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# Proceedings

# 27<sup>th</sup> ANNUAL GROUP MEETING OF RAPESEED-MUSTARD RESEARCH WORKERS

# AUGUST 03-04, 2020

(USING VERTUAL PLATEFORM)



All India Coordinated Research Project on Rapeseed-Mustard (Indian Council of Agricultural Research)

> ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur, Rajasthan-321303

#### ICAR-DIRECTORATE OF RAPESEED-MUSTARD RESEARCH (ALL INDIA COORDINATED RESEARCH PROJECT ON RAPESEED-MUSTARD) 27<sup>th</sup> ANNUAL GROUP MEETING OF RAPESEED-MUSTARD RESEARCH WORKERS ONLINE

**Date:** AUGUST 03-04, 2020

#### AGENDA

Online Registration: From August 02-03, 2020

#### August 03,2020 Inaugural Program

10.00 hrs.	Welcome Address and presentation on Research Highlights of AICRP-RM (2019-20) and ATR	Dr. P.K. RAI, Director, ICAR-DRMR, Bharatpur
10.30 hrs.	Remarks by Chairman	Dr. T.R. Sharma, DDG (CS), ICAR, New Delhi
10.45 hrs.	Address by the Chief Guest	Dr. T. Mohapatra, Secretary DARE & DG, ICAR, New Delhi
11.15 hrs.	Vote of Thanks	Dr. P.K. RAI, Director, ICAR-DRMR, Bharatpur
Session 1	[ : PRESENTATION OF REPO	RTS (2019-20)
	Chairman and : Dr. S.F	R. Bhat, Former Professor, ICAR-BRCPB, New Delhi

Subject Expert		
Co-Chairman	: Dr. S. K. Jha, ADG (O&P), ICAR, New Delhi	
Convener	: Dr. P.K. RAI, Director, ICAR-DRMR, Bharatpur	
Rapporteurs	: Dr. H.K. Sharma, Scientist (SS), ICAR-DRMR, Bharatpur	
	Dr. Priyamedha, Scientist(SS), ICAR-DRMR, Bharatpur	
Participants	: All scientists of AICRP-RM, voluntary centers, private se	eed
	companies and invited Experts	

#### **Presentation of Results**

11.20-11.50 hrs.	Plant Breeding	:	Dr. K.H. Singh, PI, ICAR-DRMR, Bharatpur
11.50-12.10 hrs.	Agronomy	:	Dr. O.P. Premi, PI, ICAR-DRMR, Bharatpur
12.10-12.30 hrs.	Plant Physiology	:	Dr. Pushp Sharma, PI, PAU, Ludhiana
12.30-12.50 hrs.	Plant Pathology	:	Dr. P.D.Meena, PI, ICAR-DRMR, Bharatpur
12.50-13.10 hrs.	Entomology	:	Dr. (Ms.) Archana Anokhe, Scientist, ICAR-DRMR,
			Bharatpur
13.10-13.30 hrs.	Biochemistry	:	Dr. (Mrs.) Anubhuti Sharma, PI, ICAR-DRMR, Bharatpur

#### Session II PLANNING AND TECHNICAL PROGRAMME FORMULATON

# Agronomy & Front Line Demonstrations

	<sup>1</sup> Si onomy				
14.30-17.00 hrs.	Chairman & Subject	:	1. Dr. B.S. Mahapatra, Prof. GBPUA&T, Pantnagar		
	Experts		2. Dr. S.K. Jha, ADG (OP), ICAR, New Delhi		
	Presentation,	:	Dr. O.P. Premi, PI, Agronomy, ICAR-DRMR, Bharatpur		
	Discussion and				
	Finalization of				
	technical program for				
	2020-21				
	Presentation on FLDs	:	Dr. Ashok Kumar Sharma, PI, FLDs, ICAR-DRMR		
	results, Discussion		Bharatpur		
	and Finalization of				
	technical program for				
	2020-21				
	Rapporteurs	:	Dr. Ashok Kumar Sharma, PI, FLDs, ICAR-DRMR Bharatour		

	Dr. R.S. Jat, Principal Scientist, Agronomy, ICAR-DRMR,
	Bharatpur
	Dr. Rajiv Bharat, Jr. Scientist, Agronomy, SKUAS&T, Jammu
Participants :	All participants of AICRP-RM AGM

# Date: August 04, 2020

Session III	Plant Breeding	
9.30-11.30 hrs.	Chairman	: Dr. T. R. Sharma, DDG (CS), ICAR, New Delhi
	Co- Chairman	: Dr. D. K. Yadava, ADG (Seeds), ICAR, New Delhi
	Subject Expert	: Dr. S.S. Banga, National Professor, PAU, Ludhiana
	Convener	: Dr. P.K.RAI, Director, ICAR-DRMR, Bharatpur
	Presentation.	: Dr. K.H. Singh, PI, Plant Breeding, ICAR-DRMR, Bharatpur
	Discussion and	, , , , , , , , , , , , , , , , , , ,
	Finalization of	
	technical program for	
	2020-21	
11.30-12.30 hrs	Presentation on	: Dr. Bhagirath Ram, PI, Seed Project, ICAR-DRMR,
	Breeder seed	Bharatpur
	production	I.
	Rapporteurs	: Dr. V.V. Singh, Principal Scientist, ICAR-DRMR
		Prof. Kartikeva Srivastava, I.A.Sc., B.H.U.
	Participants	: All participants of AICRP-RM AGM
Session-IV	I I I I I	I I
11 30-12 30 hrs	Plant Pathology	
11.50 12.50 mb	Chairman & Subject	Dr. G.S. Saharan, Ex-Prof & Head, Plant Pathology, CCSHAU
	Fxpert	Hisar
	Presentation	· Dr PD Meena PI Plant Pathology ICAR-DRMR Bharathur
	Discussion and	
	Finalization of	
	technical program for	
	2020-21	
	Rapporteurs	· Dr. Pankai Sharma, Principal Scientist, ICAR-DRMR
	Rupporteurs	Bharathur
		Prof S S Vaish I A Sc BHI Varanasi
	Participants	· All participants of AICRP-RM AGM
	T articipants	
Session-V	Entomology	
12 30-13 30 hrs	Chairman & Subject Fx	nert
12.30-13.30 ms	Presentation	Dr Archana Anokhe PI Entomology ICAR-DRMR
	Discussion and	Bharatour
	Finalization of	Dharaipui
	technical program for	
	2020 21	
	2020-21 Rapporteurs	· Dr. Sarwan Kumar, Scientist, Entomology, PAU, Ludhiana
	Rapporteurs	Dr. Archana Anokhe PI Entomology ICAR-DRMR
		Bharathur
	Participants	· All participants of AICRP-RM AGM
	1 articipants	
Session-VI	<b>Biochemistry &amp; Plant F</b>	hysiology

13.30-14.15 hrs

Chairman & Subject	:	1. Dr. K.R. Koundal, Former Joint Director Research, ICAR-
Experts		IARI, New Delhi

	Presentation, Discussion and Finalization of technical program for 2020-21	:	<ol> <li>Dr. Maharaj Singh, Principal Scientist, IISR, Indore</li> <li>Dr. Anubhuti Sharma, PI, Biochemistry, ICAR-DRMR, Bharatpur (<b>Biochemistry</b>)</li> <li>Dr. Pushp Sharma, PI, Plant Physiology, PAU, Ludhiana (<b>Plant Physiology</b>)</li> </ol>
	Rapporteurs	:	<ol> <li>1.Dr. Anubhuti Sharma, PI, Biochemistry, ICAR-DRMR, Bharatpur</li> <li>2. Dr. Pushp Sharma, PI, Plant Physiology, PAU, Ludhiana</li> </ol>
	Participants	:	All participants of AICRP-RM AGM
Session-VII			
Varietal Identifica	tion		
15.00-16.00 hrs.	Chairman Members Member Secretary Resource person	::	Dr. T. R. Sharma, DDG (CS), ICAR, New Delhi To be nominated by DDG (CS), ICAR, New Delhi Dr. P.K.RAI, Director, ICAR-DRMR, Bharatpur Dr. K.H. Singh, PI, Plant Breeding, ICAR-DRMR, Bharatpur
16.20-16.30 hrs.	Remark by Co- chairman	:	Dr. S.K. Jha, ADG (OP), ICAR, New Delhi
16.30-16.50 hrs.	Remark by Chairman	:	Dr. T. R. Sharma, DDG (CS), ICAR, New Delhi
16.50-16.55 hrs.	Vote of thanks	:	Dr. P.K.RAI, Director, ICAR-DRMR, Bharatpur
Session-VIII Plenary session	Chairman Co-Chairman Rapporteurs	•	Dr. T. R. Sharma, DDG (CS), ICAR, New Delhi Dr. S.K. Jha, ADG (OP), ICAR, New Delhi Dr. Arun Kumar, Principal Scientist, ICAR, DRMR Dr. H.S. Meena, Senior Scientist, ICAR-DRMR
16.00-16.20 hrs.	Presentationofsummaryrecommendationhighlightsofthedifferenttechnicalsessionsbyrespective PIs	:	Dr. K.H. Singh; Dr. O.P. Premi; Dr. P.D. Meena; Dr. Archana Anokhe; Dr. Anubhuti Sharma;Dr. Pushp Sharma
16.20-16.30 hrs.	Remark by Co- chairman	:	Dr. S.K. Jha, ADG (OP), ICAR, New Delhi
16.30-16.50 hrs.	Remark by Chairman	:	Dr. T. R. Sharma, DDG (CS), ICAR, New Delhi
16.50-16.55 hrs.	Vote of thanks	:	Dr. P.K.RAI, Director, ICAR-DRMR, Bharatpur

# XXVII Annual Group Meeting of AICRP Rapeseed-Mustard August 03-04, 2020 at Online

Session: Inaugral

# Chairman: Dr. T. R. Sharma, DDG (Crop Science), ICAR, New DelhiChief Guest: Dr. T. Mohapatra, Secretary DARE, GoI & DG, ICAR, New DelhiRapporteur: Dr. H. K. Sharma, Scientist (SS) ICAR-DRMR, Bharatpur<br/>Dr. Priyamedha, Scientist (SS), ICAR-DRMR, Bharatpur

The inaugural session started with the welcome address and presentation by Dr. P. K. Rai, Director, ICAR-DRMR, Bharatpur. He welcomed Dr. T. Mohapatra, Honorable secretary DARE, Government of India & DG, ICAR, New Delhi, Dr. T. R. Sharma, DDG (Crop Science), ICAR, New Delhi, Dr. S.K. Jha, ADG (Oilseeds & Pulses), Dr. D. K. Yadava, ADG (Seed), ICAR, New Delhi, esteemed subject experts Prof. S. S. Banga, Dr. H. C. Sharma, Dr. K. R. Kaundal, Dr. S. R. Bhatt, Prof. G. S. Sahran, Dr. B. S. Mahapatra, and all the delegates from different AICRP-RM centres. Dr. Rai presented the research highlights of AICRP-RM programme along with national and international scenario of total area, production and yield of rapeseed-mustard. He threw light on the ongoing programmes and apprised that during 2019-20, 146 trials of different disciplines were conducted under AICRP-RM at different centers across all 6 zones.

Dr. T. R. Sharma, DDG (CS), ICAR, New Delhi and chairman of the inaugural session of Annual Group Meeting of AICRP-RM, emphasized on the need of germplasm evaluation for different traits including heat tolerance, earliness and diseases. He further suggested to strengthen the basic studies including pre-breeding, marker assisted selection, genome editing etc. at ICAR-DRMR and other centres. Further, he stressed upon identification of differentials for pathogens of white rust, Alternaria blight and stem rot. He emphasized that extensive efforts are needed for management of *Orobanche* parasite, which has become a major threat to the rapeseed-mustard crops. He said that there is need of collaborative work with other organization including NRCPB, Delhi University and PAU, Ludhiana etc.

Dr. T. Mohapatra, Honorable secretary DARE, Government of India & DG, ICAR, New Delhi, chief guest of the Annual Group Meeting of AICRP-RM in his address said that India is importing more than 50 percent of its total demand of edible oil, so the efforts are needed to reduce the yield gap and further enhance the yield potential of the rapeseed-mustard crop. He further emphasized that there is a need to identify the centres where the trials are rejected repeatedly. Also, centres should be given the responsibility to bridge the yield gap though transfer of technologies to the farmers. He added that AICRP centres of North-East regions should work for the area expansion of rapeseed-mustard. He also suggested that short duration varieties need to be developed for rice fellow areas, as well as, there should be improvement in inbreds for the development of productive hybrids. He emphasized that differentials should be identified for white rust and host-pathogen/parasite interaction need to be explored. He also suggested to do epidemiological studies for disease and insect-pest. He emphasized that there is need to use microbial consortia for improving the fertility of soil for rapeseed-mustard crops and as biocontrol agents against disease and insect-pest. He also said that there is need to develop standard operating procedure for precision screening and phenotyping for diseases, drought and heat. He further added that there should be strict monitoring of AICRP centres every month during crop season through video conferencing or photographs.

The session ended with the vote of thanks given by Dr. P. K. Rai, Director, ICAR-DRMR. He expressed his sincere gratitude to Dr. T. Mohapatra, Secretary, DARE, GoI & DG, ICAR, New Delhi for his constant encouragement, guidance and help to improve rapeseed-mustard research and development programme in the country. He gave his sincere thanks to Dr. T. R. Sharma, DDG (CS), ICAR, New Delhi for his guidance and chairing the inaugural session of the 27th AICRP-RM Annual Group Meeting. He also thanked Dr. S.K. Jha, ADG (OP), Dr. D. K. Yadava, ADG (Seed), ICAR, New Delhi, esteemed subject experts and all the delegates.

# XXVII Annual Group Meeting of AICRP Rapeseed-Mustard August 03-05, 2020 at Online

Session I	: Presentation of Reports
Chairman	: Dr. S. R. Bhat, Former Professor, ICAR-NRCPB, New Delhi
Co-chairman	: Dr. S. K. Jha, ADG (O&P), ICAR, New Delhi
Convener	: Dr. P.K. RAI, Director, ICAR-DRMR, Bharatpur
Rapporteurs	: Dr. H.K. Sharma, Scientist (SS) ICAR-DRMR, Bharatpur
	Dr. Priyamedha, Scientist (SS), ICAR-DRMR, Bharatpur

The session started with the presentations of progress reports of 2019-20 by respective PIs of different disciplines. Dr. K.H. Singh, PI, Plant Breeding & Genetics presented the highlights of the programme. A total of 7029 accessions were maintained through appropriate mating system. Thirty new accessions were collected and 790 accessions were evaluated. On the basis of germplasm evaluation promising donors were identified for different traits. With a view to improve seed yield, earliness, seed size, disease/pest resistance, high temperature tolerance, quality and high oil content, in total 933 crosses were attempted in Indian mustard along with 99 crosses in toria and 26 crosses in yellow sarson. A total of 645 advanced breeding lines including 56 of toria, 45 of yellow sarson and 467 of Indian mustard, 51 of gobhi sarson and 26 of karan rai were evaluated. A total of thirty-six experimental hybrids including 8 from DRMR, 12 from IARI, 9 from PAU, Ludhiana and 07 from Hisar were evaluated in three multilocation trials; early maturity group and medium to late maturity group, conducted at each of four centres. Eight hybrids were inducted in All India Coordinated Research Project for multilocation evaluation. Out of eight, 2 were evaluated in early mustard trial and remaining 6 in initial hybrid trial. Performance of 163 strains including 16 of toria, 129 of Indian mustard, 15 of gobhi sarson and 03 of taramira was tested in thirty-two performance evaluation trials consisting of toria (03), gobhi sarson (02), taramira (01) and Indian mustard (26) at 45 locations across the 6 agro-climatic zones of the country. On the basis of superiority for seed/ yield/ earliness/quality over the best check, 25 strains comprising taramira (01), gobhi sarson (05) and Indian mustard (19) were promoted for advanced stage evaluation.

Dr. O.P. Premi, PI, Agronomy presented highlights of the programme. Six experiments on various crop production aspects of rapeseed-mustard were conducted at 23 cooperating centres across 5 zones. In long term fertility experiments, on 9<sup>th</sup> year, significantly higher seed yield was recorded with the application of 150% NPK at all the locations except PNT. In agronomic evaluation of promising entries, toria entry TS 38 produced 8.2% and 21.7% higher seed yield than the best check at KLY and IMP. Under late sown condition, DRMRIC 16-38 recorded 7.4% more seed yield over the nearest check at CHT only. Brassica napus entry, AKMS 8141 gave significantly higher seed yield than the best check by 41.0% at BJR and 85.0% at LDH. The location-wise most productive cropping systems reported were; green gram-mustard at CHT and PNT, black gram-mustard at KPR and maizemustard at MOR. Raised bed planting method recorded maximum mustard seed yield at all the locations except MOR. Among different species, B. carinata at IARI, SKN and LDH; B. juncea at NAG and MOR; and B. napus at PNT recorded more seed yield. Among planting methods, transplanting found more suitable and recorded higher seed yield at IARI and PNT. Application of hydrogel 5 kg/ha at sowing time followed by foliar spray of salicylic acid 200 ppm at flowering and silique formation stages recorded highest seed yield at KDW, HSR, BAW, SGN, JOB, NAG, KNG, CHT, BND, KPR, KOT, VAR, SHL, BHU.

Dr. Pushp Sharma, PI, Plant Physiology reported that five experiments were conducted to evaluate mustard genotypes in different agro-climatic zones to abiotic stresses while sixth experiment was conducted at three locations to test efficacy of PGR's under rainfed condition. Thirty genotypes of Indian mustard were tested for high temperature tolerance at seedling stage both under field and laboratory conditions. Seedling mortality  $\leq 20\%$  and DW/10 seedlings  $\geq 40$ mg rated genotypes tolerant under controlled conditions. Genotypes JD 6(ZC), PM 25 (NC) , DRMRHT 13-22-10 at Kanpur and Ludhiana, DRMR 2018-27 at Hisar and Ludhiana, DRMRHT 13-22-10 at Kanpur and Ludhiana while RMM 10-17, PM 25 (NC), PM 27 (NC), RGN 229, DRMR 2017-27 at 3 locations showed seedling mortality  $\leq 30\%$  indicating moderate thermo tolerance under controlled condition. In the field sown trial, DRMR 2059, PM 25(NC), DRMR 2017-8 and DRMR 2275 at Dholi and Ludhiana had seedling mortality  $\leq 30\%$  and dry matter per 10 seedlings  $\geq 4.0$ g. Lesser reduction in the

physiological traits and seed yield ( $\leq 20\%$ ) identified RMM 10-1-1, RH 1676 and SVJH-108 at Hisar and Ludhiana as promising genotypes under low light stress. NPJ 214, LES 54, NPJ 210, NPJ 225, DRMR 2017-15 and DRMR 1222 at Dholi, Hisar and Ludhiana were tolerant to moisture stress. PDZ 4 seems promising at 3 locations for salinity tolerance. Out of thirty-four mustard genotypes only Raj Vijay Mustard 2 (LR) was rated highly tolerant to terminal heat stress with seed yield reduction  $\leq 20\%$ and high stability indices (HIS  $\geq 0.75$  and YSI  $\geq 0.82$ ). Foliar spray of brassinolide @ 20ppm and salicylic acid @ 200ppm at 2 locations (Hisar and Ludhiana) improved seed yield under rainfed conditions.

Dr. P.D. Meena, PI, Plant Pathology presented the results of pathological experiments and informed that disease pressure was moderate to severe during the season. He also reported promising resistant/ tolerant sources against various diseases. In screening of Brassica germplasm and breeding materials, under natural condition, PDZ 11, PDZ 12 (Bj) and AKMS 8141, AKGS 8146, AKGS 8217, GSH 1717, GSH 1699 (Bn) were found resistant to WR at all eight locations. In UDN for major diseases DRMRSJ 1, DRMRSJ 7, DRMR 2018-37 and PAB 14-5 of B. juncea showed resistance reaction to WR under natural conditions. In NDN for Alternaria blight, none of the entries were found tolerant to AB. In NDN for white rust, PRD 17-1, PRD 17-2, DRMRIJ 12-40, DRMRIJ-16-7-1, RH 1400, RH 1400-1, entries of *B. juncea* showed immune reaction to WR at MOR, PNT, HSR locations. Some of the promising strains showed resistance to WR were DRMRIJ 12-27, DRMRIJ 12-37, DRMR-5206, PDZ 5, DRMRSJ 1, DRMRSJ 4, DRMR 2018-41, DRMRDJ 1, DRMR 2018-37 and DRMRIJ 12-37 (3 locations). In NDN for Sclerotinia rot, DRMRSJ 21, DRMRSJ 22 and DRMR 5206 showed less 50 percent incidence of SR with small lesion size. Under integrated management for diseases, AB, WR, DM, PM, SR diseases were observed in integrated disease management practices and farmer's practice to standardise the best integrated disease management module. Module included seed treatment with Trichoderma harzianum @10g/ kg seed, soil application of Trichoderma (1 kg/50 kg FYM), basal application of zinc sulphate @ 15 kg/h + S (dose as per location recommendation) + boron (10 kg borax/ ha), line sowing 45 x 20 cm spacing, no irrigation during 25th to 15th Jan

Dr. Archana Anokhee, PI, Entomology presented the highlights of 2019-20 and informed that low to moderate population development of mustard aphid was observed during crop season on different Brassica species. Sixty-two entries of different trials were found promising for mustard aphid and recorded AAII  $\leq 1.5$ . Moderate to high population of mustard aphid was reported at most of the centres from 3<sup>rd</sup> to12<sup>th</sup> standard meteorological week (SMW) with peak during 7<sup>th</sup> to 11<sup>th</sup> SMW. Low to moderate population of painted bug was observed from 11<sup>th</sup> to 13<sup>th</sup> SMW. The activity of *Coccinellid* predators was moderate to high during 7<sup>th</sup> and 11<sup>th</sup> SMW. However, low population of leaf miner was observed which remained active from 3<sup>rd</sup> to 11<sup>th</sup> SMW. Survey and surveillance of insect-pests was conducted at SKN, PTN, KPR, LDH and SHL and mustard aphid, painted bug, sawfly, flea beetle and coccinellid predators were reported from fields with moderate to low activity.

Dr. Anubhuti Sharma, PI, Biochemistry, presented the highlights of biochemistry and reported that promising breeding materials and IVT/AVT quality entries were evaluated at different centres. Entries of IVT/AVT quality trials were evaluated at Bharatpur, Kangra, Pantnagar, Hisar and Ludhiana. Oil stability index which is the ratio of MUFA: PUFA, ranged from 0.40 in PR-2016-4 to 1.57 in GSH-16-99. The SFA: MUFA: PUFA ratio ranged between 1:07:09 (GSH-21-80) to 1:24:10 (PT-2015-6). RCH-1, GSH 16-99, LEC 61, PDZ- 13, RH(OE)-1705, JC-21, GSH-1707, RH(OE)-1710, RH(OE)-1711, PDZ-1, PM 29, PM-30, LES-60, LES-59 and LES-54 had < 2 % erucic acid content. Palmitic acid mean values ranged from 2.71% (PT-2015-6) to 4.27 % (GSH-17-17); Stearic acid mean value raged from 0.76 % (PT-2015-6) to 2.08% (PDZ-1). Oleic acid from 9.71 % (PRE-2017-5) to 43.62 % (GSH-1707); Linoleic acid from 15.04 % (PR-2016-8) to 40.05 % (LEC-61). Linolenic acid: 11.39 % (PT-2015-7) to 25.84 % (RH (OE)-1711); Eicosanoic acid: 4.76 % (RH (OE)-1711) to 11.50 % (GSH-21-80).  $\omega 6$  :  $\omega 3$  ratio ranged from 1.05 (PRE-2017-5) to 3.06 (LES-59).Total Protein ranged from 28.42 (JC-21) to 35.53% (RH (OE)-1706); Methionine ranged from 1.28 (JC-33) to 2.08 (LEC-61, RH(OE)-1711) g/100g protein; Tryptophan ranged from 0.81 (LES-54) to 1.25 (PR-2017-7) g/100g protein. Total antioxidant capacity ranged from 15.04 (PDZ-1) to 26.01 (JC-21) mg/g AAE;  $\beta$ -carotene ranged from 2.80 (PDZ-13) to 5.22 (PRC-2017-5). Less than 30 µmol/g glucosinolate was observed in GSH 21-80, GSH 17-17, RCH 1, GSH 16-99, PDZ-13, JC-21, GSH-1707 and JC-33 genotypes. Phytic acid content was reported less than 2% in LEC-61, JC-21, RH(OE)-1706, RH(OE)-1711, PRE-2017-5 and PRL-2017-5.

Chairman, Dr. S. R. Bhatt, Co-chairman, Dr. S. K. Jha, Dr. D. K. Yadav, ADG (Seed) and other delegates discussed about re-zonalization of AICRP-RM centres keeping in the view of

changing climatic conditions. Dr. S. R. Bhatt also emphasized the need of monthly monitoring of the AICRP-RM centres during cropping season through sending of photographs or videos of the trials by respective PIs. Dr. P. K. Rai, Director, ICAR-DRMR insisted to incorporate the suggestions of Honourable DG-ICAR, Dr. T. Mohapatra and DDG, Crop Science, Dr. T. R. Sharma in the technical programme of different disciplines to bridge the yield gap in rapeseed-mustard. Chairman expressed satisfaction over the progress made in various disciplines during 2019-20. The session ended with vote of thanks to the chair by Director, ICAR-DRMR.

# XXVII Annual Group Meeting of AICRP Rapeseed-Mustard August 3-4, 2020 Webinar

Session II: Planning and Technical Programme Formulation: Agronomy

Chairman: Prof. B.S. Mahapatra, GBPUA&T, Pantnagar

Co-Chairman: Dr. S. K. Jha ADG (O&P), ICAR, New Delhi

Rapporteurs: Dr. R.S. Jat, Principal Scientist, DRMR, Bharatpur

Dr. Rajeev Bharat, Jr. Scientist-Agronomy, SKUAST-Jammu

The session was started with the opening remarks of the Chairman, Dr. B.S. Mahapatra on the soil, water, nutrient and weeds related issues in the rapeseed-mustard. He urged upon the scientist to have critical discussion on the technical programme and formulate a viable and thematic programme with significant deliverables. He further stressed upon the supplementary field observations with laboratory analysis in long term as well as other agronomic experiments for better reasoning. Dr. S.K. Jha, Co-chairman of the session suggested to review the herbicides recommended in other similar crops for different weeds in India and abroad which can also be tried under Indian conditions. He also suggested to prepare an atlas on cropping systems and packages of practices considering the socio-economic and bio-physical indicators of all the zones.

Dr. O.P. Premi, Principal Scientist-Agronomy, DRMR presented the findings of the experiments conducted during 2019-20. The technical programme was critically discussed and finalised. It was decided to conclude the experiment on "System of mustard intensification (SMI) in rapeseed-mustard through transplanting" and "Enhancing of water use efficiency in rapeseed-mustard under rainfed conditions". Two new experiment on "Enhancing the water productivity through microbes, hydrogel and bio-regulators integration" and "Response of macro and micro nutrient bio-fertilizers in enhancing rapeseed-mustard productivity and soil health" were formulated whereas some existing experiments were modified. Dr. O.P. Premi, urged upon the scientists of various cooperating centres of AICRP (R&M) to analyse the soil samples as per technical programme and also to analyse the cost of cultivation in each experiment. The brief summary of the findings is as under:

#### **Technical programme for 2020-21**

Treatment	Season					
	Rabi (Rapeseed-mustard)	Kharif				
T1	Control	Control				
T2	100% PK	100% PK				
Т3	100% NPK	100% NPK				
Τ4	150% NPK	150% NPK				
T5	100% NPK + S (recommended as per zone)	100% NPK				
T6	100% NPK + Zn @ 25 kg ZnSO <sub>4</sub> /ha	100% NPK				
Τ7	100% NPK + B @ 1 kg B/ha	100% NPK				
Т8	100% NPK + FYM @ 2.5t/ha (dry weight basis)	100% NPK				
Т9	100% NP	100% NP				
T10	100% NK	100% NK				

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

**Replication: 3** 

#### **Design: RBD**

Locations: Khudwani (Rice-Mustard), Kangra ( Maize-Mustard), Ludhiana ( Maize-Mustard), Hisar (PM-Mustard), Pantnagar (Maize-Mustard), Morena (PM-Mustard), SK Nagar (GG-Mustard), Dholi (Rice-Mustard), Kanke (Rice-Mustard), Shillongani (Rice-Toria), Bhubhaneshwar (Rice-Mustard), Kota (Urdbean-Mustard), Sriganganagar (Pearlmillet/ cluster bean-Mustard).

#### Observations to be recorded in all crops every year

- 1. Growth and yield attributes of crops in cropping system to be reported every year.
- 2. Disease and pest incidence.
- 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 will be conducted on fixed and cannot be changed in any way.
- 5. Potassium is to be applied @ 20 kg K<sub>2</sub>O/ha in case of no recommendation for potassium application.
- 6. Observations on weed infestation needs to be recorded treatment wise.

#### Note:

- 1. Suggested to send the soil samples for major and micronutrient analysis to DRMR, Bharatpur.
- 2. Submit the data on all the aspects given in the technical programme every year.
- 3. Prepare a chart of cultural practices followed in each crop used in the cropping system.
- 4. The PI should send the protocol for recording the data, soil sampling and analysis of data.
- 5. Store the soil samples for future use.
- 6. For such long term experiments the power tiller is a pre- requisite and will be provided to concerned centre's.
- 7. The data on physical, chemical and biological properties must be reported in the next year.

# 3.2 Evaluation of herbicides for weed management in Rapeseed - mustard.

## Treatment

- 1. Pendimethalin (*Stomp extra*) 1.0 kg a.i /ha (PE)
- 2. Pendimethalin (*Stomp extra*) 0.5 kg a.i /ha (PE)
- 3. Oxadiargyl (*Raft or Topstar*) @ 90 a.i g/ha (PE)
- 4. Oxadiargyl (*Raft or Topstar*) @ 45 a.i. g/ha (PE)
- 5. Fluazifop-p-butyl (Fusilade Max)13.7 w/w @125 a.i g/ha at 25-30 DAS
- 6. Quizalofop (Turgasuper) 50 a.i. g/ha at 15-20 DAS
- 7. Control (No herbicide)
- 8. Weed free

# Design: RBD

# **Replication**: 3

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

# **Observations**:

The data will be generated as per the guidelines of Central Insecticide Board and Registration Committee (CIBRC).

1. The proforma for data recording on yield, collection of soil, plant and seed samples will be supplied by DRMR.

# 3.3 Agronomic evaluation of promising rapeseed-mustard entries

## **Objectives:**

- 1. Identified advanced strains promoted to AVT-II of rapeseed-mustard will be taken along with check varieties of national/zonal importance.
- The zone wise entries seeds should be supplied to the Director, DRMR, Bharatpur latest by 10<sup>th</sup> August 2019 by the concerned breeder.
- 3. The recommended fertility level be mentioned.
- 4. Economics be worked out giving cost of cultivation and net returns.

## a) Zone-II Quality mustard

Entries : PDZ 12, PDZ 11, RCH 1, RH 749 (ZC), Pusa Mustard 29 (LR), Kranti (NC), PDZ 1 (double low check)

# Location : New Delhi, Hisar, Ludhiana, Sriganganagar

#### b) Gobhi sarson

Entries : GSH 1699, GSL 1(NC/ZC), Kranti (NC), GSC 6 (QC)

Location : Kangra, Dhaula Kuan, Bajaura, Chatha, Ludhiana

c) Taramira

Entries : RTM 1624, T-27 (NC), RTM-314(ZC), RTM 1351 (LR), Filler 1

Location : Jobner, Bawal, Navgaon, Morena, Diggi

#### Fertility levels (for all the locations)

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

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

#### **Replications**: 3

# **Observations**:

- a) Yield and yield attributes (branches/plant, siliquae/plant, seeds/siliqua, 1000 seed weight and seed weight/plant and seed yield).
- b) Oil content.
- c) Initial fertility status of soil.
- d) Uptake of nitrogen, phosphorus and potassium at pre-flowering and harvest stage.

# 3.4 Developing resource efficient and resilient rapeseed-mustard based cropping systems under changing climate scenario

Main plot treatments: Tillage practices

- 1. Raised beds (Permanent)
- 2. Zero tillage
- 3. Conventional tillage

Sub plots treatments: Mustard based cropping systems Replications: 3

Pantnagar:

1.	Green gram-mustard
2.	Maize -mustard
3.	Soybean/ black gram-mustard
Chatha:	
1.	Pearl millet -mustard
2.	Sesame-mustard
3.	Green gram -mustard
4.	Maize -mustard
Morena:	
1.	Pearl millet -mustard
2.	Sesame-mustard
3.	Green gram -mustard
4.	Maize -mustard
5.	Soybean -mustard
6.	Cluster bean-mustard
Kanpur:	
1.	Urd-mustard
2.	Green gram -mustard
3.	Maize – mustard

### **Observations:**

- 1. Observations to be recorded in all crops every year.
- 2. Growth and yield attributes of crops in cropping system to be reported every year.
- 3. System productivity, profitability and sustainability to be reported every year.
- 4. Disease and pest incidence should be reported.

- 5. Soil samples from 0-15 cm and 15-30 cm depth to be taken after mustard harvest and prepare balance sheet of all the nutrients in soil.
- 6. Initially measure soil bulk density, pH and EC.
- 7. Water requirement also to be worked out for each crop under different practices
- 8. Send the soil samples to DRMR, Bharatpur for analysis each year.

#### Note:

- 1. Each crop should have at least 8 raised beds (4 runs of tractor)
- 2. Length of each plot should be at least 10 m
- 3. Staggered planting should be done as per maturity of the *kharif* crops in the system.
- 4. Data should be submitted in excel format along with chart of cultural practices followed in each crop.
- 5. The experiment is to be done for 5 years continuously.

# **3.5 Enhancing drought and heat tolerance in rapeseed-mustard through microbes Main plot treatments:**

M1-No irrigation M2-One irrigation at 35 DAS M3-Two irrigation at 35 & 65 DAS

#### Sub plots treatments:

S1-MRD 17 S2-MKS 6 S3-Biophos and BioPhos<sup>+</sup> S4-CRIDA MI-I S5-CRIDA MI-II S6-Control (No Culture)

#### **Design: Split plot**

#### **Replications: 3**

Location: Jobner, Nagpur, Jhansi, Banda, Dholi, Morena, Sriganganagar, Hisar, Ludhiana, SK Nagar, Varanasi, Chatha, Imphal

#### **Observations**:

- 1. Growth parameters.
- 2. Yield and yield attributes (branches/plant, siliquae/plant, seeds/siliqua, 1000 seed weight and seed weight/plant and seed yield).
- 3. Oil content and yield.
- A- 6

- 4. At sowing, before irrigation and at harvest soil moisture.
- 5. Nutrient (N, P, K) availability at 30 days interval.
- 6. Relative water content, membrane stability, yield stability index, proline content and chlorophyll content.

# **3.6** Response of macro and micro nutrient bio-fertilizers in enhancing rapeseedmustard productivity and soil health

## Treatment details:

## Main plot treatments

## **Fertility level**

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

## Sub plot

## **Microbial consortia**

- 1. Phosphate Solubilising Micro Organism (PSMO)
- 2. Azotobactor
- 3. Potassium Mobilizing Biofertiliser (KMB)
- 4. Zinc Solubilizing Biofertiliser (ZSB)
- 5. PSMO + Azotobactor + KMB + ZSB

# **Replication:** 3

Design: Split plot design

# **Observations**:

- Growth parameters.
- Yield and yield attributes (branches/plant, siliquae/plant, seeds/siliqua, 1000 seed weight and seed weight/plant and seed yield).
- Oil content and yield.
- Availability of N, P, K and Zn at harvest.

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

Locations: Khudwani, Kangra, Ludhiana, Hisar, Pantnagar, Morena, SK Nagar, Dholi, Kanke, Shillongani, Bhubhaneshwar, Kota, Sriganganagar, Varanasi, Chatha, Imphal

#### Total Agronomic trials to be conducted during the year 2020-21

- 3.1 Long-term fertility experiment on cropping systems involving rapeseed-mustard.
- 3.2 Data generation for herbicide claim in Rapeseed mustard.
- 3.3 Agronomic evaluation of promising rapeseed-mustard entries.
- 3.4 Developing resource efficient and resilient rapeseed-mustard based cropping systems under changing climate scenario.
- 3.5 Enhancing the water productivity through microbes, hydrogel and bio-regulators integration.
- 3.6 Response of macro and micro nutrient bio-fertilizers in enhancing rapeseed-mustard productivity and soil health.

#### Suggestions for proper conduct of agronomical trials

- 1. The field layout of all the agronomy trials will 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.
- 2. The treatments of any experiment should not be modified by the centres. However, Centres may have additional treatments.
- 3. The trials should be laid out on time so that treatment effects could be identified properly and yield levels are optimized.
- The centres should send the information pertaining to field trials along with date of sowing to Director, DRMR latest by 25<sup>th</sup> November.
- 5. The centres accepting the trial (whose names are given in the technical programme) must positively report the data. In case of any difficulty individual centre should write immediately to PI/Director, DRMR.
- 6. The cropping sequence and long-term trials be conducted at the same location in the same field over years.
- 7. The plot size should not be less than 21.6 m<sup>2</sup> and width of buffer channel should not be less than 1.5m.
- The economics of production must be given in each experiment; calculate on the basis of MSP and state recommended cost of cultivation for respective crops. The IBCR must be reported instead of B:C ratio.

- 9. If the yield level of recommended fertiliser dose is less than the state average, the trial will be rejected.
- 10. If any centre needs oil and nutrient analysis, please depute concern scientist along with samples to DRMR, Bharatpur latest by 30<sup>th</sup> April for timely report compilation.
- 11. If data do not follow the statistical standards should be rejected.
- 12. All the ancillary data of component crops should be recorded and reported.
- 13. The centres concluding a particular trial/experiment should compile the results and submit the comprehensive report to PI/Director for inclusion in a review of agronomic aspects.
- 14. The initial and final soil analysis should be done and reported every year. If facility is not available, can send the samples at ICAR-DRMR for analysis.
- 15. The final data must be submitted latest by 31<sup>st</sup> May, 2021. No data will be accepted after the due date.

#### Recommendations

- Soil application of hydrogel @ 2.5 kg/ha along with two foliar sprays of salicylic acid
   @ 200 ppm at flower initiation and siliquae formation stage is recommended for obtaining sustainable higher yield of rapeseed-mustard under rainfed conditions in all five zones except Zone I.
- Transplanting of *Brassica carinata* at 60 x 60 cm in Zone II, *Brassica napus* at 45 x 45 cm in zone-III gave higher seed yield, could be adopted to sustain the rapeseed mustard productivity.

# XXVII Annual Group Meeting of AICRP Rapeseed- Mustard August 3-, 2020 at Online

#### **SESSION II: Frontline Demonstrations on Rapeseed-Mustard**

Chairman: Dr. S. K. Jha, ADG (OP), ICAR, New DelhiRapporteur: Dr. Ashok Kumar Sharma, Pr. Scientist, ICAR-DRMR, Bharatpur

After brief introductory remarks of chairman about the scenario of rapeseed-mustard production, role of frontline demonstrations in technology dissemination, problems in transfer of technology to the farming community, expectations of funding agency, Dr. Ashok Kumar Sharma, Pr. Scientist, (Ag Extension), ICAR-DRMR, Bharatpur presented the results of 1405 frontline demonstrations (FLDs) on rapeseed-mustard conducted in 57 districts across 15 states during 2019-20. He reported that Rajasthan had maximum (467) followed by Manipur (240), Uttar Pradesh (183), Assam (135), and Jharkhand (78) FLDs. Two hundred thirty six FLDs were conducted on rapeseed and 1169 on mustard. All the demonstrations were conducted under whole package demonstrations in two different situations viz., irrigated (870) and rainfed (535).

The maximum average yield of 2,497 kg/ha from the IP under irrigated conditions was in Haryana followed by 2,211 kg/ha in Rajasthan; 2,157 kg/ha in Gujarat; 2,022 kg/ha in Punjab, 1,923 kg/ha in Uttar Pradesh; 1,675 kg/ha in Madhya Pradesh; 1,383 kg/ha in Uttarakhand; 1,225 kg/ha in Jharkhand and 1,143 kg/ha in Telangana. The maximum yield gap of 61.0% was recorded in Odisha followed by 54.1% in Jammu & Kashmir; 49.2% in Telangana; 33.4% Himachal Pradesh; 26.7% in Uttar Pradesh; 21.3% in Maharashtra; 19.2% in Haryana, 17.6% in Madhya Pradesh and 15.3% in Gujarat. The maximum ANMR/ha were Rs 19,027; Rs 14,602; Rs. 13,794; Rs. 12,933; Rs. 11,875, Rs. 10,681; Rs. 9,848; Rs. 7,075 and Rs. 6,670 in Jammu & Kashmir, Haryana, Uttar Pradesh, Telangana, Gujarat, Rajasthan, Odisha, Punjab and Himachal Pradesh, respectively. The cost of cultivation ranged from Rs. 14,520/ha in Maharashtra to Rs. 34,514 /ha in Haryana in IP under irrigated Whole package demonstrations.

The maximum average yield of 1,720 kg/ha from the IP of WP under rainfed conditions was in Rajasthan followed by 1,388 kg/ha in Uttar Pradesh; 1,306 kg/ha in Uttarakhand; 1,141 kg/ha in Assam; 1,076 kg/ha in Jharkhand; 1,020 kg/ha in Manipur and 916 kg/ha in Himachal Pradesh. The maximum yield gap of 45.0% was recorded in Jharkhand followed by 36.6% in Assam; 33.9% in Himachal Pradesh; 28.8% in Manipur; 26.1% in Uttar Pradesh; 20.6% in Uttarakhand and 14.0% in Rajasthan. The maximum ANMR/ha were Rs 12,478; Rs 8,780; Rs 8,221; Rs 7,429; Rs 6,699; Rs 6,220 and Rs. 5,250 in Uttar Pradesh, Manipur, Uttarakhand, Rajasthan, Assam, Himachal Pradesh and Jharkhand, respectively. The cost of cultivation ranged from Rs. 13,060/ha in Manipur to Rs. 29,702/ha in Uttar Pradesh in IP under rainfed Whole package demonstrations.

A total of 10 improved varieties of Indian mustard, 2 each of yellow sarson and toria and one of gobhi sarson were used in WP covering 12 states under irrigated condition. Under irrigated condition, improved variety RH 725 of Indian mustard demonstrated in 29 FLDs in Haryana recorded highest average yield of 2,525 kg/ha with a yield improvement of 18.1% over local (FP) followed by Giriraj demonstrated in 6 FLDs in Haryana with average seed yield of 2,358 kg/ha with yield improvement 25.1%. The minimum yield improvement of 8.5% was reported from CS 60 variety from 9 FLDs in Rajasthan, while minimum average seed yield of 826 kg/ha was reported from TAM 108-1 variety from 30 FLDs in Maharashtra. However, the variety RH 749 in Jammu & Kashmir under irrigated condition recorded highest yield improvement of 62.6% with average seed yield of 1,190 kg/ha.

The maximum yield improvement of 12.8% from Pant Sweta variety of yellow sarson in Uttarakhand, 33.4% from GSC 7 variety of gobhi sarson in Himachal Pradesh, 9.1% from PT 508 in Uttarakhand were recorded under irrigated condition.

Under rainfed condition, the demonstrations with RGN 298 recorded a highest average seed yield of 2,160 kg/ha with yield improvement of 11.1% in Rajasthan under rainfed situation. In Manipur, 85 demonstrations with NRCHB 101 recorded lowest average seed yield of 1,008 kg/ha with yield

improvement of 28.2% over FP. However, the variety PM 27 in Assam under rainfed condition recorded highest yield improvement of 84.0% with average seed yield of 1,325 kg/ha.

The maximum yield improvement of 53.8% from YSH 401 variety of yellow sarson in Assam, 33.4 % from GSC 7 variety of gobhi sarson in Himachal Pradesh, 61.0% from TS 38 variety of toria in Assam and 23.1% from RTM 1351 of taramira in Rajasthan were recorded under rainfed condition.

The chairman said that govt. is emphasizing on increasing production and productivity of oilseeds especially, rapeseed-mustard. In the coming years, allocation of fund for FLDs on rapeseed-mustard will be increased. Therefore, scientists should focus on conducting FLDs effectively and to create demand of new varieties among the farmers by showing them their production potential in the field.

Dr. Naveen Kumar, Pr. Scientist, IARI, New Delhi said that a number of new varieties are contributing in enhancing productivity of rapeseed-mustard in the country. Therefore, efforts should be done to study the impact of new varieties and technology in contribution to the increased production and productivity.

The chairman complemented the work done and presentation of FLDs. After in depth discussion in the session, the following recommendations emerged.

#### Recommendations

- 1. All centers should do the efforts to create the demand of newly released varieties by involving personnel from state department of Agriculture in FLDs programme and it should be reflected in breeder seed indent.
- 2. To utilize the rice-fallow area under oilseed, the number of FLDs should be increased in these areas.
- 3. The impact of new technology should invariably be discussed during scientist-farmer interaction, training and field visit / kisan diwas / kisan mela, etc., in the village by involving the district level extension agencies, NGOs and all stakeholders for wider coverage of technologies.
- 4. Every center should ensure that varieties of 5-7 years of age should only be used in FLDs. A report should be prepared on the participating centre wise list of varieties selected for demonstrations, their age and where new varieties are urgently required for demonstrations.
- 5. For better impact, at least 5-6 FLDs should be conducted with each selected variety.

The session ended with vote of thanks to chair.

#### Frontline Demonstrations on Rapeseed-Mustard 2020-21 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. As per new guideline, all the demonstrations will be conducted in cluster approach. Only whole package demonstrations including INP and IPM should be conducted. 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
- 3. Funds for conducting FLDs will be Rs. 2160.00 for an area of one acre.
- 4. The binding of one acre area for one demonstration may not be observed, as the holdings in some areas are too small.
- 5. Unspent balance of previous years may be utilized but subject to revalidation by ICAR-DRMR.
- 6. In the report, specifically mention the rainfed and irrigated situation and also the normal and late sown conditions under which FLDs are actually conducted.
- 7. Farmers having soil health card issued by Department of Agriculture/KVKs should only be selected for conducting FLDs in Oilseeds. Fertilizer inputs will be provided to farmers under FLDs on the basis of Soil health card. The chemical fertilizers under FLDs should only be given by identifying the gaps in adoption. Growth promoters, Micro nutrients, etc can be given.
- 8. 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.
- 9. 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.
- 10. The in-charge of the implementing centre should indent the requisite quantity of the varieties from the concerned breeders well before the start of the season.
- 11. The total cost of cultivation for improved plot (IP) and farmers' plot (FP) per ha should be reported 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).
- 12. 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
- 13. 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.
- 14. 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.
- 15. 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 of the FLD activities must be done and send good photographs to DRMR, Bharatpur for record.
- 16. 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/ the district level extension agency and NGOs, for proper monitoring, strengthening the linkages and also extending learning experiences to relatively large population of farmers.
- 17. 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, 2021.
- 18. 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.
- 19. Reservation for SC and ST community must be followed in selecting beneficiary farmers for conducting FLDs as per norms.

Zone wise improved varieties recommended for FLDs on rapeseed-mustard (2020-21)

# Zone-I: Kangra and Khudwani <u>Brown sarson:</u> Shalimar Sarson-1 Ghobhi Sarson: GSC-7

Zone -II: Chata, Hisar, Bewal, Ludhiana, Navgaon and Sriganganagar
Indian Mustard:
Irrigated Timely Sown RH 749, DRMRIJ 31, NRCDR 601, PBR 357
Rainfed: RH 406, RGN 298, GDM 5, PBR 378, RH 725, RH 761
Late Sown irrigated: RVM 2 (Raj Vijay Mustard 2), RGN 236, Pusa Mustard 26, NRCHB 101,
Quality: RLC 2, Pusa mustard 30, RLC 3, Pusa mustard 31 (Double zero)
Early Sown: Pusa mustard 27, Pusa mustard 28
Salinity/Alkalinity: CS 58, CS 60
Gobhi Sarson: GSC 7, RSPN 25

# Zone-III: Morena, Bharatpur, Kota, Faizabad, Banda, Jhansi, Agra, Varanasi, Kanpur Pantnagar and Dholi,

# Indian Mustard:

Irrigated Timely Sown: RH 749, Griraj (DMRIJ 31), NRCHB 101, RGN 73

Late Sown Irrigated: NRCHB 101

Early Sown: Pusa Mustard 27

<u>Yellow Sarson:</u> Pitambari, YSH 401, Pant Pilli Sarson 1, NRCYS 05-02, Pant Sweta, Tapeswari

Toria: Uttara,

Taramira: RTM 1351, RTM 1355

# Zone-IV: Junagarh, S.K. Nagar, Jobner, Mandore and Nagpur

Indian Mustard: GDM 4, NRCHB 101

Taramira: RTM 1351, RTM 1355

 Zone-V: Shillongani, Kanke, Jagdalpur, Imphal, Tripura, Bhubaneshwar and Berhempore Indian Mustard: NRCHB 101, DRMR 150-35, Pusa Mustard 25, Pusa Mustard 27
 <u>Yellow Sarson:</u> Pitambari, YSH 401, NRCYS 05-2, Pant Sweta, <u>Toria:</u> TS 38

S.No	Zone/Centre	Allotment
	Zone I	-
1.	Khudwani	30
2.	Kangra	50
	Sub total	80
	Zone II	
3.	Jammu	50
4.	Hisar	50
5.	Bawal	30
6.	Sriganganagar	30
7.	Ludhiana	50
8.	Amity University	50
9.	Sub total	260
	Zone III	
10.	ICAR-DRMR	600
11.	Bansur	100
12.	RVSKVV, Morena	100
13.	RLBCAU, Jhansi	100
14.	BUAT, Banda (Uttar Pradesh)	50
15.	Kota	50
16.	Pantnagar	50
17.	Kanpur	50
18.	Varanasi	100
19.	Dholi	50
20.	Sub total	1250
	Zone IV	
21.	Jobner	30
22.	Mandore	70
23.	Nagpur	50
24.	Kolhapur	40
25.	S.K. Nagar	50
26.	Sub total	240
	Zone V	
27.	Bhubaneshwar	50
28.	Shillongai	30
29.	Kalyani	40
30.	Kanke	50
31.	DEE, CAU, Imphal	150
32.	DR, AAU, Assam	200
33.	Sub total	520
	Zone VI	
34.	RARS, Jagtial, PJTSAU	50
	Grand total	2400

Centre wise allotment of FLDs on rapeseed-mustard for 2020-21

#### XXVII Annual Group Meeting of AICRP Rapeseed-Mustard August 3-4, 2020 at Online Session III: Planning and Technical Programme Formulation: Genetics & Plant Breeding

Chairman Co-Chairman	:	Dr. T.R. Sharma, DDG (CS), ICAR, Krishi Bhawan, New Delhi Dr. S. K. Jha, ADG (OP), ICAR, Krishi Bhawan, New Delhi
Subject Expert Convener	::	Dr. S.S. Banga, National Professor, PAU, Ludhiana Dr. P. K. Rai, Director, ICAR- DRMR, Bharatpur
Rapporteurs	:	Dr. V.V. Singh, Principal Scientist, ICAR-DRMR, Bharatpur Prof. Kartikeva Srivastava, I. A. Sc., BHU, Varanasi

Session started with welcome remarks of chairman. He stressed upon enhancing the precision in conduct of trials and invited suggestions from the participants for further improvement of programme. Chairman, Dr. T. R. Sharma also welcomed the participants and highlighted the importance of rapeseed-mustard as an important oilseed crop.

Dr. K. H. Singh, PI, Plant Breeding flagged the issues for discussion. After long deliberations, Following recommendations were made:

- Promotion of hybrids at par with hybrid entry as best check was discussed. Dr. S. S. Banga (Expert), Dr. S.R. Bhat (Expert) agreed with the issue. Dr. H. C. Sharma (expert), Dr. Mahak Singh, Dr. Naveen Singh emphasized to have some benchmark (5%) for promotion. Chairman decided to constitute a committee on this aspect.
- Re-zonalization of AICRP-RM centres was discussed and it was felt that a committee should be constituted to give recommendation on this issue.
- Induction of zone wise entries was also discussed at length and it was agreed by all. However, mechanism needs to be devised for implementing this issue.
- Dr. S.S. Banga emphasized to evaluate pre-breeding material at different places to identify diverse material for biotic and abiotic stress and component traits.
- Crossing of resistant material (biotic and abiotic stresses) with high yield bases should be taken up at main centres.
- Distribution of segregating/ Pre-breeding material to all centres was discussed. Chairman opined to have a field day at pre-maturity stage at ICAR-DRMR, Bharatpur and call all breeders so that they can select material of their own interest.
- QRT recommendations should be implemented.
- Abohar be added as testing centre in zone- II for rainfed, irrigated and late sown trials.
- Jhansi be added as centre in zone- III in IHT/ AHT trial and Diggi be added as centre in Taramira trial.
- It was decided to formulate centre- wise hybridization programme.
- In technical programme, method of developing an entry should also be included along with pedigree.

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

### 1. IVT Toria

SN	Entry	Pedigree	Centre
1.	TKM- 20-1	TK- 2014 X Bhawani	CSAUA&T, Kanpur
2.	TKM- 20-2	TK- 2014 X ORT- 11	CSAUA&T, Kanpur
3.	PT- 2015-8	Uttara X PT- 508	GBPUAT, Pantnagar
4.	PT- 2018-09	PT- 30 X Bhawani	GBPUAT, Pantnagar
5.	RMT-19-14	RMT-10-1 X JT-1	ZARS, Morena
6.	RMT-19-17	Bastar Toria-4 X JT-1	ZARS, Morena
7.	ORT 2019-01	Composite population	OUAT, Bhubaneshwar
8.	JT-14-5	RSPT-2 X PT-303	SKUAST, Chatha, Jammu
9.	CG toria 3	GPT 1x T9	RRS, IGKV, Jagdalpur
10.	CG toria 4	GPT 1 x Indira toria 1	RRS, IGKV, Jagdalpur
11.	BAUT 08-08	BAUST-1 X TRCT -1-1-5-1	BAU, Kanke
12.	Zonal Check		
13.	PT-303 (NC)		
14.	LR		

Zonal check: Zone I – Bhawani; Zone II - Bhawani; Zone III - Bhawani Zone V - Bhawani

Latest Release: Tapeswari

Locations:

Zone III: Kanpur, Pantnagar, Morena, Dholi

Zone V (RF): Kanke, Bhubaneswar, Shillongani, Jagdalpur, Imphal, Kalyani

#### 2. IVT YELLOW SARSON

S N	Entry	Pedigree	Centre
1	YSKM- 20-1	YSK- 04 X T- 42	CSAUA&T, Kanpur
2	YSKM- 20-2	YSK- 05 X T- 42	CSAUA&T, Kanpur
3	PYS- 2017-6	NDYS- 2018 X PYS2009-7	GBPUA&T, Pantnagar
4	PYS- 2018-02	PYSC- 53-5 X B-9	GBPUA&T, Pantnagar
5	RMYS 1	Local Selection from Bilara	ARS, Mandor
6	RMYS 2	Local Selection from Bilara	ARS, Mandor
7	DRMRYS 201	YSH 401 X SKJ 2 ( <i>B. nigra</i> )	DRMR, Bharatpur
8	DRMRYS 202	YSH 401 X SKJ 2 (B. nigra)	DRMR, Bharatpur
9	YSH-0401 (NC)		
10	Zonal Check		
11	Pitambari (LR)		

Zonal check: Zone II/Zone III - NRCYS-05-02 (Check)

Zone V - Benoy

#### Locations

**Zone-III:** Kanpur, Pantnagar, Morena, Dholi **Zone-V:** Shillongani, Imphal, Kanke, Kalyani, Bhubaneswar

# 3. IVT Mustard

# **3.1 IVT Early Mustard**

SN	Entry	Pedigree	Centre
1	KMR (E)- 20-1	Seeta X Varuna	CSAUA&T, Kanpur
2	KMR (E)- 20-2	Seeta X Aravali	CSAUA&T, Kanpur
3	DRMRCI- 129	RH- 819 X DRMR- 270	DRMR, Bharatpur
4	DRMRSJ 112	B.rapa var. Jhumka X B. nigra	DRMR, Bharatpur
5	DRMRHT 1712	BPR 549-9 X JBJ-41/15	DRMR, Bharatpur
6	RH 1999-12	RH 1402 A X RH 1401	CCS HAU, Hisar
7	RH 1999-21	MCNR 15-14 X RH 1402 A	CCS HAU, Hisar
8	PRE- 2018-8	PRE- 09-9 X Kranti	GBPUA&T, Pantnagar
9	PRE- 2018-10	PR- 19 X NDRE- 4	GBPUA&T, Pantnagar
10	NPJ- 239	Pusa Agrani X NPJ- 112	IARI, New Delhi
11	NPJ- 240	NRCHB- 101 X NPJ- 173	IARI, New Delhi
12	SKM 1746	GM 1 X RSK 219	SDAU, SK Nagar
13	SVJH-006 (hybrid)	SVJA-05 X SVJR-06	Shaktivardhak Hybrid Seeds,
			Pvt. Ltd.
14	PHR 8024 (hybrid)	DTM 40 X DTMR	PAU, Ludhiana
15	PHR 8031(hybrid)	DTM 48 X DTMR	PAU, Ludhiana
16	KGMH-3811 (hybrid)	KA 99 X KR 576 R	Kamadgiri Crop Science
			Pvt Ltd, Agra
17	RMM-19-06	JM-2 X JMM-927	ZARS, Morena
18	ORM 2019-01	Pusa Bold x NRCHB 101	OUAT, Bhubaneswar
19	TM 188	TM102 X TC5	BARC, Mumbai
20	BAUM 09-12-2	BAUSM 92-1-1 X BR 40	BAU Kanke
21	Pusa Mustard 25 (NC)		
22	JD 6 (ZC)		
23	LR		
24	PRO 5111 (hybrid check)		

**Zonal check/Latest Release:** Zone II: Pusa Mustard 28 (NPJ 124); Zone III : Pusa Mustard 27 (EJ 17), Zone IV: GM1, Zone V: NRCHB 101; Zone VI: NRCHB 101

**Locations:** 

- Zone II : Hisar, Ludhiana, Chatha, IARI New Delhi
- Zone III : Kanpur, Pantnagar, Morena, Bharatpur, Dholi, CAU Jhansi
- Zone IV : S.K. Nagar, Nagpur, Mandore, Junagarh
- Zone V : Kanke, Shillongani, Bhubaneshwar, Jagdalpur, Imphal, Kalyani

Zone VI : Dharwad, Hyderabad (DOR), Raichur

# AVT-I Early Mustard

Zone II

**Entries:** RH 1999-42, Pusa Mustard 28 (LR), JD 6 (ZC), PM 25(NC), Filler **Locations :** Ludhiana, Hisar, Delhi, Chatha

#### AVTI + AHT I Zone III

Entries: KMR (E) 19-2, NPJ 229, RH 1999-42, PRE 17-5, PRE 17-2, DRMRCI 116, NPJ 230, KMR (E) 19-1, PHR 8022 (hybrid), DRMRHJ 2403 (hybrid)\*, DRMRCI 96#, RMM 10-1-1#, Pusa Mustard 28 (LR), JD 6 (ZC), PM 25(NC), PRO 5111 (Hybrid Check) # AVT I Repeat Entry; \* hybrid promoted during 2019

Locations : Kanpur, Morena, Bharatpur, Varanasi, Dholi, CAU Jhansi, Banda

**3.2 IVT** Timely Sown, Irrigated (To be conducted in Lattice Design, layout is given in last section of plant breeding technical programme, page no. : PB 12)

SN	Entry	Pedigree	Centre
1	DRMRCI- 127	RH- 819 X Vasundhara	DRMR, Bharatpur
2	DRMR 2018-17	NRCHB101 X DRMR 2326	DRMR, Bharatpur
3	DRMRHT 1318	BPR 543-2 X BPR 549-9	DRMR, Bharatpur
4	SKM 1728	Ashirvad X GM 3	SDAU, SK Nagar
5	SKM 1620	HYT 33 X Parasmani	SDAU, SK Nagar
6	RGN-491	NPJ-153 X RGN-73	ARS, Sriganganagar
7	RGN-483	PRL 2009 X RGN-48	ARS, Sriganganagar
8	PBR 507	PBR 210 x PBR 212	PAU Ludhiana
9	RH 1974	RH 1140 X RH 1372	CCS HAU, Hisar
10	RH 1975	RH 1140 X RH 1372	CCS HAU, Hisar
11	KMR- 20-3	Pusa Bold X Urvashi	CSAUA&T, Kanpur
12	KMR- 20-4	Varuna X KR- 5610	CSAUA&T, Kanpur
13	NPJ- 241	NPJ- 124 X RB- 50	IARI, New Delhi
14	NPJ- 242	NPJ- 156 X EJ- 17	IARI, New Delhi
15	JM-14-8	RSPR-03 X NRCDR- 2	SKUAST-J, Chatha, Jammu
16	PR-2017-5	(PRB- 04-3-04 X Varuna) X PAB- 9534	GBPUA&T, Pantnagar
17	PRB- 2012-3	(NRCDR- 2 X PRB- 04-3-04) X PRB- 06-5	GBPUA&T, Pantnagar
18	TM 274	Kranti X TC5	BARC, Mumbai
19	HUJM- 19-11	MCN 10-11 X HUJM 99-03	BHU, Varanasi
20	RMM-19-18	JM-4 X B-85	ZARS,Morena
21	ACNMM-23	mutant of BIO-902 (obtained by1300 Gy	COA, Nagpur
		gamma irradiation)	
22	ORM 2019-02	Pusa Bold x NDRE 7	OUAT, Bhubaneshwar
23	AKMS-20-1	DLDC-1 X CJ 3761	SARE, Kangra
24	BAUM 08-17	BIO 133-04 X Pusa Bold	BAU, Kanke
25	Kranti (NC)		
26	Zonal Check		
27	Latest Release		

Zonal Checks: Zone I: RCC 4; Zone- II- RH 749; Zone- III - Maya; Zone- IV – Bio 902 Latest Release: Zone I- Giriraj; Zone- II (Irrigated) - Giriraj; Zone- III: RGN 73; Zone- IV-GDM-4 Locations :

Zone I : Kangara, Dhaulakua, Bazaura, Una

Zone II: Ludhiana, Hisar, Sriganganagar, Delhi, Chatha, Abohar, Modipuram, Bawal

Zone III: Kanpur, Pantnagar, Morena, Kota, Varanasi, Banda, Dholi, Jhansi

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

# AVT-I Mustard (Timely Sown, Irrigated), New + Repeat Zone I Entries: AKMS 19-2, RH 1676#, SKM 1626#, RGN 443#, PBR 385#, PR 2016-8#, PR 2016-4#, DRMR 2017-16#, RCC 4 (ZC), RH 749 (ZC), Kranti (NC), Giriraj (LR), Filler #AVT I Repeat Entry Locations : Kangara, Dhaulakua, Bazaura, Una

# Zone IV

Entries: NPJ 231, BIO 902(ZC), Kranti (NC), GDM 4 (LR), Filler Locations : S.K. Nagar, Nagpur, Jalgaon, Mandore, Pali (CAZRI), ARS Washim(COA, Nagpur)

#### **3.3 IVT Mustard (Rainfed)**

SN	Entry	Pedigree	Centre
1	DRMRCI- 128	Maya X RGN- 73	DRMR, Bharatpur
2	DRMRSJ 276	<i>B.rapa</i> var. Jhumka X B. nigra	DRMR, Bharatpur
3	DRMRHJ 908	MJA 9 X MJR 8	DRMR, Bharatpur
4	DRMRHT 1913	NRCHB 101 X BPR 549-9	DRMR, Bharatpur
5	DRMRIJ 18-62	DRMRIJ 31 X LET 36	DRMR, Bharatpur
6	NPJ- 243	Pusa Vijay X VSL- 11	IARI, New Delhi
7	NPJ- 244	NPJ- 138 X BM- 97	IARI, New Delhi
8	RGN-500	SEJ-2 X RGN-236	ARS, Sriganganagar
9	RGN-486	KDM 1049 X RGN-48	ARS, Sriganganagar
10	RH 1920	RH 0832 X Pusa Krishma	CCS HAU, Hisar
11	RH 1921	RH 0832 X Pusa Krishma	CCS HAU, Hisar
12	TM 264	RB9901xTM102	BARC, Mumbai
13	JM-13-3	RSPR-69 X RSPR-01	SKUAST-J, Chatha, Jammu
14	CAU- RM- 4-1-1	Local Yella X Kranti	CAU, Imphal
15	PBR 450	RL 198 X Navgold	PAU, Ludhiana
16	Kranti (NC)		
17	Zonal Check		
18	Latest Release		

Check : Zonal Check - Zone II : RGN 229 ; Zone V: NRCHB 101

Latest Release – Zone II : RH 0761, Zone V : DRMR 150-35 Locations:

Zone II : Sriganganagar, Hisar, Bawal, Ludhiana, Abohar

Zone V : Kanke, Jagdalpur, Shillongini, Bhubaneshwar, Imphal

# AVT I Repeat

Zone II Entries: RH 1424, Kranti (NC), RH 725 (LR), RGN 229 (ZC), Filler Locations: Sriganganagar, Hisar, Bawal, Ludhiana

#### 3.4 IVT- Mustard Late sown

SN	Entry	Pedigree	Centre
1	DRMRCI-130	RH- 819 X DRMR- 270	DRMR, Bharatpur
2	DRMR 2018-19	NRCHB 101 X DRMR 2398	DRMR, Bharatpur
3	DRMRHJ 2520	MJA 25 X MJR 20	DRMR, Bharatpur
4	RH 1999-19	RH 1402A X RH 1301	CCS HAU, Hisar
5	RH 1999-22	RH 1599-41 X RH 1402A	CCS HAU, Hisar
6	KMR (L)- 20-5	Vardan X kanti	CSAUA&T, Kanpur
7	KMR (L)- 20-6	Vardan X Maya	CSAUA&T, Kanpur
8	NPJ- 245	Pusa Vijay X Pusa Agrani	IARI, New Delhi
9	NPJ- 246	NPJ-113 X EC399299	IARI, New Delhi
10	PAB- 2014-4	EC552576 X Vaibhav	GBPUA&T, Pantnagar
11	PRL- 2017-2	EC552574 X PRL- 2007-3	GBPUA&T, Pantnagar
12	RGN-494	NPJ-153 X Laxmi	ARS, Sriganganagar
13	RGN-488	NPJ-162 X RGN-73	ARS, Sriganganagar
14	TM 179-2	TM2xIC264133	BARC, Mumbai
15	HUJM- 19-18	SEJ- 2 X HUJM- 9964	BHU, Varanasi
16	Kranti (NC)		
17	Zonal Check		
18	Latest Release		

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

Latest Release : Zone-II - RGN 236; Zone-III- CS 56

Locations:

Zone II :	Sriganganagar, Hisar, IARI New Delhi, Ludhiana, Abohar
Zone III:	Kanpur, Pantnagar, Varanasi, Morena, Dholi, Sabour

# 3.5 Hybrid Mustard

IHT

SN	Entry	Pedigree	Centre
1.	RHH 2001	Ogura based	CCS HAU, Hisar
2.	RHH 2002	Ogura based	CCS HAU, Hisar
3	RHH 2003	Ogura based	CCS HAU, Hisar
4	PHR 8076	DTM 200 X DTMR	PAU Ludhiana
5	PHR 8095	DTM 261 X DTMR	PAU Ludhiana
6	DRMRHJ 3101	OJA 1 X OJR 1	DRMR, Bharatpur
7	DRMRHJ 1108	MJA 11 X MJR 8	DRMR, Bharatpur
8	DRMRHJ 1403	MJA 14 X MJR 3	DRMR, Bharatpur
9	DRMRHJ 2409	MJA 24 X MJR 9	DRMR, Bharatpur
10	SVJH-66	SVJA-05 X SVJR-40	Shakti Vardhak Hybrid Seeds Pvt. Ltd.
11	SVJH-68	SVJA-03 X SVJR-02	Shakti Vardhak Hybrid Seeds Pvt. Ltd.
12	Pusa MH-57	Erucoides based	IARI, New Delhi
13	Pusa MH-61	Moricandia based	IARI, New Delhi
14	RMX9906	9529 X 1019	Rasi Seeds, Pvt. Ltd.
15	RMX9903	3007 X 1015	Rasi Seeds, Pvt. Ltd.
16	0IJ1010	PA1IJ104 X PR9IJ426	Bayer Bio Science Pvt. Ltd., Faridabad
17	0IJ1034	PA1IJ104 X PR9IJ521	Bayer Bio Science Pvt. Ltd., Faridabad
18	18J029C	4PDJQ29A/4PGQL32R	Corteva Agriscience, Jaipur
19	Kranti (NC)		
20	Zonal Check		
21	DMH-1 (Check)		
22	45S46 (Check)		

Observations on number of sterile/fertile plants are to be recorded on 20 plants per replication on boarder rows by covering main raceme at bud stage and recoding observation on seed set at maturity in hybrid trial

Zonal check:	Zone-III : RH 749 Zone-III : RGN 73 Zone IV : GDM 4
Locations:	
Zone II :	Hisar, Ludhiana, New Delhi, Palwal(Bayer), Gurugram (TIEARA), Mahendragarh (Shaktivardhak)
Zone III :	Kanpur, Pantnagar, Morena, Kota, Bharatpur, Varanasi, Dholi, Jhansi
Zone IV:	SK Nagar, Mandore, Nagpur, Jalgaon

SN	Entry	Pedigree	Centre
1.	LES- 62	LES- 45 X EC- 61	IARI, New Delhi
2.	LES- 63	LES- 45 X EC- 61	IARI, New Delhi
3.	PDZ- 14 #	Agrani X Heera	IARI, New Delhi
4.	PDZ- 15 #	Agrani X Heera	IARI, New Delhi
5.	JC 32#	(PBR 210 X JM 06003) X NUDHYJ 4	PAU Ludhiana
6.	JC 36#	(PBR 210 X NUDHYJ 4) X JM 06020	PAU Ludhiana
7.	RH (OE)-1804	EC 597328 X RH (HO)0502	CCS, HAU, Hisar
8.	RH (OE)-1807	EC 597328 X RH (HO)0502	CCS, HAU, Hisar
9.	0IJ5001#	PA7IJ136 X PR9IJ404	Bayer Bio Science Pvt.
			Ltd., Faridabad
10.	LR		
11.	Zonal Check		
11	Kranti (NC)		
12	PDZ1 (double low		
	check)		

#### **3.6 Quality Mustard : IVT**

# - double low strains

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

Latest Release (Quality Check): Zone II- Pusa Mustard 29; Zone III- Pusa Mustard 30 Locations:

**Zone II :** New Delhi, Hisar, Ludhiana, Sriganganagar, Bawal

Zone III : Pantnagar, Kanpur, Morena, Bharatpur, Dholi

### **AVT-I + II Quality Mustard**

Zone II

Entries: LES 60, 9IJ5001#, RH (OE) 1706)\*, PDZ 12# \$, PDZ 11#, RCH 1#, RH 749 (ZC), Pusa Mustard 29 (LR), Kranti (NC), PDZ 1 (double low check) Locations: New Delhi, Hisar, Ludhiana, Sriganganagar

\*AVT I Repeat Entry, # double low entry and \$ AVT II Strain

#### AVT-I Quality Mustard Zone III

Entries: LES 60, RGN 73 (ZC), Pusa Mustard 30 (LR), Kranti (NC) Locations : Pantnagar, Kanpur, Morena, Bharatpur, Varanasi, Dholi

# 3.7 Mustard: Saline/alkaline conditions

AVT- I

**Entries:** CS 2005-143, Kranti (NC), CS- 54 (Check), CS 60 (LR), Giriraj (LR), Filler 1 **Locations:** Agra, Hisar, Karnal, Nain (Panipat), Lucknow Note: Trial is to be conducted in the soil having minimum of ECe 10.0/pH > 9.0

# 3.8 Mustard: White Rust Resistance

/	AVI I-NIL		
SN	Entry	Pedigree	Centre
1	Rohini (A4A5)-491	WRR Introgressed Rohini	CGMCP, UDSC, New Delhi
2	PB (A4A5)-842	WRR Introgressed Pusa Bold	CGMCP, UDSC, New Delhi
3	PJK (A4A5)-21	WRR Introgressed Pusa Jaikisan	CGMCP, UDSC, New Delhi
4	Varuna (A4A5)-936-279	WRR Introgressed Varuna	CGMCP, UDSC, New Delhi
5	Rohini (Parent)		
6	Pusa Bold (Parent)		
7	Pusa Jaikisan (Parent)		
8	Varuna (Parent)		
9	Zonal Check		
10	LR		

Zonal Checks: Zone- II- RH 749; Zone- III – Maya

Latest Release: Zone- II (Irrigated) - Giriraj; Zone- III: RGN 73

Locations :

**Zone II**: Ludhiana, Hisar, Sriganganagar, Delhi, Chatha **Zone III:** Kanpur, Pantnagar, Morena, Dholi, Bharatpur

4. Gobhi sarson

AVT I + II Entries: GSH 2196, AKGS 19-8, HNS 702, GSH 2180, GSH 1699#, GSL 1(NC/ZC), Kranti (NC), GSC 6 (QC) # AVT II Strain

Locations: Kangra, Dhaula Kuan, Bajaura, Chatha, Ludhiana

# 5. Taramira

# AVT II

Entries: RTM 1624, T-27 (NC), RTM-314(ZC), RTM 1351 (LR), Filler 1

Locations: Jobner, Bawal, Navgaon, Morena, Diggi

### LAYOUT OF EXPERIMENTS

Trials	IVT	AVT
Design	RBD/Alpha Lattice	RBD
Replication	Three (two blocks in each	Four
	replication)	
Plot size Varieties- Zone II	Gross: 2.7 X 5 m; Net: 1.8 X 4.5	Gross: 4.5 X 5 m; Net: 3.6 X 4.5 m
	m	
Plot size Varieties-Zone I,	Gross: 1.8 X 5 m; Net: 1.2 X 4.5	Gross: 3.0 X 5 m; Net: 2.4 X 4.5 m
III, IV & V	m	
Plot size Hybrids	Gross Zone II; 2.70 X 5 m; Net:	Gross Zone I, III, IV and V
	1.80 X 4.5 m	Net: 4.5 X 5 m; Net: 3.6 X 4.5 m
	Gross Zone I, III, IV and V	
	2.25 X 5 m; Net: 1.35 X 4.5 m	
No. of Rows	Six, Data to be recorded from four	Ten, Data to be recorded from eight rows
Zone I, II, III, IV& V	rows	
No. of Rows	Seven of 4 m length	Twelve of 4 m length
NEH region		
Spacing varietal trials	45 X15 cm Zone II	45 X15 cm Zone II
	30 X 10 cm Zone I, III, IV and V	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 <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> 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 <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O kg/ha
Rai,Gobhi Sarson		Rainfed- 40 : 20 : 20, N : P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> 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 20<sup>th</sup> August
- Seed material of rest of the trials should be sent latest by 30<sup>th</sup> August
- 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 packet of IVT, AVT 1 and AVT 2 entries should be sent separately for Entomological and Pathological experiments.
- 250 g seed / location of AVT-2 entries should be sent separately for Agronomical experiments.

• 300 g seed of each quality strain should be sent separately for biochemical analysis

#### Data reporting:-

- Data should be sent to Director, DRMR (<u>director.drmr@gmail.com</u>) 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 must be sent latest by 10<sup>th</sup> July for inclusion in concerned IVT trial.

#### 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.

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

#### Cut off sowing dates for different trials

### 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 double zero lines, promotion shall be on the basis of 10% superiority for seed/oil yield over quality check as well as at least -10 % seed/oil yield of the best non quality check
- Those entries of AVT I trial, which yield (seed/oil yield) more than 5% but less than 10% over the best check shall be repeated for one more year in same trial, however in this case data of 1<sup>st</sup> year AVT 1 trial shall not be the part of the proposal
- 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.
- 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 General Mean
- In Salinity trials EC levels should be 10 or > 10 dS/m for inclusion of the data.
- A In toria/early mustard trial, promotion shall be based upon superiority over the earliest maturing check and 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.

# Proposed Alpha Lattice Design for IVT Mustard Timely Sown Irrigated v = 27, b = 9, r = 3, k = 9, AE = 0.9626, DE = 0.9832 $\alpha(0,1,2,3)$

### **Randomized Layout**

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

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

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

# XXVII Annual Group Meeting of AICRP Rapeseed-Mustard August 3-4, 2020 at online

#### **SESSION III: Breeder Seed Production**

Chairman	: Dr. T. R. Sharma, DDG (CS), ICAR, New Delhi
Co- Chairman	: Dr. D. K. Yadava, ADG (Seed), ICAR, New Delhi
Rapporteur	: Dr. V. V. Singh, PS, ICAR-DRMR, Bharatpur, Rajasthan
	: Prof. Kartikeya Srivastava, I.A.Sc., BHU, Varanasi

After brief introductory remarks of the Chairman, Dr T R Sharma, DDG (CS), Dr Bhagirath Ram, Pr Scientist, ICAR-DRMR presented the detailed report on breeder seed production of the year 2019-20. He appriased the house that an indent of 76.02 g of breeder seed of 54 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 2019-20. He informed to the house that against the indent of 76.02 q. 258.64 q breeder seed was produced, indicating a surplus availability of 164.20 q. Breeder seed of 02 varieties Rajendra Suphlam of Indian mustard and Binoy (B9) of yellow sarson could not produced. Further, he informed that less quantity of Sushree (-0.65q) and Tapeshwari TK- 06-1 of toria (-0.35); DRMR 601 (-0.10) of Indian mustard. In addition, 116.19 q breeder seed of 24 varieties of Indian mustard was also reported from four centres. Thereafter, he appraised the house about surplus quantity of breeder seeds produced at ICAR-DRMR, Bharatpur. Subsequently, he gave an account of the percent contribution of recently notified (2010-2019) varieties in breeder seed production chain. He informed the house that indent (BSP-1) for 2020-21 will be posted shortly by the DAC on its website for 2020-21 once the indent is finalized by DAC. The finalized version of the same will be communicated to different co-operating centres and it can also be downloaded from the website of DAC www.seednet.com. Dr S K Jha, ADG (Oilseeds & Pulses), ICAR, New Delhi suggested that Director, ICAR-DRMR, Bharatpur request PORS, Berhampore for nucleus seed of Rapeseed- mustard varieties and give responsibility of breeder seed production to BCKV, Mohanpur, (WB).

During discussion, Dr P K Rai, Director ICAR-DRMR emphasized on maintenance of nucleus seed plots of respective varieties for quality seed production. He also stressed upon increasing the varietal replacement rate through popularization of newly improved varieties.

The Chairman, in his concluding remarks, appreciated the status of breeder seed production in country. He said that the SRR is appreciable in Rapeseed- mustard but there is further need to replace the older varieties with recently released varieties. The session ended with the vote of thanks to the Chair.

# XXVII Annual Group Meeting of AICRP Rapeseed-Mustard August 3-4, 2020 Online

Session IV : Planning & Technical Programme Formulation: Plant Pathology

Chairman : Dr. G. S. Saharan, Ex-Professor & Head, Dept. of Plant Pathology, CCSHAU, Hisar

**Rapporteurs** : Dr. Pankaj Sharma, Principal Scientist, ICAR-DRMR, Bharatpur

: Dr. S.S. Vaish, Professor, I.A. Sc., BHU, Varanasi

The planning and technical programme formulation session of Plant Pathology started with introductory remark by the Chairman Dr. G. S. Saharan, Ex-Professor & Head, Dept. of Plant Pathology, CCSHAU, Hisar. Dr. P.D. Meena, PI, Plant Pathology presented significant achievements during the year 2019-20. He insisted the scientist to take up the observations as per technical program for all experiments and submit in excel format after statistical analysis. Chairman, emphasized to ensure that if the disease severity/incidence on susceptible check is less than resistant/ tolerant check will not be considered for publication in the report. White rust severity on B. napus and B. carinata checks or entries may be critically observed because some centre's are not careful in taking observations. DDG (CS) suggested for online proof of conducting trials, videos should be submitted at date of sowing, disease appearance, observations, peak of the disease and harvesting. Chairman advised to develop Near Isogenic Lines (NIL's) at ICAR-DRMR to identify the Albugo candida races with wider virulence in the host differential. It was also advised that four genotypes namely NRCDR 513, GSL 1, PBC 9221 and DRMRIJ 12-28 have shown differential reaction to the isolates may be crossed with universal susceptible genotypes and number of R-genes should be observed using pure single sporangium isolate. Dr. Saharan also suggested to record observations for different diseases in AICRP Agronomy and Entomology experiments. He also suggested to observe the cleistothesia formation in powdery mildew where ever it appears severely. The list of new entries for inclusion under different Plant Pathological trials in coming season, should be provided ten days before AICRP-RM workshop to PI, Plant Pathology. The results of different trials conducted during 2019-20 were reviewed critically and the technical programme for the year 2020-21 was finalized after through discussion. Two trials (4.7 & 4.9) standardization of differential hosts for identification of races in A. candida and testing of IDM module for major rapeseed-mustard diseases were concluded with the following recommendations:

- ✓ Seed treatment (ST) with *Trichoderma harzianum* @ 10g/ Kg seed, soil application of *Trichoderma* (1 kg/ 50kg FYM), basal application of zinc sulphate @ 15 kg/ ha+ S (dose location specific) + boron (10 kg borax/ ha), line sowing 45x20 cm, no irrigation during 25<sup>th</sup> Dec to 15<sup>th</sup> Jan minimize the disease incidence as compared to control, hence, recommended for Integrated Disease Management (IDM) for zone II, III, IV.
- ✓ Keeping in view the variable reaction observed over the years among 5 Albugo candida isolates at different locations, host differentials showed variation among isolates confirmed the existence of variability among A. candida isolates.
- ✓ After consistent testing under artificial conditions at seedling and true leaf stage, DRMRMJA-35, DRMRIJ-12-26, and DRMR 5206 genotypes are recommended as white rust resistant sources for use in breeding programme.

#### **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 2013 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**. Both soft (by email file attachment only) and hard copy of data should

reach the PI (Plant Pathology), ICAR-DRMR, Bharatpur latest by **30<sup>th</sup> April, 2021**. No hand written or unanalyzed data will be accepted.

<u>Attention</u>: (i) Seeds from different trials labelled suitably and in separate packets should reach the Director, ICAR-DRMR, Bharatpur **latest by 20 August 2020**. (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 different diseases

**Objective:** Disease response of elite accessions under different geographical conditions

a) Screening of *Brassica* AVT-I & AVT-II strains against different diseases under natural condition

S. No.	AVT-I+II (Entries)	S. No.	AVT-I+II (Entries)
Brassica juncea		Brassica juncea	
1.	RH 1999-42	21.	RH 1424
2.	KMR (E) 19-2	22.	RH 1676
3.	NPJ 229	23.	PDZ 11 (Q)
4.	PRE 17-2	24.	PDZ 12(Q)
5.	PRE 17-5	25.	9IJ5001 (Q Hybrid)
6.	DRMRCI 116	26.	RH (OE) 1706
7.	NPJ 230	27.	LES 60 (Q)
8.	NPJ 231	28.	RCH 1 (Q)
9.	RGN 443		Brassica napus
10.	PBR 385	29.	GSH 2196
11.	DRMRHJ 2403	30.	AKGS 19-8
12.	PHR 8022 (Hybrid)	31.	HNS 0702
13.	AKMS-19-2	32.	GSH 2180
14.	KMR (E) 19-1	33.	GSH 1699
15.	SKM 1626		Eruca sativa
16.	CS 2005-143	34.	RTM 1624
17.	DRMRCI 96		
18.	RMM 10-1-1		
19.	DRMR 2017-16		
20.	PR 2016-8		
Chooks	R jungar Pohini PI 1350 (SC) & I	ocal Chaol	P DIOVCD (DC) DUD 2 (TC AD), D

**Checks:** *B. juncea*: Rohini, RL 1359 (SC) & Local Check, BIOYSR (RC), PHR 2 (TC-AB); *B. napus*: GSL 1(RC-WR); *B. carinata*: DLSC 1 (RC-WR), WBN-1 (CR); *B. rapa* ssp Yellow *Sarson*: NRCYS-5-2 (SC); *B. rapa* var *Toria*: PT 303 (RC-WR); RTM 314

Location: Dholi, Pantnagar, Hisar, Morena, Jagdalpur, Ludhiana, Jhansi, S.K. Nagar, Shillongani, New Delhi, Banda, Sriganganagar, and Varanasi

**Layout:** i. Single row: two replications of 3 m row length

ii. Susceptible checks will be used after every two test rows

# b) Screening of *Brassica* AVT-I and AVT-II strains against different diseases using artificially inoculated infector-row under field condition

Disease	Location
Alternaria blight:	Dholi, Pantnagar, Ludhiana, Shillongoni
White rust:	Pantnagar, Morena, Hisar, Ludhiana
Sclerotinia rot:	Dholi, Ludhiana, Hisar, Bharatpur, Morena
Downy mildew:	Pantnagar, Jhansi
N7 (1 <sup>'</sup> 1 1	-

#### Methodology:

- 1. <u>Add oosporic material of local isolate only</u> after grinding hypertrophied plant material collected from the previous year crop along with seed for white rust and downy mildew.
- 2. For secondary spread of the disease make repeated inoculations after collecting inoculum from

the naturally infected plants for all the major diseases (AB, WR, DM, PM, SR).

3. Give frequent irrigation and higher doses of nitrogenous fertilizer to create epiphytotic.

#### **Observations to be recorded**

- a. Date of first appearance of each disease including bacterial rot
- b. 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.
- c. 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.

- d. 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).
- e. Date of each observation should be provided in the data sheet.
- f. 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

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

Percent Disease Intensity (PDI) = (N-1 X 0) + (N-2 X 1) + (N-3 X 3) + ((N-4 X 5) + (N-5 X 7) + (N-6 X 9) X 100No. of leaf samples X 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 Alternaria blight of rapeseed-mustard (Conn et al, 1990) modified and adopted by AICRP-RM Plant Pathologists 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 resistant	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 zoosporangia from naturally infected leaves with *Albugo candida*. Petri plates containing zoosporangia suspended in distilled water be kept at 4°C for 2 h to facilitate germination of zoosporangia. To assure germination of the sporangia, the plates may be examined under the low power microscope. Germinating zoosporangia 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* 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 *S. 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
- Locations: Dholi, Pantnagar, Morena, Hisar, S.K. Nagar, Ludhiana, Shillongoni, New Delhi, Sriganganagar, Jhansi, Jagdalpur, Jammu
- **Materials:** Concerned breeders/ scientists will supply the seed material to Director, DRMR indicating 'for Pathology 4.2 UDN trial'. Director, 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 50 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.

S. No.	Genotypes (B. juncea)	S. No.	Genotypes (B. juncea)
1.	PAB 14-5	23.	DRMR 2018-17
2.	RMM-10-1-1	24.	DRMR 2018-19
3.	DRMRSJ-1	25.	DRMR 2018-23
4.	DRMRSJ-7	26.	DRMR 2018-24
5.	DRMR 2018-37	27.	DRMR 2018-25
6.	DRMR 2018-41	28.	DRMR 2018-26
7.	DRMRSJ 25	29.	DRMR 2018-16
8.	DRMRSJ 26	30.	DRMRQ 202
9.	RMM-19-06	31.	DRMRQ 204
10.	RMM-19-18	32.	DRMRQ 1-2-37
11.	DRMRSJ-4	33.	DRMRQ 1-22
12.	DRMRSJ-19	34.	PAB-14-1
13.	DRMRSJ-21	35.	PAB-14-4
14.	DRMRSJ-22	36.	PAB-14-5
15.	DRMRSJ-159	37.	PAB-14-7
16.	DRMRSJ-206	38.	PAB-14-8
17.	DRMRSJ-271	39.	PAB-14-18
18.	DRMRSJ-302	40.	PMW 18
19.	DRMRSJ-312	41.	DRMRIJ-12-21
20.	DRMRSJ-349	42.	DRMRIJ-12-28
21.	DRMRSJ-361	43.	DRMRIJ-12-37
22.	DRMR 2018-1	44.	DRMRIJ-12-39
Checks:	B. juncea: Rohini, RL 1359 (SC) & Local C	heck, BIO	YSR (RC), PHR 2 (TC-AB); B. napus: GSL

**Checks:** *B. juncea*: Rohini, RL 1359 (SC) & Local Check, BIOYSR (RC), PHR 2 (TC-AB); *B. napus*: GSL 1(RC-WR); *B. carinata*: DLSC 1 (RC-WR), WBN-1 (CR); *B. rapa* ssp Yellow Sarson: NRCYS-5-2 (SC); *B. rapa* var *Toria*: PT 303 (RC-WR)

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-1, DRMRSJ-4, DRMRSJ-7, DRMRSJ-19, DRMRSJ-21, DRMRSJ-22,
	DRMRSJ-25, DRMRSJ-26, DRMRSJ-159, DRMRSJ-206, DRMRSJ-271, DRMRSJ-302,
	DRMRSJ-312, DRMRSJ-349, DRMRSJ-361, DRMRM-163, DRMRM-177, DRMR 2018-
	37, DRMR 2018-41, DRMR 2018-1, DRMR 2018-17, DRMR 2018-19, DRMR 2018-23,
	DRMR 2018-24, DRMR 2018-25, DRMR 2018-26, DRMR 2018-16,
Pantnagar	<i>Bj</i> : PAB-17-15, PAB-17-20, PAB-17-18, PAB-17-22, PAB-17-23
Morena	Bj: RMM-19-06, RMM-19-18
New Delhi	Bj: PMW 18, NPJ 247
Check:	<i>B. juncea</i> : Rohini, RL 1359 (SC) & Local Check, BIOYSR (RC), PHR 2 (TC-AB); <i>B. napus</i> :
	GSL 1(RC-WR); B. carinata: DLSC 1 (RC-WR), WBN-1 (CR); B. rapa ssp Yellow Sarson:
	NRCYS-5-2 (SC); B. rapa var Toria: PT 303 (RC-WR)
Locations:	Pantnagar, Dholi, Morena, Hisar, Ludhiana, Shillongani, Varanasi, Jammu

**Layout:** Replications: 02: Each entry should be sown in paired row of 3 m length between susceptible check *B. rapa* var Yellow Sarson (local check)

**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* using  $10^5$  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.

Scale to be used: 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

**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.

Centre	Entries to be sent
Bharatpur	Bj: DRMR-2018-37, DRMR 2018-41, DRMRSJ-7, DRMRSJ-1, DRMRSJ-4, DRMRDJ-1,
_	DRMRDJ-3, DRMRSJ-19, DRMRIJ 12-40, DRMRIJ-16-7-1, DRMRIJ 12-27, DRMRIJ 12-37,
	DRMR-5206, DRMRIJ 12-37, DRMRCI 125, DRMRCI 126, DRMRCI 131, DRMRCI 132,
	DRMRCI 138, DRMRCI 139, DRMRSJ-19, DRMRSJ-21, DRMRSJ-22, DRMRSJ-25,
	DRMRSJ-26, DRMRSJ-159, DRMRSJ-206, DRMRSJ-271, DRMRSJ-302, DRMRSJ-312,
	DRMRSJ-349, DRMRSJ-361, DRMR 2018-37, DRMR 2018-41, DRMR 2018-1, DRMR
	2018-17, DRMRM 18-35-11, DRMRM 18-36-12, DRMRM 18-37-13, DRMR 2018-19,
	DRMR 2018-23, DRMR 2018-24, DRMR 2018-25, DRMR 2018-26, DRMR 2018-16,
	DRMRIJ-12-21, DRMRIJ-12-28, DRMRIJ-12-37, DRMRIJ-12-39
New Delhi	Bj: PMW 18, NPJ 247
Hisar	<i>Bj</i> : RH 1400, RH 1400-1, RH- 1700, RH- 1700-1, RH- 1700-2, RH- 1700-3, RH- 1700-4
Pantnagar	<i>Bj:</i> PRD-17-1, PRD-17-2, PAB 14-5, PWR-13-8, PRD-14-4, PRD-14-23, PRD14-27
Morena	<i>Bj</i> : RMM-19-06, RMM-19-18
Delhi Univ.	Rohini (A4A5)-491, PB (A4A5)-842, PJK (A4A5)-21, Varuna (A4A5)-936-279,

	Rohini (Parent), Pusa Bold (Parent), Pusa Jaikisan (Parent), Varuna (Parent)
Resistant /	B. juncea: Rohini, RL 1359 (SC) & Local Check, BIOYSR (RC), PHR 2 (TC-AB); B.
Susceptible	napus: GSL 1(RC-WR); B. carinata: DLSC 1 (RC-WR), WBN-1 (CR); B. rapa ssp
check	Yellow Sarson: NRCYS-5-2 (SC); B. rapa var Toria: PT 303 (RC-WR)
Locations:	Pantnagar, Morena, Hisar, Ludhiana, Bharatpur

**Note:** Concerned breeders/ scientists will supply the seed material of each entry (minimum 50 g) to Director, DRMR indicating 'for Pathology 4.4 NDN / WR 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 the help of breeder.

**Layout:** Replications: 02; each entry should be sown in paired row of 3 m length between susceptible check *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 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

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.

Centre	Entries to be sent		
Materials:	Bj: DRMRSJ-21, DRMRSJ-22, DRMR 5206, DRMRSJ-25, DRMRSJ-26,		
	DRMR 2017-8, DRMR 2018-24		
Susceptible check:	<i>Bj</i> : Rohini, RL 1359, <i>Br</i> : NRCYS-5-2		
Tolerant check:	<i>Bc</i> : NPC 16		
Locations:	Dholi, Pantnagar, Hisar, Ludhiana, Bharatpur, Shillongani, Sriganganagar,		
	Jhansi, NBPGR, New Delhi		
Layout:	i. Two rows each of 3 m row length, three replications		
	ii. Susceptible check will be used after four test rows		

**Note:** Concerned breeders/ scientists will supply the seed material of each entry (minimum 50 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.

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

- · ·				
<b>Objective:</b>	Disease response of accessions promoted to IVT under different geographical			
_	conditions in natural conditions			
Location:	Dholi, Pantnagar, Hisar, Ludhiana, Morena, Jagdalpur, Sriganganagar, SK Nagar,			
	Shillongoni			
Layout:	i. Single row: two replications of 3 m row length			
	ii. Susceptible checks will be used after every two test rows			
<b>Observations:</b>	s: Should be recorded and reported as percent disease severity (AB, WR, PM) or			
	percent disease incidence (SR, DM, CR) as per trial 4.1.			

Brassica juncea (Early)         B. juncea (Rainfed)           1.         KMR (E)- 20-1         45.         DRMRCI-128           2.         KMR (E)- 20-2         46.         DRMRS1 276           3.         DRMRCI-129         47.         DRMRS1 276           3.         DRMRT 1712         48.         DRMRHT 1913           5.         DRMRHT 1712         49.         NPJ- 243           6.         RH 1999-12         50.         NPJ- 244           7.         RH 1999-12         51.         RGN-500           8.         PRE-2018-8         52.         RGM-486           9.         PRE-2018-10         53.         RH 1920           10.         NPJ-240         55.         TM 264           11.         NPJ-240         55.         TM 264           12.         SKM 1746         56.         JM-13-3           13.         SVJH-006         57.         CAU- RM-41-1           14.         PHR 8031(hybrid)         B. juncea (Hybrid mustard)           16.         RMM-19-06         59.         RHH 2001           17.         ORM 2019-01         60.         RHH 2002           18.         TM 188         61.         RHH 2002	S. No.	Entries	S. No.	Entries
I.         KMR (E)- 20-1         45.         DRMRCI-128           2.         KMR (E)- 20-2         46.         DRMRSJ 276           3.         DRMRCI-129         47.         DRMRHJ 1908           4.         DRMRSJ 112         48.         DRMRHJ 1913           5.         DRMRHT 1712         49.         NPJ-243           6.         RH 1999-12         50.         NPJ-244           7.         RH 1999-21         51.         RGN-486           9.         PRE-2018-8         52.         RGN-486           9.         PRE-2018-10         53.         RH 1920           10.         NPJ-239         54.         RH 1921           11.         NPJ-240         55.         TM 264           12.         SKM 1746         56.         JM-13-3           13.         SVIH-006         57.         CAU- RM-41-1           14.         PHR 8031(hybrid) <b>B. juncea</b> (Hybrid mustard)           16.         RMM-19-06         59.         RHH 2001           17.         ORM 2019-01         60.         RHH 2003           19.         BAUM 09-12-2         62.         PHR 8076           20         KGMH-3811         63. <td< th=""><th colspan="2">Brassica juncea (Early)</th><th>B. junc</th><th>ea (Rainfed)</th></td<>	Brassica juncea (Early)		B. junc	ea (Rainfed)
2.         KMR (E) - 20-2         46.         DRMRSJ 276           3.         DRMRSJ 112         47.         DRMRHJ 908           4.         DRMRSJ 112         48.         DRMRHT 1913           5.         DRMRHT 1712         49.         NPJ-243           6.         RH 1999-12         50.         NPJ-244           7.         RH 1999-21         51.         RGN-500           8.         PRE-2018-8         52.         RGN-486           9.         PRE-2018-10         53.         RH 1920           10.         NPI-239         54.         RH 1921           11.         NP4-240         55.         TM 264           12.         SKM 1746         56.         JM-13-3           13.         SVJH-006         57.         CAU-RM-41-1           14.         PHR 8024 (hybrid)         58.         PBR 450           15.         PHR 8031(hybrid) <b>B. juncea</b> (Hybrid mustard)           16.         RMM-19-06         69.         RHH 2001           17.         ORM 2019-01         60.         RHH 2002           18.         TM 188         61.         RHH 2003           19.         BAUM 09-12-2         62.	1.	KMR (E)- 20-1	45.	DRMRCI- 128
3.         DRMRCI-129         47.         DRMRHJ 908           4.         DRMRST 112         48.         DRMRHT 1913           5.         DRMRHT 1712         49.         NPJ-243           6.         RH 1999-12         50.         NPJ-243           7.         RH 1999-12         51.         RGN-500           8.         PRE-2018-8         52.         RGN-486           9.         PRE 2018-10         53.         RH 1920           10.         NPJ-239         54.         RH 1921           11.         NPJ-240         55.         TM 264           12.         SKM 1746         56.         JM.13-3           13.         SVJH-006         57.         CAU-RM-4-1-1           14.         PHR 8024 (hybrid)         58.         PBR 450           15.         PHR 8031 (hybrid) <i>B. juncea</i> (Hybrid mustard)           16.         RMM-19-06         59.         RHH 2001           17.         ORM 2019-01         60.         RHH 2002           18.         TM 188         61.         RHH 2003           19.         BAUM 09-12-2         62.         PHR 8095           B.juncea (Timely Sown Irrigated)         64.         DR	2.	KMR (E)- 20-2	46.	DRMRSJ 276
4.       DRMRSJ 112       48.       DRMRHT 1913         5.       DRMRHT 1712       49.       NPJ-243         6.       RH 1999-12       50.       NPJ-244         7.       RH 1999-12       51.       RGN-500         8.       PRE-2018-8       52.       RGN-486         9.       PRE-2018-10       53.       RH 1920         10.       NPJ-239       54.       RH 1921         11.       NPJ-240       55.       TM 264         12.       SKM 1746       56.       JM-13-3         13.       SVJH-006       57.       CAU-RM-41-1         14.       PHR 8024 (hybrid)       58.       PBR 450         15.       PHR 8031(hybrid) <b>B. juncea (Hybrid mustard)</b> 16.       RMM-19-06       59.       RHH 2001         17.       ORM 2019-01       60.       RHH 2002         18.       TM 188       61.       RHH 2003         19.       BAUM 09-12-2       62.       PHR 8076         20       KGMH-3811       63.       PHR 8076         21.       DRMRCI-127       66.       DRMRHJ 1108         22.       DRMR 2018-17       67.       DRMRHJ 1403	3.	DRMRCI- 129	47.	DRMRHJ 908
5.       DRMRHT 1712       49.       NPJ-243         6.       RH 1999-12       50.       NPJ-244         7.       RH 1999-21       51.       RGN-500         8.       PRE-2018-8       52.       RGN-486         9.       PRE-2018-10       53.       RH 1920         10.       NPJ-239       54.       RH 1921         11.       NPJ-240       55.       TM 264         12.       SKM 1746       56.       JM-13-3         13.       SVJH-006       57.       CAU- RM-4.1-1         14.       PHR 8031(hybrid) <b>B. juncea</b> (Hybrid mustard)         16.       RMM-19-06       59.       RHH 2001         17.       ORM 2019-01       60.       RHH 2002         18.       TM 188       61.       RHH 2003         19.       BAUM 09-12-2       62.       PHR 8076         20.       KGMH-3811       63.       PHR 8076         21.       DRMRCI-127       66.       DRMRHJ 1403         23.       DRMRCI-127       66.       DRMRHJ 1403         23.       DRMRHT 1318       68.       SVJH-66         24.       SKM 1728       69.       SVJH-66	4.	DRMRSJ 112	48.	DRMRHT 1913
6.         RH 1999-12         50.         NPJ-244           7.         RH 1999-21         51.         RGN-500           8.         PRE-2018-8         52.         RGN-486           9.         PRE-2018-10         53.         RH 1920           10.         NPJ-239         54.         RH 1921           11.         NPJ-240         55.         TM 264           12.         SKM 1746         56.         JM-13-3           13.         SVJH-006         57.         CAU-RM-4-1-1           14.         PHR 8024 (hybrid) <b>B.</b> juncea (Hybrid mustard)           16.         RMM-19-06         59.         RHH 2001           17.         ORM 2019-01         60.         RHH 2002           18.         TM 188         61.         RHH 2003           19.         BAUM 09-12-2         62.         PHR 8076           20         KGMH-3811         63.         PHR 8076           20         KGMH-3811         64.         DRMRHJ 2409           21.         DRMRCI-127         66.         DRMRHJ 108           22.         DRMR 2018-17         67.         DRMRHJ 1403           23.         DRMRH 2018-17         7.         DR0	5.	DRMRHT 1712	49.	NPJ- 243
7.       RH 199-21       51.       RGN-500         8.       PRE-2018-8       52.       RGN-486         9.       PRE-2018-10       53.       RH 1920         10.       NPJ-239       54.       RH 1921         11.       NPJ-239       54.       RH 1921         11.       NPJ-240       55.       TM 264         12.       SKM 1746       56.       JM-13-3         13.       SVJH-006       57.       CAU- RM -41-1         14.       PHR 8024 (hybrid)       58.       PBR 450         15.       PHR 8031(hybrid) <i>B. juncea</i> (Hybrid mustard)         16.       RMM-19-06       59.       RHH 2001         17.       ORM 2019-01       60.       RHH 2002         18.       TM 188       61.       RHH 2003         19.       BAUM 09-12-2       62.       PHR 8076         20       KGMH-3811       63.       PHR 8076         21.       DRMRCI-127       66.       DRMRH1 2409         22.       DRMR 2018-17       67.       DRMRH1 1403         23.       DRMRT1 1318       68.       SVJH-66         24.       SKM 1728       69.       SVJH-66 <t< td=""><td>6.</td><td>RH 1999-12</td><td>50.</td><td>NPJ- 244</td></t<>	6.	RH 1999-12	50.	NPJ- 244
8.         PRE- 2018-8         52.         RGN-486           9.         PRE- 2018-10         53.         RH 1920           10.         NPJ- 239         54.         RH 1921           11.         NPJ- 240         55.         TM 264           12.         SKM 1746         56.         JM-13-3           13.         SVJH-006         57.         CAU-RM-4-1-1           14.         PHR 8024 (hybrid)         58.         PBR 450           15.         PHR 8031 (hybrid) <b>B. juncea</b> (Hybrid mustard)           16.         RMM-19-06         59.         RHH 2001           17.         ORM 2019-01         60.         RHH 2003           19.         BAUM 09-12-2         62.         PHR 8076           20         KGMH-3811         63.         PHR 8076           21.         DRMRCI-127         66.         DRMRHJ 1403           22.         DRMR 2018-17         67.         DRMRHJ 1403           23.         DRMRTI 1318         68.         SVJH-66           24.         SKM 1728         69.         SVJH-68           25.         SKM 1620         70.         Pusa MH-57           26.         RGN-491         71.	7.	RH 1999-21	51.	RGN-500
9.         PRE- 2018-10         53.         RH 1920           10.         NPJ- 239         54.         RH 1921           11.         NPJ- 240         55.         TM 264           12.         SKM 1746         56.         JM-13-3           13.         SVJH-006         57.         CAU-RM-4-1-1           14.         PHR 8031(hybrid)         B. juncea (Hybrid mustard)           16.         RMM-19-06         59.         RHH 2001           17.         ORM 2019-01         60.         RHH 2002           18.         TM 188         61.         RHH 2003           19.         BAUM 09-12-2         62.         PIR 8076           20         KGMH-3811         63.         PHR 8075           8. juncea (Timely Sown Irrigated)         64.         DRMRHJ 2409           65.         DRMRHJ 2409         65.         DRMRHJ 108           22.         DRMR 2018-17         67.         DRMRHJ 2409           23.         DRMRHT 1318         68.         SVJH-66           24.         SKM 1728         69.         SVJH-68           25.         SKM 1620         70.         Pusa MH-61           27.         RGN-483         72.	8.	PRE- 2018-8	52.	RGN-486
10.         NPJ- 239         54.         RH 1921           11.         NPJ- 240         55.         TM 264           12.         SKM 1746         56.         JM-13-3           13.         SVJH-006         57.         CAU-RM-4-1-1           14.         PHR 8031(hybrid) <b>B.</b> juncea (Hybrid mustard)           16.         RMM-19-06         59.         RHH 2001           17.         ORM 2019-01         60.         RHH 2002           18.         TM 188         61.         RHH 2003           19.         BAUM 09-12-2         62.         PHR 8076           20         KGMH-3811         63.         PHR 8095 <b>B.</b> juncea (Timely Sown Irrigated)         64.         DRMRHJ 2409           65.         DRMRHJ 108         22.         DRMR 2018-17           67.         DRMRHJ 1108         23.         DRMRH 2018-17           71.         Pusa MH-66         24.         SKM 1728         69.           23.         DRMRHT 1318         68.         SVJH-68           25.         SKM 1620         70.         Pusa MH-61           27.         RGN-483         72.         RMX9903           29.         RH 1974	9.	PRE- 2018-10	53.	RH 1920
11.         NPJ-240         55.         TM 264           12.         SKM 1746         56.         JM-13-3           13.         SVJH-006         57.         CAU- RM-4-1-1           14.         PHR 8024 (hybrid)         58.         PBR 450           15.         PHR 8031(hybrid) <b>B. juncea</b> (Hybrid mustard)           16.         RMM-19-06         59.         RHH 2001           17.         ORM 2019-01         60.         RHH 2003           19.         BAUM 09-12-2         62.         PHR 8076           20         KGMH-3811         63.         PHR 8076           20         KGMH-3811         63.         PHR 8095 <b>B. juncea</b> (Timely Sown Irrigated)         64.         DRMRHJ 2409           21.         DRMRCI-127         66.         DRMRHJ 1108           22.         DRMR 2018-17         67.         DRMRHJ 1403           23.         DRMRHT 1318         68.         SVJH-66           24.         SKM 1620         70.         Pusa MH-57           26.         RGN-491         71.         Pusa MH-51           27.         RGN-483         72.         RMX9906           28.         PBR 507         73.	10.	NPJ- 239	54.	RH 1921
12.         SKM 1746         56.         JM-13-3           13.         SVJH-006         57.         CAU- RM- 4-1-1           14.         PHR 8024 (hybrid)         58.         PBR 450           15.         PHR 8031(hybrid)         B. juncea (Hybrid mustard)           16.         RMM-19-06         59.         RHH 2001           17.         ORM 2019-01         60.         RHH 2002           18.         TM 188         61.         RHH 2003           19.         BAUM 09-12-2         62.         PHR 8076           20         KGMH-3811         63.         PHR 8095           B. juncea (Timely Sown Irrigated)         64.         DRMRHJ 2409           65.         DRMRHJ 1108         22.           DRMR 2018-17         67.         DRMRHJ 1403           23.         DRMRT 1318         68.         SVJH-66           24.         SKM 1728         69.         SVJH-68           25.         SKM 1620         70.         Pusa MH-61           27.         RGN-491         71.         Pusa MH-61           27.         RGN-483         72.         RMX9906           28.         PBR 507         73.         RMX9903	11.	NPJ- 240	55.	TM 264
13.         SVJH-006         57.         CAU- RM- 4-1-1           14.         PHR 8024 (hybrid)         58.         PBR 450           15.         PHR 8031 (hybrid) <b>B. juncea</b> (Hybrid mustard)           16.         RMM-19-06         59.         RHH 2001           17.         ORM 2019-01         60.         RHH 2002           18.         TM 188         61.         RHH 2003           19.         BAUM 09-12-2         62.         PHR 8076           20         KGMH-3811         63.         PHR 8095 <b>B. juncea</b> (Timely Sown Irrigated)         64.         DRMRHJ 2409           0	12.	SKM 1746	56.	JM-13-3
14.       PHR 8024 (hybrid)       58.       PBR 450         15.       PHR 8031(hybrid) <i>B. juncea</i> (Hybrid mustard)         16.       RMM-19-06       59.       RHH 2001         17.       ORM 2019-01       60.       RHH 2002         18.       TM 188       61.       RHH 2003         19.       BAUM 09-12-2       62.       PHR 8076         20       KGMH-3811       63.       PHR 8095 <i>B. juncea</i> (Timely Sown Irrigated)       64.       DRMRHJ 2409         65.       DRMRHJ 108       22.         DRMR 2018-17       67.       DRMRHJ 1108         23.       DRMR 2018-17       67.       DRMRHJ 1403         24.       SKM 1728       69.       SVJH-66         24.       SKM 1728       69.       SVJH-68         25.       SKM 1620       70.       Pusa MH-57         26.       RGN-483       72.       RMX9906         28.       PBR 507       73.       RMX9903         29.       RH 1974       74.       0IJ1010         30.       RH 1975       75.       0IJ1034         31.       KMR- 20-3       76.       18J029C         32.       KM	13.	SVJH-006	57.	CAU- RM- 4-1-1
15.       PHR 8031(hybrid) <i>B. juncea</i> (Hybrid mustard)         16.       RMM-19-06       59.       RHH 2001         17.       ORM 2019-01       60.       RHH 2002         18.       TM 188       61.       RHH 2003         19.       BAUM 09-12-2       62.       PHR 8076         20       KGMH-3811       63.       PHR 8075         20.       KGMH-3811       63.       PHR 8076         20.       DRMRVI Sown Irrigated)       64.       DRMRHJ 2409	14.	PHR 8024 (hybrid)	58.	PBR 450
16.       RMM-19-06       59.       RHH 2001         17.       ORM 2019-01       60.       RHH 2002         18.       TM 188       61.       RHH 2003         19.       BAUM 09-12-2       62.       PHR 8095         20.       KGMH-3811       63.       PHR 8095 <b>B. juncea</b> (Timely Sown Irrigated)       64.       DRMRHJ 2409         65.       DRMRHJ 2409         62.       PLR 8076         20.       KGMH-3811       63.         7       DRMRTJ 2409         65.       DRMRHJ 1403         21.       DRMRCI-127       66.         22.       DRMR 2018-17       67.         23.       DRMRHT 1318       68.         24.       SKM 1728       69.         25.       SKM 1620       70.         26.       RGN-483       72.         27.       RGN-483       72.         28.       PBR 507       73.         29.       RH 1974       74.       0IJ 1010         30.       RH 1975       75.       0IJ 1034         31.       KMR-20-3       76.       18J029C         32.       KMR-20-4 <b>B. rapa</b> var Toria </td <td>15.</td> <td>PHR 8031(hybrid)</td> <td>B. junc</td> <td>ea (Hybrid mustard)</td>	15.	PHR 8031(hybrid)	B. junc	ea (Hybrid mustard)
17.       ORM 2019-01       60.       RHH 2002         18.       TM 188       61.       RHH 2003         19.       BAUM 09-12-2       62.       PHR 8076         20       KGMH-3811       63.       PHR 8095 <b>B. juncea (Timely Sown Irrigated)</b> 64.       DRMRHJ 2409         65.       DRMRHJ 3101         21.       DRMRCI-127       66.       DRMRHJ 1108         22.       DRMR 2018-17       67.       DRMRHJ 1403         23.       DRMRHT 1318       68.       SVJH-66         24.       SKM 1728       69.       SVJH-68         25.       SKM 1620       70.       Pusa MH-57         26.       RGN-491       71.       Pusa MH-61         27.       RGN-483       72.       RMX9906         28.       PBR 507       73.       RMX9903         29.       RH 1974       74.       011010         30.       RH 1975       75.       011034         31.       KMR-20-3       76.       18J029C         32.       KMR-20-4 <b>B. rapa var Toria</b> 33.       NPJ-241       74.       TKM-20-1         34.       NPJ-242       75. <td>16.</td> <td>RMM-19-06</td> <td>59.</td> <td>RHH 2001</td>	16.	RMM-19-06	59.	RHH 2001
18.         TM 188         61.         RHH 2003           19.         BAUM 09-12-2         62.         PHR 8076           20         KGMH-3811         63.         PHR 8095 <i>B. juncea</i> (Timely Sown Irrigated)         64.         DRMRHJ 2409           65.         DRMRHJ 3101           21.         DRMRCI-127         66.         DRMRHJ 1108           22.         DRMR 2018-17         67.         DRMRHJ 1403           23.         DRMRHT 1318         68.         SVJH-66           24.         SKM 1728         69.         SVJH-68           25.         SKM 1620         70.         Pusa MH-57           26.         RGN-491         71.         Pusa MH-61           27.         RGN-483         72.         RMX9906           28.         PBR 507         73.         RMX9903           29.         RH 1974         74.         0IJ1010           30.         RH 1975         75.         0IJ1034           31.         KMR- 20-3         76.         18J029C           32.         KMR- 20-4 <b>B. rapa var Toria</b> 33.         NPJ- 241         74.         TKM- 20-1           34.         N	17.	ORM 2019-01	60.	RHH 2002
19.         BAUM 09-12-2         62.         PHR 8076           20         KGMH-3811         63.         PHR 8095           B. juncea (Timely Sown Irrigated)         64.         DRMRHJ 2409           65.         DRMRHJ 3101           21.         DRMRCI-127         66.         DRMRHJ 1108           22.         DRMR 2018-17         67.         DRMRHJ 1403           23.         DRMRHT 1318         68.         SVJH-66           24.         SKM 1728         69.         SVJH-66           25.         SKM 1620         70.         Pusa MH-57           26.         RGN-491         71.         Pusa MH-61           27.         RGN-483         72.         RMX9906           28.         PBR 507         73.         RMX9903           29.         RH 1974         74.         0IJ1010           30.         RH 1975         75.         0IJ1034           31.         KMR- 20-3         76.         18J029C           32.         KMR- 20-4 <b>B. rapa var Toria</b> 33.         NPJ- 241         74.         TKM- 20-1           34.         NPJ- 242         75.         TKM- 20-2           35.	18.	TM 188	61.	RHH 2003
20         KGMH-3811         63.         PHR 8095           B. juncea (Timely Sown Irrigated)         64.         DRMRHJ 2409           65.         DRMRHJ 3101           21.         DRMRCI-127         66.         DRMRHJ 1108           22.         DRMR 2018-17         67.         DRMRHJ 1403           23.         DRMRHT 1318         68.         SVJH-66           24.         SKM 1728         69.         SVJH-68           25.         SKM 1620         70.         Pusa MH-57           26.         RGN-491         71.         Pusa MH-61           27.         RGN-483         72.         RMX9906           28.         PBR 507         73.         RMX9903           29.         RH 1974         74.         0IJ1010           30.         RH 1975         75.         0IJ1034           31.         KMR- 20-3         76.         18J029C           32.         KMR- 20-4 <i>B. rapa</i> var Toria           33.         NPJ - 241         74.         TKM- 20-1           34.         NPJ - 242         75.         TKM- 20-2           35.         JM-14-8         76.         PT - 2018-09           37. <th< td=""><td>19.</td><td>BAUM 09-12-2</td><td>62.</td><td>PHR 8076</td></th<>	19.	BAUM 09-12-2	62.	PHR 8076
B. juncea (Timely Sown Irrigated)         64.         DRMRHJ 2409           65.         DRMRHJ 3101           21.         DRMRCI- 127         66.         DRMRHJ 1108           22.         DRMR 2018-17         67.         DRMRHJ 1403           23.         DRMRHT 1318         68.         SVJH-66           24.         SKM 1728         69.         SVJH-68           25.         SKM 1620         70.         Pusa MH-57           26.         RGN-491         71.         Pusa MH-61           27.         RGN-483         72.         RMX9906           28.         PBR 507         73.         RMX9903           29.         RH 1974         74.         0IJ1010           30.         RH 1975         75.         0IJ1034           31.         KMR- 20-3         76.         18J029C           32.         KMR- 20-4 <b>B. rapa var Toria</b> 33.         NPJ- 241         74.         TKM- 20-1           34.         NPJ- 242         75.         TKM- 20-2           35.         JM-14-8         76.         PT - 2018-09           37.         PRB- 2012-3         78.         RMT-19-14           38.	20	KGMH-3811	63.	PHR 8095
G         DRMRCI-127         65.         DRMRHJ 3101           21.         DRMRCI-127         66.         DRMRHJ 1108           22.         DRMR 2018-17         67.         DRMRHJ 1403           23.         DRMRHT 1318         68.         SVJH-66           24.         SKM 1728         69.         SVJH-66           24.         SKM 1620         70.         Pusa MH-57           26.         RGN-491         71.         Pusa MH-61           27.         RGN-483         72.         RMX9906           28.         PBR 507         73.         RMX9903           29.         RH 1974         74.         0IJ1010           30.         RH 1975         75.         0IJ1034           31.         KMR- 20-3         76.         18J029C           32.         KMR- 20-4 <b>B. rapa var Toria</b> 33.         NPJ- 241         74.         TKM- 20-1           34.         NPJ- 242         75.         TKM- 20-2           35.         JM-14-8         76.         PT- 2015-8           36.         PR-2017-5         77.         PT- 2018-09           37.         PRB- 2012-3         78.         RMT-19-17 <td>B. junce</td> <td>a (Timely Sown Irrigated)</td> <td>64.</td> <td>DRMRHJ 2409</td>	B. junce	a (Timely Sown Irrigated)	64.	DRMRHJ 2409
21.       DRMRCI-127       66.       DRMRHJ 1108         22.       DRMR 2018-17       67.       DRMRHJ 1403         23.       DRMRHT 1318       68.       SVJH-66         24.       SKM 1728       69.       SVJH-68         25.       SKM 1620       70.       Pusa MH-57         26.       RGN-491       71.       Pusa MH-61         27.       RGN-483       72.       RMX9906         28.       PBR 507       73.       RMX9903         29.       RH 1974       74.       OIJ1010         30.       RH 1975       75.       OIJ1034         31.       KMR- 20-3       76.       18J029C         32.       KMR- 20-4 <b>B. rapa var Toria</b> 33.       NPJ-241       74.       TKM- 20-1         34.       NPJ-242       75.       TKM- 20-2         35.       JM-14-8       76.       PT- 2015-8         36.       PR-2017-5       77.       PT- 2018-09         37.       PRB-2012-3       78.       RMT-19-14         38.       TM 274       79.       RMT-19-17         39.       HUJM- 19-11       80.       ORT 2019-01         40. <td><b>j</b></td> <td></td> <td>65.</td> <td>DRMRHJ 3101</td>	<b>j</b>		65.	DRMRHJ 3101
22.       DRMR 2018-17       67.       DRMRHJ 1403         23.       DRMRHT 1318       68.       SVJH-66         24.       SKM 1728       69.       SVJH-68         25.       SKM 1620       70.       Pusa MH-57         26.       RGN-491       71.       Pusa MH-61         27.       RGN-483       72.       RMX9906         28.       PBR 507       73.       RMX9903         29.       RH 1974       74.       0IJ1010         30.       RH 1975       75.       0IJ1034         31.       KMR- 20-3       76.       18J029C         32.       KMR- 20-4 <b>B. rapa var Toria</b> 33.       NPJ- 241       74.       TKM- 20-1         34.       NPJ- 242       75.       TKM- 20-2         35.       JM-14-8       76.       PT- 2015-8         36.       PR-2017-5       77.       PT- 2018-09         37.       PRB- 2012-3       78.       RMT-19-14         38.       TM 274       79.       RMT-19-17         39.       HUJM- 19-11       80.       ORT 2019-01         40.       RMM-19-18       81.       JT-14-5         41.	21.	DRMRCI- 127	66.	DRMRHJ 1108
23.       DRMRHT 1318       68.       SVJH-66         24.       SKM 1728       69.       SVJH-68         25.       SKM 1620       70.       Pusa MH-57         26.       RGN-491       71.       Pusa MH-61         27.       RGN-483       72.       RMX9906         28.       PBR 507       73.       RMX9903         29.       RH 1974       74.       OIJ1010         30.       RH 1975       75.       OIJ1034         31.       KMR- 20-3       76.       18J029C         32.       KMR- 20-4 <b>B. rapa var Toria</b> 33.       NPJ- 241       74.       TKM- 20-1         34.       NPJ- 242       75.       TKM- 20-2         35.       JM-14-8       76.       PT- 2015-8         36.       PR-2017-5       77.       PT- 2018-09         37.       PRB- 2012-3       78.       RMT-19-14         38.       TM 274       79.       RMT-19-17         39.       HUJM- 19-11       80.       ORT 2019-01         40.       RMM-19-18       81.       JT-14-5         41.       ACNMM- 23       82.       CG toria 3         42.	22.	DRMR 2018-17	67.	DRMRHJ 1403
24.       SKM 1728       69.       SVJH-68         25.       SKM 1620       70.       Pusa MH-57         26.       RGN-491       71.       Pusa MH-61         27.       RGN-483       72.       RMX9906         28.       PBR 507       73.       RMX9903         29.       RH 1974       74.       0U1010         30.       RH 1975       75.       0U1034         31.       KMR- 20-3       76.       18J029C         32.       KMR- 20-4 <b>B.</b> rapa var Toria         33.       NPJ- 241       74.       TKM- 20-1         34.       NPJ- 242       75.       TKM- 20-2         35.       JM-14-8       76.       PT- 2015-8         36.       PR-2017-5       77.       PT- 2018-09         37.       PRB- 2012-3       78.       RMT-19-14         38.       TM 274       79.       RMT-19-17         39.       HUJM- 19-11       80.       ORT 2019-01         40.       RMM-19-18       81.       JT-14-5         41.       ACNMM- 23       82.       CG toria 3         42.       ORM 2019-02       83.       CG toria 4         43.	23.	DRMRHT 1318	68.	SVJH-66
25.       SKM 1620       70.       Pusa MH-57         26.       RGN-491       71.       Pusa MH-61         27.       RGN-483       72.       RMX9906         28.       PBR 507       73.       RMX9903         29.       RH 1974       74.       0IJ1010         30.       RH 1975       75.       0IJ1034         31.       KMR- 20-3       76.       18J029C         32.       KMR- 20-4 <b>B. rapa var Toria</b> 33.       NPJ- 241       74.       TKM- 20-1         34.       NPJ- 242       75.       TKM- 20-2         35.       JM-14-8       76.       PT- 2015-8         36.       PR-2017-5       77.       PT- 2018-09         37.       PRB- 2012-3       78.       RMT-19-14         38.       TM 274       79.       RMT-19-17         39.       HUJM- 19-11       80.       ORT 2019-01         40.       RMM-19-18       81.       JT-14-5         41.       ACNMM- 23       82.       CG toria 3         42.       ORM 2019-02       83.       CG toria 4         43.       AKMS-20-1       84.       BAUT 08-08	24.	SKM 1728	69.	SVJH-68
26.       RGN-491       71.       Pusa MH-61         27.       RGN-483       72.       RMX9906         28.       PBR 507       73.       RMX9903         29.       RH 1974       74.       0IJ1010         30.       RH 1975       75.       0IJ1034         31.       KMR- 20-3       76.       18J029C         32.       KMR- 20-4 <b>B. rapa var Toria</b> 33.       NPJ- 241       74.       TKM- 20-1         34.       NPJ- 242       75.       TKM- 20-2         35.       JM-14-8       76.       PT- 2015-8         36.       PR-2017-5       77.       PT- 2018-09         37.       PRB- 2012-3       78.       RMT-19-14         38.       TM 274       79.       RMT-19-17         39.       HUJM- 19-11       80.       ORT 2019-01         40.       RMM-19-18       81.       JT-14-5         41.       ACNMM- 23       82.       CG toria 3         42.       ORM 2019-02       83.       CG toria 4         43.       AKMS-20-1       84.       BAUT 08-08	25.	SKM 1620	70.	Pusa MH-57
27.       RGN-483       72.       RMX9906         28.       PBR 507       73.       RMX9903         29.       RH 1974       74.       OIJ 1010         30.       RH 1975       75.       OIJ 1034         31.       KMR- 20-3       76.       18J029C         32.       KMR- 20-4 <b>B. rapa var Toria</b> 33.       NPJ- 241       74.       TKM- 20-1         34.       NPJ- 242       75.       TKM- 20-2         35.       JM-14-8       76.       PT- 2015-8         36.       PR-2017-5       77.       PT- 2015-8         36.       PR-2012-3       78.       RMT-19-14         38.       TM 274       79.       RMT-19-14         38.       TM 274       79.       RMT-19-17         39.       HUJM- 19-11       80.       ORT 2019-01         40.       RMM-19-18       81.       JT-14-5         41.       ACNMM-23       82.       CG toria 3         42.       ORM 2019-02       83.       CG toria 4         43.       AKMS-20-1       84.       BAUT 08-08	26.	RGN-491	71.	Pusa MH-61
28.         PBR 507         73.         RMX9903           29.         RH 1974         74.         0IJ1010           30.         RH 1975         75.         0IJ1034           31.         KMR- 20-3         76.         18J029C           32.         KMR- 20-4 <b>B. rapa var Toria</b> 33.         NPJ- 241         74.         TKM- 20-1           34.         NPJ- 242         75.         TKM- 20-2           35.         JM-14-8         76.         PT- 2015-8           36.         PR-2017-5         77.         PT- 2018-09           37.         PRB- 2012-3         78.         RMT-19-14           38.         TM 274         79.         RMT-19-17           39.         HUJM- 19-11         80.         ORT 2019-01           40.         RMM-19-18         81.         JT-14-5           41.         ACNMM- 23         82.         CG toria 3           42.         ORM 2019-02         83.         CG toria 4           43.         AKMS-20-1         84.         BAUT 08-08	27.	RGN-483	72.	RMX9906
29.       RH 1974       74.       0IJ1010         30.       RH 1975       75.       0IJ1034         31.       KMR- 20-3       76.       18J029C         32.       KMR- 20-4 <b>B. rapa var Toria</b> 33.       NPJ- 241       74.       TKM- 20-1         34.       NPJ- 242       75.       TKM- 20-2         35.       JM-14-8       76.       PT- 2015-8         36.       PR-2017-5       77.       PT- 2018-09         37.       PRB- 2012-3       78.       RMT-19-14         38.       TM 274       79.       RMT-19-17         39.       HUJM- 19-11       80.       ORT 2019-01         40.       RMM-19-18       81.       JT-14-5         41.       ACNMM- 23       82.       CG toria 3         42.       ORM 2019-02       83.       CG toria 4         43.       AKMS-20-1       84.       BAUT 08-08	28.	PBR 507	73.	RMX9903
30.         RH 1975         75.         0IJ1034           31.         KMR- 20-3         76.         18J029C           32.         KMR- 20-4 <b>B. rapa var Toria</b> 33.         NPJ- 241         74.         TKM- 20-1           34.         NPJ- 242         75.         TKM- 20-2           35.         JM-14-8         76.         PT- 2015-8           36.         PR-2017-5         77.         PT- 2018-09           37.         PRB- 2012-3         78.         RMT-19-14           38.         TM 274         79.         RMT-19-17           39.         HUJM- 19-11         80.         ORT 2019-01           40.         RMM-19-18         81.         JT-14-5           41.         ACNMM- 23         82.         CG toria 3           42.         ORM 2019-02         83.         CG toria 4           43.         AKMS-20-1         84.         BAUT 08-08	29.	RH 1974	74.	0U1010
31.       KMR- 20-3       76.       18J029C         32.       KMR- 20-4 <b>B.</b> rapa var Toria         33.       NPJ- 241       74.       TKM- 20-1         34.       NPJ- 242       75.       TKM- 20-2         35.       JM-14-8       76.       PT- 2015-8         36.       PR-2017-5       77.       PT- 2018-09         37.       PRB- 2012-3       78.       RMT-19-14         38.       TM 274       79.       RMT-19-17         39.       HUJM- 19-11       80.       ORT 2019-01         40.       RMM-19-18       81.       JT-14-5         41.       ACNMM- 23       82.       CG toria 3         42.       ORM 2019-02       83.       CG toria 4         43.       AKMS-20-1       84.       BAUT 08-08	30.	RH 1975	75.	0IJ1034
32.       KMR-20-4       B. rapa var Toria         33.       NPJ-241       74.       TKM-20-1         34.       NPJ-242       75.       TKM-20-2         35.       JM-14-8       76.       PT-2015-8         36.       PR-2017-5       77.       PT-2018-09         37.       PRB-2012-3       78.       RMT-19-14         38.       TM 274       79.       RMT-19-17         39.       HUJM-19-11       80.       ORT 2019-01         40.       RMM-19-18       81.       JT-14-5         41.       ACNMM-23       82.       CG toria 3         42.       ORM 2019-02       83.       CG toria 4         43.       AKMS-20-1       84.       BAUT 08-08	31.	KMR- 20-3	76.	18J029C
33.         NPJ- 241         74.         TKM- 20-1           34.         NPJ- 242         75.         TKM- 20-2           35.         JM-14-8         76.         PT- 2015-8           36.         PR-2017-5         77.         PT- 2018-09           37.         PRB- 2012-3         78.         RMT-19-14           38.         TM 274         79.         RMT-19-17           39.         HUJM- 19-11         80.         ORT 2019-01           40.         RMM-19-18         81.         JT-14-5           41.         ACNMM- 23         82.         CG toria 3           42.         ORM 2019-02         83.         CG toria 4           43.         AKMS-20-1         84.         BAUT 08-08	32.	KMR- 20-4	B. rapa	var Toria
34.       NPJ- 242       75.       TKM- 20-2         35.       JM-14-8       76.       PT- 2015-8         36.       PR-2017-5       77.       PT- 2018-09         37.       PRB- 2012-3       78.       RMT-19-14         38.       TM 274       79.       RMT-19-17         39.       HUJM- 19-11       80.       ORT 2019-01         40.       RMM-19-18       81.       JT-14-5         41.       ACNMM- 23       82.       CG toria 3         42.       ORM 2019-02       83.       CG toria 4         43.       AKMS-20-1       84.       BAUT 08-08	33.	NPJ- 241	74.	TKM- 20-1
35.       JM-14-8       76.       PT- 2015-8         36.       PR-2017-5       77.       PT- 2018-09         37.       PRB- 2012-3       78.       RMT-19-14         38.       TM 274       79.       RMT-19-17         39.       HUJM- 19-11       80.       ORT 2019-01         40.       RMM-19-18       81.       JT-14-5         41.       ACNMM- 23       82.       CG toria 3         42.       ORM 2019-02       83.       CG toria 4         43.       AKMS-20-1       84.       BAUT 08-08	34.	NPJ- 242	75.	TKM- 20-2
36.       PR-2017-5       77.       PT- 2018-09         37.       PRB- 2012-3       78.       RMT-19-14         38.       TM 274       79.       RMT-19-17         39.       HUJM- 19-11       80.       ORT 2019-01         40.       RMM-19-18       81.       JT-14-5         41.       ACNMM- 23       82.       CG toria 3         42.       ORM 2019-02       83.       CG toria 4         43.       AKMS-20-1       84.       BAUT 08-08	35	IM-14-8	76	PT- 2015-8
37.       PRB- 2012-3       78.       RMT-19-14         38.       TM 274       79.       RMT-19-17         39.       HUJM- 19-11       80.       ORT 2019-01         40.       RMM-19-18       81.       JT-14-5         41.       ACNMM- 23       82.       CG toria 3         42.       ORM 2019-02       83.       CG toria 4         43.       AKMS-20-1       84.       BAUT 08-08	36	PR-2017-5	70.	PT- 2018-09
37.       11KB 2012 3       70.       1KH1 15 14         38.       TM 274       79.       RMT-19-17         39.       HUJM- 19-11       80.       ORT 2019-01         40.       RMM-19-18       81.       JT-14-5         41.       ACNMM- 23       82.       CG toria 3         42.       ORM 2019-02       83.       CG toria 4         43.       AKMS-20-1       84.       BAUT 08-08	37	PRB- 2012-3	78	RMT-19-14
39.       HUJM- 19-11       80.       ORT 2019-01         40.       RMM-19-18       81.       JT-14-5         41.       ACNMM- 23       82.       CG toria 3         42.       ORM 2019-02       83.       CG toria 4         43.       AKMS-20-1       84.       BAUT 08-08	38	TM 274	79	RMT-19-17
40.       RMM-19-18       81.       JT-14-5         41.       ACNMM-23       82.       CG toria 3         42.       ORM 2019-02       83.       CG toria 4         43.       AKMS-20-1       84.       BAUT 08-08	39	HUM-19-11	80	ORT 2019-01
41.     ACNMM-23     82.     CG toria 3       42.     ORM 2019-02     83.     CG toria 4       43.     AKMS-20-1     84.     BAUT 08-08	40	RMM-19-18	81	IT-14-5
42.       ORM 2019-02       83.       CG toria 4         43.       AKMS-20-1       84.       BAUT 08-08	41	ACNMM- 23	82	CG toria 3
43.         AKMS-20-1         84.         BAUT 08-08           44.         BAUM 08 17         BAUM 08 17         BAUM 08 17	42	ORM 2019-02	83	CG toria 4
13.         11110-20-1         01.         DA01 00-00           44         BAUM 08 17	43	AKMS-20-1	84	BAUT 08-08
	44	BAUM 08-17	UT.	D110100-00

B. juncea (Quality)		B. rapa ssp. Yellow Sarson	
85.	LES 62	109.	YSKM- 20-1
86.	LES 63	110.	YSKM- 20-2
87.	PDZ-14#	111.	PYS- 2017-6
88.	PDZ-15#	112.	PYS- 2018-02
89.	JC 32#	113.	RMYS 1
90.	JC 36#	114.	RMYS 2
91.	RH (OE)-1804	115.	DRMRYS 201
92.	RH (OE)-1807	116.	DRMRYS 202
93.	0IJ5001#	White	Rust Resistance
B. junce	ea (Late Sown)	117.	Rohini (A4A5)-491
94.	DRMRCI- 130	118.	PB (A4A5)-842
95.	DRMR 2018-19	119.	PJK (A4A5)-21
96.	DRMRHJ 2520	120.	Varuna (A4A5)-936-279
97.	RH 1999-19	121.	Rohini (Parent)
98	RH 1999-22	122.	Pusa Jaikisan (Parent)
99.	KMR (L)- 20-5	123.	Pusa Bold (Parent)
100.	KMR (L)- 20-6	124.	Varuna (Parent)
101.	NPJ- 245	Checks	
102.	NPJ- 246		Rohini (SC) (B. juncea)
103.	PAB- 2014-4		RL 1359 (SC) ( <i>B. juncea</i> )
104.	PRL- 2017-2		BIOYSR (WRR) (B. juncea)
105.	RGN-494		PHR 2 (ABT) (B. juncea)
106.	RGN-488		PT 303 (B. rapa var. Toria)
107.	TM 179-2		GSL 1 (B. napus)
108.	HUJM- 19-18		DLSC 1 (B. carinata)
			RTM 314 ( <i>E. sativa</i> )
			NRCYS-5-2 (B. rapa var. YS)

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

**Objective:** To asses yield losses caused by of the major diseases at different locations

Locations: SHL, DOL, JAG, VAR

**Layout:** The experiment shall be laid out in randomised block design with three replications with variety Varuna with different 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; insect-pest protection practices to be undertaken (it is suggested to apply seed treatment and spray with suitable insecticides as per requirement. No protection to be taken against any disease.

#### **Treatments:**

- 1. Iprodione 50WP -FS @ 0.2%
- 2. Tebuconazole 50%+trifloxistrobin 25% WG-FS @ 0.5g/l
- 3. Soil application of Potash 40 kg/ h
- 4. ST+FS with *Trichoderma harzianum* @ 10g/ kg seed
- 5. Lower three leaf removal at 45 DAS
- 6. Garlic bulb extract @ 1% w/v (ST+FS)
- 7. PGPR
- 8. Check

#### **Observations:**

Data for initial date of appearance of disease in each plot shall be recorded for per cent Alternaria blight disease severity (PDS) on leaf for and pods in each treatment/ plot –following new rating

scale adopted by the group (2010). 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.

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

**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 and 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/1 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 and 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 to PI (Plant Pathology), ICAR-DRMR, Bharatpur at the end of every month for necessary analysis.

Objective:	To find out the newer fungicides for disease management					
Locations:	Pantnagar, Morena, Hisar, Ludhiana, Dholi, Jhansi, Bharatpur, Sriganganagar,					
	Shillongani					
<b>Treatments:</b>	1. Tebuconazole 50% + trifloxostrobin 25% WG @ 0.1%					
(Folior spray	2. Propiconazole 25% EC @ 0.1%					
(Folial spray	3. Metalaxyl 4% + mancozeb 64% @ 0.25%					
at 43 and 70	4. Hexaconazole 5% SC @ 0.1%					
DAS)	5. Tebuconazole 25.9% @ 0.1%					
	6. Azoxystrobin @ 0.1%					
	7. Trifloxystrobin 50% @ 0.1%					
	8. Check					
<b>Observations:</b>	ns: 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; Variety: DRMRIJ 31					

#### 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. Fortnightly weather parameters

# XXVII Annual Group Meeting of AICRP Rapeseed-Mustard August 3-4, 2020 Online

#### Session V: Planning & Technical Programme Formulation: Entomology

Chairman : Dr. H C Sharma, Former Vice Chancellor, UHF, Solan (HP)

Rapporteurs : Dr. Sarwan Kumar, Senior Entomologist (Oilseeds), PAU, Ludhiana

: Dr. Archana Anokhe, Scientist, ICAR-DRMR, Bharatpur

The planning and technical programme formulation session of Entomology started with welcome address by Dr. K H Singh. He welcomed the Chairman, and the fellow entomologists. Dr H C Sharma, Ex-Professor & Vice Chancellor, UHF, Solan (HP) in his introductory remarks mentioned that entomologists should identify lines with atleast partial resistance to mustard aphid along with superior agronomic base that can be incorporated in mustard aphid IPM module(s). He urged to study the pollinator as well as predators' diversity on mustard crop. He also emphasized to study the bio-control agents of mustard aphid and effect of crop diversity on aphid abundance. It was further emphasized that yield loss assessment of widely grown variety against mustard aphid can be studied. The Chairman also emphasized to explore the opportunities and initiate work on transgenics, RNAi, gene editing, etc. for development and deployment of aphid resistance in rapeseed-mustard at the selected centers where facilities and competence are available.

It was emphasized by Dr Archana Anokhe, PI of AICRP-RM that the experiments must be conducted as per technical programme with proper statistical analysis and the report should be submitted latest by May 31<sup>st</sup> of the year. For data recording, a uniform format will be circulated to all the centers. Data should be submitted in the same format as circulated by PI. All crop entomologists should follow technical programme strictly. Photographs of each stage of crop, trial conducted, insect-pest along with damage and operation performed should be submitted by all the centers.

It was desired to add some resistant check along with susceptible check BSH 1 in screening trials. After thorough discussions, the house agreed to incorporate separate checks for mustard aphid in IVT and AVT trials and five new checks *i.e* RH 725, PM 30, 45S46, PDZM 31, and *Brassica fruticulosa* introgressed *Brassica juncea* line were decided to use in these trials. The house also agreed to conclude the experiment on survey and surveillance of insect-pests and their natural enemies in rapeseed-mustard. The following recommendations were made

1. Mustard aphid is the most damaging pest of rapeseed-mustard. It mostly appears on the crop starting from  $2^{nd}$  week of November and damages the crop till march. Thus, scientists and extension functionaries are required to advise the farmers to be vigilant during this period. As and when the aphid population increases economic threshold specific to the region, control interventions should be initiated.

2. In addition to the mustard aphid, the following pests appear as per the following period: the mustard sawfly appears from  $2^{nd}$  week of October to  $1^{st}$  week of November depending upon the time of sowing; mustard leaf miner appears from  $1^{st}$  week of January and remains active till march; flea beetles remain active from  $1^{st}$  week of November to  $2^{nd}$  week of January. Thus, farmers should be advised to be vigilant during this period.

#### **Technical Programme (2020-21)**

# Project 5.1 A): Screening of germplasm and advanced genotypes for resistance against mustard aphid

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	Aphid damage index (ADI)	Aphid resistance	Resistance
5.11	(API)	(ipinu uninuge mues (ippi)	index (ARI)	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)

<b>Project 5.1: Screening</b>	of germplasm	and advanced	genotypes for	resistance against	mustard
aphid					

1. <b>IV</b>	1. IVT Toria				
1.	TKM- 20-1	TK- 2014 X Bhawani	CSAUA&T, Kanpur		
2.	TKM- 20-2	TK- 2014 X ORT- 11	CSAUA&T, Kanpur		
3.	PT- 2015-8	Uttara X PT- 508	GBPUAT, Pantnagar		
4.	PT- 2018-09	PT- 30 X Bhawani	GBPUAT, Pantnagar		
5.	RMT-19-14	RMT-10-1 X JT-1	ZARS, Morena		
6.	RMT-19-17	Bastar Toria-4 X JT-1	ZARS, Morena		
7.	ORT 2019-01	Composite population	OUAT, Bhubaneshwar		
8.	JT-14-5	RSPT-2 X PT-303	SKUAST, Chatha, Jammu		
9.	CG toria 3	GPT 1x T9	RRS, IGKV, Jagdalpur		
10.	CG toria 4	GPT 1 x Indira toria 1	RRS, IGKV, Jagdalpur		
11.	BAUT 08-08	BAUST-1 X TRCT -1-1-5-1	BAU, Kanke		
2. IV	2. IVT Yellow Sarson				
1	YSKM- 20-1	YSK- 04 X T- 42	CSAUA&T, Kanpur		

2	YSKM- 20-2	YSK- 05 X T- 42	CSAUA&T, Kanpur
3	PYS- 2017-6 NDYS- 2018 X PYS2009-7		GBPUA&T, Pantnagar
4	PYS- 2018-02 PYSC- 53-5 X B-9		GBPUA&T, Pantnagar
5	RMYS 1         Local Selection from Bilara		ARS, Mandor
6	RMYS 2	Local Selection from Bilara	ARS, Mandor
7	DRMRYS 201	YSH 401 X SKJ 2 (B. nigra)	DRMR, Bharatpur
8	DRMRYS 202	YSH 401 X SKJ 2 (B. nigra)	DRMR, Bharatpur
3. <b>I</b> V	T Mustard		
(3.1	IVT Early Mustard)		
1	KMR (E)- 20-1	Seeta X Varuna	CSAUA&T, Kanpur
2	KMR (E)- 20-2	Seeta X Aravali	CSAUA&T, Kanpur
3	DRMRCI- 129	RH- 819 X DRMR- 270	DRMR, Bharatpur
4	DRMRSJ 112	<i>B.rapa</i> var. Jhumka X <i>B. nigra</i>	DRMR, Bharatpur
5	DRMRHT 1712	BPR 549-9 X JBJ-41/15	DRMR, Bharatpur
6	RH 1999-12	RH 1402 A X RH 1401	CCS HAU, Hisar
7	RH 1999-21	MCNR 15-14 X RH 1402 A	CCS HAU, Hisar
8	PRE- 2018-8	PRE- 09-9 X Kranti	GBPUA&T, Pantnagar
9	PRE- 2018-10	PR- 19 X NDRE- 4	GBPUA&T. Pantnagar
10	NPJ- 239	Pusa Agrani X NPJ- 112	IARI. New Delhi
11	NPJ- 240	NRCHB- 101 X NPI- 173	IARI, New Delhi
12	SKM 1746	GM 1 X RSK 219	SDAU SK Nagar
13	SVIH-006	SVIA-05 X SVIR-06	Shaktiyardhak Hybrid Seeds Pyt Ltd
14	PHR 8024 (hybrid)	DTM 40 X DTMR	PAIL Ludbiana
15	PHR 8031(hybrid)	DTM 48 X DTMR	PAU Ludhiana
16	KGMH-3811	KA 99 X KR 576 R	Kamadgiri Cron Science Pyt I td Agra
17	RMM-19-06	IM_2 X IMM_927	ZARS Morena
18	ORM 2019-01	Pusa Bold x NRCHB 101	OUAT Bhubaneswar
10	TM 188	TM102 X TC5	BARC Mumbai
20	BAUM 09-12-2	BAUSM 92-1-1 X BR 40	BALL Kanke
3.2 I	VT Timely Sown, Irrigated		
1	DRMRCI 127	PH 810 Y Vasundhara	DRMR Bharatour
2	DRMRCI- 127	NDCHR101 Y DDMD 2326	DRMR, Bharatpur
2	DRIVIR 2010-17	DDD 542 2 X DDD 542 2	
3	DRMRHI 1318	BPR 543-2 X BPR 549-9	DRMR, Bharatpur
4	SKM 1728	Ashirvad X GM 3	SDAU, SK Nagar
5	SKM 1620	HYT 33 X Parasmani	SDAU, SK Nagar
6	RGN-491	NPJ-153 X RGN-73	ARS, Sriganganagar
7	RGN-483	PRL 2009 X RGN-48	ARS, Sriganganagar
8	PBR 507	PBR 210 x PBR 212	PAU Ludhiana
9	KH 1974	KH 1140 X RH 1372	CCS HAU, Hisar
10	KH 1975	RH 1140 X RH 1372	CCS HAU, Hisar
11	KMR- 20-3	Pusa Bold X Urvashi	CSAUA&T, Kanpur
12	KMR- 20-4	Varuna X KR- 5610	CSAUA&T, Kanpur
13	NPJ- 241	NPJ- 124 X RB- 50	IARI, New Delhi
14	NPJ- 242	NPJ- 156 X EJ- 17	IARI, New Delhi
15	JM-14-8	RSPR-03 X NRCDR- 2	SKUAST-J, Chatha, Jammu
16	PR-2017-5	(PRB- 04-3-04 X Varuna) X PAB- 9534	GBPUA&T, Pantnagar
17	PRB- 2012-3	(NRCDR- 2 X PRB- 04-3-04) X PRB- 06-5	GBPUA&T, Pantnagar
18	TM 274	Kranti X TC5	BARC, Mumbai
19	HUJM- 19-11	MCN 10-11 X HUIM 99-03	BHU. Varanasi
20	RMM-19-18	JM-4 X B-85	ZARS.Morena
21	ACNMM- 23	Mutant of BIO-902	COA. Nagpur
		(obtained by1300 Gy	,
		gamma irradiation)	
2.2	ORM 2019-02	Pusa Bold x NDRE 7	OUAT. Bhubaneshwar
23	AKMS-20-1	DLDC-1 X CI 3761	SARE Kangra

24	BAUM 08-17	BIO 133-04 X Pusa Bold	BAU, Kanke
3.4 I	VT Mustard (Rainfed)		
1	DRMRCI- 128	Maya X RGN- 73	DRMR, Bharatpur
2	DRMRSJ 276	<i>B.rapa</i> var. Jhumka X B. nigra	DRMR, Bharatpur
3	DRMRHJ 908	MJA 9 X MJR 8	DRMR, Bharatpur
4	DRMRHT 1913	NRCHB 101 X BPR 549-9	DRMR, Bharatpur
5	DRMRIJ 18-62	DRMRIJ 31 X LET 36	DRMR, Bharatpur
6	NPJ- 243	Pusa Vijay X VSL- 11	IARI, New Delhi
7	NPJ- 244	NPJ- 138 X BM- 97	IARI, New Delhi
8	RGN-500	SEJ-2 X RGN-236	ARS, Sriganganagar
9	RGN-486	KDM 1049 X RGN-48	ARS, Sriganganagar
10	RH 1920	RH 0832 X Pusa Krishma	CCS HAU, Hisar
11	RH 1921	RH 0832 X Pusa Krishma	CCS HAU, Hisar
12	TM 264	RB9901xTM102	BARC, Mumbai
13	JM-13-3	RSPR-69 X RSPR-01	SKUAST-J, Chatha, Jammu
14	CAU- RM- 4-1-1	Local Yella X Kranti	CAU, Imphal
15	PBR 450	RL 198 X Navgold	PAU, Ludhiana
3.5 I	VT- Mustard Late sown		
1	DRMRCI- 130	RH- 819 X DRMR- 270	DRMR, Bharatpur
2	DRMR 2018-19	NRCHB 101 X DRMR 2398	DRMR, Bharatpur
3	DRMRHJ 2520	MJA 25 X MJR 20	DRMR, Bharatpur
4	RH 1999-19	RH 1402A X RH 1301	CCS HAU, Hisar
5	RH 1999-22	RH 1599-41 X RH 1402A	CCS HAU, Hisar
6	KMR (L)- 20-5	Vardan X kanti	CSAUA&T, Kanpur
7	KMR (L)- 20-6	Vardan X Maya	CSAUA&T, Kanpur
8	NPJ- 245	Pusa Vijay X Pusa Agrani	IARI, New Delhi
9	NPJ- 246	NPJ- 113 X EC399299	IARI, New Delhi
10	PAB- 2014-4	EC552576 X Vaibhav	GBPUA&T, Pantnagar
11	PRL- 2017-2	EC552574 X PRL- 2007-3	GBPUA&T, Pantnagar
12	RGN-494	NPJ-153 X Laxmi	ARS, Sriganganagar
13	RGN-488	NPJ-162 X RGN-73	ARS, Sriganganagar
14	IM 1/9-2	1MI2XIC204133	BARC, Mumbai
15	HUJM- 19-18	SEJ- 2 X HUJM- 9964	BHU, varanasi
1.	RHH 2001	Ogura based	CCS HAU, Hisar
2.	RHH 2002	Ogura based	CCS HAU, Hisar
3	RHH 2003	Ogura based	CCS HAU, Hisar
4	PHR 8076	DTM 200 X DTMR	PAU Ludhiana
5	PHR 8095	DTM 261 X DTMR	PAU Ludhiana
6	DRMRHJ 3101	OJA 1 X OJR 1	DRMR, Bharatpur
7	DRMRHJ 1108	MJA 11 X MJR 8	DRMR, Bharatpur
8	DRMRHJ 1403	MJA 14 X MJR 3	DRMR, Bharatpur
9	DRMRHJ 2409	MJA 24 X MJR 9	DRMR, Bharatpur
10	SVJH-66	SVJA-05 X SVJR-40	Shakti Vardhak Hybrid Seeds Pvt. Ltd.
11	SVJH-68	SVJA-03 X SVJR-02	Shakti Vardhak Hybrid Seeds Pvt. Ltd.
12	Pusa MH-57	Erucoides based	IARI, New Delhi
13	Pusa MH-61	Moricandia based	IARI, New Delhi
14	RMX9906	9529 X 1019	Rasi Seeds, Pvt. Ltd.
15	RMX9903	3007 X 1015	Rasi Seeds, Pvt. Ltd.
16	0IJ1010	PA1IJ104 X PR9IJ426	Bayer Bio Science Pvt. Ltd., Faridabad
17	0IJ1034	PA1IJ104 X PR9IJ521	Bayer Bio Science Pvt. Ltd., Faridabad
18	18J029C	4PDJQ29A/4PGQL32R	Corteva Agriscience, Jaipur
19	Kranti (NC)		
3.7 (	Juality Mustard : IVT		

1.	LES- 62	LES- 45 X EC- 61	IARI, New Delhi			
2.	LES- 63	LES- 45 X EC- 61	IARI, New Delhi			
3.	PDZ- 14 #	Agrani X Heera	IARI, New Delhi			
4.	PDZ- 15 #	Agrani X Heera	IARI, New Delhi			
5.	JC 32#	(PBR 210 X JM 06003) X	PAU Ludhiana			
		NUDHYJ 4				
6.	JC 36#	(PBR 210 X NUDHYJ 4) X JM	PAU Ludhiana			
		06020				
7.	RH (OE)-1804	EC 597328 X RH (HO)0502	CCS, HAU, Hisar			
8.	RH (OE)-1807	EC 597328 X RH (HO)0502	CCS, HAU, Hisar			
9.	0IJ5001#	PA7IJ136 X PR9IJ404	Bayer Bio Science Pvt. Ltd., Faridabad			
3.9	Mustard: White Rust Resis	tance				
1	Rohini (A4A5)-491	WRR Introgressed Rohini	CGMCP, UDSC, New Delhi			
2	PB (A4A5)-842	WRR Introgressed Pusa Bold	CGMCP, UDSC, New Delhi			
3	PJK (A4A5)-21	WRR Introgressed Pusa	CGMCP, UDSC, New Delhi			
		Jaikisan				
4	Varuna (A4A5)-936-279	WRR Introgressed Varuna	CGMCP, UDSC, New Delhi			
3.10	Mustard (Germplasm)					
	DRMRIS-A-18-3					
	DRMRIS-A-18-4					
	DRMRIS-A-18-5					
	DRMRIS-A-18-11					

**Checks:** RH-725 (Conventional check) BSH-1(Susceptible check), 45-S-46(Hybrid check), PDZ-1 (Quality check), Kranti (NC) and PM30,PM 25, PM 28, PM 29,JD 6, PRO 5111, RCC4, RH 749, Girraj, RGN 229,RGN 73, CS 54, CS 60, GSL 1, GSC 6, T 27, RTM 314, RTM 1351 and *Brassica fruticulosa* Introgressded *Brassica juncea* line (resistant check) will be the check entries for all screening programme.

# Project 5.1 (B): Screening of AVT I and AVT II entries of *Brassica* for resistance against mustard aphid

Table: 3 Following are the AVT-I + II entries of *Brassica* to be screened for their reaction to mustard aphid

SN	Entry	
1	AVT-I Early Mustard	
	Entries: RH 1999-42	
2	AVT- I + AHT I Early Mustard	The check entries were
	Entries: KMR (E) 19-2, NPJ 229, RH 1999-42, PRE 17-5, PRE 17-2,	selected on the basis of
	DRMRCI 116, NPJ 230, KMR (E) 19-1, PHR 8022 (hybrid) DRMRHJ	their susceptibility, and
	2403 (hybrid), DRMRCI 96#, RMM 10-1-1#,	tolerance to mustard
3	AVT- I Mustard (Time Sown, Irrigated )	aphid.
	Entries: AKMS 19-2, RH 1676#, SKM 1626#, RGN 443#, PBR 385#,	
	PR 2016-8#, PR 2016-4#, DRMR 2017-16#, NPJ 231	
4	AVT- I Mustard (Rainfed )	
	Entries: RH 1424	
5	AVT-I + II Quality Mustard	
	Entries: LES 60, 9IJ5001, RH (OE) 1706), PDZ 12, PDZ 11, RCH 1,	
6	AVT-I Quality Mustard	
	Entries: LES 60,	
7	AVT- I : Mustard: Saline/alkaline conditions	
	Entries:CS 2005-143,	
8	AVT -I + II Gobhi Sarson	
	GSH 2196, AKGS 19-8, HNS 702, GSH 2180, GSH 1699	
9	AVT- II (Taramira)	
-		
	RTM 1624,	

# AVT Repeat Entry

**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:

# At full flowering stage 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 aphid 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 insectpests. Spray should be done when the pest population reaches economic threshold level.

# Entries: The recent released/identified varieties for *Brassica juncea* were taken for yield losses trial: PM 31and RH 725 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 tagged 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 (Pl give format after the experiment, not before)

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		
PM 31									
RH 725									

Local high yielding Variety				
variety				

Locations:	Bharatpur, Ludhiana, His Shillongani	ar, Mo	orena, Kanpur, Pantnagar, S.K. Nagar, Dholi and					
Crops/Entries	(i) <i>Brassica juncea</i> (DRMRIJ 31) (ii) <i>Eruca sativa</i> (T 27) (iii) <i>B. napus</i> GSC 6 (iv) <i>B. rapa</i> BSH 1							
Plot size:	4.2 m x 3 m							
Replications :	3							
Crop sowing	(i) Timely sown		(ii) Late sown					
Observations: (Recorded at	1. Mustard aphid	:	Number of aphids/10 cm twig on 10 plants per genotype (See Project No. 5.1)					
weekly intervals)	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					
			varification from the experts)					
			c)Natural enemies ( <i>i.e.</i> parasitoids, predators					
			and entomogenous pathogens diversity etc)					
			diversity should be recorded (Species diversity					
			identification as well as image verification					
			from the experts)					

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

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

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

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
Observati ons	i)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: Bio-intensive IPM module for management of mustard aphid

Locations:	Bharatpur, Ludhiana, Hisar, New Delhi, Morena, Kanpur, Pantnagar, S.K. Nagar,
	Dholi and Shillongani
Sowing time:	Third week of November
Plot size:	4.2 m x 3 m
<b>Replications :</b>	3
Сгор	Brassica juncea (Local released variety)
Treatments:	$T_1$ : Azadirachtin 3000 ppm (CIB registered formulation) @ 5 ml/l followed by its
	second spray after 10 days and further third spray on need basis
	T <sub>2</sub> : Azadirachtin followed by application of <i>Beauveria bassiana</i> @ 2g/l after 10
	days of azadirachtin application
	T <sub>3</sub> : Beauveria bassiana followed by its second application after 10 days
	T <sub>4</sub> : Azadirachtin followed by application of Verticillium lecanii @ 2g/l after 10
	days of azadirachtin application
	T <sub>5</sub> : Verticillium lecanii @ 2g/l followed by its second application after 10 days
	$T_6$ : Dimethoate 30 EC @ 1 ml/l followed by its second application after 10 days
	T <sub>7</sub> : Control (water spray)
	Note: Treatments to be applied when the population reaches economic
	threshold level and the second spray 10 days thereafter.

1. Record the population of mustard aphid at one day before and five days after each							
application and calculate the percent reduction in pest population over control (PROC).							
2. Yield data at harvest (kg/ha) and calculate the percent increase in yield over control							
(PIOC). (Can be calculated by all centers)							
3. Record the population of natural enemies.							
4. Incremental Benefit Cost Ratio (IBCR) should be calculated as per following							
Proforma							

# 5.5: Bioefficacy of newer insecticides against mustard aphid

Locations:	Bharatpur, Ludhiana, Hisar, New Delhi, Morena, Kanpur, Pantnagar, S.K. Nagar, Dholi and Shillongani							
Sowing time:	Third week of November							
Plot size:	4.2 m x 3 m							
<b>Replications</b> :	3							
Сгор	Brassica juncea (Local released variety)							
Treatments:	$T_1$ : Imidacloprid 17.8 SL @ 0.25 ml/l							
	$T_2$ : Thiamethoxam 25 WG @ 0.2 g/l							
	$T_3$ : Acetamaprid 20 SP @ 0.1 g/l							
	$T_4$ : Dimethoate 30 EC @ 1 ml/l							
	$T_5$ : Clothianidine 50 WDG @ 0.12 g/l							
	T <sub>6</sub> : Control							
	Note: Treatments to be applied when the population reaches economic							
	threshold level and the second spray 10 days thereafter. The third spray should							
	be need based.							
<b>Observations:</b>	1. Record the population of mustard aphid at one day before and five days after each							
	application and calculate the percent reduction in pest population over control							
	(PROC).							
	2. Yield data at harvest (kg/ha) and calculate the percent increase in yield over							
	control (PIOC). (Can be calculated by all centers)							
	3. Record the population of natural enemies.							
	4. Incremental Benefit Cost Ratio (IBCR) should be calculated as per following							
	format							

# The results of experiment 5.4 and 5.5 are to be presented/compiled as per the given format This format is to calculate IBCR (not to report results, where is the column for pest population before and after treatment)

SN	Treatments	Dose	Cost of	No. of	Labour	Total expenditure	Yield	Additional yield	Gross	Income from	Net returns	IBCR
		/ha	insecticide	labour	cost	(Rs/ha)	(kg/ha)	over control	income	additional yield		(11/7)
				required/	(Rs/ha)	(4+6)			(Rs/ha)	(Rs/ha)	(11-7)	
				ha				(8-control)	(8xmsp)	(9xmsp)		
1	2	3	4	5	6	7	8	9	10	11	12	13

# 5.6: Effect of host plant diversity on abundance of mustard aphid and the associated specialist and generalist natural enemies

<b>•</b>		
Locations:	Bharatpur, Ludhiana, Hisar, Morena, Kanpur, Pantnagar, S.K. Nagar, Dholi and	
	Shillongani	
Sowing time:	Second week of November	
Plot size:	4.2 m x 3 m	
<b>Replications :</b>	3	
Mustard variety:	Brassica juncea	
Sowing time	Sowing time: Mustard: second/third week of November	
	Intercrop: Recommended sowing time of the crop	
Treatments:	T1 Mustard alone	
	T2 Mustard + Linseed	
	T3 Mustard + Chickpea	
	T4 Mustard+ coriander	
	<b>Note: Intercropping is done in</b> 16 (Mustard) :4 (Other combination of crop) (In plot size	
	of 4.2 x 3 m. only 10 lines can be sown, that is why I recommended it to discuss and	
	finalize in the session. Or the plot size can be increased to 8 m width x 4 m length (8 rows	
	of mustard followed by 4 rows of intercrop) as you can sow 24 lines in one plot.	
Observations:	1. Weekly data on the population development of mustard aphid/ 10 plants selected at	
	random	
	2. Number of mummified aphids (Parasitized by specialist parasitoid: <i>Diaeretiella</i>	
	<i>ranae</i> ) and number of generalist predators such as lady bird beetles, syrphid fly	
	larvae. Chrysoperla sp. etc.	
	3. Yield data at harvest (Mustard + intercrop).	
	Economics may be calculated per unit of area for each crop	
	Leonomies may be calculated per and of alca for cach crop	

#### Data reporting:

- Data should be sent to Director, DRMR (<u>director.drmr@gmail.com</u>) 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.

**3.** 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.

# XXVII Annual Group Meeting of AICRP Rapeseed-Mustard August 3-4, 2020 at Online Session VI: Planning and Technical Programme Formulation: Plant Physiology & Biochemistry

Chairman:	Dr. K.R. Koundal, Former Joint Director Research, ICAR-IARI, New Delhi	
Subject expert:	ert: Dr. Maharaj Singh, Principal Scientist, IISR, Indore	
<b>Rapporteurs:</b>	Dr. Pushp Sharma, Senior Physiologist, PAU, Ludhiana	
	Dr. Anubhuti Sharma, Senior Scientist, ICAR-DRMR, Bharatpur	

The session started with the formal introduction of the chairman Dr. K.R. Koundal, subject expert Dr. Maharaj Singh and scientists from different coordinating centers. After indepth discussion, the technical programme of Biochemistry and Plant Physiology was formulated for 2020-21.

The highlights of the programmes of Biochemistry and Plant Physiology were:

1. Seedling mortality  $\leq 20\%$  and DW/10 seedlings  $\geq 40$ mg rated PM 25 (NC) and DRMR2018-27 at Hisar while PM25 (NC), RGN229 and DRMR 4009 at Kanpur thermo tolerant. Seedling mortality <30% in JD6(ZC), PM25(NC), DRMRHT13-22-10 at Kanpur and Ludhiana, DRMR-2018-27 at Hisar and Ludhiana, DRMRHT13-22-10 at Kanpur and Ludhiana while RMM10-17,PM25 (NC),PM27 (NC),RGN229, DRMR2017-27 at 3 locations were moderately tolerant under controlled condition. In the field sown trial, DRMR2059, PM 25(NC), DRMR-2017-8 and DRMR2275 at Dholi and Ludhiana had seedling mortality  $\leq 30\%$  and dry matter per 10 seedlings  $\geq 4.0$ g. Conclusively, only PM 25 (NC) was highly tolerant at Hisar and Kanpur while RMM10-17, PM27 (NC), RGN229, DRMR2017-27 moderately tolerant at 3 locations (Hisar, Kanpur and Ludhiana). JD-6(ZC) was moderately tolerant at Kanpur and Ludhiana under controlled condition. PM 25(NC) and JD-6 (ZC) showed tolerance to high temperature at seedling stage both under laboratory and field conditions with STI  $\geq 50\%$  or 0.5.

2. Lesser reduction in the physiological traits and seed yield ( $\leq 20\%$ ) identified RMM10-1-1, RH1676 and SVJH-108 at Hisar and Ludhiana as promising genotypes under low light stress.

3. Overall, NPJ214, LES54, NPJ210, NPJ225, DRMR2017-15 and DRMR1222 at Dholi, Hisar and Ludhiana were tolerant to moisture stress. Only one genotype LES54 was rated highly tolerant at Hisar and Ludhiana whereas DRMRCI114 moderately tolerant at 3 locations (Dholi, Hisar and Ludhiana) to moisture stress. These genotypes maintained higher chlorophyll content, RWC, SPAD values and lesser decline in seeds per siliqua, seed weight with DSI $\leq$ 1.0 and YSI $\geq$ 0.82. Genotype RH0725 (check) suffered decline in seed yield  $\leq$ 30% and was rated moderately drought tolerant at Dholi and Hisar while highly tolerant at Ludhiana with yield reduction  $\leq$ 20%. RGN229 (check) was highly tolerant with yield reduction  $\leq$ 20% at Dholi and Hisar and moderately drought tolerant at Ludhiana with  $\leq$ 30% decline in seed yield.

4. Raj Vijay Mustard 2 (LR) was rated highly tolerant to terminal heat stress with seed yield reduction  $\leq$ 20% and high stability indices (HSI $\geq$ 0.75 and YSI  $\geq$ 0.82).Three genotypes (DRMR2059, Raj Vijay Mustard, DRMRHT13-28-8) showed yield reduction  $\leq$ 30% with HSI  $\geq$ 0.48 and YSI $\geq$ 0.70 at Hisar and Ludhiana and were considered moderately tolerant to terminal high temperature with relatively lesser depression in membrane stability, seed weight, seeds per siliqua and cooler canopies.

5. PDZ 4 seems promising for salinity at Hisar, Kanpur and Ludhiana with relatively lesser decline in germination percentage, seedling length, dry matter accumulation at 3 locations and vigor index II (19.4%) at Hisar only.

6. Foliar application of brassinolide @ 20ppm and salicylic acid @200ppm at Hisar and Ludhiana improved seed yield under rainfed conditions.

#### **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/ rainfed) along with promising strains of 2019-20: DRMRHT 13-22-10, RMM10-17, PM27, RGN229, DRMR 2017-26, DRMR-2018-27, DRMR-2059, KMR (E)- 20-1,KMR (E)- 20-2,DRMRCI 129, DRMRSJ 112 ,DRMRHT 1712, RH 1999-12 ,RH 1999-21 ,PRE- 2018-8, PRE- 2018-10 ,NPJ- 239,NPJ- 240 SKM 1746 ,SVJH-006 ,PHR 8024 (hybrid),PHR 8031(hybrid) ,KGMH-3811 ,RMM-19-06 ,ORM 2019-01 ,TM 188 ,BAUM 09-12-2 , RH 1999-42, DRMRCI 133, DRMRCI 134, DRMR 1167, DRMR1188 and checks JD-6 & PM25

#### 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  $25 \pm 1^{\circ}$ 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  $(45 \pm 1^{\circ}C)$  with 30-40% relative humidity for 4 hours daily for 4 days.

#### 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 (10seedlings), RWC, SPAD values, seedling thermotolerance index (STI) and seed to seedling thermotolerance index (SSTI).

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

Centers: Bharatpur, Dholi, Hisar, Kanpur and Ludhiana.

#### 6.2 Evaluation of genotypes under low light stress condition

Entries: RMM 10-1-1, RH-1676, SVJH108, DRMRCI96, SKM1626, PBR 385, NRCHB101 and check RH-749

#### Methodology:

1. Sowing will be done in the field from 20-25 Oct. in RCBD with 3 replications.

- 2. There will be two treatments, shading of natural light with the nets that cuts 25-30% natural sunlight and no shading (control). The shading will be given for 30 days during Dec15- Jan15.
- **Observations:** Photosynthesis of 3<sup>rd</sup> /4<sup>th</sup> physiologically matured leaf from the top of each genotype will be measured before shading, 15 days of shading and 10 days after termination of the shading treatment. Time for photosynthesis measurement will be taken during the time from 11.30 AM-2.30 PM, light intensity, transpiration, SLW, SPAD, chlorophyll (alb, total & carotenoids) content, siliquae on main shoot, total siliquae per plant, seed number per siliqua, seed weight, biological yield (kg/ha) and seed yield (kg/ha) will be recorded.

Centers: Bharatpur, Hisar, Kanpur and Ludhiana

#### 6.3 Screening of genotypes for drought tolerance

Entries of IVT/ AVT (rainfed/quality) along with promising strains identified during 2019-20: NPJ214, LES54, NPJ210, DRMRCI114, NPJ-225, DRMR2017-8, DRMR 2018-27, DRMR-1222 ,DRMRCI 136, DRMRCI 137, DRMR 1167, DRMR1188, JC32, JC36, RH1424 ,DRMRCI- 128, DRMRSJ 276 ,DRMRHJ 908 ,DRMRHT 1913 ,NPJ- 243, NPJ- 244 ,RGN-500,RGN-486,RH 1920 ,RH 1921 ,TM 264 ,JM-13-3 ,CAU- RM- 4-1-1,PBR 450 checks: RH 0725 & 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 irrigation will be given, first at 35 and second at 65 DAS while rainfed set be grown without irrigation.

#### **Design**: RCBD, **Replication**: 3

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

Centers: Bharatpur, Dholi, Hisar, Kanpur and Ludhiana.

#### 6.4 Screening of genotypes for high temperature tolerance at terminal stage

Entries of IVT/AVT (late sown/ quality) along with promising strains from 2019-20: DRMR2059, Raj Vijay mustard, Raj Vijay mustard-2(LR), DRMRHT13-28-8, JC32, JC36, PDZ14, DRMR2017-27, DRMR2018-27, DRMR1167, DRMR1188, DRMRCI133, DRMRCI 134, DRMRCI-130, DRMR 2018-19, DRMRHJ 2520, RH 1999-19, RH1999-22, KMR(L)-20-5, KMR(L)-20-6, NPJ-245, NPJ-246, PAB-2014-4, PRL-2017-2, RGN-494, RGN488, TM179-2, HUJM-19-18, DRMRIC18-1-1, DRMRIC 18-4-1, DRMRIC18-7-2 check: PM-26, NRCHB 101 and BPR 541-4.

**Procedure:** 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**: RCBD **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) and heat stability index (HSI) and yield stability index (YSI).

Centers: Bharatpur, Dholi, Hisar, Kanpur and Ludhiana

#### 6.5 Screening of genotypes for salinity tolerance of seedling stage

Entries of AVT I (saline/alkaline) along with promising strains identified during 2019-20: PDZ-4, RH1607, CS 2005-143, Kranti (NC), CS- 54 (Check), CS 60 (LR), Giriraj (LR) and check CS 58.

#### Methodology

- 1. Plastic tray should be used that can accommodate about 5-6 kg soil.
- 2. Soil salinity of 12dS/m should be created using saline solution as per the guideline given by CSSRI, Karnal.
- 3. Counted seeds (20) should be sown (25-30 Oct.) at uniform depth of about 1.5-2.0 cm in rows. About 2.5 cm distance should be maintained between two seedlings. The trays will be kept in open field under natural condition.
- 4. The experiment should be conducted during 25-30 Oct. at all the locations. Electrical conductivity and soil moisture should be monitored at the time of sowing and at regular intervals of 5 days.
- 5. 15 days old should be used for recording shoot length and dry weight.

#### Design: CRD, Replication: 3

**Observation:** Germination (%), seedling length and seedling dry weight (10 seedlings), chlorophyll stability index and seedling vigour II.

Centers: Bharatpur, Hisar, Kanpur, Karnal and Ludhiana.

#### 6.6 Effect PGRs to mitigate drought stress

**Genotype (s) :** Latest released local variety for rain fed condition **Methodology** 

- 1. Rainfed variety will be sown in 9 rows each of 5 m row length.
- 2. Treatments: Urea -1 and 2%

Trehalose -10 and 20mM Potassium nitrate – 1 and 2 % Water spray Control

Foliar sprays: Initiation of flowering and 50% flowering stage.

Design: RBD, Replication: 3

**Observation:** Photosynthetic pigments in 3<sup>rd</sup> or 4<sup>th</sup> leaf on main shoot (chla, chlb, total chl and carotenoids), RWC, LWR, siliquae on main shoot, total siliquae/plant, number of seeds/siliqua, seed weight, biomass (kg/ha) and seed yield (kg/ha).

Centers: Bharatpur, Dholi, Hisar, Kanpur and Ludhiana

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

Treatments: A i) No culture ii) MRD17 iii) MKS 6

B i) No irrigation

ii) One irrigation (35DAS)

iii) One irrigation (65DAS)

iv) Two irrigations (35 and 65 DAS)

Observations: RWC, SPAD values, Chlorophyll (chla, chlb. total chl and carotenoids), proline and total sugars

Centers: Bharatpur, Dholi, Hisar, Kanpur and Ludhiana

#### 6.8: Microbes for mitigating high temperature at terminal stage in mustard

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

**Cultures**: without culture, microbial formulation as bio stimulant (MFs) and stress adaptive consortium (Pusa Sanjeevani)

Varieties: PBR357, RH725 and Giriraj

Microbial cultures will be applied as seed dressing before sowing

**Design**: SPD **Replication**: 3

**Observation**: Soil microbial counts before and after sowing, ambient temperature (from flowering to maturity), photosynthetic pigments(chla, chlb, total chl and carotenoids), canopy temperature ,canopy temperature depression, membrane stability, RWC, total siliquae/plant, seed weight, biomass(kg/ha) and seed yield (kg/ha)

Centres: Bharatpur, Dholi, Hisar, Kanpur and Ludhiana

#### **Technical Programme: Bio-chemistry**

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

#### **Parameters:**

#### Number of Parameters: 05

- 1. Fatty acid profiling (Palmitic acid, stearic acid, Oleic acid, Linoleic acid, Linolenic acid, Eicosenoic acid, erucic acid)
- 2.  $\omega 6/\omega 3$ ,
- 3. Oil stability index,
- 4. SFA: MUFA: PUFA
- 5. Saturated and unsaturated fatty acid ratio

**Centres:** Bharatpur, Ludhiana, Kangra, Pantnagar, Hisar and Kanpur KRANTI (National Check) and PDZ-1(Quality check)

#### Methodology used:

Fatty acid profiling will be done using Gas Spectrophotometric (GC) method.

#### 7.2. Value addition screening in seed meal of promising breeding materials

#### Number of Parameters: 05

- 1. Protein content
- 2. Methionine
- 3. Tryptophan
- 4.  $\beta$ -carotene
- 5. Total Antioxidant content

**Centres:** Bharatpur, Kanpur, Kangra, Pantnagar, Hisar, Ludhiana KRANTI (National Check) and PDZ-1(Quality check)

#### Methodology Used:

Protein content will be measured using microjheldhal and amino acids can be measured using spectrophotometric method. Samples from defatted seedmeal will be prepared using Soxhlet method. Beta carotene activity will be measured using spectrophotometric method.

#### 7.3. Screening of anti-nutritional factors in quality breeding materials

#### Number of Parameters:

- 1. Total Glucosinolates
- 2. Phytic acid

**Centres:** Bharatpur, Kanpur, Kangra, Pantnagar, Hisar, Ludhiana Entries of IVT/AVT quality trials will be evaluated at Bharatpur, Ludhiana, Kangra, Kanpur, Pantnagar, and Hisar.

#### Methodology used:

Total glucosinolate content (Sodium tetra chloropalladate method) and Phytic acid will be measured using spectrophotometric method.

# **Quality Mustard strains: IVT**

#### **3.6 Quality Mustard : IVT**

SN	Entry	Pedigree	Centre
1.	LES- 62	LES- 45 X EC- 61	IARI, New Delhi
2.	LES- 63	LES- 45 X EC- 61	IARI, New Delhi
3.	PDZ- 14 #	Agrani X Heera	IARI, New Delhi
4.	PDZ- 15 #	Agrani X Heera	IARI, New Delhi
5.	JC 32#	(PBR 210 X JM 06003) X NUDHYJ 4	PAU Ludhiana
6.	JC 36#	(PBR 210 X NUDHYJ 4) X JM 06020	PAU Ludhiana
7.	RH (OE)-1804	EC 597328 X RH (HO)0502	CCS, HAU, Hisar
8.	RH (OE)-1807	EC 597328 X RH (HO)0502	CCS, HAU, Hisar
9.	0IJ5001#	PA7IJ136 X PR9IJ404	Bayer Bio Science Pvt. Ltd., Faridabad
11	Kranti (NC)		
12	PDZ1 (QC)		

# - double low strains

### AVT-I + II Quality Mustard

#### Zone II

Entries: LES 60, 9IJ5001#, RH (OE) 1706)\*, PDZ 12# \$, PDZ 11#, RCH 1#,

#### **AVT-I Quality Mustard**

#### Zone III

Entries: LES 60, RGN 73 (ZC), Pusa Mustard 30 (LR), Kranti (NC)

SN	Entry	Pedigree	Centre
10.	LES-58	Varuna x LES 1-27	IARI, New Delhi
11.	LES-59	Varuna x LES 1-27	IARI, New Delhi
12.	PDZ-11	Pusa Agrani x Heera	IARI, New Delhi
13.	PDZ-12	Pusa Agrani x Heera	IARI, New Delhi
14.	RCH 3	CJRD-1579 X RE 46	PAU Ludhiana
15.	RLC 8	PQM11 X PBR 210 X NUDHYJ	PAU Ludhiana
16.	RLC 9	NUDHYJ x PBR 210	PAU Ludhiana
17.	RLC 10	JC 210 X JC1359	PAU Ludhiana
18.	DRMRQ1-16-27	EC564648 X (NUDHYJ 3X PCR 7)	DRMR, Bharatpur
19.	DRMRQ4-7-23	JN004 X (NUDHYJ 3 X Varuna)	DRMR, Bharatpur
11	RH (OE)1705	NOID x EC 597324	CCS, HAU, Hisar
12	RH (OE)1706	NOID x EC 597324	CCS, HAU, Hisar
13	DRMRQ 202		ICAR-DRMR, Bharatpur
14	DRMRQ 204		ICAR-DRMR, Bharatpur
15	DRMRQ 1-2-37		ICAR-DRMR, Bharatpur
16	DRMRQ 1-22		ICAR-DRMR, Bharatpur

All the experiments in Plant Physiology and Biochemistry were critically discussed and following recommendations were made:

#### **Recommendation:**

All the experiments in Plant Physiology and Biochemistry were critically discussed and following suggestions/recommendations were made:

- 1. Based on four years data, sequential foliar application of Brassinolide@20ppm and Salicylic acid @200ppm at initiation and 50% flowering was effective in enhancing yield under rainfed condition. Physiological traits enhanced like RWC, LWR, photosynthetic pigments including accessory pigment carotenoids which prevents the photo oxidation of chlorophyll under moisture stress along with increase in total siliquae per plant. Benefit cost ratio was 2.28 with SA@200ppm and 2.24 with BR@20ppm over control (1.72) and 1.88 (water spray).
- 2. Tensiometer ,IRGA/photosynthesis system, pyranometer with line sensor, lux meter/canopy imager and growth chamber/ BOD incubator are essentially required for physiological experiments for Hisar and Ludhiana and at those centers which do not have this facility.
- 3. All the centers should conduct the experiments according to the technical programme and submit the report well in time.
- 4. Maximum entries to be tested should not be more than 30 with 50g of seed size.
- 5. Those centers which do not have sufficient facilities for GC, can analyze their samples at DRMR, Bharatpur.
- 6. All the centers should follow the same protocols for all the experiments.
- 7. Each center should send statistically (CV/SD/SE) analyzed report and the data in triplicate.
- 8. CV should not be more than five, failing which data will not be considered.

It was emphasized to conduct the experiment as per technical program and record the observations at specified stage/duration. All the centers should submit data for all the attributes so that definite conclusion can be made. The session ended with vote of thanks to the chairperson and participants. It was emphasized to conduct the experiment as per technical program and record the observations at specified stage/duration. All the centers should submit data for all the attributes so that definite conclusion can be made. The session ended with vote of that be the observations at specified stage/duration. All the centers should submit data for all the attributes so that definite conclusion can be made. The session ended with vote of thanks to the chairperson and participants.

# XXVII Annual Group Meeting of AICRP Rapeseed-Mustard August 3-4, 2019 at Online

#### **Session VIII: Plenary Session**

Chairman	: Dr. T. R. Sarma, DDG (Crop Science), ICAR, New Delhi	
Co-chairman	: Dr. S. K. Jha, ADG (OP), ICAR, New Delhi	
Rapporteurs	: Dr. Arun Kumar, Principal Scientist, ICAR-DRMR, Bharatpur	
	: Dr. H. S. Meena, Senior Scientist, ICAR-DRMR, Bharatpur	

Plenary session was chaired by Dr. T. R. Sarma, DDG (Crop Science), ICAR, New Delhi and Co-chaired by Dr. S. K. Jha, ADG (OP), ICAR, New Delhi. With brief introduction of Rapeseed-Mustard research work going at national level, role of rapeseed-mustard group and current scenario of oilseed requirements, Chairman invited PIs to present the recommendations of their respective discipline. Recommendations of Plant Breeding was presented by Dr. K. H. Singh, Agronomy by Dr. O. P. Premi, Plant Pathology by Dr. P. D. Meena, Entomology by Dr. Archana Anokhe, Plant Physiology by Dr. Pushp Sharma, Bio-chemistry by Dr. Anubhuti Sharma and FLDs by Dr. Ashok Sharma. Chairman stressed to do hard work in mission mode and pin point targets with dedication to take rapeseed-mustard production at newer heights to make country self-sufficient in oilseeds and edible oil.

After thorough discussion during the presentations, following recommendations / action points emerged:

- The action on decisions about criteria for promotion of hybrids and zonalization should be taken immediately before commencement of the next crop season.
- Chairman emphasized to work in better coordination with AICRP-RM centres and suggested Director, ICAR-DRMR to monitor all the activities frequently by various means like video clips / crop photos / phone etc. at different stages.
- Sharing of breeding materials, segregating populations/progenies and resistant sources with cooperating centres.
- The various recommendations of different disciplines particularly Agronomy, Plant Pathology and Entomology should be revisited and refined properly.
- Dr. S. R. Bhat, Former Professor, ICAR-NRCPB suggested adopt unique nomenclature procedure for ICAR-DRMR varieties.
- Dr H. C. Sharma, Chairman & Subject Expert (Entomology) suggested that a standardized protocol to screen, and select for resistance to insects must followed. The technique followed must ensure more than 80% damage on the susceptible check, and <25% damage in the resistance check. And only data from such experiments should be taken into account to select insect-resistant sources and breeding lines. He also provided some study material for plant protection experiments.

Dr. S. K. Jha, ADG (O&P), Co-chairman in his concluding remarks emphasized to incorporate all the QRT recommendations discipline - wise and take actions well in time. The session was ended with vote of thanks to chair and co-chair by Director, ICAR-DRMR, Bharatpur.