR 91/ RLC 3//PBR 91	MABC	PAU Ludhiana
7	RH(OE) 1702	EC 597318 X RH(OE) 0801	Back Cross	CCS, HAU, Hisar
8	RH(OE) 1704	NOID X EC 597324	Back Cross	CCS, HAU, Hisar
9	DRMRCI(Q) 197	NRCDR-02/ PDZ-1// NRCDR-02	MABC	DRMR, Bharatpur
10	DRMRCI(Q) 198	DRMR 150-35/ PDZ-1// DRMR 150-35	MABC	DRMR, Bharatpur
11	DH-2'00'7G#	Varuna/ Heera// Varuna	DH	DUSC, New Delhi
12	LR			
13	Zonal Check			
14	PM 30 (NC quality)			
15	PDZ 11 (double low check)			
16	Filler (BPMQ 47)			

- double low strains

Zonal check :- Zone II –RH 749; Zone III – RGN 73

Latest Release (Quality Check): Zone II- Pusa Mustard 34 (LES 60); Zone III- Pusa Mustard 30

Locations:

Zone II: Bawal, New Delhi, Hisar, Ludhiana, Sriganaganagar,

Zone III: Kanpur, Morena, Kota, Jhansi,

3.19. AVT-II Mustard Saline/ Alkaline

Entries: CS 2020-10, CS 54 (Salinity check), CS 60 (LR), Kranti (NC), Filler

Locations: Karnal, Lucknow, Agra, Hisar, Fatehpur

National Crossing Programme

SN	Diversity Set	SN	White Rust resistant	SN	Good Combiners
1	NPJ 243	8	DRMRMJA 35	10	M 84
2	DRMRIJ 20-77	9	DRMRIJ 12-26	11	M37
3	M 48			12	PM 30
4	DRMRIJ 20-6			13	RH 725
5	RH 1371			14	NPJ 206
6	M45			15	DRMRIJ 31
7	LES 57				

Crosses shall be attempted at ICAR-DRMR, Bharatpur in LXT fashion and seed will be distributed to AICRP centres

LAYOUT OF EXPERIMENTS

Trials	IVT	AVT
Design	RBD/Alpha Lattice	RBD
Replication	Three (two blocks in each replication)	Four
Plot size Varieties- Zone II	Gross: 2.7 X 5 m; Net: 1.8 X 4.5 m	Gross: 4.5 X 5 m; Net: 3.6 X 4.5 m
Plot size Varieties-Zone I, III, IV & V	Gross: 1.8 X 5 m; Net: 1.2 X 4.5 m	Gross: 3.0 X 5 m; Net: 2.4 X 4.5 m
Plot size Hybrids	Gross All Zones: 2.7 X 5 m Net All Zones : 1.80 X 4.5 m	Gross All Zones: 4.5 X 5 m Net All Zones : 3.6 X 4.5 m
No. of Rows Zone I, II, III, IV & V	Six, Data to be recorded from four rows	Ten, Data to be recorded from eight rows
No. of Rows NEH region	Seven of 4 m length	Twelve of 4 m length
Spacing varietal trials	45 X 15 cm Zone II (Except early & LS) 30 X 10 cm Zone I, III, IV and V	45 X 15 cm Zone II (Except early & LS) 30 X 10 cm Zone I, III, IV and V
Spacing hybrid trials	45 X 15 cm	45 X 15 cm

Note : In case of combined IVT + AVT 1 Trial, layout of AVT I Trial shall be followed

Fertilizer doses :

Toria	:	50 : 25 : 25 , N: P ₂ O ₅ : K ₂ O kg/ha
Yellow sarson	:	50 : 30: 30, N : P ₂ O ₅ : K ₂ O g/ha
Mustard, Karan	:	Irrigated-80 : 40 : 40, N : P ₂ O ₅ : K ₂ O kg/ha
Rai, Gobhi Sarson	:	Rainfed- 40 : 20 : 20, N : P ₂ O ₅ : K ₂ O kg/ha
Taramira	:	30 N kg/ha
Hybrids	:	125 % of RDF for the respective states

Seed Supply:

- Seed material of Toria and Mustard (Early sown) trials should be sent latest by 31st August this year
- Seed material of rest of the trials should be sent latest by 7th September this year
- In case of late receipt of seed material, it will not be included in the trials.
- 50 g seed for IVT and 100 g seed for AVT for each location should be sent.
- 200 g seed of IVT, AVT 1 and AVT 2 entries should be added for Entomological and Pathological experiments.
- 250 g seed / location of AVT-2 entries should be added for Agronomical experiments.
- 300 g seed of each quality strain should be added for biochemical analysis
- **Entire quantity of seed of each entry is to be sent in one lot in proper packing to avoid mixing of seed with other entry seed. Do not make separate packets and seed should be without any treatment or any other identification mark.**

Data reporting: -

- Data should be sent to Director, DRMR (director.drmr@gmail.com) on the prescribed data sheets latest by May 15, otherwise it will not be possible to include in the report
- Weather data with brief weather report should be supplied along with trial data.
- Yield data (kg/ha) should be sent after analysis. Unanalyzed data will not be included in Annual Report.

- Entries along with pedigree and method of breeding should be sent in the prescribed proforma available at DRMR website latest by 10th July for inclusion in concerned IVT trial. In case of hybrid entry, mention the name of CMS system used for hybrid development.

Note:

- In each case, preceding crop may be reported.
- Soil test for NPK may be got done and reported along with the results.
- No irrigation is to be given for rainfed experiments and 5m buffer spacing in all sides should be kept.
- If there is no rain before the sowing, pre-sowing irrigation is to be given.
- The centres, which have accepted the trials, must report data, otherwise their test entries will not be included in trials if the data are not supplied without any valid reason.

Cut off sowing dates for different trials

S.N	Trial	Zone					
		I & II	III	IV	V	VI	VII
1	Toria	10 th October	10 th October	10 th October	31 st October	15 th November	31 st October
2	Yellow sarson	10 th October	10 th October		31 st October	15 th November	31 st October
3	Early mustard	30 th September	10 th October	10 th October	15 th November	30 th November	15 th November
4	Indian mustard, TS Irrigated/ Rainfed, (Hybrid, Quality, Salinity)	31 st October	31 st October	31 st October	30 th November	30 th November	30 th November
5	Indian mustard Late Sown	November 15-30	November 15-30	November 15-30	30 th November		

Criteria for promoting the strains

- The strain (variety/hybrid) out yielding the best check by margin of at least 10 percent either for seed yield or for oil yield shall be promoted for advanced stage of testing, however an exemption upto 10 kg for seed yield may be considered.
- The qualifying strains for possessing any specific trait like quality, drought, and disease and pest resistance will be promoted even if its yield is at par with the best check.
- In single zero lines, promotion shall be on the basis of 10 % superiority for seed/oil yield over quality check as well as seed/oil yield at par/ better than the best non quality check
- In double zero lines, promotion shall be on the basis of 10% superiority for seed/oil yield over quality check as well as seed/oil yield at par/ better than the best non quality check
- The qualifying trials for computing the mean seed yield should have CV less than 15% for trials conducted under irrigated and less than 20% for trials conducted under rainfed and alkaline and saline conditions.
- If the differences in seed yield of same genotype being used as filler/check are equal or greater than CD value, the data of the centre shall not be considered.
- If the variation for seed yield among the strains of a trial is more than four times at one centre and not supported by similar trend at other centres of the zone, such data of that centre shall not be considered.
- Seed yield data of developing centres will be discarded if found two times higher than any entry of particular trial.
- The plant population should be at least 80% of the expected plant population.
Plant Population -Minimum Criteria
IVT 110
AVT 260
- The experimental mean seed yield should be equal to or greater than the state mean for the seed yield.

- 75% of state average yield during last 3 years shall be the criteria for inclusion of data on the basis of General Mean for late sown, Rainfed, Salinity. In taramira 50% of state average yield shall be the criteria for inclusion of data on the basis of grand mean of trial
- In Salinity trials EC levels should be 10 or >10 dS/m for inclusion of the data.
- In toria/early mustard trial, promotion shall be based upon superiority over the earliest maturing check. A margin of 5 days over the best check's maturity duration shall be given in early maturity toria/mustard trial.
- Non significant data shall not be considered for computation of mean.
- Expts with <5% C.V. shall not be considered for computation of mean
- Entries developed through pure line selection from germplasm/variety shall not be evaluated.

Criteria for Promotion of Indian Mustard hybrids to higher order of testing and identification

- 10% and 5% higher seed yield over the best performing variety check and hybrid check, respectively and numerically at par oil yield or 10% and 5% higher oil yield over the best performing variety check and hybrid check, respectively and numerically at par seed yield.
- Numerically at par with best performing check variety/ hybrid for seed or oil yield for specialty types like low erucic acid (< 2%); glucosinolates (< 30 umole/g defatted seed meal) or any other character of Zonal/national importance.
- Moderately resistant or resistant reaction to major key diseases/ pest of the crop at several locations while comparing with check variety/ hybrid
- Stable performance in terms of consistency in yield and oil content across locations within a zone.
- Thermo stability if indicated in physiological trials

Criteria for Promotion of Near Isogenic Lines (NILs) in AICRP- Rapeseed & Mustard

- Promotion of NILs shall be based on the consistency in the performance of target trait in the target environment and yield equivalence with recurrent parent.

Proposed Alpha Lattice Design for IVT Timely Sown (Irrigated)

v = 28, b = 12, r = 3, k = 7, AE = 0.9603, DE = 0.9812 α (0,1,2)

REPLICATION 1							
Block 1	20	16	8	12	28	4	24
Block 2	25	5	9	13	17	21	1
Block 3	7	15	19	11	23	3	27
Block 4	6	26	2	18	22	10	14

REPLICATION 2							
Block 1	13	22	7	26	4	17	11
Block 2	9	5	2	24	15	28	19
Block 3	18	8	12	14	1	23	27
Block 4	25	10	21	3	20	16	6

REPLICATION 3							
Block 1	25	7	23	13	2	12	20
Block 2	16	1	11	6	22	19	28
Block 3	17	24	26	14	9	3	8
Block 4	18	5	15	4	10	21	27

Datasheet for recording the observations Timely Sown Irrigated

rep	block	treatment	Seed yield	rep	block	treatment	Seed yield	rep	block	treatment	Seed yield
1	1	20		2	1	13		3	1	25	
1	1	16		2	1	22		3	1	7	
1	1	8		2	1	7		3	1	23	
1	1	12		2	1	26		3	1	13	
1	1	28		2	1	4		3	1	2	
1	1	4		2	1	17		3	1	12	
1	1	24		2	1	11		3	1	20	
1	2	25		2	2	9		3	2	16	
1	2	5		2	2	5		3	2	1	
1	2	9		2	2	2		3	2	11	
1	2	13		2	2	24		3	2	6	
1	2	17		2	2	15		3	2	22	
1	2	21		2	2	28		3	2	19	
1	2	1		2	2	19		3	2	28	
1	3	7		2	3	18		3	3	17	
1	3	15		2	3	8		3	3	24	
1	3	19		2	3	12		3	3	26	
1	3	11		2	3	14		3	3	14	
1	3	23		2	3	1		3	3	9	
1	3	3		2	3	23		3	3	3	
1	3	27		2	3	27		3	3	8	
1	4	6		2	4	25		3	4	18	
1	4	26		2	4	10		3	4	5	
1	4	2		2	4	21		3	4	15	
1	4	18		2	4	3		3	4	4	
1	4	22		2	4	20		3	4	10	
1	4	10		2	4	16		3	4	21	
1	4	14		2	4	6		3	4	27	

**XXXI Annual Group Meeting of AICRP Rapeseed-Mustard
August 20-22, 2024 at Khanapara Campus, AAU, Guwahati, Assam**

Session II: Formulation of technical programme 2024-25-Agronomy

Chairman: Dr. L.N. Garanak, Director Research, CAU, Imphal, Manipur
Co-Chairman: Dr. Kalyan Pathak, Professor & Head, AAU, Jorhat, Assam
Subject Expert: Dr. O.P. Premi, Principal Scientist, IISWC, Regional Station, Chandigarh
Rapporteurs: Dr. Rajeev Bharat, Chief Scientist, Agronomy, SKUAST, Jammu
 Dr. Harvir Singh, Scientist-Agronomy, DRMR, Bharatpur

The session was started with the opening remarks of the Chairman, Dr. L.N. Garanak, Director Research, CAU, Imphal, Manipur. The chairman urged upon the Agronomists to generate agro-technologies aimed at realizing the yield potential of the varieties and its demonstrations on the farmers' field through the frontline demonstrations. He further stressed upon the generation of quality data for publications in high rated journals through the use of modern statistical tools correlating with the field data. He also suggested to take station trials to resolve the locations specific problems, if any. Dr. Kalyan Pathak, Professor & Head-Agronomy, AAU, Jorhat emphasized to focus on the location specific trials and methodologies in conducting the experiments and realizing the results for the benefit of farming community. Dr. O.P. Premi, Principal Scientist, IISWC, Chandigarh stressed on improving the technical programme during the meeting for better research outcome.

Dr. R.S. Jat, PI and Principal scientist, ICAR-DRMR, Bharatpur presented the proposed technical programme to be conducted during the ensuing 2024-25 *rabi* season at various centre's under AICRP (R&M) on soil, tillage, nutrient and weed related aspects. After threadbare discussion, the technical programme was finalized and a new experiment on natural farming in accordance with the policy of the Govt. of India was framed during the meeting. The PI emphasized on increasing the precision of data of the trials conducted by respective centres and timely submission of reports to the directorate before the final submission date. The technical programme formulated in the concurrent session, were presented in the joint session of planning and technical programme formulation chaired by Dr. Sanjeev Gupta, ADG (O&P).

The following points were recommended for implementation:

1. Experiment on natural farming in comparison to organic farming and integrated nutrient management practices in mustard based cropping systems should be formulated and conducted initially at few centres.
2. It was suggested that specific entries/lines may be developed by the breeders for nitch areas of Natural farming.
3. The centres should analyse and report the data of soil samples (N, P, K, S, Zn & B), economics and all other parameters listed in the technical programme and timely submit the data.
4. Experiment on *Orobanche* management through the use of novel formulations should be formulated and conducted at few hot spot locations.

Technical programme: 2024-25

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

Treatment	Season	
	Rabi (Rapeseed-mustard)	<i>Kharif</i>
T1	Control	Control
T2	100% PK	100% PK
T3	100% NPK	100% NPK
T4	150% NPK	150% NPK
T5	100% NPK + S (recommended as per zone)	100% NPK
T6	100% NPK + Zn @ 25 kg ZnSO ₄ /ha	100% NPK
T7	100% NPK + B @ 1 kg B/ha	100% NPK
T8	100% NPK + FYM @ 2.5t/ha (dry weight basis)	100% NPK

T9	100% NP	100% NP
T10	100% NK	100% NK

Replication: 3

Design: RBD

Locations: Bharatpur (PM-Mustard), Ludhiana (Maize-Mustard), Hisar (PM-Mustard), Pantnagar (Maize-Mustard), Kota (Urdbean-Mustard), Kangra (Maize-mustard)

Observations to be recorded in all the crops every year

1. Growth, yield attributes, yield, system productivity, oil content and economics.
2. Disease and pest incidence, if any, is to be reported by the pathologist.
3. Soil samples every year from 0-15 cm and 15-30 cm depth to be taken after mustard harvest to assess build up/ depletion of soil fertility (Organic carbon, pH, N, P, K, S, Zn, B).
4. The experiment should be conducted on fixed plots.
5. Potassium is to be applied @ 20 kg K/ha in case of no recommendation for potassium application.
6. Observations on weed infestation needs to be recorded treatment wise.

3.2 Evaluation of herbicides for weed management in rapeseed - mustard

Treatment

1. Pendimethalin 1.0 kg a.i./ha (PE)
2. Pendimethalin 0.75 kg a.i./ha (PE)
3. Fluazifop-p-butyl 0.125 kg a.i./ha at 25-30 DAS (PoE)
4. Quizalofop 0.050 kg a.i./ha at 15-20 DAS (PoE)
5. Pendimethalin 0.75 kg a.i./ha (PE) *fb* Fluazifop-p-butyl 0.125 kg a.i./ha at 25-30 DAS (PoE)
6. Pendimethalin 1.0 kg a.i./ha (PE) *fb* Fluazifop-p-butyl 0.125 kg a.i./ha at 25-30 DAS (PoE)
7. Pendimethalin 0.75 kg a.i./ha (PE) *fb* Quizalofop 0.050 kg a.i./ha at 15-20 DAS (PoE)
8. Pendimethalin 1.0 kg a.i./ha (PE) *fb* Quizalofop 0.050 kg a.i./ha at 15-20 DAS (PoE)
9. Weedy check
10. Weed free

Replication: 3

Design: RBD

Locations: Ludhiana, Hisar, Pantnagar, SK Nagar, Ranital, Imphal

Observations:

1. Data on growth, yield attributes, yield, oil content and economics.
2. Species-wise weed dynamics, weed control efficiency should be reported at 45 and weed index at harvest
3. Information on plant and soil residue analysis should be reported or send the samples at ICAR-DRMR, Bharatpur.
4. Phytotoxicity effects on mustard as well as on crops in the cropping system should be reported with photographs.
5. Relative density and relative frequency of weeds should be taken

3.3 Agronomic evaluation of promising rapeseed-mustard entries

Zone II- Timely Sown, Irrigated/Quality/ WRR

Entries: DRMR 2018-25, NPJ 261, Giriraj (LR), RH 749 (ZC), Basanti (WRR), Kranti (NC)

Locations: Abohar, Hisar, Ludhiana, New Delhi, Chatha

Zone III- Timely sown irrigated/Quality:

Entries: DRMR CI (Q) 172, PM 30 (LR), RGN 73, PDZ 11, PM 30 (NC),

Locations : Jhansi, Pantnagar, Varanasi, Morena, Kota

Zone IV- AHT-II Mustard:

Entries: 18J408C, Kranti (NC), DMH- 1 (Hybrid Check), GDM 4 (ZC), 45S46 (Hybrid Check)

Locations: SK Nagar, Mandore, Pali (CAZRI), Jalgaon, Nagpur

Zone (across the zones)- Mustard Saline/ Alkaline:

Entries: CS 2020-10, CS 54 (Salinity check), CS 60 (LR), Kranti (NC), Filler

Locations: Lucknow, Agra, Hisar, Fatehpur, Karnal

Note: The experiment will only be conducted if soil chemical properties in top 50 cm soil are as under:
EC (saturation paste) >7 dSm⁻¹, or pH > 8.5

Fertility levels (for all the locations)

1. Recommended fertility level
2. 125% of the recommended fertility level
3. 150% of the recommended fertility level

Replications: 3

Design: Split-plot (Entries in main plots and fertility levels in sub- plots)

Observations:

1. Yield and yield attributes (branches/plant, siliquae/plant, seeds/silique, 1000 seed weight and seed weight/plant and seed yield).
2. Oil content.
3. Initial fertility status of soil.
4. Uptake of nitrogen, phosphorus and potassium at pre-flowering and harvest stage.
5. Calculate N, P & K economy and use efficiency at different fertility levels.
6. Always report the data in two-way table with entries and fertility levels as given in the report.
7. Identified advanced strains promoted to AVT-II of rapeseed-mustard will be taken along with check varieties of national/zonal importance.

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

Treatment details:

Main plot treatments: Fertility level

1. 100% RDF
2. 75% RDF
3. Control

Sub plot: Microbial consortia

1. Azotobactor
2. Phosphate Solubilising Micro Organism (PSMO)
3. Potassium Mobilizing Biofertiliser (KMB)
4. Zinc Solubilizing Biofertiliser (ZSB)
5. NPK consortia + ZSB
6. Control (No biofertilizer)

Replication: 3

Design: Split plot design

Locations: Kangra, Ludhiana, Pantnagar, Morena, SK Nagar, Dholi, Kanke, Shillongani, Ranital, Kota, Varanasi, Chatha, Imphal, Bawal, Bharatpur & Sriganaganagar

Observations:

1. Growth parameters.
2. Yield and yield attributes (branches/plant, siliquae/plant, seeds/silique, 1000 seed weight and seed weight/plant and seed yield).
3. Oil content, oil yield and economics.
4. Availability of N, P, K, S and Zn before sowing and at harvest and their use efficiency should be given.
5. Analyse the microbial population at initial stage and at harvest stage.
6. Always report the data in two-way table with CV (%), LSD values (p = 0.05) of main-plot, sub-plot and interactions as given in the report.
7. Involve soil microbiologist from the university for microbial studies

Note: All the biofertilizers are in liquid form and are manufactured and supplied from IFFCO.

3.5 Optimization of mineral nutrient management for higher productivity

Treatment details:

Main plot treatments: Major nutrients (NPK)

1. Control
2. 100% NPK
3. 125% NPK
4. 150% NPK

Sub plot: Secondary & micro nutrients

1. 20 kg S + 2.5 kg Zn + 0.5 kg B/ha
2. 40 kg S + 5 kg Zn + 1 kg B/ha
3. FYM (500 kg) enriched with '20 kg S + 2.5 kg Zn + 0.5 kg B/ha'
4. FYM (500 kg) enriched with '40 kg S + 5 kg Zn + 1 kg B/ha'

Replication: 3

Design: Split Plot Design

Locations: Kangra, Ludhiana, Hisar, Pantnagar, Morena, SK Nagar, Dholi, Kanke, Shillongani, Ranital, Kota, Khudwani, Chatha, Imphal, Jobner, Jhansi, Kanpur, Nagpur

Observations:

1. Growth and yield attributes, yield, oil content is to be reported every year.
2. System productivity, profitability and sustainability to be reported every year.
3. Initially measure soil physical and chemical properties from 0-15 cm and 15-30 cm depth.
4. Soil analysis (Organic carbon, pH, N, P, K, S, Zn, B) before and at harvest. Accordingly prepare balance sheet of all the nutrients and their use efficiency.
5. Always report the data in two-way table with CV (%), LSD values ($p = 0.05$) of main-plot, sub-plot and interactions as given in the report.
6. Conduct the experiment in system mode

Note: All the centres should analyse oil content, economics and analyze soil OC and nutrient

3.6 Technological advancement for mustard production in rice-fallow areas

Treatments for mustard:

Main plot: Tillage

1. CT
2. ZT+ 30% kharif rice residue + Pusa decomposer (500 ml/ha)

Sub plot: Nutrient management

1. N+P+K (100% basal)
2. N+P+K+Zn (100% basal)
3. N+P+K+Zn+B (100% basal)
4. N+P+K+Zn+B (50% N basal & 50% N as top dressing)

Replications: 3

Design: SPD

Locations: Imphal, Shillongani & Dholi

Plot size: The sub plot should be minimum of 25 m²

Rice: Sowing method-DSR and short duration variety (Prabhat) uniformly to all the centres

Mustard: Short duration mustard (DRMR 150-35)

RDF: as per location including seed treatment with microbes, biofertilizers & trichoderma

Weed management: as per recommended herbicides in rice and mustard

Crop residue: The height of rice stubbles should be same in both CT and ZT

Observations:

1. Growth attributes: plant height, dry matter, chlorophyll content
2. Yield attributes: number of primary & secondary branches/plant, siliquae/plant, seeds/siliqua, main shoot length & test weight
3. System productivity, economics and sustainability yield index.
4. Soil analysis (Organic carbon, pH, N, P, K, S, Zn, B) before and at harvest.
5. Always report the data in two-way table with CV (%), LSD values ($p = 0.05$) of main-plot, sub-plot and interactions as given in the report.

3.7 Effect of nano-fertilizers on yield and quality of rapeseed-mustard

Treatments

Factor A: RD-NP levels

1. 100% RD-NP
2. 75% RD-NP
3. 50% RD-NP

Factor B: Nano-fertilizers

1. 2 spray of nano-urea
 2. 2 spray of nano-DAP
 3. 2 spray of nano-urea & 2 spray of nano-DAP
- *Absolute control (water spray)

Total treatment: $3 \times 3 + 1 = 10$

Design: FRBD

Replications: 3

Plot size: min. 25 sq.m.

Dose: Nano-fertilizers @ 4 ml/litre, water quantity- 300 litre/ha; RDF as per location.

Stage of pray: At 25-30 & 45-50 DAS

Locations: Kangra, Ludhiana, Hisar, Pantnagar, Morena, SK Nagar, Dholi, Kanke, Shillongani, Ranital, Kota, Chatha, Imphal, Jobner, Jhansi, Kanpur, Nagpur, Mandore, Khudwani, Bawal

Note: Replace nano urea Nano Urea Plus at the same rate of application

Observations:

1. Growth attributes: plant height, dry matter, chlorophyll content & leaf area index
2. Yield attributes: number of primary & secondary branches/plant, siliquae/plant, seeds/siliqua, main shoot length & test weight
3. Seed yield, harvest index, oil content & economics.
4. Soil analysis (Organic carbon, N, P, K) before and at harvest.
5. Plant analysis: N, P & K content and uptake

3.8 Scaling of natural farming practices in rapeseed-mustard

Treatments

1. Natural farming
2. Organic farming
3. Integrated nutrient management
4. Farmers practice

Replication: 5

Plot size: 8 x 5 m

Locations: Pantnagar, Bawal, Kota

Observations:

1. Initial and final soil health parameters (physic-chemical and biological properties)
2. Seed yield, oil content an oil yield
3. System productivity, profitability and sustainability
4. Quality parameters of the produce (proteine content, fatty acid profile)

Note: Conduct the experiment in cropping system mode

3.9 Management of *Orobanche* through novel herbicide formulations

Treatments:

Main plot treatments: Time of application

1. 1 DAS
2. 2 DAS
3. 3 DAS

Sub plot treatments: Dose of application (NHF)

1. 3 ml a.i./ha
2. 4 ml a.i./ha
3. 5 ml a.i./ha
4. Weedy check
5. Weed free

Replications: 3

Plot size: 5 x 3 m

Design: Split plot design

Locations: Dausa, Chandgothi, Bawal

Observations:

1. Weed count (*Orobanche* and other weeds)
2. Seed yield of mustard
3. Weed control efficiency
4. Weed index
5. Phytotoxicity with photographs on crops in the location-wise cropping system, if any

Note: Herbicide formulation will be supplied by ICAR-DRMR, Bharatpur

Suggestions for proper conduct of agronomical trials

1. The treatments of any experiment should not be modified at their end.
2. The results should be presented in the report as per format given in the technical programme including two-way tables with interaction tables in the split plot experiments.
3. Report all the important observations as per experimental requirement.
4. The trials should be sown on time so that treatment effects could be identified properly and yield levels are optimized.
5. The reports should be submitted by 31st May, 2025 positively. No report will be accepted after the due date.
6. The centres should send the information pertaining to field trials along with date of sowing to Director, DRMR latest by 25th November, 2024.
7. The centres accepting the trial (whose names are given in the technical programme) must positively report the data. In case of any difficulty centre should report immediately to Director/PI, DRMR.
8. The fertility/Biofertilizer experiments should be conducted at the same location in the same field over the years.
9. The economics of each experiment should be calculated on the basis of MSP and state recommended cost of cultivation for respective crops. The IBCR should be reported instead of B:C ratio.
10. Data without statistics will not be considered.
11. All the ancillary data of component crops should be recorded and reported.
12. The initial and final soil analysis data of all the experiments should be done and reported every year.
13. If the yield level of recommended fertiliser dose is less than the state average, the trial will be rejected.
14. If any centre needs oil and nutrient analysis, depute concerned scientist along with samples to DRMR, Bharatpur latest by 30th April, 2025 for analysis.
15. The plot size should not be less than 21.6 m² in agronomic experiments and width of buffer channel should not be less than 1.0 m.
16. The field layout of all the agronomy trials should be provided to the Plant Pathologist/Entomologist of the AICRP-RM centres for recording of insect and disease infestation if any, and due credit will be shared with the agronomist.

**XXX Annual Group Meeting of AICRP Rapeseed-Mustard
August 20-22, 2024 at Khanapara Campus, AAU, Guwahati, Assam**

Session III : Planning and Technical Programme Formulation: Plant Pathology

Chairman & Subject Expert: Dr. R.P. Awasthi, Ex-Prof. Plant Pathology, GBPUA&T, Pantnagar

Co-Chairman : Dr. Pankaj Sharma, Joint Director (SCHBR), ICAR-NIBSM, Raipur

Rapporteurs : Prof. A.K. Tiwari, Plant Pathology, GBPUA&T, Pantnagar

: Dr. Ashish Kumar Gupta, Principal Scientist, ICAR-NIPB, New Delhi

The presentation of results, planning and technical programme formulation session of Plant Pathology started with introductory remark by the Chairman and subject expert Prof. R. P. Awasthi, Ex-Professor, Dept. of Plant Pathology, GBPUAT, Pantnagar. Significant achievements of Plant Pathological trials conducted during the year 2023-24 at different locations were presented by Dr. P.D. Meena, PI, Plant Pathology. The results were reviewed critically and the technical programme for the year 2024-25 was finalized after through discussion among the Plant Pathologists. Chairman, suggested that susceptible/resistant checks should be sown in duplicate for recording disease observations more precisely in different trials. He also suggested that observations for foliar diseases at farmer's field should be reported by all the centres under prescribed trial. As per the direction of the DDG (CS) during inaugural session, the identification of genetic sources for multiple disease resistance must be take on priority. The group discussion concluded the following recommendations:

1. After continuous testing for four years under artificial/ natural conditions at different geographical locations, Indian mustard genotypes DRMR 2018-41, RH-1700-4, DRMRCI-131, DRMRCI-132, DRMRM 18-35-11, DRMRM 18-36-12, DRMRM 18-37-13, are recommended as white rust resistant sources for use in the breeding programme.
2. Trial on Bio-management of rapeseed-mustard diseases was concluded based on three-years data with a recommendation 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.

Technical Programme

All centres should report observations on percent disease severity (AB, WR, PM) following 0-9 rating scale. Date of sowing and date of observation(s) should be indicated in data sheet itself. Data for disease severity/ incidence to be reported replication-wise as also after proper statistical analysis (angular transformation) in the same format as in the AICRP-RM Annual Progress Report 2023 with CD ($P < 0.05$) and CV (%) values for comparison of treatments. Transformed value should be indicated in parenthesis. Soft copy of data should be prepared only in **MS Excel sheets. Text of report should be in MS Word. Only soft (by email file attachment only)** copy of data should reach the PI (Plant Pathology), ICAR-DRMR, Bharatpur latest by **30th April, 2025**. Unanalyzed data will not be accepted. Data after due date will not be considered.

Attention: (i) Seeds from different trials labelled suitably and in separate packets should reach the PI, Plant Pathology, ICAR-DRMR, Bharatpur **latest by 10 September 2024**. (ii) Pathologist from respective centre should take action for supply of seed well in time. The national disease nursery (NDN) for different diseases should be conducted with artificial inoculation. Data for all other major diseases occurring on the test entries needs to be recorded and reported. Respective centres should take up detail work on sources of resistance, epidemiology, losses and control of diseases of local importance.

4.1 Screening of Brassica germplasm and breeding material against major diseases

Objective: Disease response of elite accessions under different geographical conditions

4.1.1 Screening of *Brassica* AVT-I & II strains against major diseases under natural condition

Layout:

- Single row: two replications of 3 m row length
- Susceptible checks will be used after every two test rows

Hybrid mustard	4205B284-01, Q90033, HRH191290, JKJH 11, SVJH 73, SKMH 1901, 18J408C#,
TSI mustard	RH 2299-63, SKM 2104, PBR 813-2@, DRMRCI(Q) 181**, DRMRCI(Q) 179**, DRMRCI (Q) 172***#, RH (OE) 1710, DRMR 2018-25***#, NPJ 261#, NPJ 271, LES 68**
LSI mustard	NPJ 267, NPJ 268, DRMR 2018-1***
Early mustard	4205B296-01, KMR(E) 23-1, KMR(E) 22-2@, DRMRHT 18-65
Salinity mustard	CS 2020-10#
Yellow Sarson	PYS 2018-1
Checks	<i>B. juncea</i> : Rohini, NRCHB 101 (SC) & Local Check, BIOYSR, DRMRMJA-35 (RC-WR), PHR 2 (TC-AB), DMH 1, PDZ 1; <i>B. napus</i> : GSL 1; <i>B. carinata</i> : DLSC 1, <i>B. rapa</i> ssp Yellow Sarson: NRCYS-5-2; <i>B. rapa</i> var Toria: PT 303; RTM 314
Location	Pantnagar, Hisar, Morena, Ludhiana, S.K. Nagar, Dholi, Shillongani, Jhansi
#AVT II strain, @ repeat strain, **quality strain, *** white rust resistant strain	

4.1.1 Screening of *Brassica* AVT-I and AVT-II strains against major diseases using artificially inoculated under field condition

Disease	Location
Alternaria blight:	Dholi, Pantnagar, Morena, Ludhiana, Shillongani, Hisar, Jhansi
White rust/ DM:	Pantnagar, Morena, Hisar, Ludhiana, Jhansi
Sclerotinia rot:	Dholi, Ludhiana, Pantnagar, Hisar, Bharatpur, Morena, Jhansi

Methodology:

- Add oosporic material of local isolate only after grinding hypertrophied plant material collected from the previous year crop along with seed for white rust and downy mildew.
- For secondary spread of the disease make repeated inoculations after collecting inoculum from the naturally infected plants for major diseases (AB, WR, DM, PM, SR).
- Give frequent irrigation and higher doses of nitrogenous fertilizer to create epiphytotic.
- The source of inoculum for creating epiphytotic conditions for PM screening needs to be implemented by collecting infected plant stubbles from previous crop season.

Observations to be recorded

- Date of first appearance of each disease including bacterial rot
 - Data as percent disease severity / percent disease incidence for WR (75 DAS/ at maximum disease pressure), AB / PM/ BR (90 DAS/ at maximum disease pressure) on leaves and pods and number of staghead (15 days before harvest) should be recorded on 10 randomly selected plants from each plot using 0-9 scale. Date of observation and date of sowing should be indicated in data sheet itself.
 - Cotyledonary infection due to downy mildew and pod infection due to Alternaria blight should be recorded separately.
- Staghead formation should be recorded as percent incidence and percent twigs infected.
- Staghead (% twigs affected) = (number of twigs infected/ total number of twigs) x 100.
- Data for all major diseases may be recorded as percent disease severity (AB, WR and PM) on leaves/ pods or as percent disease incidence (SR, DM, CR, BR).

- v. Date of each observation should be provided in the data sheet.
- vi. Data should be statistically analysed as per the design using ANOVA after arc sin transformation. Actual and transformed (in parenthesis) values along with mean, CD ($P < 0.05$) and CV (%) are to be submitted for report preparation.

Scale (0-9) for rating of entries for reaction to Alternaria blight, white rust and powdery mildew should be used

0 (Immune for WR)	=	No lesion
1 (HR)	=	Non-sporulating pinpoint size or small brown necrotic spots, less than 5% leaf area covered by lesion
3 (R)	=	Small roundish slightly sporulating larger brown necrotic spots, about 1-2 mm in diameter with a distinct margin or yellow halo, 5-10% leaf area covered by lesions
5 (MR)	=	Moderately sporulating, non-coalescing larger brown spots, about 2-4 mm in diam with a distinct margin or yellow halo, 11-25% leaf area covered by the spots
7 (S)	=	Moderately sporulating, coalescing larger brown spots about 4-5 mm in diam, 26-50% leaf area covered by the lesions
9 (HS)	=	Profusely sporulating, rapidly coalescing brown to black spots measuring more than 6mm diam without margins covering more than 50% leaf area

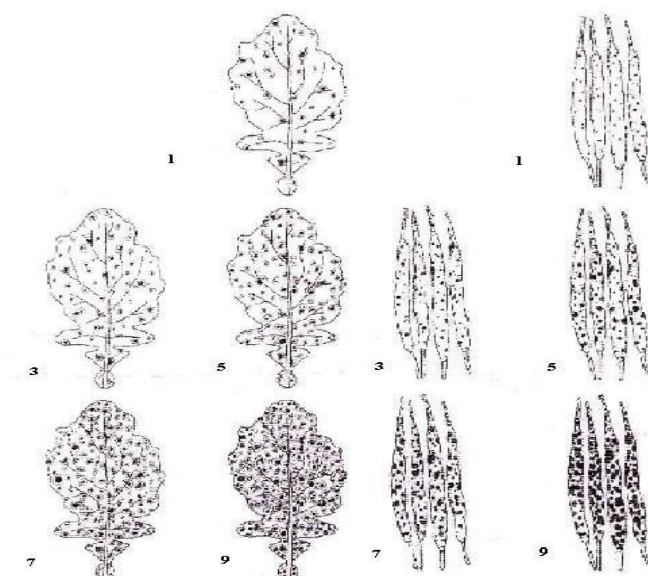
$$\text{Average severity score} = \frac{(N-1 \times 0) + (N-2 \times 1) + (N-3 \times 3) + ((N-4 \times 5) + (N-5 \times 7) + (N-6 \times 9))}{\text{Number of leaf samples}}$$

$$\text{Per cent Disease Intensity (PDI)} = \frac{(N-1 \times 0) + (N-2 \times 1) + (N-3 \times 3) + ((N-4 \times 5) + (N-5 \times 7) + (N-6 \times 9)) \times 100}{\text{No. of leaf samples} \times 9}$$

Where N-1 to N-6 represents frequency of leaves in the respective score

Note:

- (1) The word spots can be read as pustules if the same scale is used for white rust rating
- (2) In case of white rust, brown spot can be read as creamy white pustule
- (3) This scale can also be used in management trials
- (4) For PM, the same rating scale will be followed ignoring the lesion/ pustule characteristics



Diseased leaf and pod area assesment key for for Alternaria blight of rapeseed-mustard (Conn et al. 1990) modified and adopted by AICRP-RM Plant Pathologist during 17th AICRP-RM Group meeting -2010 at Gwalior

Scale (0-4) for rating of entries for reaction to *Sclerotinia* rot

Reaction	Rating	Lesion (cm)
Resistant	0	< 3
Moderately tolerant	1	3-5
Moderately susceptible	2	5-10
Susceptible	3	10-15
Highly susceptible	4	>15

*Stem diameter and % incidence must also be recorded

Method of artificial inoculation for white rust:

Test plants (including checks) should be inoculated twice i.e. at initiation of flowering and pod formation stage. Inoculum may be prepared by collecting fresh zoospores from naturally infected leaves with *Albugo candida*. Petri plates containing zoospores suspended in distilled water be kept at 4°C for 2 h to facilitate germination of zoospores. To assure germination of the sporangia, the plates may be examined under the low power microscope. Germinating zoospores would be emptied and zoospores will be visible in the suspension. Suspension containing zoospores be filtered through double layered muslin cloth and further diluted with distilled water for spraying on leaves of test plants. This may be done with the help of atomizer / small sprayer in the afternoon (after 1500 hrs). Data for disease severity may be recorded 75 DAS/ at maximum disease pressure on leaves and 15 days before harvest for staghead.

Method of artificial inoculation for Alternaria blight

Test plants (including checks) should be inoculated twice i.e. at initiation of flowering and pod formation in the afternoon (after 1500 hrs) with conidial suspension (10^5 cfu / ml) of pure culture of *Alternaria brassicae*/ *A. brassicicola* using distilled water. Disease severity should be recorded 90 DAS/ at maximum disease pressure on leaves and 15 days before harvest on pods.

Method of artificial inoculation for Sclerotinia rot

Cut 5 mm discs of fungal mycelium along with medium from 7-days old pure culture *Sclerotinia sclerotiorum* grown on thick layer of PDA at 20°C. Place one disc on third internode of plant at flowering stage. Wrap the stem along with the fungal agar disc with a swab of cotton dipped in sterile distilled water. Record observation 3-weeks after inoculation for lesion size and per cent disease incidence.

Method of artificial inoculation for downy mildew

Freshly harvested conidia in distilled water from naturally/ artificially infected cotyledonary leaves of susceptible variety should be used for preparation of conidial suspension. Inoculum concentration should be adjusted to 10^4 conidia/ ml using distilled water. Prepared conidial suspension of *Hyaloperonospora parasitica* should be inoculated directly to test plants at 2/3 leaf stage in the afternoon (after 1500 hrs). Observations should be recorded after 7-10 days of inoculation.

4.2 Uniform disease nursery (UDN) trial for major diseases of rapeseed-mustard

Objective: Disease reaction of accessions under different geographical conditions (under natural conditions) for identification of lines for respective national disease nursery trials

Materials: Concerned breeders/ scientists will supply the seed material to Director, DRMR indicating 'for Pathology 4.2 UDN trial'. PI, Plant Pathology, DRMR will in turn send the material to different centres. Pathologist of each centre, with the help of plant breeder, should be responsible for sending the seed of each entry (minimum 100 g) under proper cover labelling species and accession details. Entries must be arranged species-wise.

Observations: Should be recorded and reported as percent disease severity (AB, WR, PM) or percent disease incidence (Sclerotinia rot, Club root as per trial 4.1).

Centre	Entries to be sent
Bharatpur	Bj: DRMRDR 2116, DRMRDR 2119, DRMRDR 2133, DRMRDR 2135, DRMRDR 2140, DRMRDR 2141, DRMRDR 2151, DRMRDR 2152, DRMRDR 2155, DRMRDR 2156, DRMRDR 2195, DRMRDR 2196, DRMRDR 2201, DRMRDR 2202, DRMRDR 2203, DRMRDR 2206, DRMRDR 2227, DRMRDR 2235, DRMRDR 2236, DRMRDR 2241, DRMRDR 2242, DRMRDR 2203, DRMRCI 170, DRMRCI 179, DRMRCI 180, DRMRCI 181, DRMRCI 201, DRMRCI 202, DRMRCI 203, DRMRCI 204, DRMRCI 205, DRMRSJ 9, DRMRSJ 12, DRMRSJ 22, DRMRSJ 14, DRMR 2018-26, DRMR 2019-15, DRMR 2020-15, DRMR 2019-20, DRMR 2020-14, DRMR 2019-16, DRMR 2021-30, DRMR 2021-28, DRMRIJWR 20-12, DRMRIJWR 20-29, DRMRIJWR 20-30, DRMRDR 2301, DRMRDR 2304, DRMRDR 2305, DRMRDR 2315, DRMRDR 2317, DRMRDR 2318, DRMRDR 2319, DRMRDR 2320, DRMRDR 2322, DRMRDR 2335, DRMRDR 2342, DRMRDR 2343, DRMRDR 2349, DRMRDR 2351, DRMRDR 2352
Pantnagar	Bj: PRD-2014-23, PAB-17-10, PAB-17-11, PAB-2017-24, PRD-2014-6, PRD-2014-8, PRD-2014-15, PRD-2014-23, PRD-2014-27
Hisar	RH-1700-3
Check:	<i>Brassica juncea</i> : Rohini, NRCHB 101 (SC) & Local Check, BIOYSR, DRMRMJA 35 (RC-WR), PHR 2 (TC-AB), RH 1222-28 (TC-SR); <i>B. napus</i> : GSL 1; <i>B. carinata</i> : DLSC 1, <i>B. rapa</i> ssp Yellow Sarson: NRCYS-5-2; <i>B. rapa</i> var <i>Toria</i> : PT 303
Locations:	Dholi, Pantnagar, Morena, Hisar, S.K. Nagar, Ludhiana, Shillongoni, New Delhi, Varanasi, Jhansi, Jagdalpur, Nagpur, Durgapura

NOTE: All concerned scientists should mention the name of the species of the entry while sending seeds.

4.3 National disease nursery (NDN) for Alternaria blight

Objective:	To identify potential donors against Alternaria blight after screening under different geographical locations
Centre	Entries to be sent
Bharatpur	Bj: DRMRSJ-349, DRMR-PMJ-17, DRMRSJ 22, DRMRIJWR 20-11, DRMRIJWR 20-15, DRMRIJWR 20-16, DRMRIJWR 20-19, DRMRHJ 3130,
Pantnagar	Bj: PAB-2014-4, PAB- 2014-7, PAB- 2014-8, PAB- 2014-18, PAB-2017-15, PAB-2017-18, PAB-2017-22, PAB-2017-4, PAB-2017-25, PAB-2017-1, PRD-2014-26,
Hisar	RH-1700-3
Check:	<i>B. juncea</i> : Rohini, NRCHB 101 (SC) & Local Check, BIOYSR, DRMRMJA 35 (RC-WR), PHR 2 (TC-AB); <i>B. napus</i> : GSL 1; <i>B. carinata</i> : DLSC 1; <i>B. rapa</i> ssp Yellow Sarson: NRCYS-5-2; <i>B. rapa</i> var <i>Toria</i> : PT 303
Locations:	Pantnagar, Dholi, Hisar, Morena, Ludhiana, Jhansi, Shillongani, Jagdalpur

Layout: Repl: 02: Each entry should be sown in paired row of 3 m length between susceptible local check with 30 x 10 cm spacing.

Method of inoculation: Test plants (including checks) should be inoculated at initiation of flowering and initiation of pod formation during afternoon (after 1500 hrs) with pure culture of *Alternaria brassicae*/ *A. brassicicola* using 10⁵ conidial suspensions/ ml in distilled water. Data for disease severity may be recorded at 90 DAS/ at maximum disease pressure on leaves and 15 days before harvest on pods. **Screening is to be done strictly under artificial inoculation condition.** Data should be reported as percent disease severity as per 4.1.

Observations: Date of sowing, date of first appearance of Alternaria blight, its intensity on leaf and pod in each entry should be reported as per trial 4.1. In addition, seed infection should also be detected following standard procedure.

Note: Concerned breeder/ scientist will supply the seed material of each entry (minimum 50 g) to Director, DRMR indicating 'for Pathology 4.3 NDN / AB trial'. Director, ICAR-DRMR will in turn send the material to different centres. Pathologist of each centre should be responsible for sending the seed of his centre with help of concern breeder. No responsibility shall be taken in the absence of seed not reaching to the Incharge, Plant Pathology, ICAR-DRMR, Bharatpur.

4.4 National disease nursery (NDN) for white rust under artificial conditions

Objective: To identify potential donors against white rust under different geographical locations

Centre	Entries to be sent
Bharatpur	<i>Bj</i> : DRMRCI (Q) 57, DRMRCI 153, DRMRCI 168, DRMRCI 169, DRMRCI 171, DRMRCI 182, DRMRCI 190, DRMRCI 191, DRMRCI 192, DRMRCI-131, DRMRCI-132, DRMRCI-139, DRMR 2018-1, DRMR 2018-41, DRMRIJWR-20-11, DRMRIJWR-20-13, DRMRIJWR-20-14, DRMRIJWR-20-15, DRMRIJWR-20-17, DRMRIJWR-20-19, DRMRIJWR-20-20, DRMRIJWR-20-21, DRMRIJWR-20-23, DRMRIJWR-20-24, DRMRIJWR-20-26, DRMRIJ-12-44, DRMRIJ 1-37, DRMR 2018-26, DRMR 2019-15, DRMR 2020-15, DRMRSJ-349, DRMRM 18-35-11, DRMRM 18-36-12, DRMRM 18-37-13, DRMRM-163, DRMRSJ-271, DRMRSJ-206, DRMRDR 2116, DRMRDR 2135, DRMRDR 2141, DRMRDR 2143, DRMRDR 2151, DRMRDR 2152, DRMRDR 2195, DRMRDR 2155, DRMRDR 2196, DRMRDR 2235
New Delhi	<i>Bj</i> : PMW 18, PDZ 16, PDZ 17, NPJ 250
Hisar	<i>Bj</i> : RH 1400-1, RH- 1700, RH- 1700-1, RH- 1700-3, RH- 1700-4
Pantnagar	<i>Bj</i> : PAB 14-7, PAB 14-8, PAB 14-18
Ludhiana	<i>Bj</i> : JC 36, PMAS A 2010, PBR-813-2
Resistant / Susceptible check	<i>B. juncea</i> : Rohini, NRCHB 101 (SC) & Local Check, BIOYSR, DRMRMJA 35 (RC-WR), PHR 2 (TC-AB); <i>B. napus</i> : GSL 1; <i>B. carinata</i> : DLSC 1, <i>B. rapa</i> ssp Yellow Sarson: NRCYS-5-2; <i>B. rapa</i> var <i>Toria</i> : PT 303
Locations:	Pantnagar, Morena, Hisar, Ludhiana, Jhansi, Dholi, Bharatpur

Note: Concerned breeders/ scientists will supply the seed material of each entry (minimum 100 g) to PI, Plant Pathology, DRMR indicating 'for Pathology 4.4 NDN / WR trial'. PI, Plant Pathology, ICAR-DRMR will in turn send the material to different centres. Pathologist of each centre should be responsible for sending the seed of his centre with the help of breeder.

Observations: Date of sowing, date of first appearance of white rust on each entry, its intensity should be reported as per trial 4.1. Screening is to be done under artificial inoculation condition.

Layout: Replications: 02; each entry should be sown in paired row of 3 m length between susceptible check of *B. juncea* (local check).

Method of artificial inoculation against white rust: Test plants (including checks) should be inoculated at initiation of flowering and initiation of pod formation. Inoculum may be prepared and inoculated as per method described in 4.1. Data for WR disease severity may be recorded at 75 DAS at maximum disease pressure on leaves and 15-days before harvest for stagheads.

4.5 National disease nursery (NDN) for Sclerotinia rot

Objective: To identify potential donors against Sclerotinia rot after screening under different geographical locations

Layout: Repln: 2; each entry should be sown in paired row of 3 m length between susceptible checks of *B. rapa* ssp. Yellow Sarson.

Centre	Entries to be sent
Materials:	<i>Bj</i> : DRMRCI 171, DRMRSJ-25, DRMRSJ 361, DRMRIS 20-1, DRMRIS 20-4, DRMRIS 20-5, DRMRIS 20-11, DRMRDR 2119, DRMRDR 2156, DRMRDR 2220, DRMRDR 2237, DRMRDR 2238, DRMRDR 2239, DRMRDR 2315, DRMRDR 2317, DRMRDR 2320, DRMRDR 2322, DRMRDR 2335, DRMRDR 2342, DRMRDR 2343, DRMRDR 2349, DRMRDR 2351, DRMRDR 2352, PRD 2014-21, PAB 2017-25
Susceptible check:	<i>Bj</i> : Rohini, NRCHB 101, BIOYSR, DRMRMJA 35, <i>Br</i> : NRCYS-5-2
Tolerant check:	<i>Bj</i> : RH 1222-28; <i>Bc</i> : NPC 16
Locations:	Pantnagar, Hisar, Ludhiana, Morena, Bharatpur, Shillongani, Jhansi, Dholi, Varanasi

Method of artificial inoculation for Sclerotinia rot: As described 4.1.

Observations: Date of sowing, date of first appearance of disease on each entry, percent disease incidence/ intensity of different diseases should be reported at 20 days before harvest as per trial 4.1. In addition, data on lesion length stem diameter and 1000-seed weight should also be recorded. **Screening is to be done strictly under artificial inoculation condition.**

Note: Concerned breeders/ scientists will supply the seed material of each entry (minimum 100 g) to Director, DRMR indicating 'for Pathology 4.5 NDN / SR trial'. Director, DRMR will in turn send the material to different centres. Pathologist of each centre should be responsible for sending the seed of his centre with help of concern breeder(s). All centres must sow zonal check. Artificial inoculation should be done by stem inoculation. Monitoring team must visit the trial to observe uniform disease appearance, if it is not so than trial may be rejected on spot to avoid inconsistent data.

4.6 Screening of IVT entries of *Brassica* against different diseases

Objective:	Disease response of accessions promoted to IVT under different geographical conditions in natural conditions
Location:	Dholi, Pantnagar, Hisar, Jhansi, Ludhiana, SK Nagar, Shillongoni, Morena, Nagpur

- Layout:**
- i. Single row: two replications of 3 m row length
 - ii. Susceptible checks will be used after every two test rows

Observations: Should be recorded and reported as percent disease severity (AB, WR, PM) or percent disease incidence (SR, DM, CR) as per trial 4.1.

Early mustard	KMR (E) 24-1, KMR (E) 24-2, RH 1999-18, RH 2399-2, PRE-2022-6, PRE-2022-12, DRMRHT-13-2, DRMRHT-22125, NPJ 274, NPJ 275, DRMRCI-206, NJI24-401, Kesari 5113, HUJM(E)-23-7
Timely sown irrigated mustard	DRMR 2022-4, DRMRCI 195, DRMRIJ 21-57, SKM 2206, SKM 2209, RH 2263, RH 2399-6, KMR 24-3, KMR 24-4, NPJ 278, NPJ 279, PR-2020-16, PYR-2018-1, HUJM-23-12, AKMS-1003-50, ACN -231, TM 416, RB-118, RGN 593, RL-19-162, RL-19-237, CS 2009-219, ORM 2019-31, 18-52, RKM 460
Timely sown rainfed mustard	DRMR 2019-16, DRMRCI 196, DRMRIJ- 138, DRMRHT-2090, NPJ 280, NPJ 281, RH 2265, RH 2299-64, RGN 599, CAURM 4-1S, RKM 588, RMM 19-06, HUJM-23-1, RAURD 14-18, BAUM-13-6
Late sown mustard	DRMR 2022-16, DRMRDR 2141, DRMRIJ 22-2, RH 2370, RH 2374, KMR (L) 24-5, KMR (L) 24-6, NPJ 276, NPJ 277, Pusa MH 218, TM132-1, PRL-2022-1, PRL-2022-5, HUJM-23-4, RGN 592, SVJH- 78 (Hybrid), ORM 2019-30, RKM 599, RMWR 19-01
Hybrid mustard	RHH 2401, RHH 2402, PHR 10143, PHR 10265, DRMRHJ 410, DRMRHJ 520, DRMRHJ 2420, Pusa MH 194, Pusa MH 226, SVJH- 77, NMH90M03, NJH-24-101, 4205D300-01, KBH 5256, US 8787, NIMOH-02, AMH-511, HT7262, SBH 618, NRCHB 506, PA 5235
Quality mustard	LES-70, LES-71, PDZ-22, PDZ-23, PMAS 1602, PMAS 1604, RH(OE) 1702, RH(OE) 1704, DRMRCI(Q) 197, DRMRCI(Q) 198, DH-2'00'7G
Yellow Sarson	DRMRYS-24-3, DRMRYS-202, YSKM 24-1, YSKM 24-2, PYS-2020-3, PYS-2021-21, RMYS 6, BRYS 2, BYS-24
<i>B. rapa</i> var. Toria	TKM 24-1, TKM 24-2, PTC-2021-1, PTC-2021-2, CG Toria-02, JT-17-1, BAUT-08-12
Checks	<i>B. juncea</i> : DMH-1, Rohini, NRCHB 101 (SC), BIOYSR, DRMRMJA 35 (RC-WR), PHR 2 (TC-AB); PDZ 1 (Q), DMH-1, <i>B. rapa</i> var. <i>Toria</i> : PT 303; <i>B. napus</i> : GSL 1; <i>B. carinata</i> : DLSC 1; <i>Eruca sativa</i> : RTM 314; <i>B. rapa</i> var. <i>YS</i> : NRCYS-5-2

4.7 Management of rapeseed-mustard diseases using novel bio-formulations

Objective:	To assess the effect of some novel bio-formulation on major diseases of rapeseed-mustard at different locations
Locations:	PNT, HSR, LDH, JHS, SKN, SHL
Treatments: (Foliar spray at 45 and 70 DAS)	<ol style="list-style-type: none"> 1. ST with Th3 @ 5ml/kg seed + FS Th3@ 1ml/lit (45 DAS) 2. ST with Th3 @ 10ml/kg seed + Th3 incubated FYM @ 100 ml/ton FYM incorporation before sowing @ 2.5 ton/ ha 3. ST with Th3 @ 20ml/kg seed 4. ST with green fungicide @ 10gram/ kg seed 5. ST with Bio-care @ 10gram/ kg seed 6. ST with Crop-care @ 10gram/ kg seed 7. ST with Eco-pesticide @ 10gram/ kg seed 8. ST with Bio-pulse @ 10gram/ kg seed 9. Control (without seed treatment)
Observations:	Disease occurrence, severity/ incidence for major diseases including Alternaria blight and AB on pods, white rust, % stag head, powdery mildew—following new rating scale adopted by the group (2010), Sclerotinia rot incidence should be recorded as per trial 4.5. Data may be recorded from 10-tagged plants randomly in experimental plot. Seed yield per plot be recorded and provided in kg/ ha. Data should be reported after statistical analysis along with IBCR
Layout:	Repln: 3; Plot size: 3x5m, Spacing: 30x10cm; D/S: 20-25 Oct; Var: DRMRIJ 31

4.8 Epidemiology of major rapeseed-mustard diseases

Objective: To develop models for forecasting of the major diseases at different locations

Locations: Pantnagar, Hisar, Shillongani, SK Nagar, Dholi, Jhansi, Morena, Jagdalpur

Layout: The experiment shall be laid out in split-plot design with one replication with varieties Varuna & Local (important variety of the locality) as main-plot treatments and dates of sowing (08) at weekly interval (01, 08, 15, 22, 29 Oct, 05, 12 and 19 Nov) as sub-plot treatments. Each plot shall be of 1.5 m x 5 m size with a spacing of 30 cm x 10 cm (the plot may have 5 rows at 30 cm spacing). Recommended doses of N and P fertilizers shall be applied with no application of K fertilizer; insect-pest protection practices to be undertaken (apply seed treatment with appropriate insecticide and spray 1 ml/ l at 15-day interval). No protection to be taken against any disease.

Observations: Data for initial date of appearance of disease in each plot shall be recorded on copies of data sheet with data for percent disease severity (PDS) in each treatment/ plot twice-a-week (on Tuesday morning and Friday evening) till harvest on leaf for Alternaria blight (powdery mildew in SK Nagar) and white rust and Alternaria blight PDS on pods – all following new rating scale adopted by the group (2010). Plot-wise observation for staghead percent and percent incidence of Sclerotinia rot shall also be recorded. Data may be recorded from 10-tagged plants randomly in experimental plot (tagged by stacking with stick). Seed yield per plot be recorded and provided in kg/ ha. Maximum possible details of daily weather data for crop period (September to day of harvest of the last plot) for different parameters [Min & max. temp. (°C), rainfall (mm), max and min RH (%), solar intensity/ sunshine hours] may also be recorded and submitted to PI, Plant pathology, ICAR- DRMR, Bharatpur at end of every month. Wherever possible, data for leaf wetness and wind velocity (km/ h) may also be recorded and submitted. Data should be reported after correlation regression analysis along with disease severity of different diseases during the year accompanied by weather data for its finalization. Data for disease severity/ incidence may be recorded in excel of prescribed data sheets and they may be sent along with daily weather data at the end of every month for necessary analysis.

4.9 National Genetic Stock Nursery

Objective: To maintain resistant/ tolerant sources

Location: ICAR-DRMR, Bharatpur

Layout: Five lines of each entry to be sown 3m length row. All checks from different trials to be taken for sowing. Maintain purity of different species according to breeding methods i.e. selfing/ isolation etc.

Entries:

NRCHB 101& Rohini (SC), Varuna, DRMRIJ 31 (Mgt trials), DRMRMJA 35, BIOYSR (RC-WR), PHR 2 (TC-AB), RH 1222-28 (TC-SR), DMH 1 (HBC), PDZ 1 (QC), NRCYS-05-2 (YSC), NPC 16, DLSC 1 (Bc C), GSL 1 (Bn C), PT 303 (Br C), RTM 314 (Es C)
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4.10 Farmers' field for disease outbreak**Objective:** Survey of farmers' fields for occurrence of major/minor diseases**Observations at all centre:**

- i. Initial appearance of the disease with intensity and cultivars affected
- ii. Fortnightly observations on the same field
- iii. Emerging diseases must be reported from all centres
- iv. Fortnightly weather parameters

**XXXI Annual Group Meeting of AICRP Rapeseed-Mustard Workers
August 20-22, 2024, Khanapara Campus, AAU, Guwahati**

Session IV Planning & Technical Programme Formulation: Entomology

Chairman : Dr. Badal Bhattacharya, Head, Department of Entomology, AAU, Jorhat
Co-chairman : Dr. M.K. Dhillon, Head, Division of Entomology, ICAR-IARI, New Delhi
Rapporteurs : Prof. M.S. Khan, Deptt. of Entomology, GBPUA&T, Pantnagar
: Dr. Sarwan Kumar, PAU, Ludhiana

The planning and technical programme formulation session of Entomology began with welcome address by Dr. Rudra Narayan Bokarkati, Jr. Scientist (Entomology) at RARS, AAU, Shillongani, Navgaon. He extended a warm welcome to the Chairman, co-chairman and the fellow entomologists. Dr MK Dhillon proposed conducting AVT II trial under artificial infestation conditions. Additionally, it was decided to include the latest release varieties in the yield losses trial. For trial 5.3, Chairman Dr. Badal Bhattacharya advised to be vigilant and report the incidence of new and emerging pests. Dr Sanjeev Gupta, ADG (O & P) suggested to include a trail on survey and surveillance of mustard for various insect-pests.

Dr. Sarwan Kumar, PI of AICRP-RM, emphasized that experiments must be conducted according to the technical programme with proper statistical analysis, and that report should be submitted by May 15th each year. A uniform data recording format will be distributed to all centres, and data must be submitted in this format as provided by the PI. All entomologists should follow technical programme strictly. After four years of experimentation, a trial on the 'Effect of Host Plant Diversity on the Abundance of Mustard Aphid and the Associated Specialist and Generalist Natural Enemies' concluded with the following recommendation:

Recommendation:

Sowing of three rows of coriander around and within mustard can be used as an effective habitat management strategy to manage mustard aphid.

Technical Programme (2024-25)

Project 5.1 (A): Screening of germplasm and advanced genotypes for their reaction to mustard aphid infestation

Locations: Bharatpur, Ludhiana, Hisar, New Delhi, Morena, Kanpur, Pantnagar, S.K. Nagar, Dholi, Shillongani

Methodology: Grow entries in 3 m long paired rows in 3 replications. Delay the sowing by 20 to 25 days than the normal to ensure heavy aphid pressure under natural conditions.

Observations: Record observations on number of aphids per plant (10 cm top twig), per cent plants with aphids on 10 randomly selected plants per entry, and derive aphid population index (API), aphid damage index (ADI), and aphid resistance index (ARI) as described in the below given table.

Time of observation: 1. At full flowering stage 2. At full siliqua formation stage.

Note: The material will be supplied by the PI, Entomology.

Record data separately for different *Brassica* spp.

Material for screening will be provided by the respective breeders.

Maximum grading either at full flowering stage or at pod formation stage should be considered to classify the genotypes.

Self at least two plants per entry for genetically pure seed.

Aphid infestation index can be calculated as per the following table:

Table 1: Aphid population, damage and resistance indices to categorize rapeseed-mustard for resistance to *Lipaphis erysimi*

S.N	Aphid population index (API)	Aphid damage index (ADI)	Aphid resistance index (ARI)	Resistance category
1	1 = No or less than 20 aphids on the inflorescences of test Plants	1 = Normal plant growth, no symptoms of injury, no curling or yellowing of leaves	0.1-1.0 (API+ADI/2)	0.0-1.0 = Resistant
2	2 = upto 25% inflorescences have 21-100 aphids on the test plants	2 = Average plant growth, curling and yellowing of few leaves, flowering and fruiting	1.1-2.0 (API+ADI/2)	1.1-2.0 = Moderately resistant
3	3 = upto 50% of inflorescences have 101-250 aphids across test plants	3 = Poor plant growth, curling and yellowing of leaves on some branches, drying of few flowers and poor pod setting	2.1-3.0 (API+ADI/2)	2.1-2.5 = Tolerant
4	4 = upto 75% inflorescences have 251-500 aphids across test plants	4 = Stunted plant growth, heavy curling and yellowing of leaves all through the plant, drying and curling of almost half the inflorescence with poor flowering and rare pod setting	3.1-4.0 (API+ADI/2)	2.6-3.5 = Susceptible
5	5 = 100% of inflorescences have more than 500 aphids across test plants	5 = Severe stunting and ragged plant appearance, yellowing and curling of almost all the leaves, complete drying of inflorescence without any flower and immature drying of pods if any	4.1-5.0 (API+ADI/2)	3.6-5.0 = Highly susceptible

(Ref. Dhillon, 2018)

Project 5.1: Screening of germplasm and advanced genotypes for their reaction to mustard aphid infestation

S No	IVT Toria
1	TKM 24-1
2	TKM 24-2
3	PTC-2021-1
4	PTC-2021-2
5	CG Toria-02
6	JT-17-1
7	BAUT-08-12
8	PT 303 (NC)
9	Bhawani
10	TS 38
	IVT Yellow Sarson
1	DRMRYS-24-3
2	DRMRYS 202
3	YSKM 24-1
4	YSKM 24-2
5	PYS-2020-3
6	PYS-2021-21
7	RMYS 6
8	BRYS 2
9	BYS-24
10	YSH-0401 (NC)
11	Pitambari
12	Benoy

	IVT Early Mustard
1	KMR (E) 24-1
2	KMR (E) 24-2
3	RH 1999-18
4	RH 2399-2
5	PRE-2022-6
6	PRE-2022-12
7	DRMRHT 13-2
8	DRMRHT-22125
9	NPJ 274
10	NPJ 275
11	DRMRCI-206
12	NJI24-401
13	Kesari 5113
14	HUJM(E)-23-7
15	Pusa Mustard 25
16	JD 6
17	GDM 4
18	NRCHB 101
19	PRO 5111
	IVT Timely Sown Irrigated
1	DRMR 2022-4
2	DRMRCI 195
3	DRMRIJ 21-57

4	SKM 2206
5	SKM 2209
6	RH 2263
7	RH 2399-6
8	KMR 24-3
9	KMR 24-4
10	NPJ 278
11	NPJ 279
12	PR-2020-16
13	PYR-2018-1
14	HUJM-23-12
15	AKMS-1003-50
16	ACN -231
17	TM416
18	RB-118
19	RGN 593
20	RL-19-162
21	RL-19-237
22	CS 2009-219
23	ORM 2019-31
24	18-52
25	RKM 460
26	Kranti
27	RCC 4
28	RH 749
29	Maya
30	Bio 902
31	RH 1975
32	RGN 73
	IVT Mustard, Timely Sown (Rainfed)
1	DRMR 2019-16
2	DRMRCI 196
3	DRMRIJ- 138
4	DRMRHT-2090
5	NPJ 280
6	NPJ 281
7	RH 2265
8	RH 2299-64
9	RGN 599
10	CAURM 4-1S
11	RKM 588
12	RMM 19-06
13	HUJM-23-1
14	RAURD 14-18
15	BAUM-13-6
16	RH 725
17	RH 1424
18	DRMR 150-35
	IVT Mustard, Late Sown
1	DRMR 2022-16
2	DRMRDR 2141
3	DRMRIJ 22-2
4	RH 2370
5	RH 2374
6	KMR (L) 24-5
7	KMR (L) 24-6
8	NPJ 276
9	NPJ 277

10	Pusa MH 218
11	TM132-1
12	PRL-2022-1
13	PRL-2022-5
14	HUJM-23-4
15	RGN 592
16	SVJH- 78
17	ORM 2019-30
18	RKM 599
19	RMWR 19-01
20	Pusa Mustard 26
21	Radhika
22	BPM 11
23	CS 56
	IHT Hybrid Mustard
1	RHH 2401
2	RHH 2402
3	PHR 10143
4	PHR 10265
5	DRMRHJ 410
6	DRMRHJ 520
7	DRMRHJ 2420
8	Pusa MH 194
9	Pusa MH 226
10	SVJH- 77
11	NMH90M03
12	NJH-24-101
13	4205D300-01
14	KBH 5256
15	US 8787
16	NIMOH-02
17	AMH-511
18	HT 7262
19	SBH 618
20	NRCHB 506
21	PA 5235
22	DMH 1
23	RH 749
24	RGN 73
	IVT Quality Mustard
1	LES-70
2	LES-71
3	PDZ-22
4	PDZ-23
5	PMAS 1602
6	PMAS 1604
7	RH(OE) 1702
8	RH(OE) 1704
9	DRMRCI(Q) 197
10	DRMRCI(Q) 198
11	DH-2'00'7G
12	Pusa Mustard 34 (LES 60)
13	Pusa Mustard 30
14	PDZ 11
15	PDZ 15

Checks: RH-749 (Conventional check), BSH-1 (Susceptible check), 45-S-46 (Hybrid check), PM 34 (Quality check), Kranti (NC) and BPM 11 (LR) and *Brassica fruticulosa* introgressed *Brassica juncea* line (resistant check) will be the check entries for all screening programme.

Project 5.1 (B): Screening of AVT I entries of *Brassica* for their reaction to mustard aphid infestation

Following are the AVT-I entries of *Brassica* to be screened for their reaction to mustard aphid

SN	Entry
1	AVT-I Yellow Sarson (Repeat) Entries: PYS 2018-1, YSH-401(NC), Benoy (ZC), Piambari (LR)
2	AVT- I Early Indian Mustard Entries: DRMRHT 18-65, KMR(E) 23-1, 4205B296-01, KMR(E) 23-1, KMR(E) 22-2, PM 25, NRCHB 101, JD 6, Pro 5111,
3	AVT-I: (Timely Sown, Irrigated/Quality/WRR) Entries: RH 2299-63, SKM 2104, PBR 813-2, NPJ 271, DRMRCI(Q) 179, DRMRCI(Q) 181, RH (OE) 1710, LES 68, Giriraj (LR), RH 749 (ZC), Kranti (NC), PM 30 (NC), PM 32 (Quality LR), RGN 73 (ZC), Basanti (WRR C), PDZ 11 (DLC), GED1\$, GED2\$, Varuna
4	AVT –I Mustard, Late Sown (Irrigated) NPJ 267, NPJ 268, DRMR 2018-1, Kranti (NC), Radhika (LR), PM 26 (ZC), CS 56 (LR), NRCHB 101 (ZC)
5	AHT I Mustard 4205B284-01, Q90033, HRH191290, JKJH 11, SVJH 73, SKMH 1901, Kranti(NC), DMH-1 (HybridCheck), RH 0749 (ZC), RGN 73, 45 S 46

Checks: RH-749 (Conventional check), BSH-1 (Susceptible check), 45-S-46 (Hybrid check), PM 34 (Quality check), Kranti (NC) and BPM 11 (LR) and *Brassica fruticulosa* introgressed *Brassica juncea* line (resistant check) will be the check entries for all screening programme.

Project 5.1 (C): Screening of AVT II entries under artificial infestation conditions

Locations: Bharatpur, Ludhiana, Hisar, New Delhi, Morena, Kanpur, Pantnagar, S.K. Nagar, Dholi, Shillongani

Following are the AVT-II entries of *Brassica* to be screened for their reaction to mustard aphid

SN	Entry
1	AVT-II: (Timely Sown, Irrigated/Quality/WRR) Entries: DRMR 2018-25, NPJ 261, DRMRCI (Q) 172, CS 2020-10, Giriraj (LR), RH 749 (ZC), Kranti (NC), PM 30 (NC), PM 32 (Quality LR), RGN 73 (ZC), Basanti (WRR C), PDZ 11 (DLC), GED1\$, GED2\$, Varuna, RGN 73, GED1\$, GED2\$
2	AVT–II Hybrid Mustard 18J408C, Kranti (NC), DMH- 1 (Hybrid Check), RGN 73 (ZC), 45S46 (Hybrid Check)

Checks: RH-749 (Conventional check), BSH-1 (Susceptible check), 45-S-46 (Hybrid check), PM 34 (Quality check), Kranti (NC) and BPM 11 (LR) and *Brassica fruticulosa* introgressed *Brassica juncea* line (resistant check) will be the check entries for all screening programme.

Methodology: Grow entries in 3 m long paired rows in 3 replications as detailed in project 5.1 (A). At flowering artificially infested 5 plants in each entry @ 20 aphids/ plant and cover them with muslin cage. For artificial infestation, collect the aphid population from the naturally infested plot in the field. For the release of aphids, pin the twig infested with aphids on the side shoot of the test entry. After 15 days, when the aphid population has multiplied, remove the muslin cage and record the data as in project 5.1 A.

Observations: Record aphid infestations index (AII) on 0-5 scale, average aphid population per plant (10 cm top twig) and per cent plant infestation on the basis of 10 randomly selected plants per entry [Calculated as per the given methods in table:1, (Ref. Dhillon, 2018)]

Time of observation:

1. At full flowering stage
2. At full siliqua formation stage.

Note:

1. The material will be supplied by the PI, Entomology.
2. Record data separately for different *Brassica* sp.
3. Material for screening will be provided by the respective breeders.
4. Maximum grading either at full flowering stage or at pod formation stage should be considered to classify the genotypes.
5. Self at least two plants per entry for genetically pure seed.

Project 5.2: Assessment of yield losses due to insect-pests in *Brassica* crops

Objective: To find out yield losses caused by various insect-pests

Locations: Bharatpur, Ludhiana, Hisar, New Delhi, Morena, Kanpur, Pantnagar, S.K. Nagar, Dholi and Shillongani

Treatments (2) (i) Protected (ii) Unprotected

The protected set to be sprayed with locally recommended insecticide against insect-pests. Spray should be done when the pest population reaches economic threshold level or pest appearance where ETL is not available.

Entries: The recent released/identified varieties for *Brassica juncea* were taken for yield losses trial: BPM 11 and RH 1975 and locally high performing variety

Design - RBD, Plot size: 4.2 m x 3m, **Replications** 4**Sowing time:** Second fortnight of November

- Observations:**
1. Observations of different insect pests to be recorded on randomly selected 10 plants per plot as per standard methodology given in 5.3. However, before every spray data on insect-pests population will be recorded and per cent reduction in pest population will be worked out.
 2. Percent reduction in insect pest population in protected set over unprotected one of the same variety.
 3. Yield data at harvest.
 4. Yield loss to be worked out.

Format for data recording of project 5.2

Project 5.2: Assessment of yield losses due to insect pests in <i>Brassica</i> crops								
Date of Sowing: ----- Date of Harvesting: -----								
Entries	Aphid population before treatment		Aphid population after treatment		% reduction in aphid population in protected set over unprotected	Yield kg/ha		Avoidable yield loss (%)
	Protected	Unprotected	Protected	Unprotected		Protected	Unprotected	
BPM 11								
RH 1975								
Local high yielding Variety								

Project 5.3(A): Agro-ecological analysis of various insect-pests on *Brassica* crops

Locations: Bharatpur, Ludhiana, Hisar, Morena, Kanpur, Pantnagar, S.K. Nagar, Dholi and Shillongani
 Crops/Entries (i) *Brassica juncea* (DRMRIJ 31) (ii) *Eruca sativa* (T 27) (iii) *B. napus* (GSC 7)
 (iv) *B. rapa* (BSH 1)
 Plot size: 4.2 m x 3 m
 Replications: 3

Crop sowing (i) Timely sown (ii) Late sown

Observations: (Recorded at weekly intervals)

1. Mustard aphid and cabbage aphid: Number of aphids/10 cm twig on 10 plants per genotype (See Project No. 5.1)
2. Mustard sawfly : Number of larvae/10 plants (sawfly larval population to be recorded at 3 days interval)
3. Painted bug : Number of bugs (adult + nymph)/10 plants
4. Flea beetle : Number of beetles/10 plants
5. Cabbage caterpillar : Number of larvae/10 plants
6. Others : a) Number of insects/10 plants

b) Pollinator diversity should be recorded (Species diversity can be recorded through taxonomic identification as well as image verification from the experts)

c) Natural enemies (i.e. parasitoids, predators and entomogenous pathogens diversity etc) diversity should be recorded (Species diversity can be recorded through taxonomic identification as well as image verification from the experts)

Format for data recording for Project 5.3(A): Agro-ecological analysis of various insect-pests

Date of Harvesting : Date of sowing :											
SM	Weather Parameters						Aphids /10cm top twig				
W	Temperature (°C)		R.H. (%)		Sunshine (hrs)	Wind speed Kmph	Rainfall (mm)	<i>B. juncea</i>	<i>Eruca sativa</i>	<i>B. napus</i>	<i>B. rapa</i>
	Max	Min.	Max	Min.							

Note- The same format can be used for other pests as well.

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

Objective: All the centres will install yellow (chrome) painted smeared with transparent greasy material on 1 kg oil tin box (round) at 5 locations in the experimental farm at 1.5 m above ground from first week of October onwards. The height of trap should be adjusted so that it remains 1 foot above the crop canopy. The data on the winged trapped mustard aphid is to be recorded daily by taking care of cardinal directions throughout the year

Locations: Bharatpur, Ludhiana, Hisar, Morena, Kanpur, Pantnagar, S.K. Nagar, Dholi and Shillongani

Observations: Temperature (maximum and minimum), RH (morning and evening), sunshine hours, rainfall and rainy days

Analysis: Data on the insect-pests infestation from different centres will be analyzed with respect to meteorological parameter

5.4 Management of mustard aphid with exogenous application of salicylic acid

Locations: Bharatpur, Ludhiana, Hisar, Morena, Kanpur, Pantnagar, S.K. Nagar, Dholi and Shillongani

Plot size: 4.2 m x 3 m

Replications: 3

Mustard variety: *Brassica juncea*: Giriraj

Sowing time second/third week of November

Treatments: T₁: Salicylic acid 0.5 mM (69 ppm)

T₂: Salicylic acid 1.0 mM (138 ppm)

T₃: Salicylic acid 1.5 mM (207 ppm)

T₄: Thiamethoxam 25 @ 0.1 g/l

T₅: Control

Treatments to be applied at the initiation of aphid population.

Observations: 1. Data on the population of mustard aphid will be recorded before, 1, 3, 7, 10 and 14 days after treatment from 10 plants selected at random in each replication.

2. Also record data for the other pests prevalent in the centre.

3. Yield data at harvest

4. Economics

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

Locations: Bharatpur, Ludhiana, Hisar, Pantnagar

Plot size: 4 m x 3 m

Replications: 3

Mustard variety: Conventional genotypes: *B. juncea*-DRMR IJ 31, *B. napus*: GSL 1

Quality genotypes: *B. juncea*-PM 30, *B. napus*: GSC 7

Design: RBD

Sowing time Sowing time: Mustard: **second/third week of November**

Treatments: **T₁** Aphid infested
 T₂ Uninfested

Methodology: At flowering, in the infested plot release aphids @ 20 aphids/ plant on 5 randomly selected plants. After 48 hours, collect the top 10 cm twig of plants from both infested and uninfested plots for biochemical analysis. To avoid natural aphid infestation in uninfested plots, spray the plots with recommended insecticide of the state.

Biochemical analysis:

- 1 Peroxidase
- 2 Myrosinase
- 3 Total glucosinolates
- 4 Total phenols
- 5 Ortho-dihydroxy phenols
- 6 Flavonols

Data and Recording Analysis:

All centres will also record aphid population data at weekly intervals.

- 1 Analyze the data w.r.t. increase/decrease in biochemical constituent in infested treatment over uninfested.
2. Record the yield data at harvest.

5.6 Survey and surveillance of insect pests and their natural enemies in Rapeseed-Mustard:

Locations : Ludhiana, Hisar, Bharatpur, Kanpur, Pantnagar, S.K. Nagar, Dholi, Morena, New Delhi and Shillongani

- Observations:**
- i) Insect-pests population / infestation will be recorded from sowing to harvesting at fortnightly intervals at 10 locations in the zone.
 - ii) Natural enemies of insect-pests will also be recorded.
 - iii) Four places will be selected in a field and observations will be recorded from 5 plants from each place per location.

Data reporting:

- Data should be sent to Director, DRMR (director.drmr@gmail.com) on the prescribed data sheets latest by May 15, otherwise it will not be possible to include in the report
- Weather data with brief weather report should be supplied along with trial data.
- Yield data (kg/ha) should be sent after analysis. Unanalyzed data will not be included in the report.

Note:

- 1 Report should be submitted on time
- 2 As suggested by DG, ICAR, Pictures of different stages of the crop, trial conducted, insect damage and operation performed to be submitted from all the centers.

Problem faced by center PI with respect to conducting the AICRP-RM trials can be communicated to DRMR through official mail as and when they come across so needful can be done.

**XXXI Annual Group Meeting of AICRP Rapeseed-Mustard
August 20-22, 2024 at Khanapara Campus, AAU, Guwahati, Assam**

Session V Planning and Technical Programme Formulation: Plant Physiology & Biochemistry

Chairman & Subject expert	: Dr. Samindra Baishya, HOD (Biochemistry), AAU, Jorhat
Co-Chairman	: Dr. Priyanka Das, Prof Biochemistry, AAU, Jorhat
Rapporteurs	: Dr. Anubhuti Sharma, PS, ICAR-DRMR, Bharatpur : Dr. Pushp Sharma, Prof. Plant Physiology, PAU, Ludhiana

The technical session on Plant Physiology was chaired by Dr. Samindra Baishya, HOD (Biochemistry) and Co-Chaired by Dr. Priyanka Das, Prof Biochemistry, AAU, Jorhat. The rapporteurs of the technical session were Dr. Anubhuti Sharma, PS, ICAR-DRMR, Bharatpur and Dr. Pushp Sharma, Prof. Plant Physiology, PAU, Ludhiana. The detailed report of plant physiology experiments conducted by different centres during *rabi* 2023-24 was presented by me.

The major recommendations are

1. Oil content parameter should be incorporated in all field experiments.
2. A new trial 6.4 “Effect of biostimulants to mitigate drought stress” was formulated and volume of the foliar spray should be calculated and mentioned.
3. In trial 6.5 “Microbes for mitigating high temperature at terminal stage in mustard”, the microbial consortia I & II will be used instead of MF and PS.
4. Mandore centre should be added as voluntary center to conduct physiological trials.

The highlights of the program of Plant Physiology in 2023-24 were

1. Twenty five entries of AVT (*early sown*) along with promising strains of 2022-23 and checks (JD-6 and PM 25) were screened for high-temperature tolerance at the seedling stage under controlled laboratory and field condition. Results showed some promising genotypes PM28, PM25, DRMRCI 187, DRMRCI 188 with seedling mortality $\leq 30\%$ and DW/10 seedlings ≥ 40 mg but none of the genotypes were found tolerant under laboratory conditions. In field conditions, 20 out of 25 genotypes exhibited seedling mortality of $\leq 20\%$ at Bharatpur and Ludhiana centres. Genotypes which show high-temperature tolerance at seedling stage were DRMRCI 125, DRMRCI 165, PM 28, DRMRDR 2116, NRCHB 101, DRMR 1188, DRMR 19-35, DRMRSJ 272, DRMRDR 2133 with seedling mortality $\leq 20\%$; Dry matter ≥ 20.0 g and STI $\geq 85\%$ under field condition.
2. Twenty three entries of AVT (*rainfed*) along with promising strains of 2022-23 and checks were evaluated for drought tolerance under field conditions at Bharatpur, Dholi, Hisar and Ludhiana. Results revealed significant genotypic differences for RWC, CT, photosynthetic pigments, SPAD values, yield attributes and seed yield. Genotypes DRMRCI 163, NPJ 214 with seed yield reduction $\leq 20\%$, DSI ≤ 0.5 and YSI ≥ 0.9 rating highly tolerant to drought. Some promising genotypes for tolerant to drought were RB 113, DRMRDR 2141, DRMRCI 148 and DRMR 2019-19.
3. Nineteen entries of AVT (*late sown*) along with promising strains of 2022-23 and checks were tested in the field at two dates *i.e.* normal sowing (NS) in the third week of October and late sown in the last week of November (LS). The genotypes x environment (GxE) interaction effects were significant for MSI and seeds/siliquea at Dholi and Ludhiana centres, for 1000 seed weight at Hisar and Ludhiana, for seed yield at Dholi, Hisar and Ludhiana centres. Genotype DRMR 2018-1, DRMRDR 2195 showed tolerance to terminal heat stress with seed yield reduction $\leq 20\%$, HSI ≤ 0.5 and YSI ≥ 0.8 .
4. The local varieties DRMR 1165-40 (Bharatpur), RH 725 (Hisar), and PBR 97 (Ludhiana) were selected to evaluate the efficacy of these growth-regulating substances. Two foliar sprays of trehalose @ 10 and 20 mM, urea @ 1% and 2%, and potassium nitrate @ 1% and 2%. The PGRs proved effective in enhancing yield by positively impacting several factors, including RWC, photosynthetic pigments, CSI, SMS, total siliqueae per plant, seeds per siliquea and 1000-seed weight. Foliar

application of potassium nitrate @ 2% led to maximum seed yield and B:C ratio at Bharatpur and Hisar; and application of trehalose @ 20 mM at Ludhiana center.

5. Evaluate the efficacy of stress-adaptive consortium Pusa Sanjeevni (IARI, New Delhi) and a microbial formulation (CSIR-Lucknow) in three mustard varieties across Bharatpur, Dholi, Hisar and Ludhiana centre. Results showed that both microbial inoculations positively influenced RWC and MS under both normal and late-sown conditions at all four centers. CT was lower in late-sown inoculated conditions in all three varieties at Hisar and Ludhiana centers. Chlorophyll a and total chlorophyll content improved with microbial inoculations in normal and late-sown conditions at Bharatpur, Dholi and Ludhiana centers. Total siliquae per plant and 1000-seed weight increased when using the microbes in the three varieties at Bharatpur, Dholi and Ludhiana centers. Both inoculations led to improved biological yield and seed yield under normal and late-sown conditions across all four locations.
6. Two recommendations based on 4 years data of trials:
 - a) Recommendations based on 4 years data of “Effect PGRs to mitigate drought stress” in mustard trial at Bharatpur, Hisar and Ludhiana centre. Result shows foliar sprays of potassium nitrate @ 2% at initiation of flowering and 50% flowering stage led to maximum seed yield and biological yield with higher B:C ratio. The PGRs also effective in enhancing various attributes *i.e.* RWC, LWR, CSI, photosynthetic pigments, SMS, total siliquae per plant, seeds per siliqua and 1000-seed weight.
 - b) Recommendations based on 4 years data of “Microbes for mitigating high temperature at terminal stage in mustard” trial at Bharatpur, Dholi, Hisar and Ludhiana centre. Result revealed microbial formulation (MFs) led to improved seed yield and biological yield under normal and late-sown conditions. Microbial formulation also positively influenced MS, CT and 1000-seed weight.

Technical Programme Plant Physiology

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

Entries of IVT/AVT (early/germplasm) along with promising strains of 2023-24: DRMRCI 187, DRMRCI 188, DRMRCI 125, DRMRCI 165, DRMRDR 2116, DRMR 19-35, DRMRSJ 272, DRMRDR 2133, KMR (E) 24-1, KMR (E) 24-2, RH 1999-18, RH 2399-2, PRE-2022-6, PRE-2022-12, DRMRHT-13-2, DRMRHT-22125, NPJ 274, NPJ 275, DRMRCI-206, NJI24-401, Kesari 5113, HUJM(E)-23-7, DRMR 20-33, DRMR 19-36, DRMR 2019-7, DRMRDR 2198, 4205B296-01, KMR(E) 23-1, KMR(E) 22-2@, DRMRHT 18-65, NRCHB 101 Checks: PM 25 (NC), JD 6 (ZC), GDM 4 (LR), Pro 5111 (hy. check)

Methodology:

Controlled condition (Laboratory)

1. Take 5 kg soil in plastic trays and add water to bring it to field capacity.
2. Sow the seeds in rows and place the tray in seed germinator at $25\pm 1^{\circ}\text{C}$ for germination.
3. After 4-5 days (when the seedlings have about 2.5 cm height), the seedling should be exposed to high temperature ($45\pm 1^{\circ}\text{C}$) with 30-40% relative humidity for 4 hours daily for 4 days.
4. Maintain uniform soil moisture level.

Observations: Seedling mortality, dry weight (10 seedlings)

Field condition

1. Sowing should be done around 20-25 September.
2. Plot will be irrigated prior to the sowing (Only pre-sowing irrigation).
3. 100 count seeds will be sown in 2 m row length.
4. Experiment will be continued for 30 days.

Observations: Soil moisture at depth of 0-15cm (at the time of seeding, 10, 20 and 30 DAS), ambient temperature, daily soil temperature, seedling mortality, dry weight (10 seedlings), canopy temperature, membrane stability, seedling thermo tolerance index (STI) and seed to seedling thermotolerance index (SSTI).

Design: CRD (Lab.)/RCBD (Field), **Replication:** 3

Centers: Bharatpur, Hisar, Ludhiana and Mandore

6.2 Screening of genotypes for drought tolerance

Entries of IVT/AVT (rainfed/germplasm) along with promising strains identified during 2023-24: DRMRCI 163, DRMRDR 2141, DRMRCI 148, DRMR 2019-19, DRMRSJ 276, DRMRCI 161, DRMRDR 2135, DRMR 2020-3, DRMR 2019-16, DRMRCI 196, DRMRIJ-138, DRMRHT-2090, NPJ 280, NPJ 281, RH 2265, RH 2299-64, RGN 599, CAURM 4-1S, RKM 588, RMM 19-06, HUJM-23-1, RAURD 14-18, BAUM-13-6, DRMRCI 207, DRMR 21-17, DRMR 19-21, DRMR 2019-7 Checks: Kranti (NC), RH 725, RH 1424 and RGN-229

Methodology:

1. Sowing will be done in 5 rows each of 2.5 m row length.
2. Surface irrigation (5-6 cm) will be done prior to the sowing.
3. In irrigated condition, two irrigations will be given, first at 35 and second at 65 DAS while *rainfed* set be grown without irrigation.

Design: RBD, **Replication:** 3

Observations : Soil moisture (0-30, 30-60 cm) at the time of seeding, before 2nd irrigation and maturity, field capacity, rainfall, SPAD value, chlorophyll content, RWC, CT, 1000 seed weight, siliquae on main shoot (SMS) , seeds/siliqua, biological yield (kg/ha), seed yield (kg/ha), harvest index, oil content, yield stability index (YSI) and drought susceptibility index (DSI).

Centers: Bharatpur, Dholi, Hisar, Ludhiana and Mandore

6.3 Screening of genotypes for high temperature tolerance at terminal stage

Entries of IVT/AVT (late sown/germplasm) along with promising strains from 2023-24: DRMRDR 2195, DRMR 2017-27, DRMR 2022-16, DRMRDR 2141, DRMRIJ 22-2, RH 2370, RH 2374, KMR (L) 24-5, KMR (L) 24-6, NPJ 276, NPJ 277, Pusa MH 218, TM132-1, PRL-2022-1, PRL-2022-5, HUJM-23-4, RGN 592, SVJH-78, ORM 2019-30, RKM 599, RMWR 19-01, NPJ 267, NPJ 268, DRMR 2018-1, DRMRCI 212, DRMR 2019-19 Check: Radhika, PM26, BPM-11, DRMR150-35 and NRCHB 101

Methodology: Two rows of each genotype will be sown at optimum date of sowing and one month thereafter as late sown.

Plot Size: 5.0 x 0.6m, Spacing: 30 x 10 cm

Design: RBD, **Replication:** 3

Observations: Ambient temperature (from flowering to maturity), canopy temperature, canopy temperature depression (CTD), membrane stability index, number of seeds/siliqua, 1000 seed weight, seed yield (kg/ha), oil content (%), heat stability index (HSI) and yield stability index (YSI).

Centers: Bharatpur, Dholi, Hisar, Ludhiana and Mandore

6.4 Effect of biostimulants to mitigate drought stress

Methodology

1. Latest released local variety for *rainfed* condition.
2. *Rainfed* variety will be sown in 5 rows each of 5 m row length.
3. Treatments:
 - Sodium thiosulphate (Na₂S₂O₃) – 3 mM and 5 mM
 - Seaweed extract – 3ml/L and 5ml/L
 - Orthosilic Acid – 3ml/L and 5 ml/L
 - Water spray

➤ Control (No spray)

4. Foliar sprays at initiation of flowering and at 50% flowering with the spray volume of 350 lit/ha

Design: RBD, **Replication:** 3

Observations: Photosynthetic pigments in 3rd or 4th leaf on main shoot (chl a, chl b, total chl and carotenoids), RWC, Moisture Content, LWR, Number of branches, siliquae on main shoot (SMS), total siliquae/plant, number of seeds/siliqua, 1000 seed weight, biomass (kg/ha), seed yield (kg/ha), oil content (%) and B:C ratio.

Centers: Bharatpur, Dholi, Hisar, Ludhiana and Mandore

6.5 Microbes for mitigating heat stress at terminal stage in mustard

Methodology:

1. Sowing will be done in 5 rows each of 3m row length at optimum date of sowing and one month thereafter as late sown.

2. Microbial cultures will be applied as seed dressing before sowing

3. Treatments:

➤ Without culture

➤ Microbial consortium - I (NBAIM, Mau)

➤ Microbial consortium - II (NBRI, Lucknow)

4. Varieties: RH 1975, BPM 1825 and PBR 357

Design: SPD, **Replication:** 3

Observations: Soil microbial counts before and after sowing, ambient temperature (from flowering to maturity), photosynthetic pigments (chl a, chl b, total chl and carotenoids), canopy temperature, canopy temperature depression, membrane stability, RWC, total siliquae/plant, 1000 seed weight, biomass (kg/ha), seed yield (kg/ha) and oil content (%).

Centres: Bharatpur, Dholi, Hisar, Ludhiana and Mandore

Seed Supply:

✧ Seed material of rest of the trials should be sent latest by 30th August. In case of late receipt of seed material, it will not be included in the trials.

✧ 250 g seed for each trial should be sent.

Data reporting:

✧ Data should be sent to Director, DRMR (director.drmr@gmail.com) on the prescribed data sheets latest by May 15, otherwise it will not be possible to include in the report.

✧ Data should be sent after analysis. Unanalysed data will not be included in Annual Report.

Technical programme (Biochemistry)

7.1 Evaluation of important breeding materials for Nutritional Quality Index (NQI) of oil.

Parameters:

➤ Oil content,

➤ Fatty acid profiling (palmitic, stearic, oleic, linoleic, linolenic, eicosenoic and erucic acid),

➤ ω6/ ω3 ration,

➤ oil stability index,

➤ SFA: MUFA: PUFA,

➤ saturated and unsaturated fatty acid ratio

Centres: Bharatpur, Ludhiana, Hisar, Pantnagar, Chatha, BHU

PM 30 and PDZM 1 (quality checks)

7.2 Screening seed meal of promising breeding materials for value addition

Parameters:

Protein content, beta carotene content, total antioxidant content, total sinapine content

Centres: Bharatpur, Ludhiana, Hisar, Pantnagar, Chatha, BHU

PM 30 and PDZM 1 (quality checks)

Glucosinolate profiling (HPLC/UPLC)

Centres: Bharatpur, Ludhiana

7.3 Screening of anti-nutritional factors in quality breeding material

Parameters:

Total glucosinolates, phytic acid

Centres: Bharatpur, Ludhiana, Hisar, Pantnagar, Chatha, BHU

PM 30 and PDZM 1 (quality checks)

Recommendations

- ❖ Maximum entries to be tested should not be more than 30 with minimum 50g seed weight.
- ❖ All the centers should follow the same protocols for all the experiments.
- ❖ Each center should send statistically (CV/SD/SE) analyzed report and the data in triplicate.
- ❖ CV should not be more than five, otherwise data may not be considered.
- ❖ Seeds sent for analysis should be free from sediments, particles and dust.
- ❖ Promising entries should be repeated for three consecutive years.
- ❖ Due credit should be given to biochemist in varietal development program at respective centers.
- ❖ Publication should be made on evaluated varieties/germplasm under biochemical trials.
- ❖ Data should be summarized on the basis of oil and meal quality.

**XXXI Annual Group Meeting of AICRP Rapeseed-Mustard
August 20-22, 2024 at AAU, Guwahati, Assam**

Session VI

: Breeder Seed Production

Chairman & Subject Expert	: Dr. Sanjay Kumar, Director, IISS Mau
Co-Chairman	: Dr. Sanjeev Gupta, ADG (OP), ICAR, New Delhi
Rapporteur	: Dr. Arun Kumar, PS, ICAR-DRMR, Bharatpur : Dr. H S Meena, PS, ICAR-DRMR, Bharatpur

The session was started with the introductory remarks by the Chairman followed by presentation of the detailed report on breeder seed production for the year 2023-24 by Dr. B. L. Meena, Sr. Scientist, ICAR-DRMR. He informed that an indent of 172.21 quintals of breeder seed of 83 varieties of rapeseed-mustard was received from Department of Agriculture and Cooperation (DAC), Ministry of Agriculture and Farmers Welfare, Govt of India for the year 2023-24. Against the indent, 282.57 quintals breeder seed was produced, indicating a surplus of 110.36 quintals. Breeder seed of 03 varieties Narendra Rai, TBM-143 and TBM-204 of Indian mustard was not produced. Further, he informed the shortage in breeder seed production of AAU TS 38, Jeuti (JT 90-1), Tapeshwari and Agrani (B-54) of toria, Jhumka and Anushka of yellow sarson. In addition, 34.14 q breeder seed of 22 varieties of Indian mustard was also reported from six centres. He presented an account of the percent contribution of recently notified (2015-2023) varieties in breeder seed production chain as well as crop wise contribution of Breeder seed indent received during 2023-24. Dr. Sanjay Kumar expressed deep concern on deficit breeder seed production of certain varieties and suggested the concern breeder/centre to take strict measures in future. Concern breeder/centre should purify the varieties TBM 143 and TBM 204 and their future breeder seed indent should be placed after purification of these varieties. Further, chairman and co-chairman suggested that the focus should be on increase in breeder seed indent of recently released varieties. The Chairman, in his concluding remarks, appreciated the status of breeder seed production in the country. The session was ended with the vote of thanks to the Chair.

**XXXI Annual Group Meeting of AICRP Rapeseed-Mustard
August 20-21, 202 at Guwahati, Assam**

Session VII : Transfer of Technology

Chairman : Dr. Sanjeev Gupta, ADG (O&P), ICAR, New Delhi
Co-Chairman : Dr. S.K. Jha, Pr. Scientist, ICAR, New Delhi
Rapporteurs : Dr. Ashok Kumar Sharma, Pr. Scientist, ICAR-DRMR, Bharatpur
: Dr. Sushil Sharma, Sr. Scientist-cum-Head, KVK, Bansur, Alwar, Raj.

After brief introductory remarks from chairman and co-chairman about the importance of frontline demonstrations for scientists in technology dissemination, its impact on popularization of new varieties and technologies, Dr. Ashok Kumar Sharma, Pr. Scientist, (Ag Extension), ICAR-DRMR, Bharatpur presented the annual report of frontline demonstrations (FLDs) on rapeseed-mustard conducted during 2023-24. He informed the house that 933 frontline demonstrations (FLDs) were conducted in 64 districts across 16 states during 2023-24 through 25 cooperating centres of AICRPRM/ ICAR institutes/ Ag. Universities 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, Government of India. The maximum FLDs were conducted in Uttar Pradesh (136) followed by Rajasthan (120), Assam (111) and Jharkhand (94).

The maximum average yield of 2,068 kg/ha from the IP under irrigated condition was in Punjab followed by 1,920 kg/ha in Uttar Pradesh; 1,892 kg/ha in West Bengal; 1,868 kg/ha in Rajasthan; 1,603 kg/ha in Uttarakhand; 1,532 kg/ha in J&K; 1,493 kg/ha in Odisha; 1,458 kg/ha in Bihar; 1,383 kg/ha in Himachal Pradesh; 1,358 kg/ha in Madhya Pradesh; 1,335 kg/ha in Assam and 862 kg/ha in Maharashtra. The maximum yield gap of 66.52% was recorded in Jammu & Kashmir followed by 61.23% in Assam; 57.65% in Odisha; 46.68% in Bihar; 39% in Himachal Pradesh; 34.92% in Uttar Pradesh; 26.3% in West Bengal; 23.85% in Maharashtra; 15.15% in Uttarakhand; 15.08% in Madhya Pradesh; 13.76% in Rajasthan and 5.24% in Punjab. The cost of cultivation ranged from Rs. 19,300/ha in Maharashtra to Rs. 47,702 /ha in Uttar Pradesh in IP under irrigated Whole package demonstrations.

The maximum average yield of 1,510 kg/ha from the IP of WP demonstrations under rainfed conditions was in Jammu & Kashmir followed by 1,391 kg/ha in Jharkhand; 1,238 kg/ha in Himachal Pradesh; 1,177 kg/ha in Rajasthan; 813 kg/ha in Manipur and 795 kg/ha in Assam. The maximum yield gap of 70.46% was recorded in Jharkhand followed by 64.4% in Jammu & Kashmir; 33.49% in Manipur; 33.40% in Himachal Pradesh; 21% in Rajasthan and 19% in Assam. The cost of cultivation ranged from Rs. 10,451/ha in Rajasthan to Rs 25,516/ha in Assam in IP under rainfed Whole package demonstrations.

A total of 90 FLDs with 09 component technologies for Indian Mustard were carried out by different centres. Among the components, Sclerotinia stem rot demonstrated by Hisar centre had maximum average yield of 2,689 kg/ha.

The chairman and delegates appreciated the work done and presentation of results. **After in depth discussion the following suggestions emerged.**

1. Yield gap analysis based on last five year FLDs data need to be documented.
2. All centres shall ensure mandatory soil health testing for all demonstration plots, with progress updates required on the Soil Health portal and the utilization of Krishi Mapper for comprehensive documentation of spatial and non-spatial data related to demonstration plots and crop cultivation. This includes yield metrics and integration of farmer demographic information through the FLD option on the Krishi Mapper platform. The services of Krishi Sakhi can be hired for this activity as per the guidelines in vogue.
3. Institutes shall involve concerned KVKS and representatives from State Departments of Agriculture/CDDs in both the implementation and monitoring of the FLD program.
4. Emphasis should be given on demonstration of single component technology on the basis of yield gap identified by the respective centers and details of the technology to be demonstrated should be clearly documented by each centre.
5. Provision of TA/PoL for effective implementation and monitoring of FLDs be made.
6. The FLDs can also be organized through SHGs/FPOs/NGOs, where ever needed, to reach new niche with the prior approval of Director, ICAR-DRMR.
7. All the guidelines of FLDs should be followed strictly by all centres

The session ended with vote of thanks to chair.

Frontline Demonstrations on Rapeseed-Mustard 2024-25

Guidelines for conducting frontline demonstrations

1. Each implementing centre will conduct the FLDs as per the allotment list given along with the technical programme.

2. All centres shall ensure mandatory soil health testing for all demonstration plots, with progress updates required on the Soil Health portal. Fertilizer inputs will be provided to farmers under FLDs on the basis of Soil health card. The chemical fertilizers/ pesticides under FLDs should only be given by identifying the gaps in adoption. Growth promoters, Micro nutrients, etc can also be given.
3. Institutes shall ensure the utilization of Krishi Mapper for comprehensive documentation of spatial and non-spatial data related to demonstration plots and crop cultivation. This includes yield metrics and integration of farmer demographic information through the FLD option on the Krishi Mapper platform. The services of Krishi Sakhi can be hired for this activity as per the guidelines in vogue.
4. Institutes shall involve concerned KVKS and representatives from State Departments of Agriculture/CDDs in both the implementation and monitoring of the FLD program.
5. Institute shall submit crop-wise and institute-wise details of beneficiary farmers covered, technologies to be demonstrated under FLDs, periodic reports, and yield gap analysis after crop harvesting as per the prescribed format.
6. Institutes shall give preference to Seed Hubs, established for various oilseed crops, for purchasing seeds. In case seeds are unavailable at the seed hub, institutes may obtain a certificate from the Seed Hub and procure seeds from outside sources.
7. Institutes shall restrict to only public sector varieties for conducting FLDs. New varieties less than 5 year old may be preferred under FLDs and ensure that in any circumstances, varieties more than 10 years old shall not be allowed.
8. Institutes shall preferably use digital crop estimation surveys using the DGCES mobile application under GCES wherever feasible replacing traditional manual processes.
9. Emphasis should be given to component technology demonstrations including INP and IPM. For organizing FLDs, adopt adjoining villages of a panchayat (Cluster approach) preferably 2-3 village in one district only to show the impact and carry out PRA for identifying the critical factor for low productivity. A group of multidisciplinary scientists, instead of one scientist should be involved in FLDs programme.
10. One FLD is for one acre plot only. Funds for conducting FLDs will be Rs. 2400.0 for an area of one acre (one FLD). No farmer should be allotted more than one FLD.
11. The binding of one acre area for one demonstration may not be observed, where holdings areas are too small. In these areas, one FLD (one acre area) can be divided in 2-3 farmers as per land holdings available.
12. Unspent balance of previous years may be utilized but subject to revalidation by ICAR-DRMR.
13. In the report, specifically mention the rainfed and irrigated situation and also the normal and late sown conditions under which FLDs are actually conducted.
14. The improved varieties recommended for a particular zone should also be tested against the local variety. At least 50 per cent of recently released varieties of the zone must be included in FLDs by each centre other than its own centers.
15. The in-charge of the implementing centre should indent the requisite quantity of the varieties to the concerned centres/ breeders well before the start of the season.
16. The total cost of cultivation for improved plot (IP) and farmers' plot (FP) per ha should be reported including all input, labour and miscellaneous cost separately and ensure that they vary from each other only on the technology being tested (whole package, component, cropping system as the case may be).
17. The package of practices should be improved / recommended for the concerned zone. Technology used in FLDs should be clear and thoroughly described along with complete package in the report
18. Each centre must work out the economics of the FLDs and report the B:C ratio for the improved plot (IP) and farmer's plot (FP) for each demonstration instead of IBCR value.
19. Document farmers' practices and the prevailing ITK during PRA and send the same along with the preliminary report to the Director, DRMR within one month after the sowing.
20. The impact of new technology should be discussed during scientist-farmer interaction, training and field visit / kisan diwas / kisan mela, etc in the village. Photography and videography of the FLD activities must be done and send good photographs to DRMR, Bharatpur for record.
21. The centres should send the preliminary report pertaining to the name of farmer, location along with date of sowing and technology demonstrated to the Director, ICAR-DRMR, Director Agriculture of the respective state/ICAR institutes/DAC&FW/ the district level extension agency and NGOs, for proper

monitoring, strengthening the linkages and also extending learning experiences to relatively large population of farmers.

22. The final data book for individual farmer, as supplied by the ICAR-DRMR, must be sent to ICAR-DRMR, Bharatpur along with the summary sheet of results latest by April 30, 2025.
23. Every center should send the list of selected farmers for the FLDs for the release of 50% budget as an advance. After receiving the audit utilization certificate of the previous season, rest 50% budget would be released.
24. Reservation for SC and ST community must be followed in selecting beneficiary farmers for conducting FLDs as per norms.
25. Every centre will do the geo tagging of all FLDs as per the guideline of DAC&FW, Govt. of India

Zone wise improved varieties recommended for FLDs on rapeseed-mustard (2024-25)

Zone-I: Kangra, Chatha, Pantnagar, Bajaura, Dhaulakuan, Una, Khudwani

Indian mustard: Pant Rai 20, Pant rai 21, RSPA 69

Brown sarson: Shalimar Sarson-2, Shalimar Sarson-3

Ghobhi Sarson: GSC-7, AKMS 8141, GSH 1699 (hybrid), Him Palam Gobhi Sarson 2

Yellow Sarson: Pant Pilli Sarson 1, Pant Sweta, Pant Girja

Zone -II: Abohar, Bawal, Ludhiana, Hisar, Sriganaganagar, New Delhi, Modipuram, Navgaon

Indian Mustard:

Irrigated Timely Sown: RH 1975, PBR 357

Rainfed: RH 1424, RH 406, GDM 5, PBR 378, RH 725, RH 761, DRMR 1165-40.

Late Sown irrigated: Brajraj, Radhika, RVM 2 (Raj Vijay Mustard 2), RGN 236.

Quality: RLC 3, Pusa mustard 31 (Double zero), PM 32, PM 33, RCH 1 (hybrid), PDZ 11 (Double Zero), PM 34

Salinity/Alkalinity: CS 58, CS 60, CS 64

Gobhi Sarson: RSPN 25, AKMS 8141, GSH 1699, Him Palam Gobhi Sarson 2

Zone-III: Kanpur, Morena, Kota, Jhansi, Banda, Bharatpur, Jaipur (RARI), Tikamgarh Pantnagar and Dholi,

Indian Mustard:

Irrigated Timely Sown: RH 1975, Surekha, Azad Mahak

Rainfed: RH 725, DRMR 1165-40

Quality: PDZM 35, PDZM 36

Late sown: BPM 11

Yellow Sarson: Pant Pilli Sarson 1, Pant Sweta, Pant Girja

Toria: Tapeswari, Azad Chetna

Taramira: RTM 1351, RTM 1355, RTM 1624

Zone-IV: S.K. Nagar, Nagpur, Jalgaon, Mandore, ARS Washim (COA, Nagpur), Pali, Jobner

Indian Mustard: GDM 4, GM 6

Taramira: RTM 1351, RTM 1355, RTM 1624

Zone-V: Kanke, Shillongani, Kalyani, Dholi, Varanashi

Indian Mustard: DRMR 150-35, TBM 204

Yellow Sarson: Pant Sweta, Sancheta, Anushka

Toria: TS 38

Zone-V: Imphal, Pasighat, Tripura (COA), Medziphema (Nagaland), Bermiok (Sikkim)

Indian Mustard: DRMR 150-35

Yellow Sarson: Pitambari, YSH 401, Pant Sweta,

Toria: TS 38, Tripura Toria 1

Zone-V: Jagdalpur, Bhubaneswar(Ranital), Kanker, Bilaspur, Ambikapur

Indian Mustard: DRMR 150-35

Yellow Sarson: Pitambari, YSH 401, Pant Sweta,

Toria: TS 38

Centre wise allotment of FLDs on rapeseed-mustard for 2024-25

S.No	Zone/Centre	Allotment
Zone I		
1.	Kangra	100
2.	Jammu	200
3.	Khudwani	100
4.	Hisar	100
5.	Bawal	100
6.	Sriganganagar	100
7.	Ludhiana	100
8.	Abhor	100
9.	RVSKVV, Morena	500
10.	RLBCAU, Jhansi	400
11.	BUAT, Banda (Uttar Pradesh)	400
12.	Kota	300
13.	Pantnagar	100
14.	Kanpur	400
15.	Varanasi	200
16.	Dholi	100
17.	Jobner	100
18.	Jodhpur	200
19.	Nagpur	400
20.	S.K. Nagar	100
21.	Bhubaneshwar	200
22.	Shillongai	200
23.	Kalyani	200
24.	Kanke	200
25.	Jagdapur, Chattisgargh	200
26.	CAU, Imphal	400
27.	DR, AAU, Assam	300
28.	RARS, Jagtial, PJTSAU	100
29.	ICAR-DRMR	600
30.	FPOs/FPC	3500
	Grand total	10000

**XXXI Annual Group Meeting of AICRP Rapeseed-Mustard
August 20-21, 202 at Guwahati, Assam**

Session VIII: Brain Storming Session on Current status of Rapeseed- Mustard cultivation in eastern and north eastern region and way forward.

Chairman	: Dr. Sanjeev Gupta, ADG (O&P), ICAR, New Delhi
Co-Chairman	: Dr. S.R. Bhatt, Former Professor, ICAR, New Delhi
	: Dr. G. N. Hazarika, Former Director Research, AAU
Rapporteurs	: Dr. Sushil Kumar Sharma, Pr. Scientist-cum-Head, KVK, Bansur, Alwar.
	: Dr. Ashok Kumar Sharma, Pr. Scientist, ICAR-DRMR, Bharatpur

The session was started with brief introductory remarks of chairman and co-chairman about the scenario of rapeseed-mustard cultivation, its area, probability of expansion and limitations in eastern and north eastern region of the country. Dr. Ashok Kumar Sharma, Pr. Scientist, (Ag Extension), ICAR-DRMR, Bharatpur presented a detailed report on status of rapeseed-mustard cultivation in eastern and north eastern region. He informed the house that rice cultivation is predominant in the region and due to late harvesting of the rice, there is a short period about 90-105 days for mustard cultivation in NE region, therefore it is required to focus on development of short duration varieties of Indian mustard or toria. He also mentioned that in 15 districts of Assam, the average yield was increased from 6.47 q/ha to 7.85 q/ha during 2020-21 to 2022-23 due to the efforts of ICAR- DRMR under APART project.

Dr. Ranjana Chakrabarty Sr. Scientist, AAU-ZRS, Shillongani, AAU, Assam presented a report on status of rapeseed-mustard cultivation in Assam state. She quoted that the state is contributing 4 per cent area of Rapeseed-Mustard which is 70 percent of NE region and contributing 2 per cent in national production. She also reported that the TS 38 Variety of toria contributed 10.5, 34.7 and 22 per cent area, production and productivity, respectively in Assam state. The report also revealed that PM 28 variety of Mustard gave 1750 kg/ha yield in Dhubri district in 2023-24 and it was 15.2 per cent higher over TS 38 variety of toria.

Another presentation was made by Dr. Pushp Rani, Scientist CAU Imphal, Manipur on mustard cultivation. She reported that there was an opportunity of zero tillage, no pre sowing irrigation requirement and no land preparation required for mustard cultivation in Manipur state.

The chairman and delegates appreciated the presentations on current status and future strategies of rapeseed-mustard cultivation in NE region. After in depth discussion the following suggestions emerged.

1. To enhance the area and production of oilseed crops in NE region, the best opportunity is Rice fallow land which is 11.5 million hectare and Lentil & Mustard both may be important for this region.
2. For mustard cultivation, there is urgent requirement of appropriate varieties, tillage equipment, fertility management, especially for acidic soils.
3. Keeping in view of short duration of toria crop and its suitability in agro climatic condition in NE condition, A concerted effort is needed for breeding program on toria crop by ICAR DRMR along with one or two coordinating center.
4. The DRMR must work on moisture regime, post emergence weedicide and also work on disease panorama in rice fallow with microbial condition. (Use of NPK consortium).
5. Considering the competitive crops viz. Maize, Potato, Pumpkin etc., scientists should conduct demonstrations on Good Agricultural Practices (GAP) viz. seed rate, line sowing, use of balance fertilizers, plant protection measures, etc.
6. For double cropped area, timely sowing of mustard/toria after sali paddy is a challenge as farmers mostly grow long duration paddy varieties. Initiative for popularization of medium duration paddy varieties. would be an ideal step in this direction. Large number of demonstrations of medium duration paddy varieties followed by mustard/pulses/potato/vegetable (as per suitability) in the same plot in cropping system mode appears to be the right approach to solve the problem. It would help expansion of area under mustard/ toria.
7. Regular programs of demonstrations/ trainings will create confidence among farmers to take up rapeseed-mustard cultivation in rice fallow.
8. Mustard cultivation requires fine tilt soil for good growth. Proper field preparation without losing conserved moisture after paddy harvesting requires proper mechanization like use of rotavator, etc.
9. Promotion of mechanization for land preparation for good crop establishment and threshing to reduce the losses due to manual threshing.
10. Demonstration of value chain through establishment of small oil expellers at community level to develop confidence among the farmers in order to make the rapeseed-mustard cultivation sustainable and more remunerative.

**XXXI Annual Group Meeting of AICRP Rapeseed-Mustard
August 20-22, 2024 at AAU, Khanapara, Assam**

Session IX : Plenary Session

Chairman : Dr. Sanjeev Gupta, ADG (O&P), ICAR, New Delhi

Co-Chairman: Dr. S.R. Bhatt, Former Professor, ICAR-NRCPB, New Delhi

Convener : Dr. P.K. Rai, Director, ICAR-DRMR, Bharatpur

Rapporteurs : Dr. V.V. Singh, Principal Scientist, ICAR-DRMR, Bharatpur
: Dr. S.K. Rai, Prof. SKUAS&T- Jammu

The session started with welcome and remark by Dr. P.K. Rai, Director, ICAR-DRMR, Bharatpur. The recommendations of each technical session were presented by respective Principal Investigators. Dr. V.V. Singh, presented recommendations of Plant Breeding session. Dr. R.S. Jat presented the highlights of Agronomy session. Dr. P.D. Meena presented the highlights of Plant Pathology session and Dr. Sarwan Kumar presented highlights of Entomology session. The highlights of Plant Biochemistry session were presented by Dr. Anubhuti Sharma; highlights of Breeder Seed production were presented by Dr. B.L. Meena, Plant Physiology session by Dr. L.K. Meena and FLDs by Dr. AK Sharma.

In plant breeding, Pantnagar centre was included for conducting IVT yellow sarson trial and last date for sowing toria trial is extended up to 10th October in Zone I.

Dr. P.K. Rai, Director, ICAR-DRMR presented the proceedings of VIC. He apprised that three hybrids and three varieties of Indian mustard and one variety of Gobhi sarson was identified by the varietal identification committee. He announced appreciation award to AAU, ZRS, Shillongani. Dr. Rai, congratulated and appreciated the efforts of the centres, and scientists whose varieties were identified and the centres received appreciation award.

Dr. Sanjeev Gupta, congratulated the group for identification of 07 varieties/hybrids of rapeseed-mustard. He thanked ICAR, Vice- Chancellor, Director Research AAU, Assam and Dr. P.K. Rai, Director, DRMR for organizing group meet.

Before the session, Dr. Mahak Singh, Professor, CSAUA&T, Kanpur; Dr. Virender Sardana, Pr. Pr. Agronomist, PAU, Ludhiana, Dr. P.K. Deb Choudhary, Pr. Scientist, AAU-ZRS, Shillongani were felicitated on the occasion of their superannuation.

The session ended with the vote of thanks by Dr. P.K. Rai, Director, ICAR-DRMR. He conveyed his regards to Dr. B.C. Deka, Vice Chancellor, AAU, Assam; Prof. Sanjay Kumar Chetia, Director Research, AAU, Jorhat and In-charge AAU-ZRS, Shillongani for hosting the 31th AGM at AAU, Khanapara, Assam. He expressed his sincere gratitude to Secretary, DARE, GoI & DG, ICAR, New Delhi, DDG (CS), ICAR, New Delhi, ADG (O&P), ADG (Seed), ICAR, New Delhi, for their constant encouragement, guidance and help to improve rapeseed-mustard research and development programme. He also thanked all the esteemed PIs, rapporteur, subject experts and all the delegates, press and electronic media and sponsoring agencies.