



Annual Progress Report 2022



PDZ 11



RCH 1



PGSH 1699



RTM-1624



All India Coordinated Research Project on Rapeseed-Mustard
ICAR-Directorate of Rapeseed-Mustard Research

(Indian Council of Agricultural Research)

Sewar, Bharatpur-321 303 (Rajasthan), India

(An ISO 9001:2008 Certified Organization)

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My profound thanks to all the collaborators from 21 coordinating and 25 voluntary centres under the umbrella of AICRP-RM programme during 2021-22. I extend my sincere appreciation to the monitoring team leaders and members for giving valuable suggestions for further improvement of the programme and express my gratitude to all the Vice-Chancellors and Directors of Research of the concerned SAUs, Directors of ICAR/other institutes, Directors of State Department of Agriculture for their valuable and timely cooperation in the successful implementation of the envisaged research and development activities.

The overall seasonal weather conditions during crop season of 2021-22, across the rapeseed-mustard production zones were quite normal and favourable for crop growth and development. Good amount of precipitation received during monsoon in the month of September at almost all the centers. Performance of 178 strains, including 02 of yellow sarson, 166 of Indian mustard and 10 of gobhi sarson was tested in nineteen performance evaluation trials consisting of yellow sarson (1), gobhi sarson (1) and Indian mustard (17) at 46 locations across the 6 agro-climatic zones of the country. On the basis of superiority for seed/oil yield/ earliness/quality/ resistance over the best check 42 strains including gobhi sarson (01) and Indian mustard (41) were promoted for advanced stage evaluation. 233.16 q breeder seed of 70 rapeseed - mustard varieties was produced, indicating a surplus availability of 160.16 q.

Foliar application of all the tested PGRs were effective in improving yield with increased siliquae on main shoot, total siliquae per plant and chlorophyll stability index. Physiological traits and osmoprotectants enhanced with the microbial treatments under moisture stress. RWC, membrane stability and chlorophyll content improved with microbial inoculations in normal and late sown varieties.

DRMR 2018-19, Rohini (A4A5)-491, PB (A4A5)-842, Varuna (A4A5)-936-279, PJK (A4A5)-21, DRMR 2017-16, JC 36, OIJ 5001 were found resistant to WR. Seed treatment (10g/kg) + foliar spray with *T. harzianum* at 60 and 75 DAS followed by foliar spray with *Bacillus subtilis* 106c.f.u. (24.0%) was found effective against AB, WR and SR diseases.


Entries of IVT/AVT quality trials were analyzed for nutritional quality index (NQI) of oil, screening for value addition in seed meal, study of anti-nutritional factors and screening of different types of glucosinolates in meal. Data obtained in all the experiments was found significant with p-value significant at 5% level.

Application of 150% NPK of the recommended doses recorded maximum seed yield of mustard at most of the locations except Kangra and Pantnagar (100% NPK + 2.5 t FYM/ha). Post emergence spray of fluazifop-p-butyl and quizalofop and pre-emergence application of pendimethalin recorded maximum mustard seed yield and WCE. Seed inoculation with biofertilizers like MRD 17, Biophos and Biophos⁺, CRIDA MI-I and CRIDA MI-II improved mustard seed yield over no inoculation. Seed treatment with NPK consortia + ZSB improved mustard seed yield at most of the locations. FYM (500 kg) enrichment with 40 kg S+5 kg Zn+1 kg B/ha markedly increased seed yield.

My sincere thanks and appreciation to all the principal investigators, associated scientists and other colleagues at the ICAR-DRMR especially Drs. K. H. Singh, Bhagirathram, R.S. Jat, A. K. Sharma, P.D.Meena, Pankaj Sharma, Anubhuti Sharma, R.L.Choudhary, M.S.Sujith, M.D.Meena, L.K.Meena, R.K.Yogi, Karnal Singh and Ms Mamta Sikrawar of ICAR-DRMR and Drs. Pushp Sharma and Sarwan Kumar of PAU Ludhiana for their painstaking efforts in compiling the data and timely bringing out the report in the present form.

Last but not the least, help rendered by the technical, administrative and supporting staff of DRMR, particularly by Mr. R. S. Meena, Mr. Amit kumar, Mrs. Veena Sharma, Mr Krishnakant Singh and Mr. Lala Ram is thankfully acknowledged.

July 15, 2022
ICAR-DRMR, Bharatpur


15.7.2022
(P. K. Rai)
Director

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सारांश

मौसम

वर्ष 2021-22 के दौरान सरसों फसल के लिये मौसम अनुकूल रहा। सितम्बर माह में देश के लगभग सभी केन्द्रों में अच्छी बारिश हुई। दिसम्बर एवं जनवरी माह में हिमाचल के काँगडा केन्द्र में न्यूनतम तापमान 2 डिग्री सेल्सियस दर्ज किया गया। इस वर्ष कीड़ों एवं बीमारियों का प्रकोप भी बहुत कम रहा, जिसके कारण फसल की पैदावार अच्छी हुई।

आनुवांषिकी एवं पादप प्रजनन

किस्मों का सुधार/विकास

अखिल भारतीय राई सरसों समन्वित परियोजना के अन्तर्गत देश के 14 राज्यों के 16 विभिन्न अनुसंधान केन्द्रों पर राई-सरसों की उन्नत किस्मों के विकास हेतु कार्यक्रम कृषि पारिस्थितिकी तंत्र की आवश्यकताओं के अनुरूप किया गया। 178 किस्मों का मूल्यांकन 46 केन्द्रों, जिसमें 25 स्वैच्छिक एवं निजी केन्द्र सम्मिलित है, पर 21 समन्वित परीक्षणों में किया गया।

जननद्रव्य संसाधन प्रबंधन

कुल 6966 प्रारूपों जिनमें तोरिया (600), लाहा (4937), पीली सरसों (305), गोभी सरसों (323), भूरी सरसों (17), करन राई (239), तारामीरा (43), *ब्रेसिका काऊडेटस* (04), *ब्रेसिका नाइग्रा* (09), *ब्रेसिका रूगोसा* (71), *रेफेनस काऊडेटस* (01) एवं अन्य वन प्रजाति (25) के प्रारूपों को उचित संकरण विधि द्वारा सुरक्षित रखा गया। तोरिया (21), लाहा (435), पीली सरसों (06), गोभी सरसों (28) एवं करन राई (05) के कुल 559 नये प्रारूप को एकत्र किया गया एवं लाहा (747), तोरिया (61), पीली सरसों (250), गोभी सरसों (14), भूरी सरसों (14), तारामीरा (110) और *ब्रेसिका रूगोसा* (48), के 1244 प्रारूपों का मूल्यांकन किया गया। मूल्यांकन के आधार पर विभिन्न गुणों के लिए उपयोगी जननद्रव्यों की पहचान की गई।

संकरण एवं चयन

अधिक उपज, पीघ पकने वाली, बीज-आकार, कीट-रोग प्रतिरोधकता, उच्चताप सहनशीलता, गुणवत्ता एवं अधिक तेल मात्रा के आधार पर तोरिया (79), पीली सरसों (66), गोभी सरसों (105), लाहा (905) के 979 नए कॉसेस नवगांव, चट्टा, भा कृ अं सं नई दिल्ली कानपुर, पंतनगर, मुरेना, हिसार, श्रीगंगानगर, लुधियाना, वाराणसी एवं एस.के. नगर में बनाए गए। तोरिया में समष्टि (पॉपुलेशन) सुधार कार्यक्रम, कम्पोजिट बनाकर एवं चयन पश्चात् समष्टि बनाकर किया गया। पीली सरसों के लिये पंतनगर एवं कानपुर में संकरण तथा 216 एकल पौधे पृथक्करणीय पीढियों में चयन किया गया। लाहा के 9632 एकल पौधे एवं 979 पुंज (बल्क) पृथक्करणीय एवं अग्रिम पीढियों में से चयन किये गये।

अग्रिम प्रजनन स्तर का मूल्यांकन

तोरिया के 69 प्रभेदों का कानपुर, पंतनगर एवं चट्टा में मूल्यांकन किया गया। पंतनगर में मानक पी०टी० 303 की तुलना में 24.3 प्रतिशत पैदावार वृद्धि दर्ज की गई। पीली सरसों के कुल 67 प्रभेदों को कानपुर, एवं पंतनगर में जाँचा गया और पंतनगर में पीताम्बरी की तुलना में 25.8 प्रतिशत अधिक उपज वृद्धि हुई। लाहा के 263 प्रभेदों को 09 केन्द्रों चट्टा, हिसार, लुधियाना, पंतनगर, ढोली, एस.के. नगर एवं वाराणसी पर 37 परीक्षणों में जाँचा गया। पंतनगर में एनआरसीएचबी101 की तुलना में 27.2 प्रतिशत उपज में वृद्धि पाई गई। गोभी सरसों के कुल 196 प्रभेदों का हिसार(10), लुधियाना(177) चट्टा(09) उपज में वृद्धि में मूल्यांकन किया गया।

संकर विकास

आईसीएआर-डीआरएमआर भरतपुर, आईसीएआर-आईएआरआई नई दिल्ली, पीएयू लुधियाना और सीएस एचएयू हिसार सहित चार केंद्रों पर "हाइब्रिड पर कंसोर्टिया रिसर्च प्लेटफॉर्म" के तहत हाइब्रिड विकास के प्रयास जारी रहे। सत्रह प्रायोगिक संकर (आईसीएआर-डीआरएमआर से 7, पीएयू से 05 सहित) 03 सीसीएसएचएयू से और 02 आईसीएआर-आईएआरआई से) को 2021-22 के दौरान बहुस्थानीय मूल्यांकन के लिए एआईसीआरपीआरएम के विभिन्न परीक्षणों में शामिल किया गया था। भारतीय सरसों के बीस प्रायोगिक संकर, जिसमें चार केंद्रों में से प्रत्येक में से पांच शामिल हैं, का मूल्यांकन सभी चार केंद्रों पर प्रतिकृति ब्लॉक डिजाइन में किया गया था। चार स्थानों (भरतपुर, नई दिल्ली, लुधियाना और हिसार) में औसत बीज उपज के आधार पर, चार संकर; आरएचएच 2104 (2665 किग्रा/हेक्टेयर), आरएचएच 2108 (2592), आरएचएच 2107 (2515 किग्रा/हेक्टेयर) और डीआरएमआरएचजे 1517 (2449 किग्रा/हेक्टेयर) के अंतर से सबसे अच्छा चेक डीएमएच-1 (2373 किग्रा/हेक्टेयर) निकला। क्रमशः 12, 9, 6 और 3%। पैंतालीस प्रायोगिक संकरों का मूल्यांकन संवर्धित ब्लॉक डिजाइन में किया गया था, जिसमें प्लॉट का आकार 3 मीटर लंबी जोड़ी वाली पंक्ति (सीआरपीएमएलटी 2)

रखा गया था। चार प्रायोगिक संकर; आरएचएच 2114 (3232 किग्रा/हेक्टेयर), एमजेए 11/आरपी13-2-2-3 (2940 किग्रा/हेक्टेयर), पीएचआर 3328बी (2888 किग्रा/हेक्टेयर) और पीएचआर 1293 (2885 किग्रा/हेक्टेयर) ने डीएमएच 1 (2789 किग्रा/हेक्टेयर) तीन स्थानों पर औसत बीज उपज के आधार पर क्रमशः 15.9, 5.4, 3.5 और 3.4% के अंतर से। सभी चार केंद्रों पर संवर्धित ब्लॉक डिजाइन में 51 एफ1 क्रॉस का मूल्यांकन किया गया। तीन स्थानों पर औसत बीज उपज के आधार पर सर्वोत्तम जांच डीएमएच 1 (2568 किग्रा/हेक्टेयर) पर छह क्रॉस प्रदर्शित > 10% बीज उपज हेटेरोसिस। डीआरएमआर, सीसीएसएचएयू, आईएआरआई और पीएयू में क्रमशः 44, 332, 69 और 17 सहित चार सौ बासठ प्रायोगिक संकरों का मूल्यांकन संबंधित केंद्रों पर किया गया। प्रत्येक केंद्र ने अपने स्थान पर आशाजनक संकरों की पहचान की। आईसीएआर-डीआरएमआर में 130, आईसीएआर-आईएआरआई में 287 और पीएयू और एचएयू में 70-70 सहित पांच सौ पचपन एफ1 क्रॉस का मूल्यांकन किया गया। प्रत्येक केंद्र पर सुपीरियर क्रॉस की पहचान की गई थी। कुल मिलाकर सीएमएस और पुनर्स्थापक को बैकक्रॉसिंग के माध्यम से क्रमशः 173 और 111 परमाणु पृष्ठभूमि में परिवर्तित किया जा रहा है। इसके अलावा 73 सीएमएस और 211 रिस्टोरर लाइनों का रखरखाव किया गया। अगले वर्ष के दौरान मूल्यांकन के लिए 199 प्रायोगिक संकर और 781 एफ1 क्रॉस के बीज का उत्पादन किया गया।

सफेद जंग प्रतिरोध, गुणवत्ता लक्षणों और कृषि संबंधी लक्षणों के लिए पैतृक वंश में सुधार के प्रयास चल रहे हैं। डीआरएमआर, आईएआरआई, सीसीएस एचएयू और पीएयू से क्रमशः 20, 15, 15 और 20 इनब्रेड / जर्मप्लाज्म लाइनों वाली 70 इनब्रेड लाइनों के एक सेट का मूल्यांकन दो चेकों के खिलाफ किया गया था। गिरिराज और पूसा सरसों 25, दूसरे के लिए संवर्धित ब्लॉक डिजाइन में साल। 88 इनब्रेड लाइनों के एक सेट को एसएसआर मार्करों के माध्यम से मूल्यांकन की गई आनुवंशिक विविधता के आधार पर दो विविध उप-जनसंख्या में बांटा गया था।

प्रजनक बीज उत्पादन

कृषि मंत्रालय, भारत सरकार द्वारा वर्ष 2021-22 के लिए प्रस्तावित 70 अनुमोदित किस्मों का प्रजनक बीज विभिन्न केन्द्रों पर आवंटित किया गया। 84.38 किंटल प्रजनक बीज की मांग की तुलना में 233.16 किंटल (जिसमें पिछले वर्ष का बीज सम्मिलित है) प्रजनक बीज तैयार किया गया।

समन्वित परीक्षण

पीली सरसों (01), लाहा (166) एवं गोभी सरसों (10) के 178 उन्नत प्रभेदों को देश के 6 कृषि जलवायु क्षेत्रों में 18 उपज परीक्षणों हेतु 46 स्थानों पर जाँचा गया। जिसके आधार पर कुल 42 जिसमें गोभी सरसों (01) एवं लाहा (41) सम्मिलित है, को अग्रिम स्तर की जाँच के लिए प्रोन्नत किया गया।

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

जोन 01	जोन 02	जोन 03	जोन 04	जोन 05
सरसों, आई.वी.टी., समय से पहले बुवाई (सिंचित)				
	डीआरएमआरसीएच टी 13-13-5-4 (2304,9.6) डीआरएमआरसीएच टी 13-13-5-5 (2345,11.5) केएमआर(ई)21-1 (2428,15.5) औआरएम 2019-25 (2361,12.3)			
सरसों, आई.वी.टी., समय पर बुवाई (सिंचित)				
	आरएच1934 (2755,14.3) एसकेएम1801 (2647,9.8) एनपीजे253 (2743,13.8)	एनपीजे253 (1192,19.0)**	पीबीआर 939 (2523,9.2) एनपीजे 252 (933,12.5)** एसीएन 237 (2568,11.2) केएमआर21-3 (2726,18.0) आरजीएन 524 (2631,13.9) एसकेएम1801(945,14.0)** एनपीजे253 (2737,18.5)	

सरसों, ए.वी.टी. I+II, समय पर बुवाई (सिंचित / गुणवत्ता / लवणीय / क्षारीय)			
आरएच1975 (1042,12.9)**	पीडीजेड-14#(1877,12.7)*		
आरएच1974 (10.35,12.1)**	पीडीजेड-15#(1853,11.3)*		
सरसों, आई.वी.टी., समय पर बुवाई (असिंचित)			
डीआरएमआरएचजे1117 (2339,3.8)*			
सरसों, आई.वी.टी., देरी पर बुवाई			
एनपीजे 250 (2333,4.1)*	एनपीजे 251 (1914,10.2) डीआरएमआरएचजे 430 (700,10.1)**		
सरसों, ए.वी.टी. I, देरी पर बुवाई			
	डीआरएमआर 2018-19 (605,6.0)***		
सरसों, आई.एच.टी.,			
18जे408सी (1225,14.2)** एसवीजेएच70 (3006, 10.3) एनएमजेएच21-01 (2902,6.5)*	केएमएच 8765(1098,10.2)** 18जे408सी (2909,13.0) एनएमजेएच 21-01 (2776,7.9)*	एनएमजेएच 21-01 (2473,4.9)* आईजे16आर1168 (965,11.4)**	
सरसों आई.वी.टी., (गुणवत्ता)			
डीआरएमआरसीआई(क्यू) 47 (2486,4.9)* आईजे19आर5004 (2426,6.6)*	पीडीजेड-16#(2438,23.6)* आईजे19आर5004 (2508,5.7)*		
सरसों आई.वी.टी., डब्लू.आर.आर.			
डीआरएमआर 2018-25 (2680,8.6)*	डीआरएमआर 2018-25 (2627,14.5)* डीआरएमआर 2018-37 (2350,2.4)* डीआरएमआर आईजे 20-157 (847,1.3)***		
लवणीय / क्षारीय आई.वी.टी.,			
सीएस 2020-10 (2237, 12.4)			
गोभी सरसों आई.वी.टी.			
जीएसएच - 2155 (2056, 10.8)			

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

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

षस्य विज्ञान

वर्ष 2021-22 के दौरान पांच क्षेत्रों (जोनों) में 25 समन्वय केंद्रों पर सस्य विज्ञान संबंधी अनुसंधान के छह प्रमुख क्षेत्रों पर परीक्षण किए गए। इन परीक्षणों से प्राप्त परिणामों को संक्षेप में प्रस्तुत किया गया है:

3.1 राई-सरसों आधारित फसल प्रणालियों में दीर्घकालीन उर्वरता परीक्षण

दीर्घकालीन उर्वरता परीक्षण 2011-12 में शुरू किया गया था और 2021-22 के दौरान 5 जोनों में 10 केंद्रों पर 11वें वर्ष के लिए आयोजित किया गया था। इन परिणामों में सरसों की पैदावार पर उर्वरता के विभिन्न स्तरों के दीर्घकालिन प्रभाव को दर्शाया गया है। कांगड़ा में, 100% एनपीके + 2.5 टन प्रति हैक्टर गोबर की खाद के एकीकृत प्रयोग से सार्थक रूप से अधिक सरसों की पैदावार प्राप्त हुई जो कंट्रोल उपचार तथा 100% एनपीके से क्रमशः 448 एवं 16% अधिक रही। पंतनगर में, 100% एनपीके + 2.5 टन प्रति हैक्टर

गोबर की खाद के एकीकृत प्रयोग से सार्थक रूप से अधिक सरसों की पैदावार प्राप्त हुई जो कंट्रोल उपचार तथा 150% एनपीके से क्रमशः 213 एवं 13% अधिक रही। लुधियाना, हिसार, श्रीगंगानगर, कोटा, मुरैना, उसके नगर, भुवनेश्वर तथा शिल्लोंगनी केन्द्रों पर 150% एनपीके के प्रयोग से सरसों की स्पष्ट रूप से उच्चतर पैदावार दर्ज की गई जो कंट्रोल उपचार से क्रमशः 211, 208, 54, 65, 324, 101, 175 एवं 241% अधिक रही। उच्चतर एनपीके दरों (150%) ने लुधियाना, हिसार, श्रीगंगानगर, कोटा, मुरैना, उसके नगर, भुवनेश्वर और शिल्लोंगनी में संबंधित अनुशंसित दरों (100% एनपीके) की तुलना में सरसों की उपज में क्रमशः 6.2, 24.2, 13.0, 18.1, 21.8, 19.4, 15.9 और 53.5% की वृद्धि दर्ज की। सरसों की 10 साल की औसत बीज उपज प्रवृत्तियों ने यह भी संकेत दिया कि 150% एनपीके के प्रयोग से परिणामस्वरूप ढोली, मुरैना, हिसार, खुड़वानी और उसके नगर में अधिकतम उपज प्राप्त हुई। जबकि, लुधियाना और पंतनगर में, 150% एनपीके, और 100% एनपीके + 2.5 टन प्रति हैक्टर गोबर की खाद के एकीकृत प्रयोग से सरसों की अधिकतम बीज उपज प्राप्त हुई।

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

यह परीक्षण 2021-22 के दौरान छह केंद्रों पर किया गया। लुधियाना में बीज अंकुरण पूर्व ऑक्साडियारगिल @ 0.09 किलोग्राम सक्रिय तत्व प्रति हैक्टर, हिसार में बुआई के 25-30 बाद फ्लूजीफॉप-पी-ब्यूटाइल @ 0.125 किलोग्राम सक्रिय तत्व प्रति हैक्टर, पंतनगर में बुआई के 15-20 बाद क्विजलोफॉप @ 0.05 किलोग्राम सक्रिय तत्व प्रति हैक्टर, उसके नगर, इम्फाल और भुवनेश्वर में बीज अंकुरण पूर्व पेंडीमेथालिन @ 1.0 किलोग्राम सक्रिय तत्व प्रति हैक्टर के अनुप्रयोग से सरसों की पैदावार में वीडो चेक (खरपतवार-सहित) उपचार की तुलना में वृद्धि दर्ज हुई। जबकि, लुधियाना (61.4%), उसके नगर (74.4%), भुवनेश्वर (83.2%) और इम्फाल (71.7%) में पेंडिमथेलिन के बीज अंकुरण पूर्व अनुप्रयोग से पंतनगर में (61.4%) क्विजलोफॉप 0.05 सक्रिय तत्व प्रति हैक्टर के अनुप्रयोग से, तथा हिसार (75%) में फ्लूजीफॉप-पी-ब्यूटाइल @ 0.125 किलोग्राम सक्रिय तत्व प्रति हैक्टर के अनुप्रयोग से उच्चतम खरपतवार नियंत्रण दक्षता दर्ज की गई।

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

वर्ष 2021-22 के दौरान विभिन्न उर्वरता स्तरों के तहत बारानी परिस्थितियों, गुणवत्ता वाली सरसों, सफेद रोली प्रतिरोधी, लवणीय/क्षारीय परिस्थितियों तथा गोभी सरसों की नई प्रविष्टियों का परीक्षण किया गया।
समय पर बोई गई सरसों (बारानी): आरएच 1425 ने श्रीगंगानगर को छोड़कर सभी केंद्रों पर अधिकतम बीज उपज दर्ज की। हिसार और बावल में, आरएच 1425 ने चेकों (आरएच 725, आरजीएन 229 और क्रांति) की तुलना में क्रमशः 9.6-46.3 और 13.0-31.1% अधिक बीज उपज दर्ज की। अबोहर और लुधियाना में, प्रविष्टि आरएच 1425 की बीज उपज में चेकों की तुलना में क्रमशः 6.3-39.4 और 3.0-28.1% की सार्थक वृद्धि हुई।
गुणवत्ता सरसों: हिसार और बावल में, चेकों (पीएम 29, आरएच 749 और क्रांति) की तुलना में आरएच (ओई) 1706 की बीज उपज में क्रमशः 23.6-29.7 और 9.2-27.2% की वृद्धि हुई। श्रीगंगानगर में, आरएच (ओई) 1706 ने खराब प्रदर्शन किया और चेक आरएच 749 से 7% अधिक को छोड़कर, सभी चेकों की तुलना में कम बीज उपज दर्ज की। एलईएस 60 ने हिसार में चेकों की तुलना में 17-25% अधिक, और बावल में केवल चेक आरएच 749 से 4% अधिक बीज उपज दर्ज की। श्रीगंगानगर में, एलईएस 60 ने खराब प्रदर्शन किया और चेकों की तुलना में कम बीज उपज दर्ज की। दिल्ली और लुधियाना में, आरएच (ओई) 1706 और एलईएस 60 दोनों ने खराब प्रदर्शन किया और चेकों की तुलना में कम बीज उपज दर्ज की।

सरसों: सफेद रोली प्रतिरोधी: एवीटी-॥ एनआईएल- (जोन-॥): लुधियाना में, वरुणा (ए4ए5)-936-279 ने चेकों (आरएच 749 और गिराज) की तुलना में बीज उपज में 12.6-15.4% की उल्लेखनीय वृद्धि की। लुधियाना में, रोहिणी (ए4ए5)-491 और पीबी (ए4ए5)-842 में क्रमशः 6.3-8.9 और 7.6-10.3% नॉन-सिगनीफिकेंटली (गैर-महत्वपूर्ण रूप से) उच्च बीज उपज दर्ज की। पीजेके (ए4ए5)-21 ने खराब प्रदर्शन किया और लुधियाना में चेकों की तुलना में 15.4-17.4% कम बीज उपज दर्ज की। हिसार में, वरुणा (ए4ए5)-936-279 ने चेकों की तुलना में 2.6-4.6% नॉन-सिगनीफिकेंटली उच्च बीज उपज दर्ज की, जबकि, पीबी (ए4ए5)-842 ने चेक आरएच 749 और

गिर्राज की तुलना में नॉन-सिगनीफिकेंटली रूप से क्रमशः अधिक (0.5%) और कम (1.5%) उपज दर्ज की। हिसार में, रोहिणी (ए4ए5)-491 और पीजेके (ए4ए5)-21 ने खराब प्रदर्शन किया और चेकों की तुलना में क्रमशः 18.1-19.7 और 0.6-2.6% कम बीज उपज दर्ज की। श्रीगंगानगर में, सभी प्रविष्टियाँ [रोहिणी (ए4ए5)-491, पीबी (ए4ए5)-842, पीजेके (ए4ए5)-21 और वरुणा (ए4ए5)-936-279] ने खराब प्रदर्शन किया और चेक आरएच 749 की तुलना में 5.9-27.4% कम बीज उपज दर्ज की। श्रीगंगानगर में चेक गिर्राज की तुलना में केवल पीबी (ए4ए5)-842 ने उच्च बीज उपज (3.9%) दर्ज की, बाकी तीन प्रविष्टियों ने कम उपज (8.0-19.9%) दर्ज की। दिल्ली में, वरुणा (ए4ए5)-936-279 ने चेकों की तुलना में बीज उपज में 75.0-105.4% की उल्लेखनीय वृद्धि दर्ज की। पीजेके (ए4ए5)-21 की बीज उपज दिल्ली में चेकों की तुलना में 2.9-17.7% अधिक दर्ज की गई। दिल्ली में, पीबी (ए4ए5)-842 की बीज उपज चेक गिर्राज की तुलना में 10.6% अधिक, लेकिन चेक आरएच 749 से 5.8% कम दर्ज की गई। दिल्ली में, रोहिणी (ए4ए5)-491 ने खराब प्रदर्शन किया और चेक आरएच 749 की तुलना में सार्थक रूप से 14.8% कम बीज उपज दर्ज की। चट्टा में, पीबी (ए4ए5)-842 और पीजेके (ए4ए5)-21 की बीज उपज चेकों की तुलना में क्रमशः 6.2-7.5 और 2.3-3.5% अधिक दर्ज की गई। चट्टा में, रोहिणी (ए4ए5)-491 ने खराब प्रदर्शन किया और चेकों (गिर्राज और आरएच 749) की तुलना में सार्थक रूप से 9.3-10.4% कम बीज उपज दर्ज की।

सरसों: सफेद रोली प्रतिरोधी: एवीटी-॥ एनआईएल-(जोन-॥): कानपुर में, वरुणा (ए4ए5)-936-279 और पीबी (ए4ए5)-842 की बीज उपज चेकों (आरजीएन 73 और माया) की तुलना में क्रमशः 4.5-25.1 और 0.3-20.1% अधिक दर्ज की गई। कानपुर में, रोहिणी (ए4ए5)-491 और पीजेके (ए4ए5)-21 ने खराब प्रदर्शन किया और चेक आरजीएन 73 की तुलना में क्रमशः 7.6 और 2.2% कम बीज उपज दर्ज की। हालांकि, कानपुर में चेक माया की तुलना में पीजेके (ए4ए5)-21 और रोहिणी (ए4ए5)-491 की बीज उपज क्रमशः 17.1 और 10.6% अधिक दर्ज की गई। पंतनगर में, सभी प्रविष्टियों ने खराब प्रदर्शन किया और चेकों की तुलना में 9.3-62.6% कम बीज उपज दर्ज की। मुरैना में, वरुणा (ए4ए5)-936-279 की बीज उपज चेक आरजीएन 73 की तुलना में सार्थक रूप से 15.0% अधिक दर्ज की गई, लेकिन चेक माया की तुलना में नॉन-सिगनीफिकेंटली रूप से 3.6% कम थी। मुरैना में, शेष तीनों प्रविष्टियाँ [रोहिणी (ए4ए5)-491, पीबी (ए4ए5)-842 और पीजेके (ए4ए5)-21] ने खराब प्रदर्शन किया और चेकों की तुलना में सार्थक रूप से 20.3-44.3% कम बीज उपज दर्ज की। भरतपुर में, वरुणा (ए4ए5)-936-279 की बीज उपज चेकों की तुलना में 3.7-12.9% अधिक दर्ज की गई। भरतपुर में, शेष तीनों प्रविष्टियों ने खराब प्रदर्शन किया और चेकों की तुलना में 12.6-26.8% कम बीज उपज दर्ज की।

लवणीय/क्षारीय परिस्थितियों के लिए सरसों: आगरा, करनाल और लखनऊ में, सीएस 2005-143 की बीज उपज में क्रमशः 19.5-22.4, 12.6-49.9 और 13.9-42.0% की वृद्धि हुई, जोकि आगरा में चेक सीएस 54 और क्रांति से, तथा करनाल और लखनऊ में सभी चेकों (सीएस 54, सीएस 60 और क्रांति) से सार्थक रूप से अधिक पाई गई।

गोभी सरसों: कांगड़ा में, प्रविष्टि एकेजीएस 19-8 की बीज उपज में चेकों (जीएससी 6 और क्रांति) की तुलना में सार्थक रूप से 9.8-74.1%, तथा चेक जीएसएल 1 (2.1%) की तुलना में नॉन-सिगनीफिकेंटली रूप से वृद्धि हुई। चट्टा में, केजीएस 19-8 की बीज उपज में चेकों की तुलना में 7.9-54.9% की वृद्धि पाई गई। लुधियाना में, एकेजीएस 19-8 की बीज उपज में जीएससी 6 और क्रांति चेकों की तुलना में सार्थक रूप से 9.8-21.3% वृद्धि हुई, लेकिन चेक जीएसएल 1 की तुलना में 0.9% की कमी दर्ज की गई।

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

यह परीक्षण 2021-22 के दौरान 13 स्थानों पर किया गया था। बीज का टीकाकरण लुधियाना (19.3%), मुरैना (6.8%) और नागपुर (17.8%) में एमआरडी 17 के साथ, बावल (12.4%) और बांदा (9.4%) में बायोफॉस और बायोफॉस+ के साथ, श्रीगंगानगर (12.9%) और झांसी (18.0%) में सीआरआईडीए एमआई-1 के साथ, तथा चट्टा (43.6%), ढोली (31.4%), वाराणसी (41.2%), जोबनेर (19.5%) और इम्फाल (32.8%) में सीआरआईडीए एमआई-॥ के साथ करने पर बीज उपज में कंट्रोल उपचार की तुलना में उल्लेखनीय वृद्धि प्राप्त

हुई। इसके नगर में, सीआरआईडीए एमआई-1 ने कंट्रोल उपचार की तुलना में नॉन-सिगनीफिकैंटली (गैर-महत्वपूर्ण) अधिक पैदावार दर्ज की। सभी स्थानों पर, अनुशंसित सिंचाई के प्रयोग से, बिना सिंचाई और 50% कमतर सिंचाई की तुलना में उच्चतम बीज उपज दर्ज की गई। बीज का टीकाकरण जोबनेर (33.0%), इंफाल (78.7%), ढोली (59.5%), चट्टा (68.7%) और वाराणसी (72.5%) में सीआरआईडीए एमआई-1 के साथ, झांसी (34.5%) में सीआरआईडीए एमआई-1 के साथ, नागपुर (146.2%) में एमआईडी 17 के साथ, तथा बावल (18.6%) और बांदा (11.7%) में बायोफॉस और बायोफॉस + के साथ करने पर शुद्ध लाभ में कंट्रोल उपचार की तुलना में उल्लेखनीय वृद्धि प्राप्त हुई। इसके नगर में, सीआरआईडीए एमआई-1 ने कंट्रोल उपचार की तुलना में नॉन-सिगनीफिकैंटली (गैर-महत्वपूर्ण) अधिक शुद्ध लाभ अर्जित किया। मृदा कार्बनिक कार्बन और पोषक तत्व (एनपीके) भी इसके नगर और इंफाल में इनोकुलेंट्स के बीज टीकाकरण के साथ स्पष्ट रूप से प्रभावित हुए।

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

यह परीक्षण 2021-22 के दौरान 15 स्थानों पर किया गया। बीज का उपचार कांगड़ा (35.3%), मुरैना (67.4%), कांके (126.4%), भुवनेश्वर (22.8%) में एज़ोटोबैक्टर के साथ, इंफाल (54.7%) में पीएसएमओ के साथ, तथा चट्टा (25.4%), ढोली (21.4%), कोटा (23.4%), वाराणसी (27.8%), बावल (14.3%) और भरतपुर (23.2%) में एनपीके कंसोर्टिया + जेडएसबी के साथ करने पर बीज उपज में कंट्रोल उपचार की तुलना में उल्लेखनीय वृद्धि प्राप्त हुई। पंतनगर, इसके नगर और शिल्लोंगनी में, एनपीके कंसोर्टिया + जेडएसबी, एज़ोटोबैक्टर और पीएसएमओ ने क्रमशः कंट्रोल उपचार की तुलना में नॉन-सिगनीफिकैंटली (गैर-महत्वपूर्ण रूप से) उच्च बीज उपज दर्ज की। बीज का उपचार चट्टा (36.7%), कोटा (29.2%), वाराणसी (41.2%), बावल (21.3%), भरतपुर (36.5%) और ढोली (32.4%) में एनपीके कंसोर्टिया + जेडएसबी के साथ, कांके, कांगड़ा (58.8%) और भुवनेश्वर में एज़ोटोबैक्टर के साथ, तथा इंफाल (101.5%) में पीएसएमओ के साथ करने पर शुद्ध लाभ में कंट्रोल उपचार की तुलना में उल्लेखनीय वृद्धि प्राप्त हुई। जबकि बीज का उपचार शिल्लोंगनी (9.7%) में पीएसएमओ के साथ, पंतनगर (45.3%) में एनपीके कंसोर्टिया + जेडएसबी के साथ, और इसके नगर (18.5%) में एज़ोटोबैक्टर के साथ साथ करने पर शुद्ध लाभ में कंट्रोल उपचार की तुलना में नॉन-सिगनीफिकैंटली (गैर-महत्वपूर्ण) रूप से अधिक शुद्ध लाभ अर्जित किया। लगभग सभी परीक्षण स्थानों पर मृदा कार्बनिक कार्बन, उपलब्ध नत्रजन, फ़ोस्फोरस और पोटेश की मात्रा एनपीके कंसोर्टिया + जेडएसबी के साथ बीज टीकाकरण करने से बिना टीकाकरण की तुलना में अधिक दर्ज की गई।

3.6 उच्च उत्पादकता के लिए खनिज पोषक तत्व प्रबंधन का अनुकूलन

यह परीक्षण 2021-22 के दौरान 18 स्थानों पर शुरू किया गया था। चट्टा, भुवनेश्वर, झांसी, जोबनेर, कांगड़ा, कानपुर, कोटा, लुधियाना, नागपुर, इसके नगर और श्रीगंगानगर में 500 किलोग्राम प्रति हैक्टर गोबर की खाद से समृद्ध 40 किलोग्राम गंधक + 5 किलोग्राम ज़िंक + 1 किलोग्राम बोरॉन प्रति हेक्टेयर के प्रयोग से, पंतनगर और शिल्लोंगनी में 500 किलोग्राम प्रति हैक्टर गोबर की खाद से समृद्ध 20 किलोग्राम गंधक + 2.5 किलोग्राम ज़िंक + 0.5 किलोग्राम बोरॉन प्रति हेक्टेयर के प्रयोग से, और इंफाल और कांके में 20 किलोग्राम गंधक + 2.5 किलोग्राम ज़िंक + 0.5 किलोग्राम बोरॉन प्रति हेक्टेयर के प्रयोग से सरसों की बीज उपज में उल्लेखनीय वृद्धि हुई। 150% एनपीके के साथ 500 किलोग्राम प्रति हैक्टर गोबर की खाद से समृद्ध 40 किलोग्राम गंधक + 5 किलोग्राम ज़िंक + 1 किलोग्राम बोरॉन प्रति हेक्टेयर के संयुक्त प्रयोग से सरसों की उपज में कोटा में 13.8-104.2% और श्रीगंगानगर में 10.7-67.4% की वृद्धि हुई। पोषक तत्वों की पूर्ति झांसी (10.3-16.1%), नागपुर (11.5-31.9%), कांगड़ा (20.5-26.0%), इसके नगर (16.5-19.4%), कोटा (11.1-16.7%) और जोबनेर (12.0%) में 500 किलोग्राम प्रति हैक्टर गोबर की खाद से समृद्ध 40 किलोग्राम गंधक + 5 किलोग्राम ज़िंक + 1 किलोग्राम बोरॉन प्रति हेक्टेयर के करने से शुद्ध लाभ में उल्लेखनीय वृद्धि प्राप्त हुई। चट्टा (35.4-43.4%) और शिल्लोंगनी (68.3-84.2%) में 500 किलोग्राम प्रति हैक्टर गोबर की खाद से समृद्ध 20

किलोग्राम गंधक + 2.5 किलोग्राम जिंक + 0.5 किलोग्राम बोरॉन प्रति हेक्टेयर के प्रयोग से शुद्ध लाभ में उल्लेखनीय वृद्धि हुई। शुद्ध लाभ और मृदा में उपलब्ध नत्रजन, फ़ोस्फोरस और पोटेश की मात्रा सभी परीक्षण स्थानों पर 150: एनपीके के प्रयोग से अधिकतम प्राप्त हुई। लगभग सभी परीक्षण स्थानों पर पोषक तत्वों की पूर्ति 500 किलोग्राम प्रति हेक्टेयर गोबर की खाद से समृद्ध 40 किलोग्राम गंधक + 5 किलोग्राम जिंक + 1 किलोग्राम बोरॉन प्रति हेक्टेयर के करने से मृदा में उपलब्ध नत्रजन, फ़ोस्फोरस और पोटेश की मात्रा में उल्लेखनीय वृद्धि प्राप्त हुई।

पादप रोग विज्ञान

वर्ष 2021-22 के दौरान, सभी जगह काला धब्बा एवं सफेद रोली रोग का प्रकोप औसत से तीव्र देखा गया। जबकि, मुसैना में पौध अवस्था पर मृदु रोमिल आसिता रोग का प्रकोप कम से मध्यम पाया गया। चूर्णिल आसिता रोग का प्रकोप एस.के.नगर और भरतपुर में औसत से तीव्र रहा। तना गलन रोग का प्रकोप भरतपुर में सामान्य से तीव्र देखा गया। राई-सरसों जननद्रव्य की विभिन्न रोगों से प्रतिक्रिया

प्राकृतिक एवं कृत्रिम परिस्थितियों में सात केंद्रों पर एवीटी 1 और एवीटी 2 की 43 जननद्रव्य में से 0आई5001 (गुणवत्तासंकर), डीआरएमआर 2017-16, रोहिणी (ए4ए5)-491, पीबी (ए4ए5)-842, वरुणा (ए4ए5)-936-279, आरजेके (ए4ए5)-21 (ब्रेसिका जुंसिया) सफेद रतुआ रोग के प्रति प्रतिरोधी पायी गई। ये सभी जननद्रव्य मुसैना केंद्र पर मृदु रोमिल आसिता रोग के प्रति प्रतिरोधी पाये गये।

जबकि, ये जनन द्रव्य मुसैना केंद्र पर मृदु रोमिल आसिता के प्रति प्रतिरोधी पाये गये। कृत्रिम परिस्थितियों में एकेजीएस 19-8, एचएनएस 1206, जीएसएच 1723, जीएसएच 1703, जीएसएच 2155, एचएनएस 1102, डीआरएमआरआईएन 20-3, एकेजीएस 8060, डीआरएमआरआईएन 20-23 (ब्रेसिका नेपस) जननद्रव्य मुसैना, हिसार और पंतनगर स्थानों पर सफेद रतुआ रोग प्रतिरोधी पाये गये।

समरूपरोग नर्सरी

प्राकृतिक परिस्थितियों में सरसों के 52 जननद्रव्य में से डीआरएमआर 2018-41, डीआरएमआर 2018-37 (4 वर्ष), डीआरएमआर एसजे 4, पीएमडब्ल्यू 18, और डीआरएमआर 2018-25 (3 वर्ष), पीएबी 14-7, डीआरएमआरक्यू -1-22, और डीआरएमआर क्यू 202 (2 वर्ष), डीआरएमआर 2018-1, डीआरएमआर 2018-19, डीआरएमआर एसजे -349, डीआरएमआर एसजे -271, डीआरएमआर डीआर 2116, डीआरएमआर डीआर 2133, डीआरएमआर डीआर 2135, डीआरएमआर डीआर 2141, डीआरएमआर आईजे 12-26, डीआरएमआर आईजे 12-21, डीआरएमआर आईजे 12-44, पीएबी 14-18, डीआरएमआर आईजेडब्ल्यूआर 20-19, डीआरएमआरआई जेडब्ल्यूआर 20-11, डीआरएमआरआई जेडब्ल्यूआर 20-13, डीआरएमआर आईजेडब्ल्यूआर 20-14, डीआरएमआर आईजेडब्ल्यूआर 20-15, डीआरएमआरआई जेडब्ल्यूआर 20-17, डीआरएमआर आईजेडब्ल्यूआर 20-20, डीआरएमआर आईजेडब्ल्यूआर 20-24, और डीआरएमआरआई जेडब्ल्यूआर 20-26 सफेद रतुआ के 10 प्रतिशत प्रकोप से नीचे होने पर प्रतिरोधी पाये गये। अतिसंवेदनशील किस्म रोहिणी और वरुणा में सफेद रतुआ का अधिकतम प्रकोप 30.3 प्रतिशत पाया गया।

काला धब्बा की राष्ट्रीय रोग नर्सरी

32 जननद्रव्य में से डीआरएमआरपीएमजे 17 और पीएबी 17-15 काला धब्बा रोग प्रतिरोधी पाये गये। हालाँकि, सरसों के जननद्रव्य डीआरएमआर 2018-41, डीआरएमआर 2018-37 (4 वर्ष), पीएमडब्ल्यू 18, डीआरएमआरएसजे 4 (3 वर्ष), डीआरएमआर 2018-25, डीआरएमआर 2018-19 और डीआरएमआर 18-1 (2 वर्ष) मुसैना, पंतनगर, शिलोंगनि, धोली और हिसार पर अतिसंवेदनशील किस्म रोहिणी और एनआरसीएचबी 101 में औसतन 30.3 प्रतिशत की तुलना में सफेद रतुआ के लिये प्रतिरोधी पाये गये।

सफेद रतुआ की राष्ट्रीय रोग नर्सरी

कुल 55 जननद्रव्य में से आरएच 1700-4, आरएच 1700, डीआरएमआर 2018-25, डीआरएमआर 2018-37, डीआरएमआर 2018-41, डीआरएमआरसीआई 131, डीआरएमआरसीआई 132, डीआरएमआरसीआई 139, डीआरएमआरडीआर 2141, डीआरएमआरएसजे 206, डीआरएमआरएसजे 349 और डीआरएमआरएम 18-36-12 (ब्रेसिका

जुंसिया) जननद्रव्य पंतनगर, हिसार व भरतपुर में सफेद रतुआ रोगमुक्त पाये गये। जबकि, कुछ आशानजक जननद्रव्य जैसे डीआरएमआर 2018-1, डीआरएमआरएम 18-35-11, डीआरएमआरएम 18-37-13, आरएच 1400, आरएच 1400-1, आरएच 1700-1, आरएच 1700-3, डीआरएमआरडीआर 2195, डीआरएमआरसीआई 126 तीनों स्थानों पर सफेद रतुआ के 10 प्रतिशत प्रकोप से नीचे होने पर प्रतिरोधी पाये गये। परिणामस्वरूप, जननद्रव्य डीआरएमआर 2018-37, डीआरएमआर 2018-41, आरएच 1400, और आरएच 1400-1 (4 वर्ष), आरएच 1700-1, आरएच 1700(3 वर्ष), डीआरएमआर 2018-25, डीआरएमआरएम 18-35-11, डीआरएमआरएम 18-36-12, डीआरएमआरएम 18-37-13, आरएच 1700-3, आरएच 1700-4, डीआरएमआरसीआई 126, डीआरएमआरसीआई 131, डीआरएमआरसीआई 132 (2 वर्ष) लगातार सफेद रोग प्रतिरोधी पायी गयी।

तना गलन की राष्ट्रीय रोग नर्सरी

कृत्रिम परिस्थितियों में कोई भी जननद्रव्य पंतनगर, हिसार और भरतपुर स्थानों पर तना गलन रोग के प्रति सहनशील एवं प्रतिरोधी नहीं पाये गये है। हालांकि, डीआरएमआरडीआर 2151 और डीआरएमआरएसजे 25 जननद्रव्य सफेद रतुआ रोग प्रतिरोधी पायी गयी।

राई-सरसों का प्रारंभिक जननद्रव्य परीक्षण

सरसों के कुल 146 आईवीटी जननद्रव्य में से डीआरएमआरआईजे 16-9-7, डीआरएमआरसीआई 139, डीआरएमआरसीआई 143, डीआरएमआरसीआई(क्यू) 47, डीआरएमआरसीआई(क्यू) 57, पीडीजेड 16, पीडीजेड 17, जेसी 16, आईजे19आर 5004, पीएबी 2014-17, डीआरएमआरएचजे 1117, पीएचआर 4457, एनएमजेएच 21-01, डीआरएमआर 2018-25, डीआरएमआरआईजे 20-157, डीआरएमआरसीआई(डब्ल्यू) 125, डीआरएमआर 2018-37 (ब्रिसिका जुंसिया) पाँच स्थानों पर सफेद रतुआ रोग प्रतिरोधी पाये गये।

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

आठ विभिन्न उपचारों में से धान-पड़त-सरसों फसल चक्र में शिलोंगनि, जगदलपुर, बनारस और धोली केन्द्रों पर लगातार दूसरे वर्ष टेबुकोनाजोल 50 प्रतिशत + ट्राइफ्लोक्सिस्ट्रोबिन 25 प्रतिशत डब्ल्यूजी का 0.5 ग्रा. प्रति लीटर की दर से तथा आईप्रोडियोन 50 डब्ल्यूपी का 0.2 प्रतिशत की दर से पर्णिय छिड़काव काला धब्बा रोग को क्रमशः 77.8 और 71.4 प्रतिशत कम करके 41.8 और 35.8 प्रतिशत तक बढ़ी हुई उपज के साथ कारगर पाया गया।

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

सरसों के पर्ण रोगों की महामारी विज्ञान पर प्रयोग वरुणा और स्थानीय किस्म का उपयोग करके नौ केन्द्रों पर 1 अक्टूबर से 19 नवंबर तक साप्ताहिक अंतराल पर आठ अलग-अलग तिथियों पर बुवाई का प्रयोग किया गया। कीट और रोगों के प्रबंधन हेतु किसी भी सुरक्षा उपायों को नहीं अपनाया गया। बीमारी की शुरुआत और सप्ताह में दो बार के अंतराल पर प्रत्येक बुवाई में बीमारी की प्रगति को दर्ज किया गया।

पंतनगर में वरुणा और क्रांति किस्मों को आठ अलग-अलग तिथियों पर बोया गया। मृदुरोमिल आसिता रोग पहली बार 15 नवंबर को बोई गई दोनों किस्मों पर बुवाई के 8 दिनों के बाद दिखाई दिया। सफेद रोलि रोग पहली बार 12 और 19 नवंबर की बुवाई में 45 दिनों के बाद दिखाई दी। काला धब्बा रोग को पहली बार बुवाई के 41 दिनों के बाद 19 नवंबर को बोई गई फसल पर दोनों किस्मों पर देखा गया। जबकि काला धब्बा रोग पहली बार 01 अक्टूबर की बुवाई में 77 दिन के बाद दिखाई दिया। फली बीमारी की शुरुआत 87 दिन के बाद 12 और 19 नवंबर की बुवाई में हुयी। 01 अक्टूबर बोई गई फसल पर, 126 दिनों बाद तक फली पर रोग लक्षण पिछले वर्ष कि तुलना में चार दिन की देरी से दिखाई दिए।

शिलोंगनी में वरुणा और टीएम-2 फसल बोई गई। दोनों किस्मों को 01 अक्टूबर से 19 नवंबर तक साप्ताहिक अंतराल पर आठ अलग-अलग तिथियों पर प्रारंभिक फसल बोई गई। भारी वर्षा के कारण 08 अक्टूबर तथा 15 अक्टूबर की बुवाई नहीं हो पायी। काला धब्बा रोग पत्तियों पर पहली बार बुवाई के 34 दिनों के बाद 19 नवंबर को टीएम-2 पर देखा गया जो पिछले साल की तुलना में 1 दिन पहले है। काला धब्बा रोग फलियों पर बुवाई के 82 दिनों के बाद 19 नवंबर को टीएम-2 पर जबकि वरुणा बुवाई के 123 दिनों के बाद 01 अक्टूबर को बोई गई फसल पर रोग के लक्षण देखे गये। अधिकतम रोग की गंभीरता बुवाई के 110 दिनों के बाद (39.7 प्रतिशत) 12 नवंबर को टीएम-2 पर दिखाई दी। जो पिछले

साल की तुलना में 12.9 प्रतिशत अधिक है। सफेद रोली रोग पहली बार 19 नवम्बर की बुवाई में 42 दिनों के बाद दिखाई दिया। 05 नवम्बर को बोई गई वरुणा की फसल में 16.7 क्विंटल/हैक्टेयर और 29 अक्टूबर को बोई गई टीएम-2 फसल में 11.5 क्विंटल/हैक्टेयर अधिकतम बीज उपज हुई। पूर्वी क्षेत्रों में उपज के आंकणों के आधार पर अक्टूबर का अंतिम सप्ताह बुवाई का उचित समय है।

एस के नगर में वरुणा और जीएम-2 किस्मों पर चूर्णिल आसिता रोग 19 नवंबर को बोई गई फसल पर पहली बार बुवाई के 89 दिनों के बाद दिखाई दिया जो पिछले सालों 2020-21 में 89 दिनों के बाद, 2019-20 में बुवाई के 78 दिनों के बाद, 2018-19 में बुवाई के 83 दिनों के बाद और 2017-18 में बुवाई के 76 दिनों के बाद दिखाई दी। अधिकतम रोग की गंभीरता 19 नवम्बर की बुवाई पर वरुणा में 100.0 प्रतिशत और जीएम-2 में 95.5 प्रतिशत देखी गई। रोगों के कारण अधिकतम बीज उपज में कमी पछेती बुवाई में हुयी यद्यपि जीएम-2 की फसल में 19.3 क्विंटल/हैक्टेयर और वरुणा में 18.5 क्विंटल/हैक्टेयर अधिकतम बीज उपज प्राप्त हुई। सफेद रोली रोग की उग्रता अधिकतम 28.6 प्रतिशत तक 12 नवम्बर की बुवाई में देखी गयी जिसकी शुरुआत 19 नवम्बर की बुवाई वाली वरुणा किस्म पर 60 दिन बाद तथा जीएम-2 पर 61 दिनों बाद हुयी।

मुरैना में वरुणा और रोहिणी किस्मों को साप्ताहिक अंतराल पर आठ तिथियों पर बोया गया। काला धब्बा रोग पत्तियों पर पहली बार 70 दिनों के बाद 12 व 19 नवम्बर की बुवाई में दोनों किस्मों में यह रोग दिखाई दिया। तना गलन रोग की शुरुआत 19 नवम्बर वाली बुवाई में 80 दिन बाद हुयी। चूर्णित आसिता रोग पहली बार बुवाई के 90 दिनों के बाद दिखाई दिया जिसकी अधिकतम तीव्रता 78.7 प्रतिशत रोहिणी में बुवाई के 130 दिनों के बाद 19 नवम्बर की बुवाई में दिखाई दिया। सफेद रोली रोग पहली बार 12 व 19 नवम्बर की बुवाई में 48 दिनों के बाद रोहिणी, वरुणा दोनों में दिखाई दिया जो 5 नवम्बर और 12 नवम्बर की बुवाई में 320 दिनों तक यह रोग बढ़ता हुआ दिखाई दिया। सफेद रोली रोग की तीव्रता अधिकतम 36.4 प्रतिशत तक 19 नवम्बर को बोई गयी रोहिणी में पायी गयी। जबकि रोहिणी में 66.7 प्रतिशत अधिकतम स्टैग हेड का प्रकोप 12 नवम्बर की बुवाई में पायी गयी। अधिकतम बीज उपज 15 अक्टूबर की बुवाई में 34.7 क्विंटल/हैक्टेयर रोहिणी में पायी गयी।

जगदलपुर में वरुणा और सीजी सरसों दोनों किस्मों को साप्ताहिक अंतराल पर आठ अलग-अलग तिथियों पर फसल को अनुशंसित कृषि पद्धतियों का प्रयोग करते हुये बोयी गई। सफेद रोली रोग पहली बार बुवाई के 42 दिनों के बाद दोनों किस्मों पर 19 नवम्बर को बोई गई फसल पर दिखाई दिया। शुरुआत में काला धब्बा रोग बुवाई के 36 दिनों के बाद 12 नवम्बर की बुवाई में दोनों पाया गया है। चूर्णित आसिता रोग पहली बार बुवाई के 40 दिन बाद वरुणा में 19 नवम्बर की बुवाई में पाया गया है। अधिकतम बीज उपज 29 अक्टूबर की बुवाई में 18.2 क्विंटल/हैक्टेयर प्राप्त हुयी।

ढोली में वरुणा और राजेन्द्र सुपलाम दोनों किस्मों को साप्ताहिक अंतराल पर पाँच अलग-अलग तिथियों में 12 अक्टूबर से 19 नवम्बर में बुवाई की गयी। काला धब्बा रोग पत्तियों पर पहली बार बुवाई के 25 दिनों के बाद वरुणा में और बुवाई के 30 दिनों के बाद राजेन्द्र सुपलाम में पाया गया। यह रोग पत्तियों पर लगातार 140 दिनों तक दोनों किस्मों में पाया गया।

हिसार में वरुणा और आरएच 30 दोनों किस्मों को साप्ताहिक अंतराल पर सात अलग-अलग तिथियों में अनुशंसित कृषि पद्धतियों के प्रयोग करते हुये बोयी गई। सफेद रोली पहली बार बुवाई के 53 दिनों के बाद 19 नवम्बर में बुवाई की गई आरएच 30 में यह रोग पाया गया। जोकि 05 नवम्बर और 12 नवम्बर तक की बुवाई में फैल गया। पहली बार स्टैग हेड बनने की शुरुआत 19 नवम्बर की बुवाई में 81 दिनों बाद वरुणा और आरएच 30 में पाया गया। काला धब्बा रोग पहली बार पत्तियों पर बुवाई के 15 दिनों के बाद 19 नवम्बर की बुवाई में दोनों किस्मों में पाया गया। तना गलन रोग की शुरुआत पहली बार 12 नवम्बर और 19 नवम्बर की बुवाई के 70 दिनों बाद वरुणा और आरएच 30 दिनों किस्मों में पाया गया। तना गलन की अधिकतम तीव्रता 46.7 प्रतिशत आरएच 30 में और 44.8 प्रतिशत वरुणा में 05 नवम्बर की बुवाई में देखी गयी। अधिकतम उपज 01 अक्टूबर की बुवाई वाली वरुणा में 29.9 क्विंटल/हैक्टेयर और आरएच 30 में 29.0 क्विंटल/हैक्टेयर पायी गयी।

झांसी में गिरीराज और वरुणा दोनों किस्मों को साप्ताहिक अंतराल पर आठ अलग-अलग तिथियों में 01 अक्टूबर से 19 नवम्बर तक बुवाई की गई। काला धब्बा रोग पहली बार पत्तियों पर 19 नवम्बर की बुवाई के 42 दिनों के

बाद और फलियों पर 83 दिनों के बाद वरुणा में दिखाई दिया। सफेद रोली पहली बार बुवाई के 47 दिनों के बाद 19 नवम्बर की बुवाई वाली वरुणा किस्म में दिखाई दिया। चूर्णित आसिता रोग की शुरुआत बुवाई के 79 दिनों के बाद 19 नवम्बर की बुवाई वाली किस्म वरुणा में दिखाई दिया। बुन्देलखण्ड क्षेत्र में अधिकतम बीज उपज प्राप्त करने के लिए बुवाई की उपयुक्त समय अक्टूबर का पहला पखवाड़ा है, जोकि 29 अक्टूबर को बोई गयी वरुणा किस्म से 32.4 क्विंटल/हैक्टेयर तक प्राप्त हुयी।

राई-सरसों के प्रमुख रोगों के विरुद्ध कवकनाशियों का प्रभाव

नये कवकनाशियों की प्रभावकारिता का परीक्षण 9केन्द्रों पर किया गया। जाँच के दौरान टेबुकोनाजोल 50 प्रतिशत + ट्राइफ्लोक्सिस्ट्रोबिन 25 प्रतिशत डब्ल्यूजी 0.1 प्रतिशत की दर से कवकनाशी के प्रयोग करने से काला धब्बा रोग की व्यापकता न्यूनतम (14.0 प्रतिशत) पायी गई, जोकि बिना छिड़काव वाले परीक्षण में 31.5 प्रतिशत की तुलना में 44.0 प्रतिशत तक कम हैं। हालाँकि सभी कवकनाशी पत्तियों और फलियों दोनों पर काला धब्बा रोग की गंभीरता को कम करने के लिये प्रभावी पाये गये। मेटलेक्सल 4 प्रतिशत + मैनकोजेब 64 प्रतिशत का 0.25 प्रतिशत का घोल का प्रयोग करने से सफेद रोली को नियंत्रण (34.3 प्रतिशत) की तुलना में (13.5 प्रतिशत) कम करने में प्रभावी पाया गया। टेबुकोनाजोल 50 प्रतिशत + ट्राइफ्लोक्सिस्ट्रोबिन 25 प्रतिशत डब्ल्यूजी 0.1 प्रतिशत की दर से घोल का प्रयोग करने से चूर्णित आसिता रोग की गंभीरता में (7.8 प्रतिशत) कमी पाई गई, जबकि नियंत्रण में यह 40.7 प्रतिशत थी। प्रोपिकोनाजोल 25 ईसी 0.1 प्रतिशत की दर से कवकनाशी के प्रयोग करने से तना गलन रोग की तीव्रता को क्रमशः 10.3 प्रतिशत उग्रता तक कम करने में प्रभावी पाये गये, जो कि नियंत्रण में 28.3 प्रतिशत थी। टेबुकोनाजोल 50 प्रतिशत + ट्राइफ्लोक्सिस्ट्रोबिन 25 प्रतिशत डब्ल्यूजी 0.1 प्रतिशत के छिड़काव से अधिकतम उपज 20 क्विंटल/हैक्टेयर प्राप्त हुयी।

कीट विज्ञान

इस वर्ष 2020-21 में कीटों के विकास के लिए मध्यम से उच्चतम तक मौसम उपयुक्त रहा। औआरएम 18-29-5 एवं आरएच टीएम 1927 में चैपा का आक्रमण 1.5 से कम पाया गया।

राई-सरसों की उपज में कीटों के द्वारा अधिकतम हानि राधिका (45.3 प्रतिशत) मुरैना में, डीआरएमआरआईजे 31(33.5 प्रतिशत) एवं पीएम 31(30.9 प्रतिशत) ढोली में पायी गयी। जबकि लुधियाना में (30.3 प्रतिशत) राधिका में, पीबीआर 357(28.1 प्रतिशत) एवं डीआरएमआरआईजे 31 (27.9 प्रतिशत), एस.के नगर में जीडीएम 4 (27.11 प्रतिशत), हिसार में डीआरएमआरआईजे 31 (25.8 प्रतिशत), शिलोंगनी में पीएम 27 (25.7 प्रतिशत), पंतनगर में वरुणा (16.2 प्रतिशत), नई दिल्ली में राधिका (12.7 प्रतिशत) एवं कानपुर में राधिका (3.5 प्रतिशत) की उपज में कीटों द्वारा अधिकतम हानि पायी गयी।

ज्यादातर केन्द्रों पर मध्यम से अधिकतम 2वें से 13वें सप्ताह तक सार्थक संख्या में चैपा दिखाई दिया जो कि 7 से 11 वें सप्ताह में अधिकतम बिन्दु पर पाया गया। लुधियाना में दोनों बुवाई में समय से बुवाई और पछेती बुवाई के अन्तर्गत पत्ता गोभी की सूंडी बहुत कम संख्या में पायी गयी। यह दोनों बुवाई में 8-12वें सप्ताह में सक्रिय पाया गया। चितकबरा कीट हिसार कम से मध्यम संख्या में 44वें से 49वें सप्ताह में सक्रिय तक पाया गया। जबकि मुरैना में यह 47वें से 50वें सप्ताह में सक्रिय तक रहा। परभक्षी कॉक्सीनेला की सक्रियता कम से मध्यम 50वें से 8वें सप्ताह तक रही। शिलोंगनी में आरा मक्खी 50वें से 12वें सप्ताह, पलो बीटल 49वें से 12वें सप्ताह तक और परभक्षी कॉक्सीनेला 52वें से 14वें सप्ताह तक सक्रियता पायी गयी।

पंखदार चैपा की संख्या का अवलोकन सात केन्द्रों द्वारा किया गया। लुधियाना में पंखदार चैपा 43वें सप्ताह में दिखाई दिया। अधिकतर केन्द्रों पर 50वें -1वें सप्ताह से बढ़ना शुरू हुआ जबकि 5वें 11वें सप्ताह में बहुत अधिक संख्या में पंखदार चैपा दिखाई दिया। एस.के नगर में (3649.6 चैपा/ट्रेप) 8वें सप्ताह में बहुत अधिक संख्या में पंखदार चैपा दिखाई दिया। अधिकतर केन्द्रों पर 12वें सप्ताह से कमी शुरू हो गई तथा 16वें सप्ताह के बाद पंखदार चैपा विलुप्त हो गया।

सरसों के साथ दूसरी फसलो बुवाई का चैपा की संख्या के प्रभाव वाले यह परिक्षण में पाया गया कि अगर सरसों की चार कतारों के बाद धनिये की चार कतारों की बुवाई की जाए तो अकेली सरसों की बुवाई के मुकाबले सरसों के चैपा की संख्या में कमी दर्ज की जाती है। ढोली शिलोंगनी, लुधियाना और हिसार में सरसों + धनिये की बुवाई में चैपा की संख्या सिर्फ सरसों के मुकाबले कम रही जबकि पंतनगर में ऐसा सरसों + सौफ की बुवाई में पाया गया।

चेंपे द्वारा रस चूसने के बाद सरसों के पौधों की जैवरासायनिक संरचना में परिवर्तन पाया गया। हिसार में सरसों की किस्मों डीआरएमआरआईजे 31 और जीएससी 6 पर चेंपे द्वारा रस चूसने के बाद पर आकसीडेज की गतिविधि में 31.03 एवं 62.96 प्रतिशत क्रमानुसार वृद्धि दर्ज की गई थी। इस प्रकार ग्लूकोसिनोलेट्स, आर्थोडाईहाईड्राकसी फिनोलस और फ्लेवोनोलस की मात्रा में वृद्धि पाई गई। लगभग इसी प्रकार के नतीजे लुधियाना में प्राप्त किये गए। सामान्य तौर पर, राई सरसों और गोभी सरसों में चेंपे के रस चूसने के बाद पौधों में सभी रक्षा से संबंधित यौगिकों का प्रेरण पाया गया।

पादप कार्यिकी

विभिन्न कृषि-जलवायु क्षेत्रों से लेकर अजैविक तनावों तक सरसों के जीनोटाइप का मूल्यांकन करने के लिए पांच प्रयोग किए गए; एक प्रयोग तीन स्थानों पर पीजीआर की बाराणी परिस्थितियों में प्रभावकारिता का परीक्षण करने के लिए किया गया था जबकि दो प्रयोगों ने सूखे और तापमान के तनाव को कम करने के लिए रोगाणुओं की क्षमता का आकलन किया था। अंकुर मृत्यु दर 20% और DW/10 अंकुर ≥ 35 मिलीग्राम रेटेड जीनोटाइप नियंत्रित परिस्थितियों में सहनशील। भरतपुर, हिसार और लुधियाना केंद्रों में केवल एक जीनोटाइप आरएमएक्स 9310 चयन मानदंडों को पूरा करता है। भरतपुर और लुधियाना केंद्रों में JD6 में 30% और DW/10 अंकुर ≥ 40 mg की अंकुर मृत्यु दर्ज की गई। खेत में बोए गए परीक्षण में RH1999-14, क्रांति, ORM2019-25, PM25, RH1999-42, KMR (E) 21-1, PHR8081, RMX 9310, DRMRCI 128 और Pro5111 में अंकुर मृत्यु दर 20% और शुष्क पदार्थ 6.0g था। भरतपुर और लुधियाना केंद्रों में एसटीआई 62.1% के साथ JD6 में भरतपुर और लुधियाना केंद्रों में 30% की अंकुर मृत्यु दर थी और 7.8g के DW के साथ 79.1 के STI और SSTI 82.6% केवल लुधियाना केंद्र में थे। केवल एक जीनोटाइप RMX9310 प्रयोगशाला और खेत दोनों स्थितियों में अंकुर अवस्था में उच्च तापमान के प्रति सहिष्णु था। 30 दिनों के लिए छायांकन के कारण हल्का तनाव जीनोटाइप के भीतर और तीन स्थानों पर भी परिवर्तनशील सीमा तक शारीरिक और उपज लक्षणों को प्रभावित करता है। शारीरिक लक्षणों में न्यूनतम कमी, बीज/सिलिका, परीक्षण वजन, उच्च सीएसआई के साथ प्रति पौधा कुल सिलिका और बीज उपज ($\leq 30\%$) ने भरतपुर और लुधियाना में DRMTCI-96 को कम रोशनी वाले तनाव के तहत आशाजनक जीनोटाइप के रूप में पहचाना। 35 और 65 डीएस पर सिंचाई रोककर लगाए गए नमी के दबाव ने 3 स्थानों पर परीक्षण किए गए चौंतीस जीनोटाइप के प्रदर्शन को महत्वपूर्ण रूप से प्रभावित किया। कुल मिलाकर, CAU-RMM3, NPJ210, DRMRCI-128 और क्रांति बीज उपज में कमी के साथ भरतपुर, हिसार और लुधियाना केंद्रों में नमी के तनाव के प्रति सहिष्णु थे $\leq 20\%$ । इन जीनोटाइप ने उच्च एसपीएडी मूल्यों, क्लोरोफिल सामग्री, आरडब्ल्यूसी को सिलिका में अपेक्षाकृत कम कमी के साथ बनाए रखा। मुख्य अंकुर, बीज/सिलिका, बीज भार, डीएसआई 1.0 और वाईएसआई ≥ 0.83 पर। नमी के दबाव ने हिसार और लुधियाना केंद्रों में DRMR1188 और JC6 में बीज उपज में 20% की कमी की और 3 स्थानों पर एक जीनोटाइप DRMRSJ276 में 25% तक कम किया। इन तीन जीनोटाइप में शारीरिक लक्षणों में कम कमी के साथ YSI 0.58 था। RH0725 (चेक) में हिसार और लुधियाना केंद्रों में 20 प्रतिशत जबकि भरतपुरसेंटर में 30% बीज उपज में गिरावट आई। हालांकि, RGN229 (चेक) को भरतपुर, हिसार और लुधियाना केंद्रों में 20% उपज में गिरावट के साथ अत्यधिक सहनशील बताया गया। इकतीस सरसों के जीनोटाइप में से, HJUM 20-6 और JC1 ने सभी 4 स्थानों पर बीज उपज में कमी 30% और स्थिरता सूचकांकों (HSI ≥ 0.40 और YSI ≥ 0.53) के साथ टर्मिनल हीट स्ट्रेस के प्रति सहिष्णुता दिखाई। ढोली, हिसार और लुधियाना केंद्रों में क्रांति और RH2050 ने बीज उपज में 30%, HSI ≥ 0.50 और YSI ≥ 0.54 में गिरावट के साथ थर्मो टॉलरेंस दिखाया। JC32 में भरतपुर और लुधियाना केंद्रों में HSI ≥ 0.58 और YSI ≥ 0.62 था। इन जीनोटाइप को झिल्ली स्थिरता में कम अवसाद का सामना करना पड़ा, कूलर कैनोपियों के साथ प्रति सिलिका बीज। PM 26 (चेक) ने केवल भरतपुर केंद्र में 20% और ढोली, हिसार और लुधियाना केंद्रों में HSI-0.45 और YSI-0.53 के साथ उपज हानि की सूचना दी। क्रांति, CS2020-10 और CS54 केवल लुधियाना केंद्र में अंकुरण प्रतिशत, अंकुर लंबाई, शुष्क पदार्थ संचय और SVII में कम गिरावट ($\leq 30\%$) के साथ हिसार और लुधियाना में लवणता सहिष्णुता के लिए आशाजनक प्रतीत होता है। भरतपुरसेंटर में यूरिया @ 1 और 2% और KNO3 @ 2% बेहतर बीज उपज के पत्तेदार आवेदन, जबकि पर्ण स्प्रे हिसार और लुधियाना केंद्रों पर उपज में सुधार के लिए प्रभावी थे, मुख्य शूट पर बढ़ी हुई सिलिका, प्रति पौधे कुल सिलिका और क्लोरोफिल स्थिरता के साथ। अनुक्रमणिका। ढोली और लुधियाना केंद्रों में नमी की कमी के तहत

माइक्रोबियल उपचार के साथ शारीरिक लक्षण और ऑस्मोप्रोटेक्टेंट्स को बढ़ाया गया। आरडब्ल्यूसी में अधिकतम वृद्धि ढोली केंद्र में सीआरआईडीए एमआई II और लुधियाना केंद्र में एमआरडी 17 से पीछे बायोफॉस + बायोफोस के साथ थी; दोनों स्थानों पर क्रिडामी II के साथ स्पाड; ढोली केंद्र में दोनों सीआरआईडीए उपभेदों के साथ कुल क्लोरोफिल जबकि लुधियाना केंद्र में एमकेडी17 और बायोफॉस+बायोफोस; लुधियाना केंद्र में सीआरआईए एमआई I के साथ प्रोलाइन और टोटल शुगर। सामान्य और देर से बोई जाने वाली परिस्थितियों में माइक्रोबियल फॉर्मूलेशन और पूसा संजीवनी के साथ अध्ययन किए गए लक्षणों के लिए तीन किस्मों में भिन्नता मौजूद थी। सामान्य और देर से बोई जाने वाली किस्मों में माइक्रोबियल टीकाकरण के साथ आरडब्ल्यूसी, झिल्ली स्थिरता और क्लोरोफिल सामग्री में सुधार हुआ है। केवल लुधियाना केंद्र में देर से बोई गई टीका किस्मों में सीटी कम थी। माइक्रोबियल फॉर्मूलेशन के साथ प्रति संयंत्र और बायोमास में कुल सिलिका में वृद्धि हुई और पूसा संजीवनी ने ढोली, हिसार और लुधियाना केंद्रों में 3 किस्मों का टीकाकरण किया। भरतपुर केंद्र में देर से बुवाई की स्थिति के तहत माइक्रोबियल फॉर्मूलेशन के साथ आरएच 725 को छोड़कर 4 स्थानों पर सामान्य और देर से बोई जाने वाली किस्मों के तहत दोनों टीकों के साथ बीज उपज में सुधार हुआ, आरएच 725 और गिरिराज में पूसा संजीवनी के साथ क्रमशः सामान्य और देर से बोई जाने वाली स्थितियों के तहत हिसार केंद्र में गैर - टीका नियंत्रण।

जैव रसायन

सत्रह आईवीटी/एवीटी जननद्रव्यों की गुणवत्ता परीक्षणों का मूल्यांकन भरतपुर, लुधियाना, हिसार, और पंतनगर में किया गया था। तेल स्थिरता सूचकांक, जो कि मुफा:पुफा का अनुपात है, 0.86 (डीआरएमआर क्यू 143-9) से 1.70 (पीडीजेडएम -31) (सी.वी. ≤ 0.20) तक थी। सभी प्रविष्टियाँ का विभिन्न वसीय अम्लों के लिए परीक्षण किया गया। पाल्मेटिक एसिड: 2.86% (डीआरएमआर क्यू 143-9) से लेकर 5.13 % (पीडीजेड -16) (सी.वी. ≤ 0.17) तक पाया गया। स्टैरिक एसिड: 1.26 % (डीआरएमआर क्यू 143-9) से लेकर 2.73% (एल. इ.एस.-60). (सी.वी. ≤ 0.19). ओलेइक एसिड: 13.02 % (डीआरएमआर क्यू 143-9) से 50.66 % (पीडीजेडएम -31). (सी.वी. ≤ 0.21); लिनोलेइक एसिड: 15.13 % (डीआरएमआर क्यू 143-9) से 42.11 % (पीडीजेड-16)(सी. वी. ≤ 0.20); लिनोलेनिक एसिड: 10.36 % (एलइएस-65) से 21.16 % (डीआरएमआर क्यू 143-9) (सी.वी. ≤ 0.24); ईकोसोनोइक एसिड: 0.56 % (आरएच (ओई)-1807) से 1.31 % (डीआरएमआर क्यू 143-9) (सी.वी. ≤ 0.24); एरुसिक एसिड: 0.33 % (पीएम -32) से 46.18 % (डीआरएमआर क्यू 143-9) (सी.वी. ≤ 2.23). $\omega 6: \omega 3$ अनुपात 0.72 (डीआरएमआर क्यू 143-9) से 3.97 (पीडीजेड -16) (सी.वी. ≤ 0.37) तक पाया गया। एस एफ ए:मुफा:पुफा अनुपात 1:05:07 से 1:19:11 के बीच पाया गया। संतृप्त और असंतृप्त का अनुपात 1:12 से 1:30 पाया गया। आईवीटी/एवीटी प्रविष्टियों का पोषकीय परीक्षण किया गया जिसमें कुल प्रोटीन: 29.61% (पीएम-32) से 33.88% (पीएम-29) (सी.वी. ≤ 0.05); कुल एंटीऑक्सीडेंट क्षमता 14.54 (पीडीजेड -14) से लेकर 23.04 (एलइएस-64) मिलीग्राम प्रति ग्राम ए.ए.ई.(सी.वी. ≤ 0.15); β कैरोटीन की मात्रा 2.99% (एलइएस-65) से लेकर 5.01% (एलइएस-60) (सी.वी. ≤ 0.13) दर्ज की गई। कुल सिनैपिक एसिड की मात्रा 1.25% (एलइएस -60) से लेकर 2.23% (आरएच (ओई)-1807) के बीच थी। सत्रह आईवीटी/एवीटी प्रविष्टियों का एएस के माध्यम से खनिज संरचना के लिए भी विश्लेषण किया गया है। उच्च तांबा मात्रा वाले आशा जनक जीनोटाइप पीएम-30 (0.89 पीपीएम), डीआरएमआर क्यू 143-9 (0.86 पीपीएम), एलइएस-60 (0.82 पीपीएम) है। उच्च जस्ता की मात्रा वाली प्रविष्टियाँ जीनोटाइप पीडीजेड-15 (0.957 पीपीएम), आरएच (ओई)-1808 (0.854 पीपीएम), एलइएस-60 (0.845 पीपीएम), पीएम-30 (0.833 पीपीएम) थीं। उच्च लौह की मात्रा वाले जीनोटाइप पीएम-30 (16.58 पीपीएम), आरएच (ओई)-1808 (15.48 पीपीएम), पीडीजेड-15 (13.38 पीपीएम) थीं। उच्च मैगनीज की मात्रा वाले जीनोटाइप पीएम-30 (0.614 पीपीएम), आरएच (ओई)-1612 (0.518 पीपीएम) थीं। पीडीजेड-16, पीडीजेड-17, पीडीजेड-14, पीडीजेड-15 और पीडीजेडएम-31 की कुल ग्लूकोसिनोलेट मात्रा 30 माइक्रो मोल प्रति ग्राम से कम पायी गई। यह 15.93 माइक्रो मोल प्रति ग्राम (पीडीजेड-16) से 62.02 माइक्रो मोल प्रति ग्राम (एलइएस-60) (सी.वी. ≤ 0.34) पाया गया। 2.25% से कम फाइटिक एसिड केवल एलइएस-64, एलइएस-65, डीआरएमआर क्यू 143-9, पीएम-30, पीएम-32, पीएम-29, पीडीजेड-15 और पीडीजेडएम-31 में पायी गई।

यूपीएलसी का उपयोग करके एलीफैटिक ग्लूकोसाइनोलेट्स की पहचान सिनिग्रीन, ट्रोपोलिन, ग्लूकोनापिन के और कुछ अज्ञात चोटियों के रूप में की गई। एसपीएसएस संस्करण 22 सॉफ्टवेयर का उपयोग करके डेटा का सांख्यिकीय विश्लेषण किया गया है।

अग्रिम पंक्ति प्रदर्शन 2021-22

वर्ष 2021-22 में तिलहनों के अग्रिम पंक्ति प्रदर्शन और अन्य संबंधित गतिविधियों की योजना के तहत 36 अखिल भारतीय राई-सरसों समन्वित अनुसंधान परियोजना के केन्द्रों/भारतीय कृषि अनुसंधान परिषद और कृषि विश्वविद्यालय/गैर सरकारी संस्थाओं/एफ.पी.ओ द्वारा 16 राज्यों के 85 जिलों में सिंचित एवं बारानी अवस्था में राई सरसों के 2534, जिसमें राजस्थान में सर्वाधिक 835 एवं उत्तरप्रदेश, आसाम, मणीपुर, तथा मध्य प्रदेश में क्रमशः 398, 359, 150, एवं 122 अग्रिम पंक्ति प्रदर्शनो का आयोजन किया गया। इसमें 1905 राई समूह के फसलों पर तथा 629 सरसों समूह की फसलों पर थे, जिन्हें सिंचित (1785) एवं बारानी (604) अवस्था में लगाया गया था।

सिंचित अवस्था में राई-सरसों की अधिकतम औसत पैदावार 2,462 किलोग्राम प्रति हैक्टेयर हरियाणा में प्राप्त हुई। इसके बाद गुजरात, उत्तरप्रदेश, मध्य प्रदेश, राजस्थान, पंजाब, उत्तराखण्ड, हिमाचल प्रदेश, पश्चिम बंगाल, आसाम, तेलंगाना जम्मू एवं कश्मीर, झारखण्ड, महाराष्ट्र, उड़ीसा में क्रमशः 2,325; 2,228; 2,102; 2,001; 1,882; 1,456; 1,349; 1,331; 1,289; 1,244; 1,203; 1,111; 991 एवं 982 किलोग्राम प्रति हैक्टेयर औसत पैदावार दर्ज की गई। सम्पूर्ण तकनीकी प्रदर्शनों से उपज में अधिकतम बढ़ोत्तरी 73.0, 66.7, 56.6, 39.5, 35.0, 32.5, 25.9, 22.1, 20.0, 17.1, 16.8, 14.7, 14.6, 12.7 एवं 8.2 प्रतिशत क्रमशः जम्मू एवं कश्मीर, आसाम, उड़ीसा, तेलंगाना, हिमाचल प्रदेश, झारखण्ड, उत्तरप्रदेश, पश्चिम बंगाल, महाराष्ट्र, उत्तराखण्ड, राजस्थान, हरियाणा, मध्य प्रदेश, गुजरात तथा पंजाब में प्राप्त हुई।

अधिकतम अतिरिक्त शुद्ध लाभ 30,019, 28,065, 26,461, 20,350, 18,186, 17,686, 16,410, 14,979, 14,611, 14,407, 13,645, 13,420, 9,465, 8,909, एवं 8,456 रुपये प्रति हैक्टेयर क्रमशः आसाम, जम्मू एवं कश्मीर, उत्तरप्रदेश, तेलंगाना, राजस्थान, हरियाणा, हिमाचल प्रदेश, मध्य प्रदेश, गुजरात, उड़ीसा, झारखण्ड, पश्चिम बंगाल, उत्तराखण्ड, पंजाब, एवं महाराष्ट्र, में प्राप्त हुआ। सिंचित अवस्था में राई-सरसों की उत्पादन लागत सबसे कम 19,250 रुपये प्रति हैक्टेयर जम्मू एवं कश्मीर, में तथा अधिकतम 39,697 रुपये प्रति हैक्टेयर हरियाणा में आई।

बारानी अवस्था में राई-सरसों की अधिकतम औसत पैदावार 1495 किलोग्राम प्रति हैक्टेयर राजस्थान में प्राप्त हुई। इसके बाद, जम्मू एवं कश्मीर, आसाम, मणीपुर एवं हिमाचल प्रदेश में क्रमशः 1,166; 1,075; 861 एवं 668 किलोग्राम प्रति हैक्टेयर औसत पैदावार दर्ज की गई। अधिकतम 35.9 प्रतिशत तक उपज में बढ़ोत्तरी आसाम में प्राप्त हुई। हिमाचल प्रदेश, मणीपुर, जम्मू एवं कश्मीर तथा राजस्थान में क्रमशः 27.2, 16.3, 15.0 तथा 14.7 प्रतिशत तक उपज में बढ़ोत्तरी दर्ज की गई। अधिकतम अतिरिक्त औसत शुद्ध लाभ 15,712, 11,830, 7,553, 7,085 एवं 5,994 रुपये प्रति हैक्टेयर, आसाम, राजस्थान, जम्मू एवं कश्मीर, हिमाचल प्रदेश एवं मणीपुर में प्राप्त हुई। असिंचित अवस्था में राई-सरसों की उत्पादन लागत सबसे कम 12,690 रुपये प्रति हैक्टेयर हिमाचल प्रदेश में तथा अधिकतम 39,155 रुपये प्रति हैक्टेयर जम्मू एवं कश्मीर में आई।

सम्पूर्ण तकनीकी प्रदर्शनों में भारतीय राई की 12, पीली सरसों एवं तोरिया प्रत्येक की 3 तथा गोभी सरसों की 4 उन्नत प्रजातियों को 15 राज्यों में सिंचित अवस्था में प्रयोग किया गया। भारतीय राई के प्रदर्शनों में उत्तरप्रदेश में सिंचित अवस्था में 96 प्रथम पंक्ति प्रदर्शनों में आर. एच.-725 प्रजाति का प्रयोग था जिससे 26.4 प्रतिशत उपज बढ़ोत्तरी के साथ अधिकतम उपज 2,648 किलोग्राम प्रति हैक्टेयर प्राप्त हुई। इसके बाद उत्तरप्रदेश, में ही 131 प्रदर्शनों में प्रदर्शित गिरिराज प्रजाति की औसत पैदावार 2,530 किलो प्रति हैक्टेयर तथा 23.1 प्रतिशत उपज में बढ़ोत्तरी दर्ज की गई। पंजाब में 23 प्रदर्शनों में प्रदर्शित आरसीएच-01 प्रजाति से न्यूनतम 7 प्रतिशत उपज बढ़ोत्तरी दर्ज की गई जबकि न्यूनतम औसत पैदावार 982 किलोग्राम प्रति हैक्टेयर उड़ीसा में 20 प्रदर्शनों में प्रदर्शित एन. आर. सी. एच. बी.-101 प्रजाति में दर्ज की गई। हालांकि जम्मू एवं कश्मीर में आर.एच.-725 किस्म से सिंचित अवस्था में किसान की स्थानीय प्रजाति की तुलना में सर्वाधिक 74 प्रतिशत तक उपज बढ़ोत्तरी के साथ औसत पैदावार 1,203 किलोग्राम प्रति हैक्टेयर दर्ज की गई।

सिंचित अवस्था में उत्तरप्रदेश, में पीली सरसों की पीताम्बरी प्रजाति, हिमाचल प्रदेश में गोभी सरसों की ए.के.एम.एस.-8141 प्रजाति एवं आसाम में तोरिया की टी. एस.-38 प्रजाति से उपज में अधिकतम बढ़ोत्तरी क्रमशः 20.4, 37.0 एवं 66.6 प्रतिशत तक प्राप्त हुई।

भारतीय राई के असिंचित अवस्था में राजस्थान में प्रदर्शित आर. जी. एन.-298 प्रजाति से अधिकतम औसत पैदावार 1,892 किलोग्राम प्रति हैक्टेयर के साथ 9.4 प्रतिशत तक उपज में बढ़ोत्तरी दर्ज की गई। हिमाचल प्रदेश में 33 प्रदर्शनों में प्रदर्शित आरसीसी-4 प्रजाति से न्यूनतम औसत पैदावार 695 किलोग्राम प्रति हैक्टेयर के साथ 32.4 प्रतिशत तक उपज में बढ़ोत्तरी प्राप्त हुई। असिंचित अवस्था में आसाम में तोरिया की टी. एस.-36 प्रजाति एवं राजस्थान में तारामीरा की आर. टी. एम. 1624 प्रजाति से उपज में अधिकतम बढ़ोत्तरी क्रमशः 32.4 एवं 22.5 प्रतिशत तक प्राप्त हुई।

असिंचित अवस्था में हिमाचल प्रदेश में गोभी सरसों की जी. एस. सी.-7 प्रजाति एवं जम्मू एवं कश्मीर में भूरी सरसों की शालीमार सरसों-2 प्रजाति से उपज में बढ़ोत्तरी क्रमशः 23.8 एवं 15 प्रतिशत तक प्राप्त हुई।

विभिन्न केन्द्रों ने भारतीय राई के 5 तकनीकी अवयवों पर कुल 145 तकनीकी अग्रिम पंक्ति प्रदर्शनों का आयोजन किया। सभी अवयवों में से, भरतपुर केन्द्र द्वारा प्रदर्शित सभी घटकों में सल्फर एवं बोरॉनउर्वरकों की बुआई से अधिकतम औसत उपज 2,052 किलोग्राम प्रति हैक्टेयर प्राप्त हुई। हालांकि भूवनेश्वर केन्द्र द्वारा प्रदर्शित बीज और पौधों की सुरक्षा के साथ 58 प्रतिशत की अधिकतम उपज वृद्धि दर्ज की गई। इसके बाद बानसूर द्वारा प्रदर्शित स्क्लेरोटिनिया रोट प्रबंधन द्वारा 29.9 प्रतिशत उपज में वृद्धि दर्ज की गई और अधिकतम अतिरिक्त शुद्ध लाभ 23,040 प्रति हैक्टेयर अर्जित की गई। बावल केन्द्र द्वारा प्रदर्शित निराई और थिनिंग अवयवों ने बिना निराई और थिनिंग से क्रमशः 19 और 15 प्रतिशत उपज वृद्धि दर्ज की।

Summary

Seasonal Conditions

Weather was favorable for the mustard crop during the crop season 2021-22. Good rains were received during monsoon in the month of September at all the centres. The extremely low temperature, 2.0°C was reported at Kangra centre in the month of January, 2022. Incidence of diseases and pest was very low resulting high production of the crop.

Genetics and Plant Breeding

Varietal Improvement

Sixteen centres, spread over 14 states, carried out the varietal development activities as per the approved technical programme. The salient achievements during the year 2021-22 in Yellow sarson (*B. rapa* var yellow sarson), gobhi sarson (*B. napus*), Indian mustard (*B. juncea*), are discussed below:

Genetic Resource Management

A total of 6966 accessions comprising toria (600), Indian mustard (4937), yellow sarson (305), gobhi sarson (323), brown sarson (17), karan rai (239), taramira (43), *B. caudatus* (04), *B. tournifortii* (07), *B. rugosa* (71), *B. nigra* (09) *S. Alba* (07), *Crambe* sp (02), *B. chinensis* (01), *B. fruticulosa* (07), *Camelina sativa* (02), *Capsella bursapastoris* (02), *Diplotaxis assurgens* (02) and *Lapidium* sp (02) were maintained through appropriate mating system at Bhubneshwar, Dholi, Hisar, Pantnagar, Ludhiana, Kanpur, Hisar, IARI, New Delhi, Jobner, Morena, Pantnagar, Chatha-Jammu, Jagdalpur and SK Nagar. In addition, 559 new accessions comprising toria (21), Indian mustard (435), yellow Sarson (06), gobhi sarson (28) and karan rai (05) were collected. Further, 1244 accessions consisting of 747 Indian mustard, 61 toria, 250 yellow sarson, 14 gobhi sarson, 14 brown sarson, 110 taramira and 48 *B. rugosa* accessions were evaluated. On the basis of germplasm evaluation, promising accessions were identified for seed yield, earliness, yield components, thermo-tolerant (early and terminal stages), resistance/tolerance to diseases/pests and quality traits in toria at Dholi, Chatha-Jammu and Jagdalpur.

Creation of genetic variability through hybridization/ mutagenesis and selection

Creation of variability is the essence and backbone of the breeding programme. To cater the need of diverse agro-climatic conditions of the country, 79 crosses were attempted in toria, 66 in yellow sarson at Pantnagar, Bhubneshwar, Chatha-Jammu, Jagdalpur and Morena 105 in gobhi sarson at Chatha- Jammu and Ludhiana and 905 in Indian mustard at Bhubneshwar, Chatha-Jammu, Sriganaganagar, Hisar, IARI New Delhi, Ludhiana, Kanpur, Pantnagar, SK Nagar, Morena, Sriganaganagar, Jhansi, Kota and Varanasi to improve seed yield, earliness, seed size, component traits, disease/pest resistance, heat tolerance suitable for late sown condition, drought tolerance, “0” and “00” quality characters and high oil content. Selection of superior plants/bulks at different centres was practised in toria, yellow sarson and Indian mustard. In toria, development of composites population after the selection was the main objective. In yellow sarson, hybridization and 216 single plants selection from segregating generations were attempted at Kanpur and Pantnagar. In Indian mustard, 9632 single plants were selected at New Delhi, Jhansi, Kanpur, Bhubneshwar, Chatha-Jammu, Pantnagar, Ludhiana, SK Nagar, Jagdalpur, Kota, Varanasi and Morena. In Indian mustard, about 979 bulks were selected from segregating and advanced generations.

Evaluation of advanced breeding lines

The advanced breeding lines were evaluated under different station/state /preliminary yield trials at various centres. 67 strains of toria were tested at Kanpur, Chatha-Jammu, and Pantnagar. The yield superiority in toria station trial was up to 24.3 % over the check (PT-303) at Pantnagar. In

yellow sarson, 67 strains were tested at Kanpur and Pantnagar. The yield superiority in station trial II up to 25.8 % over the check Pitambari was recorded at Pantnagar. In Indian mustard, 263 strains were evaluated at 09 centres; Chatha, Imphal, Hisar, Kannpur, Ludhiana, Pantnagar, Dholi, SK Nagar and Varanasi in 37 trials. Seed yield superiority up to 27.2 % over the check NRCHB101 was recorded at Pantnagar. Ten strains at Hisar, 177 strains at Ludhiana and 09 strains at Chatha of gobhi sarson were evaluated for seed yield and its component characters.

Hybrid development

Efforts for hybrid development continued under “Consortia Research Platform on Hybrids”, at four centres including ICAR-DRMR Bharatpur, ICAR-IARI New Delhi, PAU Ludhiana and CCS HAU Hisar Seventeen experimental hybrids (including 7 from ICAR-DRMR, 05 from PAU, 03 from CCSHAU and 02 from ICAR-IARI) were inducted into different trials of AICRPRM for multilocation evaluation during 2021-22. Twenty experimental hybrids of Indian mustard, comprising five from each of four centres were evaluated in replicated block design at all four centres. On the basis of mean seed yield over four locations (Bharatpur, New Delhi, Ludhiana and Hisar), four hybrids; RHH 2104 (2665 kg/ha), RHH 2108 (2592), RHH 2107 (2515 kg/ha) and DRMRHJ 1517 (2449 kg/ha) out yielded the best check DMH-1 (2373 kg/ha) by a margin of 12, 9, 6, and 3 % respectively. Forty five experimental hybrids were evaluated in augmented block design, keeping plot size of 3m long paired row (CRPMLT 2). Four experimental hybrids; RHH 2114 (3232 kg/ha), MJA 11/RP13-2—2-3 (2940 kg/ha), PHR 3328B (2888 kg/ha) and PHR 1293 (2885 kg/ha) outyielded the best check DMH 1 (2789 kg/ha) by a margin of 15.9, 5.4, 3.5 and 3.4 %, respectively on the basis of average seed yield over three locations. 51 F₁ crosses were evaluated in augmented block design at all four centres. Six crosses exhibited > 10% seed yield heterosis over the best check DMH 1 (2568 kg/ha) on the basis of average seed yield over three locations. Four hundred sixty two experimental hybrids including 44, 332, 69 and 17 at DRMR, CCSHAU, IARI, and PAU, respectively were evaluated at respective centre. Each centre identified promising hybrids at their location. Five hundred fifty seven F₁ crosses including 130 at ICAR-DRMR, 287 at ICAR-IARI and 70 each at PAU and HAU were evaluated. Superior crosses were identified at each centre. In total CMS and restorer are being converted to 173 and 111 nuclear backgrounds, respectively, through backcrossing. In addition 73 CMS and 211 restorer lines were maintained. Seed of 199 experimental hybrids and 781 F₁ crosses was produced for evaluation during next year. Efforts are underway to improve parental lines for white rust resistance, quality traits and for agronomic traits. A set of 70 inbred lines comprising 20, 15, 15 and 20 inbred/germplasm lines from DRMR, IARI, CCS HAU and PAU, respectively, were evaluated against two checks viz., Giriraj and Pusa Mustard 25, in augmented block design for second year. A set of eighty eight inbred lines was grouped into two diverse subpopulations on the basis of genetic diversity assessed through SSR markers.

Breeder seed production

Indents of 84.38q breeder seed of 70 Rapeseed-Mustard varieties were received from Department of Agriculture and Cooperation (DAC), Ministry of Agriculture and Farmer Welfare, Govt. of India for production during 2021-22. The allocation was made to 20 centres for the production of 84.13q breeder seed of 69 varieties during the 28th annual group meeting held through virtual-video conferencing. Against the indent of 84.13q, 233.16q breeder seed was produced, indicating a surplus availability of 160.16 q. Breeder seed of 03 varieties RH-819, RVM-3 and Pusa Kalyani of Indian mustard and one variety Pant Giriya of yellow sarson could not be produced. Further, less quantity of RVM-1 of Indian mustard; Pusa Mustard-26 of Indian mustard; RTM-1355 of Taramira was produced. In addition, 35.67 q breeder seed of 17 varieties was also produced by different centres. The centre and variety-wise details of breeder seed production are reported in Table 2.2.

Coordinated Trials

Performance of 178 strains including 02 of yellow sarson, 166 of Indian mustard and 10 of gobhi sarson was tested in nineteen performance evaluation trials consisting of yellow sarson (1), gobhi sarson (1) and Indian mustard (17) at 46 locations across the 6 agro-climatic zones of the country. On the basis of superiority for seed/oil yield/ earliness/quality/ resistance over the best check 42 strains including gobhi sarson (01) and Indian mustard (41) were promoted for advanced stage evaluation.

Rapeseed-Mustard strains promoted for advance stage testing on the basis of higher seed/oil yield/quality/ disease resistance (2021-22)

Zone I	Zone II	Zone III	Zone IV	Zone V
Early Mustard, IVT, Irrigated				
	DRMRHT 13-13-5-4 (2304, 9.6) DRMRHT 13-13-5-5 (2345, 11.5) KMR(E) 21-1 (2428, 15.5) ORM 2019-25 (2361, 12.3)			
Mustard, Timely Sown, Irrigated, IVT				
	RH 1934 (2755,14.3) SKM- 1801 (2647, 9.8) NPJ 253 (2743, 13.8)	NPJ 253 (1192,1 9.0)**	PBR 939 (2523, 9.2) NPJ 252 (933,12.5)** ACN 237 (2568, 11.2) KMR 21-3 (2726, 18.0) RGN- 524 (2631, 13.9) SKM- 1801 (945,14.0)** NPJ 253 (2737, 18.5)	
Mustard, AVT- I+II Timely Sown (Irrigated/ Quality/ Salinity)				
	RH 1975 (1042,12.9)** RH 1974 (1035,12.1)**	PDZ- 14 (dl) (1877, 12.7) # PDZ- 15(dl) (1853, 11.3) #		
Mustard, Timely Sown, Rainfed, IVT				
	DRMRHJ 1117 (2339, 3.8)*			
Mustard, Late Sown, IVT				
	NPJ 250 (2333,4.1)*	NPJ 251 (1914, 10.2) DRMRHJ 430 (700,10.1)**		
Mustard, Late Sown, AVT-I				
		DRMR 2018-19 (605,6.0)***		
Mustard, Initial Hybrid Trial (IHT)				
	18J408C (1225,14.2)** SVJH- 70 (3006, 10.3) NAMJH 21-01 (2902,6.5)*	KMH 8765 (1098,10.2)** 18J408C (2909, 13.0) NAMJH 21-01 (2776, 7.9)*	NAMJH 21-01 (2473,4.9)* IJ16R1168 (965, 11.4)**	
Mustard, White Rust Resistance IVT				
	DRMR 2018-25 (2680, 8.6)*	DRMR 2018-25 (2627,14.5)* DRMRIJ 20-157 (847,1.3)*** DRMR 2018-37 (2350, 2.4)*		
Mustard, Quality IVT				
	DRMRCI(Q) 47(2486, 4.9)* IJ19R5004 (2526, 6.6)*	PDZ- 16# (2438, 23.6)* IJ19R5004 (2508, 5.7)*		
Saline/ Alkaline IVT				
		CS 2020-10 (2237, 12.4)		
Gobhi Sarson IVT				
		GSH- 2155 (2056, 10.8)		

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

Crop Production

Experiments on six major areas of agronomic practices were conducted during 2021-22 at 25 centres across the five zones. The results are summarised as;

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

The experiment was initiated in 2011-12 and conducted at 10 centres in 5 Zones during 2021-22. At Kangra, the application of 100% NPK + 2.5 t FYM/ha markedly increased the mustard seed yield by 448 and 16% over the control and 100% NPK, respectively. Application of 100% NPK + FYM @ 2.5 t/ha also recorded significantly highest mustard seed yield at Pantnagar which was higher by 213 and 13% over the control and 150% NPK, respectively. Application of 150% NPK recorded highest mustard seed yield at Ludhiana, Hisar, Sriganaganagar, Kota, Morena, SK Nagar, Bhubneswar and Shillongani which was 211, 208, 54, 65, 324, 101, 175 and 241% higher over the control, respectively. The higher NPK rates (150%) increased seed yield of mustard by 6.2, 24.2, 13.0, 18.1, 21.8, 19.4, 15.9 and 53.5% over the respective recommended rates (100% NPK) at Ludhiana, Hisar, Sriganaganagar, Kota, Morena, SK Nagar, Bhubneswar and Shillongani, respectively. The 10-year mean seed yield of mustard also indicated that application of 150% NPK resulted into maximum yield at Dholi, Morena, Hisar, Khudwani and SK Nagar. Whereas, at Ludhiana and Pantnagar, the application of 150% NPK and 100% NPK+2.5 t FYM/ha produced maximum mustard seed yield.

3.2 Evaluation of herbicides for weed management in rapeseed – mustard

The experiment was conducted at six centres during 2021-22. Pre-emergence application of oxadiargyl 0.09 kg a.i./ha at Ludhiana, fluazifop-p-butyl 0.125 kg a.i./ha at 25-30 DAS at Hisar, quizalofop 0.05 kg a.i./ha at 15-20 DAS at Pantanagar, pendimethalin 1.0 kg a.i./ha at SK Nagar, Bhubneswar and Imphal increased mustard seed yield over the weedy check. Whereas, the highest weed control efficiency was recorded with the pre-emergence application of pendimethalin at Ludhiana (61.4%), SK Nagar (74.4%), Bhubneswar (83.2%) and Imphal (71.7%), with quizalofop 0.05 kg a.i./ha at Pantanagar (61.4%) and with fluazifop-p-butyl 0.125 kg a.i./ha at Hisar (75%).

3.3 Agronomic evaluation of promising rapeseed-mustard entries

Mustard timely sown (Rainfed): RH 1425 recorded the maximum seed yield at all the centres, except at Sriganaganagar. At Hisar and Bawal, seed yield of RH 1425 increased significantly by 9.6-46.3 and 13.0-31.1%, respectively over the checks (RH 725, RGN 229 and Kranti). At Abohar and Ludhiana, seed yield of entry RH 1425 non-significantly increased by 6.3-39.4 and 3.0-28.1%, respectively over the checks.

Quality mustard: At Hisar and Bawal, seed yield of RH (OE) 1706 was significantly increased by 23.6-29.7 and 9.2-27.2%, respectively over the checks (PM 29, RH 749 and Kranti). At Sriganaganagar, RH (OE) 1706 performed poorly and recorded lower seed yield than checks, except 7% higher over the RH 749. The LES 60 recorded 17-25% higher seed yield at Hisar and 4% higher over the check RH 749 at Bawal. At Sriganaganagar, LES 60 performed poorly and recorded lower seed yield than checks. At Delhi and Ludhiana, both RH (OE) 1706 and LES 60 performed poorly and recorded lower seed yield compared to the checks.

Mustard: White Rust Resistance: AVT II-NIL (Zone-II): At Ludhiana, Varuna (A4A5)-936-279 significantly increased the seed yield by 12.6-15.4% over the checks (RH 749 and Giriraj). At Ludhiana, Rohini (A4A5)-491 and PB (A4A5)-842 recorded 6.3-8.9 and 7.6-10.3% non-significantly higher seed yield over the checks, respectively. PJK (A4A5)-21 performed poorly than the checks at Ludhiana. At Hisar, Varuna (A4A5)-936-279 and PB (A4A5)-842 yielded non-significantly higher seed yield over the checks. Rohini (A4A5)-491 and PJK (A4A5)-21 performed poorly than the checks at Hisar. At Sriganaganagar, all the entries [Rohini (A4A5)-491, PB (A4A5)-842, PJK (A4A5)-21 and Varuna (A4A5)-936-279] performed poorly than the checks. At Delhi, entry Varuna (A4A5)-936-279 and PJK (A4A5)-21 significantly increased the seed yield by 75.0-105.4% and 2.9-17.7% over the checks. Seed yield of PB (A4A5)-842 was recorded 10.6% higher over the check Giriraj, but 5.8% lower than the check RH 749 at Delhi. At Delhi, Rohini (A4A5)-491 performed poorly than the check RH 749. At Chatha, the seed yield of PB (A4A5)-842 and PJK (A4A5)-21 was recorded 6.2-7.5

and 2.3-3.5% higher over the check Giriraj and RH 749, respectively. At Chatha, Rohini (A4A5)-491 performed poorly than the checks.

Mustard: White Rust Resistance: AVT II-NIL (Zone-III): At Kanpur, the seed yield of Varuna (A4A5)-936-279 and PB (A4A5)-842 was recorded 4.5-25.1 and 0.3-20.1% higher over the checks RGN 73 and Maya, respectively. At Kanpur, Rohini (A4A5)-491 and PJK (A4A5)-21 performed poorly than the check RGN 73. However, seed yield of PJK (A4A5)-21 and Rohini (A4A5)-491 was recorded 17.1 and 10.6% higher over the check Maya at Kanpur. At Pantnagar, all the entries performed poorly than the checks. At Morena, the seed yield of Varuna (A4A5)-936-279 was recorded 15.0% higher over the check RGN 73, but 3.6% lower over the check Maya. Remaining all three entries [Rohini (A4A5)-491, PB (A4A5)-842 and PJK (A4A5)-21] performed poorly than the checks. At Bharatpur, the seed yield of Varuna (A4A5)-936-279 was recorded 3.7-12.9% higher over the checks. Remaining all three entries performed poorly than the checks at Bharatpur.

Saline/alkaline conditions: At Agra, Karnal and Lucknow, seed yield of entry CS 2005-143 increased significantly by 19.5-22.4, 12.6-49.9 and 13.9-42.0% over the checks CS 54 and Kranti at Agra, and all checks (CS 54, CS 60 and Kranti) at Karnal and Lucknow, respectively.

Gobhi sarson: At Kangra, seed yield of entry AKGS 19-8 increased significantly by 9.8-74.1% over the checks (GSC 6 and Kranti), and non-significantly over the check GSL 1 (2.1%). At Chatha, seed yield of AKGS 19-8 was increased by 7.9-54.9% over the checks. At Ludhiana, seed yield of AKGS 19-8 increased significantly by 9.8-21.3 over the checks (GSC 6 and Kranti), but seed yield decreased by 0.9% than check GSL 1.

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

The experiment was conducted at 13 locations during 2021-22. Seed inoculation markedly increased seed yield with MRD 17 at Ludhiana (19.3%), Morena (6.8%) and Nagpur (17.8%), with Biophos and Biophos⁺ at Bawal (12.4%) and Banda (9.4%), with CRIDA MI-I at Sriganganagar (12.9%) and Jhansi (18.0%), and with CRIDA MI-II at Chatha (43.6%), Dholi (31.4%), Varanasi (41.2%), Jobner (19.5%) and Imphal (32.8%) over the control. At SK Nagar, CRIDA MI-I recorded non-significantly higher seed yield over the control. Application of recommended irrigations recorded highest seed yield as compared to no irrigation and one irrigation at all the locations. Seed inoculation increased net returns with CRIDA MI-II at Jobner (33.0%), Imphal (78.7%), Dholi (59.5%), Chatha (68.7%) and Varanasi (72.5%), with CRIDA MI-I at Jhansi (34.5%), with MRD 17 at Nagpur (146.2%), and with Biophos and Biophos⁺ at Bawal (18.6%) and Banda (11.7%) as compared to control. At SK Nagar, CRIDA MI-I recorded non-significantly higher (7.6%) net returns over the control. Soil organic carbon and nutrient content also influenced markedly with the seed inoculation of inoculants at SK Nagar and Imphal.

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

The experiment was conducted at 15 locations during 2021-22. Seed treatment markedly increased seed yield with *Azotobacter* at Kangra (35.3%), Morena (67.4%), Kanke (126.4%), Bhubhaneshwar (22.8%), with PSMO at Imphal (54.7%), with **NPK consortia + ZSB** at Chatha (25.4%), Dholi (21.4%), Kota (23.4%), Varanasi (27.8%), Bawal (14.3%) and Bharatpur (23.2%) over the control. At Pantnagar, SK Nagar and Shillongani, **NPK consortia+ZSB**, *Azotobacter* and PSMO, respectively recorded non-significantly higher seed yield over the control. Seed treatment increased net returns significantly with **NPK consortia+ZSB** at Chatha (36.7%), Kota (29.2%), Varanasi (41.2%), Bawal (21.3%), Bharatpur (36.5%) and Dholi (32.4%), with *Azotobacter* at Kanke, Kangra (58.8%), Bhubhaneshwar, and with PSMO at Imphal (101.5%) as compared to control. Whereas, seed treatment increased the net returns non-significantly with PSMO at Shillongani (9.7%), with **NPK consortia+ZSB at Pantnagar (45.3%), and with *Azotobacter* at SK Nagar (18.5%) over the control. Seed inoculation with **NPK consortia+ZSB** recorded higher soil organic carbon, available N, P and K content at most of the locations compared to no inoculation.**

3.6 Optimization of mineral nutrient management for higher productivity

The experiment was initiated during 2021-22 at 18 locations. Application of 40 kg S+5 kg Zn+1 kg B/ha enriched with 500 kg FYM/ha markedly increased seed yield at Chatha, Bhubhaneshwar,

Jhansi, Jobner, Kangra, Kanpur, Kota, Ludhiana, Nagpur, SK Nagar and Sriganganagar. The higher seed yield was recorded with 20 kg S+2.5 kg Zn+0.5 kg B/ha enriched with 500 kg FYM/ha at Pantnagar and Shillongani, and with 20 kg S+2.5 kg Zn+ 0.5 kg B/ha at Imphal and Kanke. Combined use of 150% NPK along with 40 kg S+5 kg Zn+1 kg B/ha enriched with 500 kg FYM/ha increased seed yield by 13.8-104.2% at Kota and 10.7-67.4% at Sriganganagar. Nutrient supplementation significantly increased net returns with 40 kg S +5.0 kg Zn+ 1 kg B/ha enriched with 500 kg FYM/ha at Jhansi (10.3-16.1%), Nagpur (11.5-31.9%), Kangra (20.5-26.0%), SK Nagar (16.5-19.4%), Kota (11.1-16.7%) and Jobner (12.0%). Application of 20 kg S +2.5 kg Zn+ 0.5 kg B/ha enriched with 500 kg FYM/ha significantly increased the net returns at Chatha (35.4-43.4%) and Shillongani (68.3-84.2%). Application of 150% NPK recorded the maximum net returns and soil available NPK at all the locations. Nutrient supplementation significantly increased soil available N, P and K content with 40 kg S +5.0 kg Zn+ 1 kg B/ha enriched with 500 kg FYM/ha at most of the locations.

Plant Pathology

Disease Scenario

During 2021-22 crop season, moderate to severe incidence of *Alternaria* blight and white rust diseases was recorded at all locations. Low to the moderate occurrence of downy mildew was recorded at cotyledonary stage from MOR. Occurrence of Powdery mildew noticed moderate at BPR to severe at SKN, JAG and MOR. Moderate to severe incidence of *Sclerotinia* rot was observed at BPR.

Screening of *Brassica* breeding material

Among 43 AVT-I and AVT-II breeding lines, DRMR 2018-19, JC 36, Rohini (A4A5)-491, PB (A4A5)-842, Varuna (A4A5)-936-279, PJK (A4A5)-21, 0IJ 5001 (Q hybrid), DRMR 2017-16 (Bj) were found resistant to WR at all seven locations and resistant to DM at MOR, both under natural and artificial conditions. AKGS 19-8, HNS 1102, GSH 1703, DRMRIN 20-3, AKGS 8060, GSH 2155, DRMRIN 20-23, GSH 1723, HNS 1206, and JGS 15-6 of *B. napus* were found resistant to WR at MOR, HSR and PNT locations under artificial condition.

Uniform Disease Nursery for major diseases

Among 52 entries, DRMR 2018-41, DRMR 2018-37 (4 years), DRMRSJ 4, PMW 18, DRMR 2018-25, (3 years), PAB 14-7, PAB 14-8, DRMRQ-1-22, DRMRQ-202, (2 years), DRMRDR 2135, DRMRIJWR 20-15, DRMRIJ 12-26, PAB 14-18, DRMRIJWR 20-19, DRMR 2018-19, DRMRDR 2133, DRMRIJWR 20-13, DRMRIJ 12-21, DRMRIJWR 20-24, DRMRSJ 271, DRMRIJWR 20-11, DRMRIJWR 20-17, DRMRDR 2141, DRMRIJ 12-44, DRMRIJWR 20-14, DRMRSJ 349, DRMRIJWR 20-26, DRMR 2018-1, DRMRIJWR 20-20, and DRMRDR 2116 of *B. juncea* showed resistance reaction to WR under natural conditions with mean disease severity <10%, and highest WR severity was in checks Rohini (30.2%) and NRCHB 101 (30.3%) at 7 locations.

National Disease Nursery (NDN) for *Alternaria* blight

Out of 32 entries, DRMR-PMJ 17 (20.8%) and PAB 17-15 (24.8%) showed tolerant reaction to AB on leaves in comparison to susceptible check Rohini (33.1%) and NRCHB 101 (35.4%) under artificial condition at HSR, PNT, SHL, MOR, DOL and VAR locations. DRMR 2018-37, DRMR 2018-41 (4 years), PMW 18, DRMRSJ 4 (3 years), DRMR 2018-1, DRMR 2018-19, DRMR 2018-25 (2 years) of *B. juncea* showed consistent WR resistant reaction. However, DRMRSJ 349, DRMRM 163, PRD 17-22, DRMRSJ 206, DRMRDR 2141, DRMRDR 2116, and PAB 2014-8 entries of *B. juncea* showed resistant reaction to WR at MOR, PNT, SHL, DOL and HSR locations. Moderate WR severity was recorded on susceptible check Rohini (38.4%) and NRCHB 101 (31.3%).

National Disease Nursery (NDN) for white rust

Among 55 entries, DRMR 2018-25, DRMRCI 132, DRMRCI 139, DRMR 2018-37, RH 1700, DRMRDR 2141, RH 1700-4, DRMR 2018-41, DRMRSJ 349, DRMRM 18-36-12, DRMRSJ 206, and DRMRCI 131 of *B. juncea* showed immune reaction to WR at PNT, HSR and BPR locations. While, some of the promising strains, sowed resistance to WR with <10% disease severity were DRMR 2018-1, DRMRM 18-35-11, RH 1400-1, DRMRWR 153, RH 1400, PDZ 16, RH 1700-

3, DRMRDR 2195, DRMRCI 126, DRMRM 18-37-13, RH 1700-1 at 3 locations. Consequently, DRMR 2018-25, DRMRM 18-36-12, DRMRM 18-37-13, DRMR 18-35-11, RH 1700-1, RH 1700-4, RH 1700-3, DRMRCI 126, DRMRCI 131, DRMRCI 132 (2 years), RH 1700, RH 1700-1 (3 years), DRMR 2018-37, DRMR 2018-41, RH 1400-1, and RH 1400 (4 years) were found reliably resistant to WR.

National Disease Nursery (NDN) for Sclerotinia rot

None of the entries of *B. juncea* showed tolerance to SR. Although, entries of *B. juncea* DRMRDR 2151 and DRMRSJ 25 showed resistance to WR at PNT, HSR and BPR.

Screening of IVT entries of Brassica against different diseases

Among 146 IVT entries, DRMRIJ 16-9-7, DRMRCI 139, DRMRCI(Q) 57, PDZ 17, JC 16, IJ19R 5004, DRMRCI(Q) 47, PDZ 16, PAB 2014-17, DRMRHJ 1117, DRMRCI 143, PHR 4457, NAMJH 21-01, DRMR 2018-25, DRMRIJ 20-157, DRMRCI(W) 125, DRMR 2018-37 of *B. juncea* were resistant to WR at five locations.

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

Among 8 different treatments, foliar spray of tebuconazole 50% + trifloxistrobin 25% WG @ 0.5g/l gave maximum 77.8% AB disease reduction over check followed by iprodion 50WP @ 0.2% which gave 71.4% AB reduction with increase in yield by 41.8 and 35.8% successively for second year, under rice-fellow-mustard cropping system at SHL, JAG, VAR and DOL.

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

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

PNT

Downy mildew disease first appeared 8 DAS on Oct 15 sown Varuna and Kranti cultivars. WR disease first appeared 45 DAS Nov 12, 19 sown crop. AB disease was first noticed at 41 DAS on Nov 19 sown both cultivars. On Oct 01 sown crop, the disease appeared late i.e. 77 DAS. AB on pods first appeared 87 DAS on late sown (Nov 12, 19) crop. On early (Oct 01) sown crop, the symptoms on pod appeared late after 126 days of sowing which was 4 days late than last year

SHL

ABL was first observed 34 DAS on Nov 19 sown TM 2. AB on silique first appeared 82 DAS on Nov 19 sown cv TM 2, which appeared 123 DAS on early sown (Oct 01) Varuna. Maximum disease severity was at 39.7% (110 DAS) on Nov 12 sown cv TM 2. WR disease first appeared 42 DAS on Nov 19 sown crop. Maximum yield was recorded in Nov 05 sown cv Varuna (16.7 q/ha) and 11.5 q/ha of TM 2 sown on Oct 29. Yield data revealed that the best sowing time of crop in the eastern region could be last week of October.

SKN

Powdery mildew disease first appeared at 88 DAS instead of 89 DAS, 79 DAS, 83 DAS, 76 DAS during 2020-21, 2019-20, 2018-19, 2017-18, respectively on Nov 19 sown both Varuna and cv GM 2. The maximum disease severity was observed in Nov 19 sown cv Varuna (100.0%) and GM 2 (95.5%). The maximum seed yield reduction was observed in late sown crop. The highest yield was observed in Oct 01 sown GM 2 (19.3q/ha) and Varuna (18.5q/ha). WR was observed first 60 DAS on Varuna and 61 DAS on GM 2 on Nov 19 sown crop which was maximum (28.6%) on Nov 12 sown crop.

MOR

AB on leaf first appeared at 70 DAS on Nov 12, 19 sown both Varuna and Rohini. Whereas, SR appeared at 80 DAS in late sown crop of Nov 19. PM was observed first 90 DAS and was maximum 78.7% reported on cv Rohini at 130 DAS in Nov 19 sown crop. WR appeared first on 48 DAS in Nov 12, 19 sown Rohini and Varuna progressed till 130 DAS on early sown crop. WR disease severity was maximum up to 36.4% on Nov 19 sown Rohini. Maximum staghead incidence,

66.7% was observed on Nov 12 sown Rohini. Maximum yield (34.7 q/ha), was recorded in Oct 15 sown Rohini.

JAG

WR first appeared at 42 DAS on both Varuna and CG Sarson sown on Nov 19. Initiation of AB was reported at 36 DAS on Nov 12 sown crop of Varuna and CG Sarson. PM was appeared first at 40 DAS on Nov 19 sown Varuna. Maximum yield (18.2 q/ha) was recorded in Oct 29 sown Varuna.

DOL

AB was first observed at 25 DAS and 30 DAS on Varuna and Rajendra Suflam, respectively. The disease continued to progress on leaves up to 140 DAS on both cultivars.

HSR

WR appeared first at 53 DAS on Nov 19 sown RH 30 which was further spread on Nov 12 and Nov 5 sown crop. Staghead formation observed first at 81 DAS on both Varuna and RH 30 on Nov 19 sown crop. AB first appeared 85 DAS on Nov 19 sown crop of both the cultivars. SR disease initiation was observed 70 DAS in Nov 12 and Nov 19 sown cv Varuna and RH 30. Maximum incidence was 46.7% in cv. RH 30 and 44.8% in cv. Varuna sown on Nov 05. The maximum yield was obtained in Oct 01 sown Varuna (29.9 q/ha) and RH 30 (29.0 q/ha).

JHS

AB appeared first on leaves at 42 DAS and seen on siliquae at 83 DAS on Nov. 19 sown Varuna. WR appeared first at 47 DAS on Nov. 19 sown Varuna (Table 4.8.6b). PM initiated at 79 DAS in Nov 19 sown Varuna. Optimum time of sowing in the Bundelkhand region for obtaining higher seed yield is first fortnight of October, which was obtained 32.4 q/ha in Oct. 29 sown Varuna.

Efficacy of fungicides against major rapeseed-mustard diseases

Data revealed that AB severity was minimum (14.0%) in Tebuconazole 50% + Trifloxostrobin 25% WG@0.1% in comparison to control (31.5%) successively for second year. Although, all tested fungicides were effective to reduce AB severity over control both on leaves and pods (Table 4.9.1), Metalaxyl 4% + Mancozeb 64% @ 0.25% was found effective to minimize both WR severity on leaf (13.5%) and staghead incidence (9.5%) in comparison to check (34.3%). similar as last year. PM severity was observed minimum 7.8% in Tebuconazole 50% + Trifloxostrobin 25% WG@ 0.1% over control (40.7%). Propiconazole 25% EC @0.1% was found effective in reducing the incidence of SR (10.3%) as compared to control (28.3%). Seed yield 1997.5 kg/ha was obtained highest in Tebuconazole 50% + Trifloxostrobin 25%.

Bio-management of rapeseed-mustard diseases

Minimum AB severity observed on leaves 23.2% and pods 20.1%, WR severity 25.4% and SR incidence 14.8% by applying seed treatment (10g/kg) + foliar spray with *T. harzianum* at 60 and 75 DAS followed by foliar spray with *Bacillus subtilis* 10⁶c.f.u. (24.0%) over control with highest severity 38.7% ABL, 29.7% ABP, 37.0% WR on leaves, SR incidence 27.2%. Maximum yield 1655 kg/ha was observed in the same treatment due to reduction of AB, WR, PM and SR diseases.

Entomology

The crop season 2021-22 witnessed moderate to high population development of mustard aphid on different Brassica species. Strain ORM 18-29-5 and RH 1927 were found promising as these recorded AII <1.5.

The highest yield losses were observed in Radhika at Morena (45.3%) followed by DRMRIJ 31 (33.5%), while at DHO PM 31 suffered 30.9% yield loss due to insect-pests. At LDH, Radhika suffered 30.3% loss followed by 28.1% in PBR 357 and 27.9% in DRMRIJ 31. It was followed by 27.1% in GDM 4 at SKN, 25.8% in DRMRIJ 31 at HSR, 25.7% in PM 27 at SHL, 16.2% in Varuna at PTN, 12.7% in Radhika at NDH and 3.5% in Radhika at KAN.

Moderate to high population of mustard aphid was reported at most of the centres from 2nd to 13th standard week with peak during 7th to 11th standard week. Very low to moderate activity of cabbage caterpillar was recorded both under timely and late sown conditions at LDH. It remained active from 8th-12th standard week under both timely and late sown conditions. Low to moderate population of painted bug was observed from 44th-49th standard week at HSR, while at MOR, it

remained active from 47th-50th standard week. The activity of coccinellid predators was low to moderate during 50th-8th standard week. At SHL, sawfly observed during 50th-12th std. week, flea beetle 49th-12th std. week and coccinellid predators during 52nd-14th std. week.

The alate aphid population was recorded by seven centres. Alate aphid appeared as early as 43rd week at LDH. It started increasing at most of the centres from 50th-1st std. week and reached its peak from 5th-11th std week. The highest peak (3649.6 aphids/ trap) was recorded from SKN during 8th std. week. After 12th std. week a general trend of decline in aphid population was observed which disappeared from most of centres after 16th standard week.

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

Aphid herbivory resulted in changes in biochemical parameters of host plant. At HSR, 31.03 and 62.96% increase in peroxidase activity was recorded after aphid feeding in DRMR IJ 31 and GSC 6, respectively. Similarly, increase in glucosinolates content, ortho-dihydroxy phenols content flavonols content was observed after aphid feeding. Almost similar results were obtained at LDH. In general, there was an induction of all defense related compounds after aphid feeding in *B. juncea* and *B. napus*.

Plant Physiology

Five experiments were conducted to evaluate mustard genotypes from different agro-climatic zones to abiotic stresses; one experiment was at three locations to test the efficacy of PGR's under rainfed conditions while two experiments assessed the potentials of microbes to mitigate drought and temperature stress. Seedling mortality $\leq 20\%$ and DW/10 seedlings ≥ 35 mg rated genotypes tolerant under controlled conditions. Only one genotype RMX 9310 met the selection criteria at Bharatpur, Hisar and Ludhiana centres. Seedling mortality of $\leq 30\%$ and DW/10 seedlings ≥ 40 mg was recorded in JD6 at Bharatpur and Ludhiana centres. In the field sown trial RH1999-14, Kranti, ORM2019-25, PM25, RH1999-42, KMR (E) 21-1, PHR8081, RMX 9310, DRMRCI 128 and Pro5111 had seedling mortality $\leq 20\%$ and dry matter ≥ 6.0 g with STI 62.1% at Bharatpur and Ludhiana centres. JD6 had seedling mortality of $\leq 30\%$ at Bharatpur and Ludhiana centres and with DW of 7.8g with STI of 79.1 and SSTI 82.6% only at Ludhiana centre. Only one genotype RMX9310 was tolerant to high temperature at seedling stage both under laboratory and field conditions. Light stress due to shading for 30 days impaired physiological and yield traits to variable extent within the genotypes and also at three locations. Minimum reduction in the physiological traits, seeds/siliquea, test weight, total siliqueae per plant with higher CSI and seed yield ($\leq 30\%$) identified DRMTCI-96 at Bharatpur and Ludhiana as promising genotype under low light stress. Moisture stress imposed by withholding irrigations at 35 and 65 DAS significantly affected the performance of thirty four genotypes tested at 3 locations. Overall, CAU-RMM3, NPJ210, DRMRCI-128 and Kranti were tolerant to moisture stress at Bharatpur, Hisar and Ludhiana centres with seed yield reduction $\leq 20\%$. These genotypes maintained higher SPAD values, chlorophyll content, RWC with relatively low reduction in siliqueae on main shoot, seeds/siliquea, seed weight, DSI ≤ 1.0 and YSI ≥ 0.83 . Moisture stress reduced seed yield by $\leq 20\%$ in DRMR1188 and JC6 at Hisar and Ludhiana centres and by $\leq 25\%$ in one genotype DRMRSJ276 at 3 locations. These three genotypes had YSI ≥ 0.58 with low reduction in physiological traits. RH0725 (check) declined in seed yield $\leq 20\%$ at Hisar and Ludhiana centres while $\leq 30\%$ at Bharatpur centre. However, RGN229 (check) was reported highly tolerant at Bharatpur, Hisar and Ludhiana centres with $\leq 20\%$ yield decline. Out of thirty one mustard genotypes, HUJM20-6 and JC1 showed tolerance to terminal heat stress with seed yield reduction $\leq 30\%$ and stability indices (HSI ≥ 0.40 and YSI ≥ 0.53) at all the 4 locations. Kranti and RH2050 at Dholi, Hisar and Ludhiana centres showed thermo tolerance with seed yield decline $\leq 30\%$, HSI ≥ 0.50 and YSI ≥ 0.54 . JC32 had HSI ≥ 0.58 and YSI ≥ 0.62 at Bharatpur and Ludhiana centres. These genotypes suffered lesser depression in membrane stability, seeds per siliquea with cooler canopies. PM26 (check) reported yield loss $\leq 20\%$

only at Bharatpur centre and $\leq 30\%$ at Dholi, Hisar and Ludhiana centres with $HSI \geq 0.45$ and $YSI \geq 0.53$. Kranti, CS2020-10 and CS54 seems promising for salinity tolerance at Hisar and Ludhiana with lesser decline ($\leq 30\%$) in germination percent, seedling length, dry matter accumulation and SVII only at Ludhiana centre.

Foliar application of urea @ 1 and 2% and KNO_3 @ 2% improved seed yield at Bharatpur centre while foliar sprays all the tested PGRs were effective in improving yield at Hisar and Ludhiana centres with increased siliquae on main shoot, total siliquae per plant and chlorophyll stability index. Physiological traits and osmoprotectants enhanced with the microbial treatments under moisture stress at Dholi and Ludhiana centres. Maximum increase in RWC was with CRIDA MI II at Dholi centre and with Biophos+Biophos trailed by MRD17 at Ludhiana centre; SPAD with CRIDAMI II at both the locations; total chlorophyll with both the CRIDA strains at Dholi centre while MKD17 and Biophos+Biophos at Ludhiana centre; proline and total sugars with CRIDA MI I at Ludhiana centre. Variation existed in the three varieties for the studied traits with microbial formulation and Pusa Sanjeevni under normal and late sown conditions. RWC, membrane stability and chlorophyll content improved with both the microbial inoculations in normal and late sown varieties. CT was lower in late sown inoculated varieties at Ludhiana centre only. Total siliquae per plant and biomass increased with microbial formulation and Pusa Sanjeevni inoculated 3 varieties at Dholi, Hisar and Ludhiana centres. Seed yield improved with both the inoculations under normal and late sown varieties at 4 locations except for RH725 inoculated with microbial formulation under late sown condition at Bharatpur centre, RH725 and Giriraj inoculated with Pusa Sanjeevani under normal and late sown conditions respectively at Hisar centre over non-inoculated control.

Biochemistry

Entries of IVT/AVT quality trials were evaluated at Bharatpur, Pantnagar, Hisar and Ludhiana. Among the 17 genotypes analyzed, Oil stability index, which is the ratio of MUFA: PUFA, ranged from 0.86 in DRMR Q143-9 to 1.70 in PDZM-31 ($CV \leq 0.20$). Entries were also analyzed for fatty acid profile and Palmitic acid ranged from 2.86% (DRMRQ 143-9) to 5.13% (PDZ-16). ($CV \leq 0.17$). **Stearic acid:** 1.26% (DRMRQ 143-9) to 2.73% (LES-60). ($CV \leq 0.19$). **Oleic acid:** 13.02% (DRMRQ 143-9) to 50.66% (PDZM-31). ($CV \leq 0.21$). **Linoleic acid:** 15.13% (DRMRQ 143-9) to 42.11% (PDZ-16). ($CV \leq 0.20$). **Linolenic acid:** 10.36% (LES-65) to 21.16% (DRMRQ 143-9). ($CV \leq 0.24$). **Eicosanoic acid:** 0.56% (RH (OE)-1807) to 1.31% (DRMRQ 143-9). ($CV \leq 24$). **Erucic acid:** 0.33% (PM-32) to 46.18% (DRMRQ 143-9). ($CV \leq 2.23$). $\omega 6$: $\omega 3$ ratio ranged from 0.72 (DRMRQ 143-9) to 3.97 (PDZ-16). ($CV \leq 0.37$). SFA: MUFA: PUFA ratio ranged between 1:05:07 to 1:19:11. Saturated and unsaturated ratio ranged between 4:1:12 to 1:30. ($CV \leq 0.15$). In nutritional profiling of entries of IVT/AVT quality trials, protein ranged from 29.61% (PM-32) to 33.88% (PM-29) ($CV \leq 0.05$). Total antioxidant capacity ranged from 14.54 (PDZ-14) to 23.04 (LES-64) mg/g AAE ($CV \leq 0.15$). **β -carotene** ranged from 2.99% (LES-65) to 5.01% (LES-60) ($CV \leq 0.13$). **Total sinapic acid content** ranged from 1.25% (LES-60) to 2.23% (RH(OE)-1807) ($CV \leq 0.15$). Entries were also analyzed for mineral composition through AAS. The promising genotypes having high copper content were PM-30 (0.89 ppm), DRMRQ 143-9 (0.86 ppm), LES-60 (0.82 ppm). The promising genotypes having high zinc content were PDZ-15 (0.957 ppm), RH(OE)-1808 (0.854 ppm), LES-60 (0.845 ppm), PM-30 (0.833 ppm). The promising genotypes having high iron content were PM-30 (16.58 ppm), RH (OE)-1808 (15.48 ppm), PDZ-15 (13.38 ppm). The promising genotypes having high Mn content were PM-30 (0.614 ppm), RH (OE)-1612 (0.518 ppm). Estimation of anti-nutritional factors in quality breeding materials includes total glucosinolate content and phytic acid analysis. Total Glucosinolate mean values for four centres (Bharatpur, Pantnagar, Ludhiana, Hisar) were $< 30 \mu\text{mol/g}$ in PDZ-16, PDZ-17, PDZ-14, PDZ-15 and PDZM-31 genotypes. It ranged from $15.93 \mu\text{mol/g}$ (PDZ-16) to $62.02 \mu\text{mol/g}$ (LES-60) ($CV \leq 0.34$). Phytic acid content mean values were $< 2.25\%$ in LES-64, LES-65, DRMR Q 143-9, PM-30, PM-32, PM-29, PDZ-15 and PDZM-31. Aliphatic glucosinolates were identified as sinigrin, tropeolin, gluconapin and few unknown peaks were unidentified using UPLC. Data was statistically analysed using SPSS version 22 software.

Frontline demonstrations 2021-22

Under the scheme “Frontline demonstrations and other related activities of Oilseeds” 36 cooperating centres of AICRPRM/ ICAR institutes/ Ag. Universities/NGOs/FPOs conducted 2534 frontline demonstrations (FLDs) on rapeseed-mustard in 85 districts across 16 states during 2021-22. Rajasthan had maximum (835) followed by Uttar Pradesh (398), Assam (359) Manipur (150) and Madhya Pradesh (122) FLDs. The 629 FLDs on rapeseed and 1905 on mustard were conducted. All the demonstrations were conducted in two different situations viz., irrigated (1785) and rainfed (604).

The maximum average yield of 2,462 kg/ha from the IP under irrigated conditions was in Haryana followed by 2,325 kg/ha in Gujarat; 2,228 kg/ha in Uttar Pradesh; 2,102 kg/ha in Madhya Pradesh; 2,001 kg/ha in Rajasthan; 1,882 kg/ha in Punjab; 1,456 kg/ha in Uttarakhand; 1,349 kg/ha in Himachal Pradesh; 1,331 kg/ha in West Bengal; 1,289 kg/ha in Assam; 1,244 kg/ha in Telangana; 1,203 kg/ha in Jammu & Kashmir; ; 1,111 kg/ha in Jharkhand; 991 kg/ha in Maharashtra and 982 kg/ha in Odisha. The maximum yield gap of 73.0% was recorded in Jammu & Kashmir followed by 66.7% in Assam; 56.6% in Odisha; 39.5% in Telangana; 35% in Himachal Pradesh; 32.5% in Jharkhand, 25.9% in Uttar Pradesh; 22.1% in West Bengal; 20% in Maharashtra; 17.1% in Uttarakhand; 16.8% in Rajasthan; 14.7% in Haryana; and 14.6% in Madhya Pradesh, 12.7% in Gujarat and 8.2% in Punjab. The maximum ANMR/ha were Rs 30,019; Rs 28,065; Rs. 26,461; Rs. 20,350; Rs. 18,186; Rs. 17,679; Rs. 16,410; Rs. 14,979; Rs.14,611; Rs. 14,407; Rs. 13,645; Rs. 13,420, Rs.9,465; Rs. 8,909; and Rs. 8,456 in Assam, Jammu & Kashmir, Uttar Pradesh, Telangana, Rajasthan, Haryana, Himachal Pradesh, Madhya Pradesh; Gujarat, Odisha, Jharkhand, West Bengal, Uttarakhand, Punjab, Maharashtra respectively. The cost of cultivation ranged from Rs. 19,250/ha in Jammu & Kashmir to Rs. 39,697 /ha in Haryana in IP under irrigated Whole package demonstrations.

The maximum average yield of 1495 kg/ha from the IP of WP demonstrations under rainfed conditions was in Rajasthan followed by 1,166 kg/ha in Jammu & Kashmir; 1,075 kg/ha in Assam; 861 kg/ha in Manipur; 668 kg/ha in Himachal Pradesh . The maximum yield gap of 35.9% was recorded in Assam followed by 27.2% in Himachal Pradesh; 16.3% in Manipur; 15.0% in Jammu & Kashmir 14.7% in Rajasthan. The maximum ANMR/ha were Rs 15,712; Rs 11,830; Rs 7553; Rs 7,085; and Rs. 5994 in Assam, Rajasthan, Jammu & Kashmir, Himachal Pradesh, Manipur, respectively. The cost of cultivation ranged from Rs. 12,690/ha in Himachal Pradesh to Rs 39,155/ha in Jammu & Kashmir in IP under rainfed Whole package demonstrations.

A total of 12 improved varieties of Indian mustard, 3 each of yellow sarson and toria and 4 of gobhi sarson were used in WP covering 15 states under irrigated condition. Under irrigated condition, improved variety RH 725 demonstrated in 96 FLDs in Uttar Pradesh, recorded highest average yield of 2,648 kg/ha with a yield improvement of 26.4% over local (FP) practice followed by Giriraj (131 FLDs) with average seed yield of 2,530 kg/ha with yield improvement 23.1%. The minimum yield improvement of 7% was reported from RCH-1 variety from 23 FLDs in Punjab, while minimum average seed yield of 982 kg/ha was reported from NRCHB 101 variety from 20 FLDs in Odisha. However, the variety RH-725 in Jammu & Kashmir, under irrigated condition, recorded highest yield improvement of 74% with average seed yield of 1,203 kg/ha.

The maximum yield improvement of 20.4% from Pitambari variety of yellow sarson in Uttar Pradesh, 37 % from AKMS8141 variety of gobhi sarson in Himachal Pradesh, 66.6% from TS 38 variety of toria in Assam were recorded under irrigated condition.

Under rainfed condition, the demonstrations with RGN 298 recorded the highest average seed yield of 1,892 kg/ha with yield improvement of 9.4% in Rajasthan under rainfed situation. In Himachal Pradesh, 33 demonstrations with RCC4 recorded lowest average seed yield of 695 kg/ha with yield improvement of 32.4% over FP. However, the variety RCC-4 in Himachal Pradesh under rainfed condition recorded highest yield improvement of 32.4% with average seed yield of 695 kg/ha.

The maximum yield improvement of 40.4% from TS 36 variety of toria in Assam and 22.5% from RTM 1624 oftaramira in Rajasthan were recorded under rainfed condition.

The yield improvement of 23.8% from GSC 7 variety of gobhi sarson in Himachal Pradesh, 15% from Shalimar sarson 2 variety of brown sarson in Jammu & Kashmir were recorded under rainfed condition.

A total of 145 FLDs with 5 component technologies for Indian mustard were carried out by different centres. Among all the components, sulphur and boron fertilization demonstrated by Bharatpur centre had maximum average yield of 2,052 kg/ha. However, maximum yield increase of 58.0% was recorded with seed and plant protection demonstrated by Bhubaneswar centre followed by 29.9% yield increase with Sclerotinia rot management demonstrated by Bansur resulting maximum ANMR of Rs 23,040/ha.

Weeding and thinning component demonstrated by Bawal centre gave 19.0 and 15.0% yield enhancement over FP, respectively.

Monitoring Report

Six teams comprising scientists from ICAR-DRMR and other AICRP-R&M Centres were constituted to monitor the conduct of different coordinated trials, breeder seed production and front line demonstrations. Monitoring was conducted during Feb. - March 2022 following centres virtual / physical mode.

Zone	Team	Centres	Duration
I	Team Leader Dr. P.D.Meena, Pr. Scientist, Pl. Pathology, ICAR-DRMR, Bharatpur Team Members Dr. Vinod Goyal, Jr. Pl. Physiology, CCSHAU, Hisar Dr. Sarwan Kumar, Entomologist, PAU, Ludhiana Dr. H. S. Meena. Sr. Scientist, (PB),ICAR-DRMR, Bharatpur	Kangra Dhaura kuan Bajaura,Una Chatha Abohar, Ludhiana	01-15 March 2022
II	Team Leader Dr. V.V.Singh. Pr. Scientist, Pl. Breeding, ICAR-DRMR, Bharatpur Team Members Dr. R.S.Jat, Pr. Scientist, Agronomy, ICAR-DRMR, Bharatpur Dr. A.K. Tiwari, Professor, Pl. Pathology, GBPUA&T, Pantnagar Dr. Bhagirath Ram, Pr,Scientist, Pl. Breeding, ICAR-DRMR, Bharatpur	Kanpur Faizabad (Namdhari seeds) Varanasi Morena Banda Jhansi	25February- 10 March 2022
III	Team Leader Dr. Mahak Singh, Professor & Head, Pl. Breeding,CSAUAT, Kanpur Team Members Dr. S.S.Rathore, Pr. Scientist, Agronomy , IARI-New Delhi Dr. H. K .Sharma, Sr. Scientist, (PB), ICAR-DRMR, Bharatpur Dr. Pankaj Sharma, Pr. Scientist, Plant Pathology, ICAR-DRMR, Bharatpur Dr. Kartikeya Srivastava, Professor , Pl. Breeding,IAS, BHU, Varanasi	Jobner Mandore S.K.Nagar Kota	15February - 07 March 2022
IV	Team Leader Dr. Dr. Naveen Singh, Pr. Scientist,(PB) , IARI-New Delhi Team Members Dr. Harvir Singh, Scientist, Agronomy, ICAR-DRMR Bharatpur Dr. M. S. Khan, Entomologist,GBPUA&T, Pantnagar Dr. P.S.sandhu, Pathologist, PAU, Ludhiana Dr. S.K.Rai, Jr. Pl. Breeder, SKUAST-Jammu	Hisar Palwal Gurugram (Bayer) Mahendragarh (Shaktivardhak) Alwar (Corteva) Bawal SriGanganagar	20 February - 10 March 2022
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Centre wise salient observations

Zone I

KNG, DLK, BJR

All trials were well managed with proper plant stand and expression of plants was good. The crop was in good condition and worth for considering. The crop was good at all three centres.

Zone II

LDH

Allotted trials of all disciplines were conducted as per technical programme. Team also interacted with farmers to know their feedback about new varieties. Farmers were satisfied with improved varieties.

CHT

All trials allotted to this centre were conducted. Trials were properly managed and were in good condition. Moderate incidence of white rust and Alternaria blight was observed.

ABH

White rust and sclerotinia appeared in late season in timely sown trials but these were not able to cause significant losses.

NDH

Trials were conducted as per the technical programme and expression of crop was excellent. White rust disease appeared and adequate plant protection measures were taken.

BAW

All the assigned trials were nicely conducted. White rust in some regions and painted bug in early sown crops were reported.

KAR

Trials were conducted as per the prescribed standard guidelines of AICRP-RM. The growth condition of crop was healthy.

PAL (Bayer)

The trial was nicely conducted. Only one trial IHT (hybrid) was allotted.

HSR

All the trials allotted to the centre with respect to different disciplines were conducted excellently. Herbicide Isoproturon was not available; therefore, this treatment was not included in herbicide trial of Agronomy.

Zone III

PNT

Trials were conducted properly as per the technical programme. White rust, Alternaria blight (low to moderate) Sclerotinia rot (low), moderate to high pressure for mustard aphid was observed. Toria varieties were preferred by the farmers in rotation with wheat crop while, yellow sarsan varieties were preferred by the farmers in rotation with sugarcane crop.

BPR

All the allotted trials were conducted as per the technical programme. However, there was some infection of aphid in expt. No 6.4 and no difference was observed between different entries in trial 6.2 evaluation of genotypes under low light stress condition.

MOR

All breeding trials were conducted as per the technical programme/ expression was satisfactory. However, there was no scientist in AICRPRM only technical staff was there.

BND

Trials were in good condition and conducted properly as per the technical programme.

VAR

All the experimental trials conducted very well as per guidelines. RH 725 is very good variety along with recommended package and practices. Training of progressive farmers at Bharatpur is required.

KPR

All the trials conducted were laid properly as per guidelines. Early mustard trials were harvested timely.

JHS

Experimental trials were conducted as per guideline. Performance was satisfactory and minor attack of Painted bug in IVT- Early and AHT-I was observed.

DOL

Centre conducted all assigned trials in good manner under adverse weather and heavy rain condition.

NGP

All assigned trials were conducted. Farmers desired market for mustard.

KOT

There was no deviation in conducting experiments. All trials were conducted properly. Moderate to heavy infestation of aphid was observed.

ZONE IV

SKN

All trials were conducted properly as per technical programme. However all the three trials of breeding were harvested early due to increasing temperature. Moderate to heavy infestation of Aphid was observed. Low incidence of white rust was observed.

PLI

All assigned trials were conducted as per technical programme.

MDR

All assigned trials were conducted as per technical programme. IVT- Early trial failed due no germination caused by high temperature.

JBR

All allotted trials were conducted as per technical programme.

ZONE V

KNK

Centre conducted all the assigned trials i.e. 03 breeding, 02 agronomy, 01 NCP trials and 30 FLD under adverse weather due to rains. Centre conduct IVT (Early) sown on 14th Nov. IVT (TS) rainfed could not be considered as it failed 08th Nov. and re-sown very late on 14th Dec.

JAG

IVT (Early) and IVT (TS) rainfed trials could not be considered due to uneven sowing dates within trials. Moderate AB & WR noticed in trials.

SHL

Centre conducted all the assigned trials i.e.03 breeding, 03 agronomy, 10 pathology, 06 entomology and 30 FLD in a good manner. All the 30 FLDs were conducted on TS 38 and most FLDs gave excellent followed by good, average and poor performances.

KLN

02 breeding trials assigned & conducted by the centre. AVT-I (YS) sown in scheduled time but due to adverse weather and rains IVT (Early) could be delayed sown on 04th Nov. TBM 204 seed production has been rejected due to problem related to its seed colour observed by Breeder Seed Monitoring Team.

1. Seasonal Conditions

Weather was favorable for the mustard during the crop season 2021-22. Good rains were received during monsoon in the month of September at almost all the locations.

Zone I

The lowest temperature 2.0⁰C was reported in the month of January, 2022 whereas, maximum temperature ranged from 12.8 to 35.8⁰C at Kangra center. Only 314.6 mm rainfall was received from October to April 2021-22 at Kangra center.

Table: 1.1 Weather conditions during crop season in Zone I

Location	Sep. 21	Oct. 21	Nov. 21	Dec. 21	Jan. 22	Feb. 22	Mar. 22	Apr. 22
Max. Temp. (⁰C)								
KNG	-	29.6	26.4	16.8	12.8	17.4	28.3	35.8
Min. Temp. (⁰C)								
KNG	-	17.4	10.0	3.0	2.0	6.6	13.2	18.9
Rainfall (mm) (rainy days)								
KNG	-	56.4(30)	32.0(2)	16.2(1)	171.6(11)	27.0 (7)	6.8(1)	4.6(1)
Max. R.H. (%)								
KNG	-	77.0	77.2	77.7	82.0	73.2	68.0	65.3
Min. R.H. (%)								
KNG	-	60.6	68.3	65.2	70.1	60.2	54.5	45.4

Zone II

The mean maximum temperature varied from 15.2⁰C (Abohar) in January, 2022 to 41.8⁰C (Bawal) in the month of April, 2022. The minimum temperature 5.0⁰C reported by Chatha center during the month of January, 2022. Good precipitation was received during crop season at all the centers. Maximum morning humidity was observed at Bawal (94.8%) in the month of January, 2022.

Table: 1.2 Weather conditions during crop season in Zone III

Location	Sep. 21	Oct. 21	Nov. 21	Dec. 21	Jan. 22	Feb. 22	Mar. 22	Apr. 22
Max. Temp. (⁰C)								
BAW	33.7	33.8	28.2	22.5	16.6	24.2	33.7	41.8
SGN	-	31.1	28.2	22.4	17.2	23.0	33.3	40.7
LDH	31.6	30.9	26.1	21.1	15.7	22.2	32.0	39.0
CHT	33.0	31.2	26.4	21.1	16.1	21.0	30.5	37.9
NDH	32.4	32.3	27.1	21.9	17.4	23.1	32.4	40.2
ABR	-	31.1	26.7	21.4	15.2	20.3	29.8	38.3
Min. Temp. (⁰C)								
BAW	23.8	18.6	9.7	5.6	6.1	6.3	13.2	19.6
SGN	24.3	14.5	11.0	5.9	5.4	6.5	10.4	17.7
LDH	25.3	19.1	9.9	6.5	8.4	8.9	16.6	20.6
CHT	24.2	18.0	9.0	5.0	7.4	6.5	13.2	18.0
NDH	24.8	19.3	10.6	7.3	7.4	8.7	15.3	19.9
ABR	-	15.8	12.1	5.9	6.1	6.6	13.7	17.1
Rainfall (mm) (rainy days)								

BAW	181.3(12)	33.5(3)	NIL	1.1	152.4(6)	9.5(1)	NIL	1.5
SGN	-	27.6(1)	NIL	NIL	46.1 (4)	2.3	NIL	NIL
LDH	295.8 (6)	37.6 (3)	NIL	NIL	144.4 (8)	13.3(2)	NIL	NIL
CHT	173.4 (7)	107.2 (2)	NIL	0.8)	191 (7)	45.4 (5)	1	4.6 (1)
NDH	527.8 (13)	127.1(5)	NIL	9.6 (3)	128.9(5)	30.0 (3)	NIL	NIL
ABR	-	12.4(1)	NIL	NIL	52.8 (7)	1.5 (4)	0.5(2)	0.5 (1)
Max. R.H. (%)								
BAW	88.5	81.0	84.2	90.3	94.8	91.0	77.6	38.8
SGN	-	82.8	84.9	87.9	89.9	83.7	66.9	45.3
LDH	86.8	85.2	90.0	95.3	94.0	90.8	85.3	57.5
CHT	84.0	81.0	88.0	92.0	92.0	91.0	83.0	54.0
NDH	90.2	88.7	91.6	90.6	92.3	89.6	80.2	65.1
ABR	-	78.9	81.4	85.0	88.2	86.5	84.6	64.8
Min. R.H. (%)								
BAW	69.8	38.5	33.4	45.3	67.8	41.0	24.8	11.8
SGN	-	46.2	44.7	46.2	70.2	40.4	43.6	29.7
LDH	68.5	44.6	33.0	48.8	73.2	47.3	39.8	15.0
CHT	65.0	48.0	36.0	47.0	73.0	54.0	44.0	20.0
NDH	76.7	59.5	52.0	64.2	75.7	51.6	39.0	15.0
ABR	-	56.7	46.8	57.0	59.5	44.8	35.7	6.6
Sunshine (hours/day)								
BAW	4.4	7.5	4.5	4.8	3.2	7.2	7.5	7.9
SGN	5.0	6.5	5.4	3.9	3.4	6.1	7.4	7.4
LDH	5.4	8.2	6.6	5.3	2.3	8.0	9.4	9.5
CHT	6.0	7.0	7.2	4.7	2.6	5.4	6.7	7.4
NDH	4.6	7.5	4.5	3.7	2.4	6.5	8.2	8.7

Zone III

Maximum temperature varied from 17.5⁰C at Pantnagar in January, 2022 to 42.3⁰C atBharatpur in April2022. The minimum temperature ranged from 6.5⁰C to 26.0⁰C during the crop season. Dholicenterreported 100% morning humidity from November, 2021to March,2022.

Table: 1.3 Weather conditions during crop season in Zone III

Location	Sep. 21	Oct. 21	Nov. 21	Dec. 21	Jan. 22	Feb. 22	Mar. 22	Apr. 22
Max. Temp. (°C)								
PNT	31.6	30.9	27.2	24.0	17.5	20.3	30.7	37.5
KPR	32.9	32.7	27.8	23.0	18.7	24.7	33.4	41.0
BPR	32.0	33.4	27.5	22.0	17.3	24.4	34.8	42.3
KOT	-	31.9	26.9	22.3	20.2	26.9	36.2	-
DOL	33.1	32.0	28.8	24.8	19.2	22.7	32.1	36.2
MOR	31.0	32.9	28.9	24.0	19.6	27.2	36.2	-
VAR	32.4	32.4	28.4	23.9	20.5	25.7	34.3	40.4
SBR	32.7	31.6	27.7	25.0	20.4	25.0	33.2	37.7
Min. Temp. (°C)								

PNT	24.9	19.7	12.1	8.4	9.5	8.5	14.4	18.6
KPR	26.0	21.3	12.6	9.8	7.7	9.7	16.1	20.8
BPR	25.9	20.9	12.3	8.8	6.5	9.1	15.7	22.3
KOT	-	21.6	16.2	10.7	9.3	12.4	19.7	-
DOL	25.2	23.0	14.5	11.0	10.3	10.3	16.7	22.6
MOR	24.8	22.1	12.2	8.3	8.0	11.9	18.5	-
VAR	24.1	20.9	12.6	9.7	9.1	10.6	17.0	21.3
SBR	27.3	23.7	16.1	12.0	10.7	11.7	19.7	22.2
Rainfall (mm) (rainydays)								
PNT	39.0 (3)	427.5(4)	NIL	5 (1)	98.9 (6)	50.4(2)	NIL	2.6 (1)
KPR	190 (7)	144.8(3)	1.2	8.6(1)	41.1(4)	13.0(1)	NIL	NIL
BPR	200.8 (12)	55.6 (2)	2.7 (1)	NIL	12.5 (2)	16.4 (2)	NIL	NIL
KOT	-	32.0(10)	54.0	16.0 (1)	13.0 (2)	NIL	NIL	-
DOL	126.8(5)	287.2(5)	NIL	15.4 (1)	6.0(1)	17.8(1)	NIL	NIL
MOR	59.3	34.5	NIL	4.0	29.7	NIL	NIL	-
VAR	303.9	120.7	NIL	8.6	59.9	0.7	NIL	NIL
SBR	117.4	210.0	NIL	15.6	29.7	10.4	NIL	0.4
Max. R.H. (%)								
PNT	86.0	89.0	91.0	91.0	93.0	92.0	85.0	65.0
KPR	87.0	86.0	92.0	92.0	94.0	91.0	82.0	59.0
BPR	91.2	85.2	87.9	88.3	91.5	89.6	79.0	60.2
KOT	-	55.5	72.9	76.9	82.4	74.1	61.5	-
DOL	98.8	99.6	100.0	100.0	100.0	100.0	100.0	97.8
MOR	79.3	68.9	60.3	60.2	75.4	61.5	59.2	-
VAR	92.8	93.6	94.5	94.8	95.0	92.8	85.5	73.2
SBR	91.9	94.2	93.7	94.6	95.3	93.0	86.3	83.2
Min. R.H. (%)								
PNT	63.0	54.0	39.0	47.0	71.0	60.0	43.0	22.0
KPR	69.0	51.0	43.0	53.0	69.0	50.0	38.0	23.0
BPR	81.8	70.3	66.4	75.6	82.0	73.2	57.1	40.1
KOT	-	41.3	50.3	65.7	58.7	46.1	37.7	-
DOL	77.5	84.6	94.7	95.3	97.1	93.5	79.9	62.0
MOR	70.7	58.8	45.4	46.7	59.8	44.2	43.7	-
VAR	80.3	60.6	48.3	55.8	69.6	54.0	48.8	32.0
SBR	75.5	73.0	73.6	68.4	65.8	56.3	46.9	49.4
Sunshine (hours/day)								
PNT	6.6	7.2	7.1	5.7	2.5	6.0	8.1	9.3
KPR	3.1	6.7	4.7	3.5	2.9	7.2	6.0	6.4
BPR	4.3	8.1	4.7	3.9	4.0	7.7	8.1	7.2
KOT	31.9	7.8	7.3	6.3	6.5	9.1	9.8	-
DOL	-	-	-	-	-	-	-	-
MOR	-	-	-	-	-	-	-	-
VAR	5.4	7.3	6.5	4.7	3.5	8.1	9.1	9.5
SBR	5.1	5.8	5.0	4.3	2.3	7.2	6.1	6.5

Zone IV

The maximum temperature ranged from 25.1°C to 37.1°C, while minimum temperature from 8.6°C to 24.6°C at S.K. Nagar during crop season. The humidity ranged from 20.9 to 94%, maximum relative humidity was reported at Nagpur center during the month of September, 2021. Bright sunshine hours from 1.7 to 7.7 hours were observed at Nagpur during the crop season. At Nagpur center 341.8 mm rainfall was received in the month of September.

Table: 1.4 Weather conditions during crop season in Zone IV

Location	Sep. 21	Oct. 21	Nov. 21	Dec. 21	Jan. 22	Feb. 22	Mar. 22
Max. Temp. (°C)							
SKN	33.9	35.7	32.6	27.9	25.1	30.9	37.1
NGP	31.8	32.1	31.5	30.2	30.3	33.4	34.9
Min. Temp. (°C)							
SKN	24.6	21.2	16.5	12.0	8.6	11.9	16.9
NGP	22.7	20.5	16.0	12.7	11.2	14.2	16.9
Rainfall (mm) (rainy days)							
SKN	257.2 (11)	NIL	6.2 (2)	3.0(1)	NIL	NIL	NIL
NGP	341.8(20)	NIL	NIL	NIL	27.6 (3)	13.6	13.6.
Max. R.H. (%)							
SKN	82.5	71.8	71.8	71.6	66.6	66.8	70.4
NGP	94.0	65.4	56.6	47.8	49.0	52.5	52.5
Min. R.H. (%)							
SKN	78.0	60.6	50.9	37.8	40.8	27.4	20.9
NGP	67.5	44.4	41.0	35.3	36.4	45.8	45.8
Sunshine (hours/day)							
SKN	-	-	-	-	-	-	-
NGP	1.7	6.7	6.4	5.8	7.1	7.7	7.7

Zone V

All threecenters reported weather data. Good rain was received during cropseason. The maximum temperature ranged from 21.0°C to 35.4°C while minimum temperature ranged 7.3 to 24.4°C during the crop season. Bright sunshine hours varied from 2.8 to 8.3 hrs. Minimum relative humidity ranged from 23.9% to 71.5% while maximum relative humidity from 78.1 to 94.1 during crop season.

Table: 1.5 Weather conditions during crop season in Zone V

Location	Sep. 21	Oct. 21	Nov. 21	Dec. 21	Jan. 22	Feb. 22	Mar. 22	Apr. 22
Max. Temp. (°C)								
JAG	29.7	30.9	29.2	26.8	26.8	29.5	35.0	35.4
KNK	32.7	31.2	28.5	24.5	-	-	-	-
IMP	-	29.4	26.6	22.5	21.0	22.2	29.4	28.5
Min. Temp. (°C)								
JAG	22.2	20.4	17.8	11.8	11.6	11.9	17.2	21.7
KNK	24.4	21.7	16.9	7.3	-	-	-	-
IMP	-	20.0	13.4	10.0	7.9	7.3	13.7	18.2
Rainfall (mm) (rainy days)								
JAG	188.9	57.7	150.5	0.3	65.4	0.5	1.6	12.6
KNK	446.2 (13)	85.8 (4)	24.2 (2)	22.6(2)	-	-	-	-
IMP	-	77.7 (3)	2.0 (0)	70.9(4)	30.4 (3)	47.9 (5)	57.6 (5)	141 (10)
Max. R.H. (%)								
JAG	92.2	93.8	94.1	93.1	93.7	89.4	81.4	78.1
KNK	85.4	85.9	85.2	85.8	-	-	-	-
IMP	-	85.0	84.5	91.4	91.9	87.3	79.7	80.9
Min. R.H. (%)								
JAG	71.5	59.1	55.2	49.7	42.4	30.6	23.9	37.8
KNK	69.4	69.1	69.1	68.9	-	-	-	-
IMP	-	61.5	47.8	53.5	57.8	37.3	37.4	54.9
Sunshine (hours/day)								
JAG	3.4	5.7	4.9	5.2	2.8	7.0	6.5	6.2
KNK	-	-	-	-	-	-	-	-
IMP	-	6.1	8.3	6.6	6.1	7.8	6.8	5.3

2. Genetics & Plant Breeding

2.1 Varietal Improvement

Sixteen centres, spread over 14 states, carried out the varietal development activities as per the approved technical programme. The salient achievements during the year 2021-22 in toria (*B. rapa* var toria), yellow sarson (*B. rapa* var yellow sarson), gobhi sarson (*B. napus*), Indian mustard (*B. juncea*), are discussed below:

2.1.1 Genetic Resource Management

A total of 6966 accessions comprising toria (600), Indian mustard (4937), yellow sarson (305), gobhi sarson (323), brown sarson (17), karan rai (239), taramira (43), *B. caudatus* (04), *B. tournifortii* (07), *B. rugosa* (71), *B. nigra* (09) *S. Alba* (07), Crambe sp (02), *B. chinensis* (01), *B. fruticulosa* (07), *Camelina sativa* (02), *Capsella bursapastoris* (02), *Diplotaxis assurgens* (02) and *Lapidium sp* (02) were maintained through appropriate mating system at Bhubneshwar, Dholi, Hisar, Pantnagar, Ludhiana, Kanpur, Hisar, IARI, New Delhi, Jobner, Morena, Pantnagar, Chatha-Jammu, Jagdalpur and SK Nagar (Table 2.1.1). In addition, 559 new accessions comprising toria (21), Indian mustard (435), yellow Sarson (06), gobhi sarson (28) and karan rai (05) were collected. Further, 1244 accessions consisting of 747 Indian mustard, 61 toria, 250 yellow sarson, 14 gobhi sarson, 14 brown sarson, 110 taramira and 48 *B. rugosa* accessions were evaluated. On the basis of germplasm evaluation, promising accessions were identified for seed yield, earliness, yield components, thermo-tolerant (early and terminal stages), resistance/tolerance to diseases/pests and quality traits in toria at Dholi, Chatha-Jammu and Jagdalpur.

2.1.2 Creation of genetic variability through hybridization/ mutagenesis and selection

Creation of variability is the essence and backbone of the breeding programme. To cater the need of diverse agro-climatic conditions of the country, 79 crosses were attempted in toria, 66 in yellow sarson at Pantnagar, Bhubneshwar, Chatha-Jammu, Jagdalpur and Morena 105 in gobhi sarson at Chatha- Jammu and Ludhiana and 905 in Indian mustard at Bhubneshwar, Chatha-Jammu, Sriganaganagar, Hisar, IARI New Delhi, Ludhiana, Kanpur, Pantnagar, SK Nagar, Morena, Sriganaganagar, Jhansi, Kota and Varanasi to improve seed yield, earliness, seed size, component traits, disease/pest resistance, heat tolerance suitable for late sown condition, drought tolerance, “0” and “00” quality characters and high oil content (Table 2.1.2). Selection of superior plants/bulks at different centres was practised in toria, yellow sarson and Indian mustard. In toria, development of composites population after the selection was the main objective. In yellow sarson, hybridization and 216 single plants selection from segregating generations were attempted at Kanpur and Pantnagar. In Indian mustard, 9632 single plants were selected at New Delhi, Jhansi, Kanpur, Bhubneshwar, Chatha-Jammu, Pantnagar, Ludhiana, SK Nagar, Jagdalpur, Kota, Varanasi and Morena. In Indian mustard, about 979 bulks were selected from segregating and advanced generations.

2.1.3 Evaluation of advanced breeding lines

The advanced breeding lines evaluated under different station/state /preliminary yield trials at various centres have been presented in Table 2.1.3. 67 strains of toria were tested at Kanpur, Chatha-Jammu, and Pantnagar. The yield superiority in toria station trial was up to 24.3 % over the check (PT-303) at Pantnagar. In yellow sarson, 67 strains were tested at Kanpur and Pantnagar. The yield superiority in station trial II up to 25.8 % over the check Pitambari was recorded at Pantnagar. In

Indian mustard, 263 strains were evaluated at 09 centres; Chatha, Imphal, Hisar, Kannpur, Ludhiana, Pantnagar, Dholi, SK Nagar and Varanasi in 37 trials. Seed yield superiority up to 27.2 % over the check NRCHB101 was recorded at Pantnagar. Ten strains at Hisar, 177 strains at Ludhiana and 09 strains at Chatha of gobhi sarson were evaluated for seed yield and its component characters.

2.1.4 Hybrid Development

Efforts for hybrid development continued under “Consortia Research Platform on Hybrids”, at four centres including ICAR-DRMR Bharatpur, ICAR-IARI New Delhi, PAU Ludhiana and CCS HAU Hisar Seventeen experimental hybrids (including 7 from ICAR-DRMR, 05 from PAU, 03 from CCSHAU and 02 from ICAR-IARI) were inducted into different trials of AICRPRM for multilocation evaluation during 2021-22. Twenty experimental hybrids of Indian mustard, comprising five from each of four centres were evaluated in replicated block design at all four centres. On the basis of mean seed yield over four locations (Bharatpur, New Delhi, Ludhiana and Hisar), four hybrids; RHH 2104 (2665 kg/ha), RHH 2108 (2592), RHH 2107 (2515 kg/ha) and DRMRHJ 1517 (2449 kg/ha) out yielded the best check DMH-1 (2373 kg/ha) by a margin of 12, 9, 6, and 3 % respectively. Forty five experimental hybrids were evaluated in augmented block design, keeping plot size of 3m long paired row (CRPMLT 2). Four experimental hybrids; RHH 2114 (3232 kg/ha), MJA 11/RP13-2—2-3 (2940 kg/ha), PHR 3328B (2888 kg/ha) and PHR 1293 (2885 kg/ha) outyielded the best check DMH 1 (2789 kg/ha) by a margin of 15.9, 5.4, 3.5 and 3.4 %, respectively on the basis of average seed yield over three locations. 51 F₁ crosses were evaluated in augmented block design at all four centres. Six crosses exhibited > 10% seed yield heterosis over the best check DMH 1 (2568 kg/ha) on the basis of average seed yield over three locations. Four hundred sixty two experimental hybrids including 44, 332, 69 and 17 at DRMR, CCSHAU, IARI, and PAU, respectively were evaluated at respective centre. Each centre identified promising hybrids at their location. Five hundred fifty seven F₁ crosses including 130 at ICAR-DRMR, 287 at ICAR-IARI and 70 each at PAU and HAU were evaluated. Superior crosses were identified at each centre. In total CMS and restorer are being converted to 173 and 111 nuclear backgrounds, respectively, through backcrossing. In addition 73 CMS and 211 restorer lines were maintained. Seed of 199 experimental hybrids and 781 F₁ crosses was produced for evaluation during next year. Efforts are underway to improve parental lines for white rust resistance, quality traits and for agronomic traits. A set of 70 inbred lines comprising 20, 15, 15 and 20 inbred/germplasm lines from DRMR, IARI, CCS HAU and PAU, respectively, were evaluated against two checks viz., Giriraj and Pusa Mustard 25, in augmented block design for second year. A set of eighty eight inbred lines was grouped into two diverse subpopulations on the basis of genetic diversity assessed through SSR markers.

2.2 Breeder seed production

Indents of 84.38q breeder seed of 70 Rapeseed-Mustard varieties were received from Department of Agriculture and Cooperation (DAC), Ministry of Agriculture and Farmer Welfare, Govt. of India for production during 2021-22. The allocation was made to 20 centres for the production of 84.13q breeder seed of 69 varieties during the 28th annual group meeting held through virtual-video conferencing. Against the indent of 84.13q, 233.16q breeder seed was produced, indicating a surplus availability of 160.16 q. Breeder seed of 03 varieties RH-819, RVM-3 and Pusa Kalyani of Indian mustard and one variety Pant Girija of yellow sarson could not be produced. Further, less quantity of RVM-1 of Indian mustard; Pusa Mustard-26 of Indian mustard; RTM-1355 of Taramira was produced. In addition, 35.67 q breeder seed of 17 varieties was also produced by different centres. The centre and variety-wise details of breeder seed production are reported in Table 2.2.

Table 2.1.1 Genetic Resource Management activities

Crop	Centre	No. of accessions procured/ collected	No. of lines maintained	No. of lines Evaluated	Promising accessions identified	Traits for which identified
1	2	3	4	5	6	7
Torja	Bhubaneswar Ranital (OUAT)	3	132	32	ORT 18-6-16, RAUDT 14-09, PT 2015-8	Earliness, High Yield under late sown conditions
	Dholi	16	16	--	IGT-2, IGT-64, IGT-91, RAUDT-62, RAUDT-15, RAUDT-7, RAUDT-67, RAUDT-36, RAUDT-16, RAUDT-74, RAUDT-79, RAUDT-7, DC9401, TH-9802, Dwarf Torja, Satha local	Earliness and yield components
	Imphal (CAU)	2	7	-	---	-
	Hisar	-	100	-		
	Kanpur	-	255	2 Lines each	-	-
	Pantnagar	-	15	15	GP-2017-22, GP-2016-253, PCPGR-32, PCPGR-33	Seed yield
	Chatha-Jammu	-	44	12		-
Morena		31				
Total		21	600	61	-	-
Indian mustard	Bhubaneswar	4	123	24	TPM1, ORM 2019-01, ORM 41-3-5, TM409, TM 307	Earliness, High Yield under late sown conditions
	Chatha-Jammu	18	104	23	-	White rust resistance
	Dholi	27	27	--	MDOC-8, MDOC-53, MDOC-27, TPM-1, RK-8401, NDRE -4, IC -401574, IC-399788, TM-12, BIO94, Domo, Jatai Local, EC 339000, EC 338997, EC-399301, PAB 9511, PAB 9534, IC401574, IC-399788, RAURDA09-32, RAURDA 09-34, RAURDA 09-78, RAURDA 09-153, RAURDA 09-170, RAURDA 09-172, RAURDA 09-212, RAURDA 09-214	Yield, Earliness, Yield components, Thermo-tolerant (Early and Terminal stages); Resistance/Tolerance to Diseases –Pests, and Quality traits like Oil Content.
	Jobner (SKNAU)	40	40	110	--	--

	Imphal (CAU)	15 (National crossing programme)	27	15	CAU RM 4-1S	Higher yield
	Hisar	-	359	-	-	-
	IARI, New Delhi	14	14	14	Released varieties from other centres	Productivity traits, Seed Size and Adaptability
		-	519	155+ 98	HOC Genotypes; NPJ 253 & NPJ 255, HUJM 19-11, RH 406, DRMRA B 72, and; MSTCDL21-19	High Oil Content, Seed Size and Long main shoot (~1.5m)
		11	8	11	WRW 34, WRW 151, ALT 6	White rust resistance
		-	99	99	-	Low erucic/ Low Glucosinolates content
	Kanpur	-	1465	--	-	-
	Ludhiana		420			
			263 Diversity fixed foundation set-1 (Newton Pori Indo-UK Project)			
			289 Diversity fixed foundation set-2 (ICAR-NASF)			
			Radiation panel (439)			
			70	--	--	<i>Brassica juncea</i> (0/00)
	Nagpur	27	171	198	-	Thermo tolerance (terminal stage) Low erucic acid & glucosinolate
	Pantnagar	264	339		CRP-3, CRP-5, CRP-14, PRHC-17-5, PRHC-14-10, WRR-3, WRR-5, WRR-7, ERJ-159, ERJ-171, ERJ-186, ERJ-191, ERJ-194, ERJ-201, PWR-13-7, PWR-13-16, PWR-13-8, PWR -13-14	Earliness, White rust resistance, <i>Alternaria</i> blight resistance, Immune reaction against white rust
	Morena		161			

	Varanasi	15 (RE 11,NC 37362,RE 44,CN 105364,IC 597880,RLC 3 RE-8, DRMRMJA- 35,DRMRIJ 12-48 ,DRMRIJ 31,LES 39,TN 3,NPJ 112,M 34	-	--	--	
Total		435	4937	747		
Yellow Sarson	Bhubaneswar	-	13	-		
	Dholi	05	05	--	RAUDYS-89-111, RAUDYS-9701, RAUDYS-9702, RS-1, Pendent Local	Yield , Earliness , Yield components Resistance/Tolerance to AB Disease and Oil Content.
	Imphal (CAU)	-	19	-	-	-
	Hisar	-	12	-	-	-
	Delhi	1	28			
	Pantnagar	-	73	27	GP-2017-422, GP 2017-7, PYSC-12-47, PYSC-12-51, PYSC-12- 52, PYSC-55, DRMR 2386, DRMR 2516, DRMR 632	Basal branching, long main raceme , long pod length and yield Component traits
	Kanpur	-	155	--	-	-
Total		06	305	250		
Gobhi Sarson	Dholi	03	03	--	Tower, HNS 0004 and HYOLA 401	Resistance/Tolerance to AB Disease and Quality traits like Oil Content.
	Hisar	-	39	-	-	-
	IARI, New Delhi	-	15	-	-	-
	Ludhiana		230			
	Chatha-Jammu	-	36	14	-	High seed yield
Total		03	323	14		

Brown Sarson	Pantnagar	--	17	14	GP-2011-162, PCPGR-2018-1333, GP-2015-38, PCPGR-7782	Basal and profuse branching, branching
Total		--	17	14		
Karan rai	Dholi	05	05	--	Kiran, PBN-2001, PBN-2002, PBN9501, PBC9221	Resistance/Tolerance to AB Disease
	Hisar	-	8	-	-	-
	Pantnagar		15		IARI-11, IARI-7. IARI-13	Earliness and dwarf height
	IARI, New Delhi	-	171	-	-	-
	Ludhiana		40			
Total		05	239	--	-	
B rapa	IARI, New Delhi	1	28	-	-	-
	Ludhiana	-	150			
		-	192 (Diversity set)			
Total		01	370	-		
Taramira	Jobner	40	40	110		Seed yield
	IARI, New Delhi	-	3	-	-	-
Total		40	43	110		
R. caudatus	IARI, New Delhi	-	4	-	-	-
Total		-	04	-		
B. nigra	IARI, New Delhi	-	8	-	-	
B. nigra	Hisar		01			
Total		-	09	-		
B. rugosa	Pantnagar	48	71	48	EEC-5, EEC-3, EEC-1, IC-399839. IC524259, IC-399826, IC-597933, EEC-25, IC597873	Alternaria blight resistance, Good for vegetable purpose, morphological traits and phytochemical property
		48	71	48		

<i>S. Alba</i>	IARI, New Delhi	-	1	-	-	
<i>S. Alba</i>	Hisar		4			
<i>S. Alba</i>	Ludhiana		2			
Total			07			
<i>Crambe sp</i>	IARI, New Delhi	-	1	-	-	
<i>Crambe sp</i>	Hisar		1			
Total			02			
<i>Crambe abyssinica</i>	ICAR-IARI, New Delhi	-	6			
Total			06			
<i>Lepidium sp</i>	IARI, New Delhi	-	2	-	-	-
Total			02			
<i>Lepidium sativum</i>	IARI, New Delhi		01	-	-	-
Total			01	-	-	-
<i>B. tournifortii</i>	IARI, New Delhi	-	4	-	-	Crossed with <i>B. nigra</i>
<i>B. tournifortii</i>	Hisar		1			
<i>B. tournifortii</i>	Ludhiana		2			
Total			07			
<i>B. chinensis</i>	IARI, New Delhi	-	1	-	-	-
Total			01			
<i>B. fruticulosa</i>	IARI, New Delhi	-	2	-	-	
<i>B. fruticulosa</i>	Hisar		1			
<i>B. fruticulosa</i>	Ludhiana		4			
Total			07			
<i>Sisimbrium (BWMR)</i>	IARI, New Delhi	-	1	-	-	Aphid reaction
Total			01			
<i>Camelina sativa</i>	IARI, New Delhi	-	1	-	-	
<i>Camelina sativa</i>	Hisar		1			
Total			02			
<i>Capsella-bursapastoris</i>	ICAR-IARI, New Delhi	-	2	-	-	
Total			02			

<i>Diplotaxis assurgens</i>	ICAR-IARI, New Delhi	-	1	-	-	Aphid reaction
<i>Diplotaxis assurgens</i>	Hisar		1			
Total			02			
<i>Brassica oxyrrhina</i>	IARI, New Delhi	-	1	-	-	
Total			01			
<i>Diplotaxis muralis</i>	IARI, New Delhi	-	1	-	-	
Total			01			
<i>Diplotaxis siettiana</i>	IARI, New Delhi	-	1	-	-	
Total			01			
<i>Diplotaxis tenuisilique</i>	IARI, New Delhi	-	1	-	-	Aphid reaction
<i>Diplotaxis tenuisilique</i>	Hisar		01			
Total			02			
<i>Enarthrocarpus lyratus</i>	IARI, New Delhi	-	1	-	-	
Total			01			
<i>Erucastrum canariense</i>	IARI, New Delhi	-	1	-	-	
<i>Erucastrum spp</i>	Hisar		01			
Total			02			
<i>Diplotaxis viminea</i>	IARI, New Delhi	-	1	-	-	
Total			01			
<i>Diplotaxis gomez-campoi</i>	IARI, New Delhi	-	01	-	-	
Total			01			
<i>Diplotaxis erucoides</i>	IARI, New Delhi	-	01			
Total			01			
Grand Total		559	6966	1244		

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

Centre	Objective (s)	Generation	Pedigree	No. of crosses/ lines	Selection	
					No. of single plants	No. of bulks
1	2	3	4	5	6	7
Crop: Toria						
Bhubaneswar (OUAT RRTS, Ranital)	Breeding for early maturity, high seed yield strains of Toria suitable for rice-fallows	Fresh Single Crosses	Parents involved: RMT 19-14, Sushree, PT 2015-8, PT 303, RMT 19-17, Parbati	8		
		Multiple crosses	F1 x F1	3		
		F1	24 F1s derived from the crosses among Toria genotypes :Uttara, Sushree, Anuradha, Tapeswari TS-38, TKM 18-1,RAUDT 14-9, CAU-Toria1 , Parbati	24		
		F2	Parbati x PT 303, PT 303 x TS-38 , PT 303 x TKM 18-2	Three F2 populations were grown in large plots		Desirable plants having target trait combinations were selected
		Segregating generations (F3 -F9)	Derived from the crosses: Sushree x PT303, Anuradha x TS-38, PT303 x Panchali, TS-29 x Panchali	10	51	4
		Development of high seed yielding strains of Toria suitable for rice-fallows	Population Improvement:			
			<u>Population1:</u>	PT 303, Tapeswari, RAUDT 14-09, TS-38, Parbati, CAU-Toria1, Anuradha		
<u>Population2:</u> TKM 18-2, PT-2015-10, JT-90-1, Tapeswari, Bhawani, Pant Hill Toria-1, Uttara, PT-508, RAUDT 14-09, Parbati						
	<u>Population3:</u> CAU Toria, Bhawani, Tapeswari, PT-2013-7, PT 303,TKM 18-2, RMT 10-15, T-9, PT-141					
Chatha-Jammu	Early, high yielding	Fresh cross	Composite populations	07		
		F ₁	RSPT-1,RSPT-6,TL-15,PT-303& Uttara , Satha local	08		
		F ₂	Six single crosses using parents RSPT-6, Bhawani,Uttara,PT-303,TL-15&RSPT-9.	06		
		F ₃	PT-2013-5,PT-2013-8,TS-38,TRS-79,TKM-16-1 With Bhawani, PT-303 & Tapeswari	15		
		F ₄	RSPT-3, RSPT-11, TL15 & RSPT-8 With Bhawani & satha local	08		
		F ₅	Composite populations	12		
		F ₆	Open pollination (Early and late populations)	07		

		F ₇	RSPT-1, RSPT-2 , RSPT- 6 cross with PT-303 , PTC-2009-3, RAUDT-10 , TL15 ,TL-21 lines.	10		
			Population improvement in RSPT-1(Recurrent selection)			
Jagdapur		F ₆	Indira toria x PT 303, Indira toria x Panchali, Indira toria x IVT-T 5, Indira toria x IVT-T 14, PT 303 x Panchali, PT 303 x IVT-T 5, PT 303 x IVT-T 14, Panchali x IVT-T 5, Panchali x IVT-T 14, IVT-T 5 x IVT-T 14			
		F ₆ onwards	GPT-1 x GPT-61, GPT-1 x GPT-83, GPT-1 x Indira Toria, GPT-1 x PT-303, GPT-1 x T-9, GPT-61 x GPT-1, GPT-61 x GPT-83, GPT-61 x Indira Toria, GPT-61 x PT-303, GPT-61 x T-9, GPT-83 x Indira Toria, GPT-83 x GPT-1, GPT-83 x GPT-61, GPT-83 x PT-303, GPT-83 x T-9, Indira Toria x GPT-1, Indira Toria x GPT-61, Indira Toria x GPT-83, Indira Toria x PT-303, Indira Toria x T-9, PT-303 x GPT-1, PT-303 x GPT-61, PT-303 x GPT-83, PT-303 x Indira Toria, PT-303 x T-9, T-9 x GPT-1, T-9 x GPT-61, T-9 x GPT-83, T-9 x Indira Toria, T-9 x PT-303			
Morena	Earliness, high seed yield bold seed and quality	F ₁	Crosses among PT-303, TKM—20-02, BAUST-08-08,RMT-19-14, CG Toria-3, TKM-20-1,ORT 2019-01, Tapeswari, CG Toria-4, Bhawani,RMT-19-17,PT-2015-09, JT-14-05	27		
		F ₂	CG Toria-2-, TKM 19-01, TL-19, ORT 18-6-16, Tapeswari, CAU Toria-2, JT 13-8,PT 2015-6,TL-18, TKM 19-2,BAUT 08-06,PT 303, CAU Toria-1-1, PT-2015-07, RMT 10-5-18, BAUT-08-07	16		
		F ₃	Crosses among JT-1, PT-303, TKM—18-2, RMT-10-15, CAU Toria-1, TKM-18-1, Bhawani, Tapeswari, PT-2015-10, PT-2013-1, RVT-1, RVT-2	14		
		F ₄	JT-1 x BAUT-08-01, TKM 17-1, TKM 17-2, PT-2015-3,	5		
		F ₅	JT-1 x TS-36, JT-1 x TRL-79 (ASR), RMT-10-9-1,TH-1502, PT-2013-8	5	25	
		F ₆	JT-1 x PT-303, JT-1 TKM-15-1 Tapeswari	3	15	
		F ₁₁	RMT-02-6, RMT-10-6	1	5	
		F ₁₂	NDT 5-3, JT-1	1	-	
Pantnagar	Earliness	Fresh crosses	PT-30 x Bhawani, , PT-507 x Bhawani, , PHT-1 x Bhawani, , Uttara x Bhawani, PT-2015-6 x Bhawani, PT-2015-7 x Bhawani, PT-2017-2 x Bhawani	7	-	-
		F ₁	T-9 x PT-141, T-9 x PT-2020-8, T-9 x PT-2020-9, PT-2020-2 x PT-141, PT-2020-3 x PT-2020-9, PT-2020-4 x PT-2020-9	6	-	5
		F ₂	PT-2015-6 x Bhawani, PT-508 x Bhawani, Tapeswari x PT-141, PT-2017-2 x PT-141, PT-2012-5 x Bhawani	5		5
		F ₃	(PT-15-6 x PT-16-24) x PT-141	1		1
		F ₄	(KBS – 49 x Uttara) x PT-141	1		1
				Population improvement in PT-141 (recurrent selection)		

	Seed yield	Fresh crosses	PT-2017-2 × PT-2017-3, PT-2018-6 × PT-2017-2, PT-2018-6 × PT-2017-3, PT-2018-3 × PT-2018-6, PT-2018-3 × PT-2017-2, PT-2018-3 × PT-2017-3, PT-30 × Tapeswari, PT-30 × T-9, PT-507 × Tapeswari, PT-507 × T-9	10	-	-	
		F1	PT-2020-1 × PT-2018-8, PT-2020-5 × PT-2018-8, PT-2020-5 × PT-15-4, PT-2020-7 × PT-2020-2, PT-2020-7 × PT-2015-4, PT-2020-2 × PT-2020-7, PT-2020-2 × PT-2020-9, PT-2016-3 × PT-2020-5, PT-2016-3 × PT-2020-7, PT-2016-3 × PT-2019-1, PT-2020-3 × PT-2019-1, PT-2020-3 × PT-2020-9, PT-2020-4 × PT-2020-9	13	-	6	
		F2	PT-2016-16×Tapeswari, PT-2018-5×PT-30, PT-2018-9×Uttara, TCN-19-1×PT-508, TCN-19-4×PT-508, TCN-19-18×PT-30, Tapeswari × TCN-19-15, PT-30×TCN-19-9	8		3	
		F3	PT-15-3×PT-16-6, PT-15-3×TKM-17-1, (Tapeswari × PT-30) × RAUDT-10-33, TKM-18-2×PT2017-3	4		3	
		F4	PT-15-10 ×PT-16-10, PT-15-4×Tapeswari, Tapeswari×PT-30	3		3	
		Composite					
		C0	PTC-2022-1, PTC-2022-2, PTC-2022-3, PTC-2022-4, PTC-2022-5, PTC-2022-6,	6	-	-	
		C1	PTC-2021-1, PTC-2021-2, PTC-2021-3, PTC-2021-4, PT-2021-5	5		3	
		C3	PTC-2020-1, PTC-2020-2	2		1	
		Recurrent selection	PT 2020-3, PT 2020-9, PT 2020-6, PT 2020-7, PT2008-7×RAUDT-10-22				
			Development of inbred in toria				
		Fresh crosses	PHT-1 × Tapeswari, PHT-1 × T-9, Uttara × Tapeswari, Uttara × T-9, PT-2017-2 × Tapeswari, PT-2017-2 × T-9, PT-2015-6 × Tapeswari, PT-2015-6 × T-9, PT-2015-7 × Tapeswari, PT-2015-7 × T-9,	10	-	-	
		Specific adaptation to hill	F1	BSGP-6 × PT-2015-6, BSGP-6 × PT-2018-3, BSGP-6 × PT-2018-9, BSGP-25 × PT-2015-7, BSGP-25 × PT-2018-9, BSGP-25 × PT-2018-3, PT-2020-1 × GP-11-162, PT-2020-1 × PCPGR-7810, PT-2020-3 × PCPGR-7785, PT-2020-5 × PCPGR-348, PT-2020-6 × Lahi-1-06, PT-2020-6 × GP-7771	12	-	3
			F2	PT-2016-16 × PHT-1, PT-2018-1×PHT-1, PT-2018-9×PHT-1, TCN-19-4 ×PHT-1	4		3
F3	Uttara × KBS-49, Uttara × PHT-1, Uttara × PTHC-10-1, PT-16-3 × KBS-49, PT-16-3 × PHT-1, PT-16-3 × PTHC-10-1		6		2		
F4	(KBS-49 × PHT-1) × PT-30, (KBS 49×PHT-1)×Uttara,		2		2		
Crop: Yellow Sarson							
Bhubaneswar (OUAT RRTTS, Ranital)	Development of high -yielding strains of Yellow Sarson suitable for rice-fallow s of Odisha	Fresh Single crosses	Seven fresh single crosses were done involving parents DRMYS 202 x YSH 401, RMYS2 x NRCYS 05-02, Pitambari x PYS 2018-02, B9	7			
		F1	Parents: Pitambari, YSH 04-01,NRCYS 05-02 , Pant Sweta	11			
		M4-generation (EMS-induced mutation breeding)	Parents: NRCYS 05-02 YSH 04-01 Mutagen: 0.5% EMS		34		
Pantnagar	High seed yield	Fresh crosses	PYS 841 x Pitambari, PYS 841 x PYS-21-21, PYS 841 x PYS-21-4, PYS 842 x NRCYS 0502, PYS 842 x PYS 21-12, PYS 842 x YSH 0401, PYS 89-7 x PYS-21-21, PYS 89-7 x PYS-21-4, PYS 89-7 x YSH 0401, PYS-17-8 x Pitambari, PYS-17-8 x PYS-21-15, PYS-17-8 x PYS-21-12, PYS-17-11 x PYS-21-15, PYS-17-11 x PYS-21-4, PYS-17-11 x PYS-21-2, PYS-17-13 x	59	-	-	

			PYS-21-18, PYS-17-13 x NRCYS 0502, PYS-17-13 x NDYS 2018, PYS-17-13 x PYS-21-2, PYS-18-7 x PYS-21-21, PYS-18-7 x PYS-21-15, PYS-18-7 x PYS-21-12, PYS-21-1 x Pitambari, PYS-21-1 x NDYS-20-18, PYS-21-6 x NRCYS 0502, PYS-21-6 x PYS-21-2, PYS-21-7 x NDYS-107, PYS-21-7 x NDYS 2018, PYS-21-7 x YSH 0401, PYS-21-12 x PYS-18-3, PYS-21-12 x PYS-18-1, PYS-21-12 x YSH 0401, PYS-21-14 x PYS-21-18, PYS-21-14 x NRCYS 0502, PYS-21-14 x PYS-6, PYS-21-20 x NRCYS 0502, PYS-21-20 x YSH 0401, PYS-21-21 x PYS-18-3, PYS-21-21 x PYS-842, PYS-21-21 x PYS-21-2, YSCN-20-1 x NRCYS 0502, YSCN-20-1 x PYS-18-1, YSCN-20-2 x YS 89-7, YSCN-20-2 x PYS-17-8, YSCN-20-2 x NRYS-05-02, PYS-18-8 x PYS-21-2, PYS-18-8 x PYS-18-1, PYS-18-1 x YSH 0401, PYS-18-1 x NRCYS 0502, PYS-18-1 x Pitambari , PYS-18-2 x YSH 0401, PYS-18-2 x NRCYS 0502, PYS-18-2 x Pitambari, PYS-18-3 x YSH 0401, PYS-18-3 x NRCYS 0502, PYS-18-3 x Pitambari, PYS-18-6 x YSH 0401, PYS-18-6 x NRCYS 0502, PYS-18-6 x Pitambari			
			PYS-2018-1 x DRMR-208, PYS-2018-1 x PYS-842, PYS-2018-1 x PYS-20-7, PYS-18-1 x NRCYS-0502, PYS-18-1 x PYS-16-15, PYS-18-4 x DRMR-2332, PYS-18-4 x PYS-20-3, PYS-18-4 x NDYS-12-3, PYS-17-8 x PYS -20-8, PYS-17-8 x PYS-842, PYS-17-8 x NDYS-123, PYS-18-4 x PYS-16-15, PYS-18-4 x PYS-842, PYS-17-8 x DRMR-632, PYS-17-8 x PYS-20-8, PYS-17-8 x NRCYS-0502, PYS-17-8 x PYS-16-15, PYS-17-8 x PYS-18-1, PYS-17-11 x PYS-16-15, PYS-17-11 x PYS-18-8, PYS-17-11 x PYS-20-3, PYS-841 x PYS-16-15, PYS-841 x PYS-18-9, PYS-841 x PYS-16-8, YS-0401 x PYS-16-15, YS-0401 x PYS-6, YS-0401 x PYS-20-8, PYS-841 x PYS-17-4, PYS-841 x YS-89-1, PYS-841 x PYS-16-13, YSGP7 x PYS7, YSGP6 x PYS8, PYS-17-11 x PYS-18-2, PYS-17-11 x PYS-18-3, PYS-17-11 x PYS-17-6 YSGP6 x Pant Sweta, YSGP6 x PYS-17-8, YSGP6 x PYS-16-8, YSGP6 x PYS-7, YSGP6 x PYS-16-15, YSGP7 x Pant Sweta, YSGP7 x PYS-16-8, YSGP7 x GP 51, YSGP7 x PYS-89-2, PYS-18-3 x PYS-17-8, PYS-18-3 x PYS-842, PYS-18-3 x PYSGP-55, PYS-18-3 x YSH-0401, PYS-18-3 x PYS-18-4, GP-49 x GP-55, GP-49 x GP-52, GP-51 x GP-55, GP-51 x GP-52, PYS-18-1 x GP-49, PYS-18-1 x PYS-841, PYS-18-1 x PYS-17-6, YSGP-51 x PYS-18-4, YSGP-51 x PYS-1, YSGP-51 x PYS-18-1, YSGP-51 x PYS-16-15, YSGP-51 x NDYS-123, YSGP 49 x PYS-6, YSGP 49 x PYS-841, YSGP 49 x YS-89-1, YSGP 49 x PYS-17-6, YSGP 49 x PYS-17-4, YSGP 55 x PYS-841, YSGP 55 x PYS-18-1, YSGP 55 x PYS-18-4, YSGP 55 x YSGP 51, YSGP 55 x PYS-17-8, YSGP 52 x PYS-18-4, YSGP 52 x PYS-18-1, YSGP 52 x PYS-20-3, YSGP 52 x YSGP 49, YSGP 52 x PYS-1	75	-	24
	F ₂	B-9 x PYS-2018-4, B-9 x PYS-2017-6, B-9 x PYS-2017-8, PPS-1 x PYS-2018-4, PPS-1 x PYS-2017-6, Pant Sweta x PYS-2018-4, Pant Sweta x PYS-2017-6, Pant Girija x PYS-2017-6, NRCYS-0502 x PYS-2018-4, NRCYS-0502 x PYS-2017-6, NRCYS-0502 x PYS-2017-8, Pitambari x PYS-2018-4, Pitambari x PYS-2017-6, Pitambari x PYS-2017-8, YSH-401 x PYS-2018-4, PYS 2018-10 x PYS-6, YSH-401 x PYS-2017-6, YSH-401 x PYS-2017-8, NDYS 123 x PYS-6, PYS-17-6 x PYS-6, NDYS 2018 x PYS-6	20	182 IPS	02	
	F ₃	YS-89-7 x NDYS-107, Pitambari x NDYS-107, Pitambari x NDYS-2018, NDYS-842 x PYS-16-7, NDYS-842 x NDYS-2018, NDYS-842 x NDYS-123, PYS-17-6 x PYS-16-7, PYS-17-6 x NDYS-2018, PYS-17-6 x NDYS-123, PYS-17-6 x PYS-2016-15, PYS-17-11 x NDYS-2018, PYS-17-11 x NDYS-123, PYS-17-11 x PYS-2016-15,	14		11 (257 IPS)	
	F ₄	PYS-58-13 x NRCYS-05-02, PYSC-21-6 x YS-89-7, PYSC-41-3 x NRCYS-05-02, PYSC-40-4 x RAUDYS-14-9, PYS-841 x RAUDYS-14-9, PYSC-53-5 x RAUDYS-14-9, (PYS-2016-6 x	8		5 (148 IPS)	

			PYS-6) × RAUDTYS-14-9, PYS-842 × NRCYS-0502			
		F ₅	PYS-6 × NDYS-123, PYS-6 × NDYS-115 (BL), PYS-6 × NDYS-115 (ML), DRMRYS-2016-42 × YSH-842, PYS-2016-6 × PYS-6, PYS-2011-43 × PYS-2012-4	6 (154 IPS)		77 IPS
		F ₆	NDYS-2018 × YSH-401, PYSC-11-43 × YSH-401, NDYS-123 × Sweta, NDYS-123 × PPS-1	4 (94 IPS)	-	43 lines
		F ₇	PYS-841 × PYSC-11-47, PYS-6 × PYSC-11-47, NRCYS-502 × PYSC-11-47, NRCYS-502 × PYSC-11-43, PYSC-11-31 × PYSC-11-43	5 (30 lines)	-	15 lines
Crop: Indian mustard						
Bhubaneswar (OUAT RRTS, Ranital)	Breeding for early maturity, high seed yield strains Mustard suitable for rice-fallows	Fresh single crosses	Agronomic bases: ORM 2019-02, TM 258, NRCHB 101, PM 25 Donors: DRMRIJ 31(bold seed, high yield, good combining ability) NPJ 112 (Earliness, good combining ability) RLC3 (Genetic diversity, low erucic acid) LE39 (Low erucic acid, good combining ability)	28 crosses		
		Multiple crosses	F1 x F1	9crosses		
		F ₁	Parents involved: NRCHB101, Pusa Bold, Pusa Mustard 25, KMR(E) 19-1, PRE 17-2, BAUM-09-12-1, Pusa Mustard 28, OMR-41-3-5, TM 106, TM 117, TM 208, TM 108-1	31 crosses		
		F ₂	RMM-10-1-1 x NRCHB 101, RMM 10-1-1 x NPJ 226	Two F2 populations were grown in large plots and desirable plants having target trait combinations were selected		
	Earliness and high yield	Segregating generations (F3 to F6)		9 crosses	56	
	High yield under late sown conditions	M ₄ -generation	Parents: Kranti, NRCHB101 Dosage: 0.4% EMS, 8hr and 0.7% for 6hr		65 single plants selected	
Chatha-Jammu	High Seed yield & White rust resistance	Fresh crosses (National hybridization programme)	RSPR-69, RSPR-01, RSPR-03 With RE-11, NC 37362, RE-44, CN105364, IC-597880, RLC-3, RE-8, DRMRMJB-35, DRMRIJ 12-48, DRMRIJ 12-40, NPJ-112,TN-3 , M-34 ,DRMR-2035, DRMR-2019 & Bioysr.	48		
	Breeding for Stress (Moisture Stress)	F ₁	RH-1658,SKJM-16,PBR-378,RH-1584,RH-1424,PMM 12-2-18,RSPR-01,DRMR 15-35&OMR4-3-5 With RH-406,RGN-48, RB-50 & RH-725	36		
		F ₂	Attempted using agronomically superior 15 genotypes with RH-761, RB-24& RH725.	45		
		F ₃	RSPR-69,RSPR-5,RSPR-1,RSPR-3,RH-1209,RH-0923,SKJM-5,SKJM-3 With NRCHB-101,	24		

	High Seed yield		RH-406 & RH-749			
		F ₄	RGN-400,DRMRIJ-16-1,PRE-2013-10,DRMRCI-55,NRCHB-101,RH-1207 WITH RH-406,PM-25&RH-1573	16		
		F ₅	RSPR-01, RH-30, RSPR-03, RH-749,RSPR-69 & RB-24 with RH-406,RB-50, RH-819 & DRMR 541-44	20		
		F ₆	NRCDR-2, NRCHB-101, NPJ-112, DRMRIJ-31, PUSA BOLD, RB-50, RH-749 with RSPR-69, RSPR-01 & RSPR-03	12		
		F ₇	Early and late populations	05		
		Advanced lines		12		
Dholi	To develop high temperature tolerant mustard strains for early sown condition	M6	Source material :RajendraSuflam (i)Dosages of Gamma Rays: 05, 80Kr, 90Kr, 100Kr, 110Kr, 120 Kr (ii) Dosages of Gamma Rays +EMS: 0490Kr +0.2%EMS, 90 Kr+0.3% EMS, 100Kr +0.2%EMS, 100 Kr+0.3% EMS	09	351	199
	Early Maturity, Yield & component traits	Fresh crosses	Set 01 : RX*DRRIJ-31, RS*CN-105364, VARUNA*DRMRIJ-31, VARUNA*CN105364, RS*RE44, RS*DRMRJA-35, RS*TN-3, RS*NPJ112, RS*DRMRJA-35, RS*DMRIJ-12-48, RS*DRMRIJ-12-40, RS*NC-37362, RS*RE11, RS*IC597880, RS*M-34 (15 Crosses) Set 02 : RS*RE11, RS*NC-37362, RS*RE44, RS*CN105364, RS*IC59M880, RS*RE-8, RE-11*NC37362, RE11*RE44, RE11*CN-105364, RE11*IC-597880, RE11*RE8, NC37362*RE44, NC*37362*CN-105364, NC37362*IC597880, NC37362*RE8, RE44*CN105364, RE44*IC594880, RE44*RE8, CN105364*IC-597880, CN-105364*RE-8 and IC597880*RE-8 (21 Crosses)	36	--	--
Imphal (CAU)	High yield and non shattering habit suitable for rainfed condition	F5	Local Yella x Kranti	2		
	High yield and oil content	F2	Local Yella x PM 25, Local Yella x JD 6, Local Yella x Pusa bold, Local Yella x DRMR 150-35	4	20	
	High yield, earliness, white rust resistance	Fresh crosses attempted	Local Yella x RE11, Local Yella x RE8, Local Yella x DRMRJB 35, Local Yella x DRMRIJ 12-48, Local Yella x DRMRIJ 12-40, Local Yella x DRMR IJ 31, Local Yella x NPJ 112	7	-	-
Hisar	Breeding for early raya	F1(New crosses)	RH 1999-23, RH 1999-31, RH 1999-38 and RH 2199-11 as agronomically superior backgrounds and IC-424421, IC-426383, WRR 21-6 and MCN 21-24 as donor sources	16	-	-
		F2	-	4	31/12	-
		F3	-	20	46/22	-
		F5	-	13	28/10	-
		F6	-	9	48	8
	Breeding for component traits	F1(New crosses)	RH 1839, RH 1928, RH 2022, RH 2067, RH 2076, RH 2078, RH 2111, RH 2121, RH 2128 and RH 2150 as base population and MCNR 21-12 and RH 2070 as donor sources in one set. RH 2049 as agronomical superior back ground and MCN 21-21, MCN 21-25 and MCN 21-28 as donor sources in another set.	27	-	-
	F2	-	18	289/78	-	

		F3	-	45	170/48	-
		F4	-	23	102/44	-
		F5	-	47	161/80	-
		F6	-	86	439	70
	Breeding for Disease resistance	F ₁ (New crosses)	RH 1839, RH 1928, RH 2022, RH 2067, RH 2076, RH 2078, RH 2111, RH 2121, RH 2128 and RH 2150 as base population and EC-766091 as donor source for white rust resistance.	10	-	-
		F2	-	4	29/13	-
		F3	-	15	118/24	-
		F4	-	14	117/17	-
		F5	-	8	33/8	-
		F6	-	5	78	4
	Breeding for aphid tolerance	F ₁ (New crosses)	RH 1839, RH 1928, RH 2022, RH 2067, RH 2076, RH 2078, RH 2111, RH 2121, RH 2128 and RH 2150 as base population and Glossy-1 as donor source for aphid tolerance.	10	-	-
		F2	-	4	27/13	-
		F3	-	12	94/14	-
		F4	-	15	88/17	-
		F5	-	5	33/8	-
		F6	-	10	44	8
	Breeding for quality traits	F ₁ (New crosses)	RH 1839, RH 1928, RH 2022, RH 2067, RH 2076, RH 2078, RH 2111, RH 2121, RH 2128, and RH 2150 as base population and RH (OE) 1706 as donor source for '0 erucic acid'.	10	-	-
		Intermate	Third, second and first inter mate in 12, 9 and 17 low erucic acid progenies	12,9,7	-	-
		BC 3	-	7	-	-
		BC 2	-	7	-	-
		BC 1	-	6	-	-
	Development of hybrids in Indian mustard		Two Small Scale Trials comprising 16 experimental hybrids in each trial and two checks, RH 725 and 45S46 were conducted and results are being compiled			
			268 new test hybrids based upon <i>Ogura</i> CMS system were evaluated against three checks. The data analysis is in progress.			
			13 A lines of <i>Mori</i> and 26 A lines of <i>Ogura</i> CMS system were maintained.			
			39 R lines of <i>Mori</i> CMS and 91 R lines for <i>Ogura</i> CMS system were maintained.			
			Generations were advanced for incorporation/diversification of <i>Ogura</i> CMS system into 68 different genetic backgrounds			
			Six new agronomical superior genotypes were used for diversification of R lines in <i>Ogura</i> CMS system.			
			160 new test F ₁ hybrids based upon <i>Ogura</i> CMS systems were developed for evaluation.			
IARI, New Delhi	Development of High yielding Varieties Suitable for Timely Sown Irrigated and Rainfed Situations					
	Development of high yielding mustard varieties	Single crosses	NPJ 252, NPJ 253, NPJ 254, NPJ 176, NPJ 156, RH 406, RH 1224, RH 1222-28, RH 9811, DRMR 601, DRMRIJ20-109, DRMR 1165-40, DRMRAB 158 and station trials entries from IARI	70	-	-
		(Multiple crosses)	NPJ 231, NPH 253, NPJ 241, NPJ 243, PM 27, Pusa 119-1-1-2, Pusa 36-1-1-3-2	26	-	-
		F ₁	Diverse <i>B. juncea</i> genotypes	79	-	-

	MCF ₁	Diverse <i>B. juncea</i> genotypes	22	66	-
	F ₂	Diverse <i>B. juncea</i> genotypes	47	196	-
	MCF ₂ / BC ₁ F ₂	Diverse <i>B. juncea</i> genotypes	38	50	-
	F ₃	Diverse <i>B. juncea</i> genotypes	95	80	-
	F ₄	Diverse <i>B. juncea</i> genotypes	37	30	-
	MC F ₄	Diverse <i>B. juncea</i> genotypes	33	28	-
	F ₅	Diverse <i>B. juncea</i> genotypes	58	43	-
	F ₆	Diverse <i>B. juncea</i> genotypes	9	3	-
	MC F ₆	Diverse <i>B. juncea</i> genotypes	17	2	10
	F ₇	Diverse <i>B. juncea</i> genotypes	20	-	17
	F ₈	Diverse <i>B. juncea</i> genotypes	2	-	1
Incorporation of white rust resistance in improved genetic backgrounds suitable for timely sown conditions	Single crosses	Pusa Bold (A4A5)-842, Varuna (A4A5)- 936-279, Rohini (A4A5)-491, Pusa Jaikisan (A4A5)-21, Alt 6, Ooty Local, NPJ 252, NPJ 253, NPJ 176, WRW 28, WRW 34, WRW 71, and station trial entries from IARI.	30	-	-
	Multiple crosses	NPJ 231, NPJ 241, RH 725, Donskaja, Heera and entries from station trials from IARI	10	-	-
Incorporation of white rust and powdery mildew resistance in improved genetic backgrounds suitable for timely sown conditions	Multiple crosses	RDV 29, RH 725, NPJ 253, NPJ 176 etc.	5	-	-
Development of high yielding bold seeded <i>B. juncea</i> genotypes	Single crosses	Bold, medium and small seeded diverse <i>B. juncea</i> genotypes	210	-	-
Wide hybridization for trait introgression for related/ wild species	Single crosses (F ₁)	SEJ 8, NPJ 176, Pusa Tarak, NPJ 253, <i>B. tournefortii</i> , <i>Sanapis alba</i> , <i>Diploptax erucoides</i> , <i>oxy-campastris</i> etc.	15	-	-
Development of High Yielding Hybrids					
Maintenance of CMS lines	Backcross (3 pairs each)	CMS lines developed at ICAR-IARI and other national programme.	62 x 3	186 single plants were used	-
Development of New CMS lines	Backcross	Pusa Mehak, LES 57, RH 555, Pusa 77-1-1-1, Pusa 94-1-1-2, NPJ 196, DRMRAB 158, DRMRAB 714.	09	09 backcrosses	-
Development of new fertility Restorers	BC ₁ F ₄ /F ₁	NPJ 253, DRMRIJ 31, Pusa Bahar etc.	52	52	-
Generated test crosses	F ₁ (A x R)	28 CMS Lines and about 25 R lines	119	-	-
Development of Short Duration Varieties Suitable for Early or Late Sown Conditions					
Development of Short duration varieties for early and late sown conditions	Single	MCNL21-7, MCNL21-8, MCNL21-9, MCNL21-15, PM 25, PM 26, PM 27, Radhika, NPJ 240, NPJ 248, NPJ 250, NPJ 230, PM 27, MCN E21-4, MCN E21-17, CN-101846, CN-597881, RH 1999-18, DRMR 2017-21, DRMRIJ	46	-	-

			17-46, DTM-12, Vasundhra, CN-105234, RH 1730			
Wide hybridization for development of short duration varieties suitable for early sown conditions	Single		PM 27/TL 15 and Pusa Jagannath/ TL 15	2	-	-
Development of short duration varieties suitable for early sown conditions	F1		Diverse <i>B. juncea</i> genotypes	21	21	-
	F2		Diverse <i>B. juncea</i> genotypes	19	63	-
	F3		Diverse <i>B. juncea</i> genotypes	42	24	-
	F4		Diverse <i>B. juncea</i> genotypes	78	56	-
	F5		Diverse <i>B. juncea</i> genotypes	18	15	-
	F6		Diverse <i>B. juncea</i> genotypes	17	1	11
	F7		Diverse <i>B. juncea</i> genotypes	16	-	14
Development of short duration varieties suitable for late sown conditions	F2		Diverse <i>B. juncea</i> genotypes	22	106	-
	F3		Diverse <i>B. juncea</i> genotypes	48	50	-
	F4		Diverse <i>B. juncea</i> genotypes	54	49	-
	F5		Diverse <i>B. juncea</i> genotypes	41	40	-
	F6		Diverse <i>B. juncea</i> genotypes	58	5	33
	F7		Diverse <i>B. juncea</i> genotypes	7	-	7
Generating mapping populations (RILs) and development of short duration genotypes with powdery mildew resistance	F6:F7		PMW 25 x RDV 29	246	-	-
Generating mapping populations (RILs) and development of High Temperature tolerant short duration genotypes	F ₄ : F ₅		Pusa Mustard 28 x Pusa Karishma	521	-	-
Generating Breeding Material with Improved Oil and Seed Meal Quality						
Enhancement of oil and meal quality coupled with improved yield in Indian mustard	Single cross		PM-32, PDZM-33, QM21-6, IVT-QM21-12	4	-	-
	Multiple crosses		DMH-1, 45S46, PDZM-33, PM-32, RLC-3, RH-801, RH 1706, Giriraj, RCH-1, Heera, PM-30	22	-	-
Complimenting white rust resistance with quality traits	F ₁ / BC2F ₃ , /BC2F ₃ , BC3F ₃ / etc.		PM 22, PM 30, PM 25, PM 32, PM 26, Pusa Jagannath, Heera, Donskaja, RLC 3	10	-	-
Wide hybridization for trait improvement in quality mustard	Single		PM 32/GSL 7, PM 32/BCEF-1-00-18-1-7	2	-	-

	Development of high yielding genotypes with low erucic acid in oil and low glucosinolates in the seed meal cake	F1	Diverse <i>B. juncea</i> genotypes	14	-	-
		MCF1	Diverse <i>B. juncea</i> genotypes	12	60	-
		F2	Diverse <i>B. juncea</i> genotypes	15	121 (0/00)	-
		MCF2/ BC1F2	Diverse <i>B. juncea</i> genotypes	64	65(0)+121 (00)	-
		F3	Diverse <i>B. juncea</i> genotypes	29+70	56(0)+201 (00)	-
		F4	Diverse <i>B. juncea</i> genotypes	24+4	80(0)+10 (00)	-
		F5	Diverse <i>B. juncea</i> genotypes	18+24	80(0)+49 (00)	-
		F6	Diverse <i>B. juncea</i> genotypes	20+10	7(0)+3 (00)	10(0)+7 (00)
		F7	Diverse <i>B. juncea</i> genotypes	18+10	-	13(0)+7 (00)
Ludhiana	For productivity, diversity maturity	Introgression sets	<i>B. juncea</i> x <i>D. cardamoides</i> <i>B. juncea</i> x <i>B. fruticulosa</i>	-	-	
		Fresh crosses	PBR-814-1 X RE-44, PBR-814-1 X RE-8, PBR-814-1 X RE-11, PBR-814-1 X CN-105364, PBR-814-1 X NPJ-112, PBR-814-1 X TN-3, PBR-814-1 X DRMRIJ-31, PBR-814-1 X M-34, PBR-814-1 X DRMRIJ-35, PBR-814-1 X NC-37362, PBR-357 X RE-44, PBR-357 X RE-8, PBR-357 X RE-11, PBR-357 X RE-44, PBR-357 X DRMRIJ-31, PBR-357 X M-34, PBR-357 X NC-37362, PBR-357 X NPJ-112, PBR-825-5 X RE-11, PBR-825-5 X RE-8, PBR-825-5 X RE-44, PBR-825-5 X TN-3, PBR-825-5 X DRMRIJ-31, PBR-825-5 X M-34, PBR-825-5 X DRMRIJ-35, PBR-825-5 X NC-37362, PBR-825-5 X CN-105364, PBR-825-5 X NPJ-112, PBR-825-5 X IC-597880, PBR-939 X RE-11, PBR-939 X RE-44, PBR-939 X RE-8, PBR-939 X DRMRIJ-31, PBR-939 X M-34, PBR-939 X NC-37362, PBR-939 X NPJ-112, PBR-939 X IC-597880, PBR-758-1 X RE-8, PBR-758-1 X RE-11, PBR-758-1 X RE-44, PBR-758-1 X TN-3, PBR-758-1 X DRMRIJ-31, PBR-758-1 X M-34, PBR-758-1 X NC-37362, PBR-758-1 X NPJ-112, PBR-758-1 X IC-597880, PBR-788-1 X RE-11, PBR-788-1 X RE-8, PBR-788-1 X RE-44, PBR-788-1 X DRMRIJ-31, PBR-788-1 X M-34, PBR-788-1 X M-34, PBR-788-1 X NC-37362, PBR-788-1 X NPJ-112, PBR-788-1 X IC-597880, PBR-788-1 X IC-597880, PBR-813-2 X RE-11, PBR-813-2 X RE-44, PBR-813-2 X RE-8, PBR-813-2 X TN-3, PBR-813-2 X DRMRIJ-31, PBR-813-2 X M-34, PBR-813-2 X NC-37362, PBR-813-2 X NPJ-112, PBR-813-2 X IC-597880	65		
	F1	AD-101 X AD-104, AD-101 X PBR-357, AD-101 X PBR-91, AD-101 X WRR-20-1, AD-104 X WRR-20-1, AD-64 X AD-101, AD-64 X WRR-20-1, AD-64 X PBR-357, AKGS-8146 X NDT-84, AKMS- 19-2 X RH-1799-24, AKMS- 19-2 X SKM-17-2, AKMS-19-2 X RE-13, AKMS-19-2 X NPJ-232, BAUM-08-14 X DTM-214, BAUM-08-14 X DTM-220, BAUM-08-14 X DTM-235,BAUM-08-18 X JA-23, BAUM-08-18 X JA-39, BAUM-08-18 X JA-92, BAUM-08-18 X PBR-450, DONSKAJA X PBR-450, DONSKAJA X PBR-507, DONSKAJA X RLM-619, DRMR- 5J-47 X NPJ-233, DRMR-5J-47	103			

			X JA-42, DRMR-5J-47 X PBR-450, DRMR-5J-47 X RGN-472, DRMR-5J-47 X TM-263-6, DRMR- IC -16- 38 X IM-39, DRMR-CI-117 X IM-59, DRMR-CI-117 X RE-11, DRMR-CI-117 X RE-13, DRMR-CI-117 X RE-14, DRMR-CI-118 X BAUM-08-18, GIRIRAJ X IVT-TS-20-22, GIRIRAJ X PBR-357, GIRIRAJ X RE-11, GIRIRAJ X RE-13,GIRIRAJ X RH-1424, GIRIRAJ X RH-725, GIRIRAJ X RL-1359, JA-23 X JA-39, JA-23 X JA-42, JA-39 X JA-42, KMR-19-3 X DRMR-CI-117, LES-54 X LES-60, LES-54 X RE-46, LES-60 X RE-46, NPJ-229 X PRE-17-5, NPJ-229 X RH-1999-42, NPJ-233 X BAUM-08-18, NPJ-233 X JA-42, NPJ-472 X JA-39, NPJ-472 X JA-42, PB-50 X DRMR-5J-47, PB-50 X JA-42, PB-50 X PBR-450, PB-50 X RH-1799-24, PBR- 357 X RL-1359, PBR- 378 X IVT-TS-20-22, RGN-236 X RH-1599-41, RGN-236 X RLM-619, RH-1424 X NPJ-232, RH-1424 X RE-11, RH-1424 X RE-13, RH-1424 X RE-14, RH-1424 X RH-1799-24, RH-1424 X SKM-1712, RH-1599-41 X IM-17, RH-1599-41 X IM-39, RH-1799-24 X DRMR-5J-47, RH-1799-24 X DRMR-CI-118, RH-1799-24 X JA-23, RH-1799-24 X JA-39, RH-1799-24 X JA-42, RH-1799-24 X NPJ-233, RH-1799-24 X PBR-450, RH-1799-24 X RGN-472, RH-1799-42 X DTM-235, RH-1799-42 X RH-1999-18, RH-1999-18 X BAUM-08-14, RH-1999-18 X DTM-214, RH-1999-18 X DTM-220, RH-1999-42 X DTM-214, RH-1999-42 X DTM-220RH-1999 -18 X DTM-231, RH-725 X PBR-357, RH-749 X IM-59, RH-749 X PBR-357, RH-749 X PBR-507, RH-749 X RE-11, RH-749 X RE-13, SKM-1712 X RE-13, SKM-1712 X RE-14, TM-236-6 X JA-23			
		F2	DRMR IJ 14-261 X JJ-31, DRMR IJ 14-261 X NPJ-112, DRMR IJ 14-261 X TN-3, DRMR IJ 14-261 X RC-273, DRMR IJ 14-261 X M-34, DRMR IJ 30 X M-34, DRMR IJ 30 X LES-39, DRMR IJ 15-148 X RC-273, DRMR IJ 15-148 X LES-39, DRMR IJ 15-148 X M-34, DRMR IJ 15-108 X LES-39, DRMR IJ 14-30 X RC-273, DRMR IJ 14-137 X RC-273, RC-12 X M-34, RC-12 X LES-39, RC-12 X IJ-31, RC-273 X IJ-31, RC-273 X NPJ-112, RC-110 X IJ-31, RC-110 X M-34, RC-110 X NPJ-112, RC-20 X RC-273, RC-20 X IJ-31, RC-8 X RC-273, RC-8 X IJ-31, RC-8 X NPJ-112,RC-5 X IJ-31, M-5 X NPJ-112, M-5 X M-34, M-5 X IJ-31, M-5 X TN-3, M-49 X IJ-31, M-49 X NPJ-112, M-49 X LES-39, M-84 X LES-39, M-20 X RC-273, M-20 X IJ-31, PUSA TARAK X IJ-31, PUSA TARAK X RC-273, PUSA TARAK X M-34, EJ-17 X RC-273, LET-17 X RC-273, EC-27 X RC-273	43		
		F3		142		
		F4		70		
		F5/F6		65		
	Brassica juncea (0/00): For early maturity and productivity traits	Fresh crosses	JC-1 X RE-11, JC-1 X RE-44, JC-1 X TN-3, JC-1 X TN-3, JC-1 X DRMRIJ-31, JC-1 X NC-37362, JC-1 X NPJ-112, JC-15 X RE-11, JC-15 X RE-44, JC-15 X RE-8, JC-15 X TN-3, JC-15 X DRMRIJ-31, JC-15 X NC-37362, JC-15 X CN-105364, JC-15 X NPJ-112, JC-36 X RE-44, JC-36 X TN-3, JC-36 X DRMRIJ-31, JC-36 X NPJ-112, RLC-3 X RE-11, RLC-3 X RE-44, RLC-3 X TN-3, RLC-3 X DRMRIJ-31, RLC-3 X DRMRIJ-35, PDZ-11 X RE-44, PDZ-11 X TN-3, PDZ-11 X DRMRIJ-31, PDZ-11 X M-34, PDZ-11 X NPJ-112, RCH-1 X RE-44, RCH-1 X TN-3, RCH-1 X DRMRIJ-31, RCH-1 X NPJ-112, JC-16 X RE-44, JC-16 X TN-3, JC-16 X DRMRIJ-31, JC-16 X M-34, RLC-3 X NC-37362, RLC-3 X CN-105364, RLC-3 X NPJ-112,	41		

			RLC-3 X IC-597880			
		F1	AD-104 X JC-40, AD-104 X RLC-3, AD-104 X RLC-7, AD-64 X RLC-3, JC-21 X JC-33, JC-21 X JC-36, JC-21 X JC-40, JC-21 X LES-54, JC-21 X LES-60, JC-21 X PDZ-1, JC-21 X PDZ-12, JC-21 X PDZ-13, JC-21 X RE-46, JC-21 X RLC-10, JC-21 X RLC-7, JC-21 X RLC-8, JC-33 X JC-36, JC-33 X JC-40, JC-33 X LES-54, JC-33 X LES-60, JC-33 X PDZ-12, JC-33 X PDZ-13, JC-33 X RE-46, JC-33 X RLC-7, JC-36 X JC-40, JC-36 X LES-60, JC-36 X PDZ-1, JC-36 X PDZ-12, JC-36 X PDZ-13, JC-36 X RE-41, JC-36 X RE-46, JC-36 X RLC-7, JC-36 X RLC-8, JC-40 X PDZ-1, JC-40 X PDZ-12, JC-40 X PDZ-13, RH-1424 X JC-6, RLC-10 X PDZ-12 RLC-10 X PDZ-13, RLC-10 X RE-46 ,RLC-3 X JC-40, RLC-7 X JC-33, RLC-7 X JC-40, RLC-7 X LES-54, RLC-7 X PDZ-1, RLC-7 X PDZ-12, RLC-8 X PDZ-1, RLC-8 X LES-54	47		
		F2		70		
		F3		300		
		F4		100		
		F5		25		
	For quality traits	RILs	NUDHYJ-4 x RL 1359 RL1359 x CBJ001	2		
	Hybrid development (<i>B. juncea</i> Conventional mustard): For higher productivity	CMS lines developed/maintained	Natural mustard -82 Introgressed mustard-100 Resynthesized mustard-42 Exotic mustard-20 Determinante mustard-209	432		
		Fertility Restorers		5		
	Hybrid development (<i>B. juncea</i> Quality mustard): CMS lines developed/maintained	CMS lines developed/maintained		100		
		Fertility Restorers		2		
Kanpur	To developed high yielding, early maturing bold seeded, having high oil content and resistance to shattering & white rust resistance in Indian Mustard	F0	RE11X Varuna, RE11X Kanti, RE11X Rohini, RE11X Basanti	Total number of crosses 60 attempted		
			NC37362X Varuna, NC37362X Kanti, NC37362X Rohini, NC37362X Basanti			
			RE44X Varuna, RE44X Kanti, RE44X Rohini, RE44X Basanti			
			CN105364X Varuna, CN105364X Kanti, CN105364X Rohini, CN105364X Basanti			
			IC 597880X Varuna, IC 597880X Kanti, IC 597880X Rohini, IC 597880X Basanti			
			RLC 3X Varuna, RLC 3X Kanti, RLC 3X Rohini, RLC 3X Basanti			
			RE 8X Varuna, RE 8X Kanti, RE 8X Rohini, RE 8X Basanti			
			DRMRMJA 35X Varuna, DRMRMJA 35X Kanti, DRMRMJA 35X Rohini,			

			DRMRMJA 35X Basanti			
			DRMRIJ 12-48X Varuna, DRMRIJ 12-48X Kanti, DRMRIJ 12-48X Rohini, DRMRIJ 12-48X Basanti			
			DRMRIJ 12-40X Varuna, DRMRIJ 12-40X Kanti, DRMRIJ 12-40X Rohini, DRMRIJ 12-40X Basanti			
			DRMRIJ 31X Varuna, DRMRIJ 31X Kanti, DRMRIJ 31X Rohini, DRMRIJ 31X Basanti			
			LES 39 X Varuna, LES 39 X Kanti, LES 39 X Rohini, LES 39 X Basanti			
			TN 3X Varuna, TN 3X Kanti, TN 3X Rohini, TN 3X Basanti			
			NPJ 112X Varuna, NPJ 112X Kanti, NPJ 112X Rohini, NPJ 112X Basanti			
			M 34 X Varuna, M 34 X Kanti, M 34 X Rohini, M 34 X Basanti			
Morena	Identification of good combiners for seed yield and WRR quality	Fresh crosses	60 fresh crosses were made during rabi 2021-22			
	High seed yield and quality	F ₁	Crosses among JM-1, RMM 10-1-1, JM-2, JMM991, JMWR 945-2-2, JMM 927, RVM-3, Giriraj, L-4, L-6, RVM-2, RH 749, Kranti, Vasundhara, PM 25, PM 27, PM 30	65		
		F ₂	RGN 73, Kranti, PM 25, PM 26, PM 27, PM 28, JMWR 908-1, Girieaj, RH 749,	84		
		F ₃	Crosses among NRCDR-2, Pusa Jagannath, JM-1, JM-2, JM-3, DRMRIJ-31, NRCHB-101, NRCHB-506, RB-50, RH-406, RVM-1,	7		
		F ₄	RH-749 x RVM-3, JM-3 x RH-749, JMM-09-3 x RVM-3, JMM-09-1-1 x Kranti	4	20	
		F ₅	RVM-2 x SLT 1111(Hybrid), RVM-2 x RDZ-6, MRNJ 77 x SLT 1111(Hybrid), SLT 1111(Hybrid) x JM 4, RDZ-6 x MRNJ-77, DRMRIJ-15-85 x MRNJ-77	6	30	
		F ₆	44 S 31 x Kranti , 44 S 31 x DMH 1, PM-28 x Pusa Mustard- 25, RH-1134 x RGN-73, Pusa Mustard- 25 x PM-28, Pusa Mustard- 25 x RVM-2	6	30	
		F ₁₀	JM-1 x L-4	1		
		F ₁₃	MJA-3 x HUJM 0201	1		
Nagpur	Breeding for high yield & earliness	Fresh crosses	Attempted using agronomical superior genotypes ACN 141, ACN 184, TAM 108-1, ACN 9, PC-6, Bhawani, NRCHB 101 and CG Sarso as base population and RE 11, NC 37362, RE 44, CN 105364, IC 597880, RLC 3, RE 8, DRMRIJ 12-48, DRMRIJ 12-40, DRMRIJ 31, LES 39, TN 3, NPJ 112 and M34 as donor source for genetic diversity, quality, white rust resistance and earliness	120 (600)	-	
	Breeding for earliness and suitable for late sown condition	F ₁	TAM 108-1x CG Sarso, TAM 108-1 x <i>S. alba</i> , TAM 108-1 x PC -6, ACN 9 x CG Sarso, ACN 9 x <i>S. alba</i> , ACN 9 x PC -6, Kranti x CG, Kranti x <i>S. alba</i> , Kranti x PC -6, Bio -902 x CG Sarso, Bio -902 x <i>S. alba</i> , Bio -902 x PC -6, PM - 26 x CG Sarso, PM - 26 x <i>S. alba</i> , PM - 26 x PC -6, PM - 28 x CG Sarso, PM - 28 x <i>S. alba</i> and PM - 28 x PC -6	18 crosses	90	-
	Breeding for earliness, Powdery Mildew resistance and suitable for late sown condition	F ₁	Bhawani x TAM 108-1, Bhawani x Kranti, Bhawani x Bio 902, ACN-9 x Bhawani, PM 26 x ACN-9, PM 26 x TAM 108-1, PM 26 x Kranti, PM 26 x Bio.902, PM 26 x <i>B. napus</i> , PM 28 x PM 26, PM 28 x TAM 108-1, PM 28 x Local (lambat), PM 28 X ACN-9, TAM 108-1 x Kranti, TAM 108-1 x Local (Lambat), TAM 108-1 x <i>B. napus</i> , TAM 108-1 X Bhawani, TAM 108-1 x ACN-9, TAM 108-1 x Bio 902, TAM 108-1 x NRCHB 101, ACN-9 x Local (lambat), ACN-9	45 crosses	225	

			x Kranti, ACN-9 x Bio 902, ACN-9 x NRCHB 101, ACN-9 x TAM 108-1, ACN-9 x PM 26, Bio 902 x PM 26, Bio 902 x Local (Lambat), Bio 902 x TAM 108-1, Bio 902 x ACN-9, Bio 902 x Kranti, Bio 902 x NRCHB 101, Kranti x Bio 902, Kranti x ACN-9, Kranti x TAM 108-1, Kranti x NRCHB 101, ACN-246 x TAM 108-1, Local (Lambat) x Bio 902, Local (Lambat) x Kranti, PC6 x Bio 902, PC 6 x TAM 108-1, NRCHB 101x TAM 108-1, NRCHB 101 x Kranti, NRCHB 101 x Bio 902 and NRCHB 101 x PC- 6.			
Breeding for high yield & earliness	F ₂	Geeta x Kranti, Geeta x RH 406, Geeta x NRCHB 101, Geeta x RH 749, Geeta x Giriraj, NRCHB 101 x Geeta, RH 749 x Geeta, RH 406 x Geeta, Giriraj x Geeta	9 Crosses	90		
Breeding for high yield & earliness	F ₃	NRCHB 101 x RH-749, NRCHB 101 x RH 406, NRCHB 101 x P M-31, NRCHB 101 x Kranti, RH 749 x NRCHB 101, RH 749 x Giriraj, RH 749 x RH-406, RH 749 x P M-31, RH 749 x Kranti, Giriraj x NRCHB 101, Giriraj x RH 749, Giriraj x RH-406, Giriraj x P M-31, Giriraj x Kranti, RH 406 x NRCHB 101, RH 406 x RH 749, RH 406 x Giriraj, RH 406 x P M-31, RH 406 x Kranti and P M-31 x NRCHB 101, P M-31 x Giriraj, P M-31 x RH 406, P M-31 x Kranti, Kranti x NRCHB 101, Kranti x RH 749, Kranti x Giriraj, Kranti x RH 406, Kranti x PM 31	28 Crosses	300	-	
Breeding for high yield, earliness & boldness	F ₄	Pusabold (1000Gy) × Bio-902 (1300Gy), Pusabold (1000Gy) ×Bio-902 (900Gy+EMS), Pusabold (1000Gy) ×Pusabold (1200Gy), Pusabold (1000Gy) ×Bio-902 (1000Gy+EMS), Pusabold (1000Gy)× Bio-902 (1100Gy), Bio-902 (1300Gy)× Bio-902 (900Gy+EMS), Bio-902 (1300Gy)× Pusabold (1200Gy), Bio-902 (1300Gy)× Bio-902 (1000Gy+EMS), Bio-902 (1300Gy) ×Bio-902 (1100Gy), Bio-902 (1300Gy)× Pusabold (1000Gy), Bio-902 (900Gy+EMS)× Pusabold (1200Gy), Bio-902 (900Gy+EMS)× Bio-902 (1000Gy+EMS), Bio-902 (900Gy+EMS)× Bio-902 (1100Gy), Bio-902 (900Gy+EMS)× Pusabold (1000Gy), Bio-902 (900Gy+EMS)× Bio-902 (1300Gy), Pusabold (1200Gy)× Bio-902 (1000Gy+EMS), Pusabold (1200Gy)× Bio-902 (1100Gy), Pusabold (1200Gy)× Pusabold (1000Gy), Pusabold (1200Gy)× Bio-902 (1300Gy), Pusabold (1200Gy)× Bio-902 (900Gy+EMS), Bio-902 (1000Gy+EMS)× Bio-902 (1100Gy), Bio-902 (1000Gy+EMS)× Pusabold (1000Gy), Bio-902 (1000Gy+EMS)× Bio-902 (1300Gy), Bio-902 (1000Gy+EMS)× Bio-902 (900Gy+EMS), Bio-902 (1000Gy+EMS)× Pusabold (1200Gy), Bio-902 (1100Gy)× Pusabold (1000Gy), Bio-902 (1100Gy)× Bio-902 (1300Gy), Bio-902 (1100Gy)× Bio-902 (900Gy+EMS), Bio-902 (1100Gy)× Pusabold (1200Gy) and Bio-902 (1100Gy)×Bio-902 (1000Gy+EMS)	28 Crosses	260	-	
Seed yield plant & earliness	F ₅	ACN 9 x ACN 119	01 Crosses	10	-	
Seed yield plant & earliness	F ₆	Crosses were effected in half diallel Pusa Bold x Kranti, ACN 9 x Bio 902, ACN 9 x Kranti and ACN 9 x RH 1134	4 crosses	16	-	
Transferring of powdery mildew resistance and terminal heat tolerance into <i>B. juncea</i>	BC ₁ F ₂	(ACN 9 x ACN 202) x TAM 108-1	10	20	-	
		(P. Bold x ACN 202) x TAM 108-1	10	15	-	
		(ACN 9 x ACN 202) x ACN 9	30	40	-	
		(P. Bold x ACN 202) x P. Bold	10	15	-	
	BC ₂ F ₁	(ACN 9 x ACN 202) x TAM 108-1) x TAM 108-1	08	30	-	

			(ACN 9 x ACN 202) x ACN 9) x ACN 9)	06	20	
		BC ₂ F ₂	(P. Bold x ACN 202) x P. Bold) x P. Bold	10	30	-
		BC ₁ F ₁	(TAM 108-1 x PC 6) x TAM 108-1	01	06	-
			(TAM 108-1 x PC 5) x TAM 108-1	01	05	-
			(PC 6 x TAM 108-1) x TAM 108-1	01	05	-
			(ACN 9 x PC 6) x ACN 9	01	04	
			(Kranti x PC 6) x Kranti	01	05	
			(Bio 902 x PC 6) x Bio 902	01	05	
			(NRCHB 101 x PC 6) x NRCHB 101	01	05	
			(NRCHB 101 x PC 5) x NRCHB 101	01	05	
			(PC 6 x NRCHB 101) x NRCHB 101	01	05	
		Interspecific F ₃	NRCHB 101 x <i>B. rapa</i>	02	05	
			NRCHB 101 x <i>B. napus</i>	02	10	
		Interspecific F ₂	Bio 902 x <i>B. rapa</i>	02	05	
			ACN 9 x ACN 202	10	15	
			P. Bold x ACN 202	05	10	
			TAM 108-1 x <i>B. rapa</i>	02	05	
			Kranti x <i>B. rapa</i>	02	05	
			ACN 9 x <i>B. rapa</i>	02	05	
		Interspecific Multiple crosses	(Bio 902 x <i>B. rapa</i>) x (ACN 9 x ACN 202) x TAM 108-1)	03	16	
			(Bio 902 x <i>B. rapa</i>) x (NRCHB 101 x <i>B. napus</i>)	02	10	
			(ACN 9 x <i>B. rapa</i>) x (ACN 9 x ACN 202) x ACN 9)	08	24	
			(ACN 9 x <i>B. rapa</i>) x (NRCHB 101 x <i>B. napus</i>)	02	20	
Pantnagar	Early sown	F1	PRE-13-3 × PRE-20-12, PRE-13-3 × CRP-8, PRE-13-3 × CRP-12, PRE-13-3 × PRHC-14-15, PRE-13-3 × PRHC-14-1-1, PRE-16-2 × PRE-20-12, PRE-16-2 × CRP-8, PRE-16-2 × CRP-12, PRE-16-2 × PRHC-14-15, PRE-16-2 × PRHC-14-1-1, PRE-16-5 × PRE-20-12, PRE-16-5 × CRP-8, PRE-16-5 × CRP-12, PRE-16-5 × PRHC-14-15, PRE-16-5 × PRHC-14-1-1, PRE-16-1 × PRE-20-12, PRE-16-1 × CRP-8, PRE-16-1 × CRP-12, PRE-16-1 × PRHC-14-5, PRE-16-1 × PRHC-14-1-1, PRE-19-7 × PRE-20-12, PRE-19-7 × CRP-8, PRE-19-7 × CRP-12, PRE-19-7 × PRHC-14-15, PRE-19-7 × PRHC-14-1-1, CRP-11 × PRE-20-12, CRP-11 × CRP-8, CRP-11 × CRP-12, CRP-11 × PRHC-14-15, CRP-11 × PRHC-14-1-1, PRHC-13-7 × PRE-20-12, PRHC-13-7 × CRP-8, PRHC-13-7 × CRP-12, PRHC-13-7 × PRHC-14-15, PRHC-13-7 × PRHC-14-1-1, CRP-17 × CRP-8, CRP-17 × CRP-12, CRP-17 × PRHC-14-15, CRP-17 × PRHC-14-1-1, SKM1512 × PRE-20-12, SKM1512 × CRP-8, SKM1512 × CRP-12, SKM1512 × PRHC-14-15, SKM1512 × PRHC-14-1-1, CRP-12 × PRE-20-2, CRP-12 × CRP-8, PRE-16-2 × CRP-12 CRP-12 × PRHC-14-15, CRP-12 × PRHC-14-1-1, CRP-12 × PRHC-12-7	50		28

		F2	PR-19×CRP-8, PR-19×PRHC-14-10, PM-25×CRP-5, PM-25×PRHC-14-5, PRE-18-14×CRP-10, PRE-18-14×PRHC-14-1-1, PRE-18-8×CRP-15, PR-20×CRP-3, PR-20×PRHC-6-3, NRCHB-10×PRHC-14-5-4, PR-16-4×CRP-3, PR-16-4×PRHC-14-1-1, PM-27×CRP-8, PM-27×PRHC-14-10, PM-28×PRHC-14-5, DRMRIJ-16-15×PRHC-14-1-1, PRE-17-2×PM-27, PRE-17-1×PM-25, PRE-18-1×PM-25, PRE-18-9×DRMRIJ-16-51, PRE-18-12×DRMRIJ-16-51, PRE-18-13×DRMRIJ-16-51, PRE-18-13×PM-25,	24		14
		F3	NDRE-4×DRMR-IJ-16-51, NDRE-4×DRMR-IJ-16-56, DRMR-IJ-16-51×PM-25, RH-1656×PM-25, PRE-16-2×PM-27, (RH-1209×GP-1-8)×NPJ-112, (RH-1209×GP-1-8)×PR-20, (RH-1209×GP-1-14)×NDRE-4, (RH-1209×GP-1-4)×PR-19, (RH-1209×GP-1-7)×NPJ-112, (PR-2015-1×CRP-3)×PR-19, (PRE-13-13×PR-20)×NDRE-4, (PRE-13-13×PR-20)×NPJ-112	13		10
		F4	RH-1209 × GP-1-7, PR-15-1 × GP-3, PR-15-1 × GP-1-5, Giriraj × GP-I-22, Giriraj × GP-I-14, PR-21 × GP-I-7, RH-1209 × GP-I-3, Giriraj × GP-I-3, PR-19 × EJ-17, NPJ-203 × GP-I-7, NPJ-203 × GP-1-3, NPJ-203 × GP-1-5, PR-2012-4 × CRP-3, RH-406 ×PRE-2013-13, PR-12-4 × GP-I-22, PR-21 × GP-I-4, (PRE-13-10 × Krishna) × CRP-1-14, Rohini × PRHC-17-7-10, PR-2013-2 × PRHC-14-10, PR-2013-2 × PRHC-13-7-10	20		13
		F5	PRE-13-19 × PBML-2, PRE-13-19 × Divya-88, PRHC-13-7 (MH) × PRHC-13-7(DH), PRHC-13-7 (MH) × PRHC-13-7(DH), PRE-10-7 × PRHC-13-7, PRHC-13-7 (MH) × PRHC-13-7(DH), PRHC-13-7 (MH) × PRHC-13-7(DH)	5	93 IPS	-
		F6	Albeli × NPJ-112, PR-21 × NDRE-4, PRE-11-6 × Albeli, PRE-12-6 × Albeli, RGN-145 × NDYR-8, NPJ-203 × GP-1-5, Rohini × PRHC-13-7, PR-2013-2 × PRHC-14-10	8 (79 IPS)	16 IPS	27 lines
		F7	PRE-2011-15 × RRN-778, PRE-2011-15 × Maya, Divya 55 × NPJ-112, Maya × NPJ-112	4 (38 lines)	-	15 Lines
		F7	(PRE-2010-19×EJ-17)×Maya, (PRE-2010-19×NDRE-4)×Maya, (PRE-2010-19×EJ-17)×Albeli, NPJ-112 × PRE-2010-15, PRE-2010-19 × PRE-2010-15, NDRE-4 × (PRE-2010-15× RGN-73), PRB-08-5×PRE-2010-15, Albeli × PRE-2010-15	31	-	15 Lines
		Fresh crosses	CRP-2 × RH-1585, CRP-2 × Giriraj, CRP-2 × PR-21, Albeli x RH-1585, Albeli x Giriraj, Albeli x PR-21, PR-18-5 x RH-1585, PR-18-5 x Giriraj, PR-18-5 x PR-21, PR-19-1 x RH-1585, PR-19-1 x Giriraj, PR-19-1 x PR-21, PR-19-5 x RH 1585, PR-19-5 x Giriraj, PR-19-5 x PR-21, PR-20-3 x RH-1585, PR-20-3 x Giriraj, PR-20-3 x PR-21, PR-20-1 x RH-1585, PR-20-1 x Giriraj, PR-20-1 x PR-21, RB-57 x RH-1585, RB-57 x Giriraj, RB-57 x PR-21, PR-19-8 x RH-1585, PR-19-8 x Giriraj, PR-19-8 x PR-21, PR-19-2 x RH-1585, PR-19-2 x Giriraj, PR-19-2 x PR-21	30	-	-
	Timely sown	F1	Giriraj × PRHC-13-7-5, Giriraj × PRHC-13-7-10, Giriraj × PRB-16-1, PR-17-2 × PRHC-13-7-5, PR-17-2 × PRHC-13-7-10, PR-17-2 × PRB-16-1, PR-17-2 × PR-13-7, PR-17-5 × PRHC-13-7-5, PR-17-5 × PRHC-13-7-10, PR-17-5 × PRB-16-1, PR-17-5 × PR-13-7, PR-19-8 × YR-9, PR-19-8 × PRHC-13-7-5, PR-19-8 × PRHC-13-7-10, PR-19-8 × PRB-16-1, PR-19-8 × PR-13-7, Albeli × PR-2017-11, Albeli × PR-2013-7, Albeli × PRHC-2013-7-10, Albeli × PRHC-13-7-5, PR-2018-2× CRP-14, CRP-14× PR-2018-2, PR-2017-2× NPJ113, CRP-14× PR-2018-2	25	-	21
		F2	PM-26×Albeli, PM-26×Rajvijay, PM-26×PR-18-6, RH-749×Rajvijay, Krishna × Albeli, Krishna×RH-749, PR-19-11×Rajvijay, PR-19-11×RH-749, PR-19-9×Rajvijay, PR-19-10×Rajvijay, PR-19-10× RH-749, PR-19-2×RH-749, PR-18-6×CRP-5, PR-17-2×RGN-73, RH-1599-41×Rajvijay, PR-18-6×RH749, PR-2018-6× CRP-5	21		16

		F3	(Rohini ×PRHC-13-7-10)×PR-20, (Rohini ×PRHC-13-7-10)×Albeli, (PR-2013-2×PRHC-13-7-10)×PR-20, (PR-2013-2×PRHC-13-7-10)×Albeli, (PR-2013-2×PRHC-13-7-10)×RH-749, (RGN-394×PRHC-13-7-1)×Giriraj, (RGN-394×PRHC-13-7-1)×Albeli, (PR-2013-7×PRHC-14-10)×PR-20, (PR-2013-7×PRHC-14-10)×Giriraj, (PR-2013-7×PRHC-14-10)×RH-1585, KMR-17-3× Kranti, PR-15-7× Kranti, RH-749× PR-20, RH-749× PR-12-4, PR-17-5× RH-749, PR-17-8× Albeli	16		7
		F4	PR-2015-5 × IC-264133, RGN-394 × PRHC-14-7-1, PR-2013-7 × PRHC-17-7-10, RGN-394 × PRHC-13-7-1, PR-2013-7 × PRHC-14-10, (PR-15-5 × Divya) × PRHC-14-9, PRE-10-15×NDRE-4, EJ-17×PRE-2007-6, PR-2015-1 × IC-264133, CRP-14× PR-2018-2	9		6
		F5	PRE-2013-19 × PBML-1, PRE-2013-10 × RH-749, PRE-2013-19 × Maya, PRE-2013-10 × PBML-2, PR-2015-1 × Maya, PR-2016-3 × Giriraj, PR-2015-1 × Giriraj, PR-2016-5 × Maya, PR-2012-12 × PBML-1, PR-2016-1 × Maya, PR-2016-6× IC 520478, PR-20 × IC-355931, RRN-9-11 × RH-749, Giriraj × NDYR-8, (PRE-2011-6 × Rajvijay) × RH-1209, PR-2019-RH749, PR-2019-10 × RH749, PR-2019-2 × RH749, PM-26 × PR-2018-6, RH749 × Rajvijay, PR-19-11× RH 749, PR-19-11× RH 749, PR-19-10× RH 749, PR-19-2× RH 749, PM-26× PR-2018-6, RH 749× Raj vijay,	20	139IPS	-
		F6	ACN-83 × PR-20, Divya 55 × Kranti, RH-1019 × Raj Vijay, NPJ-191 × Albeli, NPJ-191 × Raj Vijay, (RMM-09-4 × NPJ-112) × Albeli, (DRMR-675-3 × PRE-11-15) × Albeli, Giriraj × PR-20	8 (114 IPS)	-	36 lines
		F7	Divya-55 × RRN-778, Divya-55 × RB-57, PR-2009-6 × RGN-73, PR-2009-6 × Albeli, (PR-2009-6 × Albeli) × Albeli, (PR-2009-6 × RGN-73) × PR-2009-6, (PR-2009-6 × Albeli) × PR-2009-6, (KMR-13-3 × PR-20) × KMR-13-3	24 lines	-	14 Lines
		Fresh crosses	PRL-20-2 x NRCHB 101, PRL-20-2 x PRL-20-20, PRL-20-2 x PRL-20-9, PRL-20-5 x NRCHB 101, PRL-20-5 x PRL-20-20, PRL-20-5 x PRL-20-9, PRL-20-16 x NRCHB 101, PRL-20-16 x PRL-20-20, PRL-20-16 x PRL-20-9, PRL-20-19 x NRCHB 101, PRL-20-19 x PRL-20-20, PRL-20-19 x PRL-20-9, Giriraj x NRCHB 101, Giriraj x PRL-20-20, Giriraj x PRL-20-9, RGN 73 x NRCHB 101, RGN 73 x PRL-20-20, RGN 73 x PRL-20-9, PRL-20-22 x NRCHB 101, PRL-20-22 x PRL-20-20, PRL-20-22 x PRL-20-9, Krishna x NRCHB 101, Krishna x PRL-20-20, Krishna x PRL-20-9	24	-	-
	Late sown		PRL-2020-1 × NRCHB-101, PRL-2020-1 × NPJ-113, PRL-2020-1 × PRL-17-3, PRL-20-4 × NRCHB-101, PRL-20-4 × NPJ-113, PRL-20-4 × PRL-17-3, PAB-17-16 × NRCHB-101, PAB-17-16 × NPJ-113, PAB-17-16 × PRL-17-3, PRL-20-13 × NRCHB-101, PRL-20-13 × NPJ-113, PRL-20-13 × PRL-17-3, PRL-20-30 × NRCHB-101, PRL-20-30 × NPJ-113, PRL-20-30 × PRL-17-3, PRL-20-29 × NRCHB-101, PRL-20-29 × NPJ-113, PRL-20-29 × PRL-17-3, PRL-20-16 × NRCHB-101, PRL-20-16 × NPJ-113, PRL-20-16 × PRL-17-3, PRL-20-20 × NRCHB-101, PRL-20-20 × NPJ-113, PRL-20-20 × PRL-17-3, PRL-20-22 × NRCHB-101, PRL-20-22 × NPJ-113, PRL-20-22 × PRL-17-3, PAB-17-11 × NRCHB-101, PAB-17-11 × NPJ-113, PAB-17-11 × PRL-17-3, PRL-2017-3× CRP-14, CRP-14× PRL-2017-3, PRL-17-5×NRCHB101,PRL-2020-4 × NRCHB-101, PRL-2020-4 × PRL-2017-3, PRL-2020-4 × NPJ113, PRL-2017-1 × NRCHB-101, PRL-2017-1 × NPJ113, PRL-2017-1 × PRL-2017-3, PAB-2017-16 × NRCHB-101	29	-	7

		F2	PRL-17-1×NRCHB-101, PRL-17-1×NPJ-126, PRL-17-2×NRCHB-101, PRL-17-2×NPJ-113, PRL-17-2×NPJ-126, PRL-17-3×NRCHB-101, PRL-17-3×DRMRIJ-16-38, PRL-17-6×Rajvijay, NPJ-216×Albeli, NPJ-216×PR-18-6	10		7
		F3	PRL-2013-9×DRMR-2017-5, PRL-2016-6× DRMR-2017-5, PRL-2018-5×PRL-2018-19, PRL-2018-4×PRL-2018-19, PRL-2016-5×MCN-2018-9, PRL-2017-1×NRCHB-101, PRL-2017-2×MCN-2018-14, PRL-2017-2×NRCHB-101, Albeli×MCN-15-21, Rajvijay×MCN-15-2, NPJ-112×MCN-15-21,	12		7
		F4	RH-1599 × NRCHB-101, PRL-2013-17 × Ashirwad, DRMR-2035 × NRCHB-101, RH-1599 × NPJ-113, NRCHB-101× PRHC-14-8, PR-2015-1× GP-1-7, PR-2015-1× GP-1-22, PR-2015-1× GP-1-23, RH-1599 × Ashirwad	9		7
		F5	PRD-2013-6 × NPJ-113, NPJ-113 × NRCHB-101, PR-2016-3 × PAB-9511, PR-2016-5 × PWR-2013-8, (Albeli × NPJ-113) × NRCHB-101, (NRCHB-101× Vardan) × NPJ-113	7		6 (63 IPS)
		F6	NRCHB-101 × Ashirwad, NRCHB-101 × Vardan, PRL-10-8 × NRCHB-101, PRD-13-2 × NRCHB-101, PRD-13-9 × Ashirwad, PRD-13-9 × NRCHB-101, PRL-12-13 × Raj Vijay, PRB-2013-2 × NRCHB-101,	8 (87 IPS)	-	18 lines
		F7	PRB-2013-7 × NRCHB-101, PRL-2012-6 × Raj Vijay, PRL-12-13 × RMM-09-4, PRL-12-13 ×NRCHB-101, PRL-12-13 ×Divya 55, NRCHB-101 × Maya, NRCHB-101 × DRMR-675-39, DRMR-675-39 × RRN-778, RB-57 × RRM-09-4	9 (23 lines)	-	12 Lines
	Yellow seed coat color	Fresh crosses	NDYR 10 × PYR-2009-5, NDYR 10 × PYR-2017-1, NDYR 10 × PYR-2017-3, PYR-2009-8 × PYR-2009-5, PYR-2009-8 × PYR-2017-1, PYR-2009-3 × PYR-2009-5, PYR-2009-3 × PYR-2017-3, Basanti × PYR-2009-5, Basanti × PYR-2017-1, PYR-2017-5 × PYR-2009-5, PYR-2017-5 × PYR-2017-3, PYR-2017-7 × PYR-2009-5, PYR-2017-7 × PYR-2017-3, PYR-2017-9 × PYR-2009-5, PYR-2018-2 × PYR-2009-5, PYR-2018-2 × PYR-2017-1, PYR-2018-5 × PYR-2009-5, PYR-2018-5 × PYR-2017-3, PYR-2018-6 × PYR-2009-5, PYR-2018-6 × PYR-2017-3, PYR-2018-6 × PYR-2017-1	21	-	-
		F1	RGN73×PYR-2009-5, PR-20×NDYR-8, (PR-2017-5×PYR-2009-13) ×Pro 0306, (PR-2019-8×PYR 2009-13) ×Pro 0306, (PR-2017-2×PYR-2009-13) ×Pro 0306, (Giriraj× PYR 2009-13) ×Pro 0306, (Albeli× PYR 2009-13) ×Pro 0306	8	-	8
		F2	PR-20×NDYR-8, PR-20×PYR-2009-5, DRMR-61-106×NDYR-8, DRMR-61-106×PYR-12-5, RGN-73×PYR-95, (NDYR-8 × Maya) ×NDYR-10, (NDYR-8 × PR-20) ×NDYR-10	7	-	5
		F3	NDYR-10 × Maya, NDYR-10 × RH-749, NDYR-10 × PR-20, NDYR-10 × NRCHB-101	4	-	2
		F5	(NDYS-12-5 × NDYR-8) × DRMR-101, (NDYR-10 × PRY-2009-8) × PR-2012-12, (PYR-2012-5 × NDYR-8) × PR-2012-12, (PYR-2012-5 × NDYR-8) × NPJ-112, Griraj × NDYR-8	5	59 IPS	4
		F6	Navgold× NDYR-8, PYR-2012-5 × NDYR-8,	2 (17 IPS)		10 lines
		F7	RH-0923 × NDYR-8, PR-2009-6 × NDYR-8, (PYR-2009-13 × novgold) × (PYR-2009-13 × Pro-0306)	3 (11 lines)	-	7 Lines

		Fresh crosses	Krishna X PAB-9511, RGN 73 X PAB-17-3, RGN 73 X PHR-2, Rohini x PAB-9511, (Krishna X PAB-9511) X PAB-9511, (RGN 73 X PAB-17-3) X RGN 73, (RGN 73 x PHR-2) x RGN 73, (Rohini x PAB-9511) x Rohini, (Krishna x PAB-9511) x Krishna, (RGN 73 x PAB-17-3) x PAB-17-3, (RGN 73 x PHR-2) x PHR-2, (Rohini x PAB-9511) x PAB-9511 PAB-9511 x PAB-17-1, PAB-9511 x PAB-17-3, PAB-9511 x PHR-2, PAB-17-1 x PAB-17-3, PAB-17-1 x PHR-2, PAB-17-3 x PHR-2, PAB-9511 x PAB-17-1, PAB-9511 x PAB-17-3, PHR-2 x PAB-9511, PHR-2 x PAB-17-3 PAB-17-3 x Donskaja, PAB-17-3 x WR-II, PAB-17-3 x PWR-13-8-7, PAB-17-3 x PWR-9511, PHR-2 x PWR-13-8-7, PAB-17-1 x PWR-13-8-7, PAB-17-1 x Donskaja, PAB-9511 x WR-II, PAB-9511 x PWR- 9541, PAB-9511 x Donskaja, PRL-20-20 x (PAB-9511 x Donskaja), PRL-20-22 x (PAB-9511 x Donskaja)	33	-	-
Alternaria resistance blight	F1	Rohini x PAB-9511, Rohini x PAB-17-4, RGN-73 x PAB-9511, RGN73 x PHR-2, RGN 73 x PAB-17-4, NRCHB101 x PAB-9511, NRCHB101 x PHR-2, NRCHB101 x PAB-17-1, NRCHB101 x PAB-17-4, Krishna x PAB 9511, Krishna x PHR-2, PR 20 x PAB 9511, PR 21 x PAB 9511, PR 21 x PHR1, NPJ-126x PHR-1, Ashirwadx PAB 9511, Ashirwadx PHR1, PAB-2014-4 x NRCHB-101, PAB-2014-4 x NPJ-113, PAB-2014-4 x PRL-17-3, PAB-14-17 x NRCHB-101, PAB-14-17 x NPJ-113, PAB-14-17 x PRL-17-3, PAB-17-1 x NRCHB-101, PRD-14-25 x NRCHB-101, PRD-14-25 x NPJ-113, PRD-14-25 x PRL-17-3, PRD-14-23 x NRCHB-101, PRD-14-23 x NPJ-113, PRD-14-23 x PRL-17-3, PAB 9511 x PHR1, PAB 9511 x PAB 9534, PAB 9511 x PAB 17-2, PAB 9511 x PAB-17-4, PHR-2 x PAB-17-1, PHR-2 x PAB-17-4	34	-	-	
	F2	PAB-14-4 x EC-399302, EEC-2 x PAB-9511, EEC-3 x PAB-9511, EEC-6 x PAB-9511, EC-399299 x PAB-9511, EC-399299 x EC-399294, PAB-14-15 x MCNL-19-6, PAB-2014-4 x RH-1590-41, PAB-2014-25 x MCNL-19-6, PAB-14-1 x DRMR-2017-5, PAB-14-4 x Ashirwad, PRD-2014-21 x NPJ-113, PAB-2014-17 x NRCHB-101, PAB-2014-17 x MCNL-19-6, PAB-14-4 x NRCHB-101, PAB-14-1 x NRCHB-101, PAB-2014-7 x MCNL-19-55, PAB-2014-25 x MCNL-19-55, PAB-14-1 x NRCHB-101, PAB-2014-7 x MCNL-19-55, PAB-2014-25 x MCNL-19-55	19	-	12	
	F3	PHR-1 x PAB 9511, PAB-06-5 x NRCHB-101, PAB-14-7 x MCN-18-5, PAB-14-21 x NRCHB-101, PAB-14-21 x MCN-18-17, PAB-14-4 x MCN-18-17, MCN-14-5 x NRCHB-101, MCN-14-5 x MCN-18-19, PAB-14-7 x MCN-18-5, PAB-14-5 x MCN-18-19, PAB-14-4 x NRCHB-101, PAB-14-4 x MCN-18-7, PAB-17-2 x NRCHB-101, PAB-17-4 x PHR-1, PAB-17-5 x PAB 9511, PAB-17-5 x PHR-2, PAB-17-5 x PHR-1, PAB-17-15 x PHR-1, PAB-17-21 x PAB 9511, PAB-17-20 x PAB 9511, PAB-17-20 x PHR-2, PAB-17-21 x NRCHB 101	22	-	17	
	F3	Varuna x PAB-06-5, EC399301 x PRB-04-3-4, EC399301 x PRB-06-5, EC399301 x Varuna	5	-	3	
	F5	PR-2016-6 x PAB 9511, PR-2015-5 x PAB 9511	2	15 IPS	-	
	Advanced lines	-	31			
	Fresh crosses	NRCHB 101 x WR-II, RGN 73 x PWR-13-8-7, NRCHB 101 X Donskaja, NRCHB 101 x PWR-13-8-7, (NRCHB 101 x WR-II) x NRCHB 101, (RGN 73 x PWR-13-8-7) x RGN 73, (NRCHB 101 x Donskaja) x NRCHB 101, (NRCHB 101 x PWR-13-8-7) x NRCHB 101, (NRCHB 101 x WR-II) x WR-II, (RGN 73 x PWR-13-8-7) x PWR-13-8-7, (NRCHB 101 x Donskaja) x Donskaja, (NRCHB 101 x PWR-13-8-7) x PWR-13-8-7, Donskaja x PWR-9541,				

			Donskaja x WR-II, Donskaja x PWR-13-8-7, PWR-9541 x WR-II, PWR-9541 x PWR-13-8-7, WR-II x PWR-13-8-7, WR-II x Donskaja, WR-II x PWR-9541, PWR-9541 x Donskaja, PWR-13-8-7 x Donskaja, PWR-13-8-7 x PWR-9541,			
White rust resistance	F1	Rohini x Donskaja, Rohini x PWR 9534, RGN 73 x PWR-13-8-7, NRCHB101 x Donskaja, NRCHB101 x PWR-13-8-7, Krishna x Donskaja, Krishna x PWR 954, Kranti x Donskaja, Kranti x PWR 9538, PR 21 x PWR 13-8-1, PR 21 x Donskaja, PR 20 x PWR 9538, PR 20 x PWR 13-8-1, NRCBH 101 x Heera, PR 20 x Donskaja Donskaja x PWR 9538, DONSKAJA x PWR 13-8-1, PWR 9538 x PWR 13-8-1, Donskaja x PWR 9541, Donskaja x PWR-13-8-7, PWR-13-8-7 x PWR 9541, Giriraj x BIOYSR, Varuna x Heera, Heera x BIOYSR, BIOYSR x Giriraj	26	-	-	
	F2	PWR-13-8 x PHR-1, PWR-13-8 x PHR-2, PWR-13-8 x ABR-14, PWR-3-8 x PAB-9534, (PWR-13-8 x PRB-2006-5) x PRB-2006-5, (Varuna x PWR-13-8) x Varuna, PRD-14-1 x Donskaja, EEC-2 x Donskaja, EEC-3 x Donskaja, EEC-6 x Donskaja, EC-399299 x Donskaja, PRD-2014-21 x NPJ 126, PRD-2014-21 x NRCHB 101	10	-	5	
	F3	PAB 9511 x Donskaja, PAB 9511 x PWR-13-8, PWR-2012 x Donskaja, PWR-2012 x PWR-13-8, PWR-2012 x PAB 9511, PWR 9538 x Donskaja, PWR 9538 x PAB 9511, PHR-1 x Donskaja, PHR-1 x PWR-13-8, PHR-1 x PAB 9511, PAB-06-5 x Donskaja, PAB-06-5 x NRCHB-101, PAB-14-4 x PWR-15-8	13	-	11	
	F4	PWR-13-8 x PRB-04-3-4, PWR-13-8 x PRB-06-5, PWR-13-8 x EC 399301, Donskaja x NRCHB 101, Donskaja x PWR-13-8, PWR-13-8 x NRCHB 101 Donskaja x Kranti, PR-16-6 x Donskaja, PWR-13-8-2 x Donskaja, PR-16-5 x Donskaja, PWR-13-8-8-6 x Donskaja, PWR-13-8-14-1 x Donskaja, PR-16-3 x Donskaja, PWR-3-8-8-7 x Donskaja, (EEC-2 x PWR-13-8) x PWR-13-8, (EEC-4 x PWR-13-8) x PWR-13-8, (EEC-7 x PWR-13-8) x PWR-13-8, (EEC-10 x PWR-13-8) x PWR-13-8, (RS-13-8 x PWR-13-8) x PWR-13-8 (FS-13-6 x PWR-13-8) x PWR-13-8, PR-21 x PWR-13-8, PR-2016-5 x PWR-13-8, (IC-320932 x Kiran) x PWR-13-8, (Kranti x PWR-13-8) x PWR-13-8, (Kranti x PWR-13-8) x Kranti, PWR-13-8-8-6 x EC-399299, (NRCHB-101 x PWR-13-8) x NRCHB-101, (NRCHB-101 x PWR-13-8) x PWR-13-8	22	-	20	
	F5	Donskaja x PAB 9511	1	9 IPS		
	Advanced lines	-	25			
Prebreeding activity	F1	ERJ-45 x Varuna, ERJ-171 x Varuna, ERJ-186 x Varuna, ERJ-191 x Varuna, ERJ-194 x Varuna, ERJ-201 x Varuna, ERJ-161 x ERJ-3, ERJ-161 x NRCHB101, ERJ-161 x ERJ-8, ERJ-161 x Giriraj, ERJ-161 x ERJ-3, ERJ-127 x ERJ-1, ERJ-127 x NRCHB101, ERJ-171 x Giriraj, ERJ-161 x ERJ-2, ERJ-172 x ERJ-3, ERJ-172 x Krishna, ERJ-161 x ERJ-8, ERJ-161 x RGN-73, ERJ-189 x ERJ-9, ERJ-189 x Kranti, ERJ-111 x RGN-73	22	-	-	
	BC1	(BR-9 x BNi-5) x BJ, (BR-9 x BNi-5) x BN, (BR-9 x BN-5) x BC, (BR-8 x RGN-73) x BJ, (BR-8 x RGN-73) x BN, (BR-8 x RGN-73) x BC, (BR-8 x PCPGR 7780) x BJ, (BR-8 x PCPGR 7780) x BN, (BR-8 x PCPGR 7780) x BC, (BR-8 x BNi-5) x BJ, (BR-8 x BNi-5) x BN, (BR-8 x BNi-5) x BC, (BR-1 x BNi-4) x BJ, (BR-1 x BNi-5) x BJ, (BR-8 x BNi-5) x BN, (BR-8 x BNi-5) x BC	16	-	-	
	F2	BR-9 x BNi-5, BR-8 x RGN-73, BR-8 x PCPGR 7780, BR-8 x BNi-5, BR-8 x BNi-5	5			
S K	Early maturing & high	Fresh crosses	Fresh crosses were attempted using GM 1, GDM 4, GM 6, RE 8, TN 3, RLC 3, LES 39, M 34,	45	--	--

Nagar	seed yield		DRMR JA 35 and PM 25 (10 parents Diallel excluding reciprocals)			
	Early maturing, High seed yield & Bold seed	F ₁	RMM 10-1-1 x SKM 1746-w, RMM 10-1-1 x CS 56, RMM 10-1-1 x GM 1, RMM 10-1-1 x PM 26, RMM 10-1-1 x NRCHB 101, SKM 1746 w x CS 56, SKM 1746 w x GM 1, SKM 1746 w x PM 26, SKM 1746 w x NRCHB 106, CS 56 x GM 1, CS 56 x PM 26, CS 56 x NRCHB 101, GM 1 x PM 26, GM 1 x NRCHB 101, PM 26 x NRCHB 101, NRCHB 101 x PM 26, NRCHB 101 x GM 1, NRCHB 101 x CS 56, NRCHB 101 x SKM 1746-w, NRCHB 101 x RMM 10-1-1, PM 26 x GM 1, PM 26 x CS 56, PM 26 x SKM 1746-w, PM 26 x RMM 10-1-1, GM 1 x CS 56, GM 1 x SKM 1746-w, GM 1 x RMM 10-1-1, CS 56 x SKM 1746 w, CS 56 x RMM 10-1-1 and SKM 1746 w x RMM 10-1-1	30	--	30
	Early maturing, High seed yield, Bold seed & quality	F ₂	SKM 1328, SKM 1746-W, NPJ 112, NPJ 203, KP 9905, ANDM 14-9, GM 1, GM 3, GDM 4, SKM 1621, SKM 1324, SKM 1319, Ranasan 2, RS 1, DRMR 659-49, RH 8812, LES 44 were used as parents	90	197	--
	Early maturing, Dwarf, high seed yield	F ₃ - I	ANDM 14-9, NPJ 203, DRMR-IJ 16-66, KM 126, MCN 18-10, SKM 1746, GM 1, GDM 4 were used	55	136	--
	Interspecific	F ₃ - II	GM 1, GM 3, GDM 4, BCRS 3 (<i>B. Carinata</i>) were used	04	09	--
	Early maturing, Temp. tolerance & High seed yield	F ₄ - I	Urvashi, NPJ 112, ANDM 14-9, PDZM 31, P. Vijay, SKM 219, DRMR IJ-31, GM 3, DRMR 150-35, GM 1, PM 26, BPR 349-9, NRCDR 2, PM 21, NRCHB 101, GDM 4, PM 27, GM 2, NRCDR 601, PM 28, Kranti, PM 30 were taken as parents	72	167	--
	Interspecific	F ₄ - II	GDM 4, BCRS 3 were used	02	14	--
	Early maturing, & High seed yield	F ₅	PR 2012-2, SKJM 5, SYJ 64, PM 25, SKM 219, GM 1, KMR 15-4, KM 126, RB 50, RB 55, RB 24, GM 3, GDM 4 were used as parents	23	84	38
	Early maturing, Temp. tolerance & High seed yield	F ₆ - I	RH 119, Urvashi, Kanti, P. Vijay, RH 749, Navgold, RS 1, GM 2, RH 1134, P. Vijay, GM 1, NRCHB 101, PM 25, PM 28, SKM 1313, RB 50, TM 108, BPR 540-6, SKM 1313, GM 3, GDM 4, NRCDR 2 were taken as parents	53	--	51
	Interspecific	F ₆ - II	GM 3, GS 1, BCRS 3, NRCG 4, SKBN 95-1 were used	03	--	05
	High seed yield, bold seed & quality	F ₇	GM 1, GM 2, GM 3, GDM 4, RB 50, BPR 540-6, Bio 902, LES 46, RGN 303 were used	25	02	31
	Hybrid development	CMS lines maintained	Involving CMS lines with <i>Mori</i> , <i>Ogura</i> , <i>Oxyrrhina</i> and <i>Sifolia</i> system	36	--	--
Restorer lines developed/ maintained			25	--	--	
F ₁		New test hybrids based upon <i>Mori</i> CMS system were evaluated	28			
Varanasi	Development of new crosses in Line × Tester Fashion for yield in timely and late sown conditions, terminal heat and drought stress tolerance and disease (alternaria, white rust and sclerotinia)	New F ₁ developed	NCP-01× HUJM-99-03, NCP-01× HUJM-08-01, NCP-01× HUJM-08-12, NCP-01× HUJM-07-06, NCP-01× HUJM-05-03, NCP-01× HUJM-08-04, NCP-01× HUJM-09-07, NCP-01× HUJM-10-6, NCP-01, *HUJM-16-8, NCP-01× HUJM-17-6, NCP-01× HUJM-17-7, NCP-01× HUJM-17-7, NCP-01× HUJM-17-8, NCP-01× HUJM-18-6, NCP-01× HUJM-18-7, NCP-01× HUJM-18-9, NCP-01× HUJM-19-11, NCP-01× HUJM-19-18, NCP-01× HUJM-19-11, , NCP-02× HUJM-99-03, NCP-02× HUJM-08-01, NCP-02× HUJM-08-12, NCP-02, *, HUJM-07-06, NCP-02 × HUJM-05-03, NCP-02× HUJM-08-04, NCP-02× HUJM-09-07, NCP-02× HUJM-10-6, NCP-02× HUJM-16-6, NCP-02× HUJM-17-7, NCP-02× HUJM-17-8, NCP-02× HUJM-18-6, NCP-02×	184	-	-

	tolerance through pedigree selection		<p>HUJM-18-7, NCP-02* HUJM-18-9, NCP-02* HUJM-19-11, NCP-02* HUJM-19-18, NCP-02* HUJM-10-6, NCP-03* HUJM-99-03, NCP-03* HUJM-08-01, NCP-03* HUJM-08-12, NCP-03* HUJM-07-06, NCP-03* HUJM-05-03, NCP-03* HUJM-08-04, NCP-03* HUJM-09-07, NCP-03* HUJM-10-6, NCP-03* HUJM-16-8, NCP-03* HUJM-17-6, NCP-04* HUJM-99-03, NCP-04* HUJM-08-01, NCP-04* HUJM-08-12, NCP-04* HUJM-07-06, NCP-04* HUJM-05-03, NCP-04* HUJM-08-04, NCP-04* HUJM-09-07, NCP-04* HUJM-10-6, NCP-04* HUJM-16-8, NCP-04* HUJM-17-6, NCP-04* HUJM-17-7, NCP-04* HUJM-17-7, NCP-04* HUJM-17-8, NCP-05* HUJM-99-03, NCP-05* HUJM-08-01, NCP-05* HUJM-08-12, NCP-05* HUJM-07-06, NCP-05* HUJM-05-03, NCP-05* HUJM-08-04, NCP-05* HUJM-09-07, NCP-05* HUJM-10-6, NCP-05* HUJM-16-8, NCP-06* HUJM-99-03, NCP-06* HUJM-08-01, NCP-06* HUJM-08-12, NCP-06* HUJM-07-06, NCP-06* HUJM-05-03, NCP-06* HUJM-08-04, NCP-06* HUJM-09-07, NCP-06* HUJM-10-6, NCP-06* HUJM-16-8, NCP-06* HUJM-17-6, NCP-06* HUJM-17-7, NCP-06* HUJM-17-7, NCP-06* HUJM-17-8, NCP-06* HUJM-18-6, NCP-06* HUJM-18-7, NCP-07* HUJM-99-03, NCP-07* HUJM-08-01, NCP-07* HUJM-08-12, NCP-07* HUJM-07-06, NCP-07* HUJM-05-03, NCP-07* HUJM-08-04, NCP-07* HUJM-09-07, NCP-07* HUJM-10-6, NCP-07* HUJM-16-8, NCP-07* HUJM-17-6, NCP-07* HUJM-17-7, NCP-07* HUJM-17-7, NCP-07* HUJM-17-8, NCP-07* HUJM-18-6, NCP-08* HUJM-99-03, NCP-08* HUJM-08-01, NCP-08* HUJM-08-12, NCP-08* HUJM-07-06, NCP-08* HUJM-05-03, NCP-08* HUJM-08-04, NCP-08* HUJM-09-07, NCP-08* HUJM-10-6, NCP-08* HUJM-16-8, NCP-08* HUJM-17-6, NCP-08* HUJM-17-7, NCP-08* HUJM-17-7, NCP-08* HUJM-17-8, NCP-09* HUJM-99-03, NCP-09* HUJM-08-01, NCP-09* HUJM-08-12, NCP-09* HUJM-07-06, NCP-09* HUJM-05-03, NCP-09* HUJM-08-04, NCP-09* HUJM-09-07, NCP-09* HUJM-10-6, NCP-09* HUJM-16-8, NCP-09* HUJM-17-6, NCP-10* HUJM-99-03, NCP-10* HUJM-08-01, NCP-10* HUJM-08-12, NCP-10* HUJM-07-06, NCP-10* HUJM-05-03, NCP-10* HUJM-08-04, NCP-10* HUJM-09-07, NCP-10* HUJM-10-6, NCP-11* HUJM-99-03, NCP-11* HUJM-08-01, NCP-11* HUJM-08-12, NCP-11* HUJM-07-06, NCP-11* HUJM-05-03, NCP-11* HUJM-08-04, NCP-11* HUJM-09-07, NCP-11* HUJM-10-6, NCP-11* HUJM-16-8, NCP-11* HUJM-17-6, NCP-11* HUJM-17-7, NCP-11* HUJM-17-7, NCP-11* HUJM-17-8, NCP-12* HUJM-99-03, NCP-12* HUJM-08-01, NCP-12* HUJM-08-12, NCP-12* HUJM-07-06, NCP-12* HUJM-05-03, NCP-12* HUJM-08-04, NCP-12* HUJM-09-07, NCP-12* HUJM-10-6, NCP-12* HUJM-16-8, NCP-12* HUJM-17-6, NCP-12* HUJM-17-7, NCP-12* HUJM-17-7, NCP-12* HUJM-17-8, NCP-13* HUJM-99-03, NCP-13* HUJM-08-01, NCP-13* HUJM-08-12, NCP-13* HUJM-07-06, NCP-13* HUJM-05-03, NCP-13* HUJM-08-04, NCP-13* HUJM-09-07, NCP-13* HUJM-10-6, NCP-13* HUJM-16-8, NCP-13* HUJM-17-6, NCP-14* HUJM-99-03, NCP-14* HUJM-08-01, NCP-14* HUJM-08-12, NCP-14* HUJM-07-06, NCP-14* HUJM-05-03, NCP-14* HUJM-08-04, NCP-14* HUJM-09-07, NCP-14* HUJM-10-6, NCP-14* HUJM-16-8, NCP-14* HUJM-17-6, NCP-15* HUJM-99-03, NCP-15* HUJM-08-01, NCP-15* HUJM-08-12, NCP-15* HUJM-07-06, NCP-15* HUJM-05-03, NCP-15* HUJM-08-04, NCP-15* HUJM-09-07, NCP-15* HUJM-10-6</p>			
		F ₁	RH 749 * TM 143, RH 749 * TM 258, RH 749 * TM 130, RH 749 * TM 108, RH 749 * TPM 1, RH 749 * TM-217, RH 749 * TM 108-1, RH 749 * TM 117, RH 749 * TM 52, RH 749 * TM 263 -3, GIRIRAJ * TM 143, GIRIRAJ * TM 258, GIRIRAJ * TM 130, GIRIRAJ * TM 108, GIRIRAJ * TPM 1, GIRIRAJ * TM 217, GIRIRAJ * TM 108-1, GIRIRAJ * TM 117, GIRIRAJ			

		* TM 52, GIRIRAJ * TM 263-3, HUJM 10-6 * TM 143, HUJM 10-6 * TM 258, HUJM 10-6 * TM 130, HUJM 10-6 * TM 108, HUJM 10-6 * TPM 1, HUJM 10-6 * TM 217, HUJM 10-6 * TM 108-1, HUJM 10-6 * TM 117, HUJM 10-6 * TM 52			
	F₂	RH 406*HUJM 9901, RH 406 * HUJM 08-01, RH 406 * HUJM- 07-06, RH 406 * HUJM-9903, RH 406 * HUJM-08-12, RH 406 * HUJM-95-04, RH 406 * HUJM-05-03, RH 406 * HUJM -18-2, RH 406 * HUJM-18-7, NRCHB 101 * HUJM 9901, NRCHB 101 * HUJM 08-01, NRCHB 101 * HUJM- 07-06, NRCHB 101 * HUJM-9903, NRCHB 101 * HUJM-08-12, NRCHB 101 * HUJM-95-04, NRCHB 101 * HUJM-05-03, NRCHB 101 * HUJM -18-2, NRCHB 101 * HUJM-18-7, PM 25 * HUJM 9901, PM 25 * HUJM 08-01, PM 25 * HUJM-07-06, PM 25 * HUJM-9903, PM 25 * HUJM-08-12, PM 25 * HUJM-95-04, PM 25 * HUJM-05-03, PM 25 * HUJM -18-2, PM 25 * HUJM-18-7, Vardan * HUJM 9901, Vardan * HUJM 08-01, Vardan * HUJM- 07-06, Vardan * HUJM-9903, Vardan * HUJM-08-12, Vardan * HUJM-95-04, Vardan * HUJM-05-03, Vardan * HUJM -18-2, Vardan * HUJM-18-7, Giriraj * HUJM 9901, Giriraj * HUJM 08-01, Giriraj * HUJM- 07-06, Giriraj * HUJM-9903, Giriraj * HUJM-08-12, Giriraj * HUJM-95-04, Giriraj * HUJM-05-03, Giriraj * HUJM -18-2, Giriraj * HUJM-18-7, JD 6 * HUJM 9901, JD 6 * HUJM 08-01, JD 6 * HUJM- 07-06, JD 6 * HUJM-9903, JD 6 * HUJM-08-12, JD 6 * HUJM-95-04, JD 6 * HUJM-05-03, JD 6 * HUJM -18-2, JD 6 * HUJM-18-7, RH 406 * HUJM 9901, RH 406 * HUJM 08-01, RH 406 * HUJM- 07-06, RH 406 * HUJM-9903, RH 406 * HUJM-08-12, RH 406 * HUJM-95-04, RH 406 * HUJM-05-03, RH 406 * HUJM -18-2, RH 406 * HUJM-18-7, NRCHB 101 * HUJM 9901, NRCHB 101 * HUJM 08-01, NRCHB 101 * HUJM- 07-06, NRCHB 101 * HUJM-9903, NRCHB 101 * HUJM-08-12, NRCHB 101 * HUJM-95-04, NRCHB 101 * HUJM-05-03, NRCHB 101 * HUJM -18-2, NRCHB 101 * HUJM-18-7, PM 25 * HUJM 9901, PM 25 * HUJM 08-01, PM 25 * HUJM- 07-06, PM 25 * HUJM-9903, PM 25 * HUJM-08-12, PM 25 * HUJM-95-04, PM 25 * HUJM-05-03, PM 25 * HUJM -18-2, PM 25 * HUJM-18-7, Vardan * HUJM 9901, Vardan * HUJM 08-01, Vardan * HUJM- 07-06, Vardan * HUJM-9903, Vardan * HUJM-08-12, Vardan * HUJM-95-04, Vardan * HUJM-05-03, Vardan * HUJM -18-2, Vardan * HUJM-18-7, Giriraj * HUJM 9901, Giriraj * HUJM 08-01, Giriraj * HUJM- 07-06, Giriraj * HUJM-9903, Giriraj * HUJM-08-12, Giriraj * HUJM-95-04, Giriraj * HUJM-05-03, Giriraj * HUJM -18-2, Giriraj * HUJM-18-7, JD 6 * HUJM 9901, JD 6 * HUJM 08-01, JD 6 * HUJM- 07-06, JD 6 * HUJM-9903, JD 6 * HUJM-08-12, JD 6 * HUJM-95-04, JD 6 * HUJM-05-03, JD 6 * HUJM -18-2, JD 6 * HUJM-18-7	108	316	-
	F₃	KRANTI * BIO YSR * KRANTI, KRANTI * BASANTI * KRANTI, BASANTI * RH 749 * BASANTI, RH 749 * BASANTI * RH 749, RH 749 * BIO YSR * RH 749, VARUNA * HEERA * VARUNA, HEERA * RH749 * HEERA, BASANTI * KRANTI * BASANTI, VARUNA * BASANTI * VARUNA, BASANTI * VARUNA * BASANTI, VARUNA * BIO YSR * VARUNA, HEERA * KRANTI * HEERA, BIO YSR * KRANTI * BIO YSR, RH 749 * HEERA * RH 749, VARUNA * BIO YSR * BIO YSR, VARUNA * HEERA * HEERA, HEERA * KRANTI * KRANTI, RH 749 * BIO YSR * BIO YSR, VARUNA * BASANTI, VARUNA * BIO YSR, KRANTI * HEERA, RH 749 * BASANTI, RH 749 * BIO YSR, RH 749 * HEERA, VARUNA * HEERA, KRANTI * BASANTI, KRANTI * BIO YSR, RH 749 * RH 119, RH 749 * PM 27, RH 749 * RH 119, RH 749 * VARDAN, RH 749 * RH 406, RH 749 * DRMR 150-35, RH 749 * RGN 229, RH 749 * PUSA BOLD, RH 749 * NRCHB 101, RH 749 *	111	333	-

		PM 28, RH 749 * RGN 298, RH 749 * DRMR 150-35, RGN 73 * PM 28, RGN 73 * DRMR 150-35, RGN 73 * NRCHB 101, RGN 73 * PUSA BOLD, RGN 73 * RH 406, RGN 73 * RH 119, RGN 73 * RGN 298, RGN 73 * PM 27, RGN 73 * RGN 229, RGN 73 * VARDAN, GIRIRAJ * PM 28, GIRIRAJ * DRMR 150-35, GIRIRAJ * PM 28, GIRIRAJ * PUSA BOLD, GIRIRAJ * RH 119, GIRIRAJ * RGN 229, GIRIRAJ * RH 406, GIRIRAJ * NRCHB 101, GIRIRAJ * PM 27, GIRIRAJ * RGN 298, GIRIRAJ * VARDAN, RH 749 * PM 28, MJB 3 * RE 35-4, EC 597309 * RE 13, JUNCEA YS * DONSKAJA, MJB 10 * RE 8, JUNCEA YS * RE 44, EC 597309 * RE 44, EC 597309 * RE 8, EC 597309 * DONSKAJA, JUNCEA YS * RE 8, MJB 3 * RE 14			
	F₄	KRANTI * PUSA BOLD, VARDAN * PUSA BOLD, VARDAN * SEJ 2, KRANTI * PM 26, NRCHB 101 * PM 30, KRANTI * SEJ 2, KRANTI * RH 406, VARDAN * BPR 541-4, KRANTI * PM 25, NRCHB 101 * PUSA BOLD, KRANTI * URVASHI, VARDAN * URVASHI, KRANTI * PM 30, VARDAN * PM 25, NRCHB 101 * RH 406, VARDAN * PM 30, NRCHB 101 * PM 25, NRCHB 101 * PM 26, KRANTI * GIRIRAJ, VARDAN * RH 406, NRCHB 101 * SEJ 2, NRCHB 101 * URVASHI, VARDAN * PM 26, NRCHB 101 * GIRIRAJ, VARDAN * GIRIRAJ, NRCHB 101 * BPR 541-4, KRANTI * BPR 541-4	28	74	
	F₅	VARUNA * PUSA BOLD, SEJ 2 * PUSA BOLD, VARDAN * PM 25, MAYA * NDRE 4, VARDAN * SWARN JYOTI	5	15	
	F₆	SEJ 2 * HUJM 9903, MAYA * RH 8813, NPJ 112 * HUJM 9901, SEJ 2 * HUJM 9964, DIBYA * KRANTI, ASHIRWAD * LP, SEJ 2 * RH 8813, ASHIRWAD * PUSA BOLD, MAYA * NPJ 112, RGN 73 * HUJM 9901, NPJ 112 * RH 8813, VARDAN * SWARN JYOTI, PR 19 * ABR 4, VARUNA * LP, VARDAN * LP, VARDAN * HUJM 9901, PR 19 * RH 8813, ASHIRWAD * HUJM 9901, ASHIRWAD * NPJ 112, NPJ 112 * LP, , KRANTI * JATAI RAI, ASHIRWAD * HUJM 9903, ASHIRWAD * RLM 1359, KRANTI * LP, NRCHB 101 * JATAI RAI, VARUNA * LP, MAYA * JATAI RAI, VARUNA * JATAI RAI, KRANTI * NPJ 112, GIRIRAJ, VARDAN * HUJM 9901, VARUNA * PUSA BOLD, ASHIRWAD * SWARN JYOTI, NDRE 4 * LP, ASHIRWAD * RH 8812, MAYA * PUSA BOLD, MAYA * RLM 1359, NPJ 112 * KRANTI, NPJ 112 * HUJM 9964, NRCHB 101 * HUJM 07-06, VARUNA * HUJM 07-06, KRANTI * HUJM 9901, RGN 73 * RLM 1359, RGN 73 * HUJM 9903, ASHIRWAD * RH 781, NDRE 4 * PUSA BOLD, NDRE 4 * RH 8812, SEJ 2 * NDRE 4, SEJ 2 * PUSA BOLD, DIBYA * ABR 4, PR 19 * HUJM 9964, MAYA * RH 781, PR 19 * VARUNA, KRANTI * HUJM 9964	53	150	
	F₇	SEJ 2 * KRANTI, NPJ 112 * ASHIRWAD, MAYA * NPJ 112, NPJ 112 * LP, NPJ 112 * HUJM 9964, SEJ 2 * RH 8813, KRANTI * LP, PR 19 * KRANTI, MCN 10-11 * HUJM 9901, SEJ 2 * HUJM 9901, NPJ 112 * HUJM 9901, SEJ 2 * VARUNA, VARUNA * HUJM 9901, PR 19 * RH 8814, PR 19 * HUJM 9964, NDRE 4 * ABR 4, DIBYA * KRANTI, PR 19 * ABR 4, PR 19 * PUSA BOLD, PR 19 * RH 8813, DIBYA * RH 8814, HUJM 09-04-1, NDRE 4 * VARUNA, PR 19 * HUJM 9901, NPJ 112 * RH 8812	23	69	
		MCN 6-22 * ABR 4 (9511), LP * VARDAN (4-2-2-2-2-1), HUJM 09-04, HUJM 10-24 (MCN 05-28 * RH 8812), HUJM 09-25-2, HUJM 10-28, HUJM 10-24, HUJM 08-18-11-1-1, HUJM 05-28 * RH 8812-1-1-1-1, HUJM 08-18-11-1-1, MCN 05-28 * PUSA BOLD, HUJM 09-13-2	12	36	
	F₉	LP * RH 781-3-11, ABR 4 * KRANTI 3-2-1, LP * RH 8813-3-2-1-2-1-2-1-2, ISH 7-3-2 * HUJM 9903-4-1-2, NDRE 4 * HUJM 9901-3-1-1-2-1, LP * RH 8813-3-2-1-2-1-2-1-2, ISH 7-3-	14	94	

			2 * RH 781-1-2-1, MCN -03-35-2-1-2-2-1-1-1-2, MCN -08-12 * HUJM 99-03-3-3-3-2, MCN 08-12 * HUJM 99-01-3-3-1-2, HUJM-10-2-3-2-1 (MCN 05-28 * RH 8812), ASHIRWAD * MCN-22-1-1-2, HUJM-09-19-2-1-1 (MCN 03-23 * RH 8814), HUJM 09-19-1-1-1 (VARUNA * NDR-9321 MUTANT)			
		F ₁₀	HUJM 09-26-1, HUJM 10-30-1, HUJM 14-2-1-1, ISH-7-3-2 * HUJM 9903-1-1-3, MCN 05-28 * PUSA BOLD 3-1-2-1-1, MCN 08-12 * HUJM 9904-05, NRCHB 803-1-2-1, RGN 239-2-1-1-1	8	24	
Kota	High yield & white rust resistance (National Crossing Programme)	Fresh Crosses	NPJ-231 x DRMRMJB 35, NPJ 231 x DRMRIJ 12-48, NPJ-231 x RLC-3, NPJ-232 x DRMRMJB 35, NPJ 232 x DRMRIJ 12-48, NPJ-232 x RLC-3	06	-	-
	High yield, high oil content & earliness (Station Programme)	Fresh Crosses (10 L x 4 T)	RH 749 x PM-27, RH 749 x JM-1, RH 749 x CS-54, RH 749 x EJ-20, RH 74DRMRIJ-319 x PM-27, DRMRIJ-31 x JM-1, DRMRIJ-31 x CS-54, DRMRIJ-31 x EJ-20, NRCHB 101 x PM-27, NRCHB 101 x JM-1, NRCHB 101 x CS-54, NRCHB 101 x EJ-20, Kranti x PM-27, Kranti x JM-1, Kranti x CS-54, Kranti x EJ-20, PM-30 x PM-27, PM-30 x JM-1, PM-30 x CS-54, PM-30 x EJ-20, P. Mahak x PM-27, P. Mahak x JM-1, P. Mahak x CS-54, P. Mahak x EJ-20, P. Tarak x PM-27, P. Tarak x JM-1, P. Tarak x CS-54, P. Tarak x EJ-20, RH-30 x PM-27, RH-30 x JM-1, RH-30 x CS-54, RH-30 x EJ-20, IC 597889 x PM-27, IC 597889 x JM-1, IC 597889 x CS-54, IC 597889 x EJ-20, IC 597910 x PM-27, IC 597910 x JM-1, IC 597910 x CS-54, IC 597910 x EJ-20	40	-	-
	Terminal heat tolerance, yield and contributing traits	F ₁	RH 749 x RVM-2, RH 749 x Urvashi, RH 749 x DRMR 2059, RH 725 x RVM-2, RH 725 x Urvashi, RH 725 x DRMR 2059, DRMRIJ 31 x RVM-2, DRMRIJ 31 x Urvashi, DRMRIJ 31 x DRMR 2059, NRCHB 101 x RVM-2, , , NRCHB 101 x Urvashi, , NRCHB 101 x DRMR 2059, PM-27 x RVM-2, PM-27 x Urvashi, PM-27 x DRMR 2059, NPJ-231 x RVM-2, NPJ-231 x Urvashi, NPJ-231 x DRMR 2059, NPJ-232 x RVM-2, NPJ-232 x Urvashi NPJ-232 x DRMR 2059	21	-	-
	Breeding high yielding genotypes for different maturity groups	F ₂	12 Lines x 4 Testers (L x T mating)	48	318	-
		F ₃		109/388	307	-
		F ₄		16/232	215	-
F ₅			12/87	140	53	
F ₆			6/23	47		
Jagdalpur	Earliness, high seed yield, bold seed and quality	Fresh Crosses	RE 11 x NC 37362, RE 11 x RE 44, RE 11 x CN 105364, RE 11 x IC 597880, RE 11 x RIC 3, RE 11 x RE 8, NC 37362 x RE 44, NC 37362 x CN 105364, NC 37362 x IC 597880, NC 37362 x RIC 3, NC 37362 x RE 8, RE 44 x CN 105364, RE 44 x IC 597880, RE 44 x RIC 3, RE 44 x RE 8, CN 105364 x IC 597880, CN 105364 x RIC 3, CN 105364 x RE 8, IC 597880 x RIC 3, IC 597880 x RE 8, RIC 3 x RE 8, DRMRMIB 35 x DRMRIJ 12-48, DRMRMIB 35 x DRMRIJ 12-40, DRMRMIB 35 x DRMRIJ 31, DRMRMIB 35 x LES 39, DRMRMIB 35 x TN 3, DRMRMIB 35 x NPJ 112, DRMRIJ 12-48 x DRMRIJ 12-40, DRMRIJ 12-48 x DRMRIJ 31, DRMRIJ 12-48 x LES 39, DRMRIJ 12-48 x TN 3, DRMRIJ 12-48 x NPJ 112, DRMRIJ 12-40 x DRMRIJ 31, DRMRIJ 12-40 x LES 39, DRMRIJ 12-40 x TN 3, DRMRIJ 12-40 x NPJ 112, DRMRIJ 31 x LES 39, DRMRIJ 31 x TN 3, DRMRIJ 31 x NPJ 112, LES 39 x TN 3, LES 39 x NPJ 112, TN 3 x NPJ 112	42		
		F ₃	Laxmi x Pusa Bold, Pusa Agrim x Pusa Bold, DRMR IJ-31 x Pusa Bold, CG Sarson x Pusa Bold, RH-406 x Pusa Bold, Laxmi x Kranti, Pusa Agrim x Kranti, DRMR IJ-31 x Kranti, CG	20		

			Sarson x Kranti, RH-406 x Kranti, Laxmi x Varuna, Pusa Agrim x Varuna, DRMR IJ-31 x Varuna, CG Sarson x Varuna, RH-406 x Varuna, Laxmi x PM-27, Pusa Agrim x PM-27, DRMR IJ-31 x PM-27, CG Sarson x PM-27, RH-406 x PM-27			
		F4	Laxmi x Pusa Bold, Pusa Agrim x Pusa Bold, DRMR IJ-31 x Kranti, DRMR IJ-31 x Varuna, Kranti x Varuna, Pusa Agrim x Kranti, DRMR IJ-31 x Pusa Bold, Pusa Agrim x Varuna, Laxmi x Varuna	9		
	Earliness, high seed yield, bold seed and quality	F5	RH-749 x RH-119, RH-749 x RH-406, RH-749 x DRMR IJ-31, RH-749 x NRCHB-101, RH-119 x RH-406, RH-119 x DRMR IJ-31, RH-119 x NRCHB-101, RH-406 x DRMR IJ-31, RH-406 x NRCHB-101, DRMR IJ-31 x NRCHB-101	10	60	
		F6	NPJ-112 x Laxmi, NPJ-112 x DRMR IJ-31, NPJ-112 x Pusa Bold, NPJ-112 x Kranti, Laxmi x DRMR IJ-31, Laxmi x Pusa Bold, Laxmi x Kranti, DRMR IJ-31 x Pusa Bold, DRMR IJ-31 x Kranti, Pusa Bold x Kranti	10	50	
Crop: Gobhi Sarson						
Chatha-Jammu.	High seed yield & oil content	Fresh crosses	DGS-1, RSPN-25, GSL-1 With HNS 1102, DRMRIN 20-23, AKGS 8060 & GSH-1723	12		
		F ₁	GSH-1699, RSPN-28, RSPN-25, DGS-1, GSH-1707, AKGS-8146, HNS-1102, GSH-1717 & AKGS-8217 With GSC-6, GSL-1 & AKMS-8141	27		
		F ₂	Improved breeding lines/varieties	12		
		F ₃	Advanced fixed genotypes with GSC-6, GSL-1 & RSPN-25	18		
		F ₄	CNH-11-1, RSPN-28, CNH-11-13, HNS0901, RSPN-25 With GSC-6, GSL-1 & DGS-1	15		
		F ₅	GSL-1 x RSPN-28, GSL-1 x RSPN-29, DGS-1 x GSC-101, RSPN-25 x RSPN-28, RSPN-25 x GSC-101.	05		
Ludhiana	For early maturity and productivity	Fresh crosses	P-68 X I-75, BLN-33-51 X I-75, NECN-12-6 X I-75, P-128 X I-75, P-140 X I-75, TRILOGY X D-22, TRILOGY X I-75, P-80X I-75, P-125 X I-75, JCN-8 X I-75, P-125 X I-75, P 51 X I-75, D-21X I-75, HCN-12-12X I-75, DT-15-6-4 X I-75, DT-14-8-6 X I-75, P-174 X I-75, DT-6-19-P1 X I-75, P-123 X I-75, P-120 X I-75, P-139 X I-75, P-134 X I-75, P-85X I-75, P-124 X I-75, D-34X I-75, I-115 X I-75, I-129 X I-75, I-96 X I-75, P-89X I-75, P-100 X I-75, P-66X I-75, P-61X I-75, GSC-6 X I-75, P-113 X I-75, JCN-8 X D-22, PN-5-6-1 X D-22, DT-14-8-6 X D-22, BCN-28X D-22, P-125 X D-22, NECN-12-6 X D-22, I-115 X D-22, P-126 X D-22, OCN-98X D-22, P-132 X D-22, GSC-6 X D-22, I-96 X D-22, DT-15-6-4 X D-22, D-21X D-22, P-134 X D-22, P-124 X D-22, I-129 X D-22, P-120 X D-22, P-68X D-22, NCN-11-6 X GSC-21, I-115 X GSC-21, NECN-12-6 X GSC-21, D-25X GSC-21, P-66X GSC-21, DT-6-19-P1 X GSC-21, P-68X GSC-21, P-85X GSC-21, I-96 X GSC-21, P-85X GSC-21, DT-14-8-6 X GSC-21, P-120 X GSC-21, P-123 X GSC-21, P-134 X GSC-21, BC-2 X GSC-21, P-126 X GSC-21, DM X GSC-21, P-140 X GSC-21, I-129 X GSC-21, P-132 X GSC-21, P-139 X GSC-21, D-34 X GSC-21, GSC-6 X GSC-21, P-100 X GSC-21, DM X GSC-21, P-124 X GSC-21, P-89 X GSC-21, P-80 X GSC-6, P-124 X GSC-6, P-100 X GSC-6, P-89 X GSC-6, P-113 X GSC-6, BC-2 X GSC-6, P-29 X GSC-7, GSC-7 X DM, GSC-6 X DM, DT-6-19-P1 X GSC-22, P-85X GSC-22, P-80 X GSC-22, DM X GSC-22	93		
		F ₁	-	150		
		F ₅	-	264		
		Quality, productivity and	RILs	GSL1x Rivette GSL1x Monty	2	

	earliness							
	Hybrid development (B. napus): CMS lines developed/ maintained	Indian group -57 Introgressed B. napus -94 Exotic B. napus -18 Determinate B. napus -15					184	
		Fertility Restorers					4	
National crossing programme								
Pantnagar	National crossing programme	F ₁	RLC-3×CRP-5, RLC-3×PRE-2020-16, RLC-3×PRHC-2014-5-1, RE-11×CRP-5, RE-11×PRE-2020-16, RE-11×PRHC-2014-5-1, LES-39×CRP-5, LES-39×PRE-2020-16, LES-39×PRHC-2014-5-1, M-34×CRP-5, M-34×PRE-2020-16, M-34×PRHC-2014-5-1, DRMR-12-48×CRP-5, DRMR-12-48×PRE-2020-16, DRMR-12-48×PRHC-2014-5-1, DRMRIJ-31×RH1585 DRMRIJ-31×Giriraj DRMRIJ-31×PR-21, NC-37362×RH1585, NC-37362×Giriraj, NC-37362×PR-21,					

Table 2.1.3 Evaluation of advanced breeding lines at different centres.

Centre	Name of trials	No. of trials	No. of strains tested	Name of best strain excelling the check	Yield (kg/ha)	Check	Superiority over the check (%)	Specific objective
1	2	3	4	5	6	7	8	9
Crop: Toria								
Kanpur	State Varietal Trail	01	10	TKM 19-1 TKM 16-1,TKM 19-2 TKM 18-1	1697 1620 1582	Tapeshwari (1389.00)	22.19 16.65 13.89	High Yielding, bold seeded & high oil content (%)
	Preliminary Yield Trail	01	12	TKM 21-108 TKM 21-110 TKM 21-109	1657 1620 1582	Tapeshwari (1389.00)	19.41 16.63 13.89	
Pantnagar	ST-I	1	12	PT-2020-7	1721	PT-303 (1384)	24.34	Earliness and high yield
				PT-2019-4	1645		18.85	
				PT-2020-5	1642		18.64	
	ST-II	1	12	PT-2021-5	1722	PT-303 (1417)	21.52	High yield
				PT-2020-2	1616		14.04	
				PT-2021-2	1582		11.16	
	SVT	1	09	TP-207	1952			
TP-205				1813				
				TP-201	1683			
Chatha-KS	Station trial	01	12	JT-11-9,	1359	PT-303	10.4	Earliness and high yield
				JT 15-2	1385		11.5	
Crop: Yellow Sarson								

Pantnagar	ST-I	1	14	PYS-2016-7	1844	Pitambari (1428)	29.13	High yield
				PYS-2020-7	1700		19.04	
				PYS-2020-12	1667		16.74	
	ST-II	1	24	PYS-2021-13	1800	Pitambari (1431)	25.78	High yield
				PYS-2021-12	1667		16.49	
				PYS-2021-8	1628		13.38	
	SVT	1	07	YPS-305	1795			High yield
				YSP-304	1696			
				YSP-301	1495			
Kanpur	State Varietal Trail	01	10	TKM 19-1 TKM 16-1,TKM 19-2 TKM 18-1	1697 1620 1582	Tapeshwari (1389.00)	22.19 16.65 13.89	High Yielding, bold seeded & high oil content (%)
	Preliminary Yield Trail	01	12	TKM 21-108 TKM 21-110 TKM 21-109	1658 1620 1582	Tapeshwari (1389.00)	19.41 16.63 13.89	
Crop: Indian Mustard								
Chatha	Station trial	01	16	JM-12-6, JM 14-9	1660 1765	Kranti	16.9 15.8	High Yield
Imphal (CAU)	STIM	1	15	CAU RM 4-1S	1632	NRCHB 101 (1465.6)	11.4	High yield
Hisar	FYT	1	10	Compilation in progress	-			
	FYT (LS)	1	10	Compilation in progress	-			
	FYT(Toria+early raya)	1	10	Compilation in progress				
	LST	3	35	Compilation in progress	-			
	SST	5	110	Compilation in progress	-			
	SST (ER)	1	25	Compilation in progress	-			
	SST (hybrid)	2	32	Compilation in progress	-			
Kanpur (Early Sown -Mustard)	State Varietal Trail	01	10	KMR(E) 18-2 DRMRCI 96 KMR(E) 16-2, KMR(E) 171	1813 1813 1775	Kanti (1620)	11.91 11.89 9.53	
	Preliminary Yield Trail	01	12	KMR(E) 21-305 KMR(E) 21-307 KMR(E) 21-302	1891 1852 1813	Kanti (1620)	16.68 14.29 11.91	
Kanpur (Timely Sown Sown-Mustard)	State Varietal Trail	01	08	KMR 20-4 KMR 19-3 KMR 19-4	2778 2726 2700	Maya (2469)	12.52 10.42 9.38	

	Preliminary Yield Trail	01	12	KMR 21-401, KMR 21-408 KMR 21-405 KMR 21-402	2804 2778 2752	Maya (2469)	13.55 12.52 11.46	
Kanpur (Late Sown -Mustard)	State Varietal Trail	01	10	KMR(L) 18-5 KMR(L) 19-5 KMR(L) 21-6	2212 2160 2135	Ashirwad (1801)	22.82 19.96 18.55	
	Preliminary Yield Trail	01	12	KMR(L) 21-510 KMR(L) 21-501 KMR(L) 21-507	2263 2227 2186	Ashirwad (1801)	25.69 23.69 21.42	
Ludhiana (conventional) : <i>Brassica juncea</i>	Multilocation – Timely sown	1	6+1©	PBR-788-1, PBR-813-2, PBR-825-2	>10% productivity as compared to the best check	PBR-357	-	Productivity Assessment
	Multilocation – Rainfed	1	6+2©	-	-	PBR-97 RH-725	--	Productivity Assessment under moisture stress conditions
	Multilocation – Late sown	1	7+1©	PBR-814-1, PBR-833	>10% productivity as compared to the best check	RLM-619	-	Productivity Assessment and terminal heat stress
Brassica juncea (0,00)	Multilocation – Timely sown	1	6+3©	JC-33, JC-36	>10% productivity as compared to the best check	RCH-1 RLC-3 PDZ-11	-	Productivity Assessment
	Multilocation – Timely sown	1	18+2©	PMAS-06, PMAS 07, HO-81, HO 93	>10% productivity as compared to the best check	RCH-1 PBR-357	-	Productivity Assessment
Hybrid Development in <i>B. juncea</i>	MLHT	1	22	PHR 3281, PHR 4284, PHR 8024, PHR 5175	>10% productivity as compared to the best check	DMH-1, PHR-126, PBR 357	-	High yield, earliness and oil content
	LSHT-1	1	20	PHR 3281, PHR 8031, PHR 8063, PHR 8067, PHR 8095, PHR 8410	>10% productivity as compared to the best check	DMH-1, PHR-126, PBR 357	-	High yield, earliness and oil content
	LSHT-2	1	28	PHR 3828, PHR 3281, PHR 3328, PHR 1293, PHR 8425	>10% productivity as compared to the best check	DMH-1, PHR-126, PBR 357	-	High yield, earliness and oil content
	SSHT-1	1	54	PHR-8151, PHR 8446, PHR-8135, PHR 8037, PHR 8444, PHR-3228	>10% productivity as compared to the best check	DMH-1, PHR-126, Giriraj, PBR-357	-	High yield, earliness and oil content
	HPRT	1	144	PHR 9167, PHR 9054, PHR 9081, PHR 9051, PHR 9097	>10% productivity as compared to the best check	PHR-126, Giriraj, DMH-1, PBR-357	-	High yield, earliness and oil content

	LST-1 (Introgressed mustard)	1	56	JT-183, JT-707, JT-529, JT-623, JT-M19, IAN DTRAYA, JA-49, JA-69, JA 79, JA 308, JA331	Higher productivity as compared to the best check	Giriraj, PBR-357	-	High yield and terminal stage heat tolerance
	LST-2 (Determinate mustard)	1	40	DTM-274-3, IAN-DTRAYA, DTM 239-3, DTM 172-4	Higher productivity as compared to the best check	PBR 91 PBR 357 PBR 210 Giriraj	-	Plant height, high yield and earliness
	Paired row -1 (Determinate mustard)	1	121	DTM-214, DTM 307, DTM 308, DTM 315, IAN-DT, DTM 321, DT-57-3	Higher productivity as compared to the best check	PBR 91 PBR 357 PBR 210 Giriraj	-	<i>Sclerotinia</i> resistance
	MLHT	1	22	PHR 3281, PHR 4284, PHR 8024, PHR 5175	>10% productivity as compared to the best check	DMH-1, PHR-126, PBR 357	-	High yield, earliness and oil content
	LSHT-1	1	20	PHR 3281, PHR 8031, PHR 8063, PHR 8067, PHR 8095, PHR 8410	>10% productivity as compared to the best check	DMH-1, PHR-126, PBR 357	-	High yield, earliness and oil content
Pantnagar	ST-I	1	14	PRE-2018-1	1807	PM-25 (1454)	29.71	Earliness and high yield
				PRE-2021-17	1648		13.34	
				PRE-2018-1	1657		13.96	
	ST-II	1	20	PRE-2021-13	2117	PR-19 (1668)	26.92	Earliness and high yield
				PRE-2021-14	2003		20.08	
				PRE-2021-15	1970		18.10	
	ST-III	1	14	PYR-2018-1	1822	Kranti (1479)	23.19	Timely sown and High yield
				PR-2020-14	1746		18.05	
				PR-2017-8	1632		10.34	
	ST-IV	1	14	PR-2021-7	2159	Kranti (1685)	28.13	Timely sown and High yield
				PR-2021-11	2000		18.69	
				PR-2021-4	1941		15.19	
	ST-V	1	14	PYR-2021-6	1624	Kranti (1322)	22.84	Yellow seed color
				PYR-2019-3	1436		8.6	
ST-VI	1	20	PAB-2017-3	1951	NRCHB101(1534)	27.18	Late sown and high yield	
			PRL-2020-3	1694		10.48		
			PRL-2020-20	1696		10.57		
SVT	1	08	RP-406	2035			High yield	
			RP-404	2010				
			RP-401	1936				
Dholi	CSVT	01 (Eleven locations)	07	Multi location data under Analysis	--	PM 25, RGN 73& Kranti	--	To develop high yielding varieties for Bihar

S K Nagar	LSVT (E)	01	08	SKM 1805	2615	GM 1	17.90	Early maturing & High seed yield	
				SKM 1731	2591		16.82		
				SKM 1746	2472		11.44		
	LSVT (M)	01	12	SKM 1801	3203	GDM 4	17.54	High seed yield & Medium maturing	
				SKM 1924	3017		10.71		
				SKMH 1901	3303	NRCHB 506	22.51		
	SSVT	01	14	SKM 2012	2918	Kranti	18.68	High seed yield	
				SKM 2008	2792		13.54		
				SKM 2011	2726		10.87		
	PYT - I	01	22	SKM 2015	2422	GM 1	13.86	Early maturing. High seed yield & Dwarf	
				SKM 2104	2322		09.17		
				SKM 2112	2271		06.79		
	PYT - II	01	20	SKM 2120	2956	GDM 4	11.28	High seed yield & Bold seed	
				SKM 2113	2937		10.59		
	PYT - III	01	18	SKM 2135	2548	GDM 4	11.68	High seed yield & Medium maturing	
				SKM 2133	2526		10.73		
	Varanasi	SVT-1 (EARLY)	1	24	HUJM-21(E)-1	4311	3744 kg/ha	15.1	High yield
					HUJM (E)-21-2	4277	3744 kg/ha	14.2	
HUJM (E)- 21-9					4255	3744 kg/ha	13.7		
SVT-2 (TIMELY)		1	12	HUJM-21-4	3244 kg/ha	2933 kg/ha	10.61		
				HUJM-21-1	3200 kg/ha	2933 kg/ha	9.09		
				HUJM-21-9	3200 kg/ha	2933 kg/ha	9.09		
SVT-3 (LATE)		1	12	HUJM-21-1	4088 kg/ha	3022 kg/ha	35.29		
				HUJM-21 - 8	3866 kg/ha	3022 kg/ha	27.94		
				HUJM-21-4	3733 Kg/ha	3022 kg/ha	23.53		
Crop: Gobhi Sarson									
Hisar	LST	1	10	Compilation in progress					
Chatha	Station trial	01	09	JGS 15-6, JGS 16-3	1909 1954	GSC-7	11.6 13.4	High Yield	
Ludhiana									
Hybrid Development in Gobhi Sarson	MLHT	1	12	GSH 1711	>10% productivity as compared to the best check	GSC-7, GSH-1699, Hyola 405, GSH-1707	-	Earliness, plant height, yield and oil content	
	PRHT	1	80	GSH 2526, GSH 1692, GSH 2571, GSH 2546, GSH 2207, GSH 2549, GSH 2406, GSH 2547	>10% productivity as compared to the best check	GSC-7, GSH-1699, Hyola 405, GSH-1707	-	Earliness, plant height, yield and oil content	
	PRT	1	85	D 34, D13, D25, P 80, P41	>10% productivity as compared to the best check	GSC-6, GSC 7, GSH-1699, GSH-1707	-	Early maturity and shattering tolerance	

2.2 Breeder seed production

Indents of 84.38q breeder seed of 70 Rapeseed-Mustard varieties were received from Department of Agriculture and Cooperation (DAC), Ministry of Agriculture and Farmer Welfare, Govt. of India for production during 2021-22. The allocation was made to 20 centres for the production of 84.13q breeder seed of 69 varieties during the 28th annual group meeting held through virtual-video conferencing. Against the indent of 84.13q, 233.16q breeder seed was produced, indicating a surplus availability of 160.16 q. Breeder seed of 03 varieties RH-819, RVM-3 and Pusa Kalyani of Indian mustard and one variety Pant Girija of yellow sarson could not be produced. Further, less quantity of RVM-1 of Indian mustard; Pusa Mustard-26 of Indian mustard; RTM-1355 of Taramira was produced. In addition, 35.67 q breeder seed of 17 varieties was also produced by different centres. The centre and variety-wise details of breeder seed production are reported in Table 2.2.

ICAR-DRMR, Bharatpur, Rajasthan

BSP- IV

Breeder Seed Production of indented Rapeseed-Mustard varieties during 2021-22

S. No.	State	Producing centre	Crop	Name of variety	Year of notification	DAC indent (q)	Actual allocation as per BSP-1 target(q)	Actual Production (q)	Production surplus(+)/ Deficit(-) over BSP-1 Target
1	Assam	AAU, Shilongani, Assam	Toria	TS-38	2020	1.00	1.00	0.00#	0.00
2	Chhattisgarh	IGKV Jagdalpur	Indian mustard	Chhattisgarh Sarson	2010	4.30	4.30	0.00	0.00
3	Gujarat	SDAU, SKNagar	Indian mustard	Gujarat Mustard -4	2015	0.10	0.10	3.40	3.30
4	Gujarat	SDAU, SKNagar	Indian mustard	Gujarat Mustard -5	2016	0.20	0.20	0.30	0.10
5	H.P.	Kangra	Gobhi Sarson	ONK-1 (Him Sarson)	2019	1.00	1.00	1.03	0.03
6	H.P.	Kangra	Gobhi Sarson	Neelam	2001	0.70	0.70	0.70	0.00
7	H.P.	Kangra	Indian mustard	RCC - 4	2001	0.10	0.10	0.25	0.15
8	Haryana	CCS HAU Hisar	Indian mustard	RH-725	2018	5.65	5.65	17.0	11.35
9	Haryana	CCS HAU Hisar	Indian mustard	RH 406	2013	0.05	0.05	0.96	0.91
10	Haryana	CCS HAU Hisar	Indian mustard	RH 0749	2013	0.07	0.07	2.55	2.48
11	Haryana	CCS HAU Hisar	Indian mustard	RH-761	2019	0.77	0.77	8.00	7.23
12	Haryana	CCS HAU Hisar	Indian mustard	RH-819	1991	0.20	0.20	0.00***	0.00
13	Haryana	CCS HAU Hisar	Indian mustard	RH-30	1985	0.02	0.02	6.00	5.98
14	Haryana	CCS HAU Hisar	Yellow Sarson	YSH 0401	2009	0.30	0.30	0.74	0.44
15	Haryana	CSSRI Karnal	Indian mustard	CS-58	2017	0.66	0.66	6.00	5.34
16	Haryana	CSSRI Karnal	Indian mustard	CS-60	2018	1.31	1.31	12.00	10.69
17	Haryana	SVHSP Ltd Hisar	Indian mustard	SVJ 64	2019	0.50	0.50	4.50	4.00
18	Jammu & Kashmir	SKUAT, Jammu	Toria	RSPT-06	2019	0.05	0.05	0.30	0.25
19	Jharkhand	BAU, Ranchi	Indian mustard	BAUR9502- (Shivani)	2005	0.25	0.25	0.70	0.45
20	Madhya Pradesh	ZARS, Morena	Indian mustard	RVM-1	2016	9.58	9.58	5.22	-4.36
21	Madhya Pradesh	ZARS, Morena	Indian mustard	RVM-3		0.13	0.13	0.00	0.00
22	Madhya Pradesh	ZARS, Morena	Toria	Raj Vijay Toria-1	2017	0.40	0.40	1.27	0.87
23	Madhya Pradesh	ZARS, Morena	Toria	Raj Vijay Toria-3	2020	0.25	0.25	3.68	3.43
24	New Delhi	IARI, New Delhi	Indian mustard	Pusa Mustard-32	2020	1.05	1.05	1.10	0.05
25	New Delhi	IARI, New Delhi	Indian mustard	Pusa Double Zero Mustard-31 (PDZ-1)	2016	4.91	4.91	5.0	3.43

26	New Delhi	IARI, New Delhi	Indian mustard	Pusa Mustard-25 (NPJ112)	2010	2.12	2.12	4.0	1.88
27	New Delhi	IARI, New Delhi	Indian mustard	Pusa Mustard-26 (NPJ113)	2011	6.00	6.00	3.75	-2.25
28	New Delhi	IARI, New Delhi	Indian mustard	Pusa Muastard-27 (EJ17)	2011	3.75	3.75	4.0	0.25
29	New Delhi	IARI, New Delhi	Indian mustard	Pusa Mustard 28 (NPJ124)	2012	4.02	4.02	5.0	0.98
30	New Delhi	IARI, New Delhi	Indian mustard	Pusa Mustard-30 (LES-43)	2013	6.40	6.40	8.0	1.60
31	New Delhi	IARI, New Delhi	Indian mustard	PusaTarak	2009	0.10	0.10	0.20	0.10
32	New Delhi	IARI, New Delhi	Indian mustard	Pusa Vijay (NPJ 93)	2008	0.50	0.50	0.50	0.00
33	New Delhi	IARI, New Delhi	Brown sarson	Pusa Kalyani (PN-15-5/19) **	1974	0.15	0.00	0.00	0.00
34	Orissa	OUAT Bhubaneswar	Toria	Sushree	2015	2.00	2.00	2.05	0.05
35	Punjab	PAU, Ludhiana	Indian mustard	PBR- 357	2013	0.23	0.23	3.5	3.27
36	Punjab	PAU, Ludhiana	Indian mustard	RLC-3	2016	0.03	0.03	1.0	0.97
37	Punjab	PAU, Ludhiana	Indian mustard	PBR- 91	1996	0.01	0.01	2.5	2.49
38	Punjab	PAU, Ludhiana	Toria	TL-17	2016	0.03	0.03	3.0	2.97
39	Punjab	PAU, Ludhiana	Gobhisarson	GSC-7	2014	0.13	0.13	10.0	9.87
40	Rajasthan	DRMR, Bharatpur	Indian mustard	Giriraj (DRMRIJ 31)	2013	5.72	5.72	10.00	4.28
41	Rajasthan	DRMR, Bharatpur	Indian mustard	DRMR 1165-40	2020	0.29	0.29	1.50	1.21
42	Rajasthan	DRMR, Bharatpur	Indian mustard	NRCHB-506 (f)	2009	0.25	0.25	0.50	0.25
43	Rajasthan	DRMR, Bharatpur	Indian mustard	NRCHB 101	2009	2.07	2.07	5.00	2.93
44	Rajasthan	DRMR, Bharatpur	Indian mustard	DRMR 2017-15 (Radhika)		0.65	0.65	3.50	2.85
45	Rajasthan	DRMR, Bharatpur	Indian mustard	DRMR 150-35	2020	0.40	0.40	1.40	1.00
46	Rajasthan	DRMR, Bharatpur	Indian mustard	DRMRIC 16-38	2020	0.10	0.10	0.40	0.30
47	Rajasthan	DRMR, Bharatpur	Yellow Sarson	NRCYS 05-02	2009	0.05	0.05	0.25	0.20
48	Rajasthan	SK RAU, Sriganganagar	Indian mustard	RGN-298	2014	1.13	1.13	0.85	-0.28
49	Rajasthan	SK RAU, Sriganganagar	Indian mustard	RGN-236	2011	2.00	2.00	1.35	0.65
50	Rajasthan	SK NAU, Jobner	Taramira	RTM-1351	2018	0.70	0.70	1.40	0.70
51	Rajasthan	SK NAU, Jobner	Taramira	RTM-1355 (Jwala Tara)	2017	2.70	2.70	2.50	-0.20
52	Uttar Pradesh	CSAUA&T Kanpur	Indian mustard	Azad Mahak (KMR 15-2)	2021	0.10	0.10	3.50	3.40
53	Uttar Pradesh	CSAUA&T Kanpur	Toria	Tapeshvari TK 06-1	2014	3.26	3.26	6.65	3.39
54	Uttar Pradesh	CSAUA&T Kanpur	Toria	Bhawani (TK-8401)	1986	1.50	1.50	3.31	1.81
55	Uttar Pradesh	CSAUA&T Kanpur	Yellow sarson	Pitambari (RYSK-05-02)	2010	0.50	0.50	4.00	3.50
56	Uttarakhand	GBPUAT, Pantnagar	Indian mustard	Pant Rai-21	2017	0.08	0.08	2.00	1.92
57	Uttarakhand	GBPUAT, Pantnagar	Indian mustard	Pant Rai-19 (PR-2006-1)	2012	0.10	0.10	2.49	2.39
58	Uttarakhand	GBPUAT, Pantnagar	Indian mustard	Pant Rai-20	2015	0.02	0.02	0.10	0.08
59	Uttarakhand	GBPUAT, Pantnagar	Toria	Pant Hill Toria-1 (PT 2006-4)	2017	0.05	0.05	1.00	0.95
60	Uttarakhand	GBPUAT, Pantnagar	Toria	Pant Toria-508 (PTE-2008-2)	2017	0.70	0.70	1.00	0.30
61	Uttarakhand	GBPUAT, Pantnagar	Toria	PT-303	1985	0.05	0.05	6.00	5.95
62	Uttarakhand	GBPUAT,	Yellow sarson	Pant Pili Sarson -1	2010	0.30	0.30	26.00	25.70

		Pantnagar							
63	Uttarakhand	GBPUAT, Pantnagar	Yellow sarson	Pant Sweta (PYS 2007-10)	2017	1.02	1.02	14.00	12.98
64	Uttarakhand	GBPUAT, Pantnagar	Yellow sarson	Pant Girija	2018	0.50	0.50	0.00	-0.50
65	Uttarakhand	GBPUAT, Pantnagar	Toria	Uttara (PT-2002-25)	2010	0.52	0.52	5.00	4.48
66	West Bengal	PORS, Behampore	Yellow sarson	Benoy (B 9)	1980	0.22	0.22	1.85	1.63
67	West Bengal	PORS, Behampore	Yellow Sarson	Anushka (YSWB-2011-10-1)	2020	0.06	0.06	0.07	0.01
68	West Bengal	PORS, Behampore	Yellow Sarson	Sachita (YSWB-2014/2)	2020	0.06	0.06	0.045	-0.015
69	West Bengal	BCKV, Kalyani	Indian mustard	TBM-209 (Trombay Bidhan Mustard-204) TM-204	2019	0.16	0.16	0.00**	0.00
70			Indian mustard	PSB-7 *		0.10	0.00	0.00	0.00
	Total					84.38	84.13	233.16	160.16

*BS could not be allotted due to none availability of record and nucleus seed.

BSP failed due to hail storm.

** Certification failed.

*** Variety not in seed chain

Additional Breeder Seed Produced

S. No.	State	Crop	Name of variety	Actual Production (q)
	Gujarat			
1.	SDAU, SK Nagar	Indian mustard	GM 1	1.20
2.			GM 2	1.20
3.			GM 3	1.50
	New Delhi			
4.	ICAR-IARI, New Delhi	Indian mustard	Pusa Double Zero Mustard 33*	1.00
	Haryana			
5.	IARI, Regional Station, Karnal	Indian mustard	Pusa Mehak (JD 6)	0.50
6.			Pusa Bold#	1.80#
7.			Pusa Jaikisan#	0.49#
	Maharashtra			
8.	PDKV, Nagpur	Indian mustard	TAM 108-1	1.00
	Uttar Pradesh			
9.	C. S. Azad University of Agriculture & Technology, Kanpur-208002(U.P.)	Toria	Azad Chetna	2.91
10.		Yellow Sarson	Pitambari	4.00
11.		Indian mustard	Ashirwad	2.00
12.			Rohini	4.50
13.			Maya	2.50
	M.P.			

14.	ZARS, Morena	Indian mustard	RVM-2	5.42
Uttarakhand				
15.	GBPUAT, Pantnagar	Indian mustard	Kranti	5.0
Jammu & Kashmir				
16.	SKUAST-Chatha, Jammu	Indian mustard	RSPR-69	0.40
17.		Gobhi Sarson	RSPN-25	0.25
Total				35.67

Carry over breeder seed produced during *Rabi 2020-21* crop season.

2.3 Coordinated Trials

Performance of 178 strains, including 02 of yellow sarson, 10 of gobhi sarson and 166 of Indian mustard was tested in nineteen performance evaluation trials consisting of yellow sarson (01), gobhi sarson(01) and Indian mustard (17) at 46 locations across the 6 agro-climatic zones of the country. On the basis of superiority for seed/oil yield/ earliness/quality over the best check, 42 strains comprising gobhi sarson (01) and Indian mustard (41) were promoted for advanced stage evaluation. The performance of the strains was tested against following national check (NC), zonal check (ZC) and the latest release (LR) varieties/hybrids.

Trial	NC	ZC	LR
Yellow sarson	YSH 401	Benoy, NRCYS 05-2	Pitambari
Indian mustard			
Early mustard	Pusa Mustard 25	JD 6 PRO 5111 (Hybrid Check)	Pusa Mustard 27, Pusa Mustard 28, GDM 4, NRCHB 101
Timely sown irrigated	Kranti	RCC 4, RH 749, Maya, Bio 902	Giriraj, RGN 73, GDM 4,
Rainfed	Kranti	RH 725, NRCHB 101, RGN 229	RH 0761, DRMR 150-35,
Late sown	Kranti	PM 26, NRCHB 101	Radhika, CS 56
Hybrid	Kranti	RGN 73, RH 749, GDM 4	DMH 1, 45S46
Quality	Kranti	RGN 73, RH 749, PDZ 1 (Double low check)	Pusa Mustard 29, Pusa Mustard 30, PM 32
Salinity	Kranti	CS 54	CS 60
White Rust Resistance	Basanti	RH 749, Maya	Giriraj, RGN 73
Gobhi Sarson	Kranti	GSL 1	GSC 6, AKMS 8141

Table 2.3.1a. Performance of yellow sarson strains in AVT- I Zone-V (RF)

S.No.	Code	Strain	Seed yield (kg/ha)						Plant Stand				
			SHL	IMP	KNK	KLN	BHU	Mean	SHL	IMP	KNK	KLN	BHU
			1	2	3	4	5	(1-5)	1	2	3	4	5
1	YSCN-21-1	YSH 401 (NC)	683	1280	1218	1009.72	916	1021	289	351	395	232	280
2	YSCN-21-2	RMYS- 2	660	1655	954	1251.16	885	1081	282	357	389	225	281
3	YSCN-21-3	Pitambri (Filler)	810	1410	1197	1291.2	1010	1144	295	352	389	232	287
4	YSCN-21-4	Pitambri (LR)	694	1544	1162	1164.58	936	1100	272	352	403	233	279
5	YSCN-21-5	PYS 2018-02	903	1336	977	1275.93	1066	1111	291	339	391	241	292
6	YSCN-21-6	NRCYS-05-02 (ZC)	660	1002	899	1120.14	1005	937	309	346	392	239	289
		GM	735	1371	1068	1185.46	970	1066					
		CD (5%)	164	258	163	186	98						
		CV (%)	14.7	12.5	10.2	11.0	6.7						
		DOS	30.10.2021	27.10.2021	15.10.2021	30.10.2021	30.10.2021						

Table 2.3.1b. Performance of yellow sarson strains in AVT- I Zone-V (RF)

S.No.	Code	Strain	Days to maturity					1000-Seed wt. (g)					Oil Content		Oil Yield (kg/ha) (2-3)	
			SHL	IMP	KNK	KLN	BHU	SHL	IMP	KNK	KLN	BHU	IMP	KNK		Mean
			1	2	3	4	5	1	2	3	4	5	2	3		
1	YSCN-21-1	YSH 401 (NC)	102	94	107	96	89	6.6	5.0	3.9	3.1	3.9	46.5	46.8	46.6	476
2	YSCN-21-2	RMYS- 2	97	94	102	93	92	6.9	5.4	4.3	4.2	4.1	47.5	46.5	47.0	508
3	YSCN-21-3	Pitambri (Filler)	101	94	104	96	97	6.8	4.6	3.3	3.7	4.2	47.6	47.3	47.4	543
4	YSCN-21-4	Pitambri (LR)	101	94	106	96	91	6.8	4.6	4.2	3.4	4.0	47.4	46.8	47.1	518
5	YSCN-21-5	PYS 2018-02	103	95	107	96	96	6.4	4.7	3.7	3.7	4.1	45.0	44.2	44.6	496
6	YSCN-21-6	NRCYS-05-02 (ZC)	100	94	103	92	93	6.1	4.5	3.8	3.7	4.0	47.9	44.3	46.1	432

Table 2.3.2a. Performance of early Indian mustard strains in IVT Zone-II

S.No.	Code	Strain	Seed Yield (Kg/ha)					Plant Stand				Days to Maturity					1000-Seed Wt. (g)				
			HSR	LDH	CHT	NDH	Mean	HSR	LDH	CHT	NDH	HSR	LDH	CHT	NDH	Mean	HSR	LDH	CHT	NDH	
			1	2	3	4	(1-4)	1	2	3	4	1	2	3	4	(1-4)	1	2	3	4	
1	MCN (E)-21-01	SVJH-69 (Hybrid)	2304	2274	2025	3471	2519		111	127	130	113	121	133	125	130	127	5.4	4.3	4.7	4.6
2	MCN (E)-21-02	DRMRCI- 141	2428	1475	1848	2682	2108		111	123	127	106	124	134	130	137	131	5.5	4.6	5.0	4.4
3	MCN (E)-21-03	PM- 25 (NC)	2414	1605	1603	2603	2056		114	128	126	103	125	132	129	118	126	5.0	4.4	5.2	4.2
4	MCN (E)-21-04	TM- 311	1871	1429	1723	1940	1741		110	133	123	114	116	126	116	116	118	4.6	5.0	5.1	3.6
5	MCN (E)-21-05	RH 1999-18	2683	1629	1875	2248	2109		115	130	129	114	115	136	130	132	128	5.4	4.1	4.8	4.3
6	MCN (E)-21-06	KMR(E) 21-2	1935	2070	1780	2367	2038		115	135	137	109	125	131	124	136	129	5.4	5.0	5.0	4.8
7	MCN (E)-21-07	PHR- 8425 (Hybrid)	1567	1768	1919	2221	1869		113	128	128	92	129	135	126	134	131	4.6	4.4	5.2	3.7
8	MCN (E)-21-08	RMX- 9310 (Hybrid)	2303	1875	1588	2631	2099		114	132	132	113	124	137	127	138	131	5.4	5.0	4.7	4.6
9	MCN (E)-21-09	PM- 28 (LR)	2407	1723	1555	2726	2103		113	127	138	111	125	136	124	126	128	4.6	4.4	4.9	3.9
10	MCN (E)-21-10	PRO 5111 (Hy Check)	2450	2054	1889	3102	2374		110	132	134	104	116	135	123	120	124	4.0	4.2	5.0	3.3
11	MCN (E)-21-11	PRE- 2018-9	2293	1911	1943	2331	2119		110	122	132	107	120	131	125	124	125	4.6	4.7	5.1	4.1
12	MCN (E)-21-12	RH 1999-14	2515	1677	1975	2167	2083		113	126	137	113	116	136	127	135	129	5.2	5.0	4.5	4.5
13	MCN (E)-21-13	DRMRHT 13-13-5-4	2778	1865	2074	2498	2304	*	113	134	125	117	133	134	130	126	131	5.3	4.5	4.7	4.8
14	MCN (E)-21-14	KMR(E) 21-1	2351	2216	1838	3309	2428	*	110	134	126	111	125	137	131	137	132	5.0	4.5	4.6	4.3
15	MCN (E)-21-15	NPJ 249	2109	1800	1809	2459	2044		114	122	122	119	118	131	118	116	121	5.2	5.0	4.8	4.7
16	MCN (E)-21-16	ORM 2019-25	2246	2249	2082	2865	2361	*	113	130	127	105	125	136	127	143	133	5.1	4.7	4.7	4.5
17	MCN (E)-21-17	Mali MS 90	2079	2059	1619	2226	1996		110	132	126	121	113	124	122	113	118	3.5	3.8	4.6	2.9
18	MCN (E)-21-18	BAUM- 21-3	1869	1689	1721	2081	1840		114	125	121	120	125	139	124	140	132	4.4	3.8	5.3	3.4
19	MCN (E)-21-19	PHR- 8081 (Hybrid)	1859	1841	1781	2591	2018		110	127	131	109	128	135	128	143	134	4.3	4.6	4.6	3.3
20	MCN (E)-21-20	NPJ 248	2344	2316	1561	2412	2158		117	129	133	104	113	131	123	118	121	5.6	4.6	4.7	5.4
21	MCN (E)-21-21	PRE- 2018-7	2529	2182	1988	2503	2301		112	125	127	109	120	132	125	117	124	4.9	5.2	4.9	4.5
22	MCN (E)-21-22	DRMRSJ 364	2179	1967	1874	2563	2146		118	128	129	122	125	129	130	135	130	4.9	5.0	5.2	4.1
23	MCN (E)-21-23	DRMRHT 13-13-5-5	2399	2259	1724	2998	2345	*	114	130	126	120	122	134	127	120	126	4.8	4.2	4.9	4.2
24	MCN (E)-21-24	ACN226	2603	1947	1633	1345	1882		112	126	122	109	132	139	131	144	137	4.0	4.7	5.3	3.0
25	MCN (E)-21-25	JD 6 (ZC)	2007	1829	1978	2051	1966		111	126	134	114	129	140	125	139	133	4.5	4.4	5.0	3.5
26	MCN (E)-21-26	HUJM(E) 20-4	1895	1431	1729	2359	1854		110	129	133	120	128	137	129	138	133	5.3	5.1	4.8	4.3
27	MCN (E)-21-27	DRMRIJ 16-9-7	1671	1615	1729	2189	1801		112	127	131	117	121	131	121	118	123	5.2	5.1	4.3	4.2
		GM	2225	1880	1810	2479	2099														
		CD (5 %)	424	276	277	357															
		CV (%)	11.9	9.2	9.6	9.0															
		DOS	30.09.2021	30.09.2021	29.09.2021	22.09.2021															

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

Table 2.3.2b. Performance of early Indian mustard strains in IVT Zone-II

S.No.	Code	Strain	1000-Seed Wt. (g)				Oil Content (%)					Oil Yield (kg/ha)
			HSR	LDH	CHT	NDH	HSR	LDH	CHT	NDH	Mean	
			1	2	3	4	1	2	3	4	(1-4)	
1	MCN (E)-21-01	SVJH-69 (Hybrid)	5.4	4.3	4.7	4.6	41.3	39.7	39.2	39.2	39.9	1004
2	MCN (E)-21-02	DRMRCI- 141	5.5	4.6	5.0	4.4	40.2	41.0	35.8	38.2	38.8	818
3	MCN (E)-21-03	PM- 25 (NC)	5.0	4.4	5.2	4.2	42.3	43.9	32.9	38.8	39.5	811
4	MCN (E)-21-04	TM- 311	4.6	5.0	5.1	3.6	40.8	44.3	32.8	40.5	39.6	689
5	MCN (E)-21-05	RH 1999-18	5.4	4.1	4.8	4.3	42.1	41.6	35.5	38.4	39.4	831
6	MCN (E)-21-06	KMR(E) 21-2	5.4	5.0	5.0	4.8	39.0	41.6	34.2	38.8	38.4	783
7	MCN (E)-21-07	PHR- 8425 (Hybrid)	4.6	4.4	5.2	3.7	37.6	38.7	35.1	36.2	36.9	689
8	MCN (E)-21-08	RMX- 9310 (Hybrid)	5.4	5.0	4.7	4.6	42.0	35.4	39.1	39.9	39.1	820
9	MCN (E)-21-09	PM- 28 (LR)	4.6	4.4	4.9	3.9	41.0	42.9	36.6	39.5	40.0	841
10	MCN (E)-21-10	PRO 5111 (Hy Check)	4.0	4.2	5.0	3.3	44.1	39.7	36.5	39.0	39.8	946
11	MCN (E)-21-11	PRE- 2018-9	4.6	4.7	5.1	4.1	38.7	41.1	32.8	35.0	36.9	782
12	MCN (E)-21-12	RH 1999-14	5.2	5.0	4.5	4.5	38.2	38.5	34.6	35.8	36.8	766
13	MCN (E)-21-13	DRMRHT 13-13-5-4	5.3	4.5	4.7	4.8	40.3	42.8	38.3	40.6	40.5	933
14	MCN (E)-21-14	KMR(E) 21-1	5.0	4.5	4.6	4.3	40.2	41.8	37.7	37.4	39.3	954
15	MCN (E)-21-15	NPJ 249	5.2	5.0	4.8	4.7	41.2	40.8	33.4	38.8	38.5	788
16	MCN (E)-21-16	ORM 2019-25	5.1	4.7	4.7	4.5	39.8	40.3	35.0	36.2	37.8	893
17	MCN (E)-21-17	Mali MS 90	3.5	3.8	4.6	2.9	39.7	37.5	30.6	36.4	36.0	719
18	MCN (E)-21-18	BAUM- 21-3	4.4	3.8	5.3	3.4	37.5	40.3	33.4	37.3	37.1	683
19	MCN (E)-21-19	PHR- 8081 (Hybrid)	4.3	4.6	4.6	3.3	36.9	39.0	35.9	33.1	36.2	731
20	MCN (E)-21-20	NPJ 248	5.6	4.6	4.7	5.4	40.6	36.5	31.1	35.1	35.8	773
21	MCN (E)-21-21	PRE- 2018-7	4.9	5.2	4.9	4.5	36.7	39.0	32.3	37.5	36.4	837
22	MCN (E)-21-22	DRMRSJ 364	4.9	5.0	5.2	4.1	41.0	44.9	40.4	39.9	41.5	891
23	MCN (E)-21-23	DRMRHT 13-13-5-5	4.8	4.2	4.9	4.2	42.8	43.7	34.6	39.6	40.2	942
24	MCN (E)-21-24	ACN226	4.0	4.7	5.3	3.0	31.2	37.1	34.9	33.9	34.3	645
25	MCN (E)-21-25	JD 6 (ZC)	4.5	4.4	5.0	3.5	38.2	35.6	35.6	36.4	36.4	717
26	MCN (E)-21-26	HUJM(E) 20-4	5.3	5.1	4.8	4.3	36.9	38.3	36.8	39.0	37.7	700
27	MCN (E)-21-27	DRMRIJ 16-9-7	5.2	5.1	4.3	4.2	39.3	42.4	35.4	37.6	38.7	697

Table 2.3.3a. Performance of early Indian mustard strains in IVT Zone-III

S.No.	Code	Strain	Seed Yield (kg/ha)							Plant Stand						Days to Maturity						
			MOR\$	PNT	JHS	KPR	BPR	DOL\$	Mean	MOR	PNT	JHS	KPR	BPR	DOL	MOR\$	PNT	JHS	KPR	BPR	DOL\$	Mean
			1	2	3	4	5	6	(2-5)	1	2	3	4	5	6	1	2	3	4	5	6	(3-5)
1	MCN (E)-21-01	SVJH-69 (Hybrid)	3534	1603	2256	1816	3618	1670	2323	140	109	126	121	150	165	134	120	126	120	131	123	126
2	MCN (E)-21-02	DRMRCI- 141	3261	1607	1754	1726	2887	1466	1993	133	106	127	118	141	161	134	122	135	125	124	118	128
3	MCN (E)-21-03	PM- 25 (NC)	2949	1354	2240	1396	2273	1358	1816	114	126	138	115	138	163	133	121	133	118	122	115	124
4	MCN (E)-21-04	TM- 311	2333	1133	1934	1765	2010	431	1710	127	136	127	119	135	162	132	113	120	123	119	129	121
5	MCN (E)-21-05	RH 1999-18	2967	1387	2025	1631	2908	1605	1988	130	120	133	118	163	165	136	120	131	119	122	114	124
6	MCN (E)-21-06	KMR(E) 21-2	3133	1890	1910	1620	3049	1292	2117	137	123	133	122	131	163	138	120	128	123	128	116	126
7	MCN (E)-21-07	PHR- 8425 (Hybrid)	3033	1286	1957	1654	2190	1848	1772	139	112	129	121	148	165	135	131	135	122	136	121	131
8	MCN (E)-21-08	RMX- 9310 (Hybrid)	2951	1188	2466	1593	2715	1315	1990	128	109	131	120	137	164	143	123	131	118	123	112	124
9	MCN (E)-21-09	PM- 27 (LR)	3169	2191	2235	1560	2812	1439	2199	138	111	138	118	134	161	139	119	130	123	122	119	125
10	MCN (E)-21-10	PRO 5111 (Hy Check)	2887	1793	2477	1842	2582	711	2173	129	130	144	122	162	164	134	116	128	125	122	115	125
11	MCN (E)-21-11	PRE- 2018-9	2726	1662	2051	1785	2441	1519	1985	128	133	131	120	138	167	131	119	128	121	121	111	124
12	MCN (E)-21-12	RH 1999-14	3018	1495	2519	1389	2010	1434	1853	142	112	147	112	127	165	143	124	131	124	126	113	127
13	MCN (E)-21-13	DRMRHT 13-13-5-4	3366	1512	2361	1747	2957	1373	2144	138	112	129	120	160	162	141	121	132	120	126	118	126
14	MCN (E)-21-14	KMR(E) 21-1	3348	1766	2387	1478	2676	1423	2077	142	111	144	121	142	167	142	120	133	123	124	116	127
15	MCN (E)-21-15	NPJ 249	3177	2367	2052	1714	2406	1439	2135	138	128	137	119	158	161	139	113	127	122	121	123	123
16	MCN (E)-21-16	ORM 2019-25	3390	1399	3050	1307	2868	1265	2156	134	123	153	119	140	166	136	124	134	123	125	111	128
17	MCN (E)-21-17	Mali MS 90	2505	1315	1898	1670	1987	494	1718	132	119	149	124	135	162	142	115	117	125	120	107	121
18	MCN (E)-21-18	BAUM- 21-3	2688	1390	1478	1560	2467	1309	1724	127	120	116	121	165	164	138	124	138	120	126	119	128
19	MCN (E)-21-19	PHR- 8081 (Hybrid)	3626	1650	1931	1633	1953	988	1792	131	109	133	118	139	164	136	122	133	119	133	121	128
20	MCN (E)-21-20	NPJ 248	2937	1578	2412	1739	2615	1097	2086	134	120	125	119	134	164	137	116	131	122	123	114	125
21	MCN (E)-21-21	PRE- 2018-7	2945	2146	2456	1643	2299	1069	2136	147	130	140	119	140	161	137	117	131	126	123	114	126
22	MCN (E)-21-22	DRMRSJ 364	2595	1078	1775	1495	3626	841	1993	129	132	130	114	173	165	141	128	132	121	120	121	124
23	MCN (E)-21-23	DRMRHT 13-13-5-5	2975	1735	2676	1823	2597	1411	2208	127	115	148	118	143	166	140	119	137	118	120	114	125
24	MCN (E)-21-24	ACN226	2985	1190	1967	1450	2260	1248	1717	128	112	128	120	138	163	134	130	133	122	127	124	127
25	MCN (E)-21-25	JD 6 (ZC)	2975	1445	2156	1615	2390	1560	1902	127	109	119	115	131	160	145	130	133	124	127	117	128
26	MCN (E)-21-26	HUJM(E) 20-4	2807	1835	2980	1616	2180	1635	2153	136	127	134	120	136	167	138	124	134	122	127	123	128
27	MCN (E)-21-27	DRMRIJ 16-9-7	2411	1342	1508	1630	2297	1298	1694	134	140	122	117	158	167	138	121	130	120	121	118	124
		GM	2989	1568	2182	1626	2558	1279	2034													
		CD (5 %)	937	296	354	217	426	555														
		CV (%)	19.6	11.8	10.1	8.3	10.4	27.1														
		DOS	08.10.2021	06.10.2021	10.10.2021	30.9.2021	06.10.2021	07.11.2021														

\$ data of MOR and DOL centres excluded from computation of mean due to CV greater than 15.0

Table 2.3.3b. Performance of early Indian mustard strains in IVT Zone-III

S.No.	Code	Strain	1000-Seed wt. (g)						Oil Content (%)						Oil Yield (kg/ha)
			MOR	PNT	JHS	KPR	BPR	DOL	MOR	PNT	KPR	BPR	DOL	Mean	
			1	2	3	4	5	6	1	2	4	5	6	(2,4,5)	
1	MCN (E)-21-01	SVJH-69 (Hybrid)	5.3	3.6	5.1	3.8	5.6	3.8	41.0	41.3	41.3	42.3	41.6	41.7	968
2	MCN (E)-21-02	DRMRCI- 141	4.6	3.0	4.7	3.3	6.6	4.9	40.7	34.0	41.8	41.5	40.1	39.1	780
3	MCN (E)-21-03	PM- 25 (NC)	5.4	3.1	5.2	5.2	4.8	3.9	42.5	38.5	42.6	42.8	40.4	41.3	750
4	MCN (E)-21-04	TM- 311	5.4	2.8	4.8	5.0	3.9	5.0	42.3	34.6	41.9	44.8	40.9	40.4	691
5	MCN (E)-21-05	RH 1999-18	5.3	3.0	4.9	4.9	5.4	4.0	41.2	36.6	44.0	40.6	40.4	40.4	803
6	MCN (E)-21-06	KMR(E) 21-2	5.0	3.3	5.1	5.2	5.6	4.0	42.8	40.1	41.4	42.2	40.6	41.2	873
7	MCN (E)-21-07	PHR- 8425 (Hybrid)	4.7	3.3	4.8	4.3	5.8	3.6	38.6	35.2	38.8	41.0	38.2	38.3	679
8	MCN (E)-21-08	RMX- 9310 (Hybrid)	4.9	3.3	5.5	4.9	4.7	3.6	40.3	38.7	42.2	39.8	40.2	40.2	801
9	MCN (E)-21-09	PM- 27 (LR)	5.1	2.8	4.5	4.0	4.4	2.9	42.9	38.6	42.3	43.6	39.2	41.5	913
10	MCN (E)-21-10	PRO 5111 (Hy Check)	5.7	2.8	3.7	5.9	4.1	5.0	41.3	40.7	43.3	44.1	42.1	42.7	928
11	MCN (E)-21-11	PRE- 2018-9	5.1	3.1	4.5	4.5	5.3	4.4	38.5	37.3	40.2	40.1	39.3	39.2	778
12	MCN (E)-21-12	RH 1999-14	4.8	3.4	5.1	3.2	4.3	4.0	37.9	36.8	39.5	36.6	39.3	37.6	697
13	MCN (E)-21-13	DRMRHT 13-13-5-4	5.3	3.0	5.0	5.7	4.9	4.4	40.3	34.8	42.2	40.4	41.3	39.1	839
14	MCN (E)-21-14	KMR(E) 21-1	4.7	2.8	5.3	4.7	4.7	3.2	40.8	37.3	42.4	43.1	39.4	41.0	850
15	MCN (E)-21-15	NPJ 249	5.7	3.4	5.1	4.9	5.7	3.9	43.2	37.5	42.6	41.5	40.2	40.5	865
16	MCN (E)-21-16	ORM 2019-25	5.5	3.0	5.8	4.4	5.1	4.2	40.6	36.4	42.4	44.0	41.3	40.9	882
17	MCN (E)-21-17	Mali MS 90	5.4	2.6	3.6	3.2	4.9	3.6	36.4	38.3	37.1	39.7	37.9	38.4	659
18	MCN (E)-21-18	BAUM- 21-3	5.7	2.6	4.9	3.9	4.1	3.6	40.6	38.3	42.4	42.0	39.6	40.9	705
19	MCN (E)-21-19	PHR- 8081 (Hybrid)	5.7	2.7	4.5	3.9	4.3	2.7	37.8	33.7	40.8	40.0	38.1	38.2	684
20	MCN (E)-21-20	NPJ 248	5.3	4.4	5.7	5.0	5.1	4.3	40.2	35.0	42.0	41.3	38.4	39.4	822
21	MCN (E)-21-21	PRE- 2018-7	5.2	3.5	5.4	4.8	4.8	3.6	39.1	37.6	40.5	39.9	41.9	39.3	840
22	MCN (E)-21-22	DRMRSJ 364	5.0	3.2	5.1	4.9	6.3	4.3	41.6	43.0	43.7	43.7	37.4	43.5	866
23	MCN (E)-21-23	DRMRHT 13-13-5-5	5.1	3.1	4.5	4.2	5.8	4.3	39.2	37.6	42.3	42.9	42.1	40.9	904
24	MCN (E)-21-24	ACN226	4.2	3.0	4.5	3.7	4.0	3.8	37.7	39.4	39.3	38.3	40.8	39.0	670
25	MCN (E)-21-25	JD 6 (ZC)	5.1	3.1	4.5	4.7	4.6	3.6	38.5	39.7	40.4	39.4	40.4	39.8	757
26	MCN (E)-21-26	HUJM(E) 20-4	5.0	3.5	5.3	4.9	6.1	4.1	40.6	39.5	40.1	40.5	41.6	40.0	862
27	MCN (E)-21-27	DRMRIJ 16-9-7	5.8	3.164	5.1	5.1	5.4	4.2	41.1	36.4	42.2	43.0	40.0	40.5	687

Table 2.3.4a. Performance of early Indian mustard strains in IVT Zone-IV

S.No.	Code	Strain	Seed Yield (kg/ha)				Plant Stand			Days to maturity				1000 Seed Weight		
			SKN	NGP	JUG	Mean	SKN	NGP	JUG	SKN	NGP	JUG	Mean	SKN	NGP	JUG
			1	2	3	(1-3)	1	2	3	1	2	3	(1-3)	1	2	3
1	MCN (E)-21-01	SVJH-69 (Hybrid)	3268	1700	3141	2703	141	156	178	106	120	101	108	5.5	4.1	4.6
2	MCN (E)-21-02	DRMRCI- 141	2969	1544	2202	2238	146	158	179	110	120	100	109	5.6	4.3	5.3
3	MCN (E)-21-03	PM- 25 (NC)	2502	1480	2703	2228	140	148	178	106	118	94	106	5.3	4.0	4.9
4	MCN (E)-21-04	TM- 311	1937	1418	2818	2058	127	154	178	103	114	84	101	4.9	4.0	4.1
5	MCN (E)-21-05	RH 1999-18	2648	1467	2624	2246	112	144	178	109	119	95	107	5.4	4.2	4.5
6	MCN (E)-21-06	KMR(E) 21-2	2828	2107	2727	2554	110	159	176	110	127	97	110	5.6	4.9	5.5
7	MCN (E)-21-07	PHR- 8425 (Hybrid)	3626	1821	2344	2597	152	144	176	110	123	100	109	4.5	5.4	4.4
8	MCN (E)-21-08	RMX- 9310 (Hybrid)	2595	1606	2902	2368	118	154	178	109	119	94	108	5.0	4.4	4.6
9	MCN (E)-21-09	GDM- 4 (LR)	3196	1605	2548	2450	153	147	179	108	121	99	108	5.9	4.6	5.4
10	MCN (E)-21-10	PRO 5111 (Hy Check)	2388	1716	2997	2367	147	149	177	105	120	92	105	4.0	4.3	3.4
11	MCN (E)-21-11	PRE- 2018-9	2206	2109	2766	2361	109	158	174	105	120	92	105	4.9	5.5	4.8
12	MCN (E)-21-12	RH 1999-14	2804	1598	2385	2262	143	160	177	107	115	96	108	5.4	4.3	4.8
13	MCN (E)-21-13	DRMRHT 13-13-5-4	3272	1931	2949	2717	133	153	177	109	120	96	109	5.3	5.2	4.8
14	MCN (E)-21-14	KMR(E) 21-1	3024	1549	3247	2607	118	156	179	108	121	97	111	5.1	4.3	4.5
15	MCN (E)-21-15	NPJ 249	2271	1454	3103	2276	133	149	178	105	114	92	106	5.5	4.0	4.9
16	MCN (E)-21-16	ORM 2019-25	3038	2168	2745	2650	131	147	176	111	121	100	109	5.3	5.1	5.1
17	MCN (E)-21-17	Mali MS 90	2001	1520	2362	1961	120	155	176	102	114	89	103	3.1	4.6	3
18	MCN (E)-21-18	BAUM- 21-3	2773	1994	2918	2562	151	152	176	111	119	96	109	4.4	4.7	3.8
19	MCN (E)-21-19	PHR- 8081 (Hybrid)	3288	1519	2381	2396	143	153	175	110	120	100	110	4.0	4.2	3.9
20	MCN (E)-21-20	NPJ 248	2449	1422	2910	2260	123	149	178	103	115	92	106	5.9	4.1	5
21	MCN (E)-21-21	PRE- 2018-7	2477	1503	3129	2370	137	158	176	105	115	92	106	5.0	4.4	4.6
22	MCN (E)-21-22	DRMRSJ 364	2682	2005	2577	2422	133	149	179	108	118	94	107	5.4	4.6	4.5
23	MCN (E)-21-23	DRMRHT 13-13-5-5	2593	1437	2911	2314	134	148	177	106	120	92	107	5.1	4.5	4.5
24	MCN (E)-21-24	ACN226	2815	2169	2314	2433	127	148	178	110	125	101	109	3.9	5.1	3.5
25	MCN (E)-21-25	JD 6 (ZC)	3197	1699	2973	2623	142	159	176	111	125	99	110	4.8	4.7	4.3
26	MCN (E)-21-26	HUJM(E) 20-4	3110	2229	2551	2630	141	155	177	107	128	100	108	5.2	5.3	5.2
27	MCN (E)-21-27	DRMRIJ 16-9-7	2346	1793	2272	2137	122	153	176	107	122	93	107	5.0	5.1	4.5
		GM	2752	1725	2722	2400										
		CD (5 %)	530	325	411											
		CV (%)	12	11.8	9.5											
		DOS	10.10.2021	10.10.2021	10.10.2021											

Table 2.3.4b. Performance of early Indian mustard strains in IVT Zone-IV

S.No.	Code	Strain	1000 Seed Weight			Oil Content (%)			Oil Yield (kg/ha)
			SKN	NGP	JUG	SKN	NGP	Mean	
			1	2	3	1	2	(1-2)	
1	MCN (E)-21-01	SVJH-69 (Hybrid)	5.5	4.1	4.6	38.3	30.7	34.5	933
2	MCN (E)-21-02	DRMRCI- 141	5.6	4.7	5.3	40.3	36.9	38.6	863
3	MCN (E)-21-03	PM- 25 (NC)	5.3	4.2	4.9	39.3	32.8	36.0	803
4	MCN (E)-21-04	TM- 311	4.9	4.0	4.1	40.5	32.9	36.7	755
5	MCN (E)-21-05	RH 1999-18	5.4	4.0	4.5	40.6	35.4	38.0	853
6	MCN (E)-21-06	KMR(E) 21-2	5.6	4.9	5.5	39.5	36.2	37.8	967
7	MCN (E)-21-07	PHR- 8425 (Hybrid)	4.5	4.6	4.4	37.3	32.4	34.8	904
8	MCN (E)-21-08	RMX- 9310 (Hybrid)	5.0	4.9	4.6	40.7	34.2	37.5	887
9	MCN (E)-21-09	GDM- 4 (LR)	5.9	4.6	5.4	38.3	34.7	36.5	894
10	MCN (E)-21-10	PRO 5111 (Hy Check)	4.0	4.5	3.4	38.8	33.7	36.2	857
11	MCN (E)-21-11	PRE- 2018-9	4.9	4.2	4.8	36.0	30.7	33.4	788
12	MCN (E)-21-12	RH 1999-14	5.4	5.2	4.8	38.3	36.9	37.6	851
13	MCN (E)-21-13	DRMRHT 13-13-5-4	5.3	5.1	4.8	40.3	32.9	36.6	995
14	MCN (E)-21-14	KMR(E) 21-1	5.1	5.0	4.5	38.3	35.8	37.0	966
15	MCN (E)-21-15	NPJ 249	5.5	4.4	4.9	38.5	33.0	35.7	813
16	MCN (E)-21-16	ORM 2019-25	5.3	4.6	5.1	38.1	34.8	36.5	966
17	MCN (E)-21-17	Mali MS 90	3.1	5.0	3	35.0	32.7	33.9	664
18	MCN (E)-21-18	BAUM- 21-3	4.4	4.9	3.8	39.1	33.5	36.3	930
19	MCN (E)-21-19	PHR- 8081 (Hybrid)	4.0	4.2	3.9	37.2	34.6	35.9	860
20	MCN (E)-21-20	NPJ 248	5.9	4.9	5	37.9	33.0	35.5	801
21	MCN (E)-21-21	PRE- 2018-7	5.0	4.2	4.6	36.5	31.4	34.0	804
22	MCN (E)-21-22	DRMRSJ 364	5.4	4.3	4.5	41.0	35.2	38.1	922
23	MCN (E)-21-23	DRMRHT 13-13-5-5	5.1	4.6	4.5	38.1	32.8	35.4	820
24	MCN (E)-21-24	ACN226	3.9	4.3	3.5	37.6	35.1	36.3	884
25	MCN (E)-21-25	JD 6 (ZC)	4.8	4.9	4.3	38.7	34.6	36.6	961
26	MCN (E)-21-26	HUJM(E) 20-4	5.2	4.5	5.2	37.8	31.6	34.7	913
27	MCN (E)-21-27	DRMRIJ 16-9-7	5.0	5.1	4.5	36.0	35.4	35.7	763

Table 2.3.5a. Performance of early Indian mustard strains in IVT Zone-V

S.No	Code	Strain	Seed Yield (Kg/ha)							Plant Stand					
			IMP	SHL #	BHU	JAG	KNK	KLN	Mean	IMP	SHL	BHU	JAG	KNK	KLN
			1	2	3	4	5	6	(1,3-6)	1	2	3	4	5	6
1	MCN (E)-21-01	SVJH-69 (Hybrid)	1330	1359	1084	1274	1555	1429	1335	178	185	134	172	203	194
2	MCN (E)-21-02	DRMRCI- 141	1509	619	1062	1211	1208	1377	1273	175	147	137	146	198	190
3	MCN (E)-21-03	PM- 25 (NC)	1155	862	1037	812	1265	1194	1092	170	164	130	112	196	188
4	MCN (E)-21-04	TM- 311	992	1124	1002	812	1092	1059	991	178	164	124	121	195	195
5	MCN (E)-21-05	RH 1999-18	900	1151	1059	830	1226	1123	1028	163	173	138	127	198	190
6	MCN (E)-21-06	KMR(E) 21-2	1572	966	1072	1021	1220	1485	1274	167	166	130	177	206	194
7	MCN (E)-21-07	PHR- 8425 (Hybrid)	1745	1339	912	1434	1475	1280	1369	177	178	127	171	197	188
8	MCN (E)-21-08	RMX- 9310 (Hybrid)	1298	1793	1253	1265	1353	1589	1351	169	189	142	177	195	188
9	MCN (E)-21-09	NRCHB- 101 (LR)	1796	1188	1014	1037	1527	1381	1351	162	167	128	175	198	184
10	MCN (E)-21-10	PRO 5111 (Hy Check)	1634	1871	1201	1174	1555	1482	1409	178	193	142	175	192	189
11	MCN (E)-21-11	PRE- 2018-9	1838	1860	1213	1096	1310	1546	1400	178	187	144	163	196	193
12	MCN (E)-21-12	RH 1999-14	1306	1460	1112	943	1258	1571	1238	173	160	140	190	189	190
13	MCN (E)-21-13	DRMRHT 13-13-5-4	1331	1519	975	1218	1142	1219	1177	172	161	132	163	201	193
14	MCN (E)-21-14	KMR(E) 21-1	1971	1268	1015	1196	1315	1459	1391	169	159	132	143	194	190
15	MCN (E)-21-15	NPJ 249	1197	1411	1202	941	1281	1313	1187	169	164	136	155	196	193
16	MCN (E)-21-16	ORM 2019-25	1819	1401	1074	1292	1402	1336	1385	167	163	137	174	192	184
17	MCN (E)-21-17	Mali MS 90	1113	1423	1060	1109	1011	1447	1148	173	163	130	177	194	190
18	MCN (E)-21-18	BAUM- 21-3	1160	633	963	1074	1281	997	1095	172	154	127	124	200	195
19	MCN (E)-21-19	PHR- 8081 (Hybrid)	1845	1282	986	1298	1740	1261	1426	177	172	123	160	205	191
20	MCN (E)-21-20	NPJ 248	1994	2062	1035	934	1154	1626	1349	180	190	131	162	196	194
21	MCN (E)-21-21	PRE- 2018-7	1562	1675	1051	866	1296	1422	1239	174	158	132	126	193	188
22	MCN (E)-21-22	DRMRSJ 364	1473	1618	1225	1066	1150	1334	1250	182	162	131	181	195	185
23	MCN (E)-21-23	DRMRHT 13-13-5-5	1838	965	1152	1102	1270	1310	1334	167	156	135	167	197	187
24	MCN (E)-21-24	ACN226	1522	626	1029	1304	1275	1306	1287	177	143	127	168	209	187
25	MCN (E)-21-25	JD 6 (ZC)	896	456	975	670	1322	1032	979	158	138	124	173	194	186
26	MCN (E)-21-26	HUJM(E) 20-4	1608	778	1025	1245	1529	1611	1404	170	170	128	186	197	191
27	MCN (E)-21-27	DRMRIJ 16-9-7	903	773	1003	848	1166	1312	1047	166	171	123	161	200	192
		GM	1456	1240	1066	1077	1310	1352	1252						
		CD (5 %)	338	275	339	162	135	305							
		CV (%)	14.5	13.9	6.6	9.4	6.5	14.1							
		DOS	12.11.2021	26.11.2021	12.11.2021	25.10.2021	13.11.2021	04.11.2021							

data of SHL excluded from computation of mean due to late sowing

Table 2.3.5b. Performance of early Indian mustard strains in IVT Zone-V

S.No	Code	Strain	Days to Maturity							1000-Seed Wt.(g)					
			IMP	SHL #	BHU\$	JAG	KNK	KLN	Mean	IMP	SHL	BHU	JAG	KNK	KLN
			1	2	3	4	5	6	(1,3-6)	1	2	3	4	5	6
1	MCN (E)-21-01	SVJH-69 (Hybrid)	116	106	103	118	110	97	109	4.7	6.1	3.9	3.8	4.3	3.3
2	MCN (E)-21-02	DRMRCI- 141	115	104	107	123	117	98	112	4.5	6.4	4.1	3.6	4.1	3.7
3	MCN (E)-21-03	PM- 25 (NC)	114	102	101	120	110	100	109	3.7	6.1	3.9	3.7	4.3	3.7
4	MCN (E)-21-04	TM- 311	114	99	103	122	108	93	108	3.8	6.4	3.9	3.5	3.5	3.1
5	MCN (E)-21-05	RH 1999-18	114	102	107	119	112	99	110	4.0	6.2	4.1	3.8	3.9	3.3
6	MCN (E)-21-06	KMR(E) 21-2	117	104	103	130	115	104	114	4.7	6.4	4.0	3.5	3.8	3.4
7	MCN (E)-21-07	PHR- 8425 (Hybrid)	117	102	104	124	118	107	114	4.0	5.9	3.8	3.5	3.3	3.6
8	MCN (E)-21-08	RMX- 9310 (Hybrid)	115	102	105	121	113	102	111	4.5	6.3	4.2	3.8	4.2	3.8
9	MCN (E)-21-09	NRCHB- 101 (LR)	118	102	105	123	118	106	114	4.5	7.4	3.9	3.6	4.1	4.2
10	MCN (E)-21-10	PRO 5111 (Hy Check)	113	99	100	120	109	97	108	3.4	5.3	4.0	3.5	2.9	3.6
11	MCN (E)-21-11	PRE- 2018-9	116	102	100	120	110	98	109	4.0	6.6	4.0	3.7	3.9	4.3
12	MCN (E)-21-12	RH 1999-14	114	102	104	121	113	105	111	4.6	6.3	4.0	3.8	4.3	3.5
13	MCN (E)-21-13	DRMRHT 13-13-5-4	117	102	101	122	113	100	111	4.3	6.2	3.9	3.6	3.8	4.4
14	MCN (E)-21-14	KMR(E) 21-1	116	104	104	125	113	104	112	4.2	6.1	3.9	3.8	3.8	3.8
15	MCN (E)-21-15	NPJ 249	114	104	103	118	112	95	108	4.3	6.2	4.0	3.7	3.6	3.6
16	MCN (E)-21-16	ORM 2019-25	118	104	103	120	116	105	112	4.3	6.2	3.9	3.4	3.8	3.8
17	MCN (E)-21-17	Mali MS 90	113	99	102	123	101	94	107	3.4	4.5	3.9	3.8	3.5	3.1
18	MCN (E)-21-18	BAUM- 21-3	118	102	103	119	114	99	111	3.3	6.0	3.9	3.8	3.1	2.7
19	MCN (E)-21-19	PHR- 8081 (Hybrid)	118	102	104	119	119	100	112	3.7	5.8	4.0	3.7	3.4	3.8
20	MCN (E)-21-20	NPJ 248	117	99	102	122	110	100	110	4.6	6.8	3.9	3.8	5.8	3.8
21	MCN (E)-21-21	PRE- 2018-7	115	102	101	118	107	98	108	4.5	5.3	4.0	3.4	4.5	3.2
22	MCN (E)-21-22	DRMRSJ 364	118	104	104	118	115	101	111	3.6	6.6	4.0	3.7	4.2	3.8
23	MCN (E)-21-23	DRMRHT 13-13-5-5	118	102	103	121	113	101	111	4.3	6.1	4.2	3.6	4.2	3.2
24	MCN (E)-21-24	ACN226	119	102	102	125	116	109	114	3.6	5.7	3.9	3.6	4.2	3.0
25	MCN (E)-21-25	JD 6 (ZC)	117	102	102	120	119	104	112	3.7	5.2	3.9	3.8	3.8	3.5
26	MCN (E)-21-26	HUJM(E) 20-4	117	102	102	125	118	97	112	4.4	6.3	4.0	4.0	4.4	3.6
27	MCN (E)-21-27	DRMRIJ 16-9-7	114	99	103	121	113	103	111	4.3	4.7	4.0	3.4	3.6	3.3

Table 2.3.5c. Performance of early Indian mustard strains in IVT Zone-V

S.No	Code	Strain	Oil Content (%)				Oil Yield (kg/ha)
			IMP	JAG	KNK	Mean	
			1	4	5	(1,4-5)	
1	MCN (E)-21-01	SVJH-69 (Hybrid)	37.7	35.5	43.7	38.9	520
2	MCN (E)-21-02	DRMRCI- 141	36.5	38.8	42.0	39.1	497
3	MCN (E)-21-03	PM- 25 (NC)	34.9	36.5	41.9	37.8	413
4	MCN (E)-21-04	TM- 311	36.3	36.7	44.3	39.1	388
5	MCN (E)-21-05	RH 1999-18	36.1	37.6	44.1	39.2	403
6	MCN (E)-21-06	KMR(E) 21-2	36.0	36.6	42.3	38.3	487
7	MCN (E)-21-07	PHR- 8425 (Hybrid)	32.4	36.8	40.1	36.4	499
8	MCN (E)-21-08	RMX- 9310 (Hybrid)	33.5	38.4	41.1	37.6	509
9	MCN (E)-21-09	NRCHB- 101 (LR)	34.3	39.5	44.3	39.4	532
10	MCN (E)-21-10	PRO 5111 (Hy Check)	36.9	34.8	44.4	38.7	545
11	MCN (E)-21-11	PRE- 2018-9	36.7	32.2	38.6	35.8	502
12	MCN (E)-21-12	RH 1999-14	32.8	34.2	40.6	35.9	444
13	MCN (E)-21-13	DRMRHT 13-13-5-4	36.2	35.0	42.8	38.0	447
14	MCN (E)-21-14	KMR(E) 21-1	34.9	37.4	42.8	38.4	534
15	MCN (E)-21-15	NPJ 249	35.1	35.4	43.4	38.0	450
16	MCN (E)-21-16	ORM 2019-25	34.0	35.1	41.4	36.9	510
17	MCN (E)-21-17	Mali MS 90	35.9	34.5	39.3	36.5	420
18	MCN (E)-21-18	BAUM- 21-3	35.3	34.5	41.5	37.1	406
19	MCN (E)-21-19	PHR- 8081 (Hybrid)	35.0	36.9	40.6	37.5	535
20	MCN (E)-21-20	NPJ 248	32.6	32.4	40.8	35.3	476
21	MCN (E)-21-21	PRE- 2018-7	34.6	32.6	39.4	35.5	440
22	MCN (E)-21-22	DRMRSJ 364	36.5	36.4	43.0	38.7	483
23	MCN (E)-21-23	DRMRHT 13-13-5-5	36.7	38.0	44.4	39.7	529
24	MCN (E)-21-24	ACN226	36.7	37.0	38.8	37.5	483
25	MCN (E)-21-25	JD 6 (ZC)	33.8	38.6	41.7	38.0	372
26	MCN (E)-21-26	HUJM(E) 20-4	36.2	35.6	40.4	37.4	525
27	MCN (E)-21-27	DRMRIJ 16-9-7	32.3	33.0	40.5	35.2	369

Table 2.3.6. Performance of early Indian mustard strains in IVT Zone-VI

S.No.	Code	Strain	Seed Yield (Kg/ha)					Plant Stand	Days to Maturity	1000 Seed Weight
			RAI\$	DWD#	HYD\$	JGT#	Mean	JGT	JGT	JGT
			1	2	3	4	(2)	4	4	4
1	MCN (E)-21-01	SVJH-69 (Hybrid)	949	1092	1473	668	1092	128	99	2.1
2	MCN (E)-21-02	DRMRCI- 141	690	104	1177	774	104	166	97	4.0
3	MCN (E)-21-03	PM- 25 (NC)	1198	981	1347	881	981	114	91	3.9
4	MCN (E)-21-04	TM- 311	1099	794	880	1468	794	242	84	3.1
5	MCN (E)-21-05	RH 1999-18	706	469	1326	1111	469	266	83	5.0
6	MCN (E)-21-06	KMR(E) 21-2	921	482	1598	1705	482	233	90	5.2
7	MCN (E)-21-07	PHR- 8425 (Hybrid)	997	684	1294	889	684	280	100	3.6
8	MCN (E)-21-08	RMX- 9310 (Hybrid)	907	359	1296	1519	359	264	94	4.4
9	MCN (E)-21-09	NRCHB- 101 (LR)	571	361	1234	1059	361	291	84	3.6
10	MCN (E)-21-10	PRO 5111 (Hy Check)	1242	592	1163	1109	592	275	84	3.1
11	MCN (E)-21-11	PRE- 2018-9	1282	1041	886	714	1041	244	78	1.2
12	MCN (E)-21-12	RH 1999-14	833	288	1488	470	288	180	94	3.2
13	MCN (E)-21-13	DRMRHT 13-13-5-4	1062	594	1154	878	594	201	89	2.3
14	MCN (E)-21-14	KMR(E) 21-1	795	741	1176	1109	741	218	91	3.0
15	MCN (E)-21-15	NPJ 249	1377	583	1316	527	583	152	90	2.6
16	MCN (E)-21-16	ORM 2019-25	796	758	1295	382	758	207	100	3.2
17	MCN (E)-21-17	Mali MS 90	853	861	811	3176	861	304	83	2.6
18	MCN (E)-21-18	BAUM- 21-3	597	319	969	925	319	156	102	2.4
19	MCN (E)-21-19	PHR- 8081 (Hybrid)	1133	971	1174	923	971	187	100	3.5
20	MCN (E)-21-20	NPJ 248	862	854	643	1902	854	261	87	4.1
21	MCN (E)-21-21	PRE- 2018-7	883	1142	1681	741	1142	227	87	2.7
22	MCN (E)-21-22	DRMRSJ 364	674	634	1360	473	634	201	91	2.3
23	MCN (E)-21-23	DRMRHT 13-13-5-5	900	971	1314	1052	971	214	94	3.3
24	MCN (E)-21-24	ACN226	450	132	1177	985	132	173	108	3.2
25	MCN (E)-21-25	JD 6 (ZC)	862	805	582	418	805	169	97	3.5
26	MCN (E)-21-26	HUJM(E) 20-4	717	696	1317	1718	696	166	104	4.1
27	MCN (E)-21-27	DRMRIJ 16-9-7	900	634	1627	1551	634	142	101	3.1
		GM	898	665	1213	1079	665			
		CD (5 %)	287	85	539	166				
		CV (%)	20.0	8.0	27.7	9.6				
		DOS	16.10.2021			05.11.2021				

\$ data of RAI and HYD centres excluded from computation of mean due to high CV

data of JGT and DWD excluded from computation of mean due to large variation (greater than four times) among strains

Table 2.3.7a Performance of early Indian mustard strains in AVT-I Zone-II

S.No.	Code	Strain	Seed Yield (Kg/ha)					Plant Stand				Days to Maturity				Mean
			HSR	LDH\$	CHT\$	NDH\$	Mean	HSR	LDH	CHT	NDH	HSR	LDH	CHT	NDH	
			1	2	3	4	(1)	1	2	3	4	1	2	3	4	
1	MCN (E)-21-28	JD- 6 (ZC)	2098	1306	1874	1838	2098	267	286	282	162	130	130	129	143	130
2	MCN (E)-21-29	RH 1999-42	2857	1949	1877	2438	2857	261	276	305	220	116	127	123	128	116
3	MCN (E)-21-30	PM- 28 (Filler)	2561	1903	1923	2479	2561	266	288	312	228	122	128	122	129	122
4	MCN (E)-21-31	PRE 2018-10	2453	2244	1770	2490	2453	260	288	320	206	117	131	120	130	117
5	MCN (E)-21-32	PM- 28 (LR)	2327	2194	1652	2100	2327	262	297	325	215	121	125	123	129	121
6	MCN (E)-21-33	PM- 25 (NC)	2287	1816	1983	2248	2287	266	290	310	206	117	129	121	119	117
		GM	2430	1902	1847	2265	2430									
		CD (5 %)	355	243	209	299										
		CV (%)	9.6	8.5	7.5	8.68										
		DOS	30.09.2021	30.09.2021	28.09.2021	22.09.2021										

\$ data of LDH, CHT and NDH centres excluded form computation of mean due to significant differences between same genotype used as check/Filler only single valid location, trial may be repeated

Table 2.3.7b. Performance of early Indian mustard strains in AVT-I Zone-II

S.No.	Code	Strain	1000-Seed Wt. (g)				Oil Content (%)					Oil Yield (kg/ha)
			HSR	LDH	CHT	NDH	HSR	LDH	CHT	NDH	Mean	
			1	2	3	4	1	2	3	4	(1)	
1	MCN (E)-21-28	JD- 6 (ZC)	5.4	4.1	4.5	3.3	36.4	33.9	37.7	35.3	36.4	764
2	MCN (E)-21-29	RH 1999-42	5.2	4.6	4.7	4.0	42.2	43.1	32.8	39.2	42.2	1204
3	MCN (E)-21-30	PM- 28 (Filler)	4.6	4.7	4.9	4.0	41.7	42.5	32.7	37.3	41.7	1068
4	MCN (E)-21-31	PRE 2018-10	5.3	4.6	4.6	4.7	37.8	39.0	32.9	35.6	37.8	926
5	MCN (E)-21-32	PM- 28 (LR)	4.3	4.8	5.2	4.0	39.4	40.2	35.8	37.8	39.4	916
6	MCN (E)-21-33	PM- 25 (NC)	5.1	4.6	4.8	3.9	41.0	41.4	36.5	35.6	41.0	937

Table 2.3.8a. Performance of early Indian mustard strains in AHT-I Zone-III

S.No	Code	Strain	Seed Yield (Kg/ha)							Plant Stand						Days to Maturity						
			KPR	MOR	BPR	PNT	DOL\$	JHS	Mean	KPR	MOR	BPR	PNT	DOL	JHS	KPR	MOR	BPR	PNT	DOL\$	JHS	Mean
			1	2	3	4	5	6	(1-4,6)	1	2	3	4	5	6	1	2	3	4	5	6	(1-4,6)
1	MCN (E)-21-34	PM- 25 (NC)	2083	2224	2261	1783	1294	2808	2232	213	328	228	245	335.3	332	124	132	123	116	119	125	124
2	MCN (E)-21-35	JD- 6 (ZC)	1922	2121	2275	1295	1251	2593	2041	202	330	225	246	337.8	311	122	133	130	125	123	130	128
3	MCN (E)-21-36	PRO 5111 (H.Check)	1972	1655	2861	1881	1008	3114	2297	208	329	251	250	329.5	347	125	129	123	114	117	122	123
4	MCN (E)-21-37	DRMRHJ 2403	1984	2173	3133	1554	1288	3266	2422	204	328	247	255	335.3	352	126	135	127	127	121	128	129
5	MCN (E)-21-38	PM- 28 (Filler)	2071	2117	2615	1699	1194	2722	2245	208	328	245	249	334.8	315	121	131	127	119	120	123	124
6	MCN (E)-21-39	PM- 28 (LR)	1984	2222	2732	1619	1113	2689	2249	200	329	251	247	332	326	124	134	126	119	119	125	126
		GM	2003	2085	2646	1639	1191	2866	2248													
		CD (5 %)	163	253	273	327	164	297														
		CV (%)	5.4	8.0	6.9	13.2	9.0	6.9														
		DOS	30.09.2021	08.10.2021	07.10.2021	06.10.2021	08.11.2021	10.10.2021														

\$ data of DOL excluded from computation of mean due to late sowing

Table 2.3.8b. Performance of early Indian mustard strains in AHT-I Zone-III

S.No	Code	Strain	1000-Seed wt. (g)						Oil Content (%)						Oil Yield (kg/ha)
			KPR	MOR	BPR	PNT	DOL	JHS	KPR	MOR	BPR	PNT	DOL	Mean	
			1	2	3	4	5	6	1	2	3	4	5	(1-5)	
1	MCN (E)-21-34	PM- 25 (NC)	5.4	5.4	4.5	3.3	3.3	4.5	41.8	40.7	41.4	39.2	40.24	40.7	908
2	MCN (E)-21-35	JD- 6 (ZC)	4.8	5.1	4.3	3.1	3.6	4.3	42.1	40.1	40.8	38.7	39.84	40.3	822
3	MCN (E)-21-36	PRO 5111 (H. Check)	3.5	4.2	3.9	2.9	3.0	3.5	43.6	40.9	43.3	40.7	39.2	41.5	954
4	MCN (E)-21-37	DRMRHJ 2403	4.5	4.8	4.9	3.3	3.8	4.3	42.9	40.3	43.7	38.8	41.54	41.4	1004
5	MCN (E)-21-38	PM- 28 (Filler)	4.7	4.7	4.6	3.2	3.3	4.1	43.1	41.6	42.9	38.5	39.71	41.1	924
6	MCN (E)-21-39	PM- 28 (LR)	4.8	4.5	4.6	3.1	4.4	4.1	43.3	43.1	43.5	36.0	40.56	41.3	929

Table-2.3.9. Performance of Indian mustard strains in IVT timely sown (irrigated), Zone - I

S.No.	Code	Strain	Seed Yield (kg/ha)				Plant Stand			Days to Maturity			1000 Seed Wt. (g)		
			KNG§	DLK	BJR	Mean	KNG	DLK	BJR	KNG	DLK	BJR	KNG	DLK	BJR
			1	2	3	(2,3)	1	2	3	1	2	3	1	2	3
1	MCN-21-1	JM- 16-5	807	1130	889	1009	125	146	125	158	137	158	3.4	3.3	3.4
2	MCN-21-2	HUJM- 10-6	767	1005	918	961	122	138	122	159	133	159	3.6	3.6	3.6
3	MCN-21-3	RGN- 507	761	934	886	910	121	144	121	160	138	160	3.9	4.3	3.9
4	MCN-21-4	DRMRCI- 147	821	1090	1018	1054	121	142	121	158	132	158	4.8	3.7	4.8
5	MCN-21-5	RCC 4 (ZC)	770	1185	1056	1121	125	144	125	160	138	160	4.2	3.3	4.2
6	MCN-21-6	ORM 18-29-5	730	832	862	847	122	139	122	159	138	159	4.0	4.1	4.0
7	MCN-21-7	PBR 939	951	1009	1047	1028	121	142	121	159	138	159	6.1	3.2	6.1
8	MCN-21-8	HUJM- 20-9	994	1121	1009	1065	120	147	120	158	134	158	5.5	4.6	5.5
9	MCN-21-9	RB- 109	1080	812	1046	929	126	149	126	160	134	160	2.9	3.4	2.9
10	MCN-21-10	KMR 21-4	605	1108	892	1000	125	144	125	159	137	159	5.4	2.5	5.4
11	MCN-21-11	DRMRIJ 18-62	550	1036	923	979	127	145	127	158	135	158	4.3	3.6	4.3
12	MCN-21-12	NPJ 252	964	842	992	917	119	141	119	160	138	160	5.1	3.7	5.1
13	MCN-21-13	BAUM- 21-1	697	884	865	875	120	144	120	159	130	159	3.7	4.7	3.7
14	MCN-21-14	ACN 237	1150	1001	1026	1014	124	147	124	159	136	159	5.3	3.4	5.3
15	MCN-21-15	KMR 21-3	586	1165	1038	1101	125	148	125	159	132	159	5.3	4.1	5.3
16	MCN-21-16	RGN- 524	978	904	815	860	124	142	124	159	136	159	4.6	3.7	4.6
17	MCN-21-17	SKM- 1744	752	1114	939	1027	123	146	123	159	133	159	7.5	3.3	7.5
18	MCN-21-18	Giriraj (LR)	576	820	890	855	121	141	121	160	133	160	4.0	3.1	4.0
19	MCN-21-19	DM- 1521	639	872	851	861	123	142	123	160	136	160	4.5	3.1	4.5
20	MCN-21-20	Kranti (NC)	1188	829	1036	933	122	142	122	159	137	159	5.5	4.3	5.5
21	MCN-21-21	RMM- 1918	819	922	1174	1048	124	148	124	159	136	159	5.5	3.2	5.5
22	MCN-21-22	RH- 1934	768	1194	1155	1175	120	143	120	159	133	159	5.6	3.0	5.6
23	MCN-21-23	SKM- 1801	675	1147	1189	1168	129	144	129	158	135	158	5.8	4.0	5.8
24	MCN-21-24	DRMR- 2019-19	955	999	1204	1101	124	139	124	158	137	158	4.4	3.7	4.4
25	MCN-21-25	NPJ 253	1073	789	988	889	121	142	121	158	131	158	5.6	2.9	5.6
26	MCN-21-26	PR- 2019-3	704	789	1184	986	126	136	126	159	137	159	5.1	3.7	5.1
27	MCN-21-27	RH 2049	727	1028	964	996	120	143	120	158	137	158	4.6	4.0	4.6
28	MCN-21-28	PRB- 2016-1	1015	928	965	947	123	145	123	158	134	158	4.2	3.5	4.2
		GM	826	983	993	988									
		CD (5%)	210	129	144										
		CV(%)	16	8	9.1										
		DOS	09.10.2021	29.10.2021	09.10.2021										

§ data of KNG centre excluded from computation of mean due to high CV
only two valid locations data, hence no promotion of strain(s)

Table-2.3.10a. Performance of Indian mustard strains in IVT timely sown (Irrigated), Zone - II

S.No.	Code	Strain	Seed Yield (Kg/ha)									Plant Stand								
			HSR	LDH	NDH	CHT	SGN	MOD	ABR	BAW	Mean	HSR	LDH	NDH	CHT	SGN	MOD	ABR	BAW	
			1	2	3	4	5	6	7	8	(1-8)	1	2	3	4	5	6	7	8	
1	MCN-21-1	JM- 16-5	3028	2275	2409	1741	2276	1717	2240	2484	2271	118	134	164	132	103	138	129	120	
2	MCN-21-2	HUJM- 10-6	3055	2148	2528	1731	2935	1636	2630	2244	2363	114	133	141	130	107	132	122	119	
3	MCN-21-3	RGN- 507	2649	2401	2547	1827	2475	1919	2270	2547	2329	114	133	133	129	105	141	128	128	
4	MCN-21-4	DRMRCI- 147	2351	1869	2472	2121	2313	1584	2684	2099	2187	115	141	150	134	102	132	124	122	
5	MCN-21-5	RH 749 (ZC)	2712	2023	2595	2223	2228	1876	2822	2801	2410	118	121	145	129	105	128	138	126	
6	MCN-21-6	ORM 18-29-5	2158	2193	2294	1784	2338	1485	2470	2198	2115	111	130	131	137	102	132	133	123	
7	MCN-21-7	PBR 939	2520	1633	3023	2377	3004	2092	2837	2715	2525	116	139	149	135	104	141	135	120	
8	MCN-21-8	HUJM- 20-9	2867	2221	2185	1911	2311	1564	2121	2073	2157	116	136	155	131	104	131	130	124	
9	MCN-21-9	RB- 109	2691	2314	2495	1994	2160	1666	2663	2407	2299	118	133	146	127	100	134	130	119	
10	MCN-21-10	KMR 21-4	3257	2398	2702	1966	2416	1754	2428	3115	2505	117	126	141	139	103	132	133	120	
11	MCN-21-11	DRMRIJ 18-62	2635	2098	2517	1724	2249	1987	2442	1608	2157	114	137	150	135	102	138	131	120	
12	MCN-21-12	NPJ 252	3304	2547	3186	1945	2814	1543	3010	1983	2541	116	137	152	129	103	138	133	117	
13	MCN-21-13	BAUM- 21-1	3043	2176	2237	1901	1917	1413	2623	2451	2220	112	135	164	132	99	119	134	123	
14	MCN-21-14	ACN 237	2607	2225	2584	1876	2543	1919	2419	2615	2348	114	128	159	132	105	142	138	119	
15	MCN-21-15	KMR 21-3	2452	2484	2537	1791	2361	1876	2625	2803	2366	110	134	142	132	99	144	131	113	
16	MCN-21-16	RGN- 524	2146	2055	2595	2154	2452	1786	2688	2378	2282	117	136	139	128	103	132	133	119	
17	MCN-21-17	SKM- 1744	2465	2129	2410	1731	2233	1853	2411	2291	2190	117	131	176	137	99	144	129	123	
18	MCN-21-18	Giriraj (LR)	2498	2166	2785	2102	2148	1796	2625	2358	2310	119	131	116	120	100	146	137	125	
19	MCN-21-19	DM- 1521	2538	2118	2687	1984	1695	1465	2701	2477	2208	112	125	131	134	98	131	131	122	
20	MCN-21-20	Kranti (NC)	2508	2061	2577	1980	2275	1662	2613	2574	2281	116	126	130	132	104	127	128	115	
21	MCN-21-21	RMM- 1918	2335	1847	2499	1868	2289	1910	2560	2589	2237	115	129	130	127	104	138	124	126	
22	MCN-21-22	RH- 1934	3266	2212	3109	2193	3239	2115	2952	2957	2755	*	111	130	142	126	107	146	128	119
23	MCN-21-23	SKM- 1801	2689	2523	2954	1828	2812	2263	2865	3241	2647	*	116	131	157	136	104	128	129	115
24	MCN-21-24	DRMR- 2019-19	2620	2316	2572	1863	2041	1558	2686	2640	2287	120	133	148	132	100	135	127	117	
25	MCN-21-25	NPJ 253	3355	2787	3548	2196	2414	1810	3129	2707	2743	*	116	126	121	127	103	148	134	117
26	MCN-21-26	PR- 2019-3	2107	1935	2766	1990	2536	1932	2826	3015	2388	117	131	135	134	104	148	129	116	
27	MCN-21-27	RH 2049	2339	1989	2092	1722	2495	1662	2533	2287	2140	116	143	135	126	101	142	125	122	
28	MCN-21-28	PRB- 2016-1	2403	2369	2873	2012	2526	2105	2526	2898	2464	114	131	157	129	103	139	127	121	
		GM	2671	2197	2628	1945	2408	1779	2621	2521	2346									
		CD (5%)	431	306	350	310	448	238	425	384										
		CV(%)	10.1	8.7	8.3	10.0	11.6	8.3	10.1	9.5										
		DOS	12.10.2021	21.10.2021	12.10.2021	27.10.2021	22.10.2021	28.10.2021	26.10.2021	19.10.2021										

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

Table-2.3.10b. Performance of Indian mustard strains in IVT timely sown (Irrigated), Zone - II

S.No.	Code	Strain	Days to Maturity								1000 Seed Weight (g)							
			HSR	LDH	NDH	CHT	SGN	MOD	ABR	BAW	HSR	LDH	NDH	CHT	SGN	MOD	ABR	BAW
			1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1	MCN-21-1	JM- 16-5	145	139	147	142	149	151	142	147	5.0	4.4	4.6	4.8	5.2	5.3	5.0	4.7
2	MCN-21-2	HUJM- 10-6	143	154	148	143	151	141	141	143	5.3	4.9	4.3	5.0	5.3	5.9	5.1	5.3
3	MCN-21-3	RGN- 507	144	159	152	149	153	148	140	147	5.0	6.1	5.0	5.2	4.9	5.1	5.3	4.6
4	MCN-21-4	DRMRCI- 147	143	150	146	135	148	149	141	145	5.8	5.3	4.8	5.3	4.4	5.0	5.1	5.4
5	MCN-21-5	RH 749 (ZC)	142	147	150	148	147	149	141	144	6.5	5.9	6.7	4.9	6.0	6.4	6.6	5.8
6	MCN-21-6	ORM 18-29-5	144	148	148	149	146	149	141	148	5.9	4.7	6.4	5.2	5.1	5.7	6.3	5.6
7	MCN-21-7	PBR 939	146	156	151	150	149	147	140	147	5.6	4.8	5.6	5.1	5.7	5.9	5.9	4.8
8	MCN-21-8	HUJM- 20-9	140	139	143	140	151	147	140	143	5.4	5.8	5.0	4.8	5.7	5.5	5.4	5.2
9	MCN-21-9	RB- 109	138	151	148	146	153	147	141	146	6.5	4.8	5.7	5.3	5.8	6.4	6.1	6.1
10	MCN-21-10	KMR 21-4	146	152	149	150	150	145	143	147	5.2	4.9	5.5	5.1	5.1	5.3	6.0	5.6
11	MCN-21-11	DRMRIJ 18-62	142	143	144	147	153	140	139	139	5.2	4.5	4.6	4.9	4.9	4.8	5.0	5.3
12	MCN-21-12	NPJ 252	144	147	148	136	151	147	143	142	6.1	4.5	5.5	4.9	6.1	6.2	6.3	5.6
13	MCN-21-13	BAUM- 21-1	146	148	150	145	154	149	141	144	5.5	4.6	5.5	5.1	3.9	4.8	5.9	5.3
14	MCN-21-14	ACN 237	146	148	148	143	151	141	143	144	5.9	5.0	5.4	4.9	5.1	5.2	6.0	4.5
15	MCN-21-15	KMR 21-3	146	152	146	148	153	148	141	146	5.3	5.4	5.6	5.2	4.5	5.3	5.9	4.3
16	MCN-21-16	RGN- 524	143	151	149	147	150	148	140	143	4.9	4.8	5.3	5.0	5.1	5.6	5.9	4.9
17	MCN-21-17	SKM- 1744	145	141	147	148	149	147	141	146	5.5	4.6	5.6	4.9	4.0	5.1	5.9	5.5
18	MCN-21-18	Giriraj (LR)	142	155	149	150	147	143	140	143	6.3	4.8	6.5	5.2	5.8	5.9	6.6	6.5
19	MCN-21-19	DM- 1521	144	147	150	149	148	144	140	145	6.7	5.8	7.7	5.1	6.0	7.0	6.9	6.5
20	MCN-21-20	Kranti (NC)	142	137	143	140	151	140	141	143	4.7	4.8	4.0	4.9	4.5	5.6	4.6	4.6
21	MCN-21-21	RMM- 1918	145	143	143	144	149	147	140	144	5.0	4.0	4.3	5.1	5.8	4.2	4.8	4.3
22	MCN-21-22	RH- 1934	144	156	149	145	147	148	139	143	6.3	5.2	6.7	5.2	6.2	6.0	6.7	6.1
23	MCN-21-23	SKM- 1801	143	146	147	144	149	148	141	142	4.6	4.6	5.1	4.7	4.3	5.4	5.6	4.8
24	MCN-21-24	DRMR- 2019-19	130	135	133	143	151	139	138	141	6.6	5.9	6.0	5.0	6.3	6.0	6.1	5.4
25	MCN-21-25	NPJ 253	145	146	150	151	152	143	139	143	6.8	6.0	8.2	4.8	6.2	7.6	7.1	7.2
26	MCN-21-26	PR- 2019-3	145	155	151	146	153	146	141	143	6.7	5.8	6.6	5.1	6.1	6.6	6.6	6.4
27	MCN-21-27	RH 2049	142	147	142	144	150	145	140	142	7.0	5.9	6.3	5.0	5.6	7.0	6.4	7.0
28	MCN-21-28	PRB- 2016-1	142	137	145	141	149	147	141	143	5.9	4.8	5.0	4.9	4.7	5.9	5.3	5.6

Table-2.3.10c. Performance of Indian mustard strains in IVT timely sown (Irrigated), Zone - II

S.No.	Code	Strain	Oil Content (%)					Mean	Oil Yield (kg/ha)
			HSR	LDH	NDH	CHT	BAW		
			1	2	3	4	8		
1	MCN-21-1	JM- 16-5	37.2	35.1	39.2	38.5	36.9	37.4	849
2	MCN-21-2	HUJM- 10-6	35.7	37.0	38.8	37.9	35.0	36.9	871
3	MCN-21-3	RGN- 507	35.1	36.3	37.6	33.1	34.5	35.3	823
4	MCN-21-4	DRMRCI- 147	37.8	36.9	41.8	34.5	37.5	37.7	824
5	MCN-21-5	RH 749 (ZC)	36.4	38.8	38.6	36.8	37.4	37.6	906
6	MCN-21-6	ORM 18-29-5	37.6	39.3	39.6	36.0	36.1	37.7	798
7	MCN-21-7	PBR 939	32.5	42.2	39.8	37.7	36.1	37.7	951
8	MCN-21-8	HUJM- 20-9	35.2	35.5	38.0	35.7	35.9	36.0	777
9	MCN-21-9	RB- 109	36.2	38.1	39.7	34.9	35.1	36.8	846
10	MCN-21-10	KMR 21-4	33.7	36.0	37.5	35.0	34.4	35.3	885
11	MCN-21-11	DRMRIJ 18-62	37.4	34.5	40.0	40.6	33.4	37.2	802
12	MCN-21-12	NPJ 252	39.1	34.6	40.6	35.4	36.3	37.2	945
13	MCN-21-13	BAUM- 21-1	35.8	38.0	39.8	38.1	38.4	38.0	843
14	MCN-21-14	ACN 237	33.5	37.7	38.5	36.5	36.7	36.6	859
15	MCN-21-15	KMR 21-3	36.5	37.8	37.9	36.7	36.9	37.2	879
16	MCN-21-16	RGN- 524	34.9	35.6	39.4	35.9	36.2	36.4	830
17	MCN-21-17	SKM- 1744	36.8	35.8	40.7	32.9	34.0	36.0	789
18	MCN-21-18	Giriraj (LR)	36.6	32.3	39.8	37.8	37.4	36.8	850
19	MCN-21-19	DM- 1521	34.9	36.6	39.4	37.8	37.1	37.1	820
20	MCN-21-20	Kranti (NC)	35.9	38.8	38.4	32.1	36.2	36.3	827
21	MCN-21-21	RMM- 1918	35.1	31.1	39.0	35.7	36.3	35.4	792
22	MCN-21-22	RH- 1934	34.9	34.8	37.9	34.1	36.0	35.5	979
23	MCN-21-23	SKM- 1801	36.1	36.4	39.1	34.3	35.5	36.3	960
24	MCN-21-24	DRMR- 2019-19	40.9	40.1	41.5	38.3	39.4	40.1	916
25	MCN-21-25	NPJ 253	40.8	41.6	40.1	37.8	38.5	39.7	1090
26	MCN-21-26	PR- 2019-3	31.5	37.5	36.9	34.9	37.4	35.6	851
27	MCN-21-27	RH 2049	33.6	32.7	37.9	35.4	35.4	35.0	749
28	MCN-21-28	PRB- 2016-1	35.7	37.5	41.2	31.9	37.1	36.7	904

Table 2.3.11a. Performance of Indian mustard strains in IVT timely sown (irrigated), Zone - III

S.No.	Code	Strain	Seed Yield (Kg/ha)								Plant Stand							
			MOR	PNT	KPR\$	VAR	KOT	JHS	DOL\$	Mean	MOR	PNT	KPR	VAR	KOT	JHS	DOL	
			1	2	3	4	5	6	7	(1-2,4-6)	1	2	3	4	5	6	7	
1	MCN-21-1	JM- 16-5	2700	1803	2617	3096	2749	2418	1064	2553	145	134	122	191	164	127	162	
2	MCN-21-2	HUJM- 10-6	3193	1606	2443	2643	2543	1931	1420	2383	140	140	121	197	160	146	165	
3	MCN-21-3	RGN- 507	2446	1851	2463	3053	2006	1924	1037	2256	144	114	121	174	165	135.7	167	
4	MCN-21-4	DRMRCL- 147	3075	1575	2559	3013	2768	2332	1115	2553	143	133	125	176	164	133	164	
5	MCN-21-5	Maya (ZC)	2609	2174	2470	3067	2749	2205	815	2561	142	114	120	186	165	153	163	
6	MCN-21-6	ORM 18-29-5	2262	1267	2540	2579	2292	2177	1027	2116	144	144	119	187	169	152.3	161	
7	MCN-21-7	PBR 939	3130	1481	2685	2497	2667	2095	1113	2374	144	154	125	196	170	116.3	167	
8	MCN-21-8	HUJM- 20-9	2499	1494	2516	2881	2437	2393	1291	2341	145	139	120	195	164	132	162	
9	MCN-21-9	RB- 109	2430	2019	2323	2610	2908	2403	1377	2474	147	140	122	183	171	156	164	
10	MCN-21-10	KMR 21-4	2798	1775	2432	2743	2793	2716	1294	2565	149	172	118	185	172	140.7	163	
11	MCN-21-11	DRMRIJ 18-62	2113	1139	2617	2546	1669	2030	1113	1899	154	130	122	185	161	143.7	161	
12	MCN-21-12	NPJ 252	2782	1816	2350	2894	2719	2637	1222	2570	146	170	122	185	174	144.3	163	
13	MCN-21-13	BAUM- 21-1	2601	1336	2524	2929	2451	2031	925	2270	142	163	125	190	172	130.7	167	
14	MCN-21-14	ACN 237	2326	1761	2493	3105	2582	2333	1086	2421	140	165	120	181	175	138	162	
15	MCN-21-15	KMR 21-3	2810	1607	2188	2946	2799	1859	1180	2404	144	154	121	181	170	135	163	
16	MCN-21-16	RGN- 524	3204	1509	2408	2927	3147	2365	1174	2631	140	167	121	174	172	130.3	166	
17	MCN-21-17	SKM- 1744	2904	1313	2670	3086	2771	2854	1383	2586	142	119	119	178	173	132.3	169	
18	MCN-21-18	RGN 73 (LR)	2693	1866	2283	2954	2965	2387	1429	2573	141	141	124	177	168	154	164	
19	MCN-21-19	DM- 1521	2299	1916	2553	3046	2990	2136	1082	2477	144	150	120	165	166	155.3	166	
20	MCN-21-20	Kranti (NC)	2634	1869	2399	2652	2484	2479	1006	2424	144	143	117	192	171	148	163	
21	MCN-21-21	RMM- 1918	3134	1211	2352	2869	2752	1939	1139	2381	148	163	121	177	174	137	161	
22	MCN-21-22	RH- 1934	3194	1591	2464	3594	3017	2563	1255	2792	147	156	124	182	167	147.7	165	
23	MCN-21-23	SKM- 1801	2819	1702	2326	2677	3277	2166	1135	2528	143	166	123	197	164	168	165	
24	MCN-21-24	DRMR- 2019-19	2857	2155	2374	2644	2194	2285	1028	2427	145	138	120	188	165	142.3	165	
25	MCN-21-25	NPJ 253	3472	1721	2426	3176	2746	2956	1210	2814	**	142	142	121	183	164	167.3	163
26	MCN-21-26	PR- 2019-3	2873	2469	2698	2905	2928	2304	1498	2696	142	114	121	183	173	115	161	
27	MCN-21-27	RH 2049	2663	1728	2561	3007	2787	2313	1463	2500	145	135	119	179	171	153.3	160	
28	MCN-21-28	PRB- 2016-1	2837	2184	2603	2662	2826	2464	1392	2595	147	124	125	194	163	182.7	164	
		GM	2762	1706	2479	2885	2673	2306	1182	2466								
		C.D. (5%)	666	303	273	396	389	418	656									
		CV (%)	15.1	11.1	6.9	8.6	9.1	11	28.1									
		DOS	28.10.2021	29.10.2021	03.11.2021	26.10.2021	27.10.2021	27.10.2021	09.11.2021									

\$ data of KPR and DOL centres excluded from computation of mean due to late sowing and high CV at DOL

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

Table 2.3.11b. Performance of Indian mustard strains in IVT timely sown (irrigated), Zone-III

S.No.	Code	Strain	Days to Maturity							1000-Seed Wt. (g)							Oil Content (%)							
			MOR	PNT	KPR	VAR	KOT	JHS	DOL	MOR	PNT	KPR	VAR	KOT	JHS	DOL	MOR	PNT	KPR	VAR	KOT	DOL	Mean	Oil Yield (kg/ha)
			1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	7	(1-2,4-6)	
1	MCN-21-1	JM- 16-5	141	137	137	126	134	134	113	5.7	3.5	4.2	4.8	4.4	4.6	7.6	38.8	39.9	41.4	41.0	36.9	42.5	39.2	1000
2	MCN-21-2	HUJM- 10-6	143	139	134	130	138	139	116	5.8	3.7	4.5	3.4	4.9	4.8	6.4	37.0	40.5	39.7	39.2	39.0	41.5	38.9	928
3	MCN-21-3	RG- 507	135	144	138	131	140	137	118	5.3	3.6	3.8	4.4	5.0	5.4	5.8	35.5	36.1	34.2	39.1	37.0	37.8	36.9	833
4	MCN-21-4	DRMRCI- 147	142	137	138	130	136	132.7	115	6.5	3.5	4.7	4.8	4.8	4.9	5.3	40.3	40.4	41.3	38.3	44.6	41.9	40.9	1044
5	MCN-21-5	Maya (ZC)	142	134	135	120	134	133.7	117	6.6	3.8	5.2	4.6	4.9	5.1	6.3	36.8	37.7	40.8	34.5	37.6	41.3	36.6	938
6	MCN-21-6	ORM 18-29-5	137	141	136	129	139	137.3	116	5.8	4.3	5.0	4.2	5.0	5.5	6.1	38.3	38.4	39.6	40.6	39.7	44.1	39.2	830
7	MCN-21-7	PBR 939	135	142	139	131	136	131.7	114	5.6	3.8	4.1	3.8	4.1	4.8	6.0	37.7	42.3	42.7	42.3	43.5	41.1	41.4	984
8	MCN-21-8	HUJM- 20-9	146	139	132	125	133	134.3	115	6.5	3.7	4.8	4.2	5.1	5.1	5.9	35.6	36.8	38.5	38.7	38.0	39.8	37.3	872
9	MCN-21-9	RB- 109	131	137	130	130	138	134	116	5.5	4.5	4.6	4.8	5.3	6.1	7.1	38.4	39.7	40.5	39.2	39.0	41.8	39.1	967
10	MCN-21-10	KMR 21-4	141	140	135	131	139	134.3	113	5.8	3.8	4.7	4.6	4.9	4.7	6.7	37.5	38.9	39.8		39.4	41.7	38.6	990
11	MCN-21-11	DRMRIJ 18-62	137	132	136	121	133	130.7	114	5.8	2.8	4.4	3.6	4.4	4.5	7.1	36.4	34.9	37.1	35.0	37.4	41.7	35.9	682
12	MCN-21-12	NPJ 252	138	141	134	130	136	138.7	118	5.8	3.9	5.1	5.0	4.8	5.7	6.0	37.1	40.0	38.7	41.3	42.2	41.8	40.1	1032
13	MCN-21-13	BAUM- 21-1	133	142	137	132	139	132.7	116	5.8	3.4	6.2	4.8	4.8	4.6	5.8	39.3	39.4	42.7	41.1	38.3	39.1	39.5	897
14	MCN-21-14	ACN 237	139	135	133	130	135	132	113	6.5	3.3	4.5	4.8	4.6	5.1	4.7	37.5	37.7	39.0	39.5	40.7	39.4	38.9	941
15	MCN-21-15	KMR 21-3	141	136	131	123	136	132.3	120	5.4	3.7	4.4	4.0	4.9	5.5	6.1	39.2	37.6	38.2	36.3	43.2	37.9	39.1	939
16	MCN-21-16	RG- 524	133	141	135	131	139	139	113	5.7	3.3	4.2	4.4	4.8	5.2	6.1	40.3	38.0	39.6	41.1	40.0	41.9	39.8	1048
17	MCN-21-17	SKM- 1744	135	134	138	128	136	132.3	116	6.6	3.1	4.9	4.8	4.7	5.3	6.4	38.6	36.0	41.7	40.1	39.6	41.2	38.6	997
18	MCN-21-18	RG- 73 (LR)	136	140	137	131	139	132.7	115	4.9	3.4	4.6	4.0	4.2	5.1	8.0	38.1	39.8	38.3	37.0	40.8	40.4	38.9	1002
19	MCN-21-19	DM- 1521	133	137	132	131	138	133.7	115	5.4	5.3	5.8	5.2	6.2	6.7	6.0	38.5	38.3	36.6	41.5	43.4	41.3	40.4	1002
20	MCN-21-20	Kranti (NC)	140	135	130	128	134	133.3	114	5.4	3.0	3.5	5.0	3.8	4.6	7.3	38.6	39.2	37.6	40.3	40.9	43.0	39.7	963
21	MCN-21-21	RMM- 1918	132	138	133	131	138	132.3	110	7.1	2.9	4.2	5.0	4.3	4.8	6.3	37.6	33.2	39.3	37.3	38.7	36.9	36.7	873
22	MCN-21-22	RH- 1934	143	137	136	131	138	136	118	6.9	4.0	5.7	5.2	5.4	5.6	7.7	38.0	37.8	39.1	39.8	38.7	40.3	38.6	1076
23	MCN-21-23	SKM- 1801	143	138	134	132	133	135.3	119	6.7	3.0	4.3	4.2	4.2	4.5	6.1	37.9	38.8	39.6	37.7	39.9	40.5	38.6	975
24	MCN-21-24	DRMR- 2019-19	137	132	131	124	132	132.7	113	5.4	4.3	5.7	5.0	5.1	5.3	5.4	40.8	39.1	41.3	40.0	41.6	38.5	40.3	979
25	MCN-21-25	NPJ 253	144	137	132	127	139	135.7	118	5.3	4.5	6.3	4.8	6.3	7.5	5.3	41.3	39.4	40.9	44.8	43.9	42.0	42.4	1192
26	MCN-21-26	PR- 2019-3	136	136	135	131	140	135.3	115	6.4	4.7	5.1	5.6	5.5	6.6	4.8	37.9	38.3	38.2	38.4	38.5	42.6	38.3	1031
27	MCN-21-27	RH 2049	139	134	136	127	136	134.3	113	5.1	4.6	5.8	4.8	6.1	6.4	4.7	37.3	40.0	35.9	34.5	38.9	40.3	37.6	941
28	MCN-21-28	PRB- 2016-1	139	137	131	128	133	131.3	118	6.5	3.7	5.8	4.6	4.8	4.8	5.9	39.6	39.7	38.9	39.5	41.1	41.7	40.0	1037

Table2.3.12a. Performance of Indian mustard strains in IVT timely sown (irrigated), Zone - IV

S.No.	Code	Strain	Seed Yield (Kg/ha)							Plant Stand					
			SKN	NGP	JAL#	MDR	PLI\$	WSM	Mean	SKN	NGP	MDR	PLI	WSM	
			1	2	3	4	5	6	(1-4,6)	1	2	4	5	6	
1	MCN-21-1	JM- 16-5	2735	1700	849	3839	1349	1722	2499		167	149	171	165	167
2	MCN-21-2	HUJM- 10-6	2981	1537	582	2831	1228	1505	2214		135	148	168	176	160
3	MCN-21-3	RGN- 507	2722	1689	444	2897	1335	1315	2156		120	148	165	180	166
4	MCN-21-4	DRMRCI- 147	2952	1627	758	2510	1463	1316	2101		144	146	166	178	159
5	MCN-21-5	BIO- 902 (ZC)	3128	1526	529	2765	911	1678	2274		144	144	164	170	168
6	MCN-21-6	ORM 18-29-5	2763	2028	1025	2965	1082	1417	2293		149	153	165	169	161
7	MCN-21-7	PBR 939	2976	1855	1274	3601	1339	1661	2523	*	156	150	164	177	167
8	MCN-21-8	HUJM- 20-9	2743	1682	862	2898	1224	1583	2227		134	149	165	177	163
9	MCN-21-9	RB- 109	2892	1514	757	2856	1310	1756	2255		147	150	165	164	138
10	MCN-21-10	KMR 21-4	2639	2092	1809	3404	1011	1385	2380		139	151	165	179	160
11	MCN-21-11	DRMRIJ 18-62	2295	1650	1056	2313	1583	1431	1922		128	148	166	175	162
12	MCN-21-12	NPJ 252	3016	1965	1311	3566	1228	1498	2511	**	138	151	167	169	157
13	MCN-21-13	BAUM- 21-1	2495	1518	883	2766	803	1580	2090		163	144	164	177	165
14	MCN-21-14	ACN 237	2646	1557	923	4299	896	1769	2568	*	146	148	166	164	167
15	MCN-21-15	KMR 21-3	3033	1960	758	4279	1471	1631	2726	*	146	151	166	174	157
16	MCN-21-16	RGN- 524	2874	2193	660	3670	983	1787	2631	*	147	145	165	179	159
17	MCN-21-17	SKM- 1744	2737	1870	1606	2940	831	1621	2292		130	150	162	168	155
18	MCN-21-18	GDM 4 (LR)	2954	1612	699	3101	1327	1439	2276		152	146	165	169	166
19	MCN-21-19	DM- 1521	2549	1850	735	3195	1235	1546	2285		129	149	162	176	167
20	MCN-21-20	Kranti (NC)	2952	1968	487	2868	1018	1451	2310		148	151	165	179	161
21	MCN-21-21	RMM- 1918	2636	1858	817	3341	983	1543	2345		121	144	166	180	148
22	MCN-21-22	RH- 1934	2902	2041	594	3073	1304	1651	2417		149	146	165	172	151
23	MCN-21-23	SKM- 1801	3115	2188	932	3213	1654	1327	2461	**	150	153	167	178	142
24	MCN-21-24	DRMR- 2019-19	3137	1564	590	2873	1493	1325	2225		123	146	167	175	142
25	MCN-21-25	NPJ 253	3773	1874	781	3778	859	1524	2737	*	167	156	169	177	172
26	MCN-21-26	PR- 2019-3	2885	2040	939	3197	1147	1727	2463		164	154	165	174	159
27	MCN-21-27	RH 2049	2449	1824	838	2637	1559	1562	2118		114	148	163	176	164
28	MCN-21-28	PRB- 2016-1	2986	1939	904	3382	1472	1613	2480		145	155	164	178	160
		GM	2850	1810	874	3177	1212	1550	2347						
		CD (5%)	656	285	120	359	369	267							
		CV (%)	14.4	9.9	8.6	8.7	19.0	10.8							
		DOS	12.10.2021	30.10.2021	30.10.2021	22.10.2021	30.10.2021	31.10.2021							

\$ data of PLI centre excluded from computation of mean due to high CV

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

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

data of JAL centre excluded from computation of mean due to more than four times differences among strains seed yield

Table2.3.12b. Performance of Indian mustard strains in IVT timely sown (irrigated), Zone - IV

S.No.	Code	Strain	Days to Maturity					1000- Seed wt (g)					Oil Content (%)				Oil Yield (kg/ha)
			SKN	NGP	MDR	PLI	WSM	SKN	NGP	MDR	PLI	WSM	SKN	NGP	WSM	Mean	
			1	2	4	5	6	1	2	4	5	6	1	2	6	(1-2,6)	
1	MCN-21-1	JM- 16-5	114	118	129	118	117	5.1	4.5	5.1	4.1	5.2	37.8	30.6	37.4	35.2	880
2	MCN-21-2	HUJM- 10-6	116	121	127	123	119	5.3	4.8	5.4	3.7	4.3	37.7	34.2	38.1	36.7	812
3	MCN-21-3	RGN- 507	121	121	129	119	115	4.6	4.4	4.5	4.0	4.6	38.0	29.8	38.7	35.5	765
4	MCN-21-4	DRMRCI- 147	114	121	128	123	117	5.6	4.1	5.2	4.3	4.1	42.1	34.3	40.4	38.9	818
5	MCN-21-5	BIO- 902 (ZC)	115	117	123	120	117	6.7	5.2	6.7	3.4	6.2	39.0	31.1	36.7	35.6	810
6	MCN-21-6	ORM 18-29-5	119	118	128	120	120	6.2	5.5	5.9	4.1	5.0	39.6	34.9	39.2	37.9	868
7	MCN-21-7	PBR 939	112	117	130	121	119	4.9	4.8	6.3	4.3	5.9	41.0	34.8	38.9	38.2	965
8	MCN-21-8	HUJM- 20-9	112	117	126	119	116	5.5	4.4	5.9	3.6	4.8	36.0	33.4	37.3	35.6	792
9	MCN-21-9	RB- 109	116	117	129	125	116	6.3	4.5	6.1	4.3	5.8	39.8	39.0	39.7	39.5	890
10	MCN-21-10	KMR 21-4	119	121	128	126	118	5.3	5.1	5.8	3.7	5.8	38.1	32.1	40.9	37.1	882
11	MCN-21-11	DRMRIJ 18-62	117	111	120	126	119	4.9	4.5	4.9	4.2	5.6	39.2	30.6	33.0	34.2	658
12	MCN-21-12	NPJ 252	115	120	124	122	116	6.2	4.9	6.3	4.4	4.7	39.7	34.2	37.6	37.2	933
13	MCN-21-13	BAUM- 21-1	116	116	131	117	119	5.4	4.2	5.7	4.2	4.8	41.3	34.3	39.4	38.4	801
14	MCN-21-14	ACN 237	117	118	128	119	119	5.2	4.3	5.8	4.6	5.3	38.0	33.7	39.1	37.0	949
15	MCN-21-15	KMR 21-3	116	117	125	117	121	5.4	4.9	5.7	5.2	4.7	39.5	32.2	36.2	36.0	981
16	MCN-21-16	RGN- 524	118	122	129	124	119	5.3	5.3	5.3	3.5	5.4	40.0	32.4	39.6	37.3	982
17	MCN-21-17	SKM- 1744	112	117	128	125	118	5.7	4.7	5.9	4.3	5.9	40.4	35.4	37.0	37.6	861
18	MCN-21-18	GDM 4 (LR)	116	117	132	126	118	5.9	4.5	5.8	4.4	4.6	37.0	29.6	39.4	35.3	803
19	MCN-21-19	DM- 1521	120	121	124	117	117	6.6	5.3	7.0	4.4	4.8	37.6	34.0	36.9	36.2	826
20	MCN-21-20	Kranti (NC)	116	120	122	125	118	4.5	4.8	4.0	4.1	4.8	37.8	31.1	38.8	35.9	829
21	MCN-21-21	RMM- 1918	115	121	130	124	119	4.6	4.7	5.6	4.4	5.5	37.9	31.3	38.5	35.9	842
22	MCN-21-22	RH- 1934	118	121	128	120	120	6.1	5.3	5.5	4.9	5.3	37.1	35.7	37.6	36.8	889
23	MCN-21-23	SKM- 1801	117	122	119	123	115	4.9	5.2	4.3	4.7	5.1	39.4	33.8	41.9	38.4	945
24	MCN-21-24	DRMR- 2019-19	112	115	117	125	117	6.5	4.7	6.0	4.7	4.7	39.5	31.8	38.7	36.7	816
25	MCN-21-25	NPJ 253	113	119	121	122	120	6.7	5.5	6.9	4.0	4.7	41.4	38.1	39.6	39.7	1087
26	MCN-21-26	PR- 2019-3	116	120	131	117	122	6.5	5.1	6.2	4.4	5.3	37.2	33.8	35.7	35.6	876
27	MCN-21-27	RH 2049	115	121	126	123	123	6.6	5.2	6.1	5.0	4.5	35.8	29.8	34.9	33.5	710
28	MCN-21-28	PRB- 2016-1	114	119	129	126	120	6.0	5.4	4.5	4.2	4.9	38.9	34.0	36.9	36.6	908

Table 2.3.13. Performance of Indian mustard strains in AVT-I Timely sown (irrigated) Repeat Zone - I

S.No.	Code	Strain	Seed Yield (Kg/ha)				Plant stand			Days to maturity			1000 Seed wt. (g)		
			KNG	DLK	BJR	Mean	KNG	DLK	BJR	KNG	DLK	BJR	KNG	DLK	BJR
			1	2	3	(1-3)	1	2	3	1	2	3	1	2	3
1	MCN 21-29	RH 1676	955	996	794	915	314	325	321	156	139	166	6.2	4.0	5.5
2	MCN 21-30	PR 2016-4	1012	1105	841	986	314	325	321	159	147	167	4.6	3.5	4.3
3	MCN 21-31	RGN 443	836	1102	897	945	315	324	322	159	143	167	3.8	3.0	5.1
4	MCN 21-32	Kranti (NC)	1337	1351	1209	1299	315	326	318	164	156	175	3.2	2.5	2.4
5	MCN 21-33	AKMS 19-2	869	1088	1044	1000	313	328	324	155	149	168	6.2	4.6	5.3
6	MCN 21-34	DRMR 2017-16	824	1193	1158	1058	317	324	321	158	144	168	5.7	3.7	4.7
7	MCN 21-35	PBR 385	1103	1223	1079	1135	314	326	322	162	148	169	5.8	3.0	4.7
8	MCN 21-36	RCC 4 (ZC)	1028	1184	1117	1110	314	328	319	162	150	169	5.1	3.8	3.8
9	MCN 21-37	PR 2016-8	931	986	1152	1023	315	325	321	164	150	170	5.1	3.0	3.6
10	MCN 21-38	SKM 1626	1072	1209	1212	1164	316	329	320	159	147	168	5.4	2.7	4.7
11	MCN 21-39	Giriraj (LR)	952	1252	1103	1102	316	325	324	162	149	167	4.9	3.9	4.2
12	MCN 21-40	RH 749 (ZC)	949	998	993	980	315	329	319	164	152	169	3.4	2.6	2.6
		GM	989	1141	1050	1060									
		CD (5%)	104	96	86										
		CV (%)	7.4	5.8	5.7										
		DOS	16.10.2021	30.10.2021	23.10.2021										

Table 2.3.14a. Performance of Indian mustard strains in AVT-I+II Timely sown (irrigated), Zone - II

S.No	Code	Strain	Seed Yield (Kg/ha)									Plant Stand								
			ABR	BAW	CHT	HSR	LDH	MOD\$	NDH	SGN	Mean	ABR	BAW	CHT	HSR	LDH	MOD	NDH	SGN	
			1	2	3	4	5	6	7	8	(1-5,7-8)	1	2	3	4	5	6	7	8	
1	MCN-21-41	RH 749 (ZC)	2607	2525	2160	2578	2453	1962	2689	1840	2407	278	272	288	269	286	249	348	197	
2	MCN-21-42	PDZ- 14 (dl)	2203	2807	1788	2584	2313	1765	2760	2809	2466	280	261	292	260	285	245	334	214	
3	MCN-21-43	PDZ 1 (DLC)	2421	2859	1689	2603	2398	1971	2501	2329	2400	270	263	289	241	283	265	285	200	
4	MCN-21-44	CS- 60 (salinity LR)	2665	2837	2251	2756	2667	1870	2950	2761	2698	280	267	295	267	300	264	295	211	
5	MCN-21-45	RH(OE)- 1807 (sl)	2689	2556	1842	2979	2316	1892	2526	2487	2485	274	260	289	273	276	250	315	204	
6	MCN-21-46	CS 2005-143#	2684	2497	1997	2846	2290	1863	2925	2639	2554	277	267	294	265	287	234	352	201	
7	MCN-21-47	RH 1975	2610	2977	1987	3094	2499	1939	2753	2879	2686	**	280	264	288	269	277	255	333	203
8	MCN-21-48	PM- 29 (QLR)	2378	2298	1990	2259	1834	1758	2157	2463	2197	278	262	296	268	279	266	267	203	
9	MCN-21-49	Giriraj (LR)	2614	2497	2109	2507	2229	1745	2714	2973	2520	278	265	341	261	286	254	301	205	
10	MCN-21-50	RH(OE)- 1706 (sl)#	2703	2739	1722	3033	2343	2070	2839	2729	2587	277	267	304	269	306	250	349	204	
11	MCN-21-51	PDZ- 15 (dl)	2479	2711	1754	2562	2295	1853	2674	2394	2410	272	266	289	263	276	231	336	203	
12	MCN-21-52	RH 1974	2864	2920	2054	3255	2380	1900	2933	2667	2725	**	273	269	306	266	284	246	307	206
13	MCN-21-53	Kranti (NC)	2565	2327	2012	2603	2464	1623	2701	1979	2379	278	267	303	263	307	251	263	196	
14	MCN-21-54	LES- 60 (sl)#	2478	2113	2015	3016	2389	1511	2710	2339	2437	276	262	299	259	293	262	341	201	
15	MCN-21-55	JC- 36 (dl)	2351	2083	1839	2537	2496	1640	2456	2360	2303	277	259	301	260	304	266	341	200	
16	MCN-21-56	CS- 54 (salinity ZC)	2713	2800	2077	2798	2396	1857	2759	2403	2564	274	263	298	264	285	265	366	205	
		GM	2564	2597	1955	2751	2360	1826	2690	2503	2489									
		CD (5%)	348	338.0	210	406	273	107	268	332										
		CV (%)	9.5	9.1	7.5	10.3	8.1	4.2	6.97	9.3										
		DOS	26.10.2021	19.10.2021	26.10.2021	12.10.2021	21.10.2021	27.10.2021	12.10.2021	22.10.2021										

\$ data of MOD centre excluded from computation of mean due to CV less than 5.0

AVT II strain

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

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

Table2.3.14b. Performance of Indian mustard strains in AVT-I+II Timely sown (irrigated), Zone - II

S.No	Code	Strain	Days to Maturity								1000 Seed wt. (g)								Oil Content (%)						
			ABR	BAW	CHT	HSR	LDH	MOD	NDH	SGN	ABR	BAW	CHT	HSR	LDH	MOD	NDH	SGN	BAW	CHT	HSR	LDH	NDH	Mean	Oil Yield (kg/ha)
			1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	2	3	4	5	7	(2-5,7)	
1	MCN-21-41	RH 749 (ZC)	144	141	145	143	145	143	149	154	6.5	6.6	4.8	6.5	5.8	6.3	6.2	5.8	39.1	36.7	38.1	38.5	39.4	38.3	923
2	MCN-21-42	PDZ- 14 (dl)	152	142	143	144	142	149	148	151	4.3	4.6	5.0	4.1	4.1	4.8	3.6	4.6	37.6	34.3	35.6	36.1	38.5	36.4	898
3	MCN-21-43	PDZ 1 (DLC)	151	143	147	142	140	147	147	150	4.0	3.8	4.8	3.6	4.0	3.7	3.1	4.1	39.1	41.9	39.8	37.7	41.7	40.1	961
4	MCN-21-44	CS- 60 (salinity LR)	151	142	140	143	143	149	149	149	6.0	6.0	5.0	5.6	4.4	5.4	5.8	5.6	37.2	35.8	36.5	35.6	38.1	36.6	989
5	MCN-21-45	RH(OE)- 1807(sl)	147	136	138	136	140	142	141	154	4.9	5.1	4.4	5.1	4.0	4.6	3.8	4.3	34.6	33.8	33.1	31.3	37.0	34.0	844
6	MCN-21-46	CS 2005-143#	150	142	144	138	143	147	147	153	6.8	6.0	4.8	6.3	4.9	5.4	5.7	6.2	35.6	36.7	37.5	36.7	37.0	36.7	937
7	MCN-21-47	RH 1975	149	139	145	138	143	145	144	154	6.6	5.8	4.6	6.1	5.4	6.1	5.8	5.8	39.0	40.0	38.1	37.8	39.2	38.8	1042
8	MCN-21-48	PM- 29 (QLR)	151	142	148	142	146	151	145	155	6.5	5.1	5.1	5.8	4.4	5.2	5.2	5.3	32.4	30.9	32.8	32.6	33.8	32.5	714
9	MCN-21-49	Giriraj (LR)	151	142	147	140	141	149	147	154	6.6	6.4	4.8	6.4	5.9	5.7	5.9	4.0	37.3	35.1	35.6	35.9	39.3	36.6	923
10	MCN-21-50	RH(OE)- 1706(sl)	147	137	143	136	138	144	142	151	5.3	5.2	5.2	5.1	4.8	5.2	4.2	5.0	36.7	35.6	38.5	34.3	37.8	36.6	946
11	MCN-21-51	PDZ- 15 (dl)	146	139	147	140	140	147	145	152	4.3	4.5	4.6	4.3	5.8	4.1	4.3	4.3	36.6	32.1	37.4	34.9	38.1	35.8	863
12	MCN-21-52	RH 1974	148	138	141	138	140	146	142	153	6.6	6.3	5.1	6.6	5.3	5.8	6.3	6.0	39.3	35.6	38.4	37.2	39.4	38.0	1035
13	MCN-21-53	Kranti (NC)	151	140	146	143	144	143	140	150	4.6	4.8	4.6	4.3	4.0	4.6	4.1	6.5	36.9	38.9	34.8	34.8	36.5	36.4	865
14	MCN-21-54	LES- 60 (sl)	151	141	148	139	154	147	145	148	5.1	4.9	5.2	5.5	4.3	4.8	4.2	4.7	31.1	30.5	35.6	33.0	35.6	33.1	808
15	MCN-21-55	JC- 36 (dl)	151	138	145	141	140	145	144	149	4.2	4.0	4.4	3.7	4.2	3.3	3.1	4.8	37.5	40.4	38.1	35.4	37.3	37.7	869
16	MCN-21-56	CS- 54 (salinity ZC)	150	140	149	140	142	146	148	147	5.8	6.1	5.2	6.5	4.7	6.7	5.7	6.2	36.5	36.1	40.0	34.6	36.1	36.6	939

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

Table2.3.15a. Performance of Indian mustard strains in AVT-I+II Timely sown (irrigated), Zone - III

S.No.	Code	Strain	Seed Yield (Kg/ha)								Plant Stand							
			PNT	KPR\$	MOR	BPR	VAR	DOL\$	JHS	Mean	PNT	KPR	MOR	BPR	VAR	DOL	JHS	
			1	2	3	4	5	6	7	(1, 3-5,7)	1	2	3	4	5	6	7	
1	MCN-21-57	CS- 54 (ZC)	1980	2224	2322	1908	1391	1321	2085	1937	281	221	349	225	367	333	318	
2	MCN-21-58	RGN 73 (ZC)	1681	2116	2393	2143	1336	1296	2080	1927	257	214	345	243	367	334	332	
3	MCN-21-59	RGN 73 (Filler)	1952	2282	2217	1944	1418	1159	2001	1906	276	225	344	259	371	334	311	
4	MCN-21-60	OIJ5001 (dl)	2001	2521	2588	1957	1623	883	2088	2051	236	212	333	262	339	334	300	
5	MCN-21-61	JC- 36 (dl)	1361	2207	2367	1848	921	891	2133	1726	263	221	335	234	310	332	325	
6	MCN-21-62	PDZ 1 (DLC)	1263	2125	2475	1524	999		2064	1665	258	224	338	214	310	0	325	
7	MCN-21-63	CS- 60 (LR)	1857	2116	2355	2272	1735	1296	2601	2164	265	216	344	215	364	335	344	
8	MCN-21-64	PM- 30 (LR)	1584	2083	2088	1660	1647	527	2546	1905	264	208	335	244	336	335	319	
9	MCN-21-65	PDZ- 14 (dl)	1315	2480	2589	1877	1518	770	2086	1877	*	270	217	338	220	305	332	319
10	MCN-21-66	Kranti (NC)	1950	2472	2349	2077	1542	997	2122	2008	275	214	340	239	348	336	321	
11	MCN-21-67	CS 2005-143#	1734	2216	1811	1979	2205	948	2115	1969	251	220	337	215	365	336	311	
12	MCN-21-68	PDZ- 15(dl)	1274	2240	2467	2245	1203	551	2077	1853	*	239	217	336	270	345	334	326
		GM	1663	2257	2335	1953	1461	886	2166	1916								
		CD (5%)	279	138	191	237	265	93	313									
		CV (%)	11.7	4.4	5.7	8.8	12.6	7.5	10.4									
		DOS	29.10.2021	03.11.2021	29.10.2021	12.10.2021	30.10.2021	24.11.2021	28.10.2021									

§data of KNP and DOL centres excluded from computation of mean due to late sowing and significant differences between same strain

used as filler

#AVT II Strain

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

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

Table2.3.15b. Performance of Indian mustard strains in AVT-I+II Timely sown (irrigated), Zone - III

S.No	Code	Strain	Days to Maturity								1000 Seed Weight (gm)							Oil Content (%)						Oil Yield (kg/ha)	
			PNT	KPR	MOR	BPR	VAR	DOL	JHS	Mean	PNT	KPR	MOR	BPR	VAR	DOL	JHS	PNT	KPR	MOR	BPR	VAR	DOL		Mean
			1	2	3	4	5	6	7	(1-7)	1	2	3	4	5	6	7	1	2	3	4	5	6		(1-6)
1	MCN-21-57	CS- 54 (ZC)	133	132	139	139	130	120	140	133	4.0	3.3	6.3	5.8	4.2	4.6	4.8	37.5	41.1	38.5	40.8	35.2	35.2	38.0	736
2	MCN-21-58	RGN 73 (ZC)	135	136	141	140	132	121	141	135	3.1	3.7	4.6	4.6	3.4	4.1	5.1	39.5	38.7	38.9	4.6	37.0	38.8	30.0	578
3	MCN-21-59	RGN 73 (Filler)	137	133	142	141	132	120	139	135	3.5	3.6	5.4	4.6	4.7	3.4	4.4	37.8	35.3	37.4	40.4	33.8	39.2	37.4	712
4	MCN-21-60	0IJ5001	128	135	135	129	128	119	139	130	2.9	3.4	4.3	3.8	4.1	3.0	3.7	43.5	44.1	45.1	44.8	39.4	43.5	43.2	886
5	MCN-21-61	JC- 36 (dl)	131	134	136	133	133	120	140	133	2.7	3.1	3.5	3.6	4.3	4.6	3.4	41.4	38.9	40.4	41.2	38.5	38.4	40.3	696
6	MCN-21-62	PDZ 1 (DLC)	130	136	138	140	131	0	137	116	2.6	3.1	3.5	4.5	4.4	0.0	3.6	44.2	41.6	43.7	41.3	42.9	42.4	43.0	716
7	MCN-21-63	CS- 60 (LR)	135	132	139	138	131	122	140	134	3.8	4.9	6.1	5.5	4.9	4.0	4.8	37.9	36.7	37.5	38.5	38.6	37.5	38.1	825
8	MCN-21-64	PM- 30 (LR)	136	133	140	139	130	119	136	133	3.6	5.2	6.9	5.3	5.0	3.6	5.1	35.6	36.8	35.1	41.9	36.2	38.5	37.2	709
9	MCN-21-65	PDZ- 14	134	135	142	133	131	118	139	133	2.8	3.8	4.4	3.9	3.6	3.6	4.4	39.6	37.9	39.4	43.1	39.0	39.3	40.3	756
10	MCN-21-66	Kranti (NC)	132	136	139	139	128	119	136	133	2.9	3.5	5.1	4.0	4.7	3.0	3.8	37.3	37.3	38.8	40.1	34.2	36.6	37.6	755
11	MCN-21-67	CS 2005-143	137	134	141	140	133	119	138	135	3.9	3.9	6.6	5.6	4.9	5.0	5.0	34.5	42.5	38.1	43.7	35.5	39.1	37.9	747
12	MCN-21-68	PDZ- 15	129	132	143	139	128	120	139	133	2.9	3.6	4.5	3.7	4.3	3.5	4.1	37.2	40.6	40.3	42.6	38.3	39.9	39.6	734

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

Table-2.3.16a. Performance of Indian mustard strains in IVT Timely sown (rainfed), Zone - II

S.No.	Code	Strain	Seed Yield (Kg/ha)						Plant Stand					
			SGN	HSR	BAW	LDH	ABR	Mean	SGN	HSR	BAW	LDH	ABR	
			1	2	3	4	5	(1-5)	1	2	3	4	5	
1	MCNR-21-1	BAUM- 21-2	2057	2522	2238	1344	1683	1969		100	117	125	135	119
2	MCNR-21-2	RH 725 (ZC)	2444	2786	2147	1362	2519	2252		105	120	124	128	118
3	MCNR-21-3	DRMRHJ 1117	2572	2667	2340	1729	2384	2339	*	102	113	128	135	123
4	MCNR-21-4	RGN- 510	2635	2368	2380	2090	2601	2415		104	118	123	133	113
5	MCNR-21-5	PBR 552	2255	2344	2581	2293	2270	2349		101	117	122	127	127
6	MCNR-21-6	RH 761 (LR)	2109	2277	2049	1811	1744	1998		104	119	128	128	114
7	MCNR-21-7	RH 1928	2467	2195	2069	1618	2225	2115		105	117	122	126	123
8	MCNR-21-8	DRMR 2019-7	2282	2892	2226	1652	2621	2335		101	116	123	131	119
9	MCNR-21-9	DRMRCI- 148	2339	2084	2029	2058	1947	2091		103	114	120	135	113
10	MCNR-21-10	NPJ- 254	2731	2581	2384	1346	2086	2226		106	120	120	129	126
11	MCNR-21-11	RGN- 519	2548	2246	2396	1642	2216	2209		104	115	118	133	116
12	MCNR-21-12	DRMRHT 13-22-2	2093	2691	1809	1605	1918	2023		98	113	115	133	114
13	MCNR-21-13	PBR 357	2365	2498	2285	1823	2152	2225		105	117	125	131	113
14	MCNR-21-14	NPJ- 255	2211	2277	1982	1507	2787	2153		100	116	123	140	117
15	MCNR-21-15	Kranti (NC)	1718	2313	2100	1535	2229	1979		99	117	115	132	116
16	MCNR-21-16	RH 1930	2180	2459	2266	1774	2500	2236		100	115	125	134	118
17	MCNR-21-17	RB- 110	2453	2640	2206	1881	2826	2401		103	121	119	128	118
18	MCNR-21-18	CAU- RMM 3	2537	2569	1832	1040	2739	2143		106	117	122	129	121
		GM	2333	2467	2184	1673	2302	2192						
		CD (5%)	374	444	352	306	422							
		CV (%)	9.7	10.8	9.68	11.0	11.0							
		DOS	23.10.2021	11.10.2021	20.10.2021	22.10.2021	26.10.2021							

* starin outyielding/at par with best check and possessing resistance against white rust

Table 2.3.16b. Performance of Indian mustard strains in IVT Timely sown (rainfed), Zone - II

S.No.	Code	Strain	Days to Maturity					1000 - Seed Weight (g)					Oil Content (%)				Oil Yield (kg/ha)
			SGN	HSR	BAW	LDH	ABR	SGN	HSR	BAW	LDH	ABR	HSR	BAW	LDH	Mean	
			1	2	3	4	5	1	2	3	4	5	2	3	4	(2-4)	
1	MCNR-21-1	BAUM- 21-2	147	134	145	141	140	4.9	5.2	4.2	4.2	5.6	37.1	37.8	37.7	37.5	738
2	MCNR-21-2	RH 725 (ZC)	145	141	147	142	137	5.2	6.5	4.8	5.0	6.9	39.2	41.2	37.4	39.2	883
3	MCNR-21-3	DRMRHJ 1117	144	143	145	140	141	4.0	5.5	4.8	4.2	5.9	38.6	40.8	38.8	39.4	922
4	MCNR-21-4	RGN- 510	148	142	144	142	142	5.3	6.0	5.4	5.5	6.3	37.7	40.4	37.0	38.3	926
5	MCNR-21-5	PBR 552	147	142	146	141	141	4.8	5.0	4.4	4.8	5.5	37.9	40.4	37.2	38.5	904
6	MCNR-21-6	RH 761 (LR)	149	137	142	140	142	5.4	5.5	5.1	4.6	5.9	41.1	41.0	38.0	40.0	800
7	MCNR-21-7	RH 1928	150	140	143	142	139	5.7	6.2	4.9	5.1	6.3	39.2	41.1	37.7	39.3	831
8	MCNR-21-8	DRMR 2019-7	153	138	142	141	142	5.3	7.2	5.2	6.4	7.4	39.5	37.9	36.7	38.0	888
9	MCNR-21-9	DRMRCI- 148	146	141	145	140	140	5.8	6.3	5.3	5.5	6.4	40.8	38.9	37.9	39.2	820
10	MCNR-21-10	NPJ- 254	145	140	143	141	140	5.6	6.1	4.9	4.9	6.3	42.1	41.3	37.9	40.5	900
11	MCNR-21-11	RGN- 519	144	143	143	142	139	5.3	5.6	5.0	4.9	5.8	38.1	39.0	34.4	37.1	820
12	MCNR-21-12	DRMRHT 13-22-2	147	131	142	141	140	4.4	6.4	6.3	5.6	6.5	39.3	38.7	36.7	38.3	774
13	MCNR-21-13	PBR 357	149	141	146	149	140	4.0	6.2	5.7	4.8	6.2	40.9	41.2	36.0	39.4	876
14	MCNR-21-14	NPJ- 255	146	139	141	143	137	6.7	7.3	6.9	5.4	7.3	38.1	39.1	35.0	37.4	806
15	MCNR-21-15	Kranti (NC)	144	138	145	142	138	5.9	4.8	3.9	4.1	5.5	40.4	40.6	34.8	38.6	764
16	MCNR-21-16	RH 1930	145	141	143	147	138	6.8	7.2	6.5	5.7	7.4	38.2	38.5	36.2	37.6	841
17	MCNR-21-17	RB- 110	152	133	143	145	140	5.3	6.4	5.8	5.8	6.7	39.6	40.3	38.6	39.5	949
18	MCNR-21-18	CAU- RMM 3	153	130	144	141	137	5.7	4.8	4.1	4.4	5.1	40.1	37.2	36.8	38.0	815

Table 2.3.17a. Performance of Indian mustard strains in IVT Timely sown (rainfed), Zone - V

S.No.	Code	Strain	Seed Yield (Kg/ha)						Plant Stand					Days to Maturity				
			KNK	JAG	SHL\$	BHU	IMP	Mean	KNK	JAG	SHL	BHU	IMP	KNK	JAG	SHL	BHU	IMP
			1	2	3	4	5	(1-2,4-5)	1	2	3	4	5	1	2	3	4	5
1	MCNR-20-1	BAUM- 21-2	1302	1577	2130	817	1389	1271	182	171	201	121	170	119	119	119	100	116
2	MCNR-20-2	NRCHB- 101 (ZC)	1496	1891	1136	901	1377	1416	184	172	166	123	179	120	117	119	104	117
3	MCNR-20-3	DRMRHJ 1117	1337	1479	1049	859	1346	1255	180	157	179	120	178	123	121	119	103	117
4	MCNR-20-4	RGN- 510	1374	1845	864	837	1444	1375	181	178	165	121	179	124	124	129	102	118
5	MCNR-20-5	PBR 552	1464	2000	1636	840	1265	1392	184	186	191	120	179	125	117	129	99	118
6	MCNR-20-6	DRMR 150-35 (LR)	1316	1333	1296	893	1278	1205	183	165	171	120	168	121	122	119	100	117
7	MCNR-20-7	RH 1928	1395	1363	691	875	1586	1305	182	166	160	123	179	123	121	119	104	116
8	MCNR-20-8	DRMR 2019-7	1534	1646	2006	995	1265	1360	185	181	200	128	182	124	119	119	103	115
9	MCNR-20-9	DRMRCI- 148	1317	1606	1247	899	1272	1273	186	172	176	124	175	125	117	119	100	118
10	MCNR-20-10	NPJ- 254	1288	1506	821	911	1494	1300	185	175	159	128	180	122	122	119	101	117
11	MCNR-20-11	RGN- 519	1591	1232	1000	905	1463	1298	180	158	182	127	177	121	122	119	99	116
12	MCNR-20-12	DRMRHT 13-22-2	1299	1760	728	1094	1500	1413	179	179	165	128	176	118	119	119	103	115
13	MCNR-20-13	PBR 357	1617	1615	722	867	1247	1337	184	170	163	121	179	123	124	122	101	115
14	MCNR-20-14	NPJ- 255	1476	1211	802	993	1315	1249	186	113	173	122	182	125	119	119	101	116
15	MCNR-20-15	Kranti (NC)	1548	1614	1142	925	1142	1307	185	147	190	124	177	120	119	119	104	115
16	MCNR-20-16	RH 1930	1461	1936	525	891	1457	1436	183	162	154	123	177	126	124	119	101	117
17	MCNR-20-17	RB- 110	1432	1786	889	941	1340	1375	181	166	171	127	180	125	117	119	103	116
18	MCNR-20-18	CAU- RMM 3	1374	1846	914	946	951	1279	186	162	191	124	176	122	113	113	102	116
		GM	1423	1625	1089	911	1341	1325										
		CD (5%)	168	190	225	97	307											
		CV (%)	7.4	7.0	12.4	6.5	13.8											
		DOS	08.11.2021	29.10.2021	06.11.2021	20.11.2021	19.11.2021											

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

Table 2.3.17b. Performance of Indian mustard strains in IVT Timely sown (rainfed), Zone - V

S.No.	Code	Strain	Days to Maturity					1000-Seed Wt. (g)					Oil Content (%)				Oil Yield (kg/ha)
			KNK	JAG	SHL	BHU	IMP	KNK	JAG	SHL	BHU	IMP	KNK	JAG	IMP	Mean	
			1	2	3	4	5	1	2	3	4	5	1	2	5	(1-2,5)	
1	MCNR-20-1	BAUM- 21-2	119	119	119	100	116	3.2	5.4	7.0	3.9	4.4	36.9	35.0	36.6	36.2	460
2	MCNR-20-2	NRCHB- 101 (ZC)	120	117	119	104	117	4.6	5.2	8.8	3.8	5.2	39.6	38.8	39.6	39.3	557
3	MCNR-20-3	DRMRHJ 1117	123	121	119	103	117	3.8	4.9	7.5	4.0	4.3	38.3	39.8	36.7	38.3	480
4	MCNR-20-4	RGN- 510	124	124	129	102	118	4.0	5.6	7.8	3.9	3.7	38.9	40.0	34.1	37.7	518
5	MCNR-20-5	PBR 552	125	117	129	99	118	3.6	5.2	7.0	4.0	4.3	37.5	38.8	35.9	37.4	521
6	MCNR-20-6	DRMR 150-35 (LR)	121	122	119	100	117	4.1	5.6	8.2	3.8	5.1	37.3	38.8	38.6	38.2	461
7	MCNR-20-7	RH 1928	123	121	119	104	116	3.9	5.6	7.7	3.9	5.1	38.5	31.5	35.5	35.2	459
8	MCNR-20-8	DRMR 2019-7	124	119	119	103	115	4.1	5.4	9.3	4.0	6.0	36.9	32.9	34.8	34.9	474
9	MCNR-20-9	DRMRCI- 148	125	117	119	100	118	4.2	5.7	7.6	4.1	5.2	40.0	33.2	38.0	37.1	472
10	MCNR-20-10	NPJ- 254	122	122	119	101	117	3.9	5.1	7.7	3.9	4.7	40.8	31.5	39.7	37.3	485
11	MCNR-20-11	RGN- 519	121	122	119	99	116	3.9	5.4	7.5	3.9	5.1	34.4	33.4	34.1	34.0	441
12	MCNR-20-12	DRMRHT 13-22-2	118	119	119	103	115	3.8	5.4	8.1	4.1	5.1	37.1	37.6	38.2	37.7	532
13	MCNR-20-13	PBR 357	123	124	122	101	115	4.1	5.4	7.3	3.9	4.9	37.8	40.3	31.8	36.6	489
14	MCNR-20-14	NPJ- 255	125	119	119	101	116	4.7	5.2	9.5	4.1	5.7	37.1	35.2	34.4	35.6	444
15	MCNR-20-15	Kranti (NC)	120	119	119	104	115	3.3	5.3	7.2	3.8	4.0	36.2	32.9	36.5	35.2	460
16	MCNR-20-16	RH 1930	126	124	119	101	117	4.7	5.3	9.3	4.1	6.1	36.5	30.3	36.4	34.4	494
17	MCNR-20-17	RB- 110	125	117	119	103	116	3.9	5.5	8.7	3.9	5.8	41.1	34.5	36.8	37.5	515
18	MCNR-20-18	CAU- RMM 3	122	113	113	102	116	3.7	5.4	7.6	4.2	3.9	39.1	38.3	34.5	37.3	477

Table-2.3.18a. Performance of Indian mustard strains in AVT I+II Timely sown (Rainfed), Zone - II

S.No.	Code	Strain	Seed Yield (Kg/ha)					Plant Stand					Days to maturity					
			ABR	BAW	HSR	LDH	SGN\$	Mean	ABR	BAW	HSR	LDH	SGN	ABR	BAW	HSR	LDH	SGN
			1	2	3	4	5	(1-4)	1	2	3	4	5	1	2	3	4	5
1	MCNR-21-19	Kranti (NC)	2015	1973	2329	1396	2189	1928	270	261	259	288	204	137	141	139	141	149
2	MCNR-21-20	RH 725 (LR)	2309	2512	2562	1726	2919	2277	278	263	260	290	212	139	141	140	145	150
3	MCNR-21-21	DRMRCI 128	2311	2416	2497	1957	2187	2295	271	264	261	302	203	141	143	143	141	147
4	MCNR-21-22	RH 1424#	2552	2697	2890	1694	2337	2458	266	270	261	295	205	139	139	138	142	148
5	MCNR-21-23	RGN 229 (Filler)	2002	2283	2040	1661	2621	1997	271	272	263	301	209	140	146	142	143	144
6	MCNR-21-24	RH 761	2460	2268	2571	1736	2286	2259	271	262	261	301	202	138	143	141	144	149
7	MCNR-21-25	RGN 229 (ZC)	2152	2106	2165	1676	1975	2025	270	262	262	296	197	140	146	142	144	147
		GM	2257	2322	2436	1692	2359	2177										
		CD (5%)	367	374	415	251	361											
		CV (%)	10.9	10.8	11.4	10.0	10.3											
		DOS	25.10.2021	19.10.2021	11.10.2021	22.10.2021	23.10.2021											

\$ data of SGN centre excluded from computation of mean due to significant differences between same genotype used as check/filler

AVT II Strain

Table-2.3.18b. Performance of Indian mustard strains in AVT I+II Timely sown (Rainfed), Zone - II

S.No.	Code	Strain	1000 Seed Weight (g)					Oil Content (%)				Oil Yield (kg/ha)
			ABR	BAW	HSR	LDH	SGN	BAW	HSR	LDH	Mean	
			1	2	3	4	5	2	3	4	(2-4)	
1	MCNR-21-19	Kranti (NC)	4.6	4.1	4.4	4.6	4.6	37.3	39.2	36.2	37.6	724
2	MCNR-21-20	RH 725 (LR)	6.3	5.2	6.2	5.3	6.3	38.9	40.9	35.2	38.3	873
3	MCNR-21-21	DRMRCI 128	6.0	4.5	5.3	5.2	6.3	40.3	40.0	37.6	39.3	902
4	MCNR-21-22	RH 1424#	6.7	6.3	6.9	5.1	6.1	39.1	41.3	37.0	39.1	961
5	MCNR-21-23	RGN 229 (Filler)	5.8	4.6	5.3	4.0	4.7	36.8	38.0	36.4	37.0	740
6	MCNR-21-24	RH 761	6.1	5.6	6.4	5.5	5.7	38.9	38.3	37.7	38.3	864
7	MCNR-21-25	RGN 229 (ZC)	5.6	3.9	5.2	4.1	4.9	33.4	36.3	33.9	34.5	699

Table 2.3.19a. Performance of Indian mustard strains in IVT Late sown (irrigated) Zone - II

S.No.	Code	Strain	Seed Yield (Kg/h)						Plant Stand					Days to Maturity					
			SGN	HSR	NDH	LDH	ABR	Mean	SGN	HSR	NDH	LDH	ABR	SGN	HSR	NDH	LDH	ABR	
			1	2	3	4	5	(1-5)	1	2	3	4	5	1	2	3	4	5	
1	MCNL-21-1	NPJ 250	2790	2281	2394	1667	2531	2333	***	109	119	157	129	117	135	131	121	136	135
2	MCNL-21-2	HUJM-20-6	2415	1974	1878	1773	2151	2038		102	120	157	132	124	139	131	126	134	132
3	MCNL-21-3	RH 1939	2475	1820	1628	1538	2012	1895		103	119	153	147	122	133	132	127	135	136
4	MCNL-21-4	DRMR 2017-15 (LR)	2675	2275	1933	1419	2247	2110		104	119	153	141	119	140	130	126	134	136
5	MCNL-21-5	PAB- 2014-17	2156	1684	2061	1960	2475	2067		103	122	150	132	122	138	135	128	132	138
6	MCNL-21-6	BAUM- 08-15	2118	1590	1683	1264	2096	1750		101	120	154	141	121	137	130	126	135	139
7	MCNL-21-7	NPJ 251	1996	2004	2039	2070	2605	2143		99	124	151	142	117	130	130	125	135	136
8	MCNL-21-8	DRMRSJ 272	2234	2252	2111	1300	2068	1993		100	125	152	138	122	133	129	120	134	131
9	MCNL-21-9	DRMRHJ 430	2736	2033	2167	1944	2469	2270		106	120	146	135	125	135	130	126	135	130
10	MCNL-21-10	RGN 522	2863	2015	1689	1828	2522	2183		104	115	154	141	127	136	134	130	134	137
11	MCNL-21-11	KMR(L) 21-5	2616	1933	1567	1324	2139	1916		107	121	154	137	124	131	131	127	136	132
12	MCNL-21-12	DRMRCI 140	2529	1596	1883	1932	2228	2034		103	122	143	137	124	139	130	125	135	137
13	MCNL-21-13	Kranti (NC)	2593	1761	1678	1134	2167	1867		103	121	159	137	115	141	130	124	132	135
14	MCNL-21-14	KMR(L) 21-6	2453	1661	1522	1588	2022	1849		104	120	142	137	123	139	133	129	135	135
15	MCNL-21-15	DRMRHT- 13-7-113	2257	1820	1717	1994	1929	1943		101	120	159	141	118	138	130	125	136	132
16	MCNL-21-16	ACN 237	2850	1891	1983	2090	2259	2215		108	116	157	135	121	135	130	126	137	134
17	MCNL-21-17	RGN 520	2408	2098	1828	1796	2201	2066		100	119	162	137	124	132	131	128	132	137
18	MCNL-21-18	RH 2050	2583	2128	1822	2059	2244	2167		105	116	158	137	118	137	131	126	135	137
19	MCNL-21-19	PAB- 2014-7	1929	1720	1467	1929	2368	1883		98	120	154	138	121	130	133	129	137	135
20	MCNL-21-20	PM- 26 (ZC)	2667	2169	2461	1807	2102	2241		107	121	161	136	115	131	129	119	136	136
		GM	2467	1935	1876	1720	2242	2048											
		CD (5%)	388	374	291	284	326												
		CV (%)	9.5	11.7	9.4	10.0	8.8												
		DOS	26.11.2021	15.11.2021	22.11.2021	15.11.2021	26.11.2021												

*** Strain outyielding/at par with the best check and possessing resistance against white rust

le 2.3.19b. Performance of Indian mustard strains in IVT Late sown (irrigated) Zone

S.No.	Code	Strain	1000-Seed Wt. (g)					Oil Content (%)				Oil Yield (kg/ha)
			SGN	HSR	NDH	LDH	ABR	HSR	NDH	LDH\$	Mean	
			1	2	3	4	5	2	3	4	(2-4)	
1	MCNL-21-1	NPJ 250	3.9	5.2	3.5	4.4	3.4	36.0	32.2	31.5	33.2	775
2	MCNL-21-2	HUJM-20-6	3.7	4.5	3.5	4.1	3.4	34.9	33.5	32.4	33.6	685
3	MCNL-21-3	RH 1939	4.2	5.5	4.4	4.6	4.3	37.4	32.9	33.0	34.4	652
4	MCNL-21-4	DRMR 2017-15 (LR)	3.1	4.8	3.4	4.7	3.2	36.4	35.0	33.5	35.0	737
5	MCNL-21-5	PAB- 2014-17	3.4	4.0	3.4	4.1	3.4	33.3	31.3	32.4	32.3	668
6	MCNL-21-6	BAUM- 08-15	3.5	3.6	2.7	4.1	2.8	36.1	33.7	33.4	34.4	602
7	MCNL-21-7	NPJ 251	3.8	4.4	3.2	4.7	3.5	37.2	33.4	33.3	34.6	742
8	MCNL-21-8	DRMRSJ 272	4.1	4.1	3.2	4.1	3.1	36.1	33.6	29.5	33.1	659
9	MCNL-21-9	DRMRHJ 430	3.7	3.7	2.4	4.0	2.5	38.1	33.0	33.9	35.0	795
10	MCNL-21-10	RGN 522	3.8	4.8	3.2	4.2	3.2	36.3	31.3	34.9	34.2	746
11	MCNL-21-11	KMR(L) 21-5	3.5	4.1	3.3	4.1	3.5	35.5	33.2	33.5	34.1	653
12	MCNL-21-12	DRMRCI 140	4.0	4.3	3.0	4.0	2.9	37.8	34.8	34.2	35.6	724
13	MCNL-21-13	Kranti (NC)	3.4	3.6	2.8	4.1	2.8	35.7	33.2	31.7	33.5	626
14	MCNL-21-14	KMR(L) 21-6	4.3	4.3	3.0	4.0	3.1	34.6	29.2	31.9	31.9	590
15	MCNL-21-15	DRMRHT- 13-7-113	3.6	4.5	3.7	4.3	3.6	36.3	31.8	34.1	34.1	662
16	MCNL-21-16	ACN 237	3.5	4.6	3.6	4.2	3.6	34.6	32.8	33.4	33.6	744
17	MCNL-21-17	RGN 520	4.1	4.0	3.0	4.6	3.1	34.8	30.9	33.0	32.9	680
18	MCNL-21-18	RH 2050	4.0	5.6	4.1	4.3	4.1	34.0	30.2	30.9	31.7	687
19	MCNL-21-19	PAB- 2014-7	3.3	4.2	3.2	4.4	3.3	32.6	30.3	31.9	31.6	595
20	MCNL-21-20	PM- 26 (ZC)	4.1	4.2	2.9	4.1	2.9	37.2	32.1	33.8	34.4	771

Table 2.3.20a. Performance of Indian mustard strains in IVT Late Sown (Irrigated) Zone - III

S.No.	Code	Strain	Seed Yield (Kg/ha)							Plant Stand						Days to Maturity						
			KPR	PNT	VAR	MOR	DOL	SBR	Mean	KPR	PNT	VAR	MOR	DOL	SBR	KPR	PNT	VAR	MOR	DOL	SBR	
			1	2	3	4	5	6	(1-6)	1	2	3	4	5	6	1	2	3	4	5	6	
1	MCNL-21-1	NPJ 250	1775	1163	1309	2308	1273	1717	1591		124	153	95	137	161	178	128	126	120	122	116	111
2	MCNL-21-2	HUJM-20-6	1929	1254	1955	1217	1248	1887	1582		124	130	129	134	170	180	123	128	121	124	121	112
3	MCNL-21-3	RH 1939	2006	1388	2207	1186	932	1662	1563		120	115	116	128	164	177	129	133	122	122	117	108
4	MCNL-21-4	CS- 56 (LR)	1646	1610	2674	1593	937	1776	1706		125	159	116	126	168	189	125	134	125	124	117	110
5	MCNL-21-5	PAB- 2014-17	1698	1607	2303	1490	1402	1532	1672		118	157	115	131	166	163	126	135	125	126	119	114
6	MCNL-21-6	BAUM- 08-15	1723	1037	1866	1687	1280	1896	1582		121	115	101	128	163	186	123	127	121	118	115	107
7	MCNL-21-7	NPJ 251	1826	1383	2972	1979	1384	1939	1914	*	120	140	110	132	166	180	127	126	119	119	120	111
8	MCNL-21-8	DRMRSJ 272	1672	1044	1593	2092	1058	1483	1490		117	121	109	137	166	199	123	125	118	118	117	106
9	MCNL-21-9	DRMRHJ 430	1878	1420	2374	1975	1272	2229	1858	**	121	151	129	132	164	195	122	131	119	125	115	107
10	MCNL-21-10	RGN 522	1698	1502	2129	1342	1259	1499	1571		117	144	138	132	166	196	124	138	127	127	117	113
11	MCNL-21-11	KMR(L) 21-5	1620	1290	2035	1937	1173	1409	1577		122	143	120	128	163	195	125	130	126	126	117	110
12	MCNL-21-12	DRMRCI 140	1646	1249	1830	2083	1233	1428	1578		126	153	145	133	160	196	123	129	123	120	120	107
13	MCNL-21-13	Kranti (NC)	1698	1331	2401	1795	1292	1801	1720		121	139	112	129	164	196	126	125	122	118	117	109
14	MCNL-21-14	KMR(L) 21-6	1672	1479	1791	1789	1148	2171	1675		124	130	147	135	165	196	125	138	124	127	116	109
15	MCNL-21-15	DRMRHT- 13-7-113	1749	1306	2309	1724	1373	1881	1724		125	143	113	130	165	195	119	127	121	120	116	110
16	MCNL-21-16	ACN 237	1723	1344	2349	1606	1253	1915	1698		123	134	105	128	163	196	128	131	125	122	120	107
17	MCNL-21-17	RGN 520	1595	1553	2559	2000	1165	1674	1758		116	143	113	131	169	195	120	135	124	129	119	112
18	MCNL-21-18	RH 2050	1672	1143	1764	1726	1071	1634	1502		121	118	95	138	161	197	123	129	123	128	120	108
19	MCNL-21-19	PAB- 2014-7	1749	1667	2369	1594	1137	1795	1718		126	147	128	137	167	197	121	138	128	130	122	110
20	MCNL-21-20	NRCHB- 101 (ZC)	1569	1634	1957	1965	1443	1884	1742		120	180	130	138	168	195	124	131	123	128	121	107
		GM	1727	1370	2137	1754	1217	1761	1661													
		CD (5%)	258	259	519	158	202	149														
		CV (%)	9.3	11.5	12.9	5.4	10.0	9.5														
		DOS	19.11.2021	24.11.2021	15.11.2021	22.11.2019	25.11.2021	25.11.2021														

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

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

Table 2.3.20b. Performance of Indian mustard strains in IVT Late Sown (Irrigated) Zone - III

S.No.	Code	Strain	1000-Seed Wt.(g)						Oil Content (%)						Oil Yield (kg/ha)
			KPR	PNT	VAR	MOR	DOL	SBR	KPR	PNT	VAR	MOR	DOL	Mean	
			1	2	3	4	5	6	1	2	3	4	5	(1-5)	
1	MCNL-21-1	NPJ 250	3.8	3.1	4.5	4.5	3.8	4.9	34.0	32.3	34.6	30.8	37.6	33.9	539
2	MCNL-21-2	HUJM-20-6	3.5	3.0	4.1	4.1	4.9	4.8	35.2	32.3	36.0	31.4	40.7	35.1	555
3	MCNL-21-3	RH 1939	3.8	4.2	3.9	4.4	3.9	4.1	37.5	32.3	41.0	32.0	41.2	36.8	575
4	MCNL-21-4	CS- 56 (LR)	3.9	3.0	4.5	4.7	5.0	4.5	34.5	31.6	34.4	31.7	41.2	34.7	591
5	MCNL-21-5	PAB- 2014-17	3.9	3.0	4.7	4.3	3.3	3.8	33.3	32.8	33.9	32.3	38.7	34.2	572
6	MCNL-21-6	BAUM- 08-15	3.5	2.2	3.2	3.9	3.0	3.4	34.4	32.6	33.9	36.2	38.0	35.0	554
7	MCNL-21-7	NPJ 251	3.9	2.8	4.4	4.2	3.1	4.2	33.0	32.2	36.1	31.7	39.8	34.6	662
8	MCNL-21-8	DRMRSJ 272	3.1	2.8	3.9	3.7	3.5	4.1	35.6	33.3	36.2	31.5	39.1	35.1	523
9	MCNL-21-9	DRMRHJ 430	4.0	2.9	5.9	3.7	3.6	4.2	36.3	34.2	38.3	36.0	43.7	37.7	700
10	MCNL-21-10	RGN 522	3.8	3.4	4.2	4.8	3.5	5.4	36.2	34.2	38.5	33.4	38.7	36.2	569
11	MCNL-21-11	KMR(L) 21-5	3.4	3.0	4.3	4.1	3.4	4.7	35.8	36.2	35.2	29.8	40.9	35.6	561
12	MCNL-21-12	DRMRCI 140	3.2	3.0	3.1	0.3	3.3	4.6	37.6	36.2	37.0	32.3	42.2	37.0	585
13	MCNL-21-13	Kranti (NC)	3.7	2.7	3.1	3.7	3.5	3.5	34.5	33.7	36.6	30.7	40.8	35.2	606
14	MCNL-21-14	KMR(L) 21-6	3.1	3.3	4.0	4.3	3.5	4.2	33.3	34.4	38.2	31.9	37.9	35.1	589
15	MCNL-21-15	DRMRHT- 13-7-113	3.3	3.3	5.2	4.2	3.8	4.6	34.8	33.5	38.5	33.8	40.6	36.2	625
16	MCNL-21-16	ACN 237	3.6	3.3	3.0	4.8	3.6	4.2	34.1	34.4	37.4	34.9	40.6	36.3	616
17	MCNL-21-17	RGN 520	3.4	2.8	3.3	4.1	3.6	6.7	34.5	33.3	35.7	30.6	39.1	34.6	609
18	MCNL-21-18	RH 2050	4.5	3.7	3.4	5.6	4.3	5.5	34.3	31.3	32.1	31.9	40.2	34.0	510
19	MCNL-21-19	PAB- 2014-7	3.4	3.3	4.3	4.0	3.9	4.4	33.8	34.1	35.8	32.4	39.7	35.2	604
20	MCNL-21-20	NRCHB- 101 (ZC)	4.2	3.5	4.2	5.4	4.6	4.6	37.9	33.5	34.8	34.4	42.0	36.5	636

Table 2.3.21a. Performance of Indian mustard strains in AVT I Late Sown (Irrigated) Zone - III

S.No	Code	Strain	Seed Yield (Kg/ha)							Plant Stand						Days to Maturity						
			KPR	PNT	VAR	MOR	DOL\$	SBR	Mean	KPR	PNT	VAR	MOR	DOL	SBR	KPR	PNT	VAR	MOR	DOL	SBR	
			1	2	3	4	5	6	(1-4,6)	1	2	3	4	5	6	1	2	3	4	5	6	
1	MCNL-21-21	NRCHB- 101 (ZC)	1951	1505	2291	1195	1296	1507	1690		218	258	268	335	335	241	134	128	150	126	108	115
2	MCNL-21-22	DRMR 2018-19	2075	1222	2181	1379	1412	1389	1649	**	225	268	267	336	333	235	130	122	149	128	102	109
3	MCNL-21-23	CS- 56 (Filler)	2001	1522	1754	979	1273	1479	1547		225	283	323	338	337	236	132	130	154	131	103	113
4	MCNL-21-24	CS- 56 (LR)	2009	1359	1447	997	972	1333	1429		219	269	336	334	328	239	135	130	151	130	103	112
5	MCNL-21-25	Kranti (NC)	2042	1206	1480	1099	1007	1252	1416		221	284	342	335	325	221	132	125	150	129	101	109
		GM	2016	1363	1831	1130	1192	1392	1546													
		CD (5%)	223	239	497	136	248	213														
		CV (%)	7.2	11.4	11.8	7.7	13.3	10.0														
		DOS	19.11.2021	24.11.2021	15.11.2021	22.11.2021	30.11.2021	26.11.2021														

\$ data of DOL centre excluded from computation of mean due to significant difference between sam strain used as check/filler

** Strain at par/exceeding the best check for oil yield and having resistance against white rust

Table 2.3.21b. Performance of Indian mustard strains in AVT I Late Sown (Irrigated) Zone - III

S.No	Code	Strain	1000-Seed Wt.(g)						Oil Content (%)						Oil Yield (kg/ha)
			KPR	PNT	VAR	MOR	DOL	SBR	KPR	PNT	VAR	MOR	DOL\$	Mean	
			1	2	3	4	5	6	1	2	3	4	5	(1-4)	
1	MCNL-21-21	NRCHB- 101 (ZC)	3.8	3.7	4.8	3.6	5.2	3.8	34.0	34.7	35.0	31.6	42.2	33.8	571
2	MCNL-21-22	DRMR 2018-19	3.2	3.8	4.7	4.2	5.4	5.2	37.9	36.8	39.7	32.4	43.3	36.7	605
3	MCNL-21-23	CS- 56 (Filler)	3.4	3.5	4.5	3.5	4.7	3.8	30.5	32.8	37.1	29.2	40.6	32.4	501
4	MCNL-21-24	CS- 56 (LR)	3.8	3.3	3.7	3.8	5.4	4.1	31.5	31.4	37.7	27.3	40.8	32.0	457
5	MCNL-21-25	Kranti (NC)	3.7	2.7	3.3	3.4	4.1	2.1	34.5	32.8	35.0	30.6	42.5	33.2	470

Table 2.3.22a. Performance of Indian mustard hybrids in IHT, Zone-II

S.No.	Code	Strain	Seed Yield (kg/ha)							Plant Stand						Days to Maturity						
			HSR	LDH	NDH	PAL	MDG	ALW\$	Mean	HSR	LDH	NDH	PAL	MDG	ALW	HSR	LDH	NDH	PAL	MDG	ALW	
			1	2	3	4	5	6	(1-5)	1	2	3	4	5	6	1	2	3	4	5	6	
1	MH 21-01	KGMH 9198	3034	2539	3177	2891	2809	1704	2890		119	131	124	131	130	155	130	142	143	134	134	136
2	MH 21-02	DRMRHJ 2518	3255	2193	2851	2833	3211	1630	2869		120	134	138	131	132	172	133	144	143	133	138	137
3	MH 21-03	Kranti (NC)	2640	2195	2598	2425	2683	1815	2508		118	136	138	131	131	165	135	145	144	135	134	139
4	MH 21-04	Pusa MH 65	2987	2327	2730	2416	2701	1593	2632		117	132	145	129	130	173	141	145	144	133	140	138
5	MH 21-05	45 S 46 (Hy Check)	3054	2519	2556	2519	2983	1259	2726		118	138	141	131	128	146	130	136	132	129	130	128
6	MH 21-06	DRMRHJ 3720	2541	2530	2581	2816	3359	1704	2766		122	137	141	126	132	173	142	145	145	134	140	140
7	MH 21-07	RH 2103	3085	2428	2310	2586	3432	1778	2768		114	136	151	132	128	162	141	143	144	132	140	133
8	MH 21-08	RMX 9922	3195	2765	2961	2636	3214	1741	2954		118	128	146	132	130	173	141	140	142	131	141	136
9	MH 21-09	PHR 5175	2187	2584	2857	2647	2990	2111	2653		119	132	144	130	128	173	144	145	143	134	143	138
10	MH 21-10	KMH 8765	3128	1989	3210	2829	3109	2148	2853		115	129	138	132	129	172	131	136	137	129	132	134
11	MH 21-11	NAMJH 21-01	3065	2610	2891	2914	3030	2074	2902	***	118	131	137	131	131	169	133	136	143	132	138	135
12	MH 21-12	DMH- 1 (Hy Check)	3184	1550	2647	2545	2626	1481	2510		115	131	151	132	128	179	142	150	142	131	141	134
13	MH 21-13	DRMRHJ 3130	3522	2221	2360	2650	2997	1704	2750		121	132	151	131	131	178	142	145	147	134	140	139
14	MH 21-14	PHR 4457	2707	2571	2713	2373	3160	1630	2705		118	136	136	131	130	159	133	142	145	135	134	134
15	MH 21-15	IJ16R1168	2924	2470	3320	2665	2814	1852	2839		119	131	115	130	128	153	130	139	140	129	132	132
16	MH 21-16	RH 749 (ZC)	2801	2035	2710	2468	3012	2481	2605		119	132	143	132	131	191	141	135	147	136	142	137
17	MH 21-17	18J408C	2900	2874	3466	2664	2663	2519	2913	**	116	131	145	130	129	185	130	136	137	130	132	130
18	MH 21-18	SVJH- 71	3538	2229	3134	2011	3731	1815	2929		120	130	144	131	131	168	133	140	140	131	135	134
19	MH 21-19	DRMRHJ 3717	3357	2296	2428	2464	2929	1815	2695		118	135	155	132	127	180	141	154	145	135	139	138
20	MH 21-20	SVJH- 70	3459	2338	2820	2742	3669	1815	3006	*	117	129	151	132	130	151	133	136	140	131	135	135
21	MH 21-21	Pusa MH 62	2616	2272	2776	2667	2481	1481	2562		118	134	160	131	133	177	140	140	143	135	140	136
22	MH 21-22	PMH 90V02	2825	2303	3084	2441	2604	1630	2652		112	136	147	131	128	172	140	140	145	134	139	134
23	MH 21-23	NMH 90M01	2884	2362	2824	2390	2565	1704	2605		119	132	148	131	130	180	141	140	143	135	143	137
24	MH 21-24	PHR 3281	2667	2435	2714	2515	2482	2407	2563		118	136	148	130	131	181	143	150	149	138	140	140
25	MH 21-25	RHH 2101	3613	2211	2724	2256	3756	2556	2912		113	134	149	131	127	173	133	143	142	133	136	134
26	MH 21-26	RHH 2102	3022	2344	2496	2808	2740	1852	2682		116	136	153	131	130	177	143	150	144	134	143	139
		GM	3007	2354	2805	2584	2990	1858	2748													
		CD (5%)	528	368	481	611	494	533														
		CV (%)	10.7	9.5	10.42	14.8	10.1	17.9														
		DOS	11.10.2021	21.10.2021	12.10.2021	26.10.2021	20.10.2021	15.10.2021														

\$ data of ALW (Corteva) centre excluded from computation of mean due to high CV

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

*** strain outyielding the best check for seed yield and possessing resistance against white rust

** strain outyielding the best check by a margin of 10 percent for oil yield

Table 2.3.22b. Performance of Indian mustard hybrids in IHT, Zone-II

S.No.	Code	Strain	1000-Seed Wt.(g)						Oil Content (%) Zone II						Oil Yield (kg/ha)
			HSR	LDH	NDH	PAL	MDG	ALW	HSR	LDH	NDH	MDG	ALW\$	Mean	
			1	2	3	4	5	6	1	2	3	5	6	(1-5)	
1	MH 21-01	KGMH 9198	6.1	5.7	6.2	5.2	6.1	5.1	42.5	40.3	42.0	37.3	37.1	40.5	1172
2	MH 21-02	DRMRHJ 2518	4.9	4.1	4.3	4.2	4.9	3.9	38.9	37.6	39.2	37.0	38.3	38.2	1095
3	MH 21-03	Kranti (NC)	4.5	4.1	4.1	3.8	4.4	4.2	36.2	37.0	37.4	36.0	37.1	36.7	920
4	MH 21-04	Pusa MH 65	5.2	4.9	4.7	4.3	4.8	4.7	37.0	37.7	37.8	34.0	35.8	36.6	964
5	MH 21-05	45 S 46 (Hy Check)	4.2	4.0	3.3	3.6	4.7	3.8	42.3	39.9	41.0	34.2	36.8	39.4	1073
6	MH 21-06	DRMRHJ 3720	5.0	4.5	4.6	4.4	5.1	4.0	38.8	35.9	37.6	37.8	31.1	37.5	1038
7	MH 21-07	RH 2103	4.9	4.6	3.8	4.0	5.6	3.7	38.0	34.4	35.0	29.7	35.6	34.3	949
8	MH 21-08	RMX 9922	5.3	5.0	5.0	5.0	5.7	4.1	40.3	40.0	40.7	34.9	39.6	39.0	1152
9	MH 21-09	PHR 5175	4.3	4.8	4.0	3.8	4.9	3.7	36.4	35.7	34.3	33.7	29.5	35.0	929
10	MH 21-10	KMH 8765	6.1	5.1	5.3	5.2	5.7	4.8	41.0	41.0	38.9	35.2	37.8	39.0	1113
11	MH 21-11	NAMJH 21-01	5.1	4.7	4.9	4.6	5.6	4.5	39.1	38.6	34.6	35.9	36.0	37.1	1075
12	MH 21-12	DMH- 1 (Hy Check)	3.8	4.0	3.9	3.6	4.6	3.3	37.9	37.4	36.5	35.7	34.6	36.9	925
13	MH 21-13	DRMRHJ 3130	4.8	4.2	3.7	3.6	5.1	4.0	41.5	40.1	39.5	36.3	36.9	39.3	1082
14	MH 21-14	PHR 4457	4.8	4.1	4.4	3.6	5.0	3.7	37.4	37.1	35.1	34.1	37.2	35.9	971
15	MH 21-15	IJ16R1168	5.5	4.8	5.6	4.9	5.2	4.7	42.8	39.0	40.6	39.6	34.6	40.5	1150
16	MH 21-16	RH 749 (ZC)	6.5	5.6	6.2	6.4	6.1	5.8	39.6	37.0	38.8	33.8	37.1	37.3	972
17	MH 21-17	18J408C	5.4	4.6	5.4	4.7	5.7	4.7	42.8	42.1	43.8	39.5	43.2	42.1	1225
18	MH 21-18	SVJH- 71	5.5	4.5	5.2	5.0	6.2	4.5	42.5	38.8	40.2	35.7	40.1	39.3	1151
19	MH 21-19	DRMRHJ 3717	5.2	4.5	4.5	4.5	4.1	4.1	39.0	37.6	38.4	36.9	36.8	38.0	1023
20	MH 21-20	SVJH- 70	5.4	5.0	4.8	4.8	6.1	4.3	41.5	40.0	40.1	35.4	36.5	39.2	1179
21	MH 21-21	Pusa MH 62	6.3	5.2	5.8	4.6	5.6	4.8	39.7	38.8	38.1	33.2	32.5	37.5	960
22	MH 21-22	PMH 90V02	6.1	5.3	6.1	5.6	5.4	5.0	41.7	38.1	39.4	36.8	38.2	39.0	1034
23	MH 21-23	NMH 90M01	7.0	4.8	5.9	5.9	5.9	5.1	41.8	40.6	41.4	36.3	37.8	40.0	1043
24	MH 21-24	PHR 3281	4.5	5.0	4.4	3.7	4.9	3.7	38.7	36.4	37.7	36.6	38.1	37.4	957
25	MH 21-25	RHH 2101	5.9	4.8	4.9	4.5	5.8	4.1	40.6	39.1	39.4	39.4	41.2	39.6	1154
26	MH 21-26	RHH 2102	4.6	4.9	3.5	3.7	5.3	3.5	39.0	35.7	36.2	32.7	34.7	35.9	963

Table 2.3.23a. Performance of Indian mustard hybrids in IHT, Zone-III

S.No	Code	Strain	Seed Yield (kg/ha)										Plant Stand										
			KPR\$	PNT	MOR	KOT	BPR	VAR	DOL\$	JHS	FZB	Mean	KPR	PNT	MOR	KOT	BPR	VAR	DOL	JHS	FZB		
			1	2	3	4	5	6	7	8	9	(2-6,8-9)	1	2	3	4	5	6	7	8	9		
1	MH 21-01	KGMH 9198	2495	1969	2302	2,899	2754	3279	1147	2318	2209	2533		120	135	80	103	117	148	118	153	129	
2	MH 21-02	DRMRHJ 2518	2263	1332	2653	2,925	2909	3277	999	2333	2908	2619		122	149	79	110	17	155	115	144	157	
3	MH 21-03	Kranti (NC)	2649	1719	2360	2,205	2067	3150	1219	2212	3103	2402		121	144	79	101	118	151	117	126	139	
4	MH 21-04	Pusa MH 65	2392	1212	1781	2,689	1858	2586	1180	2231	2805	2166		116	127	80	101	14	148	118	144	144	
5	MH 21-05	45 S 46 (Hy Check)	2186	1419	1547	2,501	2228	2526	860	2369	2419	2144		120	123	76	105	128	148	117	134	135	
6	MH 21-06	DRMRHJ 3720	2726	1575	2616	3,112	2324	3362	1374	2345	3162	2642		123	145	79	105	122	151	121	134	154	
7	MH 21-07	RH 2103	2366	1292	2425	2,946	2368	3759	1542	2154	3203	2592		119	128	74	106	131	150	117	140	139	
8	MH 21-08	RMX 9922	2443	1556	2430	2,998	2291	3356	1546	1969	2939	2506		122	121	76	99	118	140	118	131	129	
9	MH 21-09	PHR 5175	2341	1664	2465	2,740	2291	3441	1458	1949	3247	2542		116	148	79	103	141	144	117	141	135	
10	MH 21-10	KMH 8765	2392	1853	2729	3,163	2953	3463	1269	2433	2999	2799	**	124	113	77	103	121	147	117	145	136	
11	MH 21-11	NAMJH 21-01	2418	2520	2369	3,045	2559	3336	1373	2325	3280	2776	***	121	132	78	104	116	155	117	137	132	
12	MH 21-12	DMH- 1 (Hy Check)	2186	1849	2455	2,908	2544	3105	1580	2275	2880	2574		119	170	79	107	126	141	116	141	139	
13	MH 21-13	DRMRHJ 3130	2418	1877	2558	2,519	2285	3527	1405	2008	2767	2506		122	128	79	104	142	143	117	140	142	
14	MH 21-14	PHR 4457	2418	1460	2209	3,023	1982	3134	941	2433	3118	2480		122	120	77	106	122	140	118	145	152	
15	MH 21-15	IJ16R1168	2366	2035	2165	2,984	2409	3115	1621	2441	3273	2632		117	157	79	102	123	146	116	137	137	
16	MH 21-16	RGN 73 (ZC)	2263	2481	2119	2,720	2188	3470	1099	1944	3072	2570		121	122	77	103	141	154	116	136	162	
17	MH 21-17	18J408C	2263	2510	3000	3,334	2967	3502	1383	2352	2701	2909	*	125	115	80	106	114	145	119	152	140	
18	MH 21-18	SVJH- 71	2443	1877	2214	3,020	2294	3497	1261	1966	2431	2471		118	130	80	106	131	141	119	141	132	
19	MH 21-19	DRMRHJ 3717	2315	1618	2159	2,735	1759	3726	1927	1978	2752	2390		121	147	79	106	131	144	116	149	137	
20	MH 21-20	SVJH- 70	2263	1985	2299	3,261	2264	2943	1016	2131	2231	2445		124	123	69	103	131	138	120	154	144	
21	MH 21-21	Pusa MH 62	2521	1154	1815	2,687	1933	2385	508	1995	2326	2042		118	132	77	106	126	143	118	134	143	
22	MH 21-22	PMH 90V02	2469	2384	1915	2,783	2614	3467	1429	2118	2417	2528		118	121	78	107	124	144	115	135	154	
23	MH 21-23	NMH 90M01	2469	1829	2082	3,062	2725	3197	1048	2263	2496	2522		121	125	76	104	132	150	118	127	163	
24	MH 21-24	PHR 3281	2701	1949	2177	2,825	2282	3461	1165	2168	2779	2520		124	139	81	104	133	156	115	140	183	
25	MH 21-25	RHH 2101	2392	1760	2199	2,944	2635	2909	1091	2131	2920	2500		118	143	78	103	128	151	120	140	138	
26	MH 21-26	RHH 2102	2443	1355	2405	3,295	2371	3547	1180	1984	2665	2517		120	126	81	108	127	155	117	142	151	
		GM	2408	1778	2286	2,897	2379	3251	1255	2186	2812	2513											
		CD (5%)	332	359	322	342	476	463	241	353	637												
		CV (%)	8.6	12.3	8.6	7.2	12.2	10.1	11.7	10.1	14.2												
		DOS	03.11.2021	29.10.2021	29.10.2021	27.10.2021	11.10.2021	29.10.2021	03.12.2021	28.10.2021	26.10.2021												

\$ data of KPR and DOL centres excluded from computation of mean due to late sowing

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

** Strain outyielding the best check by a margin of 10 % for oil yield

*** Strain outyielding the best check by a margin of 10 % for oil yield and possessing resistance against white rust

Table 2.3.23b. Performance of Indian mustard hybrids in IHT, Zone-III

S. No	Code	Strain	Days to Maturity									1000-Seed Wt.(g)									
			KPR	PNT	MOR	KOT	BPR	VAR	DOL	JHS	FZB	KPR	PNT	MOR	KOT	BPR	VAR	DOL	JHS	FZB	KPR\$
			1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	1
1	MH 21-01	KGMH 9198	137	134	140	130	120	124	116	137.7	125	3.9	3.7	6.0	5.3	5.3	3.9	4.2	4.9	3.8	38.7
2	MH 21-02	DRMRHJ 2518	135	142	139	135	130	126	120	140	132	3.6	3.1	4.2	4.1	4.2	3.9	3.8	4.2	3.8	38.0
3	MH 21-03	Kranti (NC)	138	140	137	133	133	131	118	140	128	3.4	2.8	4.4	4.1	4.0	3.2	3.4	3.6	3.6	35.1
4	MH 21-04	Pusa MH 65	139	140	141	137	135	129	118	138.7	133	4.5	3.3	5.1	5.1	4.9	4.3	4.1	4.3	3.7	33.4
5	MH 21-05	45 S 46 (Hy Check)	138	130	127	125	118	123	113	128.7	124	4.1	2.3	3.9	4.1	3.6	3.5	3.2	3.5	3.4	37.0
6	MH 21-06	DRMRHJ 3720	135	140	139	136	135	134	119	133.7	133	3.6	3.1	4.5	4.0	4.6	4.1	5.4	4.0	3.7	34.2
7	MH 21-07	RH 2103	132	136	132	132	133	132	121	138.7	126	3.2	3.0	4.4	4.6	4.2	3.3	5.5	3.9	3.4	31.6
8	MH 21-08	RMX 9922	134	133	134	132	133	127	119	138	128	3.7	2.9	4.5	4.4	4.7	3.6	2.9	4.1	3.7	33.9
9	MH 21-09	PHR 5175	136	141	135	135	134	135	122	138.7	135	3.7	3.1	4.1	4.5	4.2	2.5	2.3	3.6	3.4	34.2
10	MH 21-10	KMH 8765	137	131	134	129	128	144	115	137.3	125	4.4	3.0	5.4	4.8	4.8	3.1	4.3	4.4	4.0	36.7
11	MH 21-11	NAMJH 21-01	133	139	134	130	130	128	122	138.7	135	5.1	3.5	4.7	4.9	4.3	3.6	4.2	3.7	3.7	35.4
12	MH 21-12	DMH- 1 (Hybrid	132	141	133	131	131	131	123	140	135	3.5	2.9	3.8	3.9	5.0	3.7	3.7	3.4	3.1	37.9
13	MH 21-13	DRMRHJ 3130	134	142	139	137	140	134	117	139.3	133	4.0	3.2	4.2	4.4	4.7	3.3	5.1	3.8	3.7	39.8
14	MH 21-14	PHR 4457	136	140	133	137	125	131	122	138	135	4.1	3.2	4.2	4.3	4.1	2.6	3.0	3.7	3.4	35.2
15	MH 21-15	IJ16R1168	139	143	132	132	123	125	118	136.3	132	4.3	3.4	5.0	4.7	5.1	3.3	3.6	4.4	3.8	40.3
16	MH 21-16	RGN 73 (ZC)	137	134	134	138	141	135	123	137.7	134	3.9	3.7	4.7	4.5	4.6	3.2	3.8	3.8	3.6	38.8
17	MH 21-17	18J408C	138	133	130	126	120	124	118	139.7	134	4.2	3.6	5.1	4.1	4.9	3.5	7.4	4.7	3.9	40.7
18	MH 21-18	SVJH- 71	136	134	133	126	127	126	122	138.7	135	4.2	2.9	4.8	4.8	4.6	3.2	3.5	4.4	3.6	38.3
19	MH 21-19	DRMRHJ 3717	137	142	134	137	137	134	122	137.7	131	3.7	3.5	4.4	4.2	4.7	2.7	6.3	4.1	3.3	36.4
20	MH 21-20	SVJH- 70	136	135	133	130	135	135	119	139.7	126	4.3	3.4	5.2	4.8	4.7	2.4	3.3	4.4	3.5	36.2
21	MH 21-21	Pusa MH 62	134	140	136	139	137	135	116	138	127	3.9	3.9	5.9	5.2	5.6	3.4	3.1	4.9	3.5	37.1
22	MH 21-22	PMH 90V02	138	140	141	135	137	135	122	139	125	4.6	4.1	6.9	4.9	5.9	5.0	4.4	4.4	3.9	35.9
23	MH 21-23	NMH 90M01	135	139.33	140	132	136	135.33	116	140.3	124	5.0	4.1	7.1	5.7	6.0	3.1	4.3	4.4	4.0	34.4
24	MH 21-24	PHR 3281	134	142.33	140	138	141	135	119	140	136	3.4	3.0	4.8	4.3	4.0	3.4	4.1	3.5	3.4	35.9
25	MH 21-25	RRHH 2101	133	137.67	134	135	137	136	115	139.3	130	4.1	3.1	5.4	4.1	4.9	3.5	3.3	3.9	3.8	37.2
26	MH 21-26	RRHH 2102	132	138.33	136	136	138	135	117	139.3	127	3.5	2.8	4.9	4.1	4.0	2.7	3.9	3.4	3.4	35.2

Table 2.3.23c. Performance of Indian mustard hybrids in IHT, Zone-III

S.No.	Code	Strain	Oil Content (%)								Oil Yield (kg/ha)
			PNT	MOR	KOT	BPR	VAR	DOL\$	FZB	Mean	
			2	3	4	5	6	7	9	(2-6,9)	
1	MH 21-01	KGMH 9198	38.7	40.8	40.3	44.9	43.7	34.9	34.2	40.4	1024
2	MH 21-02	DRMRHJ 2518	39.0	39.9	38.2	42.9	43.5	36.7	37.5	40.2	1052
3	MH 21-03	Kranti (NC)	37.9	39.5	39.7	40.6	40.7	35.2	36.5	39.1	940
4	MH 21-04	Pusa MH 65	37.8	37.4	39.9	41.9	37.9	33.6	36.2	38.5	835
5	MH 21-05	45 S 46 (Hy Check)	37.1	41.7	40.7	42.6	39.2	36.8	38.2	39.9	855
6	MH 21-06	DRMRHJ 3720	35.9	39.6	39.9	40.4	37.3	33.2	36.5	38.3	1011
7	MH 21-07	RH 2103	30.5	38.9	35.7	40.2	37.9	31.1	37.3	36.7	952
8	MH 21-08	RMX 9922	36.4	41.4	38.9	44.2	40.7	35.5	36.2	39.6	993
9	MH 21-09	PHR 5175	33.8	36.9	39.2	38.7	38.0	37.0	36.2	37.1	943
10	MH 21-10	KMH 8765	34.8	40.6	39.4	44.7	40.0	32.8	35.8	39.2	1098
11	MH 21-11	NAMJH 21-01	37.5	39.2	39.7	41.7	40.0	34.4	38.9	39.5	1097
12	MH 21-12	DMH- 1 (Hybrid Check)	36.6	38.4	40.4	40.3	39.8	34.9	36.6	38.7	996
13	MH 21-13	DRMRHJ 3130	39.3	40.8	42.2	42.5	39.1	36.2	40.9	40.8	1023
14	MH 21-14	PHR 4457	35.0	37.6	41.0	40.0	35.8	33.4	35.2	37.4	928
15	MH 21-15	IJ16R1168	38.8	41.4	40.8	43.5	42.7	37.2	38.9	41.0	1080
16	MH 21-16	RGN 73 (ZC)	41.0	39.9	40.0	39.8	41.4	35.1	33.8	39.3	1011
17	MH 21-17	18J408C	42.1	42.2	42.4	43.1	44.4	38.3	39.6	42.3	1230
18	MH 21-18	SVJH- 71	37.6	41.0	41.3	43.4	43.0	33.6	35.0	40.2	993
19	MH 21-19	DRMRHJ 3717	37.7	40.4	39.7	40.1	41.8	34.2	35.4	39.2	936
20	MH 21-20	SVJH- 70	37.7	40.0	40.1	42.4	39.8	33.8	38.5	39.8	972
21	MH 21-21	Pusa MH 62	36.5	37.4	38.1	42.0	38.3	36.5	34.8	37.9	773
22	MH 21-22	PMH 90V02	36.6	39.2	40.7	41.8	44.1	34.8	38.2	40.1	1013
23	MH 21-23	NMH 90M01	37.9	39.6	41.5	44.2	42.5	31.7	41.1	41.1	1037
24	MH 21-24	PHR 3281	37.4	41.1	41.1	40.4	43.2	32.3	35.6	39.8	1003
25	MH 21-25	RRHH 2101	39.5	41.9	38.0	43.5	38.7	35.8	38.9	40.1	1002
26	MH 21-26	RRHH 2102	35.0	37.8	38.3	40.3	41.6	32.9	37.3	38.4	966

Table 2.3.24a. Performance of Indian mustard hybrids in IHT, Zone-IV

S. No.	Code	Strain	Seed Yield (kg/ha)						Plant Stand				Days to maturity					
			SKN	NGP	MDR	PLI\$	JAL	Mean	SKN	NGP	MDR	PLI	SKN	NGP	MDR	PLI	JAL	
			1	2	3	4	5	(1-3,5)	1	2	2	4	1	2	2	4	5	
1	MH 21-01	KGMH 9198	3237	2104	3684	1621	960	2496		132	106	116	80	114	111	120	120	87
2	MH 21-02	DRMRHJ 2518	2689	1981	4025	1738	861	2389		120	112	118	84	117	114	128	117	92
3	MH 21-03	Kranti (NC)	2408	2131	3343	2094	675	2139		116	111	116	90	117	117	123	120	90
4	MH 21-04	Pusa MH 65	2209	1533	3857	1666	620	2055		114	108	116	85	118	112	129	123	95
5	MH 21-05	45 S 46 (Hy Check)	1953	1694	2988	1885	905	1885		113	110	117	86	111	109	117	127	84
6	MH 21-06	DRMRHJ 3720	2593	2049	3516	1629	658	2204		118	112	116	89	116	116	123	124	93
7	MH 21-07	RH 2103	2553	1764	3872	1736	1070	2315		113	114	118	83	115	117	126	120	91
8	MH 21-08	RMX 9922	2335	1735	3911	1499	1037	2254		123	110	114	80	116	115	122	123	89
9	MH 21-09	PHR 5175	2838	2009	3889	1662	1147	2471		123	118	116	85	114	118	127	116	92
10	MH 21-10	KMH 8765	2552	2093	3496	1590	938	2270		106	121	114	80	112	112	123	117	90
11	MH 21-11	NAMJH 21-01	2730	2133	3620	1495	1410	2473	***	114	114	115	87	117	117	120	120	89
12	MH 21-12	DMH- 1 (Hy Check)	2872	1877	3773	1593	911	2358		125	119	114	88	116	114	122	125	88
13	MH 21-13	DRMRHJ 3130	3326	1518	3719	1333	801	2341		131	113	118	82	119	111	122	117	92
14	MH 21-14	PHR 4457	2984	1600	3235	1321	807	2157		119	116	118	80	118	111	123	120	88
15	MH 21-15	IJ16R1168	2994	1972	4247	1599	801	2504	**	122	109	115	87	112	110	115	123	86
16	MH 21-16	GDM 4 (ZC)	3093	1870	3467	1720	818	2312		121	113	116	90	115	118	123	120	92
17	MH 21-17	18J408C	2568	1847	3847	1696	1081	2336		112	116	117	88	112	109	124	121	84
18	MH 21-18	SVJH- 71	2724	1584	4252	1662	1092	2413		125	117	115	87	114	108	123	121	85
19	MH 21-19	DRMRHJ 3717	2650	1628	3723	1562	861	2216		133	112	117	85	118	116	123	117	91
20	MH 21-20	SVJH- 70	2412	1532	3556	1857	1081	2145		131	112	115	89	117	113	117	123	87
21	MH 21-21	Pusa MH 62	2407	1734	3375	1293	1202	2179		132	121	116	80	118	114	126	120	93
22	MH 21-22	PMH 90V02	2853	1575	3111	1826	889	2107		118	118	113	90	115	114	125	124	90
23	MH 21-23	NMH 90M01	2704	1552	2928	1946	625	1952		111	108	117	89	116	112	126	116	88
24	MH 21-24	PHR 3281	2860	1814	4133	1666	878	2421		119	116	119	88	118	119	117	120	92
25	MH 21-25	RRHH 2101	2324	1707	3319	1600	1064	2103		118	122	118	85	115	116	119	123	93
26	MH 21-26	RRHH 2102	3179	1585	3872	1479	1081	2429		121	112	120	86	117	114	120	124	93
		GM	2694	1793	3645	1645	934	2266										
		CD (5%)	447	293	492	440	160											
		CV (%)	10.1	10.0	8.2	16.3	10.4											
		DOS	12.10.2021	30.10.2021	22.10.2021	30.10.2021	30.10.2021											

\$ data of PLI centre excluded from computation of mean due to high CV

*** strain outyielding the best check for seed yield and possessing resistance against white rust

** strain outyielding the best check by a margin of > 10 % for oil yield

Table 2.3.24b. Performance of Indian mustard hybrids in IHT, Zone-IV

S. No.	Code	Strain	1000-Seed Wt.(g)					Oil Content (%)			Oil Yield (kg/ha)
			SKN	NGP	MDR	PLI	JAL	SKN	NGP	Mean	
			1	2	2	4	5	1	2	(1-2)	
1	MH 21-01	KGMH 9198	6.0	5.7	6.4	4.3	3.9	40.6	34.9	37.7	942
2	MH 21-02	DRMRHJ 2518	4.8	5.1	4.5	4.4	4.9	40.7	35.6	38.1	911
3	MH 21-03	Kranti (NC)	4.6	5.8	4.0	4.8	3.8	38.6	35.1	36.8	788
4	MH 21-04	Pusa MH 65	5.8	4.2	5.5	4.6	3.6	39.6	33.2	36.4	748
5	MH 21-05	45 S 46 (Hy Check)	4.3	4.6	4.0	4.6	3.9	40.0	36.5	38.2	721
6	MH 21-06	DRMRHJ 3720	5.4	5.3	5.5	5.1	4.1	38.9	34.3	36.6	807
7	MH 21-07	RH 2103	4.5	4.8	4.9	5.0	4.0	35.9	30.4	33.2	768
8	MH 21-08	RMX 9922	5.1	4.7	5.2	4.7	4.5	40.3	34.5	37.4	844
9	MH 21-09	PHR 5175	4.7	5.2	4.1	5.0	4.7	36.8	30.5	33.6	831
10	MH 21-10	KMH 8765	5.9	5.6	5.5	4.7	4.0	37.4	33.2	35.3	801
11	MH 21-11	NAMJH 21-01	5.3	5.8	5.0	4.3	4.4	37.9	36.0	37.0	914
12	MH 21-12	DMH- 1 (Hy	4.1	5.0	4.0	4.9	4.3	38.2	35.3	36.7	866
13	MH 21-13	DRMRHJ 3130	4.7	3.9	4.2	4.6	4.1	41.3	36.2	38.8	907
14	MH 21-14	PHR 4457	4.9	4.5	4.4	4.3	4.3	37.5	33.7	35.6	768
15	MH 21-15	IJ16R1168	5.7	5.0	5.8	4.9	4.1	41.3	35.9	38.6	965
16	MH 21-16	GDM 4 (ZC)	6.1	4.9	5.4	4.6	4.2	38.4	32.7	35.5	822
17	MH 21-17	18J408C	5.4	4.9	4.7	4.9	4.4	43.0	36.2	39.6	925
18	MH 21-18	SVJH- 71	5.4	4.4	5.4	4.2	4.1	39.3	38.4	38.9	937
19	MH 21-19	DRMRHJ 3717	5.2	4.5	4.6	4.1	3.4	39.2	37.9	38.6	855
20	MH 21-20	SVJH- 70	5.4	4.0	5.5	4.8	4.4	38.1	34.5	36.3	778
21	MH 21-21	Pusa MH 62	6.1	4.7	5.7	4.3	4.1	38.7	32.9	35.8	780
22	MH 21-22	PMH 90V02	6.1	4.3	5.6	4.7	4.2	38.9	33.1	36.0	758
23	MH 21-23	NMH 90M01	6.3	4.2	6.4	4.5	4.2	40.0	31.8	35.9	700
24	MH 21-24	PHR 3281	4.5	4.8	4.4	4.2	4.0	39.1	33.3	36.2	877
25	MH 21-25	RRHH 2101	5.3	4.6	5.3	5.0	3.9	40.1	36.9	38.5	810
26	MH 21-26	RRHH 2102	4.4	4.5	4.1	4.4	3.9	37.2	30.6	33.9	824

Table 2.3.24c. Percent sterile plants in different entries of IHT

S. No	Code	Strain	Zone II						Zone III						Zone IV		Mean (1-4,7, 9 -11,14)
			HSR	LDH	NDH	MDG	ALW#	PAL #	BPR	DOL\$	VAR	JHS	PNT	MOR\$	SKN#	NGP	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	
1	MH 21-01	KGMH 9198	18	41	40	10	52	33	5	0	0	10	14	0	35	20	18
2	MH 21-02	DRMRHJ 2518	17	43	24	4	7	38	20	0	0	0	0	0	18	0	12
3	MH 21-03	Kranti (NC)	0	0	0	0	4	23	0	0	0	0	0	0	32	0	0
4	MH 21-04	Pusa MH 65	5	30	10	4	4	63	2	0	18	7	7	0	12	16	11
5	MH 21-05	45 S 46 (Hy Check)	8	32	14	6	8	47	5	0	0	0	0	0	22	0	7
6	MH 21-06	DRMRHJ 3720	10	37	30	0	2	42	5	0	5	7	0	0	43	0	10
7	MH 21-07	RH 2103	22	50	89	19	181	45	80	0	32	22	54	0	33	56	47
8	MH 21-08	RMX 9922	20	30	37	12	60	53	40	0	17	27	18	0	70	22	25
9	MH 21-09	PHR 5175	31	33	40	10	52	35	20	0	9	15	25	0	13	35	24
10	MH 21-10	KMH 8765	4	4	10	0	4	13	0	0	0	0	0	0	32	0	2
11	MH 21-11	NAMJH 21-01	7	5	6	9	11	10	5	0	0	2	10	0	5	0	5
12	MH 21-12	DMH- 1 (Hy Check)	12	11	7	10	0	2	5	0	4	6	0	0	7	32	10
13	MH 21-13	DRMRHJ 3130	26	31	41	11	54	50	30	0	4	27	13	0	55	21	23
14	MH 21-14	PHR 4457	18	20	27	10	44	33	5	0	10	15	12	0	25	13	15
15	MH 21-15	IJ16R1168	0	0	1	0	3	18	0	0	0	0	0	0	35	0	0
16	MH 21-16	(ZC)	0	0	0	0	1	0	0	0	0	0	0	0	28	0	0
17	MH 21-17	18J408C	0	0	4	0	3	13	0	0	0	4	0	0	8	11	2
18	MH 21-18	SVJH- 71	14	14	24	9	38	47	30	0	4	8	11	0	7	10	14
19	MH 21-19	DRMRHJ 3717	28	43	54	11	8	70	40	0	23	19	10	0	18	8	26
20	MH 21-20	SVJH- 70	11	11	9	10	23	40	20	0	12	7	7	0	33	11	11
21	MH 21-21	Pusa MH 62	6	10	3	2	2	45	20	0	0	5	0	0	22	0	5
22	MH 21-22	PMH 90V02	14	33	31	10	56	28	20	0	17	14	15	0	12	12	19
23	MH 21-23	NMH 90M01	21	40	51	18	142	48	40	0	18	30	36	0	27	37	32
24	MH 21-24	PHR 3281	0	21	18	0	15	13	0	0	0	14	7	0	20	16	8
25	MH 21-25	RRHH 2101	4	5	3	4	3	18	0	0	3	0	0	0	13	0	2
26	MH 21-26	RRHH 2102	38	58	94	21	30	53	80	0	9	49	30	0	15	34	46

data of ALW,PAL,DOL. MOR and SK Nagar excluded from computation of mean due to erroneous reporting

Table 2.3.25a. Performance of Quality Indian mustard strains in IVT, Zone-II

S.No.	Code	Strain	Seed Yield (kg/ha)								Plant Stand					Days to Maturity					1000-Seed Wt. (g)				
			BAW	NDH	HSR	LDH	SGN	Mean	BAW		NDH	HSR	LDH	SGN	BAW	NDH	HSR	LDH	SGN	BAW	NDH	HSR	LDH	SGN	
			1	2	3	4	5	(1-5)	1		2	3	4	5	1	2	3	4	5	1	2	3	4	5	
1	QM-21-1	DRMRCI (Q) 47	2600	3059	2687	2082	2001	2486	***	120	140	116	133	100	139	135	143	143	153	4.4	3.7	4.8	4.5	3.6	
2	QM-21-2	PM- 30 (NC)	2128	1859	2297	2288	1795	2073		114	124	117	128	99	139	136	142	148	151	6.0	5.2	6.6	6.0	6.3	
3	QM-21-3	PM- 30 (Filler)	2167	1715	2360	2333	1975	2110		120	123	111	135	101	140	137	143	148	150	5.9	5.1	6.5	5.9	6.2	
4	QM-21-4	IJ19R5004	2384	2359	2644	2071	3172	2526	***	119	143	113	129	110	138	135	139	142	144	3.8	3.2	4.1	4.5	4.1	
5	QM-21-5	LES- 65	2443	2456	2407	2185	2752	2449		124	136	118	128	106	140	134	138	143	149	3.7	3.3	4.1	4.0	5.0	
6	QM-21-6	DRMRQ 143-9	2108	2219	2648	2259	2665	2380		119	140	117	131	107	140	137	132	142	145	4.9	3.5	4.8	4.6	4.6	
7	QM-21-7	LES- 64	2344	2278	2868	2337	2698	2505		117	124	116	129	104	140	137	138	147	153	4.8	4.0	5.6	5.4	4.8	
8	QM-21-8	RH 749 (ZC)	2526	2007	2541	2243	1747	2213		118	140	116	135	100	137	138	142	140	151	5.1	5.2	6.6	6.0	5.6	
9	QM-21-9	DRMRCI (Q) 57	1753	2044	2195	2078	1953	2005		119	137	114	128	98	139	144	142	152	152	4.1	3.1	4.1	4.6	3.4	
10	QM-21-10	PDZ- 17#	1970	2193	2277	2111	1810	2072		124	133	112	134	100	139	140	139	140	154	3.4	2.9	3.9	4.2	4.7	
11	QM-21-11	PDZ- 16#	2403	2000	2868	2268	1952	2298		122	144	118	126	97	137	138	138	140	150	3.8	3.0	3.8	4.1	3.9	
12	QM-21-12	RH (OE)- 1808	2699	1944	3038	2329	2264	2455		122	137	115	135	104	137	135	138	139	153	4.8	3.1	5.2	5.1	4.0	
13	QM-21-13	JC- 16	1773	1885	3034	2000	2623	2263		121	130	119	133	100	138	140	138	143	151	3.7	2.7	4.0	4.5	3.2	
14	QM-21-14	RH (OE)- 1612	2321	1944	3050	2255	2812	2476		121	134	116	133	110	139	140	139	147	149	4.1	3.1	4.4	5.0	3.9	
15	QM-21-15	JC- 1	2884	1622	2108	2399	2148	2232		118	111	117	133	104	139	140	137	147	150	3.6	2.6	3.8	4.5	3.6	
16	QM-21-16	PM- 32 (LR)	2285	2233	2746	1679	2361	2261		119	141	112	127	105	139	143	141	150	156	4.7	3.7	4.8	4.7	4.9	
17	QM-21-17	DRMR (Q) 4-3	2128	2019	2470	2169	1825	2122		117	137	117	126	99	142	144	140	151	150	4.8	3.1	4.3	4.5	4.4	
18	QM-21-18	PDZ- 1 (QC)	2640	2315	2727	2057	2106	2369		118	113	115	131	103	138	136	140	147	151	3.2	2.7	3.4	4.8	4.6	
		GM	2309	2120	2605	2174	2259	2293																	
		CD (5%)	347	407.15	511	290	362																		
		CV (%)	9.0	11.5	11.8	8.0	9.7																		
		DOS	19.10.2021	30.10.2021	12.10.2021	21.10.2021	22.10.2021																		

Strain inducted with double low characteristics

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

Table 2.3.25b. Performance of Quality Indian mustard strains in IVT, Zone-II

S.No.	Code	Strain	1000-Seed Wt. (g)					Oil Content (%) Zone II					Oil Yield (kg/ha)
			BAW	NDH	HSR	LDH	SGN	BAW	NDH	HSR	LDH	Mean	
			1	2	3	4	5	1	2	3	4	(1-4)	
1	QM-21-1	DRMRCI (Q) 47	4.4	3.7	4.8	4.5	3.6	36.4	39.6	40.8	41.3	39.5	983
2	QM-21-2	PM- 30 (NC)	6.0	5.2	6.6	6.0	6.3	33.7	32.9	33.2	36.1	34.0	705
3	QM-21-3	PM- 30 (Filler)	5.9	5.1	6.5	5.9	6.2	34.2	33.1	35.9	35.2	34.6	730
4	QM-21-4	IJ19R5004	3.8	3.2	4.1	4.5	4.1	42.5	41.8	42.9	40.0	41.8	1055
5	QM-21-5	LES- 65	3.7	3.3	4.1	4.0	5.0	34.8	33.5	38.5	36.6	35.8	877
6	QM-21-6	DRMRQ 143-9	4.9	3.5	4.8	4.6	4.6	39.6	40.1	43.3	40.1	40.8	970
7	QM-21-7	LES- 64	4.8	4.0	5.6	5.4	4.8	33.0	32.2	36.6	34.8	34.2	856
8	QM-21-8	RH 749 (ZC)	5.1	5.2	6.6	6.0	5.6	38.0	38.4	38.7	38.5	38.4	850
9	QM-21-9	DRMRCI (Q) 57	4.1	3.1	4.1	4.6	3.4	40.2	37.9	38.4	42.4	39.7	796
10	QM-21-10	PDZ- 17	3.4	2.9	3.9	4.2	4.7	40.2	39.1	41.8	43.1	41.0	851
11	QM-21-11	PDZ- 16	3.8	3.0	3.8	4.1	3.9	38.8	37.1	40.2	36.9	38.2	879
12	QM-21-12	RH (OE)- 1808	4.8	3.1	5.2	5.1	4.0	34.2	32.4	37.6	36.3	35.1	863
13	QM-21-13	JC- 16	3.7	2.7	4.0	4.5	3.2	40.5	37.5	42.0	37.8	39.4	893
14	QM-21-14	RH (OE)- 1612	4.1	3.1	4.4	5.0	3.9	36.9	35.8	39.6	36.4	37.2	921
15	QM-21-15	JC- 1	3.6	2.6	3.8	4.5	3.6	37.9	35.9	39.8	34.0	36.9	824
16	QM-21-16	PM- 32 (LR)	4.7	3.7	4.8	4.7	4.9	35.2	32.7	36.5	37.2	35.4	799
17	QM-21-17	DRMR (Q) 4-3	4.8	3.1	4.3	4.5	4.4	37.5	37.8	39.7	39.2	38.6	818
18	QM-21-18	PDZ- 1 (QC)	3.2	2.7	3.4	4.8	4.6	42.4	40.4	42.5	39.9	41.3	978

Table 2.3.26a. Performance of Quality Indian mustard strains in IVT, Zone-III

S.No	Code	Strain	Seed Yield (kg/ha)								Plant Stand							Days to Maturity							
			PNT\$\$	KPR\$	MOR	BPR	DOL\$	JHS	VAR	Mean	PNT	KPR	MOR	BPR	DOL	JHS	VAR	PNT	KPR	MOR	BPR	DOL	JHS	VAR	
			1	2	3	4	5	6	7	(1,3-4,6-7)	1	2	3	4	5	6	7	1	2	3	4	5	6	7	
1	QM-21-1	DRMRCI (Q) 47	1719	1800	3047	2104	1049	2271	1289	2178		178	121	179	137	163	148	165	135	136	135	137	109	133	126
2	QM-21-2	PM- 30 (NC)	1363	1903	2542	2357	1049	2438	1918	2314		163	124	177	143	161	151	160	139	138	137	139	106	135	129
3	QM-21-3	PM- 30 (Filler)	1631	1775	2659	2240	1111	2256	2031	2297		140	122	178	131	171	150	148	138	135	137	141	106	133	129
4	QM-21-4	IJ19R5004	1480	2135	3612	2234	1080	2490	1696	2508	***	128	120	177	136	164	132	144	135	134	131	132	109	134	129
5	QM-21-5	LES- 65	1756	1749	3600	2163	1173	2416	1404	2396		141	122	178	133	164	129	157	134	136	132	134	108	136	129
6	QM-21-6	DRMRQ 143-9	1704	1723	2806	2620	1296	2586	1365	2344		158	116	175	136	164	150	163	132	138	143	125	107	132	128
7	QM-21-7	LES- 64	1852	1749	2806	2281	1204	2946	1734	2442		147	122	177	125	168	138	163	137	137	138	136	108	134	129
8	QM-21-8	RGN 73 (ZC)	1319	1775	2920	1897	1080	2537	2261	2404		166	118	179	135	166	157	172	141	135	140	141	109	138	132
9	QM-21-9	DRMRCI (Q) 57	1344	1698	2853	1738	926	2716	1697	2251		135	120	177	111	166	138	162	137	136	144	139	109	134	131
10	QM-21-10	PDZ- 17#	1019	1878	2709	2025	710	2351	1213	2075		151	117	178	121	163	139	162	136	136	136	136	108	133	130
11	QM-21-11	PDZ- 16#	1148	1775	2924	2329	1173	2654	1845	2438	**	153	125	177	128	159	146	165	132	139	136	136	107	133	129
12	QM-21-12	RH (OE)- 1808	1598	2083	3312	2269	1327	2752	1403	2434		118	123	175	127	164	157	159	130	132	138	134	107	130	126
13	QM-21-13	JC- 16	1186	1929	2991	2193	1204	2188	775	2037		148	116	175	122	165	147	163	135	135	138	135	106	130	128
14	QM-21-14	RH (OE)- 1612	1281	2238	2861	2128	1080	2433	1484	2226		140	122	177	133	163	145	147	137	130	138	139	108	134	130
15	QM-21-15	JC- 1	1209	1800	3618	2086	926	2187	1354	2311		105	119	180	129	163	157	163	138	133	139	138	106	133	128
16	QM-21-16	PM- 30 (LR)	1698	1852	2713	2145	1080	2574	2054	2372		150	123	174	118	163	140	150	139	137	141	140	107	134	130
17	QM-21-17	DRMR (Q) 4-3	1093	1775	3078	2063	1204	2258	1460	2215		160	118	177	128	164	145	172	133	135	142	138	109	140	131
18	QM-21-18	PDZ- 1 (QC)	1169	1852	2777	1655	957	2430	1024	1972		115	121	179	112	163	154	158	137	134	139	141	105	132	127
		GM	1420	1860	2990	2140	1091	2471	1556	2290															
		CD (5%)	291	214	338	395	269	418	292																
		CV (%)	12.4	7.2	6.8	11.5	14.8	10.6	11.9																
		DOS	29.10.2021	03.11.2021	29.10.2021	12.10.2021	03.12.2021	27.10.2021	29.10.2021																

inducted as double low strains

\$ data of KPR and DOL centres excluded from computation of mean due to late sowing

\$\$ data of PNT centre excluded from computation of mean due to significant difference between same strain used as check

*** Strain outyielding/at par with best quality check and possessing white rust resistance

** double low starin outyielding the best double low quality check by a margin of > 10 % for seed yield and possessing white rust resistance

Table 2.3.26b. Performance of Quality Indian mustard strains in IVT, Zone-III

S.No.	Code	Strain	1000-Seed Wt. (g)							Oil Content (%)							Oil Yield (kg/ha)
			PNT	KPR\$	MOR	BPR	DOL\$	JHS	VAR	PNT	KPR	MOR	BPR	DOL	VAR	Mean	
			1	2	3	4	5	6	7	1	2	3	4	5	7	(3-4,6-7)	
1	QM-21-1	DRMRCI (Q) 47	3.4	3.8	4.5	4.1	4.6	4.5	4.5	40.9	42.8	40.5	42.4	42.5	36.3	39.7	864
2	QM-21-2	PM- 30 (NC)	4.1	4.8	6.7	5.8	6.0	5.8	4.6	35.9	37.9	34.6	38.0	40.3	36.3	36.3	840
3	QM-21-3	PM- 30 (Filler)	4.2	5.1	6.8	5.7	6.3	5.4	4.5	36.4	37.5	34.8	37.8	39.0	35.7	36.1	828
4	QM-21-4	IJ19R5004	3.1	3.2	4.0	3.9	3.6	3.6	3.9	36.1	43.1	42.6	43.7	45.4	41.5	42.6	1068
5	QM-21-5	LES- 65	3.1	3.5	4.4	4.1	4.7	4.1	4.6	39.9	42.8	36.3	39.1	37.7	35.3	36.9	883
6	QM-21-6	DRMRQ 143-9	3.4	3.7	4.8	4.9	6.5	5.5	5.3	42.1	42.9	40.9	45.1	43.0	31.7	39.2	919
7	QM-21-7	LES- 64	3.7	4.2	5.0	5.0	5.9	5.5	4.3	34.9	35.5	33.4	38.0	37.9	38.1	36.5	891
8	QM-21-8	RGN 73 (ZC)	3.7	4.3	4.4	4.3	5.0	4.7	4.7	37.6	41.0	36.9	38.3	42.7	38.5	37.9	911
9	QM-21-9	DRMRCI (Q) 57	3.1	3.2	4.1	4.2	4.7	4.8	4.6	42.4	42.3	40.5	42.2	42.5	36.8	39.8	896
10	QM-21-10	PDZ- 17#	2.8	3.1	3.9	3.4	3.7	3.7	4.3	42.9	42.8	40.8	44.2	43.4	39.3	41.4	859
11	QM-21-11	PDZ- 16#	2.6	3.8	3.7	3.5	3.4	3.4	4.5	41.8	42.0	39.4	41.0	38.9	31.9	37.4	912
12	QM-21-12	RH (OE)- 1808	3.2	3.5	5.2	4.4	4.6	5.9	4.6	37.6	35.8	34.5	38.2	38.3	37.4	36.7	894
13	QM-21-13	JC- 16	3.1	3.9	3.8	3.4	3.6	3.7	4.4	38.8	42.0	39.0	42.4	42.1	33.7	38.3	781
14	QM-21-14	RH (OE)- 1612	3.0	3.7	4.3	3.7	5.0	4.3	4.4	42.5	41.0	36.9	40.6	39.6	42.0	39.8	887
15	QM-21-15	JC- 1	2.6	3.8	3.8	3.3	4.8	4.0	4.6	38.8	39.1	38.0	41.8	40.9	42.6	40.8	943
16	QM-21-16	PM- 30 (LR)	4.4	5.3	6.8	5.9	4.7	6.1	4.6	36.5	36.7	34.1	39.1	44.0	38.3	37.1	881
17	QM-21-17	DRMR (Q) 4-3	2.8	3.6	4.2	3.7	3.6	4.7	4.6	37.9	41.4	37.5	43.2	40.3	36.1	38.9	862
18	QM-21-18	PDZ- 1 (QC)	2.7	3.5	3.3	4.2	3.5	3.3	4.7	43.1	42.4	43.0	43.3	41.8	33.3	39.9	786

Table 2.3.26c. Erucic acid Content (%) of entries being evaluated in IVT/AVT Quality trials

S. No.	Code	Genotypes	Erucic acid content (%)						Glucosinolate content (µmole/g)					
			BPR	HSR	LDH	PNT	NDH	Mean	BPR	HSR	LDH	PNT	NDH	Mean
1	QM-21-10	PDZ-17	0.17	0.37	0.06	1.78		0.6	15.54	18.78	26.71	14.95		19.0
2	QM-21-11	PDZ-16	0.83	0.52	0.26	1.61		0.8	13.29	14.43	20.97	15.04		15.9
3	QM-21-12	RH (OE)-1808	1.48	1.38	0.24	1.72		1.2	50.55	61.42	51.25	51.13		53.6
4	QM-21-14	RH (OE)-1612	6.12	10.77	5.57	12.65		8.8	62.91	58.86	45.64	38.94		51.6
5	QM-21-16	PM-32	0.14	0.26	0.17	0.74		0.3	68.08	47.89	54.34	44.19		53.6
6	QM-21-17	DRMRQ 4-3	10.67	11.16	11.36	13.61		11.7	37.18	45.73	48.35	33.37		41.2
7	QM-21-18	PDZM-31	1.23	0.52	0.89	1.14		0.9	28.02	22.72	26.68	23.64		25.3
8	QM-21-2	PM-30	2.07	1.96	1.38	2.69		2.0	73.19	43.75	66.04	50.88		58.5
9	QM-21-5	LES-65	0.51	0.25	0.26	0.82		0.5	34.86	48.17	64.69	36.54		46.1
10	QM-21-6	DRMRQ 143-9	46.48	48.72	44.75	44.78		46.2	51.92	55.31	38.42	35.09		45.2
11	QM-21-7	LES-64	0.72	0.84	0.84	1.26		0.9	52.99	87.05	93.23	49.33		70.7
12	MCN-21-42	PDZ-14	0.75	0.91	0.43	1.14		0.8	17.56	23.27	22.22	15.19		19.6
13	MCN-21-45	RH (OE)-1807	0.81	1.21	0.46	0.68		0.8	55.12	58.93	51.61	45.45		52.8
14	MCN-21-48	PM-29	0.85	0.16	0.59	0.82		0.6	52.27	58.75	70.06	47.01		57.0
15	MCN-21-50	RH (OE)-1706	0.68	1.97	0.56	1.12		1.1	57.98	42.15	56.48	37.47		48.5
16	MCN-21-51	PDZ-15	1.01	0.63	0.39	1.31		0.8	14.3	23.54	20.32	16.97		18.8
17	MCN-21-54	LES-60	1.2	0.16	0.23	1.89		0.9	59.88	73.18	69.06	45.94		62.0
18	MCN-21-55	JC- 36			1.9		0	1.0					36.7	36.7
19	MCN-21-60	OIJ5001					0	0.0					24.1	24.1
20	QM-21-1	DRMRCI (Q) 47			0		0	0.0					36.7	36.7
21	QM-21-4	IJ19R5004			1.58		1.9	1.7					21.9	21.9
22	QM-21-9	DRMRCI (Q) 57			0.3		0	0.2					34.9	34.9
23	QM-21-13	JC- 16			2		2.1	2.1					40.3	40.3
24	QM-21-15	JC- 1			1.9		7.8	4.9					40	40.0
25	MCN-21-42	PDZ- 14 (dl)			2.8		0	1.4					19.5	19.5
26	MCN-21-43	PDZ 1 (DLC)			0		0	0.0					24.9	24.9

Table2.3.27. Performance of Indian mustard strains in IVT under saline/alkaline conditions

S.No.	Code	Strain	Seed Yield (kg/ha)							Plant Stanc	Days to maturity			1000- Seed Wt. (g)			
			AGR	HSR	KAR	FTP	LKW	BKR	Mean		KAR	FTP	LKW	KAR	FTP	LKW	BKR
			1	2	3	4	5	6	(1-6)		3	4	5	3	4	5	6
1	CSCN-21-1	RH 1927	1822	1897	1585	1649	1220	1759	1655		158	130	129	5.7	4.3	4.3	6.2
2	CSCN-21-2	CS- 54 (Check)	2034	1679	1704	2042	1517	1882	1810		171	128	128	5.6	4.6	5.0	6.1
3	CSCN-21-3	Kranti (NC)	1874	1498	1459	1706	1111	1645	1549		167	127	127	3.7	4.3	3.5	6.2
4	CSCN-21-4	CS- 60 (LR)	2236	2119	1835	1657	1849	2245	1990		193	127	128	5.1	4.2	5.0	6.2
5	CSCN-21-5	NPJ 256	1798	1598	1317	1536	1285	1822	1559		130	124	129	4.6	4.2	4.0	6.4
6	CSCN-21-6	CS 2009-234	2136	2278	1691	2014	1572	2392	2014		180	129	128	5.8	4.5	4.7	6.1
7	CSCN-21-7	CS 2020-4	1748	1522	1627	1299	1307	2446	1658		161	123	128	4.9	4.0	4.0	6.3
8	CSCN-21-8	NPJ- 231	1793	1766	1570	1810	1378	1463	1630		143	125	128	4.7	4.2	4.3	6.3
9	CSCN-21-9	CS 2013-64	1748	1615	1704	1894	1298	2271	1755		181	128	129	5.2	4.4	4.3	6.8
10	CSCN-21-10	CS 2020-10	2437	2366	2079	2157	1770	2613	2237	*	165	127	129	5.1	4.5	4.8	5.9
11	CSCN-21-11	RH 1928	1855	1988	1509	1835	1310	2738	1872		164	126	128	4.8	4.1	3.9	6.8
		GM	1953	1848	1644	1782	1420	2116	1794								
		CD (5%)	337	294	371	350	247	382									
		C.V. (%)	11.1	9.3	13.2	11.6	10.2	10.6									
		ECe/ pH**	12 ds/m	10.3ds/m	9.3	9.4	9.2	13ds/m									
		DOS	30.10.2021	12.10.2021	20.10.2021	29.10.2021	30.10.2021	25.10.2021									

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

Table 2.3.28a. Performance of Mustard: White Rust Resistance IVT, Zone-II

S.No.	Code	Strain	Seed Yield (kg/ha)						Plant Stand					Days to Maturity					
			LDH	HSR	SGN	NDH	CHT	Mean	LDH	HSR	SGN	NDH	CHT	LDH	HSR	SGN	NDH	CHT	
			1	2	3	4	5	(1-5)	1	2	3	4	5	1	2	3	4	5	
1	WRR 21-1	DRMR 2018-25	2325	3191	2714	3145	2027	2680	*	136	113	103	154	125	145	141	154	149	142
2	WRR 21-2	Basanti	2189	2900	2277	2567	2064	2399		130	112	104	146	120	152	144	151	154	145
3	WRR 21-3	Giriraj (LR)	2288	2667	2452	2860	2072	2468		138	117	101	141	126	147	143	149	149	141
4	WRR 21-4	DRMRCI (W)- 125	1927	2175	2231	2158	1618	2022		129	114	102	150	134	145	143	153	147	138
5	WRR 21-5	RH 2070	2124	3274	2436	2593	1756	2437		133	115	105	155	128	140	134	150	141	143
6	WRR 21-6	DRMRIJ 20-157	1687	2790	2207	2501	1743	2186		133	117	102	159	132	140	144	151	146	136
7	WRR 21-7	RH 749 (ZC)	2218	2750	1557	2797	1924	2249		132	118	97	158	137	146	142	153	150	140
8	WRR 21-8	DRMR 2018-37	1782	2695	2788	2379	1620	2253		139	116	109	154	131	145	144	154	149	143
9	WRR 21-9	DRMRHJ- 317	2313	2096	2722	2210	1710	2210		131	116	107	157	129	152	141	151	149	141
10	WRR 21-10	RH 2007	2313	3010	2169	2534	2081	2421		123	114	102	150	134	153	143	152	150	149
		GM	2116	2755	2355	2574	1862	2332											
		CD (5%)	301	362	374	520	324												
		CV (%)	8.3	7.6	9.3	11.7	10.2												
		DOS	22.10.2021	11.10.2021	22.10.2021	12.10.2021	28.10.2021												

* Strain outyielding/ at par the parent and possessing resistance against white rust

Table 2.3.28b. Performance of Mustard: White Rust Resistance IVT, Zone-II

S.No.	Code	Strain	1000-Seed Wt.(g)					Oil Content (%)					Oil Yield (kg/ha)
			LDH	HSR	SGN	NDH	CHT	LDH	HSR	NDH	CHT	Mean	
			1	2	3	4	5	1	2	4	5	(1-2,4-5)	
1	WRR 21-1	DRMR 2018-25	5.5	5.6	5.6	5.7	3.8	41.6	41.1	42.0	40.3	41.2	1105
2	WRR 21-2	Basanti	4.6	5.0	4.0	4.7	4.8	41.2	44.1	42.5	33.0	40.2	965
3	WRR 21-3	Giriraj (LR)	5.2	6.6	5.9	6.9	4.3	39.0	38.5	40.5	38.4	39.1	965
4	WRR 21-4	DRMRCI (W)- 125	4.8	5.1	4.2	5.3	4.0	36.8	41.1	42.1	34.8	38.7	782
5	WRR 21-5	RH 2070	4.6	5.3	4.5	4.4	3.9	37.2	42.3	41.9	32.5	38.5	937
6	WRR 21-6	DRMRIJ 20-157	4.7	5.3	4.7	4.8	3.5	36.3	38.0	37.4	35.6	36.8	805
7	WRR 21-7	RH 749 (ZC)	4.2	6.6	6.1	6.6	4.6	37.7	39.9	39.1	37.7	38.6	868
8	WRR 21-8	DRMR 2018-37	4.3	4.7	4.2	5.1	3.8	35.8	40.7	39.0	34.8	37.6	847
9	WRR 21-9	DRMRHJ- 317	5.0	4.7	4.8	4.7	4.1	37.3	42.3	37.4	37.6	38.6	854
10	WRR 21-10	RH 2007	5.5	6.2	5.2	6.1	4.7	36.8	39.5	37.2	36.9	37.6	911

Table 2.3.29a. Performance of Mustard: White Rust Resistance IVT, Zone-III

S.No.	Code	Strain	Seed Yield (kg/ha)					Plant Stand					Days to Maturity						
			KPR\$	PNT	MOR	DOL\$	BPR	Mean	KPR	PNT	MOR	DOL	BPR	KPR	PNT	MOR	DOL	BPR	
			1	2	3	4	5	(2-3,5)	1	2	3	4	5	1	2	3	4	5	
1	WRR 21-1	DRMR 2018-25	2109	2070	2904	1111	2906	2627	*	121	138	145	161.3	115	131	133	137	104	138
2	WRR 21-2	Basanti	1980	1369	1392	802	1700	1487		122	161	143	170	134	134	135	135	107	144
3	WRR 21-3	RGN 73 (LR)	1852	1933	2138	895	2406	2159		117	151	143	163.7	116	136	136	138	104	144
4	WRR 21-4	DRMRCI (W)- 125	2083	1122	2456	926	2044	1874		120	124	148	167.7	111	132	132	139	106	137
5	WRR 21-5	RH 2070	1800	1219	2713	1019	2339	2090		116	127	147	166	112	135	128	134	100	137
6	WRR 21-6	DRMRIJ 20-157	1723	1243	2789	1080	2622	2218	**	123	155	145	162.7	109	132	126	135	101	135
7	WRR 21-7	Maya (ZC)	1595	1513	3066	1049	2306	2295		117	127	145	166	119	137	128	134	103	138
8	WRR 21-8	DRMR 2018-37	1800	1587	2881	988	2583	2350	*	121	156	144	165.7	117	132	131	133	103	138
9	WRR 21-9	DRMRHJ- 317	1878	1217	2758	1019	2211	2062		123	147	145	164	112	136	133	134	100	138
10	WRR 21-10	RH 2007	1852	2031	1896	988	2033	1987		117	175	147	166	114	138	138	135	107	139
		GM	1867	1530	2499	988	2315	2115											
		CD (5%)	247	289	251	148.73	434												
		CV (%)	7.7	11.0	5.8	8.7	10.9												
		DOS	03.11.2021	29.10.2021	29.10.2021	04.12.2021	31.10.2021												

\$ data of KPR and DOL centres excluded from computation of mean due to late sowing

* Strain outyielding/ at par the best check for seed and oil yield and possessing resistance against white rust

** Strain outyielding/ at par the best check for oil yield and possessing resistance against white rust

Table 2.3.29b. Performance of Mustard: White Rust Resistance IVT, Zone-III

S.No.	Code	Strain	1000 Seed Weight (g)					Oil Content (%)					Oil Yield (kg/ha)	
			KPR\$	PNT	MOR	DOL\$	BPR	KPR\$	PNT	MOR	DOL\$	BPR		Mean
			1	2	3	4	5	1	2	3	4	5		(2-3,5)
1	WRR 21-1	DRMR 2018-25	4.4	3.7	6.4	5.3	5.5	40.4	43.4	43.1	42.9	42.5	43.0	1129
2	WRR 21-2	Basanti	3.9	3.5	5.0	5.8	3.7	36.1	41.6	39.2	41.0	40.6	40.5	602
3	WRR 21-3	RGN 73 (LR)	3.5	3.2	5.4	5.6	3.6	35.4	40.8	37.2	40.5	35.4	37.8	816
4	WRR 21-4	DRMRCI (W)- 125	4.8	3.4	5.2	5.2	4.2	34.4	42.3	38.0	41.1	39.2	39.8	747
5	WRR 21-5	RH 2070	3.3	3.3	5.8	6.2	4.4	35.6	39.5	38.7	42.5	35.6	37.9	792
6	WRR 21-6	DRMRIJ 20-157	3.9	3.0	5.2	3.6	4.9	35.9	39.4	37.5	40.2	37.7	38.2	847
7	WRR 21-7	Maya (ZC)	3.4	3.2	6.2	4.8	5.5	38.6	39.5	35.5	38.9	34.4	36.4	836
8	WRR 21-8	DRMR 2018-37	3.9	3.2	5.3	4.1	5.2	36.9	42.2	38.2	42.0	39.1	39.8	936
9	WRR 21-9	DRMRHJ- 317	3.7	2.8	5.4	4.9	4.1	39.5	41.4	38.2	42.9	37.8	39.1	807
10	WRR 21-10	RH 2007	4.8	4.0	6.1	5.6	4.9	34.7	41.7	38.6	43.4	36.1	38.8	771

Table 2.3.30a. Performance of Mustard: White Rust Resistance, AVT II- NIL, Zone-II

S.No	Code	Strain	Seed Yield (kg/ha)					Plant Stand				Days to Maturity				1000-Seed Wt.(g)			
			LDH	SGN	NDH	CHT	Mean	LDH	SGN	NDH	CHT	LDH	SGN	NDH	CHT	LDH	SGN	NDH	CHT
			1	2	3	4	(1-4)	1	2	3	4	1	2	3	4	1	2	3	4
1	WRR 21-11	Pusa Jaikisan (Parent)	2402	1868	2703	2031	2251	305	197	319	295	148	150	148	144	5.8	6.2	6.0	5.1
2	WRR 21-12	PB (A4A5)- 842	2284	2348	2138	1984	2189	302	204	253	300	146	151	147	149	4.8	5.6	4.8	4.8
3	WRR 21-13	RH 749 (ZC)	2233	2203	2785	2145	2342	283	201	319	284	146	153	151	145	5.3	6.4	5.9	4.7
4	WRR 21-14	Varuna (Parent)	2285	2132	2472	1945	2209	300	204	296	318	146	154	140	146	5.4	5.8	4.9	5.3
5	WRR 21-15	PJK (A4A5)- 21	2024	1587	1600	1909	1780	289	198	320	277	142	151	145	143	5.7	6.7	5.5	5.1
6	WRR 21-16	Rohini (Parent)	1932	1640	1835	1999	1852	298	198	312	294	151	150	151	139	4.9	5.3	5.2	4.6
7	WRR 21-17	Rohini (A4A5)- 491	2180	1838	2206	1604	1957	304	200	296	291	149	149	150	141	4.8	5.2	4.7	4.5
8	WRR 21-18	Pusa Bold (Parent)	2340	2136	2204	1877	2139	306	202	329	287	146	148	148	146	5.8	5.6	5.5	5.2
9	WRR 21-19	Varuna (A4A5)- 936-279	2460	2602	2693	1867	2406	287	211	303	289	146	149	140	140	4.9	5.7	5.1	4.9
10	WRR 21-20	Giriraj (LR)	2678	2696	2803	1998	2544	303	208	311	320	149	153	149	146	5.8	6.2	6.1	4.8
		GM	2281	2105	2344	1936	2166												
		CD (5%)	266	331	364	230													
		CV (%)	8.1	10.9	10.7	8.2													
		DOS	22.10.2021	22.10.2021	12.10.2021	27.10.2021													

Table 2.3.30b. Performance of Mustard: White Rust Resistance, AVT II- NIL, Zone-II

S.No	Code	Strain	1000-Seed Wt.(g)				Oil Content (%) Zone II				Oil Yield (kg/ha)
			LDH	SGN	NDH	CHT	LDH	NDH	CHT	Mean	
			1	2	3	4	1	3	4	(1,3,4)	
1	WRR 21-11	Pusa Jaikisan (Parent)	5.8	6.2	6.0	5.1	36.0	39.9	37.2	37.7	849
2	WRR 21-12	PB (A4A5)- 842	4.8	5.6	4.8	4.8	33.4	34.7	34.7	34.3	750
3	WRR 21-13	RH 749 (ZC)	5.3	6.4	5.9	4.7	37.9	39.3	39.5	38.9	911
4	WRR 21-14	Varuna (Parent)	5.4	5.8	4.9	5.3	37.9	40.0	36.7	38.2	844
5	WRR 21-15	PJK (A4A5)- 21	5.7	6.7	5.5	5.1	34.1	36.0	34.5	34.9	621
6	WRR 21-16	Rohini (Parent)	4.9	5.3	5.2	4.6	42.3	42.9	36.5	40.5	751
7	WRR 21-17	Rohini (A4A5)- 491	4.8	5.2	4.7	4.5	43.4	44.3	40.8	42.8	838
8	WRR 21-18	Pusa Bold (Parent)	5.8	5.6	5.5	5.2	38.2	37.3	29.6	35.0	749
9	WRR 21-19	Varuna (A4A5)- 936-279	4.9	5.7	5.1	4.9	39.5	40.3	37.7	39.1	942
10	WRR 21-20	Giriraj (LR)	5.8	6.2	6.1	4.8	41.7	40.9	37.9	40.2	1022

Table 2.3.31a. Performance of Mustard: White Rust Resistance, AVT II- NIL, Zone-III

S.No.	Code	Strain	Seed Yield (kg/ha)						Plant Stand					Days to Maturity				
			KPR\$	PNT	MOR\$	DOL\$	BPR	Mean	KPR	PNT	MOR	DOL	BPR	KPR	PNT	MOR	DOL	BPR
			1	2	3	4	5	(2,5)	1	2	3	4	5	1	2	3	4	5
1	WRR 21-11	Pusa Jaikisan (Parent)	2447	1369	1226	854	2181	1775	225	262	347	332	212	137	131	135	110	138
2	WRR 21-12	PB (A4A5)- 842	2373	1444	1214	1355	1946	1695	222	261	348	338	206	135	133	133	110	140
3	WRR 21-13	Maya (ZC)	2149	1720	1322	992	2183	1952	220	258	344	326	214	134	127	132	106	142
4	WRR 21-14	Varuna (Parent)	1976	1246	972	1379	2123	1685	223	262	341	334	203	132	126	133	106	141
5	WRR 21-15	PJK (A4A5)- 21	2125	1451	1529	1372	1990	1720	218	256	345	337	192	136	127	128	109	137
6	WRR 21-16	Rohini (Parent)	2232	1236	1192	1083	1623	1430	223	271	348	326	214	134	137	138	111	142
7	WRR 21-17	Rohini (A4A5)- 491	2050	1106	1243	888	1590	1348	224	259	346	323	184	135	136	135	110	142
8	WRR 21-18	Pusa Bold (Parent)	2100	1590	1570	1140	1879	1734	221	252	346	330	199	138	137	139	112	139
9	WRR 21-19	Varuna (A4A5)- 936-279	2067	1353	1886	1041	2479	1916	221	260	267	330	208	133	125	138	106	143
10	WRR 21-20	RGN 73 (LR)	2159	1566	1010	1450	2415	1990	223	261	346	336	233	134	137	139	110	142
		GM	2169	1408	1316	1155	2041	1724										
		CD (5%)	178	274.1	98	153	312											
		CV (%)	5.7	13.4	5.1	9.1	10.6											
		DOS	19.11.2021	29.10.2021	22.11.2021	03.12.2021	31.10.2021											

\$ data of KPR, MOR and DOL centres excluded from computation of mean due to late sowing

Table 2.3.31b. Performance of Mustard: White Rust Resistance, AVT II- NIL, Zone-III

S.No.	Code	Strain	1000-Seed Wt.(g)					Oil Content (%)						Oil Yield (kg/ha)
			KPR	PNT	MOR	DOL	BPR	KPR	PNT	MOR	DOL	BPR	Mean	
			1	2	3	4	5	1	2	3	4	5	(2,5)	
1	WRR 21-11	Pusa Jaikisan (Parent)	4.5	4.0	4.6	5.28	5.6	38.1	35.1	28.6	39.9	37.7	36.4	646
2	WRR 21-12	PB (A4A5)- 842	3.5	3.8	2.9	5.76	5.6	37.2	34.4	26.5	38.6	36.9	35.6	604
3	WRR 21-13	Maya (ZC)	3.5	3.5	3.4	5.58	5.0	36.2	37.1	29.2	39.5	37.1	37.1	725
4	WRR 21-14	Varuna (Parent)	3.3	3.2	3.9	5.08	4.9	42.1	35.3	32.3	38.3	41.1	38.2	643
5	WRR 21-15	PJK (A4A5)- 21	3.4	4.2	5.5	6.2	6.6	36.2	34.3	30.5	39.5	35.3	34.8	598
6	WRR 21-16	Rohini (Parent)	3.3	3.4	3.6	4.3	4.3	43.7	39.9	31.9	42.6	37.3	38.6	551
7	WRR 21-17	Rohini (A4A5)- 491	3.2	3.0	3.6	4.8	3.6	42.5	40.8	33.9	43.9	42.2	41.5	559
8	WRR 21-18	Pusa Bold (Parent)	4.0	4.1	5.4	4.08	6.1	33.9	35.1	30.0	39.5	34.1	34.6	601
9	WRR 21-19	Varuna (A4A5)- 936-279	4.3	3.1	5.2	4.88	5.1	39.4	37.8	32.0	39.8	41.0	39.4	755
10	WRR 21-20	RGN 73 (LR)	4.8	3.4	5.6	5.64	4.2	34.5	39.8	30.6	41.6	36.8	38.3	762

Table 31c. Reaction of WRR strains to WR (artificial condition)

S.No.	Code	Entries	% WR severity (90/100 DAS)									% Staghead			
			PNT	SKN	JAG	MOR	HSR	NDH	BPR	SGN	Mean	PNT	MOR	BPR	Mean
1	WRR 21-1	DRMR 2018-25	0.0	2.1	13.4	0.0	5.0				4.1	0.0			0.0
2	WRR 21-2	Basanti (RC)	7.5	0.7	19.6	0.0	0.0				5.6	0.0			0.0
3	WRR 21-3	DRMRIJ 31 (C)	40.0	18.0	11.0	38.0	31.1				27.6	20.0			20.0
4	WRR 21-4	DRMRCI(W)-125	0.0	1.1	8.7	0.0	0.0				2.0	0.0			0.0
5	WRR 21-5	RH 2070	0.0	8.1	14.2	34.0	0.0				11.3	0.0			0.0
6	WRR 21-6	DRMRIJ 20-157	0.0	0.1	3.6	2.9	0.0				1.3	0.0			0.0
7	WRR 21-7	RH 749 (ZC)	30.0	22.0	22.2	21.1	40.0				27.1	20.0			20.0
8	WRR 21-8	DRMR 2018-37	0.0	0.7	3.6	0.0	0.0				0.9	0.0			0.0
9	WRR 21-9	DRMRHJ 317	10.0	4.0	12.9	2.0	30.0				11.8	20.0			20.0
10	WRR 21-10	RH 2007	40.0	17.6	25.4	16.0	33.4				26.5	10.0			10.0
11	WRR 21-11	PJK Parent	22.5		20.2	45.1	28.4	19.8	17.0	34.2	26.7	12.5	10.3	18.9	13.9
12	WRR 21-12	PB (A4A5)-842	0.0		15.9	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0
13	WRR 21-13	Maya (ZC)	17.5	0.7	16.5	2.0	4.5				8.2	25.0			
14	WRR 21-14	Varuna Parent	17.5		20.8	44.0	30.0	38.7	16.0	40.7	29.7	0.0	16.3	14.9	10.4
15	WRR 21-15	PJK (A4A5)-21	0.0		10.6	0.0	0.0	0.0	0.0	28.9	5.6	0.0	0.0	12.6	4.2
16	WRR 21-16	Rohini Parent	27.5		27.3	42.0	38.9	54.9	18.0	27.6	33.7	12.5	10.2	9.6	10.8
17	WRR 21-17	Rohini (A4A5)-491	0.0		15.9	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0
18	WRR 21-18	PB Parent	22.5		14.4	40.7	31.7	18.0	18.0	27.8	24.7	27.5	9.2	7.6	14.8
19	WRR 21-19	Varuna (A4A5)-936-279	3.5		15.8	0.0	0.0	19.8	0.0	22.4	8.8	0.0	0.0	12.8	4.3
20	WRR 21-20	RGN 73 (LR)	50.0	20.5	21.1	33.3	34.5				31.9	35.0			
21		BIOYSR (RC-WR)	4.0		19.3	22.0	0.0	21.6	16.0	28.4	15.9	7.5	0.0	29.3	12.3
22		DLSC -1 (C)	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23		DRMRMJA 35 (RC-WR)	5.0		18.9	4.2	1.7	6.3	0.0	0.0	5.2	0.0	0.0	0.0	0.0
24		NRCHB 101 (SC)	17.5		24.4	36.0	27.2	38.7	16.0	32.9	27.5	7.5	7.7	4.3	6.5
25		Rohini (SC)	37.5		23.5	37.8	35.6	45.0	40.0	23.1	34.6	27.5	11.1	9.3	16.0

Table 2.3.32a. Performance of Gobhi Sarson strains in IVT + AVT II

S.No.	Code	Strain	Seed Yield (Kg/ha)							Plant Stand						Days to Maturity						
			KNG	DLK	BJR	CHT	LDH	ABR	Mean	KNG	DLK	BJR	CHT	LDH	ABR	KNG	DLK	BJR	CHT	LDH	ABR	
			1	2	3	4	5	6	(1-6)	1	2	3	4	5	6	1	2	3	4	5	6	
1	NCN-21-1	AKGS 19-8#	1923	1248	1669	2086	2464	2001	1898		307	312	329	301	313	271	166	148	177	157	155	151
2	NCN-21-2	AKMS 8141 (LR)	2099	1318	1749	1896	2316	1761	1856		308	320	329	283	314	270	167	147	178	159	156	152
3	NCN-21-3	GSH- 2155	2388	1335	1688	2169	2607	2148	2056	*	310	320	332	313	295	273	170	154	177	161	160	151
4	NCN-21-4	Kranti (NC)	1104	903	925	1611	2037	2458	1506		307	319	328	289	320	271	158	145	168	144	140	144
5	NCN-21-5	GSH- 1703	2427	1156	1622	1996	2386	2250	1973		310	320	331	283	307	277	170	155	178	162	160	154
6	NCN-21-6	GSC 6 (QC)	1565	1142	1459	1785	1892	2295	1690		308	321	331	291	306	275	159	147	179	156	145	152
7	NCN-21-7	HNS 1206	1678	1223	1581	1766	2141	2203	1765		309	319	331	306	317	271	160	146	166	152	150	150
8	NCN-21-8	GSL 1 (NC)	1698	1128	1498	1983	2130	1976	1735		310	321	329	284	315	278	163	152	169	158	159	151
9	NCN-21-9	DRMRIN 20-3	1022	881	1241	1797	2047	1802	1465		311	321	334	290	310	273	161	144	163	151	150	149
10	NCN-21-10	DRMRIN 20-23	1033	790	1484	1726	1593	1861	1414		312	322	330	284	296	270	156	144	164	146	148	149
11	NCN-21-11	HNS 1102	1294	1084	1673	2137	2322	2324	1806		308	322	328	300	313	274	158	144	169	154	152	150
12	NCN-21-12	AKGS 8060	2299	1297	1660	1656	2348	2275	1922		309	323	328	308	306	277	171	155	179	162	160	153
13	NCN-21-13	GSH- 1723	1843	1111	1476	1885	2696	2151	1860		308	322	332	307	287	270	170	155	178	160	159	153
14	NCN-21-14	JGS- 15-6	1506	1189	1406	2242	2528	2275	1858		309	321	331	287	302	271	167	152	173	161	155	152
		GM	1705	1128	1509	1910	2250	2127	1771													
		CD (5%)	121	124	127	303	269	270														
		CV (%)	7.1	7.7	5.9	11.1	8.4	8.8														
		DOS	12.10.2021	29.10.2021	23.10.2021	21.10.2021	21.10.2021	25.10.2021														

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

AVT II strain

Table 2.3.32b. Performance of Gobhi Sarson strains in AVT- I+II

S.No.	Code	Strain	1000-seed weight (g)						Oil Content (%)			Oil Yield (kg/ha)
			KNG	DLK	BJR	CHT	LDH	ABR	CHT	LDH	Mean	
			1	2	3	4	5	6	4	5	(4-5)	
1	NCN-21-1	AKGS 19-8	3.2	3.2	4.1	4.9	3.9	3.9	42.4	36.5	39.5	749
2	NCN-21-2	AKMS 8141 (LR)	2.9	3.2	3.8	5.4	3.9	3.4	41.7	37.3	39.5	733
3	NCN-21-3	GSH- 2155	3.0	2.1	3.4	5.1	3.9	3.5	40.9	37.6	39.3	807
4	NCN-21-4	Kranti (NC)	3.7	3.5	2.9	4.7	4.2	5.3	37.9	34.7	36.3	546
5	NCN-21-5	GSH- 1703	3.0	2.6	2.2	5.4	3.5	3.1	40.6	37.8	39.2	773
6	NCN-21-6	GSC 6 (QC)	3.7	3.1	3.2	5.0	4.0	4.6	38.1	36.0	37.1	627
7	NCN-21-7	HNS 1206	3.6	3.2	3.2	4.9	4.1	3.8	43.6	41.6	42.6	752
8	NCN-21-8	GSL 1 (NC)	3.1	3.2	3.6	5.1	4.0	3.7	43.8	38.7	41.3	716
9	NCN-21-9	DRMRIN 20-3	4.2	3.8	2.7	4.9	4.1	4.7	42.6	37.4	40.0	586
10	NCN-21-10	DRMRIN 20-23	4.2	3.9	4.2	5.0	4.0	5.2	43.6	40.7	42.2	596
11	NCN-21-11	HNS 1102	3.5	3.5	2.5	5.1	3.7	3.8	43.8	43.5	43.6	788
12	NCN-21-12	AKGS 8060	3.5	3.5	3.4	4.9	3.9	3.9	40.2	38.4	39.3	755
13	NCN-21-13	GSH- 1723	2.6	2.4	3.1	4.7	4.0	2.9	43.0	40.4	41.7	775
14	NCN-21-14	JGS- 15-6	3.4	3.0	3.9	5.0	4.0	3.8	40.4	40.1	40.2	747

3. Agronomy

Experiments on six major agronomic aspects were conducted at 25 AICRP-RM centres across the five zones during 2021-22. The results are presented below:

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

The experiment was initiated in 2011-12 and conducted for 11th year at 10 centres in 5 Zones during 2021-22. In Zone I, application of 100% NPK + 2.5 t FYM/ha recorded markedly higher seed yield (1655 kg/ha) which was higher by 448 and 16% over the control 100% NPK, respectively at Kangra. In Zone II, application of 150% NPK recorded the highest seed yield at LDH (2092 kg/ha), HSR (2224 kg/ha) and SGN (2056 kg/ha) which was 211, 208 and 54% higher over the control, and 6.2, 24.2 and 13.0% higher over the 100% NPK, respectively.

Table 3.1.1. Seed yield (kg/ha) of rapeseed-mustard under different fertility levels in Zone- I and II

Treatment	Zone I		Zone II	
	KNG	LDH	HSR	SGN
Control	302	673	722	1330
100% PK	461	1375	753	1501
100% NPK	1429	1970	1790	1820
150% NPK	1583	2092	2224	2056
100% NPK + 40 kg S/ha	1571	1888	1863	1862
100% NPK + 25 kg ZnSO ₄ /ha	1595	1942	1898	1824
100% NPK + 1 kg B/ha	1393	1914	2126	1807
100% NPK + 2.5 t FYM/ha	1655	1735	1905	1992
100% NP	906	1886	2028	1648
100% NK	939	1873	2053	1608
CD (p = 0.05)	122	201	416	259
Date of sowing	Oct. 16	Nov. 01	Oct. 22	Nov 02
Variety	GSC 7	PBR 357	RH 749	RH 749
RDF (NPK kg/ha)	120:60:60	100:30:15	80:30:20	75:40:30
Year of start	2019-20	2011-12	2011-12	2018-19
Preceding crop	Maize	Maize	P. millet	P. millet

In Zone III, application of 150% NPK recorded significantly highest seed yield at KOT (2381 kg/ha) and MOR (1420 kg/ha) which was higher by 65 and 324% over the control, and 18.1, and 21.8% over the 100% NPK, respectively. At PNT, application of 100% NPK + FYM @ 2.5 t/ha recorded significantly highest seed yield (2088 kg/ha) which was higher by 213 and 13% over the control and 150% NPK, respectively. In Zone IV, application of 150% NPK recorded markedly higher seed yield at SKN, which was 101 and 19.4% higher over the control and 100% NPK, respectively. In Zone V, application of 150% NPK recorded significantly higher seed yield at BHU and SHL which was 175 and 241% higher over the control, and 15.9 and 53.5% higher over the 100% NPK, respectively.

Table 3.1.2. Seed yield (kg/ha) of rapeseed-mustard under different fertility levels in Zone III, IV and V

Treatment	Zone III			Zone IV	Zone V	
	KOT	MOR	PNT	SKN	BHU	SHL
Control	1438	335	666	892	369	381
100% PK	1671	324	1054	1247	722	418
100% NPK	2016	1166	2062	1501	875	847
150% NPK	2381	1420	1848	1792	1014	1300
100% NPK + 40 kg S/ha	2211	1251	2070	1621	952	1000
100% NPK + 25 kg ZnSO ₄ /ha	2045	1243	1932	1595	905	870
100% NPK + 1 kg B/ha	2100	1136	1927	1352	902	1100
100% NPK + 2.5 t FYM/ha	2309	1231	2088	1461	920	1253
100% NP	1888	1192	1638	1411	744	700
100% NK	1843	1132	1630	1394	705	650
CD (p = 0.05)	351	331	226	237.58	179	148
Date of Sowing	Oct. 17	Oct. 02	Oct. 26	Oct. 25	Dec. 16	Nov. 8
Variety	Giriraj	JM 3	NDRE 4	GM 3	NRCHB 101	TS 36
RDF (NPK kg/ha)	80:40:30	80:40:20	120:40:0	50:50:20	80:40:40	60:30:30
Year of start	2017-18	2011-12	2011-12	2011-12	2017-18	2017-18
Preceding crop	Urdbean	P.millet	Maize	Moong	Rice	Rice

Based on 10-year mean data analysis (Fig.1), application of 150% NPK followed by 100% NPK + 2.5 t FYM/ha resulted the maximum seed yield at Dholi, Morena, Hisar, Khudwani and SK Nagar. At Ludhiana, application of 150% NPK followed by 100% NPK + Zn @ 5 kg/ha resulted the maximum seed yield. Whereas, at Pantnagar, application of 100% NPK + 2.5 t FYM/ha followed by 100% NPK + S @ 40 kg/ha resulted the maximum seed yield.

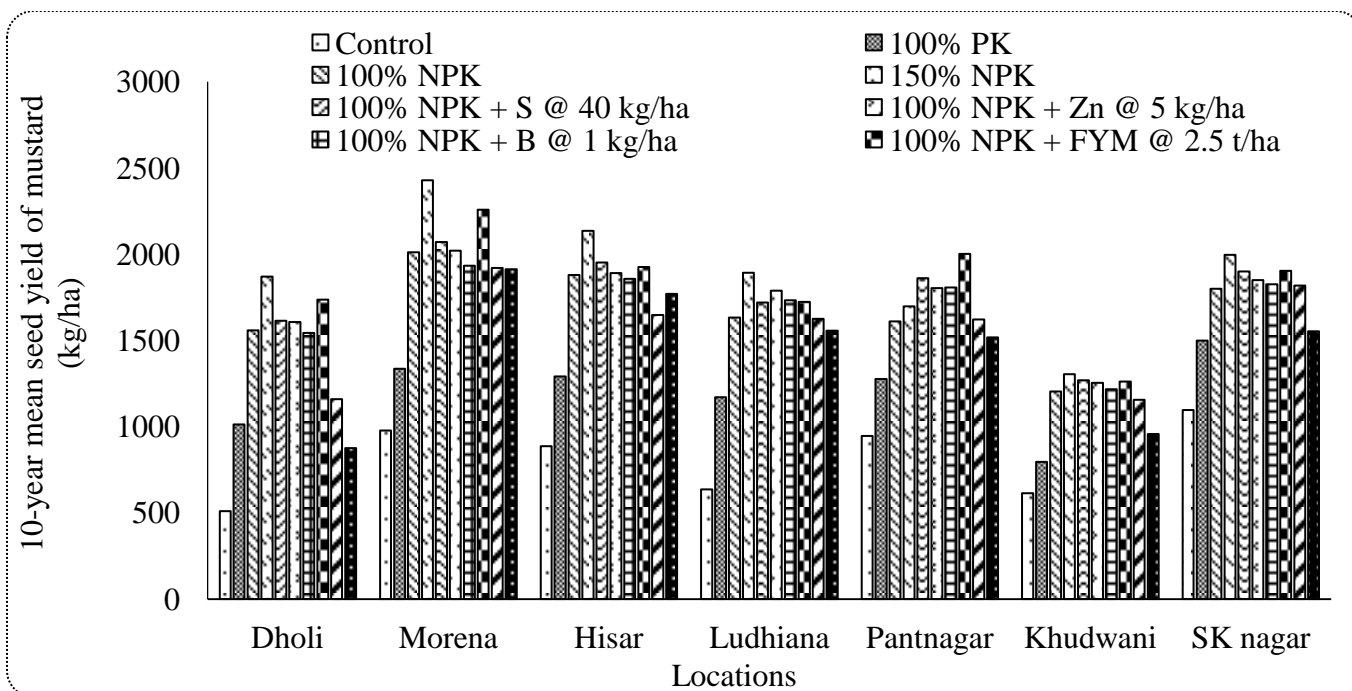


Fig. 1. 10-year mean seed yield under long term fertility experiment.

At Dholi, 10-year mean data analysis showed that application of 150% NPK significantly improved the mustard seed yield, mustard equivalent yield and system net returns compared to the remaining treatments, and at par with 100% NPK + FYM @ 2.5 t/ha (Table 3.1.3).

Table 3.1.3. 10-year mean (2011-12 to 2020-21) seed yield (kg/ha) of mustard under different fertility levels at Dholi centre

Treatments	Mustard seed yield (kg/ha)	Mustard equivalent yield (kg/ha)	System net return (Rs/ha/year)	B:C ratio
Control	510	1606	-14638	-0.17
50%NPK	1037	2452	19562	0.22
100% NPK	1558	4597	107815	1.13
150% NPK	1870	5430	141578	1.43
100% NPK +S @ 40 kg/ha	1614	4956	117671	1.16
100% NPK + Zn @ 25 kg ZnSO ₄ /ha	1607	4831	112155	1.10
100% NPK +B @ 1 kg/ha	1543	4695	110922	1.15
100% NPK + FYM @ 2.5 t/ha	1737	5187	123893	1.17
100% NP	1159	3084	43233	0.46
100% N	814	2433	18616	0.21
CD (p=0.05)	136	391	17315	0.28

At SK Nagar, 7-year mean data analysis showed that application of 150% NPK resulted the maximum seed yield, net returns and B:C ratio, which were significantly higher over the rest of the treatments (Table 3.1.4).

3.1.4. 7-year mean (2015-16 to 2021-22) seed yield and economics of mustard under different fertility levels at S.K. Nagar centre

Treatments	Seed yield (kg/ha)	Net returns (Rs/ha)	B: C ratio
Control	1068	18503	1.59
100% PK	1425	31327	1.90
100% NPK	1646	41227	2.17
150% NPK	1924	52353	2.41
100% NPK + S @ 40 kg S /ha	1762	44853	2.21
100% NPK + Zn @ 25 kg ZnSO ₄ /ha	1686	41590	2.13
100% NPK + B @ 1 kg B/ha	1644	39534	2.07
100% NPK + FYM @ 2.5 t/ha	1764	36828	1.81
100% NP	1681	43499	2.25
100% NK	1495	36587	2.11
CD (p=0.05)	115	5338	0.15

3.2 Evaluation of herbicides for weed management in rapeseed-mustard

The experiment was conducted at six centres during 2021-22 (Table 3.2.1). At Ludhiana, application of oxadiargyl 0.045 kg a.i./ha (PE) resulted significantly higher seed yield (2232 kg/ha) which was 38% higher over the weedy check. However, weed control efficiency (WCE) was the maximum with the pendimethalin 0.5 kg a.i./ha. At Hisar, post emergence application of fluazifop-p-butyl 0.125 kg a.i./ha at 25-30 DAS found most effective and recorded highest seed yield which was 44% higher over the weedy check. The same treatment also recorded the maximum WCE at Hisar. At Pantnagar, post emergence application of quizalofop 0.05 kg a.i./ha at 15-20 DAS recorded significantly highest seed yield over the weedy check. Also recorded the maximum WCE (86%). At SK Nagar, application of pendimethalin 1.0 kg a.i./ha (PE) recorded significantly higher seed yield over the weedy check. Though, the maximum WCE was recorded with pendimethalin 0.5 kg a.i./ha. At Bhubaneswar, pre-emergence application of pendimethalin @ 1.0 kg a.i./ha found most effective herbicide in controlling the weeds and registered the maximum seed yield (919 kg/ha) and WCE. Imphal, the pre-emergence application of pendimethalin @ 1.0 kg a.i./ha recorded the maximum seed yield and WCE.

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

Treatment	Seed yield (kg/ha)					
	LDH	HSR	PNT	SKN	BHU	IMP
Pendimethalin 1.0 kg a.i./ha (PE)	1985	2574	1980	2295	919	1636
Pendimethalin 0.5 kg a.i./ha (PE)	1916	2498	1767	2277	877	1444
Oxadiargyl 0.09 kg a.i./ha (PE)	2232	-	1658	-	867	-
Oxadiargyl 0.045 kg a.i./ha (PE)	2217	-	1445	-	839	-
Fluazifop-p-butyl 0.125 kg a.i./ha (PoE)	2096	3120	1783	2137	851	1519
Quizalofop 0.050 kg a.i./ha (PoE)	1740	2926	2108	2203	802	1384
Weedy check	1620	2163	1285	1879	615	846
Weed free	2623	3130	2280	2425	964	1860
CD (p=0.05)	412	539	430	312	-	320
DOS	Oct. 31	Oct. 21	Nov. 9	Oct. 22	Dec. 12	Nov. 27

Variety	PBR 357	RH725	PR 20	GDM-4	NRCHB 101	NRCHB 101
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PE: Pre-emergence; PoE: Post-emergence

Table 3.2.2. Weed control efficiency of different herbicides in mustard

Treatment	Weed control efficiency (%)					
	LDH	PNT	SKN	BHU	HSR	IMP
Pendimethalin 1.0 kg a.i./ha (PE)	52.6	84.6	58.9	83.2	51.0	71.7
Pendimethalin 0.5 kg a.i./ha (PE)	61.4	71.4	74.4	79.6	49.3	54.8
Oxadiargyl 0.09 kg a.i./ha (PE)	50.0	56.7	-	76.8	-	-
Oxadiargyl 0.045 kg a.i./ha (PE)	43.8	54.2	-	73.4	-	-
Fluazifop-p-butyl 0.125 kg a.i./ha (PostE)	32.3	61.3	24.5	68.4	75.1	64.0
Quizalofop 0.050 kg a.i./ha (PostE)	37.5	86.2	28.7	52.5	58.1	43.5
Weedy check	0.0	-	0.0	0.0	0.0	0.0
Weed free	100	100	100	100	100	100
CD (p=0.05)	-	-	19	-	-	9.37

PE: Pre-emergence; PoE: Post-emergence

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

At Pantnagar, post emergence application of quizalofop 0.05 kg a.i./ha at 15-20 DAS recorded significantly highest net returns over the rest of the treatments (Table 3.2.3). Post emergence application of quizalofop 0.05 kg a.i./ha at Pantnagar increased the net returns by 88% over the weedy check. Whereas at Imphal, pre-emergence application of pendimethalin 1.0 kg a.i./ha recorded the highest net returns followed by fluazifop-p-butyl @ 0.125 kg a.i./ha (PoE). Pre-emergence application of pendimethalin 1.0 kg a.i./ha increased the net returns by 492.4% over the weedy check at Imphal (Table 3.2.3).

Table: 3.2.3. Net returns (Rs./ha) of mustard as influenced by different herbicide

Treatment	PNT	IMP
Pendimethalin 1.0 kg a.i./ha (PE)	77354	45099
Pendimethalin 0.5 kg a.i./ha (PE)	67749	36608
Oxadiargyl 0.09 kg a.i./ha (PE)	62306	-
Oxadiargyl 0.045 kg a.i./ha (PE)	52023	-
Fluazifop-p-butyl 0.125 kg a.i./ha (PosE)	68267	40297
Quizalofop 0.050 kg a.i./ha (PosE)	84979	32682
Weedy check	45120	7613
Weed free	84615	44100
CD (p=0.05)	21524	-

PE: Pre-emergence; PoE: Post-emergence

3.3 Agronomic evaluation of promising rapeseed-mustard entries

Mustard timely sown (Rainfed): One entry of mustard for timely sown rainfed conditions (RH 1424) was evaluated against the checks (RH 725, RGN 229, Kranti and filler) at Abohar, Hisar, Ludhiana, Sriganganagar and Bawal centres in Zone-II under different fertility levels (Table 3.3.1). The entry RH 1425 recorded the maximum seed yield at all the centres, except at Sriganganagar. At Hisar and Bawal, seed yield of entry RH 1425 was significantly increased by 9.6-46.3 and 13.0-31.1%, respectively over the checks. At Abohar and Ludhiana, seed yield of entry RH 1425 non-significantly increased by 6.3-39.4 and 3.0-28.1%, respectively over the checks. Application of 150% RDF significantly increased seed yield over 100 and 125% RDF at Ludhiana, and over 100% RDF at Hisar and Bawal. At Abohar and Sriganganagar, seed yield increased non-significantly with 150% RDF over 100 and 125% RDF.

Table 3.3.1. Agronomic evaluation of timely sown (rainfed) mustard entries in Zone-II

Entries/ Varieties (E)	Fertility levels (F)			
	100% RDF	125% RDF	150% RDF	Mean
Abohar				
RH 1424	2416	2761	2880	2686
RH 725	2289	2567	2722	2526
RGN 229	2038	2396	2576	2337
Kranti	1846	1861	2075	1927
Filler (RGN 229)	2087	2420	2638	2381
Mean	2135	2401	2578	
CD (p=0.05)	Entries (E) = 162; Fertility (F) = 173; ExF = NS			
DOS: Oct. 16; Recommended fertility level- --				
Hisar				
RH 1424	2546	2734	2938	2739
RH 725	2317	2222	2646	2500
RGN 229	2163	2500	2363	2246
Kranti	1667	2739	2054	1872
Filler (RGN 229)	2104	2217	2346	2222
Mean	2159	2319	2469	
CD (p=0.05)	Entries (E) = 172; Fertility (F) = 169; ExF = NS			
DOS: Oct. 22; Recommended fertility level- 80 kg N, 30 kg P ₂ O ₅ , 20 kg K ₂ O/ha				
Ludhiana				
RH 1424	1314	1495	1579	1463
RH 725	1299	1424	1538	1420
RGN 229	1079	1216	1558	1284
Kranti	997	1218	1213	1142
Filler (RGN 229)	1279	1354	1379	1337
Mean	1193	1341	1453	
CD (p=0.05)	Entries (E) = NS; Fertility (F) = 88; ExF = NS			
DOS: Nov. 13; Recommended fertility level- 40 kg N, 20 kg P ₂ O ₅ /ha				
Sriganganagar				
RH 1424	1615	1600	1698	1638

RH 725	1815	1985	1881	1894
RGN 229	1615	1413	1637	1555
Kranti	1378	1483	1611	1491
Filler (RGN 229)	1452	1437	1785	1558
Mean	1575	1584	1723	
CD (p=0.05)	Entries (E) = 242; Fertility (F) = NS; ExF = NS			
DOS: Nov 02; Recommended fertility level- 75 kg N, 40 kg P ₂ O ₅ , 30 kg K ₂ O, 20 kg S/ha				
Bawal				
RH 1424	1720	1888	1924	1844
RH 725	1291	1449	1480	1406
RGN 229	1505	1672	1717	1631
Kranti	1316	1480	1504	1433
Filler (RGN 229)	1337	1491	1519	1449
Mean	1434	1596	1629	
CD (p=0.05)	Entries (E) = 146; Fertility (F) = 127; ExF= NS			
DOS: Oct 13; Recommended fertility levels NPS (kg/ha)-40:20:30				

Quality mustard: Two entries of quality mustard [RH (OE) 1706 and LES 60] were evaluated against the checks (PM 29, RH 749, Kranti and filler) at Delhi, Hisar, Ludhiana, Sriganaganagar and Bawal centres in Zone-II under different fertility levels (Table 3.3.2). At Hisar and Bawal, seed yield of entry RH (OE) 1706 was significantly increased by 23.6-29.7 and 9.2-27.2%, respectively over the checks. At Sriganaganagar, test entry RH (OE) 1706 performed poorly and recorded lower seed yield than checks, except 7% higher over the RH 749.

The test entry LES 60 recorded 17-25% higher seed yield at Hisar over all the checks, and 4% higher over RH 749 at Bawal. At Sriganaganagar, LES 60 performed poorly and recorded lower seed yield than checks. At Delhi and Ludhiana, both the test entries RH (OE) 1706 and LES 60 performed poorly and recorded lower seed yield compared to the checks.

Application of 150% RDF significantly increased seed yield over 100 and 125% RDF at Hisar and Ludhiana, and over 100% RDF at Delhi and Bawal. At Sriganaganagar, seed yield increased non-significantly with 150% RDF over 100 and 125% RDF.

Table 3.3.2. Agronomic evaluation of quality mustard entries in Zone-II

Entries/ Varieties (E)	Fertility levels (F)			
	100% RDF	125% RDF	150% RDF	Mean
Delhi				
RH (OE) 1706	1619	2233	2136	1996
LES 60	1839	1967	1869	1892
PM 29	1603	1919	1925	1816
RH 749	1556	2106	2447	2036
Kranti	1844	2589	2658	2364
Filler (PM 29)	1522	2447	2278	2082
Mean	1664	2210	2219	
CD (p=0.05)	Entries (E) = 228; Fertility (F) = 145; E at same level of F= 284; F at same or different level of E= 319			
DOS: Oct. 16; Recommended fertility levels NPKS (kg/ha)-80:40:40:30				

Hisar				
RH (OE) 1706	2844	2859	3052	2919
LES 60	2311	2881	3085	2759
PM 29	2115	2219	2419	2251
RH 749	2230	2326	2530	2362
Kranti	2130	2419	2426	2325
Filler (PM 29)	2163	2163	2322	2216
Mean	2299	2478	2639	
CD (p=0.05)	Entries (E) = 301; Fertility (F) = 146; ExF = NS			
DOS: Oct. 22; Recommended fertility levels NPK (kg/ha)-80:30:20				
Ludhiana				
RH (OE) 1706	1443	1540	1645	1542
LES 60	1577	1690	1808	1692
PM 29	1443	1579	1756	1592
RH 749	1573	1817	1752	1714
Kranti	1431	1504	1863	1599
Filler (PM 29)	1876	1982	1950	1936
Mean	1557	1685	1796	
CD (p=0.05)	Entries (E) = NS; Fertility (F) = 94; ExF = NS			
DOS: Oct. 29; Recommended fertility levels NPK (kg/ha)-100:30:15				
Sriganganagar				
RH (OE) 1706	1593	1413	1478	1495
LES 60	1074	1385	1593	1351
PM 29	1138	1770	1667	1525
RH 749	1301	1319	1579	1399
Kranti	1775	1667	1841	1761
Filler (PM 29)	1749	1822	1874	1815
Mean	1438	1563	1672	
CD (p=0.05)	Entries (E) = 212; Fertility (F) = NS; ExF = NS			
DOS: Nov. 02; Recommended fertility levels NPKS (kg/ha)-75:40:30:20				
Bawal				
RH (OE) 1706	1920	2109	2152	2060
LES 60	1551	1726	1774	1683
PM 29	1507	1676	1715	1632
RH 749	1491	1664	1706	1620
Kranti	1750	1931	1979	1886
Filler (PM 29)	1604	1780	1831	1738
Mean	1637	1814	1859	
CD (p=0.05)	Entries (E) = 128; Fertility (F) = 141; ExF = NS			
DOS: Oct. 23; Recommended fertility levels NPKS (kg/ha)-80:30:20:40				

Mustard: White Rust Resistance: AVT II-NIL

Zone- II: Four white rust resistance entries in mustard [Rohini (A4A5)-491, PB (A4A5)-842, PJK (A4A5)-21 and Varuna (A4A5)-936-279] were evaluated against the checks (RH 749 and Giriraj) and parents (Rohini, PB, PJK and Varuna) in Zone II (Table 3.3.3). At Ludhiana, entry Varuna (A4A5)-936-279 significantly increased the seed yield by 12.6-15.4% and 14.1% over the checks and parent, respectively. Entries Rohini (A4A5)-491 and PB (A4A5)-842 recorded 6.3-8.9 and 7.6-10.3% non-significantly higher seed yield over the checks, respectively. Entry PJK (A4A5)-21 performed poor than the checks and parent at Ludhiana.

At Hisar, Varuna (A4A5)-936-279 recorded 2.6-4.6% and 3.7% non-significantly higher seed yield over the checks and parent, respectively. Entry PB (A4A5)-842 yielded non-significantly higher (0.5%) and lower (1.5%) over the check RH 749 and Giriraj, respectively, and significantly higher (11.8%) than the parent. Rohini (A4A5)-491 performed poor and recorded lower seed yield than the checks. Similarly, the entry PJK (A4A5)-21 performed poor than the checks at Hisar.

At Sriganganagr, all the test entries performed poor and recorded 5.9-27.4% lower seed yield than the check RH 749. Only PB (A4A5)-842 recorded higher seed yield (3.9%).

At Delhi, entry Varuna (A4A5)-936-279 significantly increased the seed yield by 75.0-105.4% and 21.5% over the checks (RH 749 and Giriraj) and parent, respectively. The seed yield of the entry PJK (A4A5)-21 was recorded significantly higher (17.7%) over the check Giriraj, non-significantly higher (2.9%) over the check RH 749, but lower over the parent. Similarly, the seed yield of the entry PB (A4A5)-842 recorded non-significantly higher (10.6%) over the check Giriraj, and lower over the check RH 749 and parent. The test entry Rohini (A4A5)-491 performed poor than the check RH 749 and parent.

At Chatha, the seed yield of the entry PB (A4A5)-842 was recorded significantly higher by 7.5 and 17.0% over the check Giriraj and parent, respectively, but non-significantly higher (6.2%) over the check RH 749. Similarly, the seed yield of the entry PJK (A4A5)-21 was recorded non-significantly higher (2.3-3.5%) over the checks, but significantly higher (7.6%) over the parent. The test entry Rohini (A4A5)-491 performed poor than the checks, but higher (4.1%) than the parent.

Application of 150% RDF significantly increased seed yield over 100 and 125% RDF at Hisar, and over 100% RDF at Ludhiana, Delhi and Chatha. At Sriganganagar, seed yield increased non-significantly with 150% RDF over 100 and 125% RDF.

Table 3.3.3. Agronomic evaluation of mustard entries for white rust resistance: AVT II-NIL in Zone-II

Entries/ Varieties (E)	Fertility levels (F)			
	100% RDF	125% RDF	150% RDF	Mean
Ludhiana				
Rohini (A4A5)-491	1794	1850	1867	1837
PB (A4A5)-842	1685	1919	1976	1860
PJK (A4A5)-21	1262	1483	1537	1427
Varuna (A4A5)-936-279	1883	1920	2034	1946
Rohini (parent)	1844	1916	1937	1899
PB (parent)	1544	1856	1854	1751
PJK (parent)	1751	1889	1888	1843
Varuna (parent)	1508	1769	1838	1705

RH 749	1524	1662	1873	1686
Giriraj	1661	1739	1783	1728
Mean	1645	1800	1859	
CD (p=0.05)	Entries (E) = 213; Fertility (F) = 65; ExF = NS			
DOS: Oct. 27; Recommended fertility level NPK (kg/ha)- 100:30:15				
Hisar				
Rohini (A4A5)-491	1641	1748	1774	1721
PB (A4A5)-842	2048	2126	2163	2112
PJK (A4A5)-21	2048	2067	2152	2089
Varuna (A4A5)-936-279	2130	2215	2252	2199
Rohini (parent)	1585	1633	1641	1620
PB (parent)	1841	1852	1974	1889
PJK (parent)	1959	2000	2204	2054
Varuna (parent)	1974	2148	2237	2120
RH 749	1974	2070	2263	2102
Giriraj	2063	2126	2244	2144
Mean	1926	1999	2090	
CD (p=0.05)	Entries (E) = 134; Fertility (F) = 73; ExF = NS			
DOS: Oct. 22; Recommended fertility levels NPK (kg/ha)-80:30:20				
Sriganganagar				
Rohini (A4A5)-491	1100	1375	1501	1325
PB (A4A5)-842	1591	1766	1796	1718
PJK (A4A5)-21	1350	1597	1555	1500
Varuna (A4A5)-936-279	1532	1496	1539	1522
Rohini (parent)	1535	1533	1600	1556
PB (parent)	1462	1554	1681	1566
PJK (parent)	1344	1486	1695	1508
Varuna (parent)	1379	1406	1407	1397
RH 749	1807	1722	1947	1825
Giriraj	1679	1557	1724	1654
Mean	1478	1549	1645	
CD (p=0.05)	Entries (E) = 265; Fertility (F) = NS; ExF = NS			
DOS: Nov. 02; Recommended fertility levels NPKS (kg/ha)-75:40:30:20				
Delhi				
Rohini (A4A5)-491	1431	1861	2022	1771
PB (A4A5)-842	1808	1914	2156	1959
PJK (A4A5)-21	2122	2172	1961	2085
Varuna (A4A5)-936-279	3456	3528	3933	3639
Rohini (parent)	2189	2214	2083	2162
PB (parent)	2828	2583	3067	2826
PJK (parent)	2772	2378	2317	2489
Varuna (parent)	3083	2922	2983	2996
RH 749	1817	2178	2242	2079
Giriraj	1431	1861	2022	1771
Mean	2352	2403	2535	

CD (p=0.05)	Entries (E) = 190; Fertility (F) = 175; E ay same level of F= 360; F at same or different level of E= 385			
DOS: Oct. 23; Recommended fertility levels NPK (kg/ha)-30:20:0				
Chatha				
Rohini (A4A5)-491	1176	1210	1220	1202
PB (A4A5)-842	1300	1472	1503	1425
PJK (A4A5)-21	1283	1400	1437	1373
Varuna (A4A5)-936-279	1182	1237	1273	1231
Rohini (parent)	1116	1162	1183	1154
PB (parent)	1192	1223	1240	1218
PJK (parent)	1195	1302	1332	1276
Varuna (parent)	1150	1281	1290	1240
RH 749	1245	1373	1407	1342
Giriraj	1235	1360	1382	1326
Mean	1207	1302	1327	
CD (p=0.05)	Entries (E) = 93; Fertility (F) = 34; ExF = NS			
DOS: Oct. 31; Recommended fertility levels NPK (kg/ha)-80:40:20				

Zone- III: Four entries for white rust resistance in mustard [Rohini (A4A5)-491, PB (A4A5)-842, PJK (A4A5)-21 and Varuna (A4A5)-936-279] were evaluated against the checks (Maya and RGN 73) and parents (Rohini, PB, PJK and Varuna) in Zone III (Table 3.3.4). Dholi centre not reported the data as per format.

At Kanpur, Varuna (A4A5)-936-279 recorded significantly higher seed yield by 25.1% over the check RGN 73, non-significantly higher (4.5%) over the check Maya, but recorded lower seed yield than the parent. Entry PB (A4A5)-842 recorded significantly higher seed yield by 20.1% over the check RGN 73, non-significantly higher (0.3%) over the check Maya, but performed poor than the parent. Entries Rohini (A4A5)-491 and PJK (A4A5)-21 performed poor than the check RGN 73. However, PJK (A4A5)-21 and Rohini (A4A5)-491 recorded 17.1 and 10.6% higher seed yield over the check Maya, respectively.

At Pantnagar, all the test entries performed poor than the checks (Maya and RGN 73). At Morena, Varuna (A4A5)-936-279 recorded 15.0 and 6.4% significantly higher seed yield over the check RGN 73 and parent, but lower than the check Maya. Remaining all three entries [Rohini (A4A5)-491, PB (A4A5)-842 and PJK (A4A5)-21] performed poor than the checks (Maya and RGN 73).

At Bharatpur, Varuna (A4A5)-936-279 recorded 3.7-12.9% non-significantly higher seed yield over the checks. Remaining all three entries [Rohini (A4A5)-491, PB (A4A5)-842 and PJK (A4A5)-21] performed poor than the checks (Maya and RGN 73).

Application of 150% RDF significantly increased seed yield over 100 and 125% RDF at Morena, and over 100% RDF at Pantnagar and Bharatpur. At Kanpur, application of 125% RDF recorded significantly higher seed yield compared to 100%, and non-significantly higher over the 150% RDF.

Table 3.3.4. Agronomic evaluation of mustard entries for white rust resistance: AVT II-NIL in Zone- III

Entries/ Varieties (E)	Fertility levels (F)			
	100% RDF	125% RDF	150% RDF	Mean
Kanpur				
Rohini (A4A5)-491	1690	1884	2233	1936
PB (A4A5)-842	2021	2180	2106	2102
PJK (A4A5)-21	2042	2095	2011	2049
Varuna (A4A5)-936-279	2031	2507	2032	2190
Rohini (parent)	1640	1936	1968	1848
PB (parent)	2137	2075	2349	2187
PJK (parent)	2095	2254	2095	2148
Varuna (parent)	2074	2391	2254	2240
Maya	2042	2214	2032	2096
RGN 73	1714	1778	1757	1750
Mean	1949	2131	2084	
CD (p=0.05)	Entries (E) = 221; Fertility (F) = 103; ExF = NS			
DOS: Oct. 29; Recommended fertility levels NPK (kg/ha)-100:60:60				
Pantnagar				
Rohini (A4A5)-491	763	823	681	755
PB (A4A5)-842	944	1123	1213	1093
PJK (A4A5)-21	571	720	533	608
Varuna (A4A5)-936-279	1173	1283	1220	1225
Rohini (parent)	747	922	914	861
PB (parent)	938	1170	1199	1102
PJK (parent)	1541	1766	1687	1665
Varuna (parent)	1138	1370	1400	1303
Maya	1214	1301	1539	1351
RGN 73	1368	1559	1952	1626
Mean	1040	1204	1234	
CD (p=0.05)	Entries (E) = 229; Fertility (F) = 92; ExF = NS			
DOS: Nov. 01; Recommended fertility levels NPK (kg/ha) -120:40:20				
Morena				
Rohini (A4A5)-491	802	877	929	869
PB (A4A5)-842	855	920	1002	926
PJK (A4A5)-21	675	1048	1407	1043
Varuna (A4A5)-936-279	1294	1544	1676	1505
Rohini (parent)	795	954	1191	980
PB (parent)	975	1302	1699	1325
PJK (parent)	1355	1481	1692	1509
Varuna (parent)	1187	1488	1569	1415
Maya	1302	1596	1784	1561
RGN 73	1092	1264	1571	1309
Mean	1033	1247	1452	1244
CD (p=0.05)	Entries (E) = 33; Fertility (F) = 72; ExF = NS			

DOS: Nov. 02; Recommended fertility levels NPK (kg/ha)- 80:40:20				
Bharatpur				
Rohini (A4A5)-491	1189	1395	1268	1284
PB (A4A5)-842	1426	1346	1454	1409
PJK (A4A5)-21	964	1015	1401	1127
Varuna (A4A5)-936-279	2011	1622	1827	1820
Rohini (parent)	1265	1588	1480	1444
PB (parent)	1471	1512	1210	1398
PJK (parent)	1710	1718	1915	1781
Varuna (parent)	1622	1971	1797	1797
Maya	1574	1527	1734	1612
RGN 73	1674	1929	1663	1755
Mean	1491	1562	1575	
CD (p=0.05)	Entries (E) = 240; Fertility (F) = 63; ExF = NS			
DOS: Oct. 12; Recommended fertility levels NPK (kg/ha)- 80:60:40				

Saline/alkaline conditions: One entry of mustard (CS 2005-143) for saline/alkaline conditions was evaluated against the checks (CS 54, CS 60 and Kranti) at Agra, Karnal and Lucknow centres under different fertility levels (Table 3.3.5). At Agra, Karnal and Lucknow, seed yield of entry CS 2005-143 was significantly increased by 19.5-22.4, 12.6-49.9 and 13.9-42.0%, respectively over the checks CS 54 and Kranti at Agra, and over all the checks (CS 54, CS 60 and Kranti) at Karnal and Lucknow.

Application of 150% RDF significantly increased seed yield over 100 and 125% RDF at Agra and Lucknow, and over 100% RDF at Karnal.

Table 3.3.5. Agronomic evaluation of mustard entries for saline/alkaline conditions

Entries/ Varieties (E)	Fertility levels (F)			
	100% RDF	125% RDF	150% RDF	Mean
Agra				
CS 2005-143	2012	2352	2529	2297
CS 54	1833	1904	2027	1922
CS 60	2026	2217	2426	2223
Kranti	1688	1956	1987	1877
Filler (CS 54)	1878	1947	2091	1972
Mean	1887	2075	2212	
CD (p=0.05)	Entries (E) = 119; Fertility (F) = 90; ExF = NS			
DOS: Oct. 31; Recommended fertility level NPK kg/ha-80:40:00				
Karnal				
CS 2005-143	2308	2655	2623	2529
CS 54	1606	1909	2093	1869
CS 60	1989	2404	2345	2246
Kranti	1483	1612	1966	1687
Filler (CS 54)	1525	1879	2186	1863
Mean	1782	2092	2243	
CD (p=0.05)	Entries (E) = 266; Fertility (F) = 182; ExF = NS			

DOS: Oct. 15; Recommended fertility level NPK kg/ha-80:40:00				
Lucknow				
CS 2005-143	2075	2377	2571	2341
CS 54	1653	1778	2038	1823
CS 60	1772	2067	2331	2056
Kranti	1548	1667	1730	1648
Filler (CS 54)	1729	1903	2105	1912
Mean	1755	1958	2155	
CD (p=0.05)	Entries (E) = 151; Fertility (F) = 67; ExF = NS			
DOS: Oct. 30; Recommended fertility level NPK kg/ha-80:40:40				

Gobhi sarson: One entry of Gobhi sarson (AKGS 19-8) was evaluated against the checks (GSC 6, GSL 1 and Kranti) at Ludhiana, Kangra and Chatha centres under different fertility levels (Table 3.3.6). Data were not reported by Dhoula Kuan and Bajaura centres. At Kangra, seed yield of test entry AKGS 19-8 was significantly increased by 9.8 and 74.1% over the check GSC 6 and Kranti, respectively, and non-significantly over the check GSL 1 (2.1%). At Chatha, AKGS 19-8 recorded significantly higher seed yield by 54.9% over the check Kranti, and non-significantly over the checks GSC 6 (9.5%) and GSL 1 (7.9%). At Ludhiana, seed yield of test entry AKGS 19-8 was significantly increased by 21.3 and 9.8% over the checks GSC 6 and Kranti, respectively, and performed poor than check (GSL 1).

Application of 150% RDF significantly increased seed yield over 100 at Hisar and Ludhiana, and over 100% RDF at Delhi and Bawal. At Sriganganagar, seed yield increased non-significantly with 150% RDF over 100 and 125% RDF.

Table 3.3.6. Agronomic evaluation of Gobhi sarson entries

Entries/ Varieties (E)	Fertility levels (F)			
	100% RDF	125% RDF	150% RDF	Mean
Ludhiana				
AKGS 19-8	1815	1958	2016	1929
GSC 6	1538	1575	1657	1590
GSL 1	1764	1953	2123	1947
Kranti	1550	1820	1900	1756
Filler (GSL 1)	1996	2172	2159	2109
Mean	1733	1896	1971	
CD (p=0.05)	Entries (E) = 69; Fertility (F) = 86; ExF = NS			
DOS: Nov. 2; Recommended fertility level- NPK kg/ha-100:30:15				
Kangra				
AKGS 19-8	1738	2123	2194	2018
GSC 6	1716	1860	1936	1837
GSL 1	1667	2093	2170	1977
Kranti	1108	1255	1113	1159
Filler (GSL 1)	1709	1961	2063	1911
Mean	1587	1858	1895	
CD (p=0.05)	Entries (E) = 178; Fertility (F) = 162; ExF = NS			
DOS: Oct. 13; Recommended fertility level NPK kg/ha-120:60:60				

Chatha				
AKGS 19-8	1381	1630	1735	1582
GSC 6	1203	1565	1567	1445
GSL 1	1353	1510	1535	1466
Kranti	892	1025	1147	1021
Filler (GSL 1)	1333	1410	1483	1409
Mean	1232	1428	1493	
CD (p=0.05)	Entries (E) = 214; Fertility (F) = 85; ExF = NS			
DOS: Oct. 22; Recommended fertility levels NPK (kg/ha)-80:40:20				

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

The experiment was conducted at 13 locations during 2021-22. Irrigation frequency significantly influenced mustard seed yield at all the locations, except at Morena (Table 3.4.1). Application of recommended irrigations (normal) as per location markedly increased seed yield compared to no irrigation and 50% deficit irrigations at Sriganganagar, Jhansi, Varanasi, Jobner, Nagpur, SK Nagar and Imphal, respectively. At Chatha, Ludhiana, Bawal, Banda and Dholi, normal irrigations significantly increased mustard seed yield over no irrigation, and remained at par with 50% deficit irrigations.

Seed inoculation with microbes significantly increased seed yield at all the locations except at SK Nagar (Table 3.4.1). Seed inoculation markedly increased seed yield with MRD 17 at Ludhiana (19.3%), Morena (6.8%) and Nagpur (17.8%), with Biophos and Biophos⁺ at Bawal (12.4%) and Banda (9.4%), with CRIDA MI-I at Sriganganagar (12.9%) and Jhansi (18.0%), and with CRIDA MI-II at Chatha (43.6%), Dholi (31.4%), Varanasi (41.2%), Jobner (19.5%) and Imphal (32.8%) over the control. At SK Nagar, CRIDA MI-I recorded non-significantly higher seed yield over the control.

Interaction: Interaction effects of irrigation and microbial inoculation showed significant increase in seed yield at Sriganganagar and Jhansi (Table 3.4.1). At Sriganganagar, seed yield increased by 50.7, 50.4 and 17.3% with normal irrigations + CRIDA MI-I over control, 50% deficit irrigations and normal irrigations, respectively. Similarly, seed yield increased with normal irrigations + CRIDA MI-I over the control, 50% deficit irrigations and normal irrigations by 72.2, 37.3 and 21.3%, respectively at Jhansi.

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

Irrigation frequency (I)	Microbial inoculants (M)						Mean
	MRD 17	MKS6	Biophos and Biophos ⁺	CRIDA MI-I	CRIDA MI- II	Control	
Chatha							
No Irrigation	937	882	1010	1018	1065	820	955
50% deficit Irrigation	1405	1397	1583	1588	1610	1084	1445
Normal Irrigations	1547	1493	1703	1735	1753	1180	1569
Mean	1296	1257	1432	1447	1476	1028	
CD (p=0.05)	Irrigation Levels (I) = 146; Microbial consortia (M) = 82; ExF = NS						
DOS: Oct. 28 ; Recommended fertility levels NPK (kg/ha) - 80:40:20							
Sriganganagar							

No Irrigation	1191	1064	1156	1184	1114	1275	1164
50% deficit Irrigation	1531	1590	1511	1621	1686	1277	1536
Normal Irrigations	1744	1651	1914	1921	1824	1637	1782
Mean	1489	1435	1527	1576	1541	1396	
CD (p=0.05)	Irrigation Levels (I) = 111; Microbial consortia (M) = 75; ExF = 167						
DOS: Nov. 03; Recommended fertility levels NPKS (kg/ha) - 75:40:30:20							
Jhansi							
No Irrigation	1457	1654	1535	1697	1671	1376	1565
50% deficit Irrigation	1802	1828	1814	1897	1863	1726	1822
Normal Irrigations	2021	2158	2073	2370	2212	1953	2132
Mean	1760	1880	1807	1988	1915	1685	
CD (p=0.05)	Irrigation Levels (I) = 86; Microbial consortia (M) = 86; ExF = 207						
DOS: Oct. 28 ; Recommended fertility levels NPKS (kg/ha) - 120:60:60:40							
Ludhiana							
No Irrigation	1470	1397	1305	1323	1424	1105	1337
50% deficit Irrigation	1572	1449	1343	1378	1513	1355	1435
Normal Irrigations	1610	1523	1585	1568	1564	1441	1548
Mean	1551	1456	1411	1423	1500	1300	
CD (p=0.05)	Irrigation Levels (I) = 119; Microbial consortia (M) = 91; ExF = NS						
DOS: Nov. 12; Recommended fertility levels NPK (kg/ha) – 100:30:15							
Bawal							
No Irrigation	1769	1809	1987	1788	1844	1756	1825
50% deficit Irrigation	1950	1967	2185	1954	2019	1945	2003
Normal Irrigations	1982	1995	2215	1988	2054	1981	2036
Mean	1900	1924	2129	1910	1972	1894	
CD (p=0.05)	Irrigation Levels (I) = 135; Microbial consortia (M) = 123; ExF = NS						
DOS: Oct. 23 ; Recommended fertility levels NPKS (kg/ha) - 80:30:20:40							
Banda							
No Irrigation	1518	1547	1517	1397	1325	1385	1448
50% deficit Irrigation	2035	1984	2216	2133	2200	1990	2093
Normal Irrigations	2373	2177	2325	2239	2478	2164	2293
Mean	1975	1903	2019	1923	2001	1846	
CD (p=0.05)	Irrigation Levels (I) = 390; Microbial consortia (M) = 113; ExF = NS						
DOS: -- ; Recommended fertility levels NPKS (kg/ha) – 120:40:20							
Dholi							
No Irrigation	1145	1283	1216	1307	1392	1049	1232
50% deficit Irrigation	1300	1522	1928	1986	1547	1281	1594
Normal Irrigations	1669	1674	1503	1745	2131	1529	1708
Mean	1371	1493	1549	1679	1690	1286	
CD (p=0.05)	Irrigation Levels (I) = 198; Microbial consortia (M) = 219; ExF = NS						
DOS: Nov. 28 ; Recommended fertility levels NPK (kg/ha) - 80:40:40							
Morena							
No Irrigation	1686	1698	1813	1775	1651	1694	1720
50% deficit Irrigation	2018	1667	1619	1808	1670	1686	1745
Normal Irrigations	1972	1585	1742	1837	1873	1937	1824

Mean	1892	1650	1725	1807	1731	1772	
CD (p=0.05)	Irrigation Levels (I) = NS; Microbial consortia (M) = 119; ExF = NS						
DOS: Nov. 01 ; Recommended fertility levels NPK (kg/ha) - 80:40:20							
Varanasi							
No Irrigation	1178	1080	1287	1315	1365	981	1201
50% deficit Irrigation	1345	1278	1589	1614	1700	1181	1451
Normal Irrigations	1666	1480	1847	1903	1947	1389	1705
Mean	1396	1280	1574	1611	1671	1183	
CD (p=0.05)	Irrigation Levels (I) = 79; Microbial consortia (M) = 140; ExF = NS						
DOS: Nov. 15 ; Recommended fertility levels NPK (kg/ha) - 120:60:60							
Jobner							
No Irrigation	854	872	868	911	950	784	873
50% deficit Irrigation	1264	1303	1314	1349	1378	1149	1293
Normal Irrigations	1573	1619	1624	1652	1733	1467	1611
Mean	1230	1264	1269	1304	1354	1133	
CD (p=0.05)	Irrigation Levels (I) = 105; Microbial consortia (M) = 87; ExF = NS						
DOS: Oct. 28 ; Recommended fertility levels NPK (kg/ha) - 60:40:00							
Nagpur							
No Irrigation	773	763	711	693	653	636	705
50% deficit Irrigation	940	886	927	907	887	867	902
Normal Irrigations	1186	1070	1060	1040	1033	957	1057
Mean	966	906	899	880	857	820	
CD (p=0.05)	Irrigation Levels (I) = 29; Microbial consortia (M) = 23; ExF = NS						
DOS: Oct. 28 ; Recommended fertility levels NPK (kg/ha) - 80:40:20							
SK Nagar							
No Irrigation	1453	1461	1496	1494	1396	1392	1449
50% deficit Irrigation	1866	1940	1869	1929	1919	2026	1925
Normal Irrigations	2353	2185	2432	2430	2291	2184	2312
Mean	1891	1862	1932	1951	1869	1867	
CD (p=0.05)	Irrigation Levels (I) = 291; Microbial consortia (M) = NS; ExF = NS						
DOS: Oct. 25 ; Recommended fertility levels NPK (kg/ha) - 50:50:00							
Imphal							
No Irrigation	1285	1000	1111	1167	1433	989	1164
50% deficit Irrigation	1570	1459	1511	1559	1633	1278	1502
Normal Irrigations	1856	1748	1767	1770	1930	1496	1761
Mean	1570	1402	1463	1499	1665	1254	
CD (p=0.05)	Irrigation Levels (I) = 250; Microbial consortia (M) = 175; ExF = NS						
DOS: Nov. 24 ; Recommended fertility levels NPK (kg/ha) - 60:30:30							

Application of normal irrigations recorded maximum RWC at SK Nagar, Jobner, Bawal and Chatha (Table 3.4.2). However, at Nagpur, non-significantly higher RWC was recorded in case of normal irrigations. Microbial inoculants significantly influenced RWC at SK Nagar, Bawal and Chatha and non-significantly at Nagpur and Jobner. Inoculation with Biophos and Biophos⁺ at SK Nagar and Bawal, with CRIDA MI-II at Chatha recorded highest RWC.

Table 3.4.2. Relative water content of mustard as influenced by irrigation and microbial

Treatment	RWC (%)				
	NGP	SKN	JOB	BAW	CHT
Irrigation frequency					
No Irrigation	50.7	68.5	57.61	67	60.9
50% deficit Irrigation	58.3	77.3	65.22	76	74.4
Normal Irrigations	69.0	82.0	71.28	76	78.7
CD (p=0.05)	NS	4.65	5.21	5	5.2
Microbial inoculants					
MRD 17	66.7	77.7	64.67	69	71.4
MKS6	65.0	75.5	65.56	72	68.4
Biophos and Biophos ⁺	61.2	80.8	64.78	83	73.4
CRIDA MI-I	56.8	77.8	66.44	71	75.3
CRIDA MI- II	55.1	71.5	65.22	74	75.9
Control	51.4	72.3	61.56	69	63.7
CD (p=0.05)	NS	6.34	NS	6	2.97

inoculants

Bawal- at 80DAS; SKN-at 80 DAS

Application of normal irrigations recorded the maximum net returns at Jobner, Imphal, Dholi, Chatha, Jhansi, Varanasi, SK Nagar, Nagpur, Bawal and Banda over no irrigation and 50% deficit irrigations. Seed inoculation with microbes significantly increased the net returns at all the locations except at SK Nagar (Table 3.4.3). Seed inoculation increased net returns with CRIDA MI-II at Jobner (33.0%), Imphal (78.7%, Dholi (59.5%, Chatha (68.7%) and Varanasi (72.5%), with CRIDA MI-I at Jhansi (34.5%), with MRD 17 at Nagpur (146.2%), and with Biophos and Biophos⁺ at Bawal (18.6%) and Banda (11.7%) compared to control. At SK Nagar, CRIDA MI-I recorded non-significantly higher (7.6%) net returns over the control.

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

Treatment	Net returns (Rs/ha)									
	JOB	IMP	DOL	CHT	JHS	VAR	SKN	NGP	BAW	BND
Irrigation frequency										
No Irrigation	20909	21842	36205	30283	43761	39625	33403	12907	73748	66346
50% deficit Irrigation	40910	38894	53495	53242	56608	50508	53657	32217	82218	107754
Normal Irrigations	55814	51986	59223	58257	72097	62312	69801	36817	81968	120005
CD (p=0.05)	4790	-	9625	7355	4316	2310	13538	3031	5126	23291
Microbial inoculants										
MRD 17	37815	42354	42140	45870	55034	47129	52073	43422	76033	99524
MKS6	39538	33875	48567	43906	61015	40801	50734	34918	77433	95365
Biophos and Biophos ⁺	39573	36930	51987	52744	55889	56399	54001	31474	89753	102583
CRIDA MI-I	41408	38738	58689	53501	64930	58463	54889	23694	76613	96991
CRIDA MI- II	43910	47154	59293	54960	59782	61681	51039	18884	80353	101950
Control	33022	26393	37172	32581	48280	35753	50985	17639	75683	91797
CD (p=0.05)	4322	-	10389	4159	4317	6303	NS	4289	6908	6731

Irrigation levels significantly influenced the soil available N, P and K content at Imphal, while only organic carbon and available N content at SK Nagar (Table 3.4.4). At SK Nagar, application of normal irrigations increased soil organic carbon and available N content over the no-irrigation. At Imphal, soil available N, P and K content recorded higher under no-irrigation.

At SK Nagar, seed inoculation with CRIDA MI-I significantly increased soil organic carbon content over the MKS 6 and CRIDA MI-II, respectively. Soil available N content increased by 5.8 and 7.6% over CRIDA MI-II and control, respectively. Soil available P, K and S content did not influence significantly due to different microbes at SK Nagar. Seed inoculation with Biophos and Biophos⁺ significantly increased soil available N, P and K content by 27.7, 23.3 and 17.3%, respectively over the control at Imphal.

Table 3.4.4: Effect of irrigation and microbes on soil fertility status after harvest of mustard

Treatment	Organic carbon (%)	Available N (kg/ha)		Available P (kg/ha)		Available K (kg/ha)		Available S (kg/ha)
		SKN	IMP	SKN	IMP	SKN	IMP	
Main plot: Irrigation								
No Irrigation	0.17	113	300	48.8	21.2	187	218	15.6
50% deficit of irrigation	0.19	124	293	52.5	20.8	196	214	14.4
Normal level of irrigation	0.22	140	272	53.7	19.1	210	208	14.7
CD (p=0.05)	0.02	9	21	NS	1.5	NS	7	NS
Sub plot: Microbes								
MRD 17	0.20	127	267	51.4	19.1	199	202	14.5
MKS 6	0.19	126	302	51.4	21.6	196	209	14.7
Biophos and BioPhos+	0.20	127	320	50.9	22.0	200	232	16.2
CRIDA MI-I	0.20	130	294	51.5	20.9	202	220	15.1
CRIDA MI- II	0.19	121	297	53.1	20.8	192	216	14.8
Control (No culture)	0.20	123	251	51.6	17.8	197	198	14.1
CD (p=0.05)	0.01	6	23	NS	2.4	NS	14	NS

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

The experiment was conducted at 15 locations during 2021-22. Application of 100% RDF significantly increased mustard seed yield at Kangra, Chatha, Morena, Varanasi, SK Nagar, Bawal and Bharatpur compared to control and 75% RDF (Table 3.5.1). Whereas, at Pantnagar, Dholi, Kota, Kanke, Bhubneswar and Ludhiana seed yield increased significantly with 100% RDF over control and non-significantly over 75% RDF (Table 3.5.1). Seed yield did not influence significantly due to different fertility levels at Shillongani. At Imphal, application of 75% RDF being on par with 100% RDF significantly increased the seed yield over the control.

Seed treatment with liquid biofertilizers significantly increased seed yield at all the locations except at Pantnagar, SK Nagar and Shillongani (Table 3.5.1). Seed treatment markedly increased seed yield with *Azotobacter* at Kangra (35.3%), Morena (67.4%), Kanke (126.4%), Bhubhaneshwar (22.8%), with PSMO at Imphal (54.7%), with NPK consortia + ZSB at Chatha (25.4%), Dholi (21.4%), Kota (23.4%), Varanasi (27.8%), Bawal (14.3%) and Bharatpur (23.2%) over the control. At Pantnagar, SK Nagar and Shillongani, NPK consortia + ZSB, *Azotobacter* and PSMO, recorded non-significantly higher seed yield over the control.

Interaction: Interaction effects of fertility levels and liquid biofertilizers showed significant increase in seed yield at Kangra, Morena, Kota, Kanke, Bhubaneshwar and Bharatpur (Table 3.5.1). Seed yield increased significantly with 100% RDF + *Azotobacter* over control + 100% RDF/75% RDF/control (no fertilizer) by 28.0, 116.6 and 238.6% at Kangra, by 80.1, 78.5 and 85.3% at Morena, by 157.0, 174.1 and 174.1% at Kanke, and by 18.3, 23.8 and 287.8% at Bhubaneshwar, respectively. Whereas, combined use of 100% RDF + NPK consortia + ZSB increased the seed yield significantly over without liquid biofertilizers + 100% RDF/75% RDF/control by 24.3, 24.4 and 67.3% at Kota, and by 26.2, 46.9 and 90.4% at Bharatpur, respectively.

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

Fertility level (F)	Biofertilizers (BF)						Mean
	<i>Azotobacter</i>	PSMO	KMB	ZSB	NPK consortia+ZSB	No culture	
Kangra							
100% RDF	2130	2048	1742	1968	1996	1664	1924
75% RDF	2098	1883	1502	1772	1827	1445	1754
Control	831	751	653	714	736	629	719
Mean	1686	1561	1299	1484	1519	1246	
CD (p=0.05)	Fertility Levels (F) = 50; Biofertilizers (BF) = 80; BF at same level of F = 138; F at same or different level of BF= 171						
DOS: Oct 29 ; Recommended fertility levels NPK (kg/ha) - 120:60:60							
Chatha							
100% RDF	1693	1723	1550	1580	1773	1455	1629
75% RDF	1332	1350	1233	1277	1430	1150	1295
Control	853	759	839	707	887	655	783
Mean	1293	1278	1207	1188	1363	1087	
CD (p=0.05)	Fertility Levels (F) = 150; Biofertilizers (BF) = 86; Fx BF = NS						
DOS: Oct 29 ; Recommended fertility levels NPK (kg/ha) - 80:40:20							
Pantnagar							
100% RDF	1768	1812	1795	1880	2020	1667	1824
75% RDF	1919	1735	1712	1760	1980	1562	1778
Control	1095	987	971	958	1172	780	994
Mean	1594	1511	1493	1533	1724	1336	
CD (p=0.05)	Fertility Levels (F) = 214; Biofertilizers (BF) = NS; Fx BF = NS						
DOS: Nov. 10 ; Recommended fertility levels NPK (kg/ha) - 80:40:20							
Morena							
100% RDF	2240	2166	1838	1826	1937	1244	1875
75% RDF	2228	1867	1562	1437	2023	1255	1729
Control	1738	1238	1259	1509	1242	1209	1633
Mean	2069	1757	1553	1591	1734	1236	
CD (p=0.05)	Fertility Levels (F) = 47; Biofertilizers (BF) = 87; Fx BF = 473						
DOS: Nov. 03 ; Recommended fertility levels NPK (kg/ha) - 80:40:20							
Dholi							

100% RDF	1837	1796	1801	1881	1946	1731	1832
75% RDF	1792	1633	1671	1835	1878	1593	1734
Control	1368	1223	1252	1543	1613	1155	1359
Mean	1666	1551	1575	1753	1812	1493	
CD (p=0.05)	Fertility Levels (F) = 129; Biofertilizers (BF) = 120; FxBF = NS						
DOS: Nov. 27; Recommended fertility levels NPK (kg/ha) - 80:40:40							
Kota							
100% RDF	2011	2262	2228	2042	2296	1847	2114
75% RDF	2050	2013	2021	2024	2106	1845	2010
Control	1588	1715	1551	1514	1847	1372	1598
Mean	1883	1997	1933	1860	2083	1688	
CD (p=0.05)	Fertility Levels (F) = 250; Biofertilizers (BF) = 201; FxBF = 473						
DOS: Oct 15 ; Recommended fertility levels NPK (kg/ha) - 100:50:30							
Varanasi							
100% RDF	1882	1914	1859	1808	2070	1650	1864
75% RDF	1698	1731	1608	1594	1825	1427	1647
Control	1415	1437	1327	1311	1481	1130	1350
Mean	1665	1694	1598	1571	1792	1402	
CD (p=0.05)	Fertility Levels (F) = 86; Biofertilizers (BF) = 58; FxBF = NS						
DOS: Oct 27 ; Recommended fertility levels NPK (kg/ha) - 120:60:60							
SK Nagar							
100% RDF	2361	2036	2276	2232	2218	2008	2189
75% RDF	2044	1840	1827	1770	1954	1809	1874
Control	1581	1758	1513	1721	1516	1576	1611
Mean	1995	1878	1872	1908	1896	1798	
CD (p=0.05)	Fertility Levels (F) = 69; Biofertilizers (BF) = NS; FxBF = NS						
DOS: Oct 25 ; Recommended fertility levels NPK (kg/ha) - 50:50:00							
Kanke							
100% RDF	1560	1369	1417	1345	1083	607	1230
75% RDF	1298	1298	1345	1286	1252	417	1149
Control	405	345	364	348	381	417	377
Mean	1087	1004	1042	993	906	480	
CD (p=0.05)	Fertility Levels (F) = 125; Biofertilizers (BF) = 97; BF at same level of F = 168; F at same or different level of BF= 199						
DOS: Oct 29 ; Recommended fertility levels NPKS (kg/ha) - 80:60:40:20							
Bhubhaneshwar							
100% RDF	1078	1035	1010	968	1017	911	1003
75% RDF	1047	1015	1003	921	1006	871	977
Control	408	412	356	372	388	278	369
Mean	844	821	790	754	804	687	
CD (p=0.05)	Fertility Levels (F) = 93; Biofertilizers (BF) = 88; BF at same level of F = 168; F at same or different level of BF= 199						
DOS: Dec. 12; Recommended fertility levels NPK (kg/ha) - 80:40:40							
Imphal							
100% RDF	1748	1944	1400	1348	1585	1319	1557

75% RDF	1693	1974	1504	1589	1622	1274	1609
Control	1622	1704	1330	1115	1448	1041	1377
Mean	1688	1874	1411	1351	1552	1211	
CD (p=0.05)	Fertility Levels (F) = 181; Biofertilizers (BF) = 117; FxBF= NS						
DOS: Nov. 20 ; Recommended fertility levels NPK (kg/ha) - 60:30:30							
Bawal							
100% RDF	2034	2021	1977	1995	2186	1932	2024
75% RDF	1905	1884	1829	1867	2052	1789	1887
Control	1673	1668	1601	1625	1815	1578	1660
Mean	1871	1858	1802	1829	2018	1766	-
CD (p=0.05)	Fertility Levels (F) = 104; Biofertilizers (BF) = 128; FxBF = NS						
DOS: Oct. 25 ; Recommended fertility levels NPKS (kg/ha) - 80:30:20:40							
Bharatpur							
100% RDF	2422	2238	2217	2512	2786	2208	2397
75% RDF	2411	2179	2268	2154	2425	1897	2222
Control	1593	1558	1513	1556	1649	1463	1555
Mean	2142	1992	2000	2074	2287	1856	
CD (p=0.05)	Fertility Levels (F) = 144; Biofertilizers (BF) = 136; BF at same level of F = 235; F at same or different level of BF= 256						
DOS: Oct. 29 ; Recommended fertility levels NPK (kg/ha) - 80:40:40							
Shillongani							
100% RDF	974	734	926	1111	732	833	885
75% RDF	800	1213	926	778	706	961	897
Control	767	986	926	787	635	763	810
Mean	847	978	926	892	691	852	
CD (p=0.05)	Fertility Levels (F) = NS; Biofertilizers (BF) = NS; FxBF = NS						
DOS: Nov. 01 ; Recommended fertility levels NPK (kg/ha) - 60:30:30							
Ludhiana							
100% RDF	1749	1999	1920	1973	2047	1605	1882
75% RDF	1724	1732	1846	1863	1739	1563	1744
Control	1218	1254	1284	1126	1271	1108	1210
Mean	1564	1662	1683	1654	1686	1425	
CD (p=0.05)	Fertility Levels (F) = 176; Biofertilizers (BF) = 132; FxBF = NS						
DOS: Nov. 13; Recommended fertility levels NPK (kg/ha) - 100:30:15							

Fertility levels significantly influenced the net returns at all the locations, except at Shillongani (Table 3.5.2). Application of 100% RDF recorded the maximum net returns at Chatha, Kota, Varanasi, Kanke, Bawal, Kangra, Bhubaneswar, Bharatpur, Dholi, Pantnagar and SK over the control and 75% RDF. Whereas, application of 75% RDF recorded the maximum net returns at Imphal and Shillongani.

Seed treatment with liquid biofertilizers significantly increased the net returns at all the locations except at Shillongani, Pantnagar and SK Nagar (Table 3.5.2). Seed treatment with NPK consortia + ZSB increased net returns at Chatha (36.7%), Kota (29.2%), Varanasi (41.2%), Bawal (21.3%), Bharatpur (36.5%) and Dholi (32.4%), with *Azotobacter* at Kanke, Kangra

(58.8%), Bhubaneswar, and with PSMO at Imphal (101.5%) compared to the control. Whereas, seed treatment increased the net returns non-significantly with PSMO at Shillongani (9.7%), with NPK consortia + ZSB at Pantnagar (45.3%), and with *Azotobacter* at SK Nagar (18.5%) over the control.

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

Treatment	Net returns (Rs/ha)												
	CHT	KOT	VAR	KNK	IMP	BAW	KNG	BHU	BPR	DOL	SHL	PNT	SKN
Fertility levels													
100% RDF	62815	111482	68169	33087	42524	83471	75852	10268	85864	66449	41679	64540	64602
75% RDF	47011	106025	58605	30581	46288	76443	62139	9861	78788	62239	42558	63494	51284
Control	24332	83265	46842	-8274	37974	68114	13824	-18160	50002	45933	36572	28066	43626
CD (p=0.05)	7572	16240	3467	6869	-	5700	2522	-	6920	5838	NS	5644	12620
Biofertilizers													
<i>Azotobacter</i>	47549	98676	61788	28115	50458	76813	59561	3714	75929	59659	37082	55146	58008
PSMO	46780	106071	63351	23519	59872	76033	54586	2519	68078	53414	46296	50972	52559
KMB	43239	101932	58421	25318	36492	72715	46520	953	68503	54727	43762	53396	52285
ZSB	42246	97186	56994	22328	33438	74313	52086	-865	72376	64118	41464	52049	53948
NPK consortia+ZSB	51112	111426	68334	16451	43600	85611	53379	1660	83347	66849	30820	61601	53287
No culture	37390	86253	48377	-4943	29711	70575	37497	-4043	61075	50475	42196	42402	48937
CD (p=0.05)	4365	13046	2190	5361	-	7123	4048	-	6590	6667	NS	NS	NS

The effect of fertility levels and liquid biofertilizers on soil chemical properties were analysed at Dholi, SK Nagar, Kota, Imphal and Pantnagar centres (Table 3.5.3). There was no-significant difference observed in organic carbon content due to different fertility levels at Dholi and SK Nagar. Soil available N content increased significantly with 100% RDF at Kota, Imphal, Dholi and Pantnagar over the control. The soil available P content increased significantly with 100% RDF at Kota, Imphal and Pantnagar over the control. Whereas, non-significantly higher available P content was recorded with 100% RDF at Dholi, and with 75% RDF at SK Nagar. The soil available K content increased significantly with 100% RDF at Kota and Pantnagar, and with 75% RDF at Imphal over the control. Whereas, non-significantly higher available K content recorded with 100% RDF at Dholi, and with control at SK Nagar.

Soil organic carbon content increased significantly with NPK consortia + ZSB at SK Nagar (16.0%) over the control (no culture), and with ZSB at Dholi (Table 3.5.3). Soil available N content increased significantly with NPK consortia + ZSB at Kota (4.7%), Imphal (8.8%) and Pantnagar (7.8%) over the control and PSMO at Dholi (17.1%), and with KMB at Imphal (15.2%) over the control. Whereas, non-significantly higher available N content recorded with NPK consortia + ZSB over the control and PSMO at SK Nagar. Soil available P content increased significantly with NPK consortia + ZSB at Kota (17.1%) and at Imphal (21.5%) over the control. Whereas, non-significantly higher available P content recorded with ZSB at Dholi and SK Nagar, and with PSMO at Pantnagar. Soil available K content increased significantly with NPK consortia + ZSB at Kota (4.5%) and at Imphal (43.3%), and with KMB at Pantnagar (11.4%) over the control, and with ZSB at Dholi (26.3%) over the PSMO. Whereas, non-significantly higher available K content recorded with control at SK Nagar.

Table 3.5.3. Soil fertility as influenced by different fertility levels and liquid biofertilizers in mustard

Treatment	OC (%)		N					P					K				
	DOL	SKN	KOT	IMP	DOL	PNT	SKN	KOT	IMP	DOL	PNT	SKN	KOT	IMP	DOL	PNT	SKN
Fertility levels																	
100% RDF	0.58	0.24	290	345	171	223	118	54.9	25.6	13.8	12.5	52.0	458	267	135	228	215
75% RDF	0.53	0.26	283	331	166	200	124	51.0	24.8	13.5	10.9	54.3	447	270	132	207	221
Control	0.50	0.28	271	317	147	162	126	46.9	21.5	12.6	8.7	53.8	421	238	128	178	229
CD (p=0.05)	NS	NS	9	17	14	-	NS	2.8	2.1	NS	-	NS	22	25	NS	-	NS
Biofertilizers																	
<i>Azotobacter</i>	0.50	0.27	279	339	168	201	123	51.1	22.8	12.6	10.7	52.9	434	268	127	206	217
PSMO	0.49	0.23	284	328	146	195	120	52.2	25.5	13.6	11.9	53.5	448	263	114	205	216
KMB	0.54	0.26	281	349	152	192	124	51.7	24.5	12.9	10.2	54.2	445	273	130	215	224
ZSB	0.58	0.27	278	317	170	186	123	50.2	23.4	13.7	10.1	55.3	440	253	144	197	222
NPK consortia + ZSB	0.55	0.29	290	348	171	206	125	54.1	26.0	13.6	10.9	51.7	453	291	141	210	224
No culture	-	0.25	277	303	-	191	121	46.2	21.4	-	10.3	52.4	432	203	-	193	226
CD (p=0.05)	NS	0.04	8	23	14	-	NS	2.4	3.0	NS	-	NS	11	27	17	-	NS
Initial value	0.50	-	305	-	150	238	-	55.5	-	13.3	20.7	-	455	-	131	226	-

3.6 Optimization of mineral nutrient management for higher productivity

The experiment was initiated during 2021-22 at 18 locations. The trial was not conducted at Banda and Dholi centres. Results showed that application of 150% NPK significantly increased mustard seed yield at Kanke, Kanpur, Nagpur, SK Nagar and Sriganganagar compared to the control, 100% NPK and 125% NPK (Table 3.6.1). At Chatha, Bhubaneswar, Jobner, Kota and Morena seed yield increased significantly with 150% NPK over the control and 100% NPK, and non-significantly over 125% NPK. At Jhansi and Ludhiana seed yield increased significantly with 150% NPK over the control, and non-significantly over 100 and 125% NPK. At Imphal, Kangra, Pantnagar and Shillongani, the maximum seed yield was recorded with 125% NPK which was significantly higher compared to 100 % NPK at Imphal and Kangra, 150% NPK at Pantnagar, and the control at Shillongani.

Application of secondary (S) and micronutrients (Zn & B) and their enrichment with FYM significantly increased the seed yield of mustard at all the locations except at Morena, Pantnagar and Shillongani (Table 3.6.1). Nutrient supplementation resulted the maximum seed yield with 40 kg S+5 kg Zn+1 kg B/ha enriched with 500 kg FYM/ha at Chatha, Bhubaneswar, Jhansi, Jobner, Kangra, Kanpur, Kota, Ludhiana, Nagpur, SK Nagar and Sriganganagar. Application of 20 kg S+2.5 kg Zn+0.5 kg B/ha enriched with 500 kg FYM/ha increased seed yield at Pantnagar and Shillongani, and 20 kg S+2.5 kg Zn+ 0.5 kg B/ha at Imphal and Kanke.

Interaction: Interaction effects of major and micronutrients showed significant increase in seed yield at Kota and Sriganganagar (Table 3.6.1). At Kota, seed yield increased significantly with 150% NPK + 40 kg S+5 kg Zn+1 kg B/ha enriched with 500 kg FYM/ha over rest of the treatments. At Sriganganagar, seed yield increased significantly with 150% NPK + 40 kg S+5 kg Zn+1 kg B/ha enriched with 500 kg FYM/ha over the all combinations of control, 100, 125 and 150% NPK + secondary and micronutrients.

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

Major nutrients (M)	Secondary & micro nutrients (SM)				Mean
	20 kg S+2.5 kg Zn+ 0.5 kg B/ha	40 kg S+5 kg Zn+1 kg B/ha	20 kg S+2.5 kg Zn+0.5 kg B/ha enriched with 500 kg FYM/ha	40 kg S+5 kg Zn+1 kg B/ha enriched with 500 kg FYM/ha	
Chatha					
Control	787	893	1002	1035	929
100% NPK	1158	1237	1587	1650	1408
125% NPK	1333	1387	1708	1767	1549
150% NPK	1410	1535	1797	1803	1636
Mean	1172	1263	1523	1564	
CD (p=0.05)	Major nutrients (M) = 100; Secondary & micro nutrients (SM) = 104; MxSM = NS				
DOS: Oct 30 ; Recommended fertility levels NPK (kg/ha) - 80:40:20					
Bhubaneswar					
Control	411	503	568	648	532
100% NPK	973	1027	1048	1075	1031
125% NPK	1077	1107	1126	1145	1114
150% NPK	1098	1145	1199	1215	1164
Mean	890	945	985	1021	

CD (p=0.05)	Major nutrients (M) = 110; Secondary & micro nutrients (SM) = 82; MxSM = NS				
DOS: Dec. 16 ; Recommended fertility levels NPK (kg/ha) – 80:40:40					
Imphal					
Control	1152	1030	1137	1070	1097
100% NPK	1404	1119	1348	1289	1290
125% NPK	1696	1196	1615	1474	1495
150% NPK	1541	1189	1363	1296	1347
Mean	1448	1133	1366	1282	
CD (p=0.05)	Major nutrients (M) = 204; Secondary & micro nutrients (SM) = 139; MxSM = NS				
DOS: Nov. 24 ; Recommended fertility levels NPK (kg/ha) – 60:30:30					
Jhansi					
Control	1012	1710	1911	2084	1679
100% NPK	1025	1769	1998	2197	1747
125% NPK	1034	1746	1926	2119	1706
150% NPK	1036	1869	2206	2399	1877
Mean	1026	1773	2011	2200	
CD (p=0.05)	Major nutrients (M) = 186; Secondary & micro nutrients (SM) = 54; MxSM = NS				
DOS: Oct 30 ; Recommended fertility levels NPK (kg/ha) - 120:60:60					
Jobner					
Control	1211	1358	1242	1367	1294
100% NPK	1650	1790	1678	1819	1734
125% NPK	1822	1987	1859	1976	1911
150% NPK	1835	1998	1878	2000	1928
Mean	1630	1783	1664	1790	
CD (p=0.05)	Major nutrients (M) = 134; Secondary & micro nutrients (SM) = 115; MxSM = NS				
DOS: Oct 21 ; Recommended fertility levels NPK (kg/ha) – 60:40:00					
Kangra					
Control	631	665	760	797	714
100% NPK	1711	1887	1988	2116	1926
125% NPK	1944	2024	2207	2318	2123
150% NPK	1925	2009	2135	2228	2074
Mean	1553	1646	1772	1865	
CD (p=0.05)	Major nutrients (M) = 117; Secondary & micro nutrients (SM) = 84; MxSM = NS				
DOS: Oct 30 ; Recommended fertility levels NPK (kg/ha) – 120:60:60					
Kanke					
Control	642	607	661	728	660
100% NPK	1305	1474	1211	1189	1295
125% NPK	1412	1218	1268	1226	1281
150% NPK	1404	1395	1219	1421	1360
Mean	1191	1173	1090	1141	
CD (p=0.05)	Major nutrients (M) = 63; Secondary & micro nutrients (SM) = 54; MxSM = NS				
DOS: Oct 30 ; Recommended fertility levels NPK (kg/ha) – 80:60:40:20					
Kanpur					

Control	1300	1376	1418	1443	1383
100% NPK	1481	1608	1799	1968	1714
125% NPK	2286	2434	2624	2709	2513
150% NPK	2836	2921	3005	3048	2652
Mean	1976	2085	2212	2291	
CD (p=0.05)	Major nutrients (M) = 69; Secondary & micro nutrients (SM) = 90; MxSM = NS				
DOS: Oct 29 ; Recommended fertility levels NPK (kg/ha) – 100:60:60					
Kota					
Control	1201	1374	1383	1633	1397
100% NPK	1884	2298	2156	2271	2152
125% NPK	2292	2241	2183	2436	2288
150% NPK	2263	2391	2225	2453	2333
Mean	1910	2076	1987	2198	
CD (p=0.05)	Major nutrients (M) = 168; Secondary & micro nutrients (SM) = 146; MxSM = 291				
DOS: Oct 16 ; Recommended fertility levels NPK (kg/ha) - 100:50:30					
Ludhiana					
Control	863	947	946	989	936
100% NPK	1967	2301	2176	2457	2225
125% NPK	2260	2403	2361	2500	2381
150% NPK	2309	2339	2456	2585	2422
Mean	1850	1997	1985	2132	
CD (p=0.05)	Major nutrients (M) = 286; Secondary & micro nutrients (SM) = 145; MxSM = NS				
DOS: Nov 15; Recommended fertility levels NPK (kg/ha) – 100:30:15					
Morena					
Control	1225	1238	1200	1338	1250
100% NPK	2213	2148	1921	1599	1970
125% NPK	2170	2119	2200	2263	2188
150% NPK	2183	2287	2302	2272	2261
Mean	1948	1948	1906	1868	
CD (p=0.05)	Major nutrients (M) = 100; Secondary & micro nutrients (SM) = NS; MxSM = NS				
DOS: Nov. 01; Recommended fertility levels NPKS (kg/ha) - 80:40:20					
Nagpur					
Control	875	890	902	910	894
100% NPK	965	960	968	977	968
125% NPK	1071	1101	1114	1127	1103
150% NPK	1181	1205	1250	1373	1252
Mean	1023	1039	1058	1097	
CD (p=0.05)	Major nutrients (M) = 27; Secondary & micro nutrients (SM) = 14; MxSM = NS				
DOS: Oct 26 ; Recommended fertility levels NPKS (kg/ha) - 80:40:20:20					
Pantnagar					
Control	964	987	1098	1067	1029
100% NPK	1997	2002	2026	2034	2015
125% NPK	2123	2144	2160	2166	2148

150% NPK	1691	1712	1769	1757	1732
Mean	1694	1711	1763	1756	
CD (p=0.05)	Major nutrients (M) = 350; Secondary & micro nutrients (SM) = NS; MxSM = NS				
DOS: Nov. 11 ; Recommended fertility levels NPK (kg/ha) – 120:40:20					
SK Nagar					
Control	1354	1383	1499	1588	1456
100% NPK	2048	2298	2227	2379	2238
125% NPK	1853	2055	2118	2381	2102
150% NPK	2422	2337	2555	2556	2468
Mean	1919	2018	2100	2226	
CD (p=0.05)	Major nutrients (M) = 286; Secondary & micro nutrients (SM) = 140; MxSM = NS				
DOS: Oct 30 ; Recommended fertility levels NPK (kg/ha) – 50:00:00					
Shillongani					
Control	308	347	393	410	364
100% NPK	719	594	555	554	605
125% NPK	788	640	948	786	791
150% NPK	509	548	833	532	605
Mean	581	532	682	579	
CD (p=0.05)	Major nutrients (M) = 148; Secondary & micro nutrients (SM) = NS; MxSM = NS				
DOS: Oct 27 ; Recommended fertility levels NPK (kg/ha) - 60-30-30					
Sriganganagar					
Control	1003	1301	1184	1376	1216
100% NPK	1439	1411	1282	1441	1393
125% NPK	1362	1368	1517	1510	1439
150% NPK	1265	1495	1636	1679	1519
Mean	1267	1394	1405	1501	
CD (p=0.05)	Major nutrients (M) = 59; Secondary & micro nutrients (SM) = 104; MxSM = 104				
DOS: Nov 03; Recommended fertility levels NPK (kg/ha) – 75:40:30					

Application of 150% NPK recorded the maximum net returns at Jobner, Chatha, Kanpur, Kota, Chatha, Jhansi, Bhubaneshwar, Nagpur and SK Nagar over the control, 100 and 125% NPK (Table 3.6.2). Application of 125% NPK recorded the maximum net returns at Imphal, Pantnagar, Kangra and Shillongani. Whereas, application of 100% NPK recorded the maximum net returns at Kanke.

Application of secondary and micronutrients and their enrichment with FYM significantly increased the net returns at all the locations except at Pantnagar. Nutrient supplementation significantly increased net returns with 40 kg S +5.0 kg Zn+ 1 kg B/ha enriched with 500 kg FYM/ha over the 20 kg S +2.5 kg Zn+ 0.5 kg B/ha, 40 kg S +5.0 kg Zn+ 1 kg B/ha and 20 kg S +2.5 kg Zn+ 0.5 kg B/ha enriched with 500 kg FYM/ha at Jhansi (10.3-16.1%) and Nagpur (11.5-31.9%), over the 20 kg S +2.5 kg Zn+ 0.5 kg B/ha and 40 kg S +5.0 kg Zn+ 1 kg B/ha at Kangra (20.5-26.0%) and SK Nagar (16.5-19.4%), over the 20 kg S +2.5 kg Zn+ 0.5 kg B/ha and 20 kg S +2.5 kg Zn+ 0.5 kg B/ha enriched with 500 kg FYM/ha at Kota (11.1-16.7%), and over the 20 kg S +2.5 kg Zn+ 0.5 kg B/ha at Jobner (12.0%). Application of 20 kg S +2.5 kg Zn+ 0.5 kg B/ha enriched with 500 kg FYM/ha significantly increased the net returns over the 20

kg S +2.5 kg Zn+ 0.5 kg B/ha and 40 kg S +5.0 kg Zn+ 1 kg B/ha at Chatha (35.4-43.4%), and over the 40 kg S +5.0 kg Zn+ 1 kg B/ha and 40 kg S +5.0 kg Zn+ 1 kg B/ha enriched with 500 kg FYM/ha at Shillongani (68.3-84.2%). Application of 20 kg S +2.5 kg Zn+ 0.5 kg B/ha significantly increased the net returns over the 20 kg S +2.5 kg Zn+ 0.5 kg B/ha enriched with 500 kg FYM/ha and 40 kg S +5.0 kg Zn+ 1 kg B/ha enriched with 500 kg FYM/ha at Kanke (21.3-31.2%). The net returns also recorded the maximum with 40 kg S +5.0 kg Zn+ 1 kg B/ha enriched with 500 kg FYM/ha at Kanpur and with 20 kg S +2.5 kg Zn+ 0.5 kg B/ha enriched with 500 kg FYM/ha at Imphal.

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

Treatment	Net return (Rs./ha)												
	JOB	KPR	KOT	CHT	JHS	BHU	NGP	IMP	PNT	KNK	KNG	SHL	SKN
Major nutrients													
Control	40458	69808	70684	28033	20195	-8961	27618	20460	28765	6382	10963	5150	32859
100% NPK	60038	86569	115998	48577	54918	12597	28938	24686	73032	35277	65372	17344	64902
125% NPK	68303	126915	122774	54802	64881	15905	35499	33690	78890	32086	74024	29153	57800
150% NPK	68493	149091	127559	58292	71891	17543	43256	24835	56460	34829	70235	15004	74068
CD (p=0.05)	6763	-	10926	5026	9340	-	2202	-	5022	3321	5931	10393	13297
Secondary & micro nutrients													
20 kg S +2.5 kg Zn+ 0.5 kg B/ha	55637	99733	99651	38557	50245	7120	28373	35525	57793	30784	49010	17432	52777
40 kg S +5.0 kg Zn+ 1 kg B/ha	62207	105272	108608	40829	52908	8119	30866	18627	57915	28952	51227	12502	54084
20 kg S +2.5 kg Zn+ 0.5 kg B/ha enriched with 500 kg FYM/ha	57138	111684	104400	55295	50387	10935	33565	27363	61227	23456	58599	23031	59769
40 kg S +5.0 kg Zn+ 1 kg B/ha enriched with 500 kg FYM/ha	62311	115692	116332	55021	58346	10910	37422	22155	60211	25382	61759	13685	62998
CD (p=0.05)	5818	-	9470	5257	2744	-	1002	-	NS	3026	4244	7863	6510

Effect of different major and micronutrients on soil chemical properties were determined at Jhansi, SK Nagar, Kota, Imphal and Pantnagar centres (Table 3.6.3). Soil organic carbon content increased significantly with 150% NPK at SK Nagar over the 100 and 125% NPK, and non-significantly with 150% NPK over the control at Jhansi. Soil available N content was increased significantly with 150% NPK at Kota, Jhansi, and Pantnagar over the control, and at SK Nagar over the 100% NPK. Non-significantly higher available N content recorded with 125% NPK over the control at Imphal. Soil available P content was increased significantly with 150% NPK at Kota, Jhansi and Pantnagar, and non-significantly higher at Imphal over the control. Non-significantly higher available P content recorded with control at SK Nagar. Soil available K content was increased significantly with 150% NPK at Kota, Jhansi and Pantnagar, and non-significantly higher at Imphal over the control. The non-significantly higher available K content recorded with control over the 100 & 150% NPK at SK Nagar.

Application of secondary and micronutrients and their enrichment with FYM significantly influenced the soil parameters at all the locations except at Jhansi (Table 3.6.3). Soil organic carbon content increased significantly with 40 kg S + 5 kg Zn + 1 kg B/ha by 12.5% over the 20 kg S + 2.5 kg Zn + 0.5 kg B/ha at SK Nagar. The available N content increased significantly with 40 kg S + 5.0 kg Zn + 1 kg B/ha enriched with 500 kg FYM/ha at Kota (4.3%), Imphal (17.4%) and Pantnagar (13.4%) over the 20 kg S + 2.5 kg Zn + 0.5 kg B/ha, and with 20 kg S + 2.5 kg Zn + 0.5 kg B/ha enriched with 500 kg/ha FYM at SK Nagar (6.2%) over the 40 kg S + 5 kg Zn + 1 kg B/ha. Application of 40 kg S + 5 kg Zn + 1 kg B/ha enriched with 500 kg/ha FYM significantly increased the available P content at Kota (15.5%) and Imphal (22.5%) over the 20 kg S + 2.5 kg Zn + 0.5 kg B/ha, and with 20 kg S + 2.5 kg Zn + 0.5 kg B/ha enriched with 500 kg/ha FYM at Pantnagar (24.8%) over the 40 kg S + 5 kg Zn + 1 kg B/ha. Application of 20 kg S + 2.5 kg Zn + 0.5 kg B/ha significantly increased the available P content at SK Nagar by 13.3% over the 40 kg S + 5 kg Zn + 1 kg B/ha enriched with 500 kg/ha FYM. The soil available K content was significantly increased with 40 kg S + 5 kg Zn + 1 kg B/ha enriched with 500 kg/ha FYM at Kota (3.7%), Imphal (9.1%), Jhansi (3.2%) and Pantnagar (17.1%) over the 20 kg S + 2.5 kg Zn + 0.5 kg B/ha. Application of 20 kg S + 2.5 kg Zn + 0.5 kg B/ha enriched with 500 kg/ha FYM significantly increased the available K content at SK Nagar by 4.2, 8.3 and 8.3% over the 20 kg S + 2.5 kg Zn + 0.5 kg B/ha, 40 kg S + 5 kg Zn + 1 kg B/ha and 40 kg S + 5 kg Zn + 1 kg B/ha enriched with 500 kg/ha FYM, respectively.

Table 3.6.3. Soil fertility as influenced by different nutrient management options in mustard.

Treatment	OC (%)		N					P					K				
	JHS	SKN	KOT	IMP	JHS	PNT	SKN	KOT	IMP	JHS	PNT	SKN	KOT	IMP	JHS	PNT	SKN
Major nutrients																	
Control	0.2	0.27	268	331	160	186	115	46.0	19.0	9.5	11.1	54.3	416	213	190	183	217
100% NPK	0.21	0.24	291	335	160	211	112	54.3	20.4	9.5	11.5	52.4	447	215	191	209	203
125% NPK	0.21	0.23	296	356	160	210	115	58.1	20.6	9.5	12.5	51.4	454	219	191	223	209
150% NPK	0.22	0.27	302	353	161	214	126	60.4	20.6	9.6	13.7	50.3	465	222	193	239	216
CD (p=0.05)	NS	0.02	9	NS	0.4	-	3	2.6	NS	0.03	-	NS	14	NS	1	-	7
Secondary & micronutrient																	
20 kg S + 2.5 kg Zn + 0.5 kg B/ha	0.19	0.24	281	311	159	194	115	49.5	17.8	9.5	11.8	54.4	435	208	189	199	213
40 kg S + 5 kg Zn + 1 kg B/ha	0.2	0.27	291	341	160	198	113	55.7	20.0	9.5	10.9	52.5	448	212	189	204	205
20 kg S + 2.5 kg Zn + 0.5 kg B/ha enriched with 500 kg/ha FYM	0.21	0.26	286	358	160	209	120	52.6	21.0	9.5	13.6	53.5	441	222	192	219	222
40 kg S + 5 kg Zn + 1 kg B/ha enriched with 500 kg/ha FYM	0.23	0.24	293	365	162	220	119	57.1	21.8	9.6	12.4	48.0	451	227	195	233	205
CD (p=0.05)	NS	0.01	8	22	NS	-	3	2.7	2.0	NS	-	1.9	7	11	1	-	7
Initial values	0.22	-	310	-	159	235	-	52.5	-	9.4	20.3		450	-	188	221	

4. Plant Pathology

Disease Scenario

During 2021-22, moderate to severe occurrence of Alternaria blight and white rust diseases was recorded at five locations. Low to moderate incidence of downy mildew was observed at the cotyledonary stage at MOR. Powdery mildew severity was moderate at BPR to high at SKN, JAG and MOR. Moderate to severe incidence of Sclerotinia rot was observed at BPR. Different trials were sown on dates as given below:

Centre	Date of sowing of different trials 2021								
	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.9	4.10
PNT	Nov 09 (A and B)	Dec 04	Dec 03	-	Dec 03	Dec 06	Dec 06	Dec 06	-
HSR	Nov 11 (A and B)	Nov 10	Nov 10	Nov 10	Nov 11	Nov 11	-	Nov 10	Nov 10
LDH	Oct 29 (A and B)	Oct 29	Oct 29	Oct 29	Oct 29	-	Oct 29	Oct 30	-
SGN	Nov 02	Nov 02	-	-	-	-	-	Nov 02	-
NDH	Oct 30 (A)	Oct 30	-	-	Nov 16	-	-	-	-
MOR	Nov 26 (A and B)	Nov 26	Nov 26	Nov 26	-	Nov 26	-	Oct 31	-
SKN	Nov 25 (A)	Nov 25	-	-	-	Nov 25	-	-	Nov 25
JAG	Dec 10 (A)	Dec 10	Dec 10	-	-	Dec 10	Dec 22	-	-
DOL	Dec 03 (A and B)	Dec 04	Dec 03	-	Dec 03	Dec 06	Dec 06	Dec 06	-
SHL	Nov 03 (A and B)	Nov 05	Nov 03	-	Nov 05	Nov 09	Nov 29	Oct 26	Nov 12
BPR	Oct 26	-	-	Oct 30	Oct 26	-	-	Nov 30	Oct 26
JHS	-	Nov 08	-	-	Nov 22	Nov 08	-	Oct 28	Oct 28
VAR	Nov 20 (A)	Nov 21	Nov 20	Nov 20	Nov 20	Nov 20	Nov 27	-	-
BND	Nov 15 (A)	-	-	-	-	-	-	-	-

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

Natural conditions: DOL, SHL, HSR, MOR, PNT, SGN, JAG, LDH, KPR, BND, SKN, VAR

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

Total 43 breeding lines including 31 Indian mustard, 10 Gobhi Sarson and 2 Yellow Sarson with 9 checks were sown in single 3-m row in randomized completely block design (RCBD) with 2 replications. Susceptible checks were used after every two test rows. Under artificial conditions, repeated inoculation was done after collecting inoculum from naturally infected plants for AB and WR to facilitate the secondary spread. For SR screening, 5 mm disc of 7-days old fungal mycelium was placed on third internode of plant at flowering stage.

Observations of DM (20 DAS), WR, AB on leaves (ABL), PM and SR (% incidence) were recorded at 75 and/or 90-100 days after sowing (DAS) depending upon location under natural and artificial conditions. Number of staghead incidence and Alternaria pod blight (ABP) severity were recorded 15-days before harvest (DBH). The results are given in table 4.1.1-5. Disease severity below 20% in susceptible check was observed at JAG, LDH, MOR (ABL), SGN, SHL, MOR, LDH (ABP), LDH, SKN, BND, VAR (WR), PNT (DM), LDH, PNT MOR, VAR, SGN (SR) and are therefore, excluded from tables. All disease data recorded in per cent were converted as arc sin

transformation value and analysed using ANOVA. None of the entries showed tolerance/resistance to AB, PM and SR.

WR: Under natural condition, DRMR 2018-19, JC 36, Rohini (A4A5)-491, PB (A4A5)-842, Varuna (A4A5)-936-279, PJK (A4A5)-21, OIJ5001 of *B. juncea* and entries of *B. napus* were found resistant (Table 4.1.2). Under artificial condition, DRMR 2018-19, PDZ 14, OIJ5001, JC 36, PB (A4A5)-842, Varuna (A4A5)-936-279, PJK (A4A5)-21, DRMR 2017-16, (Bj) and HNS 1102, GSH 1703, DRMRIN 20-3, AKGS 8060, GSH 2155, DRMRIN 20-23, GSH 1723, AKGS 19-8, HNS 1206, JGS 15-6 (Bn) were found resistant to WR at MOR, HSR, BPR and PNT locations (Table 4.1.4).

DM: DRMR 2018-19, DRMR 2017-16, PDZ 14, OIJ5001, DRMRCI 128, JC 36, Rohini (A4A5)-491, PB (A4A5)-842, Varuna (A4A5)-936-279, PJK (A4A5)-21 of *B. juncea* showed resistance to DM at MOR (Table 4.1.4).

4.2. Uniform Disease Nursery for major diseases

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

Total 52 entries of *B. juncea* with 9 checks, were sown in a single 3-m row with two replications in RCBD. Susceptible checks were sown after every two test rows. Observations on AB, WR, DM, PM severity and SR incidence were recorded in UDN under natural conditions (Tables 4.2.1-2).

WR: DRMR 2018-41, DRMR 2018-37 (4 years), DRMRSJ 4, PMW 18, DRMR 2018-25, (3 years), PAB 14-7, PAB 14-8, DRMRQ-1-22, DRMRQ-202, (2 years), DRMRDR 2135, DRMRIJWR 20-15, DRMRIJ 12-26, PAB 14-18, DRMRIJWR 20-19, DRMR 2018-19, DRMRDR 2133, DRMRIJWR 20-13, DRMRIJ 12-21, DRMRIJWR 20-24, DRMRSJ 271, DRMRIJWR 20-11, DRMRIJWR 20-17, DRMRDR 2141, DRMRIJ 12-44, DRMRIJWR 20-14, DRMRSJ 349, DRMRIJWR 20-26, DRMR 2018-1, DRMRIJWR 20-20, and DRMRDR 2116 of *B. juncea* showed resistance reaction to WR under natural conditions with mean disease severity <10%, and the highest WR severity was on check Rohini (30.2%) and NRCHB 101 (30.3%) at 7 locations (Table 4.2.2).

AB: PAB 14-18 showed tolerant reaction to AB both on leaves (22.3%), and silique (8.6%) under natural condition at HSR, SHL, MOR, DOL locations.

4.3 National Disease Nursery (NDN) for Alternaria blight

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

Total 32 strains of *B. juncea* with 9 checks were sown in paired rows of 3 m length. Observation on AB was recorded on leaves 90/100 DAS at silique formation stage and on silique 15-days before harvesting under artificial inoculation conditions at SHL, DOL, PNT, MOR and HSR. Data of JAG and LDH excluded as the disease severity was <20% on susceptible check. Data from KPR was not received. DRMR-PMJ 17 (20.8%) and PAB 17-15 (24.8%) showed tolerant reaction to AB on leaves over check Rohini (33.1%) and NRCHB 101 (35.4%) under artificial condition at HSR, PNT, SHL, MOR, DOL and VAR locations (Table 4.3.1).

Entries of *B. juncea* VIZ., DRMR 2018-37, DRMR 2018-41 (4 years), PMW 18, DRMRSJ 4 (3 years), DRMR 2018-1, DRMR 2018-19, DRMR 2018-25 (2 years) showed WR resistant reaction. Moderate WR severity was recorded on susceptible check Rohini (38.4%) and NRCHB 101 (31.3%). DRMRSJ 349, DRMRM 163, PRD 17-22, DRMRSJ 206, DRMRDR 2141, DRMRDR 2116, PAB 2014-8 of *B. juncea* entries were also found resistant to WR under natural condition (Table 4.3.2).

4.4 National Disease Nursery (NDN) for white rust

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

Total 55 genotypes, with 9 checks, were sown in paired-row of 3 m length between susceptible check. Observation for WR on leaves and stag head formation was recorded at 100 DAS under artificial inoculation conditions. Reaction to AB, SR and PM was also recorded under natural conditions (Table 4.4.1-2).

Entries of *B. juncea*, RH 1700-4, RH 1700, DRMR 2018-41, DRMRCI 131, DRMRCI 132, DRMRCI 139, DRMRDR 2141, DRMRSJ 349, DRMRM 18-36-12,

DRMRSJ 206, DRMR 2018-37, and DRMR 2018-25 showed immune reaction to WR at PNT, HSR and BPR locations. Other strains which showed resistance to WR with <10% disease severity were DRMR 2018-1, DRMRM 18-35-11, DRMRM 18-37-13, RH 1400-1, DRMRWR 153, RH 1400, PDZ 16, RH 1700-3, DRMRDR 2195, DRMRCI 126, RH 1700-1 at HSR, PNT, BPR locations (Table 4.4.2). Consequently, DRMR 2018-25, DRMRM 18-36-12, DRMRM 18-37-13, DRMR 18-35-11, RH 1700-1, RH 1700-4, RH 1700-3, DRMRCI 126, DRMRCI 131, DRMRCI 132 (2 years), RH 1700, RH 1700-1 (3 years), DRMR 2018-37, DRMR 2018-41, RH 1400-1, and RH 1400 (4 years).

None of the entries of *B. juncea* showed resistance to AB, while NPJ 249 seems promising to SR at PNT and BPR (Table 4.4.2). WR disease severity on leaves of susceptible check Rohini and NRCHB 101 were 39.7% and 41.0% respectively, being maximum 46.9% on NPJ 256.

4.5 National Disease Nursery (NDN) for Sclerotinia rot

Locations: PNT, HSR, LDH, BPR, VAR, SHL, DOL, SGN, JHS and NDH

Total 8 entries of *B. juncea* and 6 checks were sown in paired rows of 3 m length between susceptible check (Rohini, NRCHB 101 and NRCYS-5-2) and tolerant check NPC 16. Stem inoculation was done to ensure uniform SR infection. Per cent SR incidence was recorded prior to harvest and mean lesion size (cm) was also measured 3-weeks after artificial inoculation. In addition, reaction to AB, WR and PM was also recorded (Table 4.5.1-2). None of the entries of *B. juncea* showed tolerance to SR. Entries of *B. juncea* DRMRDR 2151 and DRMRSJ 25 showed resistance to WR (3 location).

4.6 Screening of IVT entries of Brassica against different diseases

Locations: MOR, DOL, SHL, PNT, HSR, LDH, JHS, KPR, SKN and VAR

Total 146 strains including 12 checks were sown in single 3m row in RCBD with 2 replications. Susceptible check(s); Rohini and NRCHB 101 were used after every 2 test rows. Observation on AB, WR, DM, and PM was recorded. Staghead incidence and AB severity on pod was recorded 15-days before harvesting. Entries showing resistant/tolerant/susceptible reaction to AB, WR, DM and PM under natural conditions are listed in Table 4.6.1-2. Data from KPR centre not received. None of the entry was found tolerant/ resistant to AB and PM.

WR: DRMRIJ 16-9-7, DRMRCI 139, DRMRCI(Q) 57, PDZ 17, JC 16, IJ19R 5004, DRMRCI(Q) 47, PDZ 16, PAB 2014-17, DRMRHJ 1117, DRMRCI 143, PHR 4457, NAMJH 21-01, DRMR 2018-25, DRMRIJ 20-157, DRMRCI(W) 125, DRMR 2018-37 of *B. juncea* were found resistant to WR at PNT, SKN, JAG, MOR and HSR (Table 4.6.2). Comparative tolerance to AB was observed in PAB 2014-7 (24.7%) and DRMRHJ 3130 (24.5%) entries. None of the entries found resistant to AB, PM and SR.

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

An experiment was conducted to assess the yield losses caused by the major diseases of rapeseed-mustard under rice-fellow-mustard cropping system at SHL, JAG, DOL and VAR locations using cv. Varuna. Among different treatments at SHL, JAG and DOL locations, the foliar spray of Tebuconazole 50%+ trifloxistrobin 25% WG @ 0.5g/l gave maximum 77.8% reduction of AB disease over check followed by Iprodione 50WP-FS @ 0.2% which gave 71.4% reduction with increased yield by 41.8 and 35.8% respectively, constantly for second year. Seed treatment along with foliar spray of garlic bulb extract @ 1% w/v, and *T. harzianum* also found effective in reducing the AB severity by 57.0% and 56.2% respectively, over check (Table 4.7.1).

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

Experiment on epidemiological studies of rapeseed-mustard diseases was conducted at PNT, SHL, SKN, MOR, JAG, DOL, HSR, JHS and KPR using cvs. Varuna and local variety sown on 8 different dates starting from October 01 to November 19 at weekly interval without adopting any protection measures against pest and diseases (Table 4.8.1-8). Data for initial appearance of disease followed by per

cent disease severity was recorded in each plot twice a week on Tuesday and Friday till harvest. Data from KPR not received.

PNT

Two cultivars Varuna and Kranti were sown at eight different dates. Downy mildew disease first appeared 8 DAS on Oct 15 sown Varuna and Kranti cultivars. WR disease first appeared 45 DAS on Nov 12, 19 sown crops (Table 4.8.2b). AB disease was first noticed at 41 DAS on Nov 19 sown crop of both the cultivars. Whereas, on Oct 01 sown crop, the disease appeared late i.e. 77 DAS (Table 4.8.2c). AB on pods first appeared 87 DAS on late sown (Nov 12, 19) crop. On early (Oct 01) sown crop, the symptoms on pod appeared late after 126 days of sowing which was 4 days late than last year (Table 4.8.2).

SHL

Experiment was laid out with cv. Varuna and TM 2 sown on 8 dates starting from Oct 01 to Nov 19 at weekly intervals. Due to heavy rains during second week of October, crop was not sown on Oct 08 and Oct 15 dates. ABL was first observed 34 DAS on Nov 19 sown TM 2. AB on silique first appeared 82 DAS on Nov 19 sown cv TM 2, which appeared 123 DAS on early sown (Oct 01) Varuna. Maximum disease severity was at 39.7% (110 DAS) on Nov 12 sown cv TM 2 (Table 4.8.4a). WR disease first appeared 42 DAS on Nov 19 sown crop. Maximum yield was recorded in Nov 05 sown cv Varuna (16.7 q/ha) and 11.5 q/ha of TM 2 sown on Oct 29. Yield data revealed that the best sowing time of crop in the region could be last week of October (Table 4.8.4).

SKN

Experiment was laid out with cv. Varuna and GM 2 sown at 8 sowing dates starting from Oct 01 to Nov. 19 at weekly intervals. Powdery mildew disease first appeared at 88 DAS instead of 89 DAS, 79 DAS, 83 DAS, 76 DAS during 2020-21, 2019-20, 2018-19, 2017-18, respectively on Nov 19 sown both Varuna and cv. GM 2. The maximum disease severity was observed in Nov 19 sown cv. Varuna (100.0%) and GM 2 (95.5%). The maximum seed yield reduction was observed in late sown crop (Table 4.8.3a). Although, highest yield was observed in Oct 01 sown GM 2 (19.3q/ha) and Varuna (18.5q/ha). WR was observed first 60 DAS on Varuna and 61 DAS on GM 2 on Nov 19 sown crop which was maximum (28.6%) on Nov 12 sown crop (Table 4.8.3b).

MOR

Experiment was laid out with cv. Varuna and Rohini as per technical programme. AB on leaf first appeared at 70 DAS on Nov 12, 19 sown crop of both the cultivars Varuna and Rohini. Whereas, SR appeared at 80 DAS in late sown crop of Nov 19 (Table 4.8.7a). PM was observed first 90 DAS and was maximum 78.7% reported on cv Rohini at 130 DAS in Nov 19 sown crop (Table 4.8.7B). WR appeared first on 48 DAS in Nov 12, 19 sown Rohini and Varuna and progressed till 130 DAS on early sown crop. WR disease severity was maximum up to 36.4% on Nov 19 sown Rohini. Maximum staghead incidence 66.7% was observed on Nov 12 sown Rohini. Maximum yield (34.7 q/ha) was recorded in Oct 15 sown Rohini (Table 4.8.7a).

JAG

Experiment on epidemiological studies of AB, WR and PM was laid out with cvs. Varuna and CG Sarson as per technical programme. WR first appeared at 42 DAS on both Varuna and CG Sarson sown on Nov 19. Initiation of AB was reported at 36 DAS on Nov 12 sown Varuna and CG Sarson. PM appeared first at 40 DAS on Nov 19 sown Varuna (Table 4.8.5). Maximum yield (18.2 q/ha) was recorded in Oct 29 sown Varuna.

DOL

Experiment was laid out using cv. Varuna and Rajendra Suflam with 5 dates of sowing starting from Oct 22 to Nov 19 at weekly intervals. AB was first observed at 25 DAS and 30 DAS on Varuna and Rajendra Suflam, respectively. The disease continued to progress on leaves up to 140 DAS on both the cultivars (Table 4.8.8).

HSR

Experiment was conducted with 7 dates of sowing using cvs. Varuna and RH 30. Initial date of sowing on Oct 01 was failed due to rains. WR appeared first at 53 DAS on Nov 19 sown RH 30 which was further spread on Nov 12 and Nov 5 sown crop (Table 4.8.1A). Staghead formation observed first at 81 DAS on both Varuna and RH 30 on Nov 19 sown crop (Table 4.8.1B). AB appeared first 85 DAS on Nov 19 sown crop of both the cultivars (Table 4.8.1C). SR disease initiation was observed 70 DAS in Nov 12 and Nov 19 sown cv Varuna and RH 30. Maximum incidence was 46.7% in cv. RH 30 and 44.8% in cv. Varuna sown on Nov 05. While, the maximum yield 29.9 q/ha was of Varuna and 29.0 q/ha of RH 30 in Oct 01 sown crop (Table 4.8.1D).

JHS

Experiment was conducted using Giriraj and Varuna varieties with 8 sowing dates starting from Oct 01 to Nov 19 at weekly interval. AB appeared first on leaves at 42 DAS on Nov 19 sown Varuna and seen on pods at 83 DAS on Nov 19 sown Varuna (Table 4.8.6a). WR appeared first at 47 DAS on Nov 19 sown Varuna (Table 4.8.6b). PM initiated at 79 DAS in Nov 19 sown Varuna. Optimum time of sowing in the Bundelkhand region for obtaining higher seed yield is first fortnight of October, which was obtained 32.4 q/ha in Oct 29 sown Varuna.

4.9 Efficacy of fungicides against major rapeseed-mustard diseases

The experiment was conducted at HSR, LDH, SHL, JHS, MOR, DOL, SGN, BPR and PNT in plot size 3x5m with 30x10 cm spacing using the variety DRMRIJ 31 with three replications to study the efficacy of fungicides against major diseases. Ten plants from each plot were tagged for recording observations on AB, WR, PM and SR severity/ incidence. Data revealed that AB severity was minimum (14.0%) in Tebuconazole 50% + Trifloxostrobin 25% WG@0.1% in comparison to control (31.5%) similar as last year results. Although, all tested fungicides were effective to reduce AB severity over control both on leaves and pods (Table 4.9.1). Metalaxyl 4% + Mancozeb 64% @ 0.25% was found effective to minimize both WR severity on leaf (13.5%) and staghead incidence (9.5%) in comparison to check (34.3%) similar as last year. PM severity was observed minimum 7.8% in Tebuconazole 50% + Trifloxostrobin 25% WG@ 0.1% over control (40.7%). Both Propiconazole 25% EC @0.1% and Tebuconazole 50% + Trifloxostrobin 25% WG@0.1% were found effective in reducing the incidence of SR up to 10.3% and 13.1% respectably, as compared to control (28.3%) consequently, the seed yield 1997.5 kg/ha was highest in Tebuconazole 50% + Trifloxostrobin 25%.

4.10 Bio-management of rapeseed-mustard diseases

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

The experiment on bio-management of rapeseed-mustard diseases was conducted at 8 locations with 3 replications on 3x5 m size plots with 30x10 cm spacing using DRMRIJ 31 cultivar with 6 treatments. Ten plants from each plot were tagged for recording observations on AB, WR, PM and SR severity/ incidence. Data from Varanasi centre not received. Minimum AB severity observed on leaves 23.2% and pods 20.1%, WR severity 25.4% and SR incidence 14.8% by applying seed treatment (10g/kg) + foliar spray with *T. harzianum* at 60 and 75 DAS followed by foliar spray with *Bacillus subtilis* 10⁶c.f.u. (24.0%) over control with highest severity 38.7% ABL, 29.7% ABP, 37.0% WR on leaves, SR incidence 27.2% (Table 4.10.1-2). Maximum yield 1655 kg/ha was observed in the same treatment due to reduction of AB, WR, PM and SR diseases.

Survey of farmer's field for disease outbreak

HSR

Survey was conducted for the appearance and severity of diseases on Indian mustard at 43 locations/villages in major mustard growing areas of Haryana state. White rust disease, which use to show its appearance early in Haryana, had made its presence twenty days later and its severity ranged between 0-15% at farmer's field, however, up to 25-30% white rust severity was noticed at some location in Hisar and Bhiwani districts. Incidence of Sclerotinia rot was noticed ranging between 5-10% at some of the locations in areas having previous history of this disease. Alternaria blight disease severity ranged between 0-25% throughout the state. Bacteria stalk rot was also noticed at some locations after first irrigation. In low lying areas, powdery mildew disease appeared moderately even in late sown conditions in Haryana.

MOR

Survey was conducted during crop season at adjoining areas of Morena. During the year, almost all the mustard diseases appeared late as compared to previous years. AB first appeared on Dec 22, WR on Dec 29, Powdery mildew on Feb 20 and Sclerotinia rot was first seen on Feb 26. The weather condition was not much favorable to disease at early stage of the crop but in month of Dec & Jan, winter rains promoted all foliar diseases. The staghead and powdery mildew disease were observed in most of the fields of late sown crop.

SKN

Survey of four farmer's fields for disease outbreak was conducted. White rust was observed in moderate form and powdery mildew was observed in severe form on late sown crops. On timely sown crops, powdery mildew disease was appeared during first fortnight of February month (8th Feb) and 25-30 per cent severity was observed. White rust disease was appeared during first fortnight of January month (10th Jan) and 15-20 per cent severity was observed.

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

Code No.	Entries	% ABL severity (100 DAS)							% ABP (15 days before harvest)				
		HSR	PNT	SHL	DOL	SGN	VAR	Mean	HSR	PNT	SHL	DOL	Mean
SBG-21-01	DRMR 2017-16	28.4	47.5	31.5	38.4	22.7	27.5	32.7	23.4	62.5	17.5	23.1	31.6
SBG-21-02	RH 1676	29.5	55.0	28.7	33.2	23.3	30.5	33.4	24.5	50.0	16.3	20.7	27.9
SBG-21-03	PR 2016-8	28.9	37.5	30.9	23.0	41.6	34.5	32.7	21.1	52.5	18.2	12.8	26.1
SBG-21-04	RH (OE) 1706	30.0	60.0	30.3	23.9	34.9	25.0	34.0	23.4	57.5	16.3	12.1	27.3
SBG-21-05	PDZ-15	27.2	57.5	31.5	29.6	16.4	26.5	31.4	22.2	50.0	18.2	16.8	26.8
SBG-21-06	LES 60	26.7	50.0	30.6	21.2	20.0	29.0	29.6	21.1	60.0	16.3	14.7	28.0
SBG-21-07	Rohini(SC)	30.0	45.0	31.8	32.2	26.4	30.5	32.6	24.5	57.5	16.1	22.3	30.1
SBG-21-08	CS 2005-143	31.2	42.5	31.1	22.3	28.0	33.0	31.3	25.1	70.0	17.3	10.6	30.7
SBG-21-09	DRMR 2018-19	31.7	50.0	31.3	32.8	30.7	36.0	35.4	26.7	60.0	15.7	19.4	30.4
SBG-21-10	PBR 385	31.1	45.0	30.2	24.1	14.0	34.5	29.8	25.1	72.5	15.6	13.7	31.7
SBG-21-11	RGN 443	33.4	50.0	31.7	24.4	13.8	33.0	31.1	28.4	47.5	16.3	16.9	27.3
SBG-21-12	RH 1999-42 (Early)	30.0	57.5	32.4	36.5	22.2	22.5	33.5	23.4	57.5	15.6	24.5	30.2
SBG-21-13	PDZ-14	32.2	45.0	31.2	37.9	21.1	26.5	32.3	22.2	62.5	19.7	29.2	33.4
SBG-21-14	RH 1424	29.5	35.0	31.9	40.4	19.3	33.0	31.5	18.9	60.0	17.8	29.5	31.5
SBG-21-15	NRCHB 101(SC)	28.9	40.0	30.3	36.9	17.3	32.0	30.9	21.1	67.5	15.6	28.1	33.1
SBG-21-16	DRMRHJ 2403 (Hybrid)	34.5	40.0	30.7	32.3	16.0	29.0	30.4	20.0	72.5	16.5	27.3	34.1
SBG-21-17	0IJ5001	31.7	35.0	32.1	25.3	14.2	33.0	28.5	22.2	55.0	16.0	17.9	27.8
SBG-21-18	PRE-2018-10 (Early)	32.2	47.5	31.7	22.2	14.4	27.5	29.2	21.1	65.0	16.9	13.2	29.0
SBG-21-19	PR 2016-4	34.5	42.5	31.7	22.9	37.3	38.5	34.6	23.4	60.0	15.7	20.0	29.8
SBG-21-20	RH 1974	32.2	55.0	31.8	15.6	20.9	41.0	32.7	20.5	65.0	16.1	10.5	28.0
SBG-21-21	SKM 1626	29.5	37.5	30.3	22.8	17.3	22.5	26.6	22.2	47.5	16.3	16.6	25.7
SBG-21-22	BIOYSR(RC-WR)	31.1	37.5	30.5	26.8	22.7	22.5	28.5	20.0	42.5	16.2	21.3	25.0
SBG-21-23	RH(OE)-1807	33.4	45.0	30.0	28.1	17.1	34.5	31.3	20.5	55.0	16.7	13.9	26.5
SBG-21-24	RH 1975	32.2	42.5	30.7	27.9	26.2	37.0	32.7	25.1	57.5	16.9	21.3	30.2
SBG-21-25	DRMRCI 128	28.4	42.5	32.4	35.3	20.9	34.5	32.3	22.2	65.0	16.5	21.4	31.3
SBG-21-26	JC 36	30.0	50.0	32.8	24.0	23.8	33.0	32.3	20.0	57.5	15.4	18.2	27.8
SBG-21-27	DRMRMJA 35(RC-WR)	31.7	35.0	31.2	33.3	40.2	30.5	33.6	17.8	55.0	16.4	23.9	28.3
SBG-21-28	Rohini (A4A5)-491	31.2	45.0	30.8	33.1	26.2	38.5	34.1	18.9	67.5	15.1	19.4	30.2
SBG-21-29	Rohini Parent	34.5	40.0	31.3	20.7	35.1	36.0	32.9	22.2	57.5	15.2	24.4	29.8
SBG-21-30	PB (A4A5)-842	27.2	25.0	31.4	26.8	20.7	37.0	28.0	16.8	55.0	17.2	12.9	25.5
SBG-21-31	PB Parent	29.5	22.5	31.9	33.8	26.7	37.0	30.2	23.4	50.0	15.2	17.9	26.6
SBG-21-32	Varuna (A4A5)-936-279	30.0	20.0	30.1	17.3	25.1	39.0	26.9	20.0	50.0	15.5	11.1	24.1
SBG-21-33	Varuna Parent	31.7	40.0	32.2	25.2	21.3	26.5	29.5	21.1	57.5	15.4	19.4	28.3
SBG-21-34	PJK (A4A5)-21	32.2	17.5	29.2	31.3	25.8	30.5	27.7	25.1	40.0	15.1	23.9	26.0
SBG-21-35	PJK Parent	29.5	42.5	30.2	23.5	22.0	30.5	29.7	16.8	42.5	15.7	14.5	22.4
SBG-21-36	PHR-2(TC-AB)	30.0	45.0	17.7	36.9	32.7	38.5	33.5	17.8	37.5	8.0	24.0	21.8
SBG-21-37	HNS 1102	8.4	15.0	26.7	29.3	15.1	22.5	19.5	6.7	70.0	14.4	21.2	28.1
SBG-21-38	GSH-1703	7.3	10.0	29.7	22.8	16.2	21.5	17.9	5.0	67.5	16.7	14.6	26.0
SBG-21-39	DRMRIN 20-3	8.9	37.5	27.9	14.5	14.4	27.5	21.8	7.3	70.0	17.0	11.4	26.4
SBG-21-40	AKGS 8060	7.8	17.5	16.5	27.7	18.2	25.0	18.8	6.7	22.5	8.1	22.8	15.0
SBG-21-41	GSH-2155	10.6	3.5	15.2	29.2	18.9	20.0	16.2	8.4	72.5	10.4	15.0	26.6
SBG-21-42	GSL-1(C)	10.6	4.0	15.8	31.4	19.6	25.5	17.8	7.3	67.5	14.1	26.9	28.9
SBG-21-43	DRMRIN 20-23	8.4	7.5	32.5	17.9	15.3	25.5	17.8	6.7	72.5	16.7	9.4	26.3
SBG-21-44	GSH-1723	8.9	12.5	17.5	18.9	44.0	25.0	21.1	7.8	62.5	10.5	10.4	22.8
SBG-21-45	AKMS 19-8	10.0	15.0	29.8	21.7	27.1	22.5	21.0	8.9	65.0	15.1	12.7	25.4
SBG-21-46	HNS 1206	11.7	3.5	28.5	24.5	34.2	33.0	22.6	8.4	60.0	13.8	22.2	26.1
SBG-21-47	JGS-15-6	8.4	12.5	31.5	27.9	36.2	22.5	23.2	7.3	70.0	14.9	19.1	27.8
SBG-21-48	PT-303(C)	29.5	52.5	30.7	23.8	20.9	35.5	32.1	20.0	62.5	15.9	13.4	28.0
SBG-21-49	PYS-2018-2	32.2	62.5	23.0	22.9	40.4	37.0	36.3	22.2	65.0	12.2	21.8	30.3
SBG-21-50	NRCYS -5-2(C)	31.1	50.0	26.2	31.2	31.8	34.5	34.1	25.1	57.5	14.6	23.9	30.3
SBG-21-51	RMYS 2	33.4	42.5	27.3	29.5	28.2	37.5	33.1	28.9	70.0	12.3	23.3	33.6
SBG-21-52	DLSC -1(C)	7.8	7.5	10.0	17.6	26.2	26.5	15.9	6.7	57.5	5.9	11.5	20.4
CD(P=0.05)		3.9	7.3	4.4	5.3	4.8	10.2		5.1	8.3	NA	4.2	
CV (%)		6.5	10.0	6.8	8.4	8.2	16.5		10.1	7.1	12.0	8.2	

Data of JAG, LDH, MOR on leaf and LDH, SHL, MOR and SGN on pod are excluded due to severity <20% on susceptible check

Table 4.1.2: Reaction of AVT-I and AVT-II Oilseed Brassica germplasm to WR, SH, PM & DM under natural condition

Entries	% WR (100 DAS)								% Staghead				% PM (100 DAS)				% DM (20 DAS)
	BPR	HSR	NDH	PNT	JAG	MOR	SGN	Mean	PNT	MOR	SGN	Mean	SKN	JAG	MOR	Mean	MOR
DRMR 2017-16	0.0	0.0	16.2	17.5	16.9	0.0	37.3	12.6	0.0	0.0	7.4	2.5	95.0	93.0	93.8	93.9	0.0
RH 1676	6.5	28.4	35.1	35.0	21.3	48.0	36.7	30.1	20.0	6.4	4.4	10.3	100.0	92.8	98.3	97.0	25.6
PR 2016-8	7.0	30.0	30.6	32.5	19.4	37.1	28.0	26.4	0.0	0.0	12.0	4.0	100.0	90.9	78.5	89.8	26.9
RH (OE) 1706	9.0	27.2	18.9	25.0	18.9	34.2	48.2	25.9	12.5	8.2	35.7	18.8	95.0	87.6	69.1	83.9	26.0
PDZ-15	7.5	20.0	18.0	27.5	20.6	19.1	44.4	22.4	5.0	0.0	20.6	8.5	75.0	82.6	89.1	82.2	14.0
LES 60	27.0	29.5	30.6	45.0	23.6	36.0	21.3	30.4	15.0	7.0	7.7	9.9	95.0	85.4	95.8	92.1	18.0
Rohini (SC)	26.0	35.6	45.0	37.5	23.5	37.8	23.1	32.6	27.5	11.1	9.3	16.0	75.0	92.8	85.4	84.4	20.7
CS 2005-143	20.0	33.4	48.2	32.5	21.9	36.7	42.4	33.6	7.5	10.5	20.8	12.9	85.0	93.1	90.3	89.5	29.1
DRMR 2018-19	0.0	0.0	29.7	0.0	21.2	0.0	0.0	7.3	0.0	0.0	0.0	0.0	75.0	88.1	90.5	84.5	0.0
PBR 385	13.0	32.2	47.7	32.5	23.4	21.1	18.2	26.9	20.0	6.9	9.4	12.1	85.0	88.0	93.1	88.7	14.0
RGN 443	16.0	26.7	37.8	20.0	28.0	46.9	23.3	28.4	27.5	13.2	3.7	14.8	85.0	88.0	90.0	87.7	22.0
RH 1999-42 (Early)	24.0	28.9	47.7	27.5	14.3	46.5	25.6	30.6	7.5	9.9	13.4	10.3	85.0	88.2	94.9	89.4	26.0
PDZ-14	0.0	0.0	36.0	3.5	19.6	4.0	41.3	14.9	5.0	0.0	7.6	4.2	95.0	90.6	89.0	91.5	1.6
RH 1424	25.0	29.5	47.7	12.5	18.3	45.1	36.2	30.6	17.5	9.9	10.0	12.5	95.0	92.8	84.9	90.9	26.0
NRCHB 101 (SC)	14.0	27.2	38.7	17.5	24.4	36.0	32.9	27.2	7.5	7.7	4.3	6.5	95.0	93.4	77.8	88.7	18.0
DRMRHJ 2403 (Hybrid)	11.0	28.4	45.9	15.0	20.5	34.0	0.0	22.1	20.0	8.0	0.0	9.3	85.0	90.6	73.1	82.9	13.1
01J5001	0.0	0.0	36.0	0.0	13.8	0.0	0.0	7.1	0.0	0.0	0.0	0.0	95.0	92.7	78.0	88.6	0.0
PRE-2018-10 (Early)	0.0	2.8	34.2	3.5	14.6	34.9	29.3	17.0	10.0	10.5	7.9	9.5	85.0	93.4	77.1	85.2	21.1
PR 2016-4	11.0	30.0	38.7	10.0	19.2	36.9	27.1	24.7	15.0	7.1	11.1	11.1	95.0	93.3	95.8	94.7	22.0
RH 1974	22.0	28.9	36.9	30.0	23.9	28.9	23.8	27.8	22.5	8.9	3.8	11.7	85.0	90.7	96.4	90.7	18.0
SKM 1626	11.0	27.2	38.7	22.5	21.1	33.3	26.4	25.7	15.0	5.7	12.6	11.1	75.0	82.6	86.9	81.5	20.2
BIOYSR (RC-WR)	9.0	0.0	21.6	4.0	19.3	22.0	28.4	14.9	7.5	0.0	29.3	12.3	90.0	90.9	89.3	90.1	12.0
RH(OE)-1807	6.0	28.4	35.1	17.5	16.4	38.0	38.0	25.6	10.0	10.8	18.6	13.1	82.5	83.0	62.5	76.0	18.9
RH 1975	20.0	30.0	38.7	30.0	15.9	38.2	29.6	28.9	0.0	12.0	15.7	9.2	85.0	90.7	70.7	82.1	19.3
DRMRCI 128	7.5	4.5	19.8	30.0	21.2	2.0	29.3	16.3	22.5	0.0	13.1	11.9	92.5	93.6	95.8	94.0	0.7
JC 36	0.0	0.0	4.9	0.0	17.9	0.0	20.4	6.2	0.0	0.0	10.2	3.4	92.5	93.4	86.9	90.9	0.0
DRMRMJA 35 (RC-WR)	0.0	1.7	6.3	5.0	18.9	4.2	0.0	5.2	0.0	0.0	0.0	0.0	95.0	87.9	69.6	84.2	2.0
Rohini (A4A5)-491	0.0	0.0	0.0	0.0	15.9	0.0	0.0	2.3	0.0	0.0	0.0	0.0	95.0	88.4	80.9	88.1	0.0
Rohini Parent	10.5	38.9	54.9	27.5	27.3	42.0	27.6	32.7	12.5	10.2	9.6	10.8	92.5	88.0	77.8	86.1	18.9
PB (A4A5)-842	0.0	0.0	0.0	0.0	15.9	0.0	0.0	2.3	0.0	0.0	0.0	0.0	95.0	88.2	68.9	84.0	0.0
PB Parent	11.0	31.7	18.0	22.5	14.4	40.7	27.8	23.7	27.5	9.2	7.6	14.8	95.0	85.6	59.8	80.1	20.0
Varuna (A4A5)-936-279	0.0	0.0	19.8	3.5	15.8	0.0	22.4	8.8	0.0	0.0	12.8	4.3	100.0	75.5	60.0	78.5	0.0
Varuna Parent	9.5	30.0	38.7	17.5	20.8	44.0	40.7	28.7	0.0	16.3	14.9	10.4	100.0	75.8	74.9	83.6	22.0
PJK (A4A5)-21	0.0	0.0	0.0	0.0	10.6	0.0	28.9	5.6	0.0	0.0	12.6	4.2	100.0	76.1	75.6	83.9	0.0
PJK Parent	7.5	28.4	19.8	22.5	20.2	45.1	34.2	25.4	12.5	10.3	18.9	13.9	100.0	72.8	91.6	88.1	29.1
PHR-2 (TC-AB)	18.0	29.5	18.0	22.5	13.9	10.0	0.0	16.0	42.5	0.0	0.0	14.2	80.0	75.5	87.2	80.9	1.8
HNS 1102	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	2.0	40.9	16.0	0.0
GSH-1703	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	2.1	22.7	9.9	0.0
DRMRIN 20-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	25.9	21.1	17.3	0.0
AKGS 8060	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	4.7	21.3	10.3	0.0
GSH-2155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	4.6	15.2	8.3	0.0
GSL-1 (C)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	15.5	18.9	14.8	0.0
DRMRIN 20-23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.0	0.0	16.0	25.3	0.0
GSH-1723	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	2.2	17.8	8.3	0.0
AKMS 19-8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	40.9	45.1	30.3	0.0
HNS 1206	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	4.7	10.9	13.5	0.0
JGS-15-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	5.8	4.2	11.7	0.0
PT-303 (C)	0.0	0.0	0.0	7.5	0.0	0.0	0.0	1.1	10.0	0.0	0.0	3.3	65.0	72.8	10.9	49.6	0.0
PYS-2018-2	0.0	0.0	0.0	7.5	0.0	2.0	0.0	1.4	7.5	0.0	0.0	2.5	67.5	55.4	37.1	53.3	0.9
NRCYS -5-2 (C)	0.0	0.0	0.0	7.5	0.0	3.8	0.0	1.6	17.5	0.0	0.0	5.8	67.5	60.8	62.7	63.7	1.6
RMYS 2	0.0	0.0	0.0	5.0	0.0	0.7	0.0	0.8	7.5	0.0	0.0	2.5	75.0	56.0	39.8	56.9	0.2
DLSC -1 (C)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.9	2.3	0.0
CD(P=0.05)	5.5	4.2	2.3	6.9	6.5	2.0	4.8		5.3	2.3	2.9		11.5	16.0	11.2		1.4
CV (%)	21.0	13.9	-	25.3	18.2	5.3	12.7		30.3	15.1	13.0		8.1	14.3	10.0		5.0

Data from LDH,VAR, SKN were not included due to disease severity <20% on susceptible check
 % DM severity data of PNT and % PM of BPR excluded due to severity <20% on susceptible check

Table 4.1.3: Reaction of AVT-I and AVT-II Oilseed Brassica germplasm to Alternaria leaf blight under artificial condition

Entries	% ABL (90 DAS)					% ABP (15 days before harvest)				
	HSR	PNT	SHL	DOL	Mean	HSR	PNT	SHL	DOL	Mean
DRMR 2017-16	29.5	47.5	33.7	40.3	37.7	26.7	67.5	21.2	26.4	35.4
RH 1676	32.2	42.5	30.3	40.9	36.5	27.2	67.5	18.6	25.4	34.7
PR 2016-8	30.0	40.0	32.7	26.4	32.3	23.4	72.5	21.7	13.0	32.7
RH (OE) 1706	33.4	62.5	33.0	27.0	39.0	28.4	72.5	19.7	14.4	33.7
PDZ-15	31.7	62.5	34.0	31.3	39.9	27.2	70.0	23.1	17.2	34.4
LES 60	29.5	57.5	34.2	23.9	36.3	24.5	65.0	19.3	12.9	30.4
Rohini (SC)	31.1	47.5	34.5	35.2	37.1	28.9	65.0	18.9	22.4	33.8
CS 2005-143	35.6	52.5	34.3	25.1	36.9	27.2	72.5	20.3	10.4	32.6
DRMR 2018-19	33.4	57.5	34.9	36.9	40.7	29.5	67.5	19.0	19.3	33.8
PBR 385	34.5	52.5	34.9	25.8	36.9	28.4	77.5	18.7	14.1	34.7
RGN 443	36.7	62.5	35.1	28.1	40.6	30.0	70.0	20.9	24.1	36.3
RH 1999-42 (Early)	31.2	62.5	36.0	33.6	40.8	27.2	60.0	19.8	21.5	32.1
PDZ-14	35.6	52.5	34.7	41.0	40.9	26.7	67.5	23.3	29.5	36.7
RH 1424	32.2	45.0	35.6	38.6	37.8	20.0	62.5	20.8	29.3	33.2
NRCHB 101 (SC)	30.0	52.5	34.9	38.7	39.0	22.2	72.5	19.2	26.7	35.1
DRMRHJ 2403 (Hybrid)	36.7	47.5	35.3	35.4	38.7	24.5	75.0	19.3	27.5	36.6
0IJ5001	34.5	52.5	36.0	25.5	37.1	26.7	57.5	19.0	17.9	30.3
PRE-2018-10 (Early)	33.4	57.5	35.1	22.2	37.1	23.4	72.5	19.3	11.3	31.6
PR 2016-4	36.7	47.5	36.8	25.2	36.6	25.1	70.0	19.3	19.6	33.5
RH 1974	35.6	60.0	36.1	16.1	36.9	21.1	67.5	18.7	10.4	29.4
SKM 1626	31.1	42.5	34.5	26.5	33.6	24.5	60.0	18.8	20.4	30.9
BIOYSR (RC-WR)	32.2	45.0	34.1	30.8	35.5	22.2	57.5	18.3	21.4	29.9
RH(OE)-1807	34.5	50.0	33.9	29.8	37.0	24.5	70.0	21.5	19.5	33.9
RH 1975	35.6	45.0	34.9	34.4	37.5	26.7	72.5	18.9	21.3	34.9
DRMRCI 128	30.0	60.0	35.4	39.0	41.1	23.4	72.5	19.0	25.5	35.1
JC 36	31.7	52.5	35.9	26.7	36.7	21.1	70.0	18.4	17.5	31.7
DRMRMJA 35 (RC-WR)	33.4	45.0	35.0	36.5	37.5	18.9	72.5	19.6	23.9	33.7
Rohini (A4A5)-491	34.5	47.5	36.4	35.8	38.6	20.0	72.5	20.7	19.6	33.2
Rohini Parent	36.7	40.0	34.5	24.0	33.8	23.4	67.5	18.8	24.2	33.5
PB (A4A5)-842	29.5	30.0	36.1	28.9	31.1	17.8	62.5	19.6	11.6	27.9
PB Parent	31.1	40.0	36.0	35.9	35.7	25.1	55.0	18.3	18.0	29.1
Varuna (A4A5)-936-279	32.2	50.0	35.0	17.4	33.6	20.5	57.5	19.1	11.1	27.1
Varuna Parent	34.5	55.0	35.2	25.4	37.5	22.2	60.0	19.2	19.3	30.2
PJK (A4A5)-21	35.6	42.5	34.0	31.4	35.9	26.7	62.5	18.2	24.2	32.9
PJK Parent	31.7	60.0	35.7	20.9	37.1	17.8	62.5	19.4	14.5	28.5
PHR-2 (TC-AB)	33.4	57.5	22.0	36.9	37.4	18.9	52.5	11.5	23.7	26.6
HNS 1102	8.9	15.0	31.2	21.7	19.2	7.3	82.5	17.6	21.3	32.2
GSH-1703	7.8	17.5	36.0	25.4	21.7	6.7	80.0	20.9	14.4	30.5
DRMRIN 20-3	10.6	40.0	33.5	19.7	25.9	8.4	72.5	21.5	11.5	28.5
AKGS 8060	8.4	27.5	22.3	27.8	21.5	6.7	80.0	12.1	21.3	30.0
GSH-2155	11.7	12.5	22.8	19.7	16.7	10.0	82.5	13.2	15.0	30.2
GSL-1 (C)	12.8	15.0	20.9	31.3	20.0	10.6	77.5	16.5	26.9	32.9
DRMRIN 20-23	8.9	15.0	38.5	17.8	20.1	7.8	75.0	20.0	9.7	28.1
GSH-1723	10.0	10.0	21.6	18.9	15.1	8.9	67.5	13.7	10.4	25.1
AKMS 19-8	8.4	12.5	36.6	24.8	20.6	7.3	70.0	18.2	13.0	27.1
HNS 1206	12.3	10.0	35.9	24.3	20.6	10.6	72.5	17.4	16.9	29.3
JGS-15-6	10.6	17.5	37.7	30.6	24.1	7.3	75.0	17.8	19.6	29.9
PT-303 (C)	31.2	65.0	36.7	29.3	40.6	25.1	67.5	18.9	17.1	32.1
PYS-2018-2	35.6	70.0	31.4	32.2	42.3	27.2	67.5	15.3	22.0	33.0
NRCYS -5-2 (C)	33.4	67.5	32.8	36.1	42.5	28.9	65.0	17.0	23.9	33.7
RMYS 2	36.7	57.5	34.9	36.5	41.4	28.4	70.0	15.5	20.4	33.6
DLSC -1 (C)	8.4	20.0	15.1	22.2	16.4	6.7	62.5	8.5	11.5	22.3
CD (P=0.05)	4.6	6.5	3.7	5.4		4.8	7.9	NA	4.3	
CV (%)	7.3	7.3	5.3	8.3		9.0	5.7	11.6	8.3	

Data excluded of % ABL and ABP were <20% on SC at LDH, NDH and MOR

Table 4.1.4: Reaction of AVT-I and AVT-II Oilseed Brassica germplasm to WR, SR, PM and DM under artificial condition

Entries	% WR (100 DAS)					% SH			% DM (20 DAS)	% PM	% Sclerotinia rot				Lesion size (cm)	Stem diameter (cm)
	HSR	PNT	MOR	BPR	Mean	PNT	MOR	Mean	MOR	MOR	HSR	PNT	BPR	Mean	BPR	
DRMR 2017-16	0.0	25.0	0.0	0.0	6.3	0.0	0.0	0.0	0.0	90.9	40.6	80.0	30.1	50.2	22.5	2.1
RH 1676	30.0	42.5	45.6	18.0	34.0	25.0	10.3	17.7	25.2	94.0	25.8	70.0	27.5	41.1	31.9	1.8
PR 2016-8	31.7	37.5	38.0	40.0	36.8	0.0	0.0	0.0	30.1	78.7	45.2	45.0	33.9	41.4	30.4	1.9
RH (OE) 1706	30.0	30.0	37.1	23.0	30.0	22.5	12.1	17.3	29.6	70.3	54.8	60.0	35.1	50.0	28.8	1.7
PDZ-15	21.1	40.0	25.1	19.0	26.3	15.0	0.0	7.5	19.9	89.8	51.3	80.0	20.5	50.6	19.7	2.0
LES 60	32.2	42.5	37.3	40.0	38.0	35.0	9.2	22.1	23.0	97.1	34.8	75.0	28.4	46.1	10.9	1.9
Rohini (SC)	41.1	45.0	41.1	40.0	41.8	37.5	10.6	24.0	29.0	86.3	52.3	60.0	29.7	47.3	25.9	2.0
CS 2005-143	38.9	35.0	42.9	36.0	38.2	15.0	10.5	12.8	33.3	86.9	78.9	40.0	29.2	49.4	14.6	2.0
DRMR 2018-19	2.8	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	94.0	73.9	60.0	44.4	59.4	39.8	1.9
PBR 385	32.2	37.5	16.9	19.0	26.4	22.5	11.3	16.9	19.4	94.3	34.3	55.0	41.5	43.6	17.5	2.1
RGN 443	30.0	27.5	49.1	24.0	32.7	47.5	15.4	31.5	26.8	91.8	41.0	90.0	25.1	52.0	31.9	2.0
RH 1999-42 (Early)	33.4	42.5	48.5	24.0	37.1	10.0	14.6	12.3	29.1	94.9	83.7	40.0	40.3	54.7	34.7	1.8
PDZ-14	5.0	12.5	5.1	0.0	5.7	10.0	0.0	5.0	5.3	90.7	46.2	70.0	29.4	48.5	18.3	2.1
RH 1424	34.5	27.5	45.6	27.0	33.6	27.5	14.5	21.0	30.7	82.9	76.0	80.0	26.1	60.7	13.4	1.9
NRCHB 101 (SC)	31.1	27.5	33.1	16.0	26.9	10.0	11.4	10.7	22.4	77.4	80.9	90.0	42.4	71.1	28.2	2.0
DRMRHJ 2403 (Hybrid)	30.0	27.5	37.1	16.0	27.7	15.0	11.1	13.1	18.7	76.0	54.9	60.0	30.8	48.6	24.6	1.9
01J5001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	72.7	55.8	90.0	36.1	60.6	21.5	2.0
PRE-2018-10 (Early)	7.3	10.0	38.0	0.0	13.8	12.5	11.3	11.9	24.8	85.1	41.7	100.0	38.1	59.9	24.0	1.8
PR 2016-4	32.2	22.5	40.0	25.0	29.9	27.5	9.6	18.5	27.1	95.8	72.0	95.0	35.9	67.6	44.5	2.0
RH 1974	31.7	45.0	37.1	24.0	34.5	35.0	11.0	23.0	24.2	97.8	74.9	75.0	26.3	58.7	18.3	1.9
SKM 1626	30.0	35.0	36.2	15.0	29.1	20.0	10.8	15.4	25.1	93.3	59.4	60.0	33.5	51.0	13.9	2.1
BIOYSR (RC-WR)	0.0	7.5	24.2	16.0	11.9	20.0	0.0	10.0	17.2	89.4	54.8	35.0	30.4	40.1	22.4	2.1
RH(OE)-1807	30.0	20.0	41.1	8.0	24.8	17.5	11.8	14.6	24.4	65.1	59.1	35.0	43.8	46.0	37.1	2.1
RH 1975	33.4	35.0	42.0	16.0	31.6	0.0	10.3	5.1	25.1	70.9	41.2	60.0	36.4	45.9	31.7	2.1
DRMRCI 128	10.6	30.0	2.9	8.5	13.0	27.5	0.0	13.8	4.3	96.7	83.7	45.0	26.8	51.8	16.9	2.1
JC 36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	83.5	80.4	65.0	29.2	58.2	24.7	2.1
DRMRMJA 35 (RC-WR)	4.5	7.5	6.0	0.0	4.5	0.0	0.0	0.0	6.5	74.9	51.7	35.0	56.7	47.8	20.0	2.1
Rohini (A4A5)-491	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	81.4	74.9	55.0	34.5	54.8	30.6	2.1
Rohini Parent	45.6	35.0	45.1	18.0	35.9	37.5	13.7	25.6	25.5	80.5	36.6	40.0	36.3	37.6	26.9	2.0
PB (A4A5)-842	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	69.1	51.5	75.0	39.6	55.4	37.4	2.0
PB Parent	36.7	27.5	44.0	18.0	31.6	35.0	9.9	22.5	11.5	62.9	83.7	95.0	41.7	73.5	35.6	2.0
Varuna (A4A5)-936-279	0.0	5.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	61.1	71.0	75.0	27.2	57.7	18.5	1.8
Varuna Parent	31.2	22.5	46.6	16.0	29.1	0.0	18.0	9.0	27.1	76.2	53.6	80.0	27.7	53.8	24.7	1.9
PJK (A4A5)-21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.1	46.2	60.0	39.6	48.6	47.9	2.0
PJK Parent	30.0	27.5	46.9	17.0	30.4	27.5	14.8	21.2	32.6	93.1	32.5	75.0	26.8	44.8	18.0	2.1
PHR-2 (TC-AB)	32.2	30.0	13.1	15.0	22.6	47.5	0.0	23.8	5.3	88.2	74.9	55.0	31.6	53.8	23.2	2.2
HNS 1102	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.0	22.2	85.0	56.3	54.5	48.9	2.1
GSH-1703	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.4	18.9	75.0	33.5	42.5	58.3	2.0
DRMRIN 20-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.0	20.5	60.0	45.8	42.1	60.5	2.0
AKGS 8060	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.5	17.8	75.0	28.6	40.5	22.9	2.1
GSH-2155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.1	21.1	55.0	31.9	36.0	29.1	2.1
GSL-1 (C)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.2	19.0	55.0	41.5	38.5	29.5	2.1
DRMRIN 20-23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.3	20.5	90.0	71.8	60.8	68.2	1.8
GSH-1723	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.5	13.4	60.0	31.5	35.0	27.6	2.1
AKMS 19-8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.9	16.8	90.0	36.5	47.8	47.7	1.9
HNS 1206	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	20.0	90.0	44.2	51.4	58.9	1.9
JGS-15-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	18.9	0.0	34.5	17.8	21.2	2.1
PT-303 (C)	0.0	10.0	0.0	0.0	2.5	17.5	0.0	8.8	0.0	12.0	21.1	90.0	58.5	56.5	57.4	1.8
PYS-2018-12	0.0	12.5	4.0	0.0	4.1	10.0	0.0	5.0	4.3	38.3	76.0	100.0	39.1	71.7	54.6	1.8
NRCYS -5-2 (C)	0.0	12.5	6.0	0.0	4.6	27.5	0.0	13.8	5.3	63.8	83.7	100.0	75.3	86.3	63.4	1.8
RMYS 2	0.0	7.5	2.0	0.0	2.4	35.0	0.0	17.5	2.1	41.1	80.9	100.0	44.7	75.2	43.9	1.7
DLSC -1 (C)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.9	12.9	55.0	35.9	34.6	44.6	2.2
CD (P=0.05)	4.0	6.5	2.3	2.4		6.9	2.1		3.9	6.1	5.8	17.4	7.4		-	-
CV (%)	12.1	18.0	5.7	-		24.8	12.5		13.3	5.4	6.5	12.6	9.8		-	-

Data of WR from LDH excluded due to WR disease severity <20% on susceptible check
 Data of SR from LDH and MOR excluded due to severity <20% on susceptible check
 Data of DM severity <20% on SC at PNT were not included

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

Code No.	Entries	% ABL (100 DAS)							% ABP (15 days before harvest)		
		HSR	PNT	SHL	MOR	DOL	VAR	Mean	PNT	DOL	Mean
UDN-21-01	DRMRQ -1-22	27.8	47.5	32.2	4.0	30.1	37.0	29.8	60.0	17.9	39.0
UDN-21-02	DRMR 2018-37	31.2	55.0	33.4	6.0	31.8	40.5	33.0	55.0	13.6	34.3
UDN-21-03	DRMRDR 2135	23.4	47.5	31.1	8.0	30.2	34.5	29.1	52.5	17.7	35.1
UDN-21-04	DRMRIJWR 20-15	26.7	40.0	31.5	13.1	33.4	33.0	29.6	67.5	14.4	40.9
UDN-21-05	DRMRIJ 12-26	30.0	55.0	29.4	14.9	33.3	34.5	32.9	62.5	18.5	40.5
UDN-21-06	PAB-14-18	18.9	35.0	17.7	14.0	17.8	30.5	22.3	7.5	9.7	8.6
UDN-21-07	DRMRIJWR 20-21	26.7	40.0	31.2	16.7	31.2	46.5	32.0	62.5	20.1	41.3
UDN-21-08	DRMRSJ-4	23.4	55.0	30.5	8.0	27.8	43.0	31.3	57.5	17.7	37.6
UDN-21-09	DRMRDR 2156	31.1	55.0	30.4	17.8	37.4	33.0	34.1	55.0	23.8	39.4
UDN-21-10	DRMRIJWR 20-19	33.4	30.0	17.9	17.6	31.4	33.0	27.2	52.5	16.6	34.5
UDN-21-11	Rohini (SC)	24.5	42.5	31.5	25.8	31.8	31.5	31.3	57.5	18.1	37.8
UDN-21-12	DRMRQ 202	29.5	42.5	32.6	20.0	34.0	33.0	31.9	57.5	20.6	39.1
UDN-21-13	DRMR 2018-19	21.1	37.5	29.9	11.7	34.4	40.5	29.2	57.5	17.4	37.4
UDN-21-14	DRMRDR 2133	23.4	47.5	30.5	16.0	38.8	37.0	32.2	67.5	19.4	43.5
UDN-21-15	DRMRIJWR 20-13	30.0	45.0	30.5	21.1	37.9	38.5	33.8	57.5	21.0	39.3
UDN-21-16	DRMRIJ 12-21	14.5	37.5	30.0	14.0	32.4	38.5	27.8	65.0	19.3	42.1
UDN-21-17	PAB-14-4	20.5	30.0	30.2	22.0	33.3	33.0	28.2	55.0	22.0	38.5
UDN-21-18	DRMRIJWR 20-24	26.7	35.0	31.1	34.9	33.7	43.0	34.1	55.0	19.7	37.4
UDN-21-19	DRMRSJ-271	17.8	47.5	31.6	34.7	36.7	48.0	36.0	55.0	18.3	36.7
UDN-21-20	DRMR 2018-41	33.4	30.0	23.5	17.1	36.1	46.0	31.0	52.5	23.4	38.0
UDN-21-21	DRMRIJWR 20-11	15.6	25.0	31.8	14.0	29.4	40.5	26.1	62.5	21.7	42.1
UDN-21-22	NRCHB 101 (SC)	22.2	42.5	30.0	25.1	34.6	37.0	31.9	57.5	23.9	40.7
UDN-21-23	DRMRIJWR 20-17	31.1	37.5	29.9	22.9	34.6	36.0	32.0	55.0	24.1	39.5
UDN-21-24	DRMR 2018-25	18.9	37.5	30.7	14.0	37.3	38.5	29.5	55.0	25.0	40.0
UDN-21-25	DRMRDR 2141	34.5	50.0	16.0	16.0	33.5	46.0	32.7	62.5	21.8	42.1
UDN-21-26	DRMRIJ 12-44	26.7	27.5	32.5	22.0	33.2	39.0	30.1	60.0	20.8	40.4
UDN-21-27	DRMRIJWR 20-16	17.8	35.0	14.7	10.9	33.9	37.5	25.0	50.0	15.3	32.6
UDN-21-28	PAB-14-7	30.0	30.0	18.8	14.9	34.4	29.0	26.2	27.5	18.0	22.8
UDN-21-29	DRMRIJWR 20-14	38.9	47.5	30.2	10.0	43.2	37.0	34.5	55.0	29.3	42.1
UDN-21-30	DRMRDR 2195	21.1	40.0	32.1	14.9	29.9	38.5	29.4	27.5	17.3	22.4
UDN-21-31	DRMRSJ-349	18.9	42.5	30.9	9.1	34.1	38.5	29.0	47.5	22.0	34.8
UDN-21-32	DRMRIJWR 20-26	36.7	37.5	30.8	40.9	31.4	43.0	36.7	52.5	25.0	38.8
UDN-21-33	BIOYSR (RC-WR)	23.4	52.5	31.3	21.1	33.2	34.5	32.7	20.0	25.4	22.7
UDN-21-34	DRMR 2018-1	21.1	47.5	29.9	22.9	32.7	37.5	31.9	42.5	23.9	33.2
UDN-21-35	DRMRIJWR 20-20	26.7	45.0	29.7	36.0	34.8	35.5	34.6	45.0	26.4	35.7
UDN-21-36	DRMRIJ 12-37	14.5	42.5	34.0	34.0	35.9	36.0	32.8	42.5	23.0	32.8
UDN-21-37	DRMRIJWR 20-23	32.2	35.0	34.3	25.1	34.1	38.5	33.2	40.0	21.8	30.9
UDN-21-38	DRMRDR 2116	22.2	55.0	31.4	26.9	33.4	38.5	34.6	47.5	26.2	36.9
UDN-21-39	PAB-14-1	13.4	30.0	32.9	23.8	35.9	38.5	29.1	37.5	23.8	30.7
UDN-21-40	DRMRSJ-7	40.0	47.5	32.1	26.0	36.5	45.0	37.8	57.5	24.9	41.2
UDN-21-41	DRMRIJWR 20-28	21.1	50.0	31.5	29.8	25.6	27.5	30.9	67.5	25.6	46.6
UDN-21-42	DRMRDR 2140	17.8	60.0	31.7	28.0	39.7	33.0	35.0	52.5	26.8	39.6
UDN-21-43	RMM-19-18	14.5	45.0	34.4	34.0	31.7	32.0	31.9	60.0	22.4	41.2
UDN-21-44	DRMRJA 35 (RC-WR)	33.4	67.5	33.2	29.1	34.3	29.0	37.7	57.5	26.3	41.9
UDN-21-45	DRMRIJWR 20-12	18.9	62.5	32.9	22.0	31.2	31.0	33.1	62.5	22.1	42.3
UDN-21-46	DRMRSJ-206	29.5	52.5	33.0	32.0	28.7	41.0	36.1	52.5	25.6	39.0
UDN-21-47	DRMRDR 2119	22.2	47.5	32.5	34.0	29.4	34.5	33.3	50.0	16.5	33.3
UDN-21-48	PAB-14-8	15.6	32.5	32.6	29.8	22.9	33.0	27.7	12.5	15.0	13.7
UDN-21-49	DRMRIJWR 20-10	34.5	37.5	29.9	33.3	33.7	34.5	33.9	52.5	24.6	38.5
UDN-21-50	DRMRIJ 12-46	31.1	42.5	29.0	34.9	32.0	32.0	33.6	57.5	19.2	38.3
UDN-21-51	DRMRDR 2196	29.5	37.5	31.1	38.9	37.3	43.0	36.2	52.5	20.0	36.2
UDN-21-52	PMW 18	27.8	35.0	32.2	20.0	40.5	40.5	32.7	60.0	21.7	40.9
UDN-21-53	DRMRIJWR 20-18	30.0	42.5	33.9	10.9	34.0	33.0	30.7	57.5	22.6	40.1
UDN-21-54	PHR-2 (TC-AB)	32.2	32.5	34.5	16.2	26.4	41.0	30.5	15.0	13.2	14.1
UDN-21-55	GSL-1 (C)	8.9	27.5	12.8	10.9	20.5	23.0	17.3	42.5	15.4	28.9
UDN-21-56	DLSC-1 (C)	7.8	15.0	12.0	10.2	33.7	29.0	17.9	37.5	19.4	28.4
UDN-21-57	NRCYS -5-2 (C)	40.0	35.0	34.2	20.0	33.6	33.0	32.6	67.5	23.8	45.6
UDN-21-58	PT-303 (C)	36.7	42.5	30.3	14.9	35.9	50.0	35.0	70.0	19.9	44.9
UDN-21-59	CS 13000-3-2-2-5-2	34.5	45.0	32.7	34.0	31.9	-	35.6	55.0	18.7	36.9
UDN-21-60	CS 15000-1-1-1-4-2	30.0	30.0	31.8	33.1	32.8	-	31.5	55.0	20.6	37.8
UDN-21-61	RL 87	33.4	42.5	31.9	37.1	35.8	-	36.1	60.0	23.7	41.8
CD(P=0.05)		4.4	7.4	4.2	2.7	5.7	9.8		7.4	5.7	
CV (%)		7.3	8.8	6.4	5.0	8.2	13.2		7.2	10.5	

Data of JAG, LDH, SGN, CHT and JHS for ABL excluded due to severity <20% on susceptible check.

Data of APB severity on SC was <20% at HSR, LDH, JHS, MOR, CHT and SGN were excluded.

Data of LDH, PNT MOR and SGN on % SR incidence on SC was <20% were excluded

Table 4.2.2: Reaction of oilseed *Brassica* germplasm to white rust and powdery mildew under UDN (natural condition)

Entries	% WR (100 DAS)								% Staghead (100 DAS)				% PM(100 DAS)				
	HSR	LDH	NDH	PNT	SKN	MOR	SGN	Mean	PNT	MOR	SGN	Mean	SKN	JAG	MOR	JAG	Mean
DRMRQ -1-22	0.0	25.7	0.0	0.0	0.9	0.0	0.0	3.8	0.0	0.0	0.0	0.0	90.0	93.4	15.2	89.5	72.0
DRMR 2018-37	0.0	3.0	0.0	1.0	1.9	2.0	0.0	1.1	0.0	0.0	0.0	0.0	100.0	86.0	76.7	82.8	86.4
DRMRDR 2135	1.7	5.5	18.9	22.5	1.3	0.0	0.0	7.1	0.0	0.0	0.0	0.0	100.0	91.1	62.0	86.9	85.0
DRMRIJWR 20-15	2.8	26.1	11.3	15.0	1.0	2.0	0.0	8.3	17.5	0.0	0.0	5.8	95.0	83.5	71.3	77.2	81.8
DRMRIJ 12-26	11.7	9.3	20.7	12.5	4.7	5.1	0.0	9.1	0.0	0.0	0.0	0.0	100.0	90.8	68.9	92.9	88.1
PAB-14-18	27.2	17.6	5.0	10.0	5.6	2.9	0.0	9.7	10.0	0.0	0.0	3.3	97.5	83.1	92.9	78.4	88.0
DRMRIJWR 20-21	0.0	8.5	19.8	1.0	5.5	17.2	18.0	10.0	0.0	7.4	8.4	5.3	100.0	93.2	97.1	89.2	94.9
DRMRSJ-4	0.0	4.1	4.5	0.0	0.3	10.9	27.8	6.8	0.0	0.0	4.0	1.3	100.0	93.5	94.9	95.2	95.9
DRMRDR 2156	5.0	13.6	19.8	27.5	4.7	5.1	26.2	14.6	27.5	0.0	11.8	13.1	90.0	93.7	98.3	93.3	93.8
DRMRIJWR 20-19	0.0	7.7	6.8	17.5	0.8	0.0	17.1	7.1	0.0	0.0	8.1	2.7	90.0	93.7	71.6	94.1	87.3
Rohini (SC)	45.6	17.6	31.5	32.5	22.0	41.0	21.3	30.2	10.0	9.6	14.1	11.2	100.0	93.7	86.3	91.8	92.9
DRMRQ 202	0.0	9.4	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	87.5	93.1	78.9	93.1	88.2
DRMR 2018-19	2.8	6.9	17.1	0.0	3.6	0.0	0.0	4.3	0.0	0.0	0.0	0.0	90.0	92.9	65.4	91.4	84.9
DRMRDR 2133	1.7	14.6	21.6	0.0	2.0	1.8	0.0	6.0	0.0	0.0	0.0	0.0	90.0	93.1	70.9	92.4	86.6
DRMRIJWR 20-13	0.0	17.3	0.0	25.0	0.2	0.0	0.0	6.1	7.5	0.0	0.0	2.5	100.0	93.6	92.7	92.7	94.7
DRMRIJ 12-21	10.6	7.0	0.0	17.5	5.0	2.0	0.0	6.0	22.5	0.0	0.0	7.5	90.0	85.9	17.4	82.4	68.9
PAB-14-4	25.1	22.6	40.1	15.0	2.5	14.9	35.1	22.2	0.0	7.2	15.0	7.4	87.5	86.0	74.7	82.4	82.6
DRMRIJWR 20-24	0.0	0.0	0.0	0.0	1.6	2.0	0.0	0.5	0.0	0.0	0.0	0.0	95.0	90.8	75.4	88.6	87.4
DRMRSJ-271	1.7	6.9	18.0	17.5	3.6	0.4	0.0	6.9	10.0	0.0	0.0	3.3	100.0	71.0	50.7	71.2	73.2
DRMR 2018-41	8.9	7.7	0.0	0.0	1.5	1.1	0.0	2.7	0.0	0.0	0.0	0.0	100.0	91.1	82.9	91.6	91.4
DRMRIJWR 20-11	0.0	0.0	15.3	0.0	0.0	10.9	0.0	3.7	0.0	0.0	0.0	0.0	95.0	90.8	84.2	93.5	90.9
NRCHB 101 (SC)	48.9	23.0	29.7	27.5	19.0	30.7	33.1	30.3	17.5	9.3	0.0	8.9	92.5	90.8	92.9	93.8	92.5
DRMRIJWR 20-17	0.0	0.0	0.0	3.5	1.1	0.0	0.0	0.7	0.0	0.0	0.0	0.0	100.0	93.1	89.8	94.1	94.2
DRMR 2018-25	0.0	8.1	0.0	0.0	1.5	0.0	0.0	1.4	0.0	0.0	0.0	0.0	100.0	93.5	94.7	93.9	95.5
DRMRDR 2141	0.0	12.9	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	92.5	93.5	82.0	94.9	90.7
DRMRIJ 12-44	0.0	1.6	0.0	0.0	1.5	0.0	0.0	0.4	0.0	0.0	0.0	0.0	100.0	90.8	75.8	90.9	89.4
DRMRIJWR 20-16	30.0	17.6	32.4	20.0	3.4	0.2	0.0	14.8	22.5	0.0	0.0	7.5	90.0	90.6	95.8	91.4	92.0
PAB-14-7	0.0	10.3	11.7	7.5	0.6	4.2	21.6	8.0	0.0	0.0	10.8	3.6	90.0	91.0	87.6	88.1	89.2
DRMRIJWR 20-14	0.0	6.9	0.0	0.0	2.1	2.0	0.0	1.6	0.0	0.0	0.0	0.0	100.0	91.5	73.8	94.2	89.9
DRMRDR 2195	12.8	17.5	30.6	22.5	27.8	16.0	18.7	20.8	27.5	6.1	11.8	15.1	90.0	93.5	79.8	95.1	89.6
DRMRSJ-349	0.0	19.0	0.0	3.5	0.4	0.0	0.0	3.3	0.0	0.0	4.3	1.4	90.0	93.7	77.8	93.2	88.7
DRMRIJWR 20-26	0.0	6.3	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	95.0	93.2	84.3	94.9	91.8
BIOYSR (RC-WR)	0.0	7.6	18.5	12.5	1.3	11.6	23.1	10.6	0.0	0.0	10.4	3.5	90.0	90.0	93.2	85.2	89.6
DRMR 2018-1	0.0	7.7	0.0	0.0	3.8	0.9	0.0	1.8	0.0	0.0	0.0	0.0	100.0	92.8	98.5	93.1	96.1
DRMRIJWR 20-20	0.0	9.1	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	90.0	88.2	97.8	85.1	90.3
DRMRIJ 12-37	17.8	3.5	24.3	17.5	0.0	0.0	22.9	12.3	17.5	0.0	6.8	8.1	65.0	90.2	92.7	93.1	85.2
DRMRIJWR 20-23	6.7	3.4	0.0	27.5	9.0	0.0	24.0	10.1	22.5	0.0	4.7	9.1	65.0	91.1	79.8	83.1	79.8
DRMRDR 2116	0.0	4.7	0.0	7.5	1.3	0.0	0.0	1.9	17.5	0.0	0.0	5.8	75.0	88.4	92.0	86.9	85.6
PAB-14-1	0.0	7.2	18.0	42.5	4.6	0.0	16.4	12.7	10.0	0.0	9.1	6.4	90.0	90.8	96.9	87.3	91.2
DRMRSJ-7	33.4	3.4	16.7	25.0	4.5	0.0	40.0	17.6	27.5	0.0	11.9	13.1	90.0	90.9	98.3	89.4	92.1
DRMRIJWR 20-28	35.6	11.4	16.2	12.5	5.5	0.4	26.7	15.5	7.5	0.0	9.9	5.8	87.5	90.9	80.9	90.3	87.4
DRMRDR 2140	0.0	17.5	16.2	15.0	14.0	0.0	46.7	15.6	10.0	0.0	4.9	5.0	90.0	93.3	91.8	92.6	91.9
RMM-19-18	17.8	16.2	31.5	7.5	9.2	6.0	26.0	16.3	0.0	0.0	6.6	2.2	90.0	93.8	94.7	94.7	93.3
DRMRJA 35 (RC-WR)	22.2	18.2	16.7	0.0	6.5	0.0	33.3	13.8	0.0	0.0	4.8	1.6	92.5	93.7	97.6	93.4	94.3
DRMRIJWR 20-12	6.7	6.9	24.3	10.0	4.3	0.0	37.3	12.8	10.0	0.0	11.0	7.0	95.0	93.6	97.1	94.3	95.0
DRMRSJ-206	0.0	7.0	24.3	0.0	4.3	0.0	44.2	11.4	0.0	0.0	8.3	2.8	95.0	93.4	98.5	93.8	95.2
DRMRDR 2119	2.8	5.9	18.0	22.5	2.9	10.0	48.7	15.8	30.0	0.0	18.2	16.1	92.5	91.3	81.6	89.5	88.7
PAB-14-8	0.0	11.9	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0	95.0	89.4	93.6	80.7	89.7
DRMRIJWR 20-10	8.4	7.7	16.7	0.0	2.0	0.0	40.2	10.7	0.0	0.0	4.9	1.6	90.0	68.3	96.0	61.9	79.1
DRMRIJ 12-46	16.8	18.2	16.2	20.0	7.0	2.0	22.7	14.7	12.5	0.0	5.0	5.8	100.0	71.3	91.6	68.1	82.7
DRMRDR 2196	18.9	6.7	17.1	15.0	3.0	0.0	16.7	11.1	10.0	0.0	7.3	5.8	95.0	65.9	90.7	58.2	77.4
PMW 18	4.5	0.0	15.8	0.0	0.0	0.0	0.0	2.9	0.0	0.0	0.0	0.0	55.0	30.7	86.7	29.5	50.5
DRMRIJWR 20-18	13.4	14.5	17.1	20.0	6.4	12.0	13.3	13.8	20.0	0.0	4.2	8.1	90.0	91.3	94.0	91.7	91.8
PHR-2 (TC-AB)	31.1	11.7	32.4	12.5	0.0	1.8	22.0	15.9	10.0	0.0	12.5	7.5	92.5	86.1	95.2	81.9	88.9
GSL-1 (C)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	9.2	21.1	5.7	15.3
DLSC-1 (C)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.1	0.0	10.3
NRCYS -5-2 (C)	0.0	0.0	0.0	22.5	0.2	0.0	0.0	3.2	17.5	0.0	0.0	5.8	75.0	50.6	78.0	45.5	62.3
PT-303 (C)	0.0	0.0	0.0	5.0	1.1	0.0	0.0	0.9	0.0	0.0	0.0	0.0	80.0	93.7	21.4	93.5	72.1
CS 13000-3-2-2-5-2	46.7	14.3	-	30.0	29.8	32.0	-	30.6	10.0	7.6	-	8.8	85.0	-	86.3	-	85.6
CS 15000-1-1-1-4-2	41.1	19.4	-	25.0	27.8	34.0	-	29.5	20.0	7.2	-	13.6	80.0	-	94.9	-	87.4
RL 87	36.7	23.8	-	25.0	41.5	32.9	-	32.0	17.5	8.5	-	13.0	95.0	-	98.0	-	96.5
CD(P=0.05)	5.1	3.6	2.6	5.5	2.5	15.4	2.9		3.6	36.0	2.3		15.6	12.1	6.8	12.9	
CV (%)	18.4	10.9	-	23.3	24.0	2.8	10.1		23.9	2.3	15.2		8.8	8.8	5.1	9.5	

Data of JAG, VAR, CHT and JHS for WR, PNT and MOR for DM excluded due to severity <20% on susceptible check
Data of JHS on PM were <20% on susceptible check excluded

Table 4.4.1: Reaction of oilseed *Brassica* germplasm against AB in NDN for white rust (natural condition)

Code No	Entries	% AB (100 DAS)					% ABP (days before harvest)		
		HSR	PNT	MOR	VAR	Mean	HSR	PNT	Mean
NDN-21-42	DRMRWR 143	28.4	47.5	18.5	34.5	32.2	20.5	42.5	31.5
NDN-21-43	DRMR 2018-1	31.7	45.0	30.0	39.0	36.4	25.1	47.5	36.3
NDN-21-44	DRMRIJ 12-26	30.0	50.0	31.4	43.0	38.6	23.4	47.5	35.5
NDN-21-45	PRD-2014-23	40.0	65.0	36.0	33.0	43.5	31.2	30.0	30.6
NDN-21-46	DRMRM 18-35-11	27.8	52.5	34.0	31.5	36.5	20.5	37.5	29.0
NDN-21-47	DRMRSJ-7	34.5	30.0	31.6	36.0	33.0	26.7	62.5	44.6
NDN-21-48	RH- 1700-2	33.4	65.0	33.1	38.5	42.5	27.8	57.5	42.7
NDN-21-49	NPJ-255	31.2	37.5	38.0	38.5	36.3	24.5	50.0	37.3
NDN-21-50	DRMR 2018-25	32.2	30.0	25.8	34.5	30.6	27.2	52.5	39.9
NDN-21-51	DRMRCI 132	30.0	55.0	34.9	43.0	40.7	24.5	47.5	36.0
NDN-21-52	PRD-2014-27	31.7	32.5	36.7	37.0	34.5	23.4	65.0	44.2
NDN-21-53	LES 64	32.2	52.5	37.1	33.0	38.7	26.7	62.5	44.6
NDN-21-54	Rohini (SC)	31.2	40.0	24.0	37.0	33.1	23.4	60.0	41.7
NDN-21-55	NPJ-256	35.6	32.5	30.9	40.5	34.9	26.7	65.0	45.9
NDN-21-56	DRMRCI 125	26.7	50.0	21.1	38.5	34.1	20.0	55.0	37.5
NDN-21-57	PWR-13-8	31.1	42.5	30.9	39.0	35.9	27.2	62.5	44.9
NDN-21-58	RH 1400-1	25.1	42.5	28.2	40.5	34.1	22.2	62.5	42.4
NDN-21-59	NPJ-250	30.0	32.5	32.0	36.0	32.6	24.5	42.5	33.5
NDN-21-60	DRMRDR 2140	28.4	37.5	37.1	37.0	35.0	23.4	50.0	36.7
NDN-21-61	DRMRSJ-271	35.6	57.5	36.9	43.0	43.3	29.5	42.5	36.0
NDN-21-62	NPJ-249	33.4	60.0	27.8	45.5	41.7	27.8	57.5	42.7
NDN-21-63	DRMRWR 153	31.7	52.5	33.3	40.5	39.5	25.1	67.5	46.3
NDN-21-64	DRMRIJ 12-40	27.8	27.5	36.0	31.5	30.7	20.5	57.5	39.0
NDN-21-65	NPJ-253	32.2	57.5	34.0	34.5	39.6	27.2	47.5	37.4
NDN-21-66	PRD-14-1	30.0	40.0	40.0	41.0	37.8	23.4	55.0	39.2
NDN-21-67	NRCHB 101 (SC)	31.2	42.5	38.0	34.5	36.6	24.5	57.5	41.0
NDN-21-68	DRMRSJ-4	34.5	35.0	14.0	36.0	29.9	26.7	52.5	39.6
NDN-21-69	DRMRCI 139	31.7	35.0	12.5	40.5	29.9	23.4	60.0	41.7
NDN-21-70	RH 1400	33.4	25.0	26.7	37.0	30.5	27.8	65.0	46.4
NDN-21-71	RMM-19-18	30.0	32.5	38.9	36.0	34.4	23.4	47.5	35.5
NDN-21-72	DRMRDR 2156	28.4	37.5	36.0	38.5	35.1	20.5	52.5	36.5
NDN-21-73	DRMRIJ 12-48	31.7	55.0	30.7	31.5	37.2	25.1	42.5	33.8
NDN-21-74	DRMR 2018-37	34.5	45.0	33.1	38.5	37.8	31.2	67.5	49.4
NDN-21-75	PDZ 16	30.0	42.5	36.0	36.0	36.1	23.4	70.0	46.7
NDN-21-76	NPJ-248	34.5	45.0	34.1	47.5	40.3	26.7	72.5	49.6
NDN-21-77	RH- 1700-3	27.8	17.5	30.5	38.5	28.6	20.5	32.5	26.5
NDN-21-78	PAB 14-1	33.4	35.0	25.1	33.0	31.6	27.8	22.5	25.2
NDN-21-79	BIOYSR (RC)	31.2	45.0	36.0	34.5	36.7	24.5	12.5	18.5
NDN-21-80	DRMRDR 2195	29.5	37.5	34.9	33.0	33.7	22.2	47.5	34.9
NDN-21-81	LES 65	27.8	45.0	34.0	47.5	38.6	21.1	62.5	41.8
NDN-21-82	RH- 1700	31.2	25.0	32.0	37.0	31.3	24.5	62.5	43.5
NDN-21-83	DRMRCI 126	30.0	37.5	38.9	30.0	34.1	23.4	52.5	38.0
NDN-21-84	DRMRM 18-37-13	25.1	55.0	27.6	34.5	35.5	21.1	60.0	40.6
NDN-21-85	NPJ-251	27.8	42.5	31.8	34.5	34.2	22.2	67.5	44.9
NDN-21-86	PDZ 17	24.5	50.0	31.6	33.0	34.8	18.9	60.0	39.5
NDN-21-87	DRMRDR 2141	35.6	37.5	34.2	43.0	37.6	29.5	57.5	43.5
NDN-21-88	RH- 1700-4	33.4	52.5	33.1	33.0	38.0	27.8	65.0	46.4
NDN-21-89	NPJ-252	31.7	30.0	34.0	31.5	31.8	25.1	62.5	43.8
NDN-21-90	DRMR 2018-41	27.8	55.0	33.3	33.0	37.3	20.5	52.5	36.5
NDN-21-91	DRMRMJA 35 (RC-WR)	32.2	57.5	34.9	35.5	40.0	27.2	65.0	46.1
NDN-21-92	PAB 14-18	30.0	25.0	15.4	34.5	26.2	23.4	7.5	15.5
NDN-21-93	DRMRSJ-349	31.2	42.5	17.4	34.5	31.4	24.5	45.0	34.8
NDN-21-94	DRMRDR 2196	34.5	40.0	33.1	35.5	35.8	26.7	45.0	35.9
NDN-21-95	DRMRM 18-36-12	31.7	57.5	33.8	33.0	39.0	23.4	52.5	38.0
NDN-21-96	DRMRSJ-206	33.4	75.0	36.0	31.5	44.0	27.8	52.5	40.2
NDN-21-97	NPJ-254	30.0	70.0	38.9	38.5	44.4	23.4	40.0	31.7
NDN-21-98	DRMRCI 131	35.6	57.5	33.1	34.5	40.2	26.7	52.5	39.6
NDN-21-99	RH- 1700-1	26.7	65.0	36.0	30.0	39.4	20.0	42.5	31.3
NDN-21-100	DRMR 2018-19	31.1	45.0	37.4	40.5	38.5	27.2	52.5	39.9
NDN-21-101	PHR-2 (TC-AB)	25.1	55.0	35.3	34.5	37.5	22.2	5.0	13.6
NDN-21-102	GSL-1 (C)	8.4	15.0	5.2	27.5	14.0	7.3	72.5	39.9
NDN-21-103	DLSC -1(C)	8.9	22.5	5.1	26.0	15.6	6.7	40.0	23.4
NDN-21-104	NRCYS -5-2 (C)	40.0	47.5	17.4	27.5	33.1	31.2	75.0	53.1
NDN-21-105	PT-303 (C)	35.6	47.5	20.0	45.5	37.2	25.1	67.5	46.3
CD(P=0.05)		4.6	8.8	3.4	8.3		5.3	8.5	
CV (%)		6.9	9.9	5.2	11.3		9.0	8.1	

*Data of LDH for ABL and MOR for ABP, PNT and MOR for DM, BPR for PM were excluded to <20% severity on susceptible check

Table 4.4.2: Reaction of oilseed Brassica germplasm to WR, SH, SR & PM NDN for white rust under artificial condition

Entries	% WR (100 DAS)				% Staghead	% SR (Natural condition)			% PM
	HSR	PNT	BPR	Mean		PNT	BPR	Mean	
DRMRWR 143	0.0	30.0	0.0	10.0	35.0	0.0	24.6	12.3	90.9
DRMR 2018-1	0.0	17.5	0.0	5.8	25.0	20.0	27.5	23.8	97.1
DRMRIJ 12-26	24.5	42.5	0.0	22.3	12.5	7.5	38.9	23.2	94.0
PRD-2014-23	42.2	52.5	24.0	39.6	35.0	10.0	35.5	22.8	90.3
DRMRM 18-35-11	0.0	30.0	0.0	10.0	15.0	15.0	45.6	30.3	93.1
DRMRSJ-7	36.7	22.5	0.0	19.7	27.5	0.0	37.5	18.8	93.1
RH- 1700-2	43.4	37.5	23.0	34.6	22.5	25.0	45.9	35.5	97.1
NPJ-255	45.6	12.5	25.0	27.7	27.5	0.0	41.2	20.6	86.0
DRMR 2018-25	0.0	0.0	0.0	0.0	0.0	10.0	46.4	28.2	97.0
DRMRCI 132	0.0	0.0	0.0	0.0	0.0	25.0	43.6	34.3	87.8
PRD-2014-27	38.9	17.5	25.0	27.1	15.0	25.0	37.9	31.5	90.9
LES 64	45.6	25.0	28.0	32.9	12.5	15.0	32.4	23.7	88.0
Rohini (SC)	46.7	47.5	25.0	39.7	20.0	35.0	44.6	39.8	88.9
NPJ-256	48.9	55.0	36.9	46.9	35.0	30.0	22.0	26.0	78.0
DRMRCI 125	26.7	10.0	0.0	12.2	15.0	45.0	43.5	44.3	93.4
PWR-13-8	15.6	22.5	0.0	12.7	30.0	25.0	53.1	39.1	86.9
RH 1400-1	20.0	5.0	0.0	8.3	0.0	30.0	26.4	28.2	94.9
NPJ-250	23.4	10.0	0.0	11.1	25.0	40.0	34.2	37.1	58.5
DRMRDR 2140	16.8	42.5	0.0	19.8	0.0	15.0	25.8	20.4	90.9
DRMRSJ-271	5.0	32.5	0.0	12.5	15.0	20.0	19.1	19.6	94.9
NPJ-249	34.5	42.5	14.0	30.3	10.0	0.0	16.7	8.4	94.7
DRMRWR 153	0.0	20.0	0.0	6.7	0.0	45.0	23.6	34.3	88.4
DRMRIJ 12-40	4.5	32.5	7.5	14.8	15.0	0.0	31.9	16.0	91.3
NPJ-253	38.9	22.5	23.0	28.1	15.0	35.0	46.8	40.9	88.0
PRD-14-1	36.7	32.5	23.0	30.7	20.0	45.0	30.9	38.0	91.4
NRCHB 101 (SC)	40.0	45.0	38.1	41.0	35.0	75.0	39.2	57.1	59.8
DRMRSJ-4	8.4	27.5	0.0	12.0	27.5	90.0	22.7	56.4	88.0
DRMRCI 139	0.0	0.0	0.0	0.0	0.0	55.0	21.8	38.4	98.0
RH 1400	24.5	0.0	0.0	8.2	0.0	40.0	33.3	36.7	92.0
RMM-19-18	34.5	42.5	0.0	25.7	22.5	25.0	34.5	29.8	94.0
DRMRDR 2156	31.2	15.0	24.0	23.4	15.0	0.0	29.7	14.9	93.3
DRMRIJ 12-48	20.0	50.0	0.0	23.3	17.5	7.5	48.6	28.1	74.3
DRMR 2018-37	0.0	0.0	0.0	0.0	0.0	45.0	43.5	44.3	94.0
PDZ 16	0.0	17.5	0.0	5.8	15.0	25.0	32.4	28.7	73.1
NPJ-248	30.0	37.5	23.0	30.2	25.0	40.0	32.1	36.1	90.0
RH- 1700-3	26.7	1.0	0.0	9.2	0.0	20.0	36.6	28.3	90.9
PAB 14-1	28.9	5.0	0.0	11.3	0.0	0.0	48.7	24.4	92.9
BIOYSR (RC)	0.0	12.5	0.0	4.2	25.0	35.0	45.5	40.3	87.4
DRMRDR 2195	8.4	5.0	0.0	4.5	0.0	20.0	36.1	28.1	94.9
LES 65	18.9	42.5	13.0	24.8	15.0	15.0	31.1	23.1	90.9
RH- 1700	0.0	0.0	0.0	0.0	0.0	0.0	42.9	21.5	92.2
DRMRCI 126	17.8	0.0	0.0	5.9	0.0	0.0	35.5	17.8	83.3
DRMRM 18-37-13	0.0	27.5	0.0	9.2	30.0	35.0	53.1	44.1	89.1
NPJ-251	35.6	40.0	26.0	33.9	27.5	25.0	35.4	30.2	89.1
PDZ 17	0.0	37.5	0.0	12.5	12.5	12.5	50.0	31.3	95.8
DRMRDR 2141	0.0	0.0	0.0	0.0	0.0	35.0	35.9	35.5	80.0
RH- 1700-4	0.0	0.0	0.0	0.0	0.0	10.0	44.4	27.2	92.0
NPJ-252	34.5	0.0	40.0	24.8	0.0	15.0	34.5	24.8	94.9
DRMR 2018-41	0.0	0.0	0.0	0.0	0.0	15.0	51.5	33.3	87.8
DRMRMJA 35 (RC-WR)	0.0	40.0	7.0	15.7	37.5	20.0	45.3	32.7	90.9
PAB 14-18	38.9	42.5	15.0	32.1	22.5	15.0	37.5	26.3	97.1
DRMRSJ-349	0.0	0.0	0.0	0.0	0.0	25.0	51.4	38.2	85.8
DRMRDR 2196	30.0	35.0	0.0	21.7	25.0	30.0	36.8	33.4	82.0
DRMRM 18-36-12	0.0	0.0	0.0	0.0	0.0	20.0	45.3	32.7	86.2
DRMRSJ-206	0.0	0.0	0.0	0.0	0.0	15.0	43.5	29.3	86.0
NPJ-254	36.7	37.5	25.0	33.1	35.0	50.0	48.5	49.3	94.0
DRMRCI 131	0.0	0.0	0.0	0.0	0.0	35.0	35.5	35.3	92.2
RH- 1700-1	0.0	32.5	0.0	10.8	25.0	47.5	48.7	48.1	94.0
DRMR 2018-19	0.0	17.5	0.0	5.8	12.5	50.0	37.5	43.8	70.0
PHR-2 (TC-AB)	34.5	42.5	26.0	34.3	15.0	0.0	24.4	12.2	87.0
GSL-1 (C)	0.0	0.0	0.0	0.0	0.0	0.0	21.2	10.6	26.9
DLSC -1 (C)	0.0	0.0	0.0	0.0	0.0	22.5	19.4	21.0	16.0
NRCYS -5-2 (C)	0.0	15.0	0.0	5.0	12.5	30.0	61.8	45.9	24.0
PT-303 (C)	0.0	5.0	0.0	1.7	0.0	35.0	24.3	29.7	22.7
CD(P=0.05)	3.7	6.6	1.6		8.2	12.0	4.2		7.0
CV (%)	9.6	15.5	-		29.5	24.4	-		5.1

Data of LDH, VAR, MOR for WR & SR and BPR for PM excluded due to <20% severity on susceptible check
BPR for PM were excluded due to <20% severity on susceptible check

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

Code no	Entries	% ABL (100 DAS)						% ABP (15 days before harvest)			% WR (100 DAS)				% Staghead	% PM
		HSR	LDH	PNT	SHL	VAR	Mean	HSR	PNT	Mean	HSR	PNT	BPR	Mean	PNT	JHS
NDN-21-106	DRMRDR 2152	34.5	32.5	42.5	32.1	34.5	35.2	26.7	55.0	40.9	1.7	32.5	0.0	11.4	17.5	15.0
NDN-21-107	DRMRIS 20-4	31.7	23.1	55.0	29.9	38.5	35.6	23.4	60.0	41.7	41.1	37.5	20.0	32.9	37.5	25.0
NDN-21-108	Rohini (SC)	33.4	21.3	50.0	31.1	33.0	33.7	27.8	62.5	45.2	48.9	32.5	26.0	35.8	27.5	25.0
NDN-21-109	DRMRSJ 361	30.0	39.9	32.5	31.0	36.0	33.9	23.4	50.0	36.7	18.9	15.0	8.0	14.0	30.0	5.0
NDN-21-110	DRMRIS 20-5	35.6	19.8	52.5	31.6	38.5	35.6	26.7	52.5	39.6	30.0	10.0	10.0	16.7	17.5	40.0
NDN-21-111	NRCHB 101 (SC)	32.2	30.3	42.5	30.6	35.5	34.2	27.2	65.0	46.1	35.6	40.0	30.0	35.2	30.0	25.0
NDN-21-112	DRMRDR 2151	30.0	30.7	57.5	31.9	40.5	38.1	23.4	55.0	39.2	0.0	0.0	0.0	0.0	0.0	5.0
NDN-21-113	DRMRSJ-25	31.2	25.0	32.5	32.7	37.0	31.7	24.5	57.5	41.0	2.8	17.5	0.0	6.8	40.0	7.5
NDN-21-114	BIOYSR (RC-WR)	32.2	39.3	32.5	31.5	31.5	33.4	27.2	30.0	28.6	0.0	7.5	0.0	2.5	0.0	5.0
NDN-21-115	DRMRDR 2155	31.7	20.2	55.0	31.0	25.0	32.6	25.1	45.0	35.1	31.2	32.5	0.0	21.2	17.5	7.5
NDN-21-116	DRMRIS 20-1	27.8	29.3	35.0	32.4	31.5	31.2	20.5	50.0	35.3	42.2	12.5	11.0	21.9	10.0	5.0
NDN-21-117	DRMRMJA 35(RC-WR)	31.1	36.8	50.0	29.6	33.0	36.1	27.2	62.5	44.9	30.0	25.0	0.0	18.3	0.0	7.5
NDN-21-118	NRCYS-5-2 (SC)	38.9	29.8	45.0	32.9	40.5	37.4	29.5	65.0	47.3	0.0	2.5	0.0	0.8	0.0	0.0
NDN-21-119	NPC 16 (TC)	10.0	21.9	12.5	15.7	14.0	14.8	7.3	10.0	8.7	0.0	0.0	0.0	0.0	0.0	0.0
CD(P=0.05)		4.9	4.4	12.4	3.3	12.4		5.1	11.2		6.1	6.1	3.5		6.1	9.3
CV (%)		6.8	6.3	13.2	5.9	9.0		8.0	10.1		12.5	14.0	12.7		16.1	20.8

Data of JHS for ABL & ABP, LDH, SHL for ABP were excluded as the severity was <20% on susceptible check

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

Entries	% SR incidence under artificial condition							SR lesion length (cm)						Stem diameter (cm)	
	HSR	NBPGR	PNT	SHL	DOL	BPR	Mean	HSR	NBPGR	PNT	SHL	BPR	Mean	SHL	BPR
DRMRDR 2152	90.0	75.0	92.5	93.3	64.2	17.6	72.1	11.6	14.0	26.3	17.3	22.6	18.4	6.5	1.9
DRMRIS 20-4	83.3	100.0	87.5	93.3	62.8	25.6	75.4	10.4	12.5	26.1	16.3	24.8	18.0	5.8	2.1
Rohini (SC)	76.7	70.0	90.0	86.7	48.6	25.4	66.2	11.3	6.5	23.4	13.7	38.9	18.8	5.8	1.8
DRMRSJ 361	86.7	70.0	85.0	93.3	69.3	15.6	70.0	12.3	9.0	57.4	26.2	16.6	24.3	6.3	1.6
DRMRIS 20-5	83.3	80.0	55.0	93.3	41.1	20.3	62.2	9.8	13.5	9.1	10.8	9.4	10.5	5.9	2.1
NRCHB 101 (SC)	90.0	70.0	80.0	93.3	59.7	32.2	70.9	11.9	11.0	14.5	12.5	33.3	16.6	5.4	1.9
DRMRDR 2151	80.0	100.0	100.0	93.3	60.5	30.7	77.4	11.7	13.0	28.4	17.7	28.8	19.9	5.8	2.0
DRMRSJ-25	83.3	100.0	85.0	86.7	67.2	8.1	71.7	10.6	17.5	17.6	15.2	24.6	17.1	6.5	2.0
BIOYSR (RC-WR)	76.7	80.0	60.0	86.7	57.6	8.3	61.5	13.8	19.0	9.6	14.1	6.1	12.5	4.8	2.1
DRMRDR 2155	83.3	90.0	75.0	86.7	47.5	24.8	67.9	11.3	7.0	8.6	9.0	24.5	12.1	5.1	2.1
DRMRIS 20-1	90.0	85.0	55.0	93.3	59.8	35.2	69.7	12.7	17.5	6.7	12.3	54.7	20.8	6.0	2.1
DRMRMJA 35(RC-WR)	83.3	100.0	75.0	93.3	73.9	15.4	73.5	13.3	20.0	12.3	15.2	32.1	18.6	5.5	2.0
NRCYS-5-2 (SC)	93.3	100.0	100.0	100.0	62.8	63.2	86.6	15.7	19.5	12.5	15.9	72.4	27.2	4.2	1.7
NPC 16 (TC)	63.3	100.0	65.0	86.7	85.3	15.5	69.3	9.1	12.5	9.2	10.3	16.9	11.6	6.5	2.2
CD(P=0.05)		9.6	80.0	13.8	NA	12.2	7.0	2.4	6.8	3.1	2.3	8.2		0.5	N/A
CV (%)		6.6	6.8	8.1	18.4	10.7	10.1	9.4	22.5	7.9	11.0	13.0		4.8	9.1

Data of LDH for WR, SR, JHS for WR, SR, PNT for DM excluded due to <20% severity on susceptible check

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

Code No.	Entries	% AB (75 DAS)	% AB (90/100 DAS)								% ABP (15 days before harvest)				
		JAG	HSR	PNT	SHL	JAG	MOR	DOL	VAR	Mean	HSR	PNT	SHL	DOL	Mean
SIVT-21-01	RH 1999-18	13.0	25.1	47.5	29.8	14.7	14.9	33.7	40.5	29.5	18.9	47.5	19.2	22.1	26.9
SIVT-21-02	DRMRHT 13-13-5-4	16.6	29.5	47.5	31.3	17.8	14.7	37.3	38.5	30.9	24.5	52.5	19.2	23.2	29.8
SIVT-21-03	PRE-2018-9	14.4	32.2	55.0	29.8	16.0	10.0	36.9	43.0	31.8	27.8	62.5	19.2	22.8	33.1
SIVT-21-04	NPJ 249	19.1	25.1	47.5	30.9	21.2	10.9	36.5	47.5	31.4	13.4	62.5	18.6	22.3	29.2
SIVT-21-05	KMR(E) 21-2	16.4	26.7	52.5	30.3	17.4	21.8	40.5	50.0	34.2	21.1	60.0	17.5	24.9	30.9
SIVT-21-06	PHR-8425 (Hybrid)	11.6	33.4	37.5	30.9	13.9	15.0	33.3	43.0	29.6	30.0	55.0	18.1	20.5	30.9
SIVT-21-07	TM 311	5.5	35.6	62.5	30.6	7.9	16.1	33.4	38.5	32.1	29.5	55.0	18.4	24.0	31.7
SIVT-21-08	DRMRCI-141	9.7	28.9	65.0	32.2	11.2	30.9	33.5	43.0	34.9	22.2	57.5	20.8	26.6	31.8
SIVT-21-09	Mali MS 90	5.8	30.0	72.5	30.9	7.5	30.5	35.0	38.5	35.0	25.1	62.5	20.4	24.1	33.0
SIVT-21-10	RMX 9310 (Hybrid))	12.1	38.9	42.5	32.5	14.1	20.0	30.0	40.5	31.2	33.4	67.5	18.3	20.4	34.9
SIVT-21-11	DRMRSJ 364	14.2	41.1	62.5	30.9	17.1	16.1	36.0	52.5	36.6	35.6	62.5	19.9	26.3	36.1
SIVT-21-12	Rohini (SC)	22.9	36.7	70.0	32.6	24.7	21.1	38.5	38.5	37.4	23.4	72.5	20.7	26.7	35.8
SIVT-21-13	RH 1999-14	10.4	25.1	55.0	32.1	12.7	15.0	42.9	48.0	33.0	16.8	57.5	18.2	28.7	30.3
SIVT-21-14	DRMRHT 13-13-5-5	15.6	27.8	70.0	33.2	16.3	21.1	39.6	38.5	35.2	18.9	67.5	20.8	29.5	34.2
SIVT-21-15	PRE-2018-7	12.4	34.5	35.0	34.0	14.7	18.0	45.0	38.5	31.4	26.7	60.0	18.7	30.4	33.9
SIVT-21-16	NPJ 248	8.1	30.0	52.5	29.8	11.8	14.0	44.1	43.0	32.2	24.5	65.0	22.2	31.5	35.8
SIVT-21-17	KMR(E) 21-1	17.6	38.9	62.5	29.1	21.6	30.7	42.2	41.0	38.0	29.5	67.5	17.7	30.3	36.3
SIVT-21-18	PHR-8081 (Hybrid)	9.0	29.5	52.5	31.3	12.2	21.1	39.9	36.0	31.8	20.0	72.5	19.2	29.2	35.2
SIVT-21-19	ACN 226	16.9	28.9	70.0	31.2	18.5	16.0	35.3	43.0	34.7	13.4	72.5	18.8	29.6	33.6
SIVT-21-20	BAUM-21-3	14.5	30.0	62.5	31.6	17.2	12.2	41.8	38.5	33.4	23.4	62.5	18.9	23.6	32.1
SIVT-21-21	HUJM (E) 20-4	22.1	27.2	67.5	33.0	24.6	11.8	39.3	45.0	35.5	16.8	47.5	19.3	22.2	26.4
SIVT-21-22	DRMRIJ 16-9-7	16.1	35.6	60.0	34.8	19.1	14.0	39.9	37.0	34.3	22.2	47.5	20.5	29.9	30.0
SIVT-21-23	SVJH- 69(Hybrid)	17.3	28.4	67.5	31.9	21.1	15.0	38.8	43.0	35.1	17.8	52.5	20.3	29.5	30.0
SIVT-21-24	SKM 1801	15.4	26.7	77.5	33.7	17.8	14.7	34.5	43.0	35.4	15.6	57.5	20.3	25.4	29.7
SIVT-21-25	DRMR 2019-19	19.5	34.5	52.5	32.4	21.2	21.1	35.5	31.5	32.7	24.5	65.0	19.3	24.0	33.2
SIVT-21-26	RH 2049	21.9	30.0	42.5	33.9	24.4	22.0	33.6	38.5	32.1	18.9	47.5	19.0	28.4	28.4
SIVT-21-27	KMR 21-4	24.0	31.2	45.0	32.8	28.6	26.0	40.3	29.0	33.3	21.1	47.5	18.0	28.5	28.8
SIVT-21-28	NPJ-253	20.5	29.5	60.0	30.6	23.7	24.0	35.9	29.0	33.2	20.5	45.0	18.4	28.2	28.0
SIVT-21-29	PR-2019-3	8.2	23.4	45.0	30.8	12.2	30.9	38.7	30.5	30.2	14.5	52.5	18.8	30.2	29.0
SIVT-21-30	HUJM -10-6	16.8	29.5	50.0	30.9	19.0	26.9	45.9	40.5	34.7	18.9	60.0	18.3	34.9	33.0
SIVT-21-31	DRMRCI- 139	11.3	36.7	62.5	32.3	15.4	16.0	43.5	38.5	35.0	30.0	45.0	18.9	31.3	31.3
SIVT-21-32	RGN-524	8.0	31.2	50.0	32.6	12.1	14.9	37.5	47.5	32.2	17.8	47.5	19.4	25.3	27.5
SIVT-21-33	ACN 237	13.2	32.2	55.0	33.5	16.0	21.1	33.5	33.0	32.0	20.0	47.5	19.8	26.3	28.4
SIVT-21-34	JM-16-5	16.9	34.5	55.0	31.3	21.0	26.9	28.7	33.0	32.9	22.2	52.5	19.9	21.4	29.0
SIVT-21-35	RB-109	17.6	30.0	42.5	32.5	22.4	24.0	36.6	29.0	31.0	24.5	62.5	20.2	22.5	32.4
SIVT-21-36	DRMRCI 148	16.1	35.6	67.5	33.9	18.9	16.0	39.8	38.5	35.7	23.4	57.5	19.5	32.4	33.2
SIVT-21-37	NRCHB 101 (SC)	18.6	23.4	42.5	33.8	21.8	30.9	38.0	50.0	34.3	16.8	62.5	20.0	29.8	32.3
SIVT-21-38	SKM 1744	16.1	25.1	60.0	32.4	19.0	30.0	36.5	43.0	35.1	15.6	55.0	21.2	27.2	29.7
SIVT-21-39	RH 1934	16.8	22.2	65.0	31.9	21.8	30.9	35.1	45.0	36.0	14.5	55.0	20.2	26.3	29.0
SIVT-21-40	KMR 21-3	10.6	31.2	57.5	31.6	13.0	18.9	39.3	31.5	31.9	22.2	37.5	19.1	31.3	27.5
SIVT-21-41	NPJ-252	10.1	27.8	47.5	31.8	14.2	20.0	36.7	38.5	30.9	20.0	15.0	20.0	24.8	19.9
SIVT-21-42	DRMRIJ 18-62	11.1	32.2	52.5	32.4	14.1	19.8	37.4	36.0	32.1	24.5	62.5	19.1	22.0	32.0
SIVT-21-43	PBR 939	12.4	36.7	57.5	33.5	15.0	30.0	31.9	41.0	35.1	17.8	27.5	19.3	22.0	21.6
SIVT-21-44	HUJM-20-9	12.1	24.5	70.0	33.7	13.8	32.0	37.0	47.5	36.9	20.5	40.0	19.6	23.0	25.8
SIVT-21-45	RMM 19-18	8.2	28.9	57.5	33.3	10.3	34.9	36.6	40.5	34.6	16.8	37.5	17.8	19.5	22.9
SIVT-21-46	DM-1521	13.8	35.6	50.0	31.9	14.7	29.1	35.3	47.5	34.9	21.1	45.0	19.6	19.5	26.3
SIVT-21-47	DRMRCI 147	19.2	30.0	65.0	31.6	23.4	21.1	33.4	34.5	34.1	14.5	52.5	19.3	20.0	26.6
SIVT-21-48	RGN-507	13.1	23.4	55.0	33.3	15.8	22.2	34.6	31.5	30.8	18.9	37.5	20.1	22.0	24.6
SIVT-21-49	BAUM-21-1	15.4	26.7	65.0	30.7	16.3	25.1	34.4	33.0	33.0	20.5	40.0	19.4	19.5	24.9
SIVT-21-50	PRB-2016-1	21.6	36.7	62.5	32.3	22.8	17.1	36.5	45.5	36.2	25.1	47.5	19.3	20.5	28.1
SIVT-21-51	DRMRCI(Q) 57	7.6	33.4	60.0	33.6	9.8	21.1	37.9	29.0	32.1	23.4	35.0	19.9	24.2	25.6

SIVT-21-52	PDZ-17#	14.0	31.2	70.0	34.2	17.3	21.3	32.5	38.5	35.0	16.8	50.0	19.7	22.0	27.1
SIVT-21-53	RH (OE)-1808	11.8	34.5	67.5	32.5	14.8	40.9	34.9	55.0	40.0	22.2	72.5	20.9	22.0	34.4
SIVT-21-54	LES- 65	16.4	22.2	67.5	31.5	18.7	34.9	34.8	47.5	36.7	14.5	50.0	20.3	28.5	28.3
SIVT-21-55	DRMRQ 4-3	13.7	26.7	72.5	33.3	16.0	34.0	33.6	36.0	36.0	13.4	62.5	19.7	25.0	30.2
SIVT-21-56	JC-16	11.6	30.0	72.5	33.1	16.2	16.0	34.6	38.5	34.4	15.6	50.0	19.6	25.0	27.6
SIVT-21-57	BIOYSR (RC-WR)	8.9	27.2	50.0	35.0	12.2	34.9	33.1	43.0	33.6	20.5	17.5	18.7	20.5	19.3
SIVT-21-58	IJ19R5004	11.0	28.4	70.0	32.3	12.7	34.0	35.7	41.0	36.3	18.9	57.5	19.6	19.5	28.9
SIVT-21-59	DRMRCI(Q) 47	10.6	31.1	57.5	32.1	14.2	41.1	36.9	43.0	36.5	24.5	37.5	20.7	22.0	26.2
SIVT-21-60	PDZ-16#	12.7	32.2	80.0	33.9	14.3	44.0	38.6	43.0	40.9	17.8	60.0	20.2	22.0	30.0
SIVT-21-61	RH (OE)-1612	12.2	23.4	55.0	34.7	14.2	10.9	40.9	45.5	32.1	20.0	50.0	20.0	24.5	28.6
SIVT-21-62	LES- 64	12.9	25.1	75.0	34.3	15.3	25.1	40.9	38.5	36.3	22.2	47.5	20.6	24.5	28.7
SIVT-21-63	DRMRQ 143-9	10.1	27.8	80.0	31.3	12.8	21.1	40.9	36.0	35.7	16.8	40.0	18.6	24.5	25.0
SIVT-21-64	JC-1	10.2	29.5	57.5	32.7	13.4	29.1	38.6	43.0	34.8	23.4	47.5	18.0	22.0	27.7
SIVT-21-65	RH 2050	21.7	26.7	55.0	34.5	22.8	17.1	36.0	38.5	32.9	21.1	50.0	18.2	18.5	26.9
SIVT-21-66	PAB-2014-17	13.7	30.0	70.0	33.5	17.1	21.1	39.1	29.0	34.3	25.1	47.5	19.5	20.5	28.1
SIVT-21-67	NPJ 251	21.4	24.5	65.0	35.6	23.6	21.3	39.1	47.5	36.7	15.6	65.0	14.7	20.5	29.0
SIVT-21-68	DRMRHJ 430	23.5	33.4	65.0	34.3	25.4	26.0	39.1	40.5	37.7	30.0	57.5	20.0	20.5	32.0
SIVT-21-69	KMR(L) 21-6	23.0	35.6	45.0	33.1	24.4	14.9	46.6	37.0	33.8	28.4	55.0	19.5	27.0	32.5
SIVT-21-70	RGN-522	24.6	30.0	55.0	32.0	25.5	18.0	46.6	33.0	34.3	23.4	22.5	20.5	27.0	23.4
SIVT-21-71	HUJM-20-6	18.4	21.1	57.5	32.7	19.3	21.1	36.4	36.0	32.0	17.8	60.0	20.2	18.5	29.1
SIVT-21-72	DRMRHT-13-7-113	16.1	23.4	47.5	31.8	17.4	25.1	36.4	38.5	31.4	20.5	55.0	17.3	18.5	27.8
SIVT-21-73	RH 1939	26.8	27.2	52.5	34.5	27.7	21.1	38.6	30.5	33.2	16.8	60.0	18.7	19.5	28.7
SIVT-21-74	DRMRMJA 35 (RC-WR)	21.0	31.7	47.5	22.8	22.7	30.9	38.6	34.5	32.7	22.2	55.0	18.3	19.5	28.8
SIVT-21-75	PAB-2014-7	6.0	25.1	52.5	14.8	8.4	10.9	36.4	34.5	26.1	18.9	37.5	19.2	17.0	23.2
SIVT-21-76	NPJ 250	8.8	33.4	35.0	34.0	10.8	20.0	46.6	43.0	31.8	31.7	35.0	20.2	28.5	28.9
SIVT-21-77	DRMRCI 140	18.6	28.4	60.0	33.2	20.8	20.0	36.0	39.0	33.9	21.1	55.0	18.8	19.5	28.6
SIVT-21-78	KMR(L) 21-5	20.1	30.0	52.5	32.4	21.2	25.1	36.0	38.5	33.7	17.8	40.0	20.7	19.5	24.5
SIVT-21-79	RGN-520	14.7	35.6	52.5	35.1	16.7	18.9	38.6	40.5	34.0	28.4	55.0	20.0	22.5	31.5
SIVT-21-80	BAUM-08-15	24.5	33.4	60.0	33.7	27.3	28.0	38.6	37.0	36.9	25.1	52.5	19.6	22.3	29.9
SIVT-21-81	ACN 237	21.1	32.2	47.5	30.4	23.1	16.0	38.6	45.5	33.3	23.4	30.0	19.1	22.0	23.6
SIVT-21-82	DRMRSJ 272	21.1	29.5	37.5	32.0	23.9	16.9	36.1	45.0	31.6	20.0	55.0	19.2	20.5	28.7
SIVT-21-83	RGN 73	7.3	36.7	57.5	32.0	10.5	14.0	27.5	38.5	31.0	31.2	47.5	19.0	14.0	27.9
SIVT-21-84	RH 1930	15.8	31.1	55.0	32.7	16.4	17.1	36.0	40.5	32.7	18.9	55.0	18.3	19.5	27.9
SIVT-21-85	RGN-519	12.5	28.4	60.0	30.3	14.8	14.9	49.1	34.5	33.1	16.8	47.5	16.8	31.5	28.1
SIVT-21-86	DRMRHJ 1117	16.6	33.4	42.5	32.6	19.0	21.1	49.1	28.0	32.2	22.2	57.5	20.0	31.5	32.8
SIVT-21-87	NPJ-255	24.2	30.0	40.0	30.5	26.8	21.3	45.9	33.0	32.5	18.9	60.0	18.9	28.5	31.6
SIVT-21-88	PBR 357	20.3	28.4	37.5	34.9	22.0	24.0	28.6	39.0	30.6	17.8	65.0	20.5	13.0	29.1
SIVT-21-89	DM- 1521	17.3	35.6	42.5	30.3	19.7	34.0	47.6	38.5	35.5	30.0	47.5	19.1	28.5	31.3
SIVT-21-90	CAU-RMM 3	9.4	33.4	37.5	32.5	12.1	30.0	27.3	50.0	31.8	21.1	57.5	19.6	13.0	27.8
SIVT-21-91	DRMRHT 13-22-2	19.4	29.5	60.0	33.5	20.1	20.0	27.3	39.0	32.8	20.5	65.0	17.3	13.0	28.9
SIVT-21-92	RH 1928	17.8	31.7	47.5	34.0	20.2	30.0	28.6	30.5	31.8	22.2	65.0	19.5	14.5	30.3
SIVT-21-93	Basanti (RC)	18.8	31.2	55.0	32.2	21.1	34.9	27.3	28.0	32.8	18.9	62.5	19.4	13.0	28.5
SIVT-21-94	RGN-510	20.2	26.7	55.0	33.8	21.2	14.0	27.6	31.5	30.0	22.2	57.5	19.9	13.0	28.1
SIVT-21-95	DRMR 2019-7	21.8	28.4	55.0	34.2	23.8	16.0	38.0	38.5	33.4	15.6	57.5	18.6	19.5	27.8
SIVT-21-96	RB- 110	19.6	25.1	45.0	34.2	22.4	22.9	47.6	40.5	34.0	12.8	60.0	18.7	30.5	30.5
SIVT-21-97	BAUM-21-2	15.4	31.2	47.5	33.1	17.9	17.1	26.9	38.5	30.3	27.2	67.5	20.7	14.0	32.3
SIVT-21-98	NPJ-254	11.0	23.4	45.0	33.2	11.2	20.0	26.9	45.0	29.2	15.6	57.5	19.9	14.0	26.8
SIVT-21-99	PBR 552	19.5	32.2	62.5	33.9	22.2	14.9	42.6	34.5	34.7	18.9	42.5	19.9	24.5	26.4
SIVT-21-100	ORM 26-37-2	14.4	33.4	62.5	32.5	19.4	21.1	42.6	31.5	34.7	25.1	52.5	19.7	28.0	31.3
SIVT-21-101	DRMRCI-143	14.9	30.0	52.5	31.3	16.4	36.0	39.1	40.5	35.1	23.4	47.5	20.0	25.5	29.1
SIVT-21-102	RH 749	13.4	31.7	42.5	32.1	15.3	14.9	40.8	38.5	30.8	22.2	52.5	19.3	25.0	29.8
SIVT-21-103	KGMH 9198	8.7	25.1	47.5	32.6	11.1	39.8	40.9	41.0	34.0	15.6	67.5	19.3	22.5	31.2
SIVT-21-104	PHR4457	13.3	35.6	70.0	32.1	17.1	34.0	44.0	43.0	39.4	23.4	62.5	17.2	25.5	32.2
SIVT-21-105	DRMRJH 3717	17.6	33.4	57.5	32.3	20.5	34.0	36.0	31.5	35.0	21.1	50.0	19.5	19.5	27.5
SIVT-21-106	Pusa MH 65	11.0	28.4	55.0	33.7	13.4	32.0	38.6	34.5	33.7	16.8	67.5	18.9	21.5	31.2
SIVT-21-107	SVJH- 71	16.9	32.2	52.5	31.2	19.4	34.0	35.0	43.0	35.3	17.8	70.0	19.3	22.0	32.3
SIVT-21-108	RHH 2102	14.7	30.0	47.5	34.7	17.5	36.0	35.0	43.0	34.8	22.2	60.0	17.2	20.5	30.0
SIVT-21-109	DRMRHJ 3130	19.3	26.7	37.5	15.8	20.7	10.9	35.7	36.0	26.2	15.6	62.5	8.0	24.0	27.5

SIVT-21-110	NMH90M01	22.4	35.6	47.5	31.7	24.4	21.1	35.0	30.5	32.3	30.0	57.5	17.9	18.0	30.9
SIVT-21-111	KMH 8765	19.3	33.4	47.5	32.4	20.7	22.9	40.7	34.5	33.1	21.1	57.5	19.0	28.5	31.5
SIVT-21-112	DRMRHJ 3720	15.9	29.5	55.0	33.1	18.7	21.1	36.9	36.5	33.0	20.5	42.5	18.9	19.5	25.3
SIVT-21-113	PHR5175	15.3	27.2	50.0	32.7	18.3	25.1	35.2	37.0	32.2	13.4	37.5	19.9	19.5	22.6
SIVT-21-114	DRMRIJ 31 (C)	15.7	33.4	55.0	33.6	19.9	28.9	40.1	29.0	34.3	21.1	47.5	19.4	28.0	29.0
SIVT-21-115	IJ16R1168	10.2	30.0	57.5	30.8	13.6	10.0	47.6	33.0	31.8	18.9	57.5	18.4	30.5	31.3
SIVT-21-116	PMH90V02	20.7	28.4	45.0	32.0	23.8	10.0	47.6	43.0	32.8	17.8	52.5	18.5	29.9	29.7
SIVT-21-117	Pusa MH 62	10.6	31.2	52.5	32.9	13.5	26.0	38.0	45.0	34.2	16.8	67.5	20.7	25.3	32.6
SIVT-21-118	SVJH- 70	7.7	30.0	60.0	33.7	10.7	27.8	36.3	38.5	33.9	17.8	57.5	19.9	27.1	30.6
SIVT-21-119	NAMJH21-01	15.1	33.4	60.0	31.6	15.9	25.1	27.5	40.5	33.4	31.7	55.0	18.0	19.3	31.0
SIVT-21-120	RHH 2101	21.5	29.5	42.5	32.1	24.7	26.9	27.5	38.5	31.7	20.0	57.5	16.8	17.0	27.8
SIVT-21-121	DRMRHJ 2518	21.3	27.2	65.0	35.2	23.3	22.0	35.0	31.5	34.2	16.8	62.5	21.9	24.5	31.4
SIVT-21-122	RMX9922	14.9	34.5	70.0	31.9	16.7	25.1	32.6	45.5	36.6	22.2	52.5	19.4	20.3	28.6
SIVT-21-123	PHR3281	15.1	31.1	67.5	32.7	17.7	26.2	31.3	27.0	33.4	21.1	47.5	19.2	19.0	26.7
SIVT-21-124	18J408C	10.2	28.4	47.5	32.7	13.0	29.1	39.8	37.0	32.5	17.8	60.0	18.8	27.0	30.9
SIVT-21-125	RH 2103	17.0	35.6	70.0	34.0	20.4	21.1	34.3	34.5	35.7	18.9	57.5	19.8	22.0	29.6
SIVT-21-126	CS 2009-234	19.8	30.0	50.0	29.8	22.4	20.2	35.3	34.5	31.7	17.8	50.0	20.1	24.5	28.1
SIVT-21-127	NPJ 231	11.6	32.2	45.0	33.9	13.9	16.0	34.4	34.5	30.0	21.1	55.0	21.1	22.4	29.9
SIVT-21-128	RH 1928	18.9	29.5	70.0	34.4	22.7	20.0	32.4	34.5	34.8	20.0	40.0	20.9	22.3	25.8
SIVT-21-129	CS 2013-64	19.6	28.9	55.0	31.8	21.8	25.1	34.6	34.5	33.1	13.4	42.5	20.0	21.3	24.3
SIVT-21-130	PHR 2 (TC-AB)	5.2	33.4	65.0	31.9	7.7	8.2	33.9	34.5	30.7	23.4	20.0	19.1	23.4	21.5
SIVT-21-131	RH 1927	9.5	31.2	52.5	32.4	10.9	14.9	39.4	43.0	32.0	16.8	35.0	19.1	27.8	24.7
SIVT-21-132	CS 2020-4	18.3	34.5	55.0	32.3	21.2	13.1	39.9	36.0	33.1	22.2	52.5	18.7	26.8	30.0
SIVT-21-133	NPJ 256	26.4	33.4	47.5	33.4	28.8	14.9	32.2	32.0	31.7	31.7	57.5	18.9	20.4	32.1
SIVT-21-134	CS 2020-10	15.9	28.4	52.5	31.9	18.8	12.0	36.7	41.0	31.6	21.1	27.5	20.2	26.1	23.7
SIVT-21-135	DRMR 2018-25	12.5	30.0	57.5	31.4	14.8	30.0	40.1	29.0	33.3	17.8	52.5	18.5	31.3	30.0
SIVT-21-136	RH 2007	22.6	33.4	52.5	33.9	25.9	18.0	36.0	27.0	32.4	22.2	40.0	20.3	24.0	26.6
SIVT-21-137	DRMRIJ 20-157	5.4	30.0	50.0	32.8	9.4	32.9	34.3	31.5	31.5	18.9	40.0	17.6	24.7	25.3
SIVT-21-138	DRMRCI(W)-125	8.2	28.4	70.0	32.8	11.9	37.1	36.1	31.5	35.4	17.8	42.5	19.5	22.6	25.6
SIVT-21-139	Maya (C)	6.3	30.0	62.5	32.8	9.6	34.9	38.0	30.5	34.0	23.4	47.5	20.0	27.5	29.6
SIVT-21-140	DRMR 2018-37	10.0	27.2	60.0	31.3	13.7	21.1	31.9	30.5	30.8	16.8	55.0	19.0	25.0	28.9
SIVT-21-141	RH 2070	14.0	35.6	57.5	30.2	17.1	16.0	40.5	34.5	33.1	22.2	57.5	18.0	30.3	32.0
SIVT-21-142	DRMRHJ 317	14.9	28.9	57.5	33.4	17.8	16.9	35.0	33.0	31.8	16.8	52.5	20.1	23.4	28.2
SIVT-21-143	DLSC 1 (C)	2.7	8.4	15.0	13.6	4.9	5.1	35.3	24.0	15.2	6.7	5.0	6.3	23.5	10.4
SIVT-21-144	GSL 1 (C)	5.3	10.0	22.5	12.4	6.5	5.3	39.3	27.5	17.6	8.9	52.5	6.1	29.1	24.1
SIVT-21-145	PT 303 (C)	11.5	34.5	57.5	28.2	15.5	16.0	36.9	31.5	31.4	22.2	72.5	18.9	26.9	35.1
SIVT-21-146	NRCYS-5-2 (C)	12.7	40.0	65.0	33.5	15.4	14.0	43.8	43.0	36.4	30.0	67.5	25.9	28.6	38.0
CD(P=0.05)		10.7	4.4	7.7	5.1	NS	1.1	5.9	8.9		4.5	11.6	NA	4.6	
CV(%)		24.4	6.7	7.0	7.5	21.0	2.0	8.0	11.9		8.5	11.2	9.6	8.1	

Data of LDH, JHS for ABL & ABP, MOR for ABP were excluded as the severity was <20% on susceptible check

Table 4.6.2: Reaction of IVT entries of oilseed *Brassica* to WR, SH and PM

Entries	% WR (90/100 DAS)							% Staghead	% PM				
	AC*				NC**				PNT	SKN	JAG	MOR	Mean
	PNT	SKN	HSR	Mean	JAG	MOR	Mean						
RH 1999-18	42.5	37.0	36.7	38.7	23.7	41.1	32.4	0.0	90.0	73.7	81.1	81.6	
DRMRHT 13-13-5-4	40.0	14.5	31.7	28.7	15.7	34.0	24.9	0.0	80.0	81.2	86.9	82.7	
PRE-2018-9	32.5	3.0	33.4	23.0	15.5	21.1	18.3	15.0	72.5	78.8	44.9	65.4	
NPJ 249	5.0	7.0	30.0	14.0	25.1	25.1	25.1	12.5	65.0	76.2	58.0	66.4	
KMR(E) 21-2	10.0	22.5	31.1	21.2	27.5	34.0	30.8	0.0	77.5	76.1	64.0	72.5	
PHR-8425 (Hybrid)	35.0	1.2	32.2	22.8	22.8	2.0	12.4	25.0	80.0	74.0	82.9	79.0	
TM 311	22.5	3.4	0.0	8.6	13.3	34.9	24.1	10.0	65.0	58.6	50.9	58.2	
DRMRCI-141	52.5	22.2	34.5	36.4	13.9	33.3	23.6	25.0	80.0	78.3	75.8	78.0	
Mali MS 90	42.5	5.8	31.2	26.5	13.6	34.0	23.8	30.0	75.0	90.8	72.9	79.6	
RMX 9310 (Hybrid)	47.5	7.1	38.9	31.2	19.4	34.0	26.7	35.0	85.0	91.2	97.1	91.1	
DRMRSJ 364	32.5	8.8	35.6	25.6	19.8	16.2	18.0	25.0	80.0	90.5	74.9	81.8	
Rohini (SC)	57.5	34.5	41.1	44.4	23.2	34.2	28.7	35.0	80.0	81.5	86.9	82.8	
RH 1999-14	47.5	23.0	36.7	35.7	18.3	34.0	26.2	15.0	80.0	91.0	82.0	84.3	
DRMRHT 13-13-5-5	15.0	25.0	30.0	23.3	12.8	17.1	15.0	0.0	85.0	85.6	92.0	87.5	
PRE-2018-7	17.5	4.9	29.5	17.3	20.5	25.1	22.8	20.0	62.5	91.2	74.0	75.9	
NPJ 248	3.5	3.1	40.0	15.5	22.2	32.0	27.1	0.0	65.0	86.4	70.9	74.1	
KMR(E) 21-1	15.0	23.5	31.1	23.2	23.2	36.0	29.6	12.5	77.5	86.1	62.0	75.2	
PHR-8081 (Hybrid)	10.0	1.4	25.1	12.2	10.1	18.9	14.5	10.0	75.0	90.4	76.0	80.5	
ACN 226	25.0	5.7	34.5	21.7	14.8	4.0	9.4	20.0	85.0	77.9	81.1	81.3	
BAUM-21-3	27.5	5.4	36.7	23.2	23.5	2.9	13.2	20.0	77.5	83.5	82.0	81.0	
HUJM (E) 20-4	42.5	3.2	30.0	25.2	25.6	1.8	13.7	7.5	80.0	91.3	56.0	75.8	
DRMRIJ 16-9-7	0.0	0.2	10.6	3.6	26.2	0.0	13.1	0.0	95.0	86.2	78.0	86.4	
SVJH- 69(Hybrid)	32.5	3.0	31.2	22.2	25.9	2.9	14.4	25.0	72.5	91.2	69.1	77.6	
SKM 1801	52.5	14.1	32.2	32.9	20.7	10.5	15.6	30.0	75.0	73.4	61.1	69.8	
DRMR 2019-19	35.0	20.6	50.0	35.2	24.4	21.1	22.8	10.0	75.0	90.4	90.0	85.1	
RH 2049	40.0	6.3	51.1	32.5	19.0	2.0	10.5	20.0	95.0	90.5	83.8	89.8	
KMR 21-4	32.5	17.1	31.7	27.1	26.5	2.2	14.4	25.0	80.0	83.9	88.8	84.2	
NPJ-253	10.0	10.6	33.4	18.0	25.1	4.2	14.7	17.5	95.0	70.5	72.0	79.2	
PR-2019-3	30.0	46.0	40.0	38.7	24.7	5.1	14.9	27.5	97.5	85.4	80.0	87.6	
HUJM -10-6	22.5	11.5	30.0	21.3	23.5	4.9	14.2	20.0	90.0	89.9	86.9	88.9	
DRMRCI- 139	0.0	0.5	0.0	0.2	16.1	6.9	11.5	0.0	90.0	90.5	77.1	85.9	
RGN-524	40.0	31.0	36.7	35.9	23.1	10.8	16.9	45.0	95.0	90.1	66.9	84.0	
ACN 237	12.5	46.0	38.9	32.5	21.9	14.4	18.1	0.0	90.0	85.9	80.9	85.6	
JM-16-5	32.5	40.5	35.6	36.2	32.0	13.1	22.6	15.0	90.0	90.9	93.1	91.3	
RB- 109	40.0	19.0	40.0	33.0	23.6	12.0	17.8	25.0	97.5	90.3	67.1	85.0	
DRMRCI 148	25.0	18.5	30.0	24.5	17.7	8.0	12.9	25.0	90.0	90.3	94.2	91.5	
NRCHB 101 (SC)	22.5	24.0	31.7	26.1	20.1	21.1	20.6	30.0	85.0	93.6	78.0	85.5	
SKM 1744	7.5	17.0	34.5	19.7	22.4	26.0	24.2	0.0	87.5	90.9	82.9	87.1	
RH 1934	42.5	8.2	31.2	27.3	25.9	5.1	15.5	45.0	95.0	90.4	86.9	90.8	
KMR 21-3	12.5	11.8	28.9	17.7	20.3	6.9	13.6	0.0	90.0	90.8	74.9	85.2	
NPJ-252	32.5	22.0	31.1	28.5	13.9	14.9	14.4	40.0	100.0	90.5	70.0	86.8	
DRMRIJ 18-62	22.5	7.4	33.4	21.1	15.5	14.0	14.8	0.0	100.0	90.6	69.8	86.8	
PBR 939	30.0	24.6	35.6	30.1	23.3	21.1	22.2	0.0	95.0	93.6	78.9	89.2	
HUJM-20-9	22.5	13.7	30.0	22.1	15.2	22.0	18.6	0.0	95.0	91.1	75.8	87.3	
RMM 19-18	17.5	10.0	38.9	22.1	18.5	10.9	14.7	0.0	95.0	85.9	92.0	91.0	
DM-1521	17.5	14.1	40.0	23.9	20.4	34.0	27.2	15.0	85.0	83.3	90.9	86.4	
DRMRCI 147	10.0	9.1	36.7	18.6	23.6	26.9	25.3	0.0	90.0	83.7	92.2	88.6	

RGN-507	37.5	8.2	31.1	25.6	35.2	21.1	28.2	55.0	90.0	83.5	85.1	86.2
BAUM-21-1	47.5	37.0	35.6	40.0	28.8	30.0	29.4	60.0	87.5	86.7	96.0	90.1
PRB-2016-1	12.5	30.0	25.1	22.5	19.7	29.1	24.4	0.0	95.0	76.0	94.9	88.6
DRMRCI(Q) 57	3.5	0.0	0.0	1.2	10.4	0.0	5.2	0.0	95.0	70.5	87.8	84.4
PDZ-17#	0.0	0.1	0.0	0.0	14.7	0.0	7.4	0.0	90.0	51.0	90.9	77.3
RH (OE)-1808	3.5	27.5	32.2	21.1	20.1	9.1	14.6	0.0	90.0	61.1	86.9	79.3
LES- 65	10.0	0.1	30.0	13.4	14.3	2.0	8.2	0.0	95.0	76.9	90.9	87.6
DRMRQ 4-3	20.0	7.1	28.9	18.7	16.5	2.0	9.3	15.0	90.0	68.7	94.0	84.2
JC-16	0.0	0.7	0.0	0.2	19.4	0.0	9.7	0.0	100.0	83.8	62.9	82.2
BIOYSR (RC-WR)	12.5	1.3	0.0	4.6	10.4	0.0	5.2	0.0	90.0	71.3	97.1	86.1
IJ19R5004	0.0	0.1	0.0	0.0	12.3	0.0	6.2	0.0	100.0	90.8	92.0	94.3
DRMRCI(Q) 47	12.5	10.7	0.0	7.7	10.3	6.2	8.3	10.0	100.0	91.2	76.0	89.1
PDZ-16#	12.5	0.1	0.0	4.2	10.6	0.0	5.3	15.0	82.5	86.5	86.0	85.0
RH (OE)-1612	40.0	29.5	34.5	34.7	14.3	41.1	27.7	50.0	90.0	86.7	96.0	90.9
LES- 64	32.5	21.5	31.1	28.4	11.4	34.0	22.7	45.0	100.0	94.1	94.9	96.3
DRMRQ 143-9	0.0	12.5	30.0	14.2	12.7	10.9	11.8	0.0	95.0	86.1	92.2	91.1
JC-1	27.5	3.4	33.4	21.4	12.5	0.0	6.3	15.0	97.5	91.1	95.8	94.8
RH 2050	17.5	23.0	36.7	25.7	23.6	14.9	19.3	0.0	100.0	78.4	92.0	90.1
PAB-2014-17	15.0	9.1	0.0	8.0	19.4	2.0	10.7	0.0	90.0	70.8	78.0	79.6
NPJ 251	32.5	31.5	34.5	32.8	27.7	28.0	27.9	0.0	85.0	71.4	82.0	79.5
DRMRHJ 430	12.5	37.0	42.2	30.6	27.8	14.9	21.4	0.0	92.5	86.3	61.4	80.1
KMR(L) 21-6	32.5	32.5	35.6	33.5	34.1	34.0	34.1	35.0	90.0	76.6	60.9	75.8
RGN-522	42.5	19.5	43.4	35.1	29.9	35.8	32.9	30.0	97.5	63.6	64.0	75.0
HUJM-20-6	32.5	23.0	30.0	28.5	33.9	8.2	21.1	20.0	95.0	90.9	95.3	93.7
DRMRHT-13-7-113	42.5	24.0	35.6	34.0	22.4	2.0	12.2	40.0	95.0	83.6	94.9	91.2
RH 1939	40.0	34.5	30.0	34.8	28.4	26.0	27.2	45.0	100.0	91.1	80.2	90.4
DRMRMJA 35 (RC-WR)	0.0	7.3	11.7	6.3	16.7	10.9	13.8	0.0	95.0	91.1	94.0	93.4
PAB-2014-7	22.5	7.5	5.0	11.7	18.0	0.0	9.0	0.0	100.0	88.3	97.1	95.1
NPJ 250	0.0	3.2	30.0	11.1	14.9	2.0	8.5	0.0	100.0	80.7	95.8	92.2
DRMRCI 140	40.0	27.0	35.6	34.2	23.3	34.0	28.7	15.0	95.0	86.2	94.9	92.0
KMR(L) 21-5	35.0	52.5	31.1	39.5	32.6	14.9	23.8	10.0	100.0	79.9	94.9	91.6
RGN-520	50.0	26.0	40.0	38.7	30.5	36.0	33.3	55.0	90.0	71.2	97.1	86.1
BAUM-08-15	47.5	26.0	36.7	36.7	39.6	35.1	37.4	50.0	85.0	84.0	96.2	88.4
ACN 237	52.5	30.1	46.7	43.1	39.3	32.2	35.8	55.0	90.0	79.7	57.1	75.6
DRMRSJ 272	22.5	5.6	31.2	19.8	26.2	34.2	30.2	10.0	95.0	79.7	63.2	79.3
RGN 73	50.0	20.5	34.5	35.0	21.1	33.3	27.2	35.0	100.0	68.2	72.0	80.1
RH 1930	42.5	13.1	31.1	28.9	19.4	34.0	26.7	35.0	100.0	83.5	74.9	86.1
RGN-519	27.5	26.1	32.2	28.6	17.8	21.1	19.5	0.0	95.0	88.9	70.9	84.9
DRMRHJ 1117	12.5	7.8	10.6	10.3	16.8	0.0	8.4	0.0	90.0	93.7	77.1	86.9
NPJ-255	37.5	16.5	33.4	29.1	21.5	34.0	27.8	25.0	90.0	88.3	61.1	79.8
PBR 357	10.0	0.3	5.0	5.1	29.0	22.0	25.5	0.0	100.0	88.5	80.2	89.6
DM- 1521	32.5	12.7	38.9	28.0	24.2	22.0	23.1	0.0	95.0	91.0	90.9	92.3
CAU- RMM 3	7.5	10.6	30.0	16.0	16.9	34.0	25.5	0.0	100.0	90.7	94.0	94.9
DRMRHT 13-22-2	40.0	20.0	31.2	30.4	30.8	21.1	26.0	10.0	100.0	93.2	86.9	93.4
RH 1928	42.5	15.6	35.6	31.2	30.3	20.9	25.6	15.0	100.0	91.0	92.0	94.3
Basanti (RC)	7.5	0.7	0.0	2.7	19.6	0.0	9.8	0.0	95.0	88.6	94.9	92.8
RGN-510	15.0	14.1	5.0	11.4	15.7	5.4	10.5	0.0	95.0	91.1	94.9	93.7
DRMR 2019-7	22.5	29.0	32.2	27.9	27.7	41.1	34.4	40.0	100.0	93.7	89.0	94.2
RB- 110	37.5	26.5	36.7	33.6	21.4	40.9	31.2	15.0	100.0	94.0	90.9	95.0
BAUM-21-2	15.0	30.0	31.1	25.4	22.2	44.0	33.1	0.0	90.0	94.3	90.2	91.5
NPJ-254	22.5	9.6	34.5	22.2	21.1	36.2	28.7	27.5	85.0	88.6	91.8	88.5
PBR 552	7.5	16.1	38.9	20.8	13.0	2.0	7.5	0.0	100.0	91.1	94.9	95.3

ORM 26-37-2	40.0	8.6	33.4	27.3	23.9	36.0	30.0	40.0	90.0	93.8	96.0	93.3
DRMRCI-143	0.0	0.1	0.0	0.0	11.1	10.9	11.0	17.5	100.0	93.7	92.0	95.2
RH 749	30.0	22.0	40.0	30.7	22.2	21.1	21.7	20.0	100.0	93.5	89.6	94.4
KGMH 9198	1.0	9.6	29.5	13.4	19.2	38.9	29.1	0.0	85.0	93.5	89.0	89.2
PHR4457	3.5	7.7	4.5	5.2	14.8	8.2	11.5	0.0	85.0	93.9	96.0	91.6
DRMRJH 3717	40.0	10.0	35.6	28.5	22.4	38.0	30.2	0.0	100.0	93.9	93.1	95.7
Pusa MH 65	32.5	9.6	30.0	24.0	11.0	36.0	23.5	0.0	100.0	91.1	93.3	94.8
SVJH- 71	27.5	10.1	33.4	23.7	8.9	21.1	15.0	0.0	95.0	91.4	86.9	91.1
RHH 2102	45.0	5.5	38.9	29.8	20.4	2.9	11.7	15.0	95.0	93.9	93.1	94.0
DRMRHJ 3130	32.5	17.5	30.0	26.7	15.7	34.0	24.9	10.0	85.0	91.1	82.0	86.0
NMH90M01	50.0	12.0	36.7	32.9	25.1	10.9	18.0	37.5	100.0	90.7	77.1	89.3
KMH 8765	17.5	10.6	32.2	20.1	15.2	25.1	20.2	0.0	100.0	91.0	62.9	84.6
DRMRHJ 3720	7.5	12.0	10.0	9.8	15.0	14.9	15.0	0.0	90.0	93.7	81.1	88.3
PHR5175	52.5	6.2	30.0	29.6	11.4	18.9	15.2	60.0	85.0	86.4	96.0	89.1
DRMRIJ 31 (C)	40.0	18.0	31.1	29.7	11.0	38.0	24.5	20.0	95.0	93.9	90.0	93.0
IJ16R1168	3.5	5.1	31.2	13.3	11.0	10.0	10.5	0.0	100.0	93.9	94.9	96.3
PMH90V02	7.5	9.5	34.5	17.2	10.0	10.9	10.5	0.0	95.0	93.7	96.0	94.9
Pusa MH 62	3.5	6.2	30.0	13.2	8.7	32.3	20.5	0.0	100.0	94.0	78.9	91.0
SVJH- 70	0.0	7.5	31.7	13.1	7.8	33.1	20.5	0.0	90.0	93.4	80.0	87.8
NAMJH21-01	0.0	1.2	0.0	0.4	13.9	2.0	8.0	0.0	85.0	88.9	76.2	83.4
RHH 2101	37.5	12.6	33.4	27.8	8.5	34.9	21.7	25.0	90.0	91.0	82.0	87.7
DRMRHJ 2518	35.0	31.0	32.2	32.7	13.2	35.8	24.5	10.0	95.0	91.3	81.8	89.4
RMX9922	10.0	13.6	28.4	17.3	8.7	34.9	21.8	10.0	90.0	93.6	90.0	91.2
PHR3281	30.0	10.1	30.0	23.4	23.2	35.6	29.4	30.0	100.0	93.1	93.8	95.6
18J408C	5.0	4.2	31.7	13.6	14.3	9.1	11.7	0.0	100.0	91.3	94.0	95.1
RH 2103	22.5	7.1	33.4	21.0	15.6	10.9	13.3	20.0	100.0	91.3	90.9	94.1
CS 2009-234	55.0	20.0	46.7	40.6	28.2	17.1	22.7	55.0	95.0	94.0	91.4	93.5
NPJ 231	12.5	6.6	48.9	22.7	24.0	21.1	22.6	0.0	90.0	86.4	74.9	83.8
RH 1928	57.5	22.5	40.0	40.0	24.7	15.6	20.2	57.5	95.0	93.6	57.1	81.9
CS 2013-64	22.5	13.5	42.2	26.1	24.3	40.0	32.2	27.5	95.0	91.3	52.0	79.4
PHR 2 (TC-AB)	7.5	0.2	38.9	15.5	9.5	9.1	9.3	25.0	85.0	71.2	89.0	81.7
RH 1927	25.0	15.7	36.7	25.8	10.5	34.0	22.3	20.0	97.5	90.9	73.8	87.4
CS 2020-4	57.5	17.5	48.9	41.3	9.7	34.0	21.9	45.0	95.0	91.2	94.0	93.4
NPJ 256	35.0	15.5	38.9	29.8	31.1	34.2	32.7	25.0	100.0	86.1	94.7	93.6
CS 2020-10	35.0	14.5	36.7	28.7	16.8	39.8	28.3	0.0	95.0	88.9	82.9	88.9
DRMR 2018-25	0.0	2.1	5.0	2.4	13.4	0.0	6.7	0.0	90.0	91.4	77.1	86.2
RH 2007	40.0	17.6	33.4	30.3	25.4	16.0	20.7	10.0	95.0	91.6	85.1	90.6
DRMRIJ 20-157	0.0	0.1	0.0	0.0	3.6	2.9	3.3	0.0	100.0	89.4	92.0	93.8
DRMRCI(W)-125	0.0	1.1	0.0	0.4	8.7	0.0	4.4	0.0	95.0	89.0	94.9	93.0
Maya (C)	17.5	0.7	4.5	7.6	16.5	2.0	9.3	25.0	87.5	89.3	94.2	90.3
DRMR 2018-37	0.0	0.7	0.0	0.2	3.6	0.0	1.8	0.0	90.0	93.9	93.0	92.3
RH 2070	0.0	8.1	0.0	2.7	14.2	34.0	24.1	0.0	90.0	86.6	74.9	83.8
DRMRHJ 317	10.0	4.0	30.0	14.7	12.9	2.0	7.5	20.0	85.0	81.4	77.1	81.2
DLSC 1 (C)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.8	3.3
GSL 1 (C)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.9	12.0	8.0
PT 303 (C)	0.0	0.6	0.0	0.2	0.0	2.0	1.0	0.0	80.0	91.2	8.0	59.7
NRCYS-5-2 (C)	17.5	0.2	0.0	5.9	0.0	1.8	0.9	0.0	67.5	61.3	6.9	45.2
CD(P=0.05)	5.1	5.2	4.1		11.2	4.1		9.2	13.8	11.9	2.7	
CV (%)	10.9	19.2	7.0		22.9	9.1		30.8	7.8	8.8	2.0	

Data of LDH, VAR and JHS for WR on leaves and % staghead at JHS and MOR were excluded due to <20% severity on susceptible check

Data of MOR, PNT for DM, JHS for PM, LDH, PNT, MOR for SR were excluded due to severity <20% on susceptible check

*artificial condition, **natural condition

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

Treatments	% AB					% disease reduction over check	% ABP			Yield (kg/ha)					% yield increase over check	B:C ratio			IBCR
	SHL	JAG	DOL	VAR	Mean		VAR	SHL	Mean	SHL	JAG	DOL	VAR	Mean		SHL	JAG	Mean	
Iprodione 50WP -FS @ 0.2%	14.1	4.5	11.1	16.3	11.5	71.4	11.67	6.2	8.9	1648.9	1677.7	1144.3	1531.7	1500.6	35.8	2.83	3.29	3.1	8.52
Tebuconazole 50%+trifloxistrobin 25% WG-FS @ 0.5g/l	12.6	3.7	5.5	13.9	8.9	77.8	9.87	5.3	7.6	1742.2	1742.3	1488.7	1652.3	1656.4	41.8	3.07	3.31	3.2	11.15
Soil application of Potash 40 kg/ h	22.3	10.7	29.9	44.7	26.9	33.1	25.13	14.9	20.0	1288.9	1477.3	954.8	1342.7	1265.9	23.8	2.48	2.93	2.7	13.08
ST+FS with Trichodermaharzianum @ 10g/ kg seed	23.6	10.4	16.2	20.3	17.6	56.2	13.23	14.4	13.8	1346.7	1538.0	1093.0	1481.0	1364.7	29.4	2.7	2.73	2.7	31.08
Lower three leaf removal at 45 DAS	25.8	4.3	22.2	36.2	22.1	45.0	18.73	15.2	16.9	1142.2	1214.0	1057.7	1298.7	1178.1	18.2	2.24	2.28	2.3	12.43
Garlic bulb extract @ 1% w/v (ST+FS)	15.2	12.5	24.5	17.1	17.3	57.0	12.77	8.6	10.7	1462.2	1594.7	1009.5	1512.3	1394.7	30.9	2.9	3.1	3.0	27.62
Pseudomonas florescence 10 ⁶ c.f.u.	26.2	12.7	29.9	21.2	22.5	44.1	14.8	17.7	16.3	1004.4	1248.0	912.8	1427.0	1148.1	16.0	2.04	2.49	2.3	17.82
Check	33.9	14.7	40.6	71.7	40.2	-	32.8	21.3	27.1	764.4	1157.0	783.3	1151.7	964.1	-	1.59	2.35	2.0	-
CD(P=0.05)	3.5	1.5	5.0	4.3			15.6	2.3		444.1	113.8	156.3	84.0			-	0.2		-
CV (%)	7.2	4.9	10.2	8.1			4.8	6.4		19.3	4.4	8.4	3.4			-	4.5		-

Table: 4.8.1: Epidemiology of WR, AB and SR disease at Hisar during 2021-22

A. White rust

Date of sowing	First appearance (DAS)	% WR(DAS)																							
		53	56	60	63	67	70	74	77	81	84	88	91	95	98	102	105	109	112	116	119	123	126	130	133
Varuna	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 01	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	1.7	1.7	2.5	2.5	4.5	5.0	5.8	7.8	9.1	12.8	15.6	16.7	17.8	19.1
Oct. 08	79	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.7	2.8	3.3	4.6	6.7	7.3	9.6	17.8	19.1	24.1	29.2	31.1	32.2	33.3	35.6	-	-
Oct. 15	74	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.9	1.7	4.6	5.8	11.1	15.6	20.5	32.2	36.7	40.0	41.1	42.2	43.4	-	-	-	-
Oct. 22	71	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.9	1.7	4.6	5.8	11.1	15.6	20.5	32.2	36.7	40.0	41.1	42.2	43.4	-	-	-	-
Oct. 29	64	0.0	0.0	0.0	0.0	0.8	1.7	3.3	4.6	6.7	12.3	18.9	24.5	31.2	33.4	38.9	41.1	43.4	45.6	-	-	-	-	-	-
Nov. 05	59	0.0	0.0	0.8	0.9	0.9	1.7	5.0	15.6	23.4	30.0	35.6	41.1	43.4	45.6	46.7	48.9	-	-	-	-	-	-	-	-
Nov. 12	55	0.0	0.8	0.9	3.3	7.8	12.3	20.5	26.7	31.2	36.7	38.9	42.2	45.6	46.7	-	-	-	-	-	-	-	-	-	-
Nov. 19	54	0.0	0.8	1.7	8.4	18.9	30.0	33.4	38.9	40.0	42.2	43.4	45.6	-	-	-	-	-	-	-	-	-	-	-	-
RH 30																									
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 08	79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	1.7	2.8	3.3	4.5	5.0	6.7	7.3	8.4	10.6	13.3	16.7	17.8	18.9	20.5
Oct. 15	73	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.7	3.3	4.6	6.7	7.8	8.9	12.3	18.9	21.1	25.1	31.2	33.4	34.5	35.6	38.9	-	-
Oct. 22	70	0.0	0.0	0.0	0.0	0.8	1.7	3.3	4.6	8.9	14.5	20.5	23.4	34.5	38.9	41.1	42.2	43.4	45.6	46.7	-	-	-	-	-
Oct. 29	61	0.0	0.0	0.0	0.8	0.8	1.7	4.6	5.0	8.4	15.6	25.1	29.5	34.5	38.9	41.1	43.4	45.6	46.7	-	-	-	-	-	-
Nov. 05	57	0.0	0.0	0.8	0.9	1.7	4.6	6.7	18.9	24.5	33.4	38.9	43.4	45.6	46.7	48.9	50.0	-	-	-	-	-	-	-	-
Nov. 12	55	0.0	0.8	1.7	4.6	8.4	14.5	21.1	28.9	33.4	38.9	43.4	46.7	48.9	48.9	-	-	-	-	-	-	-	-	-	-
Nov. 19	53	0.8	1.7	8.9	17.8	31.1	35.6	40.0	42.2	43.4	45.6	45.6	46.7	-	-	-	-	-	-	-	-	-	-	-	-

B. Staghead

Date of sowing	First appearance (DAS)	%Staghead Incidence (DAS)																	
		81	84	88	91	95	98	102	105	109	112	116	119	123	126	130	133	137	140
Varuna																			
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 08	126	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	4.1	5.4	8.1	9.5
Oct. 15	117	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	2.2	4.5	7.9	18.0	-	-
Oct. 22	104	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	9.0	19.4	24.6	26.1	26.9	28.4	-	-	-	-
Oct. 29	98	0.0	0.0	0.0	0.0	0.0	2.8	7.0	14.8	22.5	26.8	29.6	31.0	-	-	-	-	-	-
Nov. 05	93	0.0	0.0	0.0	0.0	1.7	12.1	23.0	27.6	31.6	35.6	-	-	-	-	-	-	-	-
Nov.12	88	0.0	0.0	0.6	2.2	4.5	6.1	12.3	21.2	-	-	-	-	-	-	-	-	-	-
Nov. 19	81	0.6	1.2	3.0	7.9	11.6	20.1	-	-	-	-	-	-	-	-	-	-	-	-
RH 30																			
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 08	125	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	2.7	5.5	8.2	11.0
Oct. 15	117	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	5.2	7.2	12.4	19.6	-	-
Oct. 22	104	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	10.9	23.3	27.1	28.7	31.8	32.6	-	-	-	-
Oct. 29	97	0.0	0.0	0.0	0.0	0.0	3.6	11.5	24.5	25.9	28.1	32.4	33.1	-	-	-	-	-	-
Nov. 05	92	0.0	0.0	0.0	0.0	2.4	10.8	22.2	27.5	29.3	34.7	37.7	-	-	-	-	-	-	-
Nov.12	86	0.0	0.0	3.5	11.8	12.9	15.3	17.6	20.6	23.5	-	-	-	-	-	-	-	-	-
Nov. 19	81	0.6	1.9	3.8	8.2	11.3	13.2	22.0	-	-	-	-	-	-	-	-	-	-	-

C. Alternaria leaf blight

Date of sowing	First appearance (DAS)	%ABL (DAS)																	
		81	84	88	91	95	98	102	105	109	112	116	119	123	126	130	133	137	140
Varuna																			
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 08	94	0.0	0.0	0.0	0.0	0.8	0.8	0.9	1.7	1.7	2.8	3.3	4.6	5.0	6.7	7.3	7.8	8.9	10.6
Oct. 15	90	0.0	0.0	0.0	0.8	0.8	1.7	2.5	3.3	4.6	6.7	8.9	10.6	11.7	12.8	13.4	14.5	-	-
Oct. 22	85	0.0	0.0	1.7	2.8	4.6	6.7	7.8	10.6	12.8	14.5	15.6	18.9	20.0	20.5	-	-	-	-
Oct. 29	82	0.0	1.7	2.8	3.3	5.0	7.8	11.7	15.6	17.8	20.0	22.2	24.5	-	-	-	-	-	-
Nov. 05	93	0.0	0.0	0.0	0.0	1.7	5.0	12.8	20.5	24.5	30.0	-	-	-	-	-	-	-	-
Nov. 12	90	0.0	0.0	0.0	1.7	6.7	13.4	21.1	28.9	-	-	-	-	-	-	-	-	-	-
Nov. 19	86	0.0	0.0	2.8	10.6	17.8	20.5	-	-	-	-	-	-	-	-	-	-	-	-
RH 30																			
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 08	94	0.0	0.0	0.0	0.0	0.8	1.7	1.7	2.8	3.3	5.0	7.8	8.4	8.9	10.0	10.6	11.7	12.3	12.8
Oct. 15	89	0.0	0.0	0.0	0.8	1.7	3.3	6.7	8.9	10.6	12.8	14.5	15.6	16.7	17.8	18.9	20.0	-	-
Oct. 22	85	0.0	0.0	0.8	1.7	2.8	6.7	10.6	13.4	15.6	17.8	18.9	20.5	21.1	22.2	-	-	-	-
Oct. 29	80	0.8	1.7	5.0	8.9	12.3	16.7	18.9	20.5	21.1	23.4	24.5	25.1	-	-	-	-	-	-
Nov. 05	92	0.0	0.0	0.0	0.0	1.7	6.7	13.4	20.5	28.9	32.2	-	-	-	-	-	-	-	-
Nov. 12	90	0.0	0.0	0.0	1.7	7.8	18.9	26.7	30.0	-	-	-	-	-	-	-	-	-	-
Nov. 19	85	0.0	0.0	3.3	13.3	18.9	21.1	-	-	-	-	-	-	-	-	-	-	-	-

D. Sclerotinia rot (SR under sick plot conditions)

Date of sowing	First appearance (DAS)	%Sclerotinia rot																				Seed yield (kg/h)		
		Days after sowing																						
Varuna		70	73	77	81	84	88	91	95	98	102	105	109	112	116	119	123	126	130	133	137	140	144	
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 08	95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	2.7	4.1	6.8	8.1	8.1	9.5	12.2	13.5	16.2	17.6	18.9	20.3	21.6	23.0	2988.7
Oct. 15	87	0.0	0.0	0.0	0.0	0.0	1.1	1.1	3.4	6.7	9.0	10.1	12.4	14.6	18.0	21.3	25.8	27.0	29.2	30.3	31.5	-	-	2772.0
Oct. 22	81	0.0	0.0	0.0	0.7	1.5	3.7	6.0	7.5	9.7	13.4	16.4	20.9	22.4	26.9	28.4	30.6	32.8	35.8	-	-	-	-	2392.6
Oct. 29	77	0.0	0.0	0.7	1.4	2.1	4.2	6.3	11.3	15.5	21.1	23.2	27.5	28.9	34.5	37.3	38.7	-	-	-	-	-	-	1988.0
Nov. 05	74	0.0	0.0	0.6	1.1	1.7	4.6	9.8	16.1	22.4	24.7	28.2	31.6	35.6	39.1	44.8	-	-	-	-	-	-	-	1756.0
Nov. 12	70	0.6	0.6	1.1	1.7	4.5	10.1	14.5	19.0	23.5	27.4	34.6	35.2	-	-	-	-	-	-	-	-	-	-	1624.0
Nov. 19	70	0.6	1.8	4.3	9.8	14.6	20.1	23.8	25.0	29.3	29.9	-	-	-	-	-	-	-	-	-	-	-	-	1488.3
RH 30																								
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 08	94	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	2.7	5.5	9.6	12.3	13.7	17.8	19.2	20.5	21.9	23.3	24.7	24.7	26.0	26.0	2897.3
Oct. 15	85	0.0	0.0	0.0	0.0	0.0	1.0	2.1	4.1	7.2	9.3	9.3	12.4	14.4	17.5	21.6	25.8	28.9	29.9	32.0	34.0	-	-	2603.0
Oct. 22	77	0.0	0.0	0.8	1.6	3.9	6.2	7.8	10.1	14.0	17.1	21.7	23.3	27.9	29.5	31.8	33.3	34.9	37.2	-	-	-	-	2273.3
Oct. 29	75	0.0	0.0	0.7	1.4	2.9	5.8	7.9	13.7	16.5	23.7	25.9	29.5	30.2	36.0	38.8	41.7	-	-	-	-	-	-	1852.6
Nov. 05	72	0.0	0.6	1.2	2.4	6.0	10.2	17.4	23.4	25.7	29.3	32.9	37.1	40.7	46.7	-	-	-	-	-	-	-	-	1663.3
Nov. 12	69	0.6	1.2	1.8	2.4	5.3	11.8	15.3	20.6	24.7	28.8	36.5	37.1	-	-	-	-	-	-	-	-	-	-	1607.0
Nov. 19	70	0.6	1.9	5.0	10.1	15.1	21.4	24.5	26.4	30.2	30.8	-	-	-	-	-	-	-	-	-	-	-	-	1432.0

Table 4.8.2: Epidemiology of downy mildew, Alternaria blight and white rust at PNT during 2021-22

Date of sowing	First appearance (DAS)	DM disease incidence (%) at cotyledonary stage and disease severity (%) at true leaf to adult plant stage																											
		Date of observation																											
		2021-22																											
		Oct-23	Oct-28	Jan-01	Apr-04	Aug-08	Nov-11	Nov-15	Nov-19	Nov-23	Nov-27	Dec-02	Nov-28	Feb-12	Jun-12	Sep-12	Dec-13	Dec-16	Dec-20	Dec-23	Dec-27	Dec-30	Mar-01	Jun-01	Oct-01	Jan-13	Jan-17	Jan-20	
Varuna																													
Oct. 01	28	0.0	40.0	40.0	40.0	45.0	55.0	55.0	75.0	80.0	80.0	80.0	65.0	60.0	60.0	55.0	55.0	50.0	50.0	50.0	45.0	40.0	40.0	40.0	35.0	35.0	20.0	0.0	
Oct. 08	20	0.0	30.0	40.0	50.0	50.0	55.0	60.0	60.0	70.0	70.0	75.0	80.0	65.0	65.0	50.0	45.0	40.0	40.0	25.0	25.0	20.0	20.0	25.0	25.0	20.0	20.0	20.0	
Oct. 15	8	50.0	30.0	35.0	45.0	50.0	60.0	60.0	70.0	75.0	80.0	80.0	80.0	75.0	70.0	70.0	65.0	55.0	55.0	50.0	50.0	50.0	45.0	40.0	35.0	35.0	40.0	40.0	
Oct. 22	10	0.0	0.0	55.0	55.0	55.0	60.0	70.0	80.0	85.0	80.0	80.0	80.0	85.0	70.0	75.0	65.0	65.0	60.0	60.0	55.0	55.0	45.0	40.0	40.0	35.0	30.0	30.0	
Oct. 29	10	0.0	0.0	0.0	0.0	40.0	45.0	55.0	60.0	70.0	85.0	90.0	90.0	90.0	85.0	85.0	80.0	75.0	75.0	70.0	55.0	50.0	50.0	45.0	45.0	45.0	45.0	45.0	
Nov. 05	14	0.0	0.0	0.0	0.0	0.0	0.0	65.0	70.0	80.0	85.0	85.0	80.0	80.0	85.0	85.0	75.0	75.0	70.0	65.0	65.0	70.0	65.0	60.0	60.0	60.0	60.0	60.0	
Nov. 12	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	60.0	70.0	80.0	80.0	80.0	75.0	85.0	85.0	75.0	75.0	70.0	65.0	65.0	65.0	60.0	60.0	55.0	55.0	55.0	
Nov. 19	13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0	90.0	90.0	90.0	90.0	95.0	80.0	80.0	75.0	75.0	70.0	70.0	70.0	60.0	60.0	65.0	65.0	65.0	
Kranti																													
Oct. 01	28	0.0	40.0	40.0	40.0	45.0	55.0	55.0	75.0	80.0	80.0	80.0	65.0	60.0	60.0	55.0	55.0	50.0	50.0	50.0	45.0	40.0	40.0	40.0	35.0	35.0	20.0	0.0	
Oct. 08	20	0.0	30.0	40.0	50.0	50.0	55.0	60.0	60.0	70.0	70.0	75.0	80.0	65.0	65.0	50.0	45.0	40.0	40.0	25.0	25.0	20.0	20.0	25.0	25.0	20.0	20.0	20.0	
Oct. 15	8	0.0	30.0	35.0	45.0	50.0	60.0	60.0	70.0	75.0	80.0	80.0	80.0	75.0	70.0	70.0	65.0	55.0	55.0	50.0	50.0	50.0	45.0	40.0	35.0	35.0	40.0	40.0	
Oct. 22	10	50.0	50.0	55.0	55.0	55.0	60.0	70.0	80.0	85.0	80.0	80.0	80.0	85.0	70.0	75.0	65.0	65.0	60.0	60.0	55.0	55.0	45.0	40.0	40.0	35.0	30.0	30.0	
Oct. 29	10	0.0	0.0	0.0	0.0	40.0	45.0	55.0	60.0	70.0	85.0	90.0	90.0	90.0	85.0	85.0	80.0	75.0	75.0	70.0	55.0	50.0	50.0	45.0	45.0	45.0	45.0	45.0	
Nov. 05	14	0.0	0.0	0.0	0.0	0.0	0.0	50.0	65.0	70.0	80.0	85.0	85.0	80.0	80.0	85.0	85.0	75.0	75.0	70.0	65.0	65.0	70.0	65.0	60.0	60.0	60.0	60.0	
Nov. 12	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	60.0	70.0	80.0	80.0	80.0	75.0	85.0	85.0	75.0	75.0	70.0	65.0	65.0	65.0	60.0	60.0	55.0	55.0	55.0	
Nov. 19	13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0	90.0	90.0	90.0	90.0	95.0	80.0	80.0	75.0	75.0	70.0	70.0	70.0	60.0	60.0	65.0	65.0	65.0	

B. White rust

Date of sowing	First app.	% WR severity																							
		Date of observation																							
		2021-22																							
		Dec-13	Dec-16	Dec-20	Dec-23	Dec-27	Dec-30	Mar-01	Jun-01	Dec-01	Jan-13	Jan-17	Jan-20	Jan-24	Jan-27	Jan-31	Mar-02	Jul-02	Oct-02	Feb-14	Feb-17	Feb-21	Feb-24	Feb-28	
Varuna	DAS																								
Oct. 01	77	1.0	1.0	2.0	2.0	5.0	5.0	10.0	15.0	15.0	20.0	25.0	30.0	40.0	40.0	45.0	45.0	50.0	50.0	55.0	55.0	60.0	60.0	60.0	
Oct. 08	69	0.0	3.0	5.0	5.0	7.0	10.0	10.0	10.0	10.0	15.0	20.0	20.0	25.0	40.0	45.0	45.0	45.0	50.0	50.0	55.0	55.0	55.0	60.0	
Oct. 15	58	1.0	1.0	1.0	2.0	5.0	10.0	10.0	15.0	20.0	25.0	30.0	25.0	40.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	55.0	
Oct. 22	62	0.0	0.0	0.0	0.1	2.0	5.0	5.0	20.0	25.0	25.0	30.0	30.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	
Oct. 29	55	0.0	0.0	0.0	3.0	3.0	3.0	3.0	5.0	10.0	20.0	20.0	25.0	40.0	45.0	50.0	50.0	30.0	40.0	40.0	45.0	45.0	45.0	55.0	
Nov. 05	55	0.0	0.0	0.0	0.0	0.0	1.0	1.0	5.0	5.0	10.0	10.0	20.0	25.0	35.0	35.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	55.0	
Nov. 12	45	0.0	0.0	0.0	0.0	1.0	5.0	5.0	5.0	10.0	15.0	15.0	15.0	20.0	25.0	25.0	30.0	30.0	30.0	35.0	35.0	35.0	35.0	40.0	
Nov. 19	45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	5.0	5.0	5.0	13.0	15.0	20.0	15.0	25.0	25.0	30.0	30.0	35.0	40.0	40.0	50.0	
Kranti																									
Oct. 01	77	1.0	1.0	2.0	2.0	5.0	5.0	10.0	15.0	15.0	20.0	25.0	30.0	40.0	40.0	45.0	45.0	50.0	50.0	55.0	55.0	60.0	60.0	60.0	
Oct. 08	69	0.0	3.0	5.0	5.0	7.0	10.0	10.0	10.0	10.0	15.0	20.0	20.0	25.0	40.0	45.0	45.0	45.0	50.0	50.0	55.0	55.0	55.0	60.0	
Oct. 15	58	1.0	1.0	1.0	2.0	5.0	10.0	10.0	15.0	20.0	25.0	30.0	25.0	40.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	55.0	
Oct. 22	62	0.0	0.0	0.0	0.1	2.0	5.0	5.0	20.0	25.0	25.0	30.0	30.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	
Oct. 29	55	0.0	0.0	0.0	3.0	3.0	3.0	3.0	5.0	10.0	20.0	20.0	25.0	40.0	45.0	50.0	50.0	30.0	40.0	40.0	45.0	45.0	45.0	55.0	
Nov. 05	55	0.0	0.0	0.0	0.0	0.0	1.0	1.0	5.0	5.0	10.0	10.0	20.0	25.0	35.0	35.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	55.0	
Nov. 12	45	0.0	0.0	0.0	0.0	5.0	5.0	5.0	5.0	10.0	15.0	15.0	15.0	20.0	25.0	25.0	30.0	30.0	30.0	35.0	35.0	35.0	35.0	40.0	
Nov. 19	45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	10.0	10.0	10.0	13.0	15.0	20.0	15.0	25.0	25.0	30.0	30.0	35.0	40.0	40.0	50.0	

C. Alternaria leaf blight

Date of sowing	First app.(DAS)	% ABL																							
		Date of observations																							
		2021												2022											
		Dec-13	Dec-16	Dec-20	Dec-23	Dec-27	Dec-30	Mar-01	Jun-01	Dec-01	Jan-13	Jan-17	Jan-20	Jan-24	Jan-27	Jan-31	Mar-02	Jul-02	Oct-02	Feb-14	Feb-17	Feb-21	Feb-24	Feb-28	
Varuna	DAS																								
Oct. 01	77	0.0	5.0	5.0	10.0	15.0	15.0	20.0	25.0	25.0	30.0	30.0	40.0	45.0	45.0	50.0	50.0	55.0	55.0	60.0	60.0	60.0	65.0	65.0	
Oct. 08	66	3.0	3.0	3.0	5.0	7.0	10.0	15.0	15.0	20.0	20.0	25.0	40.0	50.0	55.0	55.0	60.0	60.0	60.0	65.0	65.0	65.0	65.0	65.0	
Oct. 15	68	0.0	0.0	0.0	2.0	15.0	15.0	15.0	20.0	30.0	30.0	40.0	50.0	50.0	50.0	55.0	60.0	60.0	65.0	65.0	70.0	70.0	70.0	70.0	
Oct. 22	58	0.0	0.0	3.0	1.0	5.0	5.0	10.0	15.0	20.0	40.0	50.0	60.0	60.0	65.0	70.0	70.0	70.0	75.0	75.0	80.0	80.0	80.0	80.0	
Oct. 29	55	0.0	0.0	0.0	2.0	12.0	15.0	20.0	20.0	30.0	40.0	40.0	55.0	55.0	55.0	60.0	60.0	65.0	65.0	65.0	70.0	70.0	70.0	70.0	
Nov. 05	48	0.0	0.0	0.0	2.0	5.0	10.0	10.0	15.0	25.0	35.0	25.0	50.0	55.0	60.0	65.0	65.0	70.0	70.0	75.0	75.0	80.0	80.0	80.0	
Nov. 12	45	0.0	0.0	0.0	0.0	3.0	5.0	10.0	15.0	15.0	20.0	20.0	35.0	40.0	45.0	45.0	50.0	50.0	50.0	55.0	55.0	55.0	55.0	60.0	
Nov. 19	41	0.0	0.0	0.0	0.0	0.0	2.0	5.0	5.0	5.0	5.0	10.0	10.0	15.0	15.0	20.0	20.0	30.0	35.0	40.0	40.0	45.0	45.0	55.0	
Kranti																									
Oct. 01	77	0.0	10.0	10.0	10.0	10.0	15.0	20.0	25.0	25.0	30.0	30.0	40.0	45.0	45.0	50.0	50.0	55.0	55.0	60.0	60.0	60.0	65.0	70.0	
Oct. 08	66	5.0	5.0	5.0	5.0	7.0	10.0	15.0	15.0	20.0	20.0	25.0	40.0	50.0	55.0	55.0	60.0	60.0	60.0	65.0	65.0	65.0	65.0	65.0	
Oct. 15	68	0.0	0.0	0.0	2.0	15.0	15.0	15.0	20.0	30.0	30.0	40.0	50.0	50.0	50.0	55.0	60.0	60.0	65.0	65.0	70.0	70.0	70.0	75.0	
Oct. 22	58	0.0	0.0	3.0	1.0	5.0	5.0	10.0	15.0	20.0	40.0	50.0	60.0	60.0	65.0	70.0	70.0	75.0	75.0	80.0	80.0	80.0	80.0	80.0	
Oct. 29	55	0.0	0.0	0.0	2.0	12.0	15.0	20.0	20.0	30.0	40.0	40.0	55.0	55.0	55.0	60.0	60.0	65.0	65.0	65.0	70.0	70.0	70.0	75.0	
Nov. 05	48	0.0	0.0	0.0	2.0	5.0	10.0	10.0	15.0	25.0	35.0	25.0	50.0	55.0	60.0	65.0	65.0	70.0	70.0	75.0	75.0	80.0	80.0	80.0	
Nov. 12	45	0.0	0.0	0.0	0.0	3.0	5.0	10.0	15.0	15.0	20.0	20.0	35.0	40.0	45.0	45.0	50.0	50.0	50.0	55.0	55.0	55.0	55.0	55.0	
Nov. 19	41	0.0	0.0	0.0	0.0	0.0	2.0	5.0	5.0	5.0	5.0	10.0	10.0	15.0	15.0	20.0	20.0	30.0	35.0	40.0	45.0	45.0	50.0	50.0	

D. Alternaria blight on pod

Date of sowing	First appearance (DAS)	% ABP										Yield (7.5 sq m) kg /plot	Yield (q/ha)	1000 seedwt (g)
		Date of observation												
Varuna		02-03-22	02-07-22	02-10-22	14-02-22	17-02-22	21-02-22	24-02-22	28-02-22	02-03-22	03-07-22			
Oct. 01	126	5.0	10.0	15.0	15.0	10.0	25.0	45.0	50.0	60.0	60.0	2.1	28.0	3.52
Oct. 08	118	3.0	7.0	10.0	15.0	15.0	30.0	40.0	45.0	45.0	65.0	2.0	26.7	3.22
Oct. 15	110	10.0	10.0	15.0	15.0	10.0	20.0	35.0	40.0	45.0	55.0	1.8	24.0	3.19
Oct. 22	104	15.0	15.0	20.0	25.0	5.0	15.0	35.0	35.0	40.0	65.0	1.6	21.3	3.04
Oct. 29	101	0.0	5.0	5.0	10.0	10.0	15.0	30.0	35.0	35.0	60.0	1.5	20.0	3.15
Nov. 05	94	0.0	10.0	10.0	15.0	20.0	20.0	20.0	30.0	35.0	60.0	1.3	17.3	2.83
Nov. 12	87	0.0	5.0	10.0	10.0	20.0	20.0	20.0	30.0	30.0	50.0	1.0	13.3	3.15
Nov. 19	87	0.0	0.0	15.0	15.0	20.0	20.0	25.0	25.0	30.0	40.0	0.8	10.7	3.07
Kranti														
Oct. 01	126	5.0	10.0	15.0	15.0	10.0	25.0	45.0	50.0	60.0	60.0	2.0	26.7	3.22
Oct. 08	118	5.0	7.0	10.0	15.0	15.0	30.0	40.0	45.0	45.0	65.0	1.9	25.3	3.2
Oct. 15	110	5.0	10.0	15.0	15.0	10.0	20.0	35.0	40.0	45.0	55.0	1.7	22.7	3.04
Oct. 22	104	10.0	15.0	20.0	25.0	5.0	15.0	35.0	35.0	40.0	65.0	1.8	24.0	2.95
Oct. 29	101	0.0	5.0	5.0	10.0	15.0	15.0	30.0	35.0	35.0	60.0	1.6	21.3	2.96
Nov. 05	94	0.0	10.0	10.0	20.0	20.0	25.0	20.0	30.0	35.0	60.0	1.3	17.3	2.81
Nov. 12	87	0.0	5.0	5.0	10.0	20.0	20.0	30.0	30.0	30.0	50.0	1.2	16.0	3.02
Nov. 19	87	0.0	0.0	10.0	15.0	20.0	20.0	25.0	25.0	30.0	40.0	1.0	13.3	3.01

Table 4.8.3: Epidemiology of white rust and Powdery mildew at SKN during 2021-22

A. Powdery mildew

Date of sowing	Date of appearance (DAS)	% Powdery mildew											Yield (q/ha)
		Days after sowing											
Varuna		91	95	98	102	105	109	112	116	119	123	126	
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	18.5
Oct. 08	118	-	-	-	-	-	-	-	-	-	3.1	11.0	15.9
Oct. 15	112	-	-	-	-	-	-	-	1.1	5.0	15.2	22.5	15.3
Oct. 22	108	-	-	-	-	-	-	3.0	14.0	20.5	35.5	44.5	15.3
Oct. 29	100	-	-	-	-	1.9	9.4	17.5	27.5	38.0	54.0	-	13.3
Nov. 05	98	-	-	-	4.1	13.0	32.5	47.0	59.5	73.5	-	-	13.0
Nov. 12	90	-	-	8.5	21.5	43.5	60.5	77.0	91.0	-	-	-	12.3
Nov. 19	88	5.0	12.0	33.0	62.5	83.5	97.5	100.0	-	-	-	-	11.9
GM-2													
Oct. 01	-	-	-	-	-	-	-	-	-	-	-	-	19.3
Oct. 08	119	-	-	-	-	-	-	-	-	-	1.0	4.5	16.4
Oct. 15	113	-	-	-	-	-	-	-	0.8	4.2	12.0	22.0	16.2
Oct. 22	109	-	-	-	-	-	-	3.2	13.2	23.0	33.0	42.0	16.0
Oct. 29	100	-	-	-	-	0.7	4.6	11.5	19.5	30.0	44.5	-	14.5
Nov. 05	99	-	-	-	2.2	8.0	15.5	30.5	46.0	61.5	-	-	14.0
Nov. 12	94	-	-	3.2	15.0	30.5	51.0	75.0	87.0	-	-	-	13.3
Nov. 19	88	2.9	9.0	21.0	42.5	65.0	88.5	95.5	-	-	-	-	12.8

B. White Rust

Date of sowing	Date of appearance (DAS)	% WR																			
		Days after sowing																			
		63	67	70	74	77	81	84	88	91	95	98	102	105	109	112	116	119	123	126	
Varuna																					
Oct. 01	92	-	-	-	-	-	-	-	-	-	0.9	1.7	2.8	3.1	5.1	7.6	10.7	11.8	14.1	15.6	
Oct. 08	92	-	-	-	-	-	-	-	-	-	0.4	1.4	2.6	4.3	5.5	7.4	10.3	14.7	-	-	
Oct. 15	85	-	-	-	-	-	-	-	0.7	1.2	1.9	3.1	4.9	6.4	9.6	14.2	-	-	-	-	
Oct. 22	83	-	-	-	-	-	-	-	2.4	6.7	11.7	15.7	19.2	22.2	-	-	-	-	-	-	
Oct. 29	78	-	-	-	-	-	3.4	6.0	10.0	13.9	18.5	24.3	-	-	-	-	-	-	-	-	
Nov. 05	75	-	-	-	-	3.7	7.5	13.5	20	25.9	-	-	-	-	-	-	-	-	-	-	
Nov. 12	68	-	-	4.1	9.5	18.5	23.5	28.6	-	-	-	-	-	-	-	-	-	-	-	-	
Nov. 19	60	4.1	11	18.3	24.8	31.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
GM-2																					
Oct. 01	99	-	-	-	-	-	-	-	-	-	-	-	0.6	1.1	2.0	2.4	4.7	6.9	10.4	13.5	
Oct. 08	96	-	-	-	-	-	-	-	-	-	-	0.3	1.0	4.0	7.1	10.7	13.0	15.9	-	-	
Oct. 15	92	-	-	-	-	-	-	-	-	-	0.8	1.8	4.1	8.0	14.7	18.2	-	-	-	-	
Oct. 22	85	-	-	-	-	-	-	-	1.4	3.8	7.8	15.3	17.4	20.3	-	-	-	-	-	-	
Oct. 29	78	-	-	-	-	-	3.5	4.9	9.0	13.8	17.6	22.0	-	-	-	-	-	-	-	-	
Nov. 05	75	-	-	-	-	4.2	9.3	14.2	18.9	23.8	-	-	-	-	-	-	-	-	-	-	
Nov. 12	68	-	-	4.3	9.0	14	20.5	27.0	-	-	-	-	-	-	-	-	-	-	-	-	
Nov. 19	61	4.4	9.1	15.2	22.0	28.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Table 4.8.4: Epidemiology of Alternaria blight disease on leaves at SHL during 2021-22

A. Alternaria blight

Date of sowing	First appearance (DAS)	% ABL											First appearance (DAS)	% ABP							
		Days after sowing												Days after sowing							
		40	50	60	70	80	90	100	110	120	130	140		70	80	90	100	110	120	130	140
Varuna																					
Oct. 01	75	0.0	0.0	0.0	0.0	2.9	5.6	12.9	15.3	20.4	24.3	0.0	123	0.0	0.0	0.0	0.0	0.0	0.0	7.5	0.0
Oct. 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 22	55	0.0	0.0	2.6	6.5	14.2	16.1	19.4	24.3	28.7	0.0	0.0	107	0.0	0.0	0.0	0.0	6.3	9.2	0.0	0.0
Oct. 29	44	0.0	2.8	5.1	11.3	16.2	18.6	24.3	29.2	0.0	0.0	0.0	93	0.0	0.0	0.0	5.8	13.9	17.1	0.0	0.0
Nov. 05	42	0.0	3.2	7.4	13.2	17.1	20.6	26.5	35.1	0.0	0.0	0.0	90	0.0	0.0	0.0	8.6	15.2	21.1	0.0	0.0
Nov. 12	38	2.4	6.9	10.3	15.1	18.3	25.4	30.4	37.2	0.0	0.0	0.0	88	0.0	0.0	3.5	9.8	14.9	24.3	0.0	0.0
Nov. 19	37	2.1	7.0	11.1	17.2	25.1	28.2	35.4	0.0	0.0	0.0	0.0	85	0.0	0.0	6.3	11.3	19.3	0.0	0.0	0.0
TM 2																					
Oct. 01	73	0.0	0.0	0.0	0.0	3.4	6.4	13.9	16.2	21.9	26.3	0.0	121	0.0	0.0	0.0	0.0	0.0	0.0	7.9	0.0
Oct. 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 22	52	0.0	0.0	4.3	9.3	16.3	19.3	22.1	25.1	31.2	0.0	0.0	105	0.0	0.0	0.0	0.0	7.5	12.7	0.0	0.0
Oct. 29	43	0.0	5.3	8.9	13.1	18.7	21.3	26.4	31.2	0.0	0.0	0.0	91	0.0	0.0	0.0	8.1	13.7	17.3	0.0	0.0
Nov. 05	40	0.0	4.2	9.9	15.3	19.3	23.4	29.1	37.2	0.0	0.0	0.0	88	0.0	0.0	1.5	8.8	17.3	20.6	0.0	0.0
Nov. 12	37	2.7	7.6	12.8	17.9	20.3	27.9	32.8	39.7	0.0	0.0	0.0	86	0.0	0.0	2.7	9.4	18.9	25.3	0.0	0.0
Nov. 19	34	3.2	8.3	13.8	18.9	26.4	32.7	38.5	0.0	0.0	0.0	0.0	82	0.0	0.0	6.3	13.2	21.7	0.0	0.0	0.0

B. White rust

Date of sowing	First appearance (DAS)	% WR											Yield (kg/plot)	Yield (q/ha)	1000-seed wt (g)		
		Days after sowing (DAS)															
		40	50	60	70	80	90	100	110	120	130	140					
Varuna																	
Oct. 01	80	-	-	-	-	0.7	1.4	2.4	3.6	-	-	-	0.7	8.7	4.2		
Oct. 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Oct. 15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Oct. 22	58	-	-	0.6	1.8	3.4	4.1	5.2	6.7	-	-	-	1.0	13.3	3.1		
Oct. 29	52	-	-	1.7	3.8	4.5	5.9	6.8	7.4	-	-	-	1.2	16.0	4.3		
Nov. 05	47	-	0.5	2.5	3.6	4.6	6.9	8.7	9.3	-	-	-	1.3	16.7	4.6		
Nov. 12	45	-	1.1	2.9	4.2	9.3	10.3	13.4	17.8	-	-	-	1.1	14.0	3.6		
Nov. 19	42	-	2.3	3.6	5.4	11.3	13.5	15.7	23.4	-	-	-	0.9	12.0	3.2		
TM 2																	
Oct. 01	79					0.9	1.8	3.2	4.5				0.5	6.8	-		
Oct. 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Oct. 15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Oct. 22	58	-	-	0.7	2.3	4.2	5.6	6.5	7.9	-	-	-	0.8	10.5	2.7		
Oct. 29	52	-	-	1.9	3.9	5.3	6.7	7.8	10.7	-	-	-	0.9	11.5	3.1		
Nov. 05	48	-	0.6	2.9	4.2	5.2	7.8	10.6	12.4	-	-	-	0.8	10.8	2.9		
Nov. 12	45	-	1.4	3.2	5.4	7.6	11.2	14.2	19.8	-	-	-	0.6	8.5	2.7		
Nov. 19	43	-	1.9	3.8	5.8	12.1	14.2	16.5	24.3	-	-	-	0.6	8.1	2.6		

Table 4.8.5: Epidemiology of Alternaria leaf blight, White rust and powdery mildew disease of mustard at JAG during 2021-22

A. Alternaria leaf blight

Date of Sowing	Disease appearance (DAS)	% ABL												
		Days after sowing												
		40	50	60	70	80	90	100	110	120				
Varuna														
Oct. 01	63	0.0	0.0	0.0	5.0	14.6	20.5	32.5	34.6	38.5				
Oct. 08	60	0.0	0.0	0.0	5.0	12.0	28.9	35.1	38.0	22.0				
Oct. 15	55	0.0	0.0	3.0	10.0	25.0	32.2	35.1	25.0	12.0				
Oct. 22	52	0.0	0.0	5.0	18.6	32.1	38.4	30.0	14.5	10.0				
Oct. 29	60	0.0	0.0	1.0	8.3	32.7	22.5	18.5	15.0	0.0				
Nov. 05	50	0.0	2.0	8.0	15.2	15.6	18.2	12.2	8.5	0.0				
Nov. 12	36	2.0	7.0	12.2	14.0	12.0	8.2	8.0	0.0	0.0				
Nov. 19	40	2.0	10.0	14.3	18.2	15.4	10.0	6.2	0.0	0.0				
CG Sarson														
Oct. 01	58	0.0	0.0	2.0	12.0	25.0	40.0	42.0	45.0	50.0				
Oct. 08	55	0.0	0.0	5.0	15.0	20.0	36.0	40.0	42.0	34.2				
Oct. 15	54	0.0	0.0	5.0	15.0	22.3	24.6	40.0	30.0	28.2				
Oct. 22	55	0.0	0.0	2.0	10.0	22.0	25.0	32.2	38.0	12.0				
Oct. 29	60	0.0	0.0	1.0	20.0	25.0	30.0	36.0	32.0	8.2				
Nov. 05	55	0.0	0.0	4.2	22.0	28.2	30.0	34.0	15.0	0.0				
Nov. 12	36	2.0	12.0	25.0	15.0	14.0	12.0	8.0	0.0	0.0				
Nov. 19	42	0.0	7.0	12.0	15.0	12.5	8.2	0.0	0.0	0.0				

A. White rust

Date of Sowing	Disease appearance (DAS)	% WR									
		Days after sowing									
Varuna		40	50	60	70	80	90	100	110	120	
Oct. 01	78	0.0	0.0	0.0	0.0	6.2	5.0	0.0	0.0	0.0	
Oct. 08	75	0.0	0.0	0.0	0.0	6.2	0.0	0.0	0.0	0.0	
Oct. 15	65	0.0	0.0	0.0	5.6	5.0	12.8	10.2	0.0	0.0	
Oct. 22	76	0.0	0.0	0.0	0.0	10.0	15.6	22.6	0.0	0.0	
Oct. 29	56	0.0	0.0	4.0	12.8	20.0	26.4	34.2	0.0	0.0	
Nov. 05	56	0.0	0.0	4.3	14.6	22.4	30.0	38.6	0.0	0.0	
Nov. 12	45	0.0	3.2	8.4	20.0	35.0	42.0	45.8	0.0	0.0	
Nov. 19	42	0.0	6.2	10.0	25.0	30.2	38.2	42.2	0.0	0.0	
CG Sarson											
Oct. 01	84	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0	0.0	
Oct. 08	75	0.0	0.0	0.0	0.0	3.6	0.0	0.0	0.0	0.0	
Oct. 15	64	0.0	0.0	0.0	4.4	5.0	0.0	0.0	0.0	0.0	
Oct. 22	62	0.0	0.0	0.0	5.0	15.0	20.0	14.6	0.0	0.0	
Oct. 29	56	0.0	0.0	2.0	20.0	25.0	20.0	18.3	0.0	0.0	
Nov. 05	52	0.0	0.0	5.8	22.0	25.5	30.0	32.0	0.0	0.0	
Nov. 12	44	0.0	4.6	20.0	30.0	34.8	40.6	42.0	0.0	0.0	
Nov. 19	42	0.0	12.4	16.8	28.4	32.4	35.6	40.5	0.0	0.0	

B. Powdery mildew

Date of Sowing	Disease appearance (DAS)	% PM									Yield (q/ha)	1000 seed wt(g)
		Days after sowing										
Varuna		40	50	60	70	80	90	100	110	120		
Oct. 01	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.2	4.77
Oct. 08	96	0.0	0.0	0.0	0.0	0.0	0.0	28.0	42.0	18.0	16.5	4.91
Oct. 15	86	0.0	0.0	0.0	0.0	0.0	16.0	76.0	68.0	47.0	17.6	5.22
Oct. 22	80	0.0	0.0	0.0	0.0	12.0	38.0	70.0	65.0	66.0	17.3	4.48
Oct. 29	68	0.0	0.0	0.0	17.0	28.0	45.0	52.0	60.0	72.0	18.2	5.39
Nov. 05	62	0.0	0.0	16.0	40.0	54.0	62.0	74.0	78.0	92.0	17.2	5.08
Nov. 12	55	0.0	10.0	42.0	64.0	74.0	78.0	92.0	90.0	92.0	12.8	5.15
Nov. 19	40	2.6	25.0	56.8	74.4	75.0	82.0	84.6	88.2	92.8	9.1	5.22
CG Sarson												
Oct. 01	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.2	4.03
Oct. 08	100	0.0	0.0	0.0	0.0	0.0	0.0	6.8	28.0	15.0	16.3	4.26
Oct. 15	85	0.0	0.0	0.0	0.0	0.0	18.0	75.0	65.0	50.0	16.4	4.11
Oct. 22	78	0.0	0.0	0.0	0.0	5.6	35.0	72.0	65.0	62.0	16.2	4.18
Oct. 29	68	0.0	0.0	0.0	7.5	30.0	48.0	55.0	62.0	70.0	17.3	4.34
Nov. 05	58	0.0	0.0	8.2	42.0	58.0	68.0	78.0	80.0	92.0	17.4	4.4
Nov. 12	52	0.0	0.0	32.0	63.0	72.0	75.0	88.0	91.0	92.0	16.8	4.15
Nov. 19	45	0.0	20.6	45.5	70.6	76.2	80.0	82.2	87.0	94.2	10.6	4.18

Table 4.8.6: Epidemiology of Alternaria blight, white rust and powdery mildew at JHS during 2021-22

A. Alternaria blight

Date of Sowing Giriraj	Disease appearance (DAS)	% ABL							Disease appearance (DAS)	% ABP							
		Days after sowing								Days after sowing							
		50	60	70	80	90	100	110		60	70	80	90	100	110	120	
Oct. 01	91	-	-	-	-	-	5.0	5.0	-	-	-	-	-	-	-	-	-
Oct. 08	85	-	-	-	-	5.0	5.0	10.0	-	-	-	-	-	-	-	-	-
Oct. 15	78	-	-	-	5.0	10.0	10.0	10.0	-	-	-	-	-	-	-	-	-
Oct. 22	68	-	-	5.0	10.0	10.0	20.0	20.0	-	-	-	-	-	-	-	-	-
Oct. 29	61	-	-	10.0	20.0	20.0	30.0	30.0	97	-	-	-	-	5.0	10.0	0.0	-
Nov. 05	54	-	10.0	10.0	30.0	30.0	50.0	-	92	-	-	-	-	10.0	20.0	0.0	-
Nov. 12	49	5.0	20.0	30.0	30.0	50.0	50.0	-	90	-	-	-	10.0	20.0	30.0	0.0	-
Nov. 19	47	5.0	10.0	20.0	20.0	30.0	50.0	-	88	-	-	10.0	20.0	20.0	30.0	0.0	-
Varuna																	
Oct. 01	90	-	-	-	-	5.0	5.0	5.0	-	-	-	-	-	-	-	-	-
Oct. 08	82	-	-	-	-	5.0	10.0	10.0	-	-	-	-	-	-	-	-	-
Oct. 15	75	-	-	-	5.0	10.0	20.0	20.0	-	-	-	-	-	-	-	-	-
Oct. 22	64	-	-	5.0	10.0	20.0	20.0	30.0	-	-	-	-	-	-	-	-	-
Oct. 29	55	-	-	10.0	20.0	30.0	50.0	-	94	-	-	-	-	10.0	20.0	0.0	-
Nov. 05	50	-	10.0	20.0	30.0	30.0	50.0	-	90	-	-	-	20.0	20.0	30.0	0.0	-
Nov. 12	45	10.0	20.0	30.0	30.0	50.0	50.0	-	89	-	-	30.0	50.0	0.0	0.0	0.0	-
Nov. 19	42	10.0	10.0	30.0	30.0	50.0	50.0	-	83	-	-	-	30.0	50.0	0.0	0.0	-

B. White rust and Powdery mildew

Date of Sowing Giriraj	Disease app. DAS	% WR							Disease app. DAS	% Staghead							Disease app. DAS	% PM							Yield (q/ha)
		Days after sowing								Days after sowing								Days after sowing							
		50	60	70	80	90	100	110		70	80	90	100	110	120	130		70	80	90	100	110	120	130	
Oct. 01	104	-	-	-	-	-	-	12.5	-	-	-	-	-	-	-	-	123	-	-	-	-	-	-	40.0	22.8
Oct. 08	95	-	-	-	-	-	15	27.0	-	-	-	-	-	-	-	-	115	-	-	-	-	-	30.0	-	25.4
Oct. 15	88	-	-	-	-	20.0	25.5	27.5	114	-	-	-	-	23.0	30.3	35.2	110	-	-	-	-	-	30.0	-	27.2
Oct. 22	80	-	-	-	-	25.0	30.0	35.2	110	-	-	-	-	24.3	25.8	32.1	103	-	-	-	-	30.0	-	-	33.2
Oct. 29	77	-	-	-	20.0	25.0	32.5	40.0	100	-	-	-	23.0	25.0	28.8	30.0	97	-	-	-	50.0	-	-	-	33.0
Nov. 05	68	-	-	26.0	32.0	34.2	40.0	50.0	99	-	-	-	25.6	27.0	30.0	32.0	90	-	-	50.0	-	-	-	-	30.0
Nov. 12	62	-	20.0	22.5	28.0	29.0	32.2	35.0	98	-	-	-	26.0	27.4	28.0	30.0	90	-	-	50.0	-	-	-	-	26.4
Nov. 19	58	-	17.0	20.2	26.9	27.4	28.0	30.0	93	-	-	-	20.2	22.5	25.0	25.4	84	-	-	26.0	-	-	-	-	25.0
Nov. 26	49	12.1	15.0	20.0	22.0	25.0	27.0	28.1	90	-	-	22.0	22.5	25.0	25.8	27.0	80	-	40.0	-	-	-	-	-	20.8
Varuna																									
Oct. 01	101	-	-	-	-	-	-	22.0	-	-	-	-	-	-	-	-	123	-	-	-	-	-	-	50.0	20.20
Oct. 08	93	-	-	-	-	-	18.0	29.2	-	-	-	-	-	-	-	-	115	-	-	-	-	-	50.0	-	22.70
Oct. 15	87	-	-	-	-	23.4	25.8	29.4	108	-	-	-	-	25.0	32.0	35.0	110	-	-	-	-	-	50.0	-	26.00
Oct. 22	82	-	-	-	-	27.3	33.0	37.1	102	-	-	-	-	22.0	25.0	30.0	103	-	-	-	-	30.0	-	-	32.40
Oct. 29	75	-	-	-	22.0	28.0	34.0	40.0	100	-	-	-	20.0	23.0	26.8	28.0	89	-	-	-	50.0	-	-	-	32.00
Nov. 05	67	-	-	26.0	32.9	34.8	40.0	50.0	98	-	-	-	25.6	27.0	30.0	32.0	90	-	-	50.0	-	-	-	-	24.80
Nov. 12	60	-	22.0	25.0	28.3	30.0	33.9	35.0	97	-	-	-	25.0	26.9	29.2	30.0	84	-	-	50.0	-	-	-	-	22.00
Nov. 19	56	-	18.5	20.8	27.0	27.4	28.9	32.0	90	-	-	19.8	20.2	22.0	23.0	26.0	80	-	30.0	-	-	-	-	-	16.60
Nov. 26	47	15.0	18.2	20.0	22.8	25.3	27.3	30.0	90	-	-	18.8	22.5	23.0	25.0	25.4	79	-	40.0	-	-	-	-	-	13.40

Table: 4.8.7: Epidemiology of AB, WR, PM, DM and SR at MOR during 2021-22

A. Alternariabligh

Date of sowing	First appearance (DAS)	% ABL									First app.	% ABP								First app.	% SR incidence						Plant Stent	Seed yield (kg/ha)
		Days after sowing										Days after sowing									Days after sowing							
		50	60	70	80	90	100	110	120	130		60	70	80	90	100	110	120	130		80	90	100	110	120	130		
VARUNA																												
Oct. 01	92	-	-	-	-	0.4	0.9	1.3	2.1	3.1	112	-	-	-	-	-	0.9	1.3	2.7	130	-	-	-	-	-	15.0	145	2052
Oct. 08	91	-	-	-	-	0.9	1.3	2.2	2.7	3.6	110	-	-	-	-	0.4	1.3	1.8	2.7	130	-	-	-	5.0	15.0	20.0	147	2650
Oct. 15	85	-	-	-	0.4	0.9	1.8	2.7	3.1	3.6	100	-	-	-	-	0.9	2.2	3.1	3.6	120	-	-	-	10.0	20.0	25.0	146	2540
Oct. 22	80	-	-	-	0.4	1.3	1.8	3.1	4.9	-	91	-	-	-	0.9	1.3	2.7	3.6	4.0	120	-	-	10.0	10.0	15.0	30.0	149	2310
Oct. 29	75	-	-	1.3	1.8	2.2	3.6	4.0	-	-	90	-	-	-	1.3	1.3	2.7	3.6	4.0	110	-	-	20.0	20.0	25.0	35.0	146	2150
Nov. 05	72	-	0.4	1.3	2.2	2.7	4.9	5.3	-	-	81	-	-	0.4	1.8	2.2	3.1	3.6	5.3	100	-	10.0	15.0	15.0	15.0	45.0	147	1960
Nov. 12	70	0.4	0.9	1.8	5.3	6.2	8.9	-	-	-	80	-	-	1.3	1.8	2.7	3.6	4.0	5.8	100	-	10.0	10.0	20.0	25.0	50.0	150	1680
Nov. 19	70	0.4	1.3	1.8	6.7	10.7	15.1	-	-	-	80	-	-	2.7	3.6	7.6	12.4	13.8	-	100	5.0	15.0	20.0	25.0	35.0	55.0	144	1271
ROHINI																												
Oct. 01	92	-	-	-	-	1.3	2.2	2.7	3.1	4.0	110	-	-	-	-	-	0.4	1.3	2.2	130	-	-	-	-	-	20.0	147	2600
Oct. 08	91	-	-	-	-	1.8	2.7	3.6	4.0	4.9	110	-	-	-	-	0.9	1.8	2.7	3.1	130	-	-	-	10.0	15.0	25.0	150	3333
Oct. 15	85	-	-	-	1.3	2.2	3.1	4.0	4.4	5.3	100	-	-	-	-	1.3	2.2	3.1	4.0	120	-	-	-	5.0	20.0	30.0	147	3467
Oct. 22	80	-	-	-	1.8	2.2	3.6	4.4	6.2	-	91	-	-	-	0.4	1.3	1.8	3.1	4.9	120	-	-	10.0	15.0	25.0	35.0	149	3120
Oct. 29	75	-	-	1.8	2.7	3.1	4.0	6.7	-	-	95	-	-	0.9	1.8	2.7	3.6	5.3	-	110	-	-	15.0	20.0	25.0	40.0	144	3773
Nov. 05	72	-	1.3	2.7	3.6	4.4	5.8	7.1	-	-	80	-	0.4	1.3	1.3	2.7	3.1	5.8	-	100	-	5.0	10.0	15.0	30.0	45.0	146	2344
Nov. 12	70	1.8	2.7	3.6	5.3	8.4	-	-	-	-	80	-	0.9	1.8	2.2	3.1	4	6.2	-	100	-	10.0	15.0	20.0	35.0	45.0	145	1904
Nov. 19	70	2.2	4.9	5.3	6.7	9.3	-	-	-	-	80	1.3	2.7	3.6	4.0	4.9	6.2	6.7	-	100	5.0	15.0	20.0	25.0	40.0	50.0	143	1733

B. WR, SH, PM and DM

Date of sowing	First app.	% WR									First app.	% SH					First app.	% PM					First app.	% DM									
		Days after sowing										Days after sowing						Days after sowing						Days after sowing									
		50	60	70	80	90	100	110	120	130		80	90	100	110	120		130	90	100	110	120		130	50	60	70	80	90	100	110	120	130
VARUNA																																	
Oct. 01	90	-	-	-	-	0.9	1.3	2.7	8.0	11.1	130	-	-	-	50.0	83.3	83	110	-	-	-	-	-	110	-	-	-	-	0.4	0.4	1.3	3.6	4.9
Oct. 08	81	-	-	-	0.4	0.4	1.3	3.6	9.3	12.4	120	-	-	-	25.0	37.5	50.0	105	-	-	-	-	69	105	-	-	-	-	0.4	0.4	0.9	3.1	5.3
Oct. 15	70	-	-	-	0.9	11.1	15.1	20.0	28.4	28.4	110	-	-	12.5	15.3	18.3	27	98	-	-	-	67.1	72.0	98	-	-	-	0.4	3.1	5.8	10.2	11.6	12.0
Oct. 22	70	-	-	3.3	6.2	12.4	15.6	31.6	-	-	110	-	-	25.0	28.3	31.3	35	96	-	-	56.0	68.0	73.3	96	-	-	1	1.3	4.9	8.0	11.1	-	-
Oct. 29	60	-	4.0	12	21.3	28.0	35.1	-	-	-	110	-	21.1	21.1	22.2	25.0	33	87	-	-	57.3	69.8	74.2	87	-	1.8	4	9.3	13.3	15.3	-	-	-
Nov. 05	55	-	5.3	13	25.3	30.2	36.0	-	-	-	100	-	20.0	27.3	41.2	43.3	47	83	-	53.8	58.2	70.7	75.1	83	-	2	4.0	10.7	14.2	16.9	-	-	-
Nov. 12	48	2	9.3	15	27.1	33.3	-	-	-	-	92	19.0	21.8	25.0	28.6	31.6	37	80	-	55.1	59.6	71.1	76.4	80	0	1	5	8.4	15.1	-	-	-	-
Nov. 19	48	2	10	16	31.6	34.7	-	-	-	-	90	20.0	26.3	31.0	38.9	47	47	80	49.3	56.4	60.4	71.6	76.9	80	0	3	5	9.3	16.4	-	-	-	-
ROHINI																																	
Oct. 01	90	-	-	-	-	1.3	2.7	4.9	6.2	7.1	130	-	-	-	20.0	26.7	25	110	-	-	-	-	-	110	-	-	-	-	0.4	0.9	1.3	1.3	1.8
Oct. 08	81	-	-	-	-	3.6	4.4	6.2	7.6	8.0	120	-	-	-	6.7	17.6	21	105	-	-	-	-	71	105	-	-	-	-	1.3	1.8	2.2	3.1	3.1
Oct. 15	70	-	-	-	3.1	4.9	5.3	6.7	8.0	8.4	110	-	-	16.7	20.0	24.0	44	100	-	-	-	-	68.0	100	-	-	-	1.3	1.8	1.8	2.2	2.2	2.7
Oct. 22	70	-	-	-	4.0	4.9	5.8	7.1	8.4	9.3	110	-	-	22.2	25.0	2.3	58	96	-	-	38	69.3	72	96	-	-	-	1.8	1.8	2.2	2.7	3.1	3.6
Oct. 29	60	-	-	3.6	4.4	25.3	26.7	28	-	-	110	-	23.1	20.0	2.2	27.3	27	90	-	-	43	59.6	73	90	-	-	1.3	1.8	11.1	11.1	11	-	-
Nov. 05	55	-	2.7	3.6	4.9	26	27.6	28.4	-	-	100	-	28.6	20.0	35.3	46.7	62	83	-	39.1	45	70.2	76	83	-	1	2	2.2	12.0	12.4	12.4	-	-
Nov. 12	48	1	2.2	4.9	26	26	36.0	-	-	-	92	15.0	21.1	22.2	33.3	50.0	67	80	-	41.3	45.3	71.1	77	80	0	2	2	12	14	14.7	-	-	-
Nov. 19	48	3	4.9	6.2	27	29	36	-	-	-	90	20.0	31.3	35.7	41.2	42	44	80	38	42.7	4.7	73.3	79	80	1	1	2	12	14	15	-	-	-

Table: 4.8.8: Epidemiology of Alternaria blight at DOL during 2021-22
Alternaria Blight

Date of sowing	First appearance	% AB(DAS)										
		50	60	70	80	90	100	110	120	130	140	
Varuna	DAS											
Oct. 01	Fail	-	-	-	-	-	-	-	-	-	-	-
Oct. 08	Fail	-	-	-	-	-	-	-	-	-	-	-
Oct. 15	Fail	-	-	-	-	-	-	-	-	-	-	-
Oct. 22	59	2.6	10.2	18.2	25.4	30.2	34.6	40.5	42.4	45.3	50.2	
Oct. 29	44	9.6	14.3	18.1	22.5	26.4	32.8	38.7	40.3	42.2	45.6	
Nov. 05	31	12.4	15.1	20.5	25.4	34.5	38.5	40.6	41.8	42.1	42.3	
Nov. 12	25	14.2	16.8	18.9	24.5	32.6	38.9	40.0	40.5	40.5	40.8	
Nov. 19	25	18.1	20.5	25.4	30.2	33.4	34.0	34.5	35.2	35.6	35.8	
RajendraSuflam												
Oct. 01	Fail	-	-	-	-	-	-	-	-	-	-	-
Oct. 08	Fail	-	-	-	-	-	-	-	-	-	-	-
Oct. 15	Fail	-	-	-	-	-	-	-	-	-	-	-
Oct. 22	65	0.0	4.2	12.5	14.2	16.8	18.7	23.5	26.7	35.5	40.4	
Oct. 29	48	1.5	6.4	10.8	16.8	20.6	26.2	28.4	30.4	33.8	35.2	
Nov. 05	36	4.5	8.4	10.8	15.2	20.8	25.6	30.4	32.6	35.2	35.6	
Nov. 12	30	8.6	15.2	18.4	21.4	25.6	28.6	30.4	33.0	35.2	35.5	
Nov. 19	30	10.4	15.4	20.4	22.9	24.6	28.0	29.0	30.2	30.4	30.5	

Table: 4.9.1 Efficacy of fungicides against major diseases of rapeseed mustard 2021-22

Treatment	% AB (100 DAS)										% ABP (15 days before harvest)								% WR (90/100 DAS)								% SH				
	HSR	LD H	SH L	JHS	MO R	DOL	SGN	PN T	BP R	Mea n	HS R	LD H	SHL	JHS	MO R	SG N	PNT	Mean	LDH	JHS	MO R	BPR	SGN	HSR	PNT	Mea n	JHS	MO R	SGN	PNT	Mea n
T1	17.8	11.8	17.9	16.3	6.2	12.6	21.9	11.7	9.5	14.0	9.1	12.8	10.8	11.8	1.9	12.4	35.0	13.4	16.8	14.5	12.0	15.0	23	28.9	28.3	19.7	12.3	10.2	7.7	21.7	13.0
T2	20.9	14.6	21.2	18.9	7.1	21.4	11.7	20.0	24.0	17.8	14.1	15.2	16.0	14.5	4.7	7.6	40.0	16.0	17.6	20.0	8.4	25.7	19	38.2	33.3	23.2	15.2	17.5	5.3	30.0	17.0
T3	21.5	20.3	19.9	18.0	8.3	27.7	22.1	36.7	14.3	21.0	15.4	23.5	13.9	16.1	5.5	15.3	48.3	19.7	6.8	16.4	7.4	12.7	12	17.8	21.7	13.5	11.5	6.9	3.1	16.7	9.5
T4	19.3	14.0	20.1	13.3	10.5	24.0	15.7	31.7	23.7	19.1	12.6	16.2	14.9	12.2	6.7	10.5	45.0	16.9	15.2	17.1	11.3	26.3	26	25.6	38.3	22.8	14.3	19.1	8.5	36.7	19.6
T5	19.6	13.1	19.3	20.2	3.6	22.7	24.3	16.7	23.0	18.0	13.3	14.8	15.7	16.8	1.8	16.3	33.3	16.0	16.2	15.3	12.0	26.3	27	30.0	13.3	20.0	13.8	21.1	7.1	13.3	13.8
T6	17.1	18.0	18.9	15.2	5.8	19.7	15.0	46.7	19.7	19.6	8.2	16.7	12.5	12.7	2.2	9.3	55.0	16.7	14.5	12.8	6.2	33.0	18	21.4	45.0	21.5	11.5	13.4	4.8	51.7	20.4
T7	33.3	30.6	31.8	30.0	14.4	52.0	46.5	18.3	26.7	31.5	20.3	24.6	23.4	25.0	10.2	28.4	41.7	24.8	23.5	40.0	25.5	38.3	32	45.2	35.0	34.3	30.0	35.3	15.8	41.7	30.7
CD(P=0.05)	2.7	1.4	2.8	3.2	1.2	9.2	2.9	8.3	1.5		3.8	2.1	1.9	3.1	1.6	2.1	10.8		1.5	-	1.2	3.6	2.9	3.1	6.3		3.3	2.6	1.6	7.5	
CV%	5.5	3.2	5.9	10.4	4.4	21.1	6.1	18.6	-		9.9	4.9	4.8	12.1	8.1	5.7	14.7		3.6	-	3.5	-	5.9	5.3	11.9		12.8	6.2	6.1	14.6	

Treatments: T1 Tebuconazole 50%+ Trifloxystrobin 25% @ 0.1%; T2 Propiconazole 25% @ 0.1%; T3 Metalaxyl4% + mancozeb 64% @ 0.25%; T4 Hexaconazole 5% @ 0.1%; T5 Tebuconazole 25.9% @ 0.1%; T6 Azoxystrobin 23% @ 0.1%; T7 Control

Table: 4.9.2 Efficacy of fungicides against Sclerotinia rot major diseases

Treatment	% PM				% DM	% SR								Yield (kg/ha)										Plant stant	1000-seed (g)	B: C Ratio			Mean	
	LDH	JHS	MOR	Mean	MOR	HSR	LDH	JHS	MOR	DOL	SGN	PNT	BPR	Mean	HSR	PNT	LDH	SHL	MOR	DOL	SGN	BPR	Mean			MOR	MOR	HSR		MOR
T1	5.5	11.1	6.7	7.8	5.9	9.3	5.2	18.0	35.0	3.7	11.3	9.4	6.1	12.2	1996.0	1630.0	1940.0	1411.1	2880.0	1705.3	1607.0	2811.1	1997.6	310.3	7.1	1.50	10.92	1.19	4.5	
T2	17	16.3	8.5	13.8	4.0	11.1	3.5	20.0	10.0	11.2	10.5	5.4	9.3	10.1	1962.0	1144.0	1820.0	1084.4	2540.0	1360.7	1853.0	2433.3	1774.7	311.7	7.2	1.67	6.84	0.51	3.0	
T3	16	11.8	21.6	16.5	4.9	17.4	11.6	23.0	10.0	22.0	11.5	8.6	22.3	15.8	1649.0	1333.0	1860.0	1266.7	2475.0	1358.7	1742.0	2655.6	1792.5	309.0	6.7	1.33	7.00	0.76	3.0	
T4	6.4	15.1	20.6	14.0	4.6	8.2	8.6	15.0	18.3	18.3	13.4	8.7	21.0	13.9	2013.0	1266.0	1840.0	1166.7	2430.0	1206.7	1524.0	2422.2	1733.6	312.0	7.0	1.74	7.00	0.75	3.2	
T5	7.6	11.5	16.7	11.9	6.2	12.4	4.5	16.2	20.0	14.5	14.0	6.9	7.3	12.0	1895.0	1311.0	1870.0	1155.6	2400.0	1317.3	1673.0	2511.1	1766.6	308.0	6.7	1.58	5.42	1.72	2.9	
T6	7.5	14.6	17.8	13.3	3.1	19.3	9.6	22.4	13.3	10.3	11.1	10.3	10.0	13.3	1769.0	1966.0	1790.0	1373.3	2557.0	1420.7	1789.0	2455.6	1890.1	311.3	6.9	1.40	7.70	0.82	3.3	
T7	19	32.0	71.6	40.7	11.6	29.2	14.5	38.0	45.0	42.3	22.8	6.1	25.3	27.9	1462.0	844.0	1420.0	857.8	2100.0	943.2	1413.0	2233.3	1409.2	309.7	7.0	-	-	-	-	
CD(P=0.05)	2.1	3.2	1.3		1.6	3.1	2.6	3.5	4.1	6.7	3.1	1.8	3.5		49.7	3.4	73.7	234.3	234.7	216.0	103.0	350.2		NS	NS	-	-	-	-	-
CV%	6.4	12.4	2.5		6.9	7.7	8.9	9.9	8.8	23.5	8.4	12.5	7.4		1.5	14.8	2.3	10.8	5.2	9.3	6.6	-		2.2	3.5	-	-	-	-	-

Table 10.1: Bio-management of rapeseed-mustard diseases during 2021-22

Treatments	% AB (90 DAS)					% ABP (15 days before harvest)					% WR (75 DAS)							% SH			
	LDH	PNT	SHL	JHS	Mean	LDH	PNT	SHL	JHS	Mean	HSR	LDH	PNT	SKN	SHL	JHS	BPR	Mean	PNT	JHS	Mean
T1	23.8	53.3	24.0	20.0	30.3	20.6	45.0	19.1	10.0	23.7	37.0	10.7	41.7	38.1	14.1	20	33.3	27.8	13.3	20.0	16.7
T2	21.0	51.7	23.1	10.0	26.4	18.5	35.0	15.3	10.0	19.7	41.5	14.2	46.7	43.0	14.4	10	33.3	29.0	16.7	12.1	14.4
T3	19.1	48.3	20.4	5.0	23.2	16.6	45.0	13.7	5.0	20.1	36.6	13.6	35.0	36.3	13.8	10	32.7	25.4	11.7	10.4	11.0
T4	22.4	43.3	25.3	10.0	25.2	20.8	41.7	18.3	10.0	22.7	40.4	15.1	46.7	33.0	15.2	10	34.0	27.8	15.0	12.8	13.9
T5	18.6	35.0	22.5	20.0	24.0	20.6	36.7	14.5	10.0	20.4	38.5	13.8	36.7	48.9	15.6	20	34.7	29.7	21.7	22.0	21.8
T6	28.2	63.3	33.1	30.0	38.7	22.5	51.7	24.4	20.0	29.7	44.1	19.6	55.0	51.1	22.4	30	36.7	37.0	35.0	28.8	31.9
CD(P=0.05)	4.2	7.3	2.7	3.3		1.3	8.2	2.4	3.6		NS	4.1	8.8	NS	NA	3.4	NS		9.0	3.6	
CV%	8.2	8.1	4.9	12.6		2.6	10.5	5.3	19.9		4.9	9.9	11.0	17.3	12.8	12.4	3.5		25.9	12.3	

Treatments: T1 Seed treatment with *Trichoderma harzianum* @ 10g/ kg of seed; T2 Soil incorporation of *T. harzianum* with mustard straw @ 2.5t/ h; T3 T₁ + Foliar spray with *T. harzianum* at 60 and 75 DAS ; T4 Soil incorporation of FYM *T. harzianum* @ 1 kg/ q FYM; T5 Foliar spray with *Bacillus subtilis* 10⁶c.f.u.; T6 Control

Table 10.2: Bio-management of rapeseed-mustard diseases during 2021-22

Treatments	% PM				% SR						Seed yield (kg/ha)					
	SKN	JHS	BPR	Mean	HSR	LDH	PNT	JHS	BPR	Mean	HSR	LDH	SKN	SHL	BPR	Mean
T1	78.0	10.0	13.3	33.8	23.1	4.3	18.9	20.2	16.8	16.7	1749	1370	1180	1122	2414	1567
T2	80.7	10.0	13.3	34.7	25.2	6.0	20.2	16.5	14.0	16.4	1699	1385	1100	1271	2480	1587
T3	80.0	5.0	12.0	32.3	20.7	7.3	15.0	19.3	11.9	14.8	1780	1350	1190	1447	2510	1655
T4	77.0	10.0	14.7	33.9	26.2	6.9	12.4	13.8	15.4	14.9	1683	1415	1200	1153	2384	1567
T5	79.0	5.0	14.7	32.9	22.9	7.9	23.9	25.0	14.2	18.8	1756	1220	1130	1342	2467	1583
T6	86.0	30.0	16.7	44.2	32.1	9.9	31.4	40.0	22.5	27.2	1499	1130	1090	736	2350	1361
CD(P=0.05)	NS	4.0	NS		3.8	NS	9.0	3.9	NS		24.8	56.4	0.8	392.1	349.5	
CV%	5.3	21.2	3.2		6.9	17.7	24.1	10.9	7.7		0.8	2.3	3.9	18.1	-	

Treatments: T1 Seed treatment with *Trichoderma harzianum* @ 10g/ kg of seed; T2 Soil incorporation of *T. harzianum* with mustard straw @ 2.5t/ h; T3 T₁ + Foliar spray with *T. harzianum* at 60 and 75 DAS ; T4 Soil incorporation of FYM *T. harzianum* @ 1 kg/ q FYM; T5 Foliar spray with *Bacillus subtilis* 10⁶c.f.u.; T6 Control

5. Entomology

The 2021-22 crop season witnessed moderate to high population development of mustard aphid on different Brassica species.

5.1 Screening of advanced breeding germplasm against mustard aphid

One hundred eighty four strains (IVT) were evaluated against mustard aphid including susceptible/tolerant checks. Aphid pressure was low at **KAN** centre and moderate to severe at **MOR, HSR, SKN, PTN, NDH, LDH, DHO and SHIL** centres. Out of 184 IVT entries, two entries *viz.* ORM 18-29-5 and RH 1927 were found promising having the $A_{II} \leq 1.5$ (Table 5.1A). Among the 43 (AVT I and AVT II) entries screened against mustard aphid, all were found susceptible with A_{II} more than 1.5 (Table 5.1B).

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

The highest yield losses were observed in Radhika (45.3%) and DRMRIJ 31 (33.5%) at **Morena** followed by PM 31 (30.9%) at **Dholi** and Radhika (30.3%) at **Ludhiana** (Table 5.2). It was followed by 28.1% yield losses in PBR 357 and 27.9% in DRMRIJ 31 at **Ludhiana** and 27.1% in GDM 4 at **SK Nagar**. The highest yield loss among the entries evaluated in other centres was 25.8% in DRMRIJ 31 at **Hisar**, 25.7% in PM 27 at **Shillongani**, 16.2% (Varuna) at **Pant Nagar**, 12.7% in Radhika at **New Delhi** and 3.5% (Radhika) at **Kanpur**.

5.3 Population dynamics of various insect-pests on Brassica crops

Incidence of various insect-pests on Brassica crops

At **Hisar**, aphid population was observed from 7th to 14th std. week with peak during 10th and 11th std. week. The aphid population was observed till 14th std. week after which it disappeared from the crop. Low to moderate population of painted bug (0.1-0.5 bugs/ mrl) was observed from 45th - 47th std. week on DRMR IJ 31, T 27, GSC 6 and BSH 1 under timely sown conditions. Similarly low activity of sawfly was recorded from 41st -50th SMW under timely sown conditions, while no population of cabbage caterpillar was observed. The activity of coccinellid predators was observed from 47th to 14th std. week (Table 5.3.1A-D). At **Dholi**, moderate to high population of mustard aphid was recorded. It remained active from 52nd to 12th SMW with peak activity during 6th-7th SMW (Table 5.3.2). At **Pant Nagar** low to moderate population of mustard aphid was recorded on DRMR IJ 31, T 27, GSC 6, BSH 1, *B. nigra*, *B. alba* and Varuna during 1st to 8th std. week (Table 5.3.3A,B). Under late sown conditions, the peak activity of mustard aphid was observed from 7th-8th SMW. At **Ludhiana**, activity of both mustard aphid and cabbage aphid was recorded with low to moderate activity both under timely and late sown conditions. Under timely sown conditions first appearance of mustard and cabbage aphid was recorded during 7th standard week on GSC 6 and remained active till 11th std. week, while under late sown conditions it remained active from 5th to 11th std. week (Table 5.3.4A,B). Low to moderate activity of cabbage caterpillar was recorded both under timely and late sown conditions. Cabbage caterpillar appeared on 8th std. week on GSC 6 under both timely and late sown conditions and remained active till 12th std. week. At **SK Nagar**, population of mustard aphid was recorded from 51st to 8th std. week in timely and late sown crop (Table 5.3.5). At **Shillongani** peak population of mustard aphid was recorded in 3rd to 5th std. week, sawfly during 52nd to 4th std. week, flea beetle activity from 49th to 12th std. week and coccinellid predators' activity during 52nd and 14th std. week (Table 5.3.7A-D). At **Morena**, mustard aphid remained active from 49th to 13th std. week, while the activity of coccinellid beetles was observed from 50th to 10th std. week. Some activity of painted bug was also recorded from 47th to 50th std week. (Table 5.3.8A-D).

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

The alate aphid population was recorded by seven centres. At **Hisar**, the alate population appeared during 1st std. week, peaked (363.7 aphids/ trap) during 11th std. week and disappeared after 14th std. week. At **S.K. Nagar**, alate mustard aphid population appeared during 50th std. week,

reached its peak (3649.6 aphids/ trap) during 8th std. week and disappeared after 11th std. week. At **Ludhiana**, alate aphid appeared as early as 43rd std week and remained active upto 15th std week with peak (430.8 aphids/ trap) during 13th std. week. At **Pant Nagar**, the alate aphid appeared in 3rd std. week and peaked (253.0 aphids/ trap) during 10th std. week while it disappeared after 12th std week. At **Kanpur**, it appeared during 9th std. week and disappeared after 12th std. week. At **Morena**, it appeared during 51st std. week, peaked (141.2 aphids/ trap) during 6th std. week and disappeared after 16th std. week. At **Dholi**, its first appearance was recorded during 52nd std. week with peak activity (128.4 aphids/ trap) during 10th std. week and disappeared after 12th std. week (Table 5.3.8).

5.4 Effect of host plant diversity on abundance of mustard aphid and associated specialist and generalist natural enemies

At **Hisar**, aphid population in the three intercrop treatments was lower than the mustard alone treatment. However, differences in coccinellid predator population were non-significant while significantly high activity of syrphid flies and honey bees was observed in the intercrop treatments over mustard alone. Maximum activity of syrphid fly (12.7 visits/ minute) was recorded in mustard+fennel treatment. Similarly, maximum mummified aphids were also recorded in this treatment. The maximum mustard equivalent yield of 2071.5 kg/ha was also recorded in mustard+fennel treatment (Tables 5.4.1A-C). At **Dholi** also, the population of mustard aphid in the mustard alone treatment remained higher than all the other intercrop treatments throughout crop season. Minimum population of mustard aphid was recorded in mustard+coriander followed by mustard+fennel and mustard+chickpea (Table 5.4.2A). The maximum activity of aphid parasitoid *Diaeretiella rapae*, lady bird beetles, syrphid fly larvae, Chrysoperla and other predators was recorded in mustard+coriander followed by mustard+fennel and mustard+chickpea. Similarly, maximum yield of 1684.0 kg/ha was recorded in mustard+coriander followed by mustard+chickpea (1396.0 kg/ha), mustard+fennel (1258.0 kg/ha) while minimum yield (855.0 kg/ha) was obtained in mustard alone (Table 5.4.2B). At **Pantnagar**, the minimum aphid population was observed in the mustard+fennel treatment followed by mustard+chickpea (Table 5.4.3A). The maximum mustard equivalent yield was recorded in mustard alone (1870.3 kg/ha) followed by mustard+fennel (1753.9 kg/ha) (Table 5.4.3B). At **Ludhiana**, the population of mustard aphid and cabbage caterpillar in the three intercrop treatments remained significantly lower than that in mustard alone. The population of two pests remained minimum in the mustard+coriander treatment followed by mustard+chickpea and mustard+fennel (Table 5.4.4A). The maximum mustard equivalent yield 3381.4 kg/ha was obtained in mustard+chickpea followed by mustard+fennel (2892.8 kg/ha), mustard+coriander (2466.0 kg/ha) as against 1497.2 kg/ha in mustard alone which was significantly lower than the three intercrop treatments (Table 5.4.4B). At **SK Nagar**, the population of mustard aphid in all the four treatments remained comparable at all the observation intervals with no effect of intercropping observed on yield as well (Table 5.4.5A-B). At **Shillongani**, the minimum mean aphid activity at both flowering and siliqua formation stage (22.8 and 13.2 aphids/ plant) was observed in mustard+coriander treatment. It was followed by mustard+chickpea treatment (39.4 and 27.6 aphids/plant at flowering and pod formation) and mustard+fennel (42.5 and 28.5 aphids/plant) as against 71.2 and 53.4 aphids/plant in mustard alone. Almost similar trend was reflected in yield in different treatments (Table 5.4.6). Thus, it can be inferred from this experiment that intercropping of mustard with coriander/chickpea/fennel results in reduction in mustard aphid population with increased activity of natural enemies.

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

Aphid feeding on host plants resulted in changes in their biochemical parameters. In general, there was an increase in the activity of peroxidase, phenyl alanine ammonia lyase (PAL), total glucosinolates, total phenols, ortho-dihydroxy phenols and phenols after aphid feeding in both *B. juncea* (DRMR IJ 31) and *B. napus* (GSC 6). At **Hisar**, there was 31.03 and 62.96% increase in enzymatic activity of peroxidase on infested plants DRMRIJ 31 and GSC 6, respectively over uninfested. The respective figures for PAL were 28.78 and 38.20% (Table 5.5.1). Similarly, 74.01%

increase in glucosinolates levels were observed in GSC 6 compared to 22.93% in DRMR IJ 31 with similar trend observed for ortho-dihydroxy phenols and Flavonols. However, induction of total phenols (47.05%) was more in DRMR IJ 31 compared to GSC 6 (40.00). At **Ludhiana**, almost similar trend was observed to that observed in Hisar except for total phenols and ortho-dihydroxy phenols where more induction of total phenols was observed in GSC 6 compared to DRMR IJ 31 and vice versa for ortho-dihydroxy phenols (Table 5.5.2). In general, there was induction of all defense related compounds after aphid feeding in both *B. juncea* and *B. napus*.

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

S. No.	Code No.	Entries	MOR	HSR	KAN	SKN	PTN	NDH	LDH	DHO	SHIL	Mean
IVT Early Mustard												
1	SBG 21-1	RMX 9310 (Hybird)	1.3	0.4	0.22	2.6	1.1	1.8	1.5	2.8	2.6	1.8
2	SBG 21-2	RH 1999-18	1.2	0.3	0.15	2.5	0.8	1.8	2.1	2.1	2.0	1.6
3	SBG 21-3	DRMRHT 13-13-5-4	1.1	1.5	0.07	2.5	1.1	1.8	1.2	2.5	2.1	1.7
4	SBG 21-4	HUJM (E) 20-4	1.4	1.8	0.08	2.4	1.1	2.2	1.1	3.0	2.4	1.9
5	SBG 21-5	KRANTI (NC)	0.8	1.5	0.08	2.5	0.8	2.2	1.7	2.9	1.9	1.8
6	SBG 21-6	PRE-2018-9	1.4	0.1	0.05	2.3	1.2	2.7	0.9	3.1	2.0	1.7
7	SBG 21-7	KMR (E) 21-2	1.7	2.0	0.05	2.5	1.2	2.8	0.5	2.1	2.3	1.9
8	SBG 21-8	NPJ 249	1.1	2.1	0.17	2.5	1.0	2.5	0.4	2.5	2.2	1.8
9	SBG 21-9	PHR-8425 (HYBRID)	0.5	1.9	0.13	2.4	0.9	2.3	0.5	2.8	2.6	1.7
10	SBG 21-10	PM 30(LR)	2.7	0.2	0.10	2.4	1.2	2.2	0.8	2.5	2.1	1.8
11	SBG 21-11	DRMRCI-141	1.6	2.1	0.07	2.5	1.4	2.3	0.3	2.4	2.0	1.8
12	SBG 21-12	Mali MS 90	1.4	1.4	0.03	2.5	1.6	3.0	0.7	3.2	1.8	2.0
13	SBG 21-13	RH 1999-14	0.6	1.5	0.05	2.5	1.3	2.3	1.1	2.2	2.4	1.7
14	SBG 21-14	DRMRHT 13-13-5-5	1.8	1.3	0.02	2.5	1.4	2.2	0.8	2.9	1.8	1.8
15	SBG 21-15	DMH-1 (C)	1.5	1.5	0.13	2.5	1.6	2.8	3.4	3.2	2.3	2.4
16	SBG 21-16	BAUM -21-3	1.3	1.4	0.10	2.5	1.2	2.7	0.7	3.1	2.2	1.9
17	SBG 21-17	PRE-2018-7	2.3	0.2	0.00	2.4	1.3	2.5	2.7	2.9	2.0	2.0
18	SBG 21-18	KMR (E) 21-1	1.2	0.0	0.00	2.5	1.6	3.0	0.7	2.2	2.2	1.7
19	SBG 21-19	NPJ-248	1.8	0.2	0.02	2.3	1.5	2.2	2.0	2.6	2.2	1.9
20	SBG 21-20	RH 725 (CC)	1.0	1.5	0.07	2.6	1.3	2.8	1.2	2.1	2.7	1.9
21	SBG 21-21	PHR-8081 (HYBRID)	2.1	0.3	0.03	2.6	1.6	2.2	2.8	2.4	1.9	2.0
22	SBG 21-22	DRMRIJ 16-9-7	1.1	1.4	0.17	2.4	1.3	2.0	0.6	2.8	1.9	1.7
23	SBG 21-23	ACN 226	1.3	0.4	0.08	2.6	1.2	2.5	2.5	2.2	2.5	1.9
24	SBG 21-24	TM 311	0.7	1.2	0.05	2.4	1.2	2.5	0.6	2.5	1.6	1.6
25	SBG 21-25	PDZM 31 (QC)	2.8	2.0	0.05	2.7	1.2	2.8	2.7	3.2	2.2	2.4
26	SBG 21-26	ORM 2019-25	--	--	--	--	--	--	--	--	--	--
27	SBG 21-27	DRMRSJ 364	1.0	1.2	0.02	2.8	1.3	2.2	2.8	2.6	2.0	2.0

28	SBG 21-28	SVJH-69 (HYBRID)	1.3	0.3	0.00	2.7	1.3	2.2	0.7	2.9	2.7	1.8
29	SBG 21-29	BSH 1 (SC)	2.0	1.2	0.08	2.7	1.3	2.5	4.8	3.1	2.1	2.5
IVT Timely Sown Irrigated												
30	SBG 21-30	PBR 939	1.4	1.3	0.17	2.6	1.6	2.3	0.9	3.2	1.6	1.9
31	SBG 21-31	HUJM 10-6	1.5	0.4	0.05	2.7	1.6	2.3	0.4	2.9	2.3	1.8
32	SBG 21-32	DRMRCI-147	1.8	2.1	0.03	2.7	1.6	2.0	0.6	2.2	1.9	1.9
33	SBG 21-33	KMR 21-4	1.8	0.1	0.13	2.6	1.6	2.5	3.5	2.5	2.1	2.1
34	SBG 21-34	KRANTI (NC)	1.9	1.2	0.08	2.6	1.6	2.2	0.9	2.8	2.1	1.9
35	SBG 21-35	RGN 524	0.5	0.5	0.12	2.5	1.5	2.0	2.8	2.4	2.0	1.8
36	SBG 21-36	NPJ 253	1.2	1.3	0.03	2.7	1.6	1.7	1.2	2.1	2.1	1.7
37	SBG 21-37	ORM 18-29-5	0.7	0.3	0.03	2.5	1.5	1.7	0.7	2.5	1.8	1.5
38	SBG 21-38	SKM 1801	1.3	1.7	0.03	2.4	1.6	2.0	1.1	3.3	2.1	1.9
39	SBG 21-39	PM 30(LR)	1.3	1.2	0.07	2.5	1.5	2.2	0.5	2.8	1.7	1.7
40	SBG 21-40	DRMR 2019-19	1.2	1.3	0.00	2.4	1.6	2.0	0.9	3.1	1.9	1.8
41	SBG 21-41	RH 2049	1.6	1.4	0.02	2.4	1.6	2.2	3.2	2.4	1.9	2.1
42	SBG 21-42	PR-2019-3	1.9	1.2	0.13	2.4	1.6	2.5	2.5	2.6	2.0	2.1
43	SBG 21-43	BAUM-21-1	1.0	1.5	0.10	2.5	1.6	3.0	3.2	3.1	2.0	2.2
44	SBG 21-44	DMH-1 (C)	1.0	0.3	0.03	2.4	1.6	2.0	3.0	2.4	2.1	1.9
45	SBG 21-45	PRB-2016-1	1.8	1.4	0.00	2.6	1.6	2.3	0.5	2.9	1.9	1.9
46	SBG 21-46	HUJM 20-9	1.2	2.3	0.02	2.5	1.5	1.8	1.2	2.7	1.8	1.9
47	SBG 21-47	DRMRIJ 18-62	1.7	1.3	0.02	2.6	1.6	2.3	0.8	2.1	1.5	1.7
48	SBG 21-48	KMR 21-3	1.7	1.4	0.08	2.6	1.5	2.2	2.9	2.3	1.7	2.0
49	SBG 21-49	RH 725 (CC)	1.9	0.2	0.08	2.7	1.3	2.2	2.1	2.2	2.2	1.9
50	SBG 21-50	RGN 507	1.0	0.2	0.02	2.6	1.5	2.3	2.1	2.5	2.3	1.8
51	SBG 21-51	NPJ 252	1.1	0.2	0.00	2.50	1.2	2.2	1.6	2.9	2.1	1.7
52	SBG 21-52	RMM 19-18	0.9	1.3	0.00	2.5	1.2	2.0	0.4	3.3	2.0	1.7
53	SBG 21-53	SKM 1744	1.2	1.2	0.03	2.7	1.6	2.0	2.5	2.8	2.1	2.0
54	SBG 21-54	PDZM 31 (QC)	0.9	1.2	0.18	2.7	1.5	2.7	2.0	2.4	1.9	1.9
55	SBG 21-55	JM 16-16-5	1.2	1.2	0.08	2.5	1.6	2.5	1.5	2.1	1.7	1.8
56	SBG 21-56	RH 1934	1.1	1.8	0.03	2.6	1.3	2.2	3.3	3.1	2.1	2.2
57	SBG 21-57	DM-1521	1.5	1.4	0.02	2.5	1.5	2.0	3.3	2.8	2.4	2.2
58	SBG 21-58	RB-109	0.8	1.6	0.08	2.5	0.9	2.2	3.0	2.4	2.3	2.0
59	SBG 21-59	ACN 237	0.6	1.3	0.12	2.6	1.3	2.0	0.5	2.5	2.1	1.6
60	SBG 21-60	BSH 1 (SC)	0.7	1.4	0.00	2.5	1.5	2.0	3.5	2.2	2.3	2.0
IVT Musard (Rainfed)												
61	SBG 21-61	RH 1930	0.7	1.8	0.02	2.5	1.6	2.0	0.6	2.9	2.0	1.8
62	SBG 21-62	CAU-RMM 3	0.7	0.7	0.02	2.4	1.5	2.0	0.7	3.1	1.7	1.6
63	SBG 21-63	DRMRHJ 1117	1.5	1.3	0.05	2.6	1.3	2.7	3.0	2.8	1.8	2.1

64	SBG 21-64	KRANTI (NC)	1.7	1.2	0.00	2.6	1.6	2.7	0.9	2.4	2.0	1.9
65	SBG 21-65	RGN 519	0.8	2.7	0.10	2.5	1.7	3.0	3.2	3.2	1.8	2.4
66	SBG 21-66	NPJ 255	0.4	1.5	0.07	2.4	1.6	2.0	0.6	2.2	2.1	1.6
67	SBG 21-67	PBR 357	0.9	1.1	0.17	2.5	1.3	2.0	2.5	2.5	1.9	1.8
68	SBG 21-68	PM 30(LR)	1.8	1.4	0.07	2.5	1.5	2.0	1.4	2.8	2.3	2.0
69	SBG 21-69	DM-1521	1.6	1.5	0.05	2.5	1.5	2.0	1.8	2.4	1.5	1.9
70	SBG 21-70	DRMRHT 13-22-2	1.1	1.2	0.03	2.4	1.6	2.3	2.3	2.7	1.7	1.9
71	SBG 21-71	RH 1928	1.8	1.1	0.02	2.4	1.6	2.0	3.0	2.4	2.3	2.1
72	SBG 21-72	DMH-1 (C)	1.3	2.6	0.12	2.3	1.6	2.5	2.7	3.5	2.1	2.3
73	SBG 21-73	ORM 26-37-2	--	--	--	--	--	--	--	--	--	--
74	SBG 21-74	RGN 510	0.8	1.9	0.07	2.5	1.6	2.5	4.4	2.8	1.4	2.2
75	SBG 21-75	DRMRCI 148	1.1	0.4	0.02	2.7	1.6	2.8	0.8	2.3	2.1	1.7
76	SBG 21-76	RH 725 (CC)	0.7	1.2	0.10	2.6	1.6	2.8	3.5	2.8	1.7	2.1
77	SBG 21-77	NPJ 254	1.3	0.3	0.00	2.5	1.6	2.5	3.6	2.9	2.0	2.1
78	SBG 21-78	RB 110	1.5	0.3	0.05	2.5	1.6	2.3	0.3	2.1	2.0	1.6
79	SBG 21-79	PBR 552	0.9	2.1	0.02	2.4	1.6	2.5	2.9	2.5	2.0	2.1
80	SBG 21-80	PDZM 31 (QC)	0.4	1.6	0.03	2.6	1.7	2.7	3.4	2.8	1.8	2.1
81	SBG 21-81	BAUM -21-2	1.3	0.5	0.03	2.5	1.6	2.0	3.1	3.4	1.7	2.0
82	SBG 21-82	DRMR 2019-7	2.0	0.3	0.02	2.4	1.5	1.7	0.5	2.9	2.6	1.7
83	SBG 21-83	BSH 1 (SC)	1.6	0.1	0.08	2.7	1.6	1.7	4.3	2.1	2.1	2.0
IVT Mustard Late Sown												
84	SBG 21-84	PAB 2014-17	0.7	2.7	0.13	2.4	1.6	1.7	3.3	2.7	2.6	2.2
85	SBG 21-85	RH 2050	1.6	0.6	0.03	2.5	1.6	2.7	0.7	2.6	2.3	1.8
86	SBG 21-86	DRMRHJ 430	1.4	0.7	0.03	2.5	1.59	2.3	0.5	2.9	2.7	1.8
87	SBG 21-87	KRANTI (NC)	1.8	1.5	0.07	2.6	1.6	2.7	1.4	2.5	2.5	2.1
88	SBG 21-88	KMR (L) 21-6	1.3	1.8	0.03	2.6	1.6	2.5	0.5	2.3	2.3	1.9
89	SBG 21-89	NPJ 251	0.3	0.6	0.08	2.5	1.6	2.7	0.7	3.4	2.2	1.8
90	SBG 21-90	RGN 522	1.1	0.9	0.02	2.6	1.6	2.8	3.7	3.2	2.3	2.3
91	SBG 21-91	PM 30(LR)	0.5	0.7	0.07	2.7	1.6	2.5	0.5	3.1	2.5	1.8
92	SBG 21-92	HUJM 20-6	1.5	1.0	0.10	2.5	1.6	2.2	0.4	2.8	2.1	1.8
93	SBG 21-93	DRMRCI 140	1.4	0.5	0.08	2.5	1.6	2.2	0.7	2.4	2.3	1.7
94	SBG 21-94	PAB 2014-7	0.4	2.8	0.07	2.4	1.5	2.2	1.5	2.5	2.4	2.0
95	SBG 21-95	DMH-1 (C)	0.9	2.6	0.02	2.4	1.5	2.5	0.5	3.1	2.5	2.0
96	SBG 21-96	RH 1939	0.6	2.4	0.07	2.6	1.3	2.2	0.6	3.5	2.2	1.9
97	SBG 21-97	KMR (L) 21-5	0.4	0.8	0.02	2.7	1.3	2.2	1.7	2.1	1.5	1.6
98	SBG 21-98	NPJ 250	1.5	1.5	0.00	2.7	1.3	2.2	1.1	2.5	2.0	1.9
99	SBG 21-99	RH 725 (CC)	0.4	0.7	0.07	2.6	1.3	2.8	1.1	2.8	2.1	1.7
100	SBG 21-100	DRMRHT-13-7-113	0.5	1.2	0.05	2.7	1.6	2.8	2.7	2.6	2.1	2.0

101	SBG 21-101	RGN 520	1.3	0.9	0.10	2.5	1.3	2.0	1.3	2.5	2.0	1.7
102	SBG 21-102	BAUM-08-15	0.5	1.3	0.05	2.5	1.3	2.5	2.6	2.2	2.1	1.9
103	SBG 21-103	PDZM 31 (QC)	1.1	2.0	0.02	2.6	1.5	2.5	3.3	3.2	1.9	2.3
104	SBG 21-104	ACN 237	1.2	1.4	0.03	2.7	1.5	2.5	2.7	2.7	2.1	2.1
105	SBG 21-105	DRMRSJ 272	1.3	0.6	0.05	2.6	1.2	2.5	3.4	2.9	2.0	2.1
106	SBG 21-106	BSH 1 (SC)	1.5	0.2	0.08	2.6	1.6	2.0	2.6	3.3	2.8	2.1
Hybrid Mustard IHT												
107	SBG 21-107	NAMJH 21-01	0.8	2.9	0.02	2.7	1.3	2.0	3.2	2.4	1.7	2.1
108	SBG 21-108	DRMRHJ 3720	1.4	0.6	0.08	2.7	1.2	2.0	3.6	3.1	1.9	2.1
109	SBG 21-109	PHR 5175	1.8	1.5	0.02	2.5	1.3	2.3	1.8	3.2	2.4	2.1
110	SBG 21-110	RH 2103	1.8	0.4	0.15	2.5	1.5	2.0	3.5	3.4	2.5	2.2
111	SBG 21-111	KRANTI (NC)	0.9	0.1	0.18	2.5	1.6	2.3	2.4	2.7	1.7	1.8
112	SBG 21-112	SVJH-71	1.6	1.2	0.00	2.5	1.6	2.0	3.4	2.9	2.0	2.2
113	SBG 21-113	Pusa MH 62	0.6	1.1	0.00	2.6	1.6	2.7	2.8	3.4	2.1	2.1
114	SBG 21-114	KMH 8765	1.4	0.4	0.00	2.7	1.6	2.0	3.5	2.8	1.8	2.0
115	SBG 21-115	DRMRHJ 2518	1.7	0.8	0.00	2.5	1.2	2.0	3.8	2.8	1.9	2.1
116	SBG 21-116	RH 725 (CC)	1.4	0.9	0.10	2.7	1.6	2.3	4.3	2.7	2.8	2.3
117	SBG 21-117	RHH 2102	2.2	0.5	0.02	2.5	1.2	2.7	1.6	2.6	2.0	1.9
118	SBG 21-118	DRMRJH 3717	0.4	1.4	0.15	2.5	1.6	2.5	2.5	2.2	2.2	1.9
119	SBG 21-119	PHR 4457	1.2	2.4	0.08	2.4	1.5	2.5	2.5	2.4	1.6	2.1
120	SBG 21-120	NMH 90M01	0.4	0.4	0.07	2.4	1.2	2.7	1.1	2.8	1.6	1.6
121	SBG 21-121	DMH-1 (C)	0.2	2.5	0.02	2.4	1.5	2.7	2.2	2.3	1.7	1.9
122	SBG 21-122	SVJH -70	0.4	0.8	0.03	2.4	1.6	2.0	2.4	2.4	1.9	1.7
123	SBG 21-123	Pusa MH 62	0.5	1.3	0.13	2.7	1.2	2.0	0.4	2.7	1.9	1.6
124	SBG 21-124	KMH 8765	0.5	0.4	0.02	2.7	1.6	2.2	0.5	2.8	2.0	1.6
125	SBG 21-125	DRMRHJ 2518	0.8	0.3	0.07	2.5	1.6	2.5	0.5	3.3	2.0	1.7
126	SBG 21-126	RH 725 (CC)	1.1	0.5	0.12	2.6	1.6	2.3	3.6	2.9	2.1	2.1
127	SBG 21-127	RHH 2101	0.7	0.4	0.08	2.4	1.5	2.2	3.7	2.7	1.8	1.9
128	SBG 21-128	PHR 3281	0.7	0.7	0.08	2.5	1.3	2.3	2.7	2.5	2.0	1.8
129	SBG 21-129	PMH90V02	1.0	0.6	0.00	2.4	1.7	2.0	0.5	2.4	1.8	1.6
130	SBG 21-130	18J408C	1.1	1.3	0.00	2.3	1.5	2.0	0.7	2.1	1.9	1.6
131	SBG 21-131	PDZM 31 (QC)	2.2	0.9	0.02	2.5	1.6	2.7	4.3	2.4	1.6	2.3
132	SBG 21-132	DRMRHJ 3130	1.1	0.4	0.02	2.4	1.3	2.3	2.9	3.2	2.4	2.0
133	SBG 21-133	RMX 9922	1.4	0.5	0.15	2.6	1.2	2.5	1.4	3.1	1.8	1.8
134	SBG 21-134	BSH 1 (SC)	2.0	1.2	0.07	2.3	1.6	2.3	4.5	3.5	2.0	2.4
Quality Mustard IVT												
135	SBG 21-135	DRMRQ 4-3	0.9	2.9	0.10	2.7	1.3	2.0	3.6	2.6	1.7	2.2
136	SBG 21-136	RH (OH) 1808	2.0	0.4	0.05	2.5	1.6	2.0	0.5	2.4	2.1	1.7
137	SBG 21-137	KRANTI (NC)	1.2	2.2	0.02	2.4	1.6	2.0	2.4	2.7	1.9	2.1
138	SBG 21-138	LES-65	1.2	0.6	0.03	2.4	1.6	2.2	3.1	2.5	1.5	1.9
139	SBG 21-139	PDZ 17#	1.9	2.7	0.12	2.5	1.3	2.8	4.8	2.3	1.3	2.5
140	SBG 21-140	PM 30(LR)	0.5	2.4	0.03	2.7	1.6	2.2	3.3	2.4	1.8	2.1
141	SBG 21-141	IJ19R5004	0.8	0.6	0.07	2.5	1.6	2.7	2.6	2.2	2.6	2.0
142	SBG 21-142	JC -16	1.7	2.2	0.08	2.5	1.3	2.3	2.5	2.8	1.4	2.1
143	SBG 21-143	DMH-1 (C)	1.5	2.1	0.08	2.6	1.6	2.5	1.8	2.8	1.5	2.1
144	SBG 21-144	DRMRCI(Q) 57	1.0	1.3	0.10	2.5	1.3	2.3	4.1	3.1	1.9	2.2
145	SBG 21-145	RH (OE) -1612	1.2	2.0	0.05	2.5	1.3	2.7	2.2	3.5	2.1	2.2
146	SBG 21-146	RH 725 (CC)	1.6	0.3	0.02	2.6	1.3	3.2	0.5	3.1	2.2	1.9
147	SBG 21-147	LES-64	0.9	1.3	0.05	2.4	1.2	3.2	2.4	2.8	1.7	2.0
148	SBG 21-148	PDZ-16#	1.4	0.5	0.18	2.5	0.9	3.2	0.3	2.4	2.0	1.7
149	SBG 21-149	PDZM 31 (QC)	1.4	0.7	0.02	2.5	1.2	2.5	2.1	2.6	2.2	1.9

150	SBG 21-150	DRMRQ 143-9	0.8	1.4	0.17	2.5	0.8	1.8	0.5	2.8	2.4	1.6
151	SBG 21-151	JC-1	1.4	0.7	0.02	2.5	1.2	2.0	1.8	2.9	2.7	1.9
152	SBG 21-152	DRMRCI(Q) 47	0.4	0.6	0.02	2.7	1.1	2.7	4.0	2.5	2.1	2.0
153	SBG 21-153	BSH 1 (SC)	1.3	0.4	0.08	2.6	0.7	2.2	4.7	2.2	2.5	2.1
IVT Mustard: Saline/Alkaline conditions												
154	SBG 21-154	CS 2020-4	1.0	0.1	0.03	2.5	1.2	2.3	2.1	2.1	2.1	1.7
155	SBG 21-155	RH 1928	1.1	0.2	0.02	2.4	1.2	2.5	2.3	2.5	2.3	1.8
156	SBG 21-156	CS 2013-64	1.2	0.3	0.03	2.5	1.2	2.8	2.0	3.5	2.1	2.0
157	SBG 21-157	RH 1927	0.5	0.1	0.03	2.5	0.9	2.0	0.6	3.1	2.3	1.5
158	SBG 21-158	KRANTI (NC)	1.1	0.3	0.08	2.4	1.3	2.0	0.7	2.5	2.4	1.6
159	SBG 21-159	CS 2020-10	0.8	0.8	0.13	2.8	1.2	2.3	1.4	2.6	2.6	1.8
160	SBG 21-160	NPJ 256	1.3	0.3	0.03	2.6	0.9	2.0	0.6	2.9	2.2	1.6
161	SBG 21-161	CS 2009-234	1.6	0.9	0.05	2.5	1.2	2.0	0.7	2.8	2.4	1.8
162	SBG 21-162	NPJ 231	0.4	0.4	0.03	2.5	1.3	2.0	0.5	3.2	2.2	1.6
163	SBG 21-163	PM 30(LR)	1.2	0.6	0.08	2.4	1.2	2.0	0.9	3.5	2.1	1.7
164	SBG 21-164	DRMR 2018-37	1.3	1.3	0.12	2.7	0.9	2.5	0.7	3.4	1.8	1.8
165	SBG 21-165	DRMRCI (W)-125	1.7	0.2	0.00	2.6	1.1	2.2	0.9	2.8	2.3	1.7
166	SBG 21-166	RH 2070	1.8	0.4	0.03	2.4	1.2	2.5	0.8	2.4	1.6	1.6
167	SBG 21-167	DRMR 2018-25	1.8	0.2	0.02	2.3	1.1	2.0	0.3	2.8	1.9	1.6
168	SBG 21-168	PRO-5111	0.2	1.3	0.17	2.4	1.2	2.5	0.6	2.5	1.8	1.6
169	SBG 21-169	DRMRIJ 20-157	0.5	0.3	0.17	2.7	1.2	2.5	0.8	2.6	2.1	1.6
170	SBG 21-170	RH 2007	1.3	1.4	0.12	2.7	1.2	2.7	0.9	2.7	2.0	1.9
171	SBG 21-171	DRMRHJ 317	1.4	0.2	0.12	2.6	1.1	2.3	2.1	2.9	2.0	1.8
172	SBG 21-172	RH 725 (CC)	2.5	0.1	0.10	2.6	1.2	2.2	0.5	3.1	2.4	1.8
173	SBG 21-173	GSH -1703	0.6	1.4	0.07	2.3	1.2	2.3	4.1	3.2	1.6	2.1
174	SBG 21-174	HNS 1206	1.1	0.5	0.08	2.3	0.9	2.2	3.6	3.0	2.0	2.0
175	SBG 21-175	AKGS 8060	1.0	0.6	0.00	2.2	0.9	2.2	1.9	2.9	2.1	1.7
176	SBG 21-176	PDZM 31 (QC)	1.4	2.9	0.15	2.6	0.8	2.5	3.0	2.5	2.2	2.2
177	SBG 21-177	GSH-1723	0.4	2.1	0.02	2.2	1.2	2.0	3.4	2.1	1.9	1.9
178	SBG 21-178	DRMRIN 20-3	1.5	2.6	0.03	2.4	0.9	2.2	4.0	2.6	2.3	2.3
179	SBG 21-179	JGS-15-6	0.5	0.7	0.02	2.2	1.1	2.0	2.8	2.5	2.5	1.8
180	SBG 21-180	DMH-1 (C)	1.5	2.5	0.07	2.3	0.9	2.2	3.5	2.6	2.1	2.2
181	SBG 21-181	HNS 1102	1.0	0.6	0.10	2.5	1.0	2.0	3.0	2.9	1.6	1.8
182	SBG 21-182	GSH 2155	0.3	0.3	0.00	2.5	1.3	2.0	3.8	3.1	2.0	1.9
183	SBG 21-183	DRMRIN 20-23	1.4	0.5	0.10	2.5	1.6	2.0	2.6	3.2	2.0	2.0
184	SBG 21-184	BSH 1 (SC)	0.7	2.3	0.07	2.6	1.3	2.0	2.9	3.0	2.0	2.1
Mean			1.2	1.1	0.06	2.5	1.4	2.3	2.0	2.7	2.1	1.9

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

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

S. No.	Code No.	Entries	MOR	HSR	KAN	SKN	PTN	NDH	LDH	DHO	SHIL	Mean
AVT I Yellow Sarson												
1	SAG 21-1	RMYS 2	1.2	1.4	0.10	2.8	1.2	2.2	2.8	2.5	2.6	2.1
2	SAG 21-2	PTS 2018-02	1.4	0.3	0.08	2.6	0.9	2.2	3.9	2.9	2.1	2.0
AVT I Early Mustard												
3	SAG 21-3	PRE 2018-10	1.4	1.2	0.03	2.4	1.2	1.8	3.3	2.6	1.7	2.0
4	SAG 21-4	RH 1999-42	1.1	0.5	0.03	2.3	0.9	1.8	2.2	2.4	2.3	1.7
AHT Early Indian Mustard												
5	SAG 21-5	DRMRHJ 2403	0.7	1.6	0.00	2.3	1.2	2.7	2.2	3.0	1.6	1.9
6	SAG 21-6	Kranti (NC)	1.5	0.3	0.05	2.4	1.2	2.2	1.8	2.8	1.9	1.8
AVT I Mustard Timely Sown Irrigated												
7	SAG 21-7	PR 2016-4	1.9	0.3	0.08	2.5	0.9	1.7	1.0	2.1	2.0	1.6
8	SAG 21-8	SKM 1616	0.8	2.2	0.00	2.5	1.1	1.5	1.7	2.5	1.9	1.8
9	SAG 21-9	RH 1974	2.4	0.7	0.10	2.4	0.8	1.8	1.7	2.9	2.2	1.9
10	SAG 21-10	PR 2016-8	2.3	0.6	0.07	2.6	1.1	2.2	3.3	3.1	2.3	2.2
11	SAG 21-11	RGN 443	2.0	1.5	0.03	2.5	1.1	2.7	3.6	2.8	2.1	2.3
12	SAG 21-12	PM 30 (C)	1.7	1.4	0.00	2.5	1.1	2.0	0.5	2.4	1.9	1.7
13	SAG 21-13	RH 1975	1.4	2.8	0.05	2.4	1.2	2.3	2.1	2.6	1.8	2.1
14	SAG 21-14	DRMR 2017-16	1.5	1.5	0.00	2.4	1.2	2.3	1.1	2.8	1.9	1.8
15	SAG 21-15	PBR 385	1.4	0.9	0.05	2.7	1.1	2.2	0.5	2.9	1.7	1.7
16	SAG 21-16	RH 1676	0.9	0.7	0.05	2.5	0.9	2.5	0.7	3.1	2.6	1.7
AVT I+II Mustard Timely Sown Rainfed												
17	SAG 21-17	DRMRCI 128	1.6	0.4	0.05	2.4	1.2	2.2	1.7	2.8	2.0	1.8
18	SAG 21-18	DMH 1 (C)	1.7	1.9	0.02	2.4	1.2	2.7	2.5	2.9	2.3	2.2
19	SAG 21-19	RH 1424	1.5	2.0	0.02	2.4	1.2	1.8	1.7	2.7	2.1	1.9
AVT I Mustard Late Sown												
20	SAG 21-20	DRMR 2018-19	1.8	0.6	0.00	2.3	1.2	1.7	3.3	2.5	2.3	2.0
AVT I+II Quality Mustard												
21	SAG 21-21	RH (OE) 1807	1.1	1.3	0.08	2.3	1.2	2.7	1.6	3.3	2.2	2.0
22	SAG 21-22	JC 36	1.7	0.4	0.00	2.4	1.2	2.8	1.9	2.8	2.1	1.9
23	SAG 21-23	PDZ 15	1.4	1.4	0.00	2.4	1.2	3.3	3.5	3.2	1.3	2.2
24	SAG 21-24	RH 725 (C)	1.4	0.6	0.00	2.5	1.2	3.0	3.8	2.8	1.9	2.2
25	SAG 21-25	01J50001	0.6	0.3	0.05	2.4	1.1	3.2	3.8	3.1	2.0	2.1
26	SAG 21-26	LES 60#	0.7	2.0	0.07	2.4	1.2	3.0	4.0	2.9	1.8	2.3
27	SAG 21-27	RH (OH) 1706#	1.3	0.7	0.00	2.6	1.2	3.5	0.8	2.8	2.1	1.9
28	SAG 21-28	PDZ 14	1.1	0.6	0.00	2.4	1.1	3.0	1.7	2.7	1.8	1.8
AVT I: Mustard-Saline/Alkaline Conditions												
29	SAG 21-29	CS 2005-143	1.3	2.5	0.05	2.6	1.2	2.0	0.8	2.2	1.9	1.8
30	SAG 21-30	CS 13000-3-2-2-5-2	1.6	0.6	0.03	2.4	0.8	2.3	1.5	3.2	1.9	1.8
31	SAG 21-31	CS 15000-1-1-1-4-2	1.6	1.7	0.07	2.5	0.9	1.5	1.3	3.1	2.0	1.8
32	SAG 21-32	PDZM 31 (QC)	0.8	0.8	0.00	2.5	1.3	2.5	3.6	3.0	2.2	2.1
AVT I White Rust Resistance												
33	SAG 21-33	Rohini (A4A5)	1.1	0.9	0.07	2.7	1.2	3.0	3.7	2.8	1.6	2.1
34	SAG 21-34	Rohini (Parent)	1.3	0.7	0.08	2.4	1.5	2.8	4.3	2.5	2.4	2.2
35	SAG 21-35	PB (A4A5)	1.5	0.2	0.00	2.7	1.5	2.5	3.1	2.7	2.4	2.1
36	SAG 21-36	Pusha Bold (Parent)	1.7	1.5	0.08	2.4	1.6	2.5	1.4	2.9	2.3	2.0
37	SAG 21-37	Varuna (A4A5)-936-279	1.6	1.1	0.00	2.4	1.5	2.5	1.8	3.1	2.4	2.1
38	SAG 21-38	Varuna (Parent)	0.7	0.6	0.07	2.4	1.6	2.3	1.0	2.8	2.4	1.7
39	SAG 21-39	PJK (A4A5)-21	1.1	0.5	0.08	2.4	1.3	2.3	1.0	2.9	2.1	1.7
40	SAG 21-40	Pusa Jai Kishan (Parent)	2.1	2.4	0.08	2.3	1.5	2.3	1.0	2.7	1.2	1.9

AVTI Gobhi Sarson												
41	SAG 21-41	AKGS 19-8	1.2	0.9	0.12	2.4	1.2	2.2	1.9	2.8	2.0	1.8
42	SAG 21-42	BSH-1 (SC)	2.5	1.3	0.17	2.7	1.0	2.2	3.4	2.4	1.8	2.2
43	SAG 21-43	RILL-87	1.1	2.5	0.10	2.5	1.2	2.8	2.2	3.4	2.0	2.2
Average			1.4	1.1	0.05	2.5	1.2	2.4	2.2	2.8	2.0	1.9

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

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

Centre	Mustard aphid population in unprotected plot		Yield (kg/ha)		Avoidable yield losses (%)
			Protected	Unprotected	
Hisar					
Radhika	185.6		1942.2	1634.4	15.8
DRMRIJ 31	147.5		1958.6	1454.5	25.8
RH 725	140.5		2502.1	1983.0	20.7
CD (p=0.05)	NS		487.2	168.7	--
Dholi					
PM 31	25.2		1494.0	1032.0	30.9
RH 725	36.6		1215.0	905.0	25.5
Rajendra Suflam	51.4		942.0	761.0	19.2
CD (p=0.05)	-		83.1	58.2	--
Ludhiana	Aphids/ plant	Cabbage caterpillars/ plant			
Radhika	61.9	24.9	2110.4	1470.8	30.3
DRMR IJ 31	79.0	15.9	2116.7	1525.0	27.9
PBR 357	71.6	17.5	1900.0	1366.7	28.1
CD (p=0.05)	11.7	12.3	166.1	104.1	-
S.K.Nagar					
Radhika	352.2		2348.0	1774.0	24.4
DRMR IJ 31	352.4		2011.0	1521.0	24.3
GDM-4	349.0		2151.0	1567.0	27.1
CD (p=0.05)			195.0		
Morena					
Radhika	107.0		1731.0	946.0	45.3
DRMR IJ 31	113.5		1763.0	1171.0	33.5
New Delhi					
Radhika	237.5		2336.4	2072.5	12.7
DRMR IJ 31	171.3		2328.1	2116.2	10.0
Pant Nagar					
Radhika	131.6		1823.0	1609.0	11.7
DRMR IJ 31	100.9		1970.0	1719.0	12.7
Varuna	98.9		1657.0	1388.0	16.2
CD (p=0.005)	9.5		297.0	433.0	--
Kanpur					
Radhika	14.2		1666.0	1607.0	3.5
DRMR IJ 31	11.2		1706.0	1660.0	2.7
Varuna	12.5		1825.0	1765.0	3.3
CD (p=0.05)	NS		NS	NS	--
Shillongani					
Radhika	98.9		1752.0	1351.0	22.9
DRMR IJ 31	127.3		1823.0	1463.0	19.7
PM 27	113.6		1274.0	947.0	25.7
CD (p=0.05)	8.7		51.3	44.8	--

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

Population dynamics of painted bug on <i>Brassica</i> varieties														
Std Week	Meteorological observations						No. of painted bugs/ m row length (mrl)							
							Timely Sown				Late Sown			
	Temperature (°C)		RH (%)		Sunshine hours	Rainfall (mm)	<i>B. juncea</i>	<i>Eruca sativa</i>	<i>B. napus</i>	<i>B. rapa</i>	<i>B. juncea</i>	<i>Eruca sativa</i>	<i>B. napus</i>	<i>B. rapa</i>
	Max.	Min.	Morn.	Even.			DRMR IJ 31	T 27	GSC 6	BSH 1	DRMR IJ 31	T 27	GSC 6	BSH 1
41	33.5	24.3	90.6	56.3	6.7	5.5	0.0	0.0	0.0	0.0	-	-	-	-
42	34.4	20.1	84.9	37.1	8.2	0.0	0.0	0.0	0.0	0.0	-	-	-	-
43	31.6	18.3	83.9	51.0	6.4	Traces	0.0	0.0	0.0	0.0	-	-	-	-
44	28.5	14.7	89.5	41.5	7.5	0.0	0.1	0.1	0.0	0.2	-	-	-	-
45	30.1	13.3	82.0	35.5	5.5	0.4	0.3	0.0	0.3	0.4	-	-	-	-
46	28.8	11.3	91.8	35.4	4.0	0.0	0.0	0.4	0.5	0.3	-	-	-	-
47	26.9	8.2	90.8	32.0	5.8	0.0	0.3	0.2	0.3	0.1	0.0	0.0	0.0	0.0
48	26.9	8.2	90.1	29.7	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	23.3	9.2	96.4	54.1	4.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	24.2	7.9	97.7	47.8	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
51	20.2	5.0	95.7	47.1	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	20.5	4.4	91.8	42.8	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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

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

Population dynamics of mustard aphid on <i>Brassica</i> varieties														
Std. Week	Meteorological observations						No. of aphids / top 10 cm central twig							
	Temp.(°C)		RH (%)		Sunshine hours	Rainfall (mm)	Timely Sown				Late Sown			
	Max.	Min.	Morn.	Even.			<i>B. juncea</i> DRMR IJ 31	<i>E. sativa</i> T 27	<i>B. napus</i> GSC 6	<i>B. rapa</i> BSH 1	<i>B. juncea</i> DRMR IJ-31	<i>E. sativa</i> T 27	<i>B. napus</i> GSC 6	<i>B. rapa</i> BSH 1
	52	20.5	4.4	91.8	42.8	6.3	0.0	0.2	0.0	0.0	1.1	0.0	0.0	0.0
1	19.6	5.5	95	56	4.1	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	18.7	10.2	99.3	67.6	3.1	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	15.2	6.8	95.4	77.4	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
4	14.2	7.1	95.9	81.1	0.8	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
5	16.0	5.9	99.2	61.5	3.7	21.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
6	20.2	6.6	97.4	64.9	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.1	1.8
7	21.7	7.8	95.1	45.6	7.3	5.8	0.0	0.0	0.0	0.0	21.2	19.4	24.4	19.1
8	25.2	6.9	97.6	48.3	8.4	0.0	0.0	0.0	0.0	0.0	34.5	28.7	33.8	25.7
9	25.0	10.2	87.1	48.0	7.6	0.0	0.0	0.0	0.0	0.0	97.3	57.4	58.2	88.9
10	24.3	8.7	94.3	46.7	8.2	0.0	0.0	0.0	0.0	0.0	130.4	108.7	129.3	102.5
11	27.8	10.8	92.5	42.0	7.4	0.0	Harvested	Harvested	Harvested	Harvested	166.5	145.6	139.8	165.1
12	33.5	16.3	88.7	40.3	7.9	0.0					68.8	55.3	51.5	61.5
13	34.9	16.2	86.5	29.0	7.6	0.0					22.9	16.7	17.8	15.1
14	37.8	15.9	71.0	15.7	8.3	0.0					5.5	3.3	2.1	2.9

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

Table 5.3.1(D): Population dynamics of various predators on *Brassica* varieties at Hisar

Population dynamics of predators on <i>Brassica</i> varieties														
Std. Week	Meteorological observations						Coccinellids (Grubs +Beetles)/ Plant							
	Temp. (°C)		RH (%)		Sunshine hours	Rainfall (mm)	Timely Sown				Late Sown			
	Max.	Min.	Morn.	Even.			<i>B. juncea</i>	<i>E. sativa</i>	<i>B. napus</i>	<i>B. rapa</i>	<i>B. juncea</i>	<i>E. sativa</i>	<i>B. napus</i>	<i>B. Rapa</i>
							DRMR IJ 31	T 27	GSC 6	BSH 1	DRMR IJ-31	T 27	GSC 6	BSH 1
47	26.9	8.2	90.8	32.0	5.8	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
48	26.9	8.2	90.1	29.7	7.0	0.0	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0
49	23.3	9.2	96.4	54.1	4.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
50	24.2	7.9	97.7	47.8	6.3	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
51	20.2	5.0	95.7	47.1	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	20.5	4.4	91.8	42.8	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	19.6	5.5	95	56	4.1	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	18.7	10.2	99.3	67.6	3.1	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	15.2	6.8	95.4	77.4	1.5	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
4	14.2	7.1	95.9	81.1	0.8	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	16.0	5.9	99.2	61.5	3.7	21.4	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.2
6	20.2	6.6	97.4	64.9	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	21.7	7.8	95.1	45.6	7.3	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	25.2	6.9	97.6	48.3	8.4	0.0	0.0	0.0	0.0	0.4	0.0	0.1	0.0	0.3
9	25.0	10.2	87.1	48.0	7.6	0.0	0.9	0.0	0.0	0.0	0.3	0.6	0.4	0.8
10	24.3	8.7	94.3	46.7	8.2	0.0	0.0	0.0	0.0	0.0	0.7	0.9	1.0	1.2
11	27.8	10.8	92.5	42.0	7.4	0.0	Harvested	Harvested	Harvested	Harvested	2.3	1.8	1.9	1.9
12	33.5	16.3	88.7	40.3	7.9	0.0					3.7	3.1	3.3	3.6
13	34.9	16.2	86.5	29.0	7.6	0.0					2.8	2.5	2.2	2.8
14	37.8	15.9	71.0	15.7	8.3	0.0					0.6	1.3	0.9	1.1

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

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

Std. Week	Weather parameters				Rainfall (mm)	Aphid population/10 cm twig on				
	Temperature (°C)		RH (%)			DRMR IJ 31	BSH 1	GSC 6	T 27	Rajendra Suflam
	Max.	Min.	Morn.	Even.						
51	22.5	7.6	96.0	56.0	0.0	0.0	0.0	0.0	0.0	0.0
52	22.4	11.0	94.0	66.0	7.7	19.2	31.5	10.2	7.9	29.5
1	18.5	10.4	94.0	80.0	-	35.8	49.6	21.8	18.6	45.5
2	22.8	12.8	97.0	69.0	4.6	45.2	66.8	29.4	26.2	58.8
3	17.5	8.6	96.0	70.0	-	64.9	85.2	42.1	35.3	78.4
4	20.0	9.9	97.0	71.0	-	79.14	98.7	49.6	41.2	87.6
5	18.6	9.1	98.0	75.0	29.6	87.2	118.3	57.5	48.9	101.2
6	21.4	7.7	96.5	65.0	-	98.7	134.7	69.0	55.1	119.7
7	24.2	9.2	97.0	55.5	-	110.2	155.5	75.0	61.7	131.5
8	24.8	11.5	90.0	59.0	-	89.5	108.2	63.2	52.8	99.12
9	27.2	12.5	95.0	54.0	-	77.5	96.2	55.7	42.5	84.56
10	30.5	14.5	96.0	49.0	-	59.2	71.8	41.2	35.4	65.7
11	31.4	16.6	93.0	55.0	-	24.5	45.7	22.5	18.6	31.4
12	35.4	20.4	94.0	54.2	-	11.5	19.8	5.6	2.4	15.3
13	38.7	23.4	92.5	52.0	-	0.0	0.0	0.0	0.0	0.0
Correlation coefficient (r) DRMR IJ 31	0.49	0.35	0.28	-0.55	-0.38					
BSH 1	0.42	0.45	0.39	-0.51	-0.42					
GSC 6	0.39	0.31	0.31	-0.46	-0.35					
T 27	0.41	0.29	0.34	-0.40	-0.41					
Rajendra Suflam	0.37	0.27	0.25	-0.35						

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

Std. Week	Temperature		Rain fall (mm)	R.H. %		Sun- Shine (Hrs)	Number of aphids/ top 10 cm central twig							
	Max	Min.		Max.	Min.		DRMR IJ 31	T 27	GSC 6	BSH 1	YST 151	<i>B. nigra</i>	<i>B. alba</i>	Varuna
1	20.2	9.1	22.2	93.0	56.0	5.0	3.8	1.4	1.1	7.5	7.7	1.9	1.9	4.5
2	19.6	11.0	54.7	94.0	73.0	3.3	7.6	4.4	2.9	11.5	13.3	4.8	6.0	10.4
3	14.1	8.7	2.8	91.0	80.0	0.6	15.4	9.2	7.8	21.9	17.2	10.2	12.0	16.5
4	17.0	9.3	19.2	93.0	71.0	2.1	27.7	18.5	17.3	28.4	37.1	21.0	22.6	87.5
5	16.0	8.6	30.7	92.0	77.0	1.7	43.9	32.4	32.9	32.5	59.1	35.7	38.1	26.9
6	16.1	7.4	17.5	94.0	76.0	3.1	25.4	16.8	14.0	35.0	72.9	15.1	18.2	34.9
7	22.2	6.7	0.0	94.0	48.0	8.6	12.0	7.4	1.9	16.5	69.5	4.0	7.9	16.6
8	23.7	9.8	0.0	86.0	45.0	8.0	1.1	0.0	0.0	2.1	34.6	0.0	0.6	2.1

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

Std. Week	Temperature		Rain fall (mm)	R.H. %		Sunshine Hours	Number of aphids/ top 10 cm central twig							
	Max.	Min.		Max.	Min.		DRMR IJ 31	T 27	GSC 6	BSH 1	<i>B. nigra</i>	<i>B. alba</i>	Varuna	
4	17.0	9.3	19.2	93.0	71.0	2.1	5.9	1.1	15.3	3.2	14.7	28.1	5.9	
5	16.0	8.6	30.7	92.0	77.0	1.7	13.6	2.6	25.5	17.6	38.4	46.2	15.8	
6	16.1	7.4	17.5	94.0	76.0	3.1	25.9	5.1	45.0	40.6	82.0	69.5	40.1	
7	22.2	6.7	0.0	94.0	48.0	8.6	49.8	10.1	73.4	52.0	84.4	102.2	45.3	
8	23.7	9.8	0.0	86.0	45.0	8.0	77.9	13.7	42.5	51.7	80.0	120.8	60.7	
9	24.7	10.0	2.2	93.0	48.0	8.0	60.2	13.1	25.2	19.1	44.2	91.0	64.8	
10	27.5	11.3	0.0	92.0	48.0	7.0	33.1	6.9	20.2	20.5	63.6	51.5	29.8	
11	30.7	16.6	0.0	90.0	49.0	7.1	16.1	2.7	2.1	6.9	17.9	25.0	20.7	

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

SMW*	Weather Parameters						No of aphids/ top 10 cm central twig								Cabbage caterpillars/ plant			
	Temp. (°C)		R.H. (%)		Rainfall (mm)	Sunshine (hrs)	GSC 6		DRMR-IJ 31		BSH 1		T27		GSC 6	DRMR-IJ 31	BSH 1	T27
	Max.	Min.	M	E			MA	CA	MA	CA	MA	CA	MA	CA				
51	18.4	5.0	95.0	48.0	0.0	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	20.7	5.1	97.0	53.0	0.0	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	17.6	8.7	93.0	68.0	51.6	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	15.5	9.7	95.0	83.0	47.8	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	13.5	8.3	92.0	77.0	0.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	14.5	8.0	96.0	76.0	13.2	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	17.5	7.4	94.0	62.0	31.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	19.9	7.8	93.0	49.0	0.0	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	23.4	7.2	94.0	42.0	0.0	9.0	18.6	16.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	23.4	10.2	85.0	41.0	3.4	7.4	59.3	25.4	1.6	0.0	5.3	0.0	0.5	0.0	3.0	0.0	0.0	1.3
9	22.0	10.4	91.0	57.0	9.9	7.3	46.2	0.0	4.4	0.0	1.7	0.0	0.9	0.0	3.6	1.6	0.9	2.3
10	27.2	13.0	91.0	58.0	0.0	8.4	106.1	13.8	17.1	0.0	15.6	0.0	15.6	0.0	47.2	4.5	8.6	10.7
11	31.8	17.3	90.0	45.0	0.0	9.4	122.6	13.0	11.6	0.0	0.0	0.0	16.0	0.0	42.6	1.0	0.0	9.8
12	33.5	18.9	83.0	33.0	0.0	9.4	6.5	0.0	0.4	0.0	Har	vest	0.0	0.0	24.0	0.0	0.0	0.0
13	35.6	17.1	79.0	23.0	0.0	10.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	0.0
14	38.2	17.6	73.0	13.0	0.0	10.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	0.0

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

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

SMW*	Weather Parameters						No of aphids/ top 10 cm central twig								Cabbage caterpillars/ plant			
	Temp. (°C)		R.H. (%)		Rainfall (mm)	Sunshine (hrs)	GSC 6		DRMR-IJ 31		BSH 1		T27		GSC 6	DRMR-IJ 31	BSH 1	T27
	Max.	Min.	M	E			MA	CA	MA	CA	MA	CA	MA	CA				
52	20.7	5.1	97.0	53.0	0.0	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	17.6	8.7	93.0	68.0	51.6	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	15.5	9.7	95.0	83.0	47.8	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	13.5	8.3	92.0	77.0	0.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	14.5	8.0	96.0	76.0	13.2	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	17.5	7.4	94.0	62.0	31.0	4.4	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0
6	19.9	7.8	93.0	49.0	0.0	8.4	0.0	0.0	0.0	0.0	0.0	6.1	0.0	0.0	0.0	0.0	0.0	0.0
7	23.4	7.2	94.0	42.0	0.0	9.0	0.0	0.0	0.0	0.0	0.9	5.7	0.0	0.0	0.0	0.0	0.0	0.0
8	23.4	10.2	85.0	41.0	3.4	7.4	12.5	0.0	8.8	0.0	0.7	7.6	0.0	0.0	3.3	0.0	0.0	0.0
9	22.0	10.4	91.0	57.0	9.9	7.3	22.1	0.0	9.7	0.0	1.9	1.4	0.0	0.0	8.0	1.3	2.3	2.7
10	27.2	13.0	91.0	58.0	0.0	8.4	111.6	18.3	45.5	0.0	11.6	16.6	11.0	0.0	40.7	8.6	3.1	2.9
11	31.8	17.3	90.0	45.0	0.0	9.4	149.0	12.0	15.5	0.0	10.5	4.4	1.7	0.0	24.5	3.7	1.7	1.2
12	33.5	18.9	83.0	33.0	0.0	9.4	24.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.5	0.0	2.3
13	35.6	17.1	79.0	23.0	0.0	10.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	38.2	17.6	73.0	13.0	0.0	10.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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

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

Std. Week	Weather parameters					No of aphids/ top 10 cm central twig							
	Temp. (°C)		RH (%)		Rain fall (mm)	DRMR IJ 31		T 27		GSC 6		BSH 1	
	Max	Min	Morn	Even		Timely	Late	Timely	Late	Timely	Late	Timely	Late
	47	27.1	12.0	91	64	0.0	0.0	-	0.0	-	0.0	-	0.0
48	28.0	9.4	91	62	0.0	0.0	-	0.0	-	0.0	-	0.0	-
49	27.6	10.7	91	61	0.0	0.0	-	0.0	-	0.0	-	0.0	-
50	25.6	8.7	92	63	0.0	0.0	-	0.0	-	0.0	-	0.0	-
51	25.4	7.6	89	58	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4
52	24.1	9.9	91	61	0.0	0.0	0.0	0.0	2.4	0.3	0.0	0.9	1.5
1	24.7	10.4	89	58	0.0	8.8	3.4	0.0	13.5	7.9	5.55	14.8	9.8
2	24.6	12.4	90	59	22.2	19.4	19.8	0.0	19.4	21.4	23.6	20.4	33.8
3	23.9	10.9	90	56	7.4	33.3	50.6	5.9	49.6	35.9	53.5	43.8	56.5
4	22.5	11.4	91	64	0.0	29.5	58.5	18.5	53.3	28.6	64.9	29.5	63.6
5	21.4	9.1	90	60	2.8	19.4	36.6	39.4	29.8	27.5	43.5	48.6	44.1
6	21.7	8.9	92	63	22.8	12.4	16.9	36.2	19.6	14.5	18.4	23.4	19.8
7	24.4	11.2	91	61	3.0	9.3	26.8	27.0	21.4	19.3	19.6	12.5	20.2
8	24.3	11.3	88	60	1.4	8.5	15.2	17.4	9.5	7.6	13.6	4.3	14.2
9	27.6	14.5	87	56	4.6	4.6	14.4	11.5	6.7	8.4	11.1	5.4	11.6
10	31.7	16.1	84	49	0.0	0.3	9.4	9.6	4.2	2.9	5.8	7.6	5.4
11	33.4	18.4	76	53	0.0	0.0	2.2	8.4	0.4	0.3	1.9	2.2	2.9
12	34.2	19.9	63	52	0.0	0.0	0.8	1.3	0.8	0.3	1.0	0.6	1.6
13	28.9	17.9	84	66	17.6	0.0	0.1	0.4	0.6	0.4	0.6	0.1	1.0
14	26.2	19.4	91	80	22.8	0.0	0.0	0.2	0.2	0.0	0.3	0.0	0.4

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

Std. Week	Weather parameters					Coccinellids (Adults+Grubs)/ plant							
	Temp. (°C)		RH (%)		Rain fall (mm)	DRMR IJ 31		T 27		GSC 6		BSH 1	
	Max	Min	Morn	Even		Timely	Late	Timely	Late	Timely	Late	Timely	Late
	47	27.1	12.0	91	64	0.0	0.0	-	0.0	-	0.0	-	0.0
48	28.0	9.4	91	62	0.0	0.0	-	0.0	-	0.0	-	0.0	-
49	27.6	10.7	91	61	0.0	0.0	-	0.0	-	0.0	-	0.0	-
50	25.6	8.7	92	63	0.0	0.0	-	0.0	-	0.0	-	0.0	-
51	25.4	7.6	89	58	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	24.1	9.9	91	61	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
1	24.7	10.4	89	58	0.0	0.3	0.4	0.1	0.0	0.0	0.5	0.0	0.6
2	24.6	12.4	90	59	22.2	1.4	1.5	1.5	0.3	0.8	0.8	0.7	1.5
3	23.9	10.9	90	56	7.4	1.3	1.8	1.6	1.4	1.3	1.3	1.6	1.8
4	22.5	11.4	91	64	0.0	1.7	1.9	2.1	2.3	2.2	1.9	1.5	1.4
5	21.4	9.1	90	60	2.8	2.5	2.0	2.3	2.6	2.7	1.7	2.8	2.9
6	21.7	8.9	92	63	22.8	2.2	2.4	2.2	1.9	2.4	2.5	2.9	2.4
7	24.4	11.2	91	61	3.0	1.5	2.6	1.6	1.4	1.3	2.2	2.6	2.2
8	24.3	11.3	88	60	1.4	0.8	1.3	1.3	1.8	1.1	2.0	1.5	1.9
9	27.6	14.5	87	56	4.6	1.3	1.1	0.4	1.6	0.4	1.7	1.6	1.7
10	31.7	16.1	84	49	0.0	0.4	2.3	0.2	1.1	0.7	1.1	0.7	0.8
11	33.4	18.4	76	53	0.0	0.2	1.1	0.2	0.7	0.2	1.3	0.9	0.9
12	34.2	19.9	63	52	0.0	0.0	0.8	0.0	0.6	0.0	1.1	0.1	0.0
13	28.9	17.9	84	66	17.6	0.0	1.2	0.0	0.8	0.1	0.7	0.0	0.2
14	26.2	19.4	91	80	22.8	0.0	0.3	0.0	0.2	0.0	0.0	0.2	0.0

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

Std. Week	Weather parameters				Rainfall (mm)	Aphid population/ top 10 cm central twig on							
	Temperature (°C)		RH (%)			Timely sown				Late sown			
	Max.	Min.	Morn.	Even.		<i>B. juncea</i>	<i>E. sativa</i>	<i>B. napus</i>	<i>B. rapa</i>	<i>B. juncea</i>	<i>E. sativa</i>	<i>B. napus</i>	<i>B. rapa</i>
						DRMR IJ 31	T 27	GSC 6	BSH 1	DRMR IJ 31	T 27	GSC 6	BSH 1
45	31.5	12.3	51.1	32.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	29.1	12.4	55.7	43.3	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47	27.6	10.6	53.9	43.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	27.2	10.5	53.1	42.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	28.9	11.1	57.1	48.0	0.0	1.0	1.4	1.2	1.6	0.0	0.0	0.0	1.8
50	24.5	10.7	66.4	54.0	0.0	1.4	1.2	1.4	2.2	3.2	3.2	3.0	3.6
51	20.9	7.5	67.6	52.7	0.0	1.6	1.2	1.6	2.6	1.8	1.2	1.8	3.0
52	21.3	7.1	66.1	54.4	0.0	1.4	1.4	1.6	1.2	1.4	2.0	2.6	1.0
1	21.8	8.2	58.4	39.7	8.0	2.8	1.4	1.0	2.6	1.6	1.6	1.8	2.6
2	20.4	7.9	59.8	39.2	0.0	1.2	0.6	1.4	1.8	1.8	2.6	2.6	2.0
3	21.6	6.7	54.4	38.7	0.0	1.0	1.0	2.0	1.9	1.3	2.9	3.2	1.8
4	23.1	6.4	57.7	40.8	0.0	1.2	1.4	1.6	2.6	1.8	1.8	1.2	3.0
5	26.9	8.1	66.8	40.6	0.0	1.4	2.2	0.8	1.6	1.8	1.8	1.4	1.4
6	27.1	10.2	70.7	42.5	0.0	2.4	1.9	2.8	2.4	1.8	2.9	2.9	2.6
7	29.2	12.3	69.8	34.2	0.0	2.8	2.2	2.4	2.8	2.4	2.6	2.4	2.6
8	29.7	13.0	68.3	34.5	0.0	2.0	2.8	2.4	1.4	2.6	1.6	2.8	2.4
9	34.6	12.5	68.5	44.0	0.0	1.2	2.2	1.2	2.2	2.2	2.3	2.4	2.4
10	34.3	12.7	64.7	38.3	0.0	0.8	2.4	2.6	1.6	2.2	3.1	2.6	1.4
11	34.6	13.6	50.1	37.1	10.0	0.0	0.6	1.2	2.2	1.2	2.2	1.2	2.2
12	34.8	15.8	39.7	33.6	0.0	0.0	0.4	1.4	0.6	1.2	0.6	1.6	1.8
13	36.8	17.5	38.4	31.3	0.0	0.0	0.6	0.4	0.6	0.6	0.2	1.4	1.4

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

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

Std. Week	Weather parameters				Rainfall (mm)	Number of painted bugs/ metre row length (mrl)							
	Temperature (°C)		RH (%)			Timely sown				Late sown			
	Max.	Min.	Morn.	Even.		<i>B. juncea</i>	<i>E. sativa</i>	<i>B. napus</i>	<i>B. rapa</i>	<i>B. juncea</i>	<i>E. sativa</i>	<i>B. napus</i>	<i>B. rapa</i>
						DRMR IJ 31	T 27	GSC 6	BSH 1	DRMR IJ 31	T 27	GSC 6	BSH 1
45	31.5	12.3	51.1	32.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	29.1	12.4	55.7	43.3	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47	27.6	10.6	53.9	43.1	0.0	0.6	0.6	0.4	0.6	0.6	0.0	0.2	0.6
48	27.2	10.5	53.1	42.0	0.0	0.4	0.4	0.4	1.2	0.6	0.0	0.6	0.0
49	28.9	11.1	57.1	48.0	0.0	0.3	0.7	0.4	0.6	0.0	0.0	0.0	0.0
50	24.5	10.7	66.4	54.0	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0
51	20.9	7.5	67.6	52.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	21.3	7.1	66.1	54.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21.8	8.2	58.4	39.7	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	20.4	7.9	59.8	39.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	21.6	6.7	54.4	38.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	23.1	6.4	57.7	40.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	26.9	8.1	66.8	40.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	27.1	10.2	70.7	42.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	29.2	12.3	69.8	34.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	29.7	13.0	68.3	34.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	34.6	12.5	68.5	44.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	34.3	12.7	64.7	38.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	34.6	13.6	50.1	37.1	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	34.8	15.8	39.7	33.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	36.8	17.5	38.4	31.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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

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

Std. Week	Weather parameters				Rainfall (mm)	Number of coccinellids (Adults+Grubs)/ plant							
	Temperature (°C)		RH (%)			Timely sown				Late sown			
	Max.	Min.	Morn.	Even.		<i>B. juncea</i>	<i>E. sativa</i>	<i>B. napus</i>	<i>B. rapa</i>	<i>B. juncea</i>	<i>E. sativa</i>	<i>B. napus</i>	<i>B. rapa</i>
						DRMR IJ 31	T 27	GSC 6	BSH 1	DRMR IJ 31	T 27	GSC 6	BSH 1
45	31.5	12.3	51.1	32.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	29.1	12.4	55.7	43.3	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47	27.6	10.6	53.9	43.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	27.2	10.5	53.1	42.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	28.9	11.1	57.1	48.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	24.5	10.7	66.4	54.0	0.0	0.2	0.2	0.2	0.2	0.2	0.6	1.2	1.2
51	20.9	7.5	67.6	52.7	0.0	0.4	0.6	1.4	1.2	0.8	1.0	0.8	1.4
52	21.3	7.1	66.1	54.4	0.0	0.4	0.6	1.0	0.6	0.4	0.8	0.8	1.2
1	21.8	8.2	58.4	39.7	8.0	1.0	0.4	0.4	1.2	1.6	0.6	1.2	1.4
2	20.4	7.9	59.8	39.2	0.0	0.0	1.2	0.6	0.4	1.2	1.2	0.3	0.2
3	21.6	6.7	54.4	38.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	23.1	6.4	57.7	40.8	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0
5	26.9	8.1	66.8	40.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	27.1	10.2	70.7	42.5	0.0	0.0	0.8	0.8	0.0	0.0	0.0	0.2	0.0
7	29.2	12.3	69.8	34.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.6
8	29.7	13.0	68.3	34.5	0.0	0.4	0.0	0.2	0.0	0.0	0.0	0.0	0.6
9	34.6	12.5	68.5	44.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0
10	34.3	12.7	64.7	38.3	0.0	0.0	0.0	0.0	0.6	0.8	0.0	0.0	0.0
11	34.6	13.6	50.1	37.1	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	34.8	15.8	39.7	33.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	36.8	17.5	38.4	31.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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

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

Std. Week	Weather parameters				Rainfall (mm)	Number of honey bee visits/ min/ plant							
	Temperature (°C)		RH (%)			Timely sown				Late sown			
	Max.	Min.	Morn.	Even.		<i>B. juncea</i>	<i>E. sativa</i>	<i>B. napus</i>	<i>B. rapa</i>	<i>B. juncea</i>	<i>E. sativa</i>	<i>B. napus</i>	<i>B. rapa</i>
						DRMR IJ 31	T 27	GSC 6	BSH 1	DRMR IJ 31	T 27	GSC 6	BSH 1
45	31.5	12.3	51.1	32.3	0.0	1.2	1.8	2.6	1.2	1.8	1.7	2.4	1.3
46	29.1	12.4	55.7	43.3	18.0	1.4	1.4	2.4	1.8	0.6	1.3	1.5	1.9
47	27.6	10.6	53.9	43.1	0.0	1.6	2.6	2.4	0.8	0.7	0.9	1.6	1.4
48	27.2	10.5	53.1	42.0	0.0	1.4	1.6	1.7	1.2	0.9	1.2	1.2	1.2
49	28.9	11.1	57.1	48.0	0.0	1.2	2.2	1.8	2.2	0.7	0.5	2.2	0.7
50	24.5	10.7	66.4	54.0	0.0	1.2	1.6	1.5	1.2	1.3	1.0	0.8	1.3
51	20.9	7.5	67.6	52.7	0.0	1.4	1.6	1.8	1.2	1.5	1.1	1.0	1.4
52	21.3	7.1	66.1	54.4	0.0	2.6	1.2	1.7	1.2	0.8	0.9	0.8	1.1
1	21.8	8.2	58.4	39.7	8.0	2.3	1.2	2.9	1.4	0.7	1.0	1.4	1.4
2	20.4	7.9	59.8	39.2	0.0	1.8	0.3	2.7	1.4	0.5	0.6	1.2	1.3
3	21.6	6.7	54.4	38.7	0.0	1.0	1.1	1.9	1.2	0.0	0.0	1.4	1.3
4	23.1	6.4	57.7	40.8	0.0	1.0	0.6	1.2	1.4	1.1	0.2	0.3	1.1
5	26.9	8.1	66.8	40.6	0.0	2.2	0.0	2.9	1.4	0.9	1.1	2.2	1.5
6	27.1	10.2	70.7	42.5	0.0	2.2	0.0	2.2	1.3	0.7	1.2	2.2	2.2
7	29.2	12.3	69.8	34.2	0.0	1.8	0.0	1.2	1.4	0.0	2.2	2.4	2.2
8	29.7	13.0	68.3	34.5	0.0	2.2	0.0	1.2	1.2	0.0	1.2	1.6	0.0
9	34.6	12.5	68.5	44.0	0.0	1.2	0.0	1.0	0.8	0.0	0.6	1.3	1.8
10	34.3	12.7	64.7	38.3	0.0	0.6	0.0	0.0	0.6	0.0	0.3	1.1	1.1
11	34.6	13.6	50.1	37.1	10.0	0.0	0.0	0.0	0.4	0.0	0.2	0.3	0.0
12	34.8	15.8	39.7	33.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	36.8	17.5	38.4	31.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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

Table 5.3.8: Monitoring of alate mustard aphid on sticky traps

Std. week	Mean mustard aphid (alate) population per trap						
	HSR	SKN	LDH	PTN	KAN	MOR	DHO
40	-	-	0.0	-	-	0.0	0.0
41	-	-	0.0	-	-	0.0	0.0
42	-	-	0.0	-	-	0.0	0.0
43	-	-	4.0	-	0.0	0.0	0.0
44	-	-	40.6	-	0.0	0.0	0.0
45	-	-	53.4	-	0.0	0.0	0.0
46	-	-	76.4	-	0.0	0.0	0.0
47	0.0	-	83.8	-	0.0	0.0	0.0
48	0.0	-	34.0	-	0.0	0.0	0.0
49	0.0	0.0	11.6	-	0.0	0.0	0.0
50	0.0	1.6	5.6	-	0.0	0.0	0.0
51	0.0	8.8	19.6	-	0.0	1.2	0.0
52	0.0	40.6	26.8	-	0.0	2.3	10.4
1	0.8	126.6	19.4	-	0.0	8.4	6.7
2	2.3	267.8	20.4	-	0.0	6.4	14.3
3	39.7	373.0	12.4	7.6	0.0	11.3	8.2
4	61.1	557.4	14.8	50.0	0.0	111.4	16.2
5	92.4	709.8	36.2	61.0	0.0	108.8	5.9
6	103.0	1060.8	77.8	82.0	0.0	141.2	27.8
7	129.1	2388.2	82.6	107.0	0.0	136.6	58.6
8	130.5	3649.6	113.2	139.0	0.0	100.4	69.2
9	140.5	3017.6	115.8	204.0	2.1	98.3	128.4
10	216.3	383.0	241.0	253.0	3.3	50.4	109.0
11	363.7	46.0	366.8	177.0	15.7	83.6	48.6
12	98.8	0.0	430.8	184.0	6.3	33.3	11.0
13	41.2	-	389.6	-	0.0	32.2	0.0
14	12.1	-	112.0	-	-	31.2	-
15	-	-	4.2	-	-	8.8	-
16	-	-	0.0	-	-	2.2	-
17	-	-	0.0	-	-	0.0	-

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

Std. Week	No of aphids / plant					CD (p=0.05)	NE: Ladybird beetle (adult + larvae)/plant					
	T1	T2	T3	T4	Mean		T1	T2	T3	T4	Mean	CD (p=0.05)
4	0.0	0.0	0.0	0.0	0.0	NS	-	-	-	-	-	-
5	0.3	0.2	0.3	0.1	0.2	NS	-	-	-	-	-	-
6	2.3	2.7	2.5	2.3	2.5	NS	0.1	0.1	0.0	0.0	0.1	-
7	8.7	7.6	9.1	9.9	8.8	0.84	0.2	0.2	0.1	0.3	0.2	NS
8	14.8	13.8	14.5	14.0	14.3	0.88	0.1	0.6	0.5	0.7	0.5	NS
9	10.8	8.6	10.4	9.3	9.8	1.43	0.3	0.5	0.4	0.4	0.4	NS
10	17.1	10.8	10.8	9.1	12.0	3.09	0.6	0.8	0.5	0.7	0.7	NS
11	33.5	22.7	28.5	25.8	27.6	6.99	0.9	1.4	1.2	1.0	1.1	NS
12	36.6	28.5	33.5	30.7	32.3	NS	6.9	9.5	4.5	10.1	7.8	NS
13	56.4	45.1	52.8	46.4	50.2	3.08	9.8	18.4	17.1	19.7	16.3	NS
14	35.5	26.7	28.1	29.0	29.8	0.96	6.2	11.7	5.9	10.8	8.7	NS
15	13.2	10.5	12.5	12.5	12.2	0.56	1.1	1.6	1.5	1.4	1.4	NS
16	3.5	1.0	4.7	4.4	3.4	NS	0.38	0.44	0.49	0.49	0.5	NS
Mean	17.9	13.7	16.0	14.9			2.4	4.1	2.9	4.0		

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

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

Tr. No.	Intercrop combination	Honey bee/minute	Syrphid fly adult/minute	Mummified adults of aphid/5cm axis	Yield kg/ha mustard	Yield kg/ha intercrop
1	Mustard alone	3.9	4.5	11.6	1873.1	1873.1
2	Mustard + Fennel	10.5	12.7	18.7	1355.7	361.4
3	Mustard + Chickpea	4.1	6.5	14.5	1180.7	448.8
4	Mustard + Coriander	10.3	12.3	15.4	1277.0	388.6
	Mean	7.2	9.0	15.1	1421.7	767.8
	CD (p=0.05)	2.14	0.62	2.35	350.22	82.62

MSP: Mustard =50.50 Rs /Kg, Gram =51.00 Rs /Kg, Fennel =100.00 Rs /Kg, Coriander =65.00 Rs /Kg

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

Tr. No.	Treatments	Mustard equivalent yield (kg/ha)	Gross return (Rs/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	BCR
1	2	3	4	5	6	7
T ₁	Mustard alone	1873.1	94591.5	32500	62092	2.9
T ₂	Mustard + fennel	2071.5	104611	33900	70711	3.0
T ₃	Mustard + chickpea	1634.1	82523	34300	48223	2.4
T ₄	Mustard + coriander	1776.8	89728	33800	55928	2.6
	CD (p=0.05)	134.39	-	-	-	-

MSP: Mustard =50.50 Rs /Kg, Gram =51.00 Rs /Kg, Fennel =100.00 Rs /Kg, Coriander =65.00 Rs /Kg

5.4.2(A) Effect of host plant diversity on abundance of mustard aphid and the associated specialist and generalist natural enemies at Dholi

Treatments	Standard week	Mustard aphid/10 plants	Mummified aphids (parasitized by <i>Diaeretiella rapae</i>)	Lady bird beetles	Syrphid fly larvae	Spiders	Others (Rove beetle, dragon flies etc)
T1 Mustard alone	51	00	00	00	00	00	00
T2 Mustard+Linseed		00	00	00	00	00	0.5
T3 Mustard+Chickpea		00	00	00	00	00	0.8
T4 Mustard+Coriander		00	00	00	00	00	00
T5 Mustard+Fennel		00	00	00	00	00	00
CD (p=0.05)		-	-	-	-	-	NS
T1 Mustard alone	52	24.21	00	1.59	0.98	0.33	1.00
T2 Mustard+Linseed		22.1	00	1.75	1.25	0.68	1.50
T3 Mustard+Chickpea		18.97	00	1.95	1.79	1.01	2.00
T4 Mustard+Coriander		11.21	00	2.48	2.15	1.23	1.75
T5 Mustard+Fennel		12.75	00	1.78	1.95	1.11	1.55
CD (p=0.05)		4.25	-	NS	NS	2.32	NS
T1 Mustard alone	1	38.22	1.25	1.78	1.88	1.05	2.25
T2 Mustard+Linseed		29.77	2.15	1.96	2.12	1.98	3.45
T3 Mustard+Chickpea		24.55	2.98	2.52	2.41	2.88	5.16
T4 Mustard+Coriander		19.12	3.87	4.99	4.52	3.11	7.05
T5 Mustard+Fennel		20.76	3.11	4.65	4.11	2.92	6.41
CD (p=0.05)		6.21	5.22	2.89	2.52	4.88	4.01
T1 Mustard alone	2	63.11	1.98	1.85	2.05	1.55	3.75
T2 Mustard+Linseed		54.21	2.55	2.25	2.75	1.89	3.99
T3 Mustard+Chickpea		47.55	3.95	3.11	3.55	2.41	5.05
T4 Mustard+Coriander		35.45	5.88	4.77	5.11	3.19	8.00
T5 Mustard+Fennel		38.41	4.79	4.10	4.55	3.45	7.11
CD (p=0.05)		10.66	3.77	2.22	3.11	1.98	0.88
T1 Mustard alone	3	78.22	2.85	2.11	2.75	1.85	4.00
T2 Mustard+Linseed		68.33	3.12	2.78	3.44	1.99	4.75
T3 Mustard+Chickpea		61.45	3.85	3.28	4.04	2.86	5.20
T4 Mustard+Coriander		42.12	6.77	5.64	5.76	4.75	9.82
T5 Mustard+Fennel		48.44	5.98	5.12	5.11	4.22	8.45
CD (p=0.05)		13.41	1.55	2.01	0.59	1.87	2.02
T1 Mustard alone	4	96.78	3.40	2.45	2.95	2.05	5.25
T2 Mustard+Linseed		85.44	3.97	3.21	3.55	2.89	6.35
T3 Mustard+Chickpea		76.12	4.55	3.87	4.75	3.75	7.88
T4 Mustard+Coriander		51.25	7.21	6.12	5.97	4.95	10.20
T5 Mustard+Fennel		58.12	6.89	5.89	5.12	4.24	9.88
CD (p=0.05)		19.22	1.87	2.44	1.25	2.11	1.45
T1 Mustard alone	5	80.78	2.25	2.01	2.15	1.58	4.29
T2 Mustard+Linseed		71.47	2.95	2.72	3.01	2.30	5.48
T3 Mustard+Chickpea		64.18	3.56	3.15	3.49	2.89	6.71
T4 Mustard+Coriander		54.27	5.12	4.11	4.82	4.06	9.06
T5 Mustard+Fennel		60.12	4.55	3.89	4.08	3.64	8.72
CD (p=0.05)		3.4	2.78	1.79	0.86	1.35	1.98

T1 Mustard alone	6	118.78	3.95	3.01	3.15	2.58	6.25
T2 Mustard+Linseed		95.44	4.55	3.82	4.15	3.10	8.88
T3 Mustard+Chickpea		88.12	5.66	4.55	5.22	3.99	9.21
T4 Mustard+Coriander		54.25	8.42	6.41	6.52	5.56	11.56
T5 Mustard+Fennel		62.12	7.55	5.99	5.88	5.44	10.12
CD (p=0.05)			21.33	1.98	2.55	0.98	1.25
T1 Mustard alone	7	135.18	4.55	4.11	4.05	3.58	8.25
T2 Mustard+Linseed		107.34	5.98	5.02	4.95	4.11	10.88
T3 Mustard+Chickpea		97.52	6.76	5.95	5.88	4.79	13.91
T4 Mustard+Coriander		75.88	9.72	8.81	7.22	6.66	18.96
T5 Mustard+Fennel		80.12	8.65	7.89	6.78	6.04	15.12
CD (p=0.05)			9.78	5.22	3.75	2.87	0.53
T1 Mustard alone	8	168.68	5.65	5.91	5.15	3.91	10.25
T2 Mustard+Linseed		129.34	6.88	6.82	6.22	5.15	13.58
T3 Mustard+Chickpea		108.52	7.96	7.25	8.89	5.99	15.41
T4 Mustard+Coriander		89.88	11.88	11.91	12.02	8.86	25.06
T5 Mustard+Fennel		95.12	10.85	9.89	9.18	7.54	21.01
CD (p=0.05)			18.22	1.58	0.8	3.66	1.55
T1 Mustard alone	9	122.18	3.65	3.21	3.18	2.38	7.22
T2 Mustard+Linseed		109.14	4.98	4.52	4.32	4.15	9.58
T3 Mustard+Chickpea		89.62	6.16	5.75	5.29	5.09	15.41
T4 Mustard+Coriander		71.98	8.18	8.11	7.92	7.46	19.46
T5 Mustard+Fennel		85.12	7.75	7.81	6.13	6.08	17.51
CD (p=0.05)			7.92	1.21	1.68	2.1	5.34
T1 Mustard alone	10	90.66	1.88	1.45	1.85	2.05	5.15
T2 Mustard+Linseed		78.45	2.25	1.95	2.55	2.99	11.09
T3 Mustard+Chickpea		67.65	2.95	2.91	3.65	3.11	13.55
T4 Mustard+Coriander		43.77	4.88	3.87	4.91	4.99	15.30
T5 Mustard+Fennel		51.21	3.79	3.15	4.05	3.55	14.31
CD (p=0.05)			0.78	4.88	2.65	7.68	1.08
T1 Mustard alone	11	70.21	1.08	0.75	1.05	1.05	2.85
T2 Mustard+Linseed		64.21	1.75	1.15	1.85	1.49	9.09
T3 Mustard+Chickpea		38.95	2.25	2.01	2.45	2.01	10.75
T4 Mustard+Coriander		26.15	3.78	2.87	3.91	2.99	12.00
T5 Mustard+Fennel		29.61	2.99	2.10	3.05	2.55	11.31
CD (p=0.05)			1.85	0.63	0.87	1.22	0.98
T1 Mustard alone	12	20.11	0.45	0.19	0.10	0.75	2.00
T2 Mustard+Linseed		15.23	1.05	0.75	0.55	1.55	7.50
T3 Mustard+Chickpea		12.77	1.54	1.15	0.79	2.06	9.00
T4 Mustard+Coriander		5.22	2.98	1.97	1.05	2.15	10.75
T5 Mustard+Fennel		6.75	2.18	1.58	0.95	2.98	9.55
CD (p=0.05)			2.35	0.84	0.65	0.48	1.1
T1 Mustard alone	13	00	00	00	00	00	01
T2 Mustard+Linseed		00	00	00	00	00	05
T3 Mustard+Chickpea		00	00	00	00	00	06
T4 Mustard+Coriander		00	00	00	00	00	03
T5 Mustard+Fennel		00	00	00	00	00	07
CD (p=0.05)			-	-	-	-	-

Table 5.4.2 (B) Economics of effect of host plant diversity on abundance of mustard aphid and the associated specialist and generalist natural enemies at Dholi

Treatments	Mustard equivalent yield (kg/ha)	Gross return (Rs/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	BCR
T1 Mustard alone	855.0	59850.0	27284.0	32566.0	1.83
T2 Mustard+Linseed	975.0	68250.0	29555.0	38695.0	2.30
T3 Mustard+Chickpea	1396.0	97720.0	32415.0	65305.0	3.01
T4 Mustard+Coriander	1684.0	117880.0	31107.0	82423.0	3.79
T5 Mustard+Fennel	1258.0	88060.0	28678.0	59382.0	3.07

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

Std. Week	No of aphids / plant					Natural enemies (<i>Coccinella</i> spp.)					Number of mummified aphids/10plants				
	T1	T2	T3	T4	CD (p=0.05)	T1	T2	T3	T4	CD (p=0.05)	T1	T2	T3	T4	CD (p=0.05)
5	5.40	4.20	5.10	2.50	1.75	0.67	0.00	0.33	0.00	0.74	0.00	0.00	0.00	0.00	0.00
6	15.43	10.83	14.17	8.97	1.37	1.00	0.00	0.67	0.00	0.58	2.00	0.33	1.00	0.00	2.88
7	20.20	14.93	18.33	12.40	1.17	1.33	0.67	1.00	0.33	0.94	1.33	1.00	1.33	0.33	0.99
8	26.63	19.77	21.73	16.43	5.53	1.00	0.67	0.67	1.33	1.37	2.00	0.67	1.33	0.33	1.37
9	32.40	22.10	23.93	17.57	8.93	2.00	1.00	1.33	0.67	1.37	3.00	1.67	2.67	1.00	0.66
10	34.03	22.70	25.30	18.00	6.72	3.00	1.33	2.33	1.33	1.52	5.33	4.00	4.33	2.33	1.53
11	35.90	23.37	27.23	18.60	4.39	2.67	1.67	2.00	1.00	1.76	7.67	6.67	7.00	4.67	1.73
12	37.30	24.53	30.63	19.77	2.84	3.33	2.00	2.67	2.33	2.13	11.33	9.33	10.33	8.33	3.69
13	30.80	16.73	23.07	13.00	3.19	2.00	1.33	1.67	1.33	1.42	10.33	8.33	10.00	6.33	2.23
14	22.17	12.70	18.63	10.63	1.84	1.67	1.00	1.67	0.67	1.52	8.33	6.33	7.33	4.67	2.88

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

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

Tr. No.	Treatments	Mustard equivalent yield (kg/ha)	Gross return (Rs/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	BCR
1	2	3	4	5	6	7
T ₁	Mustard alone	1870.37	94453.70	27000	67453.70	3.49
T ₂	Mustard + chickpea	764.55	38609.79	28100	10509.79	1.37
T ₃	Mustard + coriander	775.13	39144.18	27800	11344.18	1.41
T ₄	Mustard + Fennel	1753.97	88575.40	27500	61075.40	3.22
	C.D. at 5%	52.32				

MSP: Mustard =50.50 Rs /Kg, Gram =52.30 Rs /Kg

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

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

Table 5.4.4(A): Effect of host plant diversity on abundance of mustard aphid and the associated specialist and generalist natural enemies at Ludhiana

Std. Week	Mustard aphid (no/plant)					Cabbage caterpillar (no of larvae/plant)				
	T1	T2	T3	T4	CD (p=0.05)	T1	T2	T3	T4	CD (p=0.05)
1	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-
2	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-
3	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-
4	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-
5	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-
6	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-
7	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-
8	0.9	0.8	1.4	1.0	-	0.0	0.0	0.0	0.0	-
9	7.7	3.8	5.2	4.7	NS	0.0	0.0	0.0	0.0	-
10	63.3	42.3	42.3	11.7	26.2	20.9	18.3	17.2	7.9	5.1
11	18.7	27.3	17.3	6.2	11.5	13.9	1.0	4.8	4.8	7.7
12	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-
13	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-
Overall mean	22.7	18.6	16.6	5.9	7.5	17.4	9.7	11.0	6.3	6.0

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

No population of cabbage aphid was observed.

Table 5.4.4(B) Economics of effect of host plant diversity on abundance of mustard aphid and the associated specialist and generalist natural enemies at Ludhiana

Tr. No.	Treatments	Mustard equivalent yield (kg/ha)	Gross return (Rs/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	BCR
1	2	3	4	5	6	7
T ₁	Mustard alone	1497.2	75608.6	30000	45608.6	2.5
T ₂	Mustard + fennel	2892.8	146086.4	30500	115586.4	4.8
T ₃	Mustard + chickpea	3381.4	170760.7	32000	138760.7	5.3
T ₄	Mustard + coriander	2466.0	124533.0	31750	92783	3.9
	C.D. (p=0.05)	378.1				

MSP: Mustard =50.50 Rs /Kg, Gram =51.00 Rs /Kg

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

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

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

Std. Week	Aphids/10cm top twig of <i>Brassica</i>			
	Mustard alone	Mustard+fennel	Mustard+chickpea	Mustard+coriander
50	0.0	0.0	0.0	0.0
51	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0
1	8.9	9.9	11.8	11.7
2	13.9	12.8	13.9	13.7
3	23.4	23.8	22.6	22.5
4	27.6	29.2	22.9	27.1
5	151.6	153.3	158.7	158.5
6	304.4	300.5	298.0	306.7
7	401.7	395.7	397.5	396.9
8	136.8	132.1	141.8	134.5
9	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0
CD (p=0.05)	9.40	8.40	6.59	7.10

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

Tr. No.	Treatments	Mustard equivalent yield (kg/ha)	Gross return (Rs/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	BCR
1	2	3	4	5	6	7
T ₁	Mustard alone	1263	82117	29945	52171	2.74
T ₂	Mustard + fennel	1351	79428	30187	49241	2.63
T ₃	Mustard + chickpea	1414	87140	31355	55785	2.78
T ₄	Mustard + coriander	1176	74381	30855	43526	2.41
CD (p=0.05)		NS				

Price: Mustard =65 Rs /Kg, Gram =51.00 Rs /Kg
 Fennel =100.00 Rs /Kg, Coriander =65.00 Rs /Kg

Mustard equivalent yield = Mustard seed yield (kg/ha) + (seed yield of intercrop (kg/ha) × (Price of intercrop (Rs/kg))
 Price of Mustard (Rs/kg))

Table 5.4.6 Effect of plant diversity on abundance of mustard aphid and the associated specialist and generalist natural enemies at Shillongani

Treatments	Mean aphid population (no./plant)		Mean no. of cocinella (G+A)/plant		Yield (kg/ha)
	Flowering Stage	Siliqua formation Stage	Flowering Stage	Siliqua formation Stage	
T1 (Mustard alone)	71.2	53.4	1.7	1.2	591
T2 (Mustard + chickpea)	39.4	27.6	2.3	1.9	659+ (154 Chickpea)
T3 (Mustard + coriander)	22.8	13.2	2.7	2.1	694+ (168 coriander)
T4 (Mustard + fennel)	42.5	28.5	2.8	1.7	672+ (173 fennel)
Sem(±)	1.69	1.38	--	--	20.23
CD (5%)	3.36	2.68	NS	NS	41.53

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

Sr. No.	Variety	Biochemical parameters							Yield (kg/ha)
		No of aphids/ top 10 cm central twig	Peroxidase (µmole/min/mg protein)	Phenylalanine ammonia lyase (Δod/min/mg protein)	Total glucosinolates (µmole/g)	Total phenols* (%)	Ortho-dihydroxy phenols (mg/g)	Flavonols (mg/g)	
1	DRMRIJ 31 (Uninfested)	1.46	0.29	10.54	56.12	1.87 (7.70)	0.89	1.25	2111.0
2	GSC 6 (Uninfested)	1.67	0.27	9.81	14.24	5.15 (13.13)	0.72	1.54	1408.7
	Mean	1.57	0.28	10.18	35.18	3.51	0.81	1.40	1759.85
3	DRMRIJ 31P (Infested)	143.23	0.38	14.80	68.99	2.75 (9.53)	1.29	1.81	1870.4
4	GSC 6 (Infested)	134.60	0.44	13.56	24.78	7.21 (15.61)	1.87	2.91	1301.6
	Mean	138.91	0.41	14.18	46.89	4.98	1.58	2.36	1586.0
	CD (p=0.05)	19.08	0.012	0.077	6.99	1.06	0.059	0.018	299.71
	Increase/Decrease (%) over uninfested								
5	DRMR IJ 31		+31.03	+28.78	+22.93	+47.05	+44.94	+44.80	-11.39
6	GSC 6		+62.96	+38.20	+74.01	+40.00	+159.72	+88.96	-7.60

*Figures in parenthesis is angular transformed values in total phenols

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

Sr. No.	Variety	Biochemical parameters							Yield (kg/ha)
		No of aphids/ top 10 cm central twig	Peroxidase (AA/min/mg protein)	Phenylalanine ammonia lyase (µg-t-cinnamic acid formed/hr/mg protein)	Total glucosinolates (µmole/g DW)	Total phenols (mg/g DW)	Ortho-dihydroxy phenols (mg/g DW)	Flavonols (mg/g DW)	
1	DRMRIJ 31 (Uninfested)	1.86	0.58	48.99	42.93	5.04	0.39	0.62	1769.44
2	GSC 6 (Uninfested)	1.60	0.44	28.08	14.64	8.26	0.50	0.99	1491.66
	Mean	1.73	0.51	38.53	28.78	6.65	0.44	0.80	1670.83
3	DRMRIJ 31 (Infested)	75.7	1.16	79.07	49.69	6.07	0.65	0.68	1572.22
4	GSC 6 (Infested)	114.1	0.94	83.05	17.20	11.34	0.69	1.08	1280.55
	Mean	94.9	1.05	81.06	33.44	8.70	0.67	0.88	1426.38
	CD (p=0.05)								
	Genotypes	10.08	0.07	NS	3.85	0.55	NS	0.05	95.85
	Infestation	10.08	0.07	8.67	3.85	0.55	0.07	0.05	95.85
	G x I	14.26	NS	12.26	NS	0.79	NS	NS	NS
	Increase/Decrease (%) over uninfested								
5	DRMR IJ 31		+100.0	+61.40	+13.60	+20.43	+66.70	+9.67	-11.14
6	GSC 6		+113.63	+66.18	+17.48	+37.28	+38.00	+9.10	-14.15

6. Plant Physiology

6.1 Screening of genotypes from different agroclimatic zones at seedling stage

Thirty five Indian mustard (*B. juncea*) genotypes procured from different agro-climatic zones were tested for high-temperature tolerance at seedling stage both under laboratory and field conditions. Test genotypes were evaluated in laboratory as per the standard protocol. For field planting, 100 seeds of each genotype were sown in 2 m row length at Bharatpur and Ludhiana centres with 3 replications. The field experiment was continued for 30 days. Seedling mortality and dry matter recorded varied significantly within the genotypes at the studied locations. Maximum seedling mortality indicated more susceptibility of the genotypes to high temperature and vice-versa (Table 6.1.1 to 6.1.3).

Seedling mortality $\leq 20\%$ and DW/10 seedlings $\geq 35\text{mg}$ rated tolerant genotypes under controlled conditions. Only one genotype RMX9310 met the selection criteria at Bharatpur, Hisar and Ludhiana centres. Seedling mortality of $\leq 30\%$ and DW/10 seedlings $\geq 40\text{mg}$ was recorded in JD6 at Bharatpur and Ludhiana. In the field sown trial RH1999-14, Kranti, ORM2019-25, PM25, RH1999-42, KMR (E) 21-1, PHR8081, RMX9310, DRMRCI 128 and Pro5111 had seedling mortality $\leq 20\%$ and dry matter $\geq 6.0\text{g}$ with STI 62.1% at Bharatpur and Ludhiana centres. JD6 had seedling mortality of $\leq 30\%$ at Bharatpur and Ludhiana centres and with DW of 7.8g with STI of 79.1 and SSTI 82.6% only at Ludhiana centre. Only one genotype RMX9310 was tolerant to high temperature at seedling stage both under laboratory and field conditions.

6.2 Evaluation of genotypes under low light stress condition

Five genotypes of Indian mustard were sown in paired rows at row spacing of 30 cm in the field with 3 replications under RBD. Treatments comprised i) shading with nets which cuts 30% natural light and ii) no shading (control). Shading was given for 30 days commencing from mid-December to mid-January following all the recommended practices for raising a healthy crop. Significant differences existed in the genotypes for studied traits and shading reduced physiological traits and seed yield significantly at two locations (Table 6.2.1 to 6.2.11).

Minimum reduction in the physiological traits, seeds/silique, test weight, total siliquae per plant with higher CSI and seed yield ($\leq 30\%$) identified DRMRCI-96 at Bharatpur and Ludhiana centres as promising genotype under low light stress.

6.3 Screening of genotypes for drought tolerance

Thirty four genotypes of *B. juncea* were evaluated for drought tolerance under field conditions at Bharatpur, Hisar and Ludhiana centres. The test genotypes were sown in 5 rows with 2.5 m row length at 30 cm row spacing after pre-sowing irrigation. Treatments were replicated 3 times under RBD factorial design. Main treatment consisted of i) two post sowing irrigations at 35 and 65 DAS (IR) and ii) no post sowing irrigation (RF). Analysis of variance revealed significant genotypic differences for RWC, SPAD values, photosynthetic pigments, canopy temperature, yield components and seed yield (Table 6.3.1 to 6.3.12).

Overall, CAU-RMM3, NPJ210, DRMRCI-128 and Kranti were tolerant to moisture stress at three locations (Bharatpur, Hisar and Ludhiana) with seed yield reduction $\leq 20\%$. These genotypes maintained higher SPAD values, chlorophyll content, RWC with relatively low reduction in siliquae on main shoot, seeds/silique, seed weight, $\text{DSI} \leq 1.0$ and $\text{YSI} \geq 0.83$. Moisture stress reduced seed yield by $\leq 20\%$ in DRMR1188 and JC36 at Hisar and Ludhiana centres and by $\leq 25\%$ in one genotype DRMRSJ 276 at 3 locations. These three genotypes had $\text{YSI} \geq 0.58$ with low reduction in physiological traits. RH0725 (check) declined in seed yield $\leq 20\%$ at Hisar and Ludhiana centres while $\leq 30\%$ at Bharatpur centre. However, RGN229 (check) was reported highly tolerant at Bharatpur, Hisar and Ludhiana centres with $\leq 20\%$ yield decline.

6.4 Screening of genotypes for high-temperature tolerance at the terminal stage

Thirty one mustard genotypes were sown in the field at two dates *i.e.* optimum/normal sowing (NS) in the third week of October and late sown in the last week of November (LS). Late sown (LS) crop faced high temperature ($\geq 30^{\circ}\text{C}$) at pod filling stage. Genotypes were sown in paired rows in RBD. The percent reduction was computed under late sown over normal sown. Environmental differences due to planting dates (NS and LS) significantly influenced canopy temperature, canopy temperature depression, membrane stability, yield attributes *viz.*, number of seeds per siliqua, seed weight and seed yield. However, environment x genotypes (ExG) interaction effects were non-significant for CT at Bharatpur and Hisar centres, CTD only at Bharatpur centre, MSI at Hisar centre and yield at Bharatpur and Hisar centres (Table 6.4.1 to 6.4.6).

HUJM20-6 and JC1 showed tolerance to terminal heat stress with seed yield reduction $\leq 30\%$ and stability indices (HSI ≥ 0.40 and YSI ≥ 0.53) at all the 4 locations. Kranti and RH2050 at Dholi, Hisar and Ludhiana centres showed thermo tolerance with seed yield decline $\leq 30\%$, HSI ≥ 0.50 and YSI ≥ 0.54 . JC32 had HSI ≥ 0.58 and YSI ≥ 0.62 at Bharatpur and Ludhiana centres. These genotypes suffered lesser depression in membrane stability, seeds per siliqua with cooler canopies. PM26 (check) reported yield loss $\leq 20\%$ only at Bharatpur centre and $\leq 30\%$ at Dholi, Hisar and Ludhiana centres with HSI ≥ 0.45 and YSI ≥ 0.53 .

6.5 Screening of genotypes for salinity tolerance at seedling stage

Counted seeds of twelve mustard genotypes were sown in the plastic tray using distilled water as control and 12dS/m saline solution to identify salinity tolerant genotypes. The experiment was conducted under ambient conditions and per cent decrease in germination, seedling length, dry weight and seedling vigor II were used to assess salinity tolerance (Table 6.5.1 to 6.5.4).

Overall, Kranti, CS2020-10 and CS54 seems promising for salinity tolerance at Hisar and Ludhiana centres with lesser decline ($\leq 30\%$) in germination per cent, seedling length, dry matter accumulation and SVII at Ludhiana centre only.

6.6 Effect of plant growth regulating substances to mitigate drought stress

Foliar application was given at initiation of flowering and at 50% flowering at 3 locations under rainfed conditions. Two foliar sprays of trehalose (Tre) @10 and 20 mM, urea @1 and 2% and potassium nitrate (KNO_3) @1 and 2% were tested to mitigate moisture stress in the rainfed varieties. Local variety of centre *viz.*, DRMR 1165-40 (Bharatpur), RH 725 (Hisar) and PBR97 (Ludhiana) were selected to test the efficacy of growth regulating substances. Non-significant differences were recorded for chl_a, chl_b and total chl at Hisar centre while for seeds per siliqua, seed weight were non-significant at Hisar and Bharatpur centres (Table 6.6.1 to 6.6.4).

Foliar application of urea @ 1 and 2% and KNO_3 @ 2% improved seed yield at Bharatpur while foliar sprays of all the tested PGRs were effective in improving yield at Hisar and Ludhiana centres with increased siliquae on main shoot, total siliquae per plant and chlorophyll stability index.

6.7: Enhancing productivity of rapeseed mustard through microbes under moisture stress (Plant Physiologists associated with Agronomy trail for recording data)

Physiological traits (Chlorophyll, SPAD and RWC) enhanced with the microbial treatments under moisture stress at Dholi and Ludhiana centres and osmoprotectants (proline and total sugars) at Ludhiana (Table 6.7.1 to 6.7.3).

Maximum increase was with CRIDA MI II for RWC at Dholi and with Biophos+Biophos trailed by MRD17 at Ludhiana centre, SPAD with CRIDAMI II at both the locations, total chlorophyll with both the CRIDA strains at Dholi centre while MKD17 and Biophos+Biophos at Ludhiana centre, proline and total sugars with CRIDA MI I at Ludhiana centre.

6.8: Microbes for mitigating high temperature in mustard

The efficiency of stress adaptive consortium, Pusa Sanjeevni (IARI, New Delhi) and microbial formulation (CSIR-Lucknow) were tested under field conditions in three mustard varieties at Bharatpur, Hisar and Ludhiana centres (Table 6.8.1 to 6.8.10).

Variation existed in the three varieties for the studied traits with microbial formulation and Pusa Sanjeevni under normal and late sown conditions. RWC, membrane stability and chlorophyll content improved with both the microbial inoculations in normal and late sown varieties. CT was lower in late sown inoculated varieties at Ludhiana centre only. Total siliquae per plant and biomass increased with microbial formulation and Pusa Sanjeevni inoculated 3 varieties at Dholi, Hisar and Ludhiana centres. Seed yield improved with both the inoculations under normal and late sown varieties at 4 locations except for RH725 inoculated with microbial formulation under late sown condition at Bharatpur centre, RH725 and Giriraj inoculated with Pusa Sanjeevani under normal and late sown conditions respectively at Hisar centre over non-inoculated control.

Table 6.1.1: Screening of genotypes from different agroclimatic zones for high temperature tolerance

Entries	Code	Laboratory conditions							
		Seedling mortality (%)				DW/10 seedlings (mg)			
		Bharatpur	Hisar	Ludhiana	Avg	Bharatpur	Hisar	Ludhiana	Avg
Phy-21-1	DRMR1372	52.5	22.7	37.2	37.5	70.9	57.4	45.5	57.9
Phy-21-2	RH1999-14	87.5	52.1	49.8	63.1	39.2	44.2	42.1	41.8
Phy-21-3	BAUM-21-3	42.5	49.4	44.9	45.6	60.2	52.9	48.4	53.8
Phy-21-4	PRE-2018-9	50.0	32.3	35.9	39.4	68.2	54.0	47.7	56.6
Phy-21-5	RH1999-18	52.5	26.7	25.7	35.0	102.4	44.9	41.8	63.0
Phy-21-6	KMR(E)21-2	67.5	31.7	28.4	42.5	90.0	42.7	38.5	57.1
Phy-21-7	DRMRCI -141	60.0	36.8	43.1	46.6	81.6	57.9	51.2	63.6
Phy-21-8	Kranti	52.5	32.2	38.7	41.1	59.0	43.1	45.8	49.3
Phy-21-9	NPJ-248	50.0	53.9	48.2	50.7	96.7	51.9	53.2	67.3
Phy-21-10	DRMRSJ-364	77.5	49.2	42.1	56.3	90.8	52.9	57.9	67.2
Phy-21-11	PHR-8425	55.0	49.2	43.5	49.2	88.4	37.6	36.7	54.2
Phy-21-12	DRMRCI-145	85.0	51.9	52.9	63.3	98.3	40.4	38.9	59.2
Phy-21-13	ORM-2019-25	57.5	41.7	49.2	49.5	93.9	45.4	48.6	62.6
Phy-21-14	TM331	67.5	49.9	48.0	55.1	97.8	34.6	45.3	59.2
Phy-21-15	HUJM (E)20-4	60.0	15.7	41.5	39.1	84.4	58.6	56.2	66.4
Phy-21-16	DRMRHT13-13-5-4	62.5	32.0	39.8	44.8	64.4	39.4	55.1	53.0
Phy-21-17	RH1424	50.0	19.6	25.3	31.6	76.1	63.1	65.8	68.3
Phy-21-18	DRMRHT13-13-5-5	70.0	37.1	38.4	48.5	66.4	48.4	46.6	53.8
Phy-21-19	PM25	57.5	36.7	39.2	44.5	66.6	58.1	47.5	57.4
Phy-21-20	DRMR1167	45.0	42.1	46.5	44.5	118.6	37.1	53.6	69.8
Phy-21-21	RH1999-42	42.5	46.2	39.2	42.6	55.5	42.7	48.4	48.9
Phy-21-22	DRMRCI-133	57.5	51.6	45.3	51.5	57.0	40.4	44.1	47.2
Phy-21-23	DRMRHT-1712	42.5	19.6	38.1	33.4	56.7	63.1	59.6	59.8
Phy-21-24	KMR(E)21-1	52.5	49.2	43.2	48.3	66.8	37.8	44.2	49.6
Phy-21-25	PHR-8081	50.0	19.8	38.6	36.1	59.4	58.2	47.5	55.0
Phy-21-26	NPJ-249	70.0	19.8	42.1	44.0	61.8	58.2	53.9	58.0
Phy-21-27	DRMRIJ-16-9-7	47.5	37.1	36.7	40.4	58.7	48.6	48.5	51.9
Phy-21-28	RMX9310	15.0	18.4	20.4	17.9	36.5	56.7	39.8	44.3
Phy-21-29	ACN226	22.5	49.5	23.9	32.0	40.2	34.6	49.2	41.3
Phy-21-30	DRMRCI 128	57.5	40.3	39.3	45.7	60.8	52.7	50.3	54.6
Phy-21-31	PRE-2018-10	47.5	49.2	48.0	48.2	53.2	52.9	48.6	51.6
Phy-21-32	Pro 5111	65.0	41.7	39.8	48.8	83.0	45.4	49.3	59.2
Phy-21-33	DRMR1188	55.0	49.2	45.7	50.0	98.6	37.8	39.8	58.7
Phy-21-34	JD6	30.0	36.7	29.2	32.0	82.7	58.1	45.5	62.1
Phy-21-35	SVJH-69	72.5	53.9	46.4	57.6	67.6	51.9	57.8	59.1
	Mean	55.1	38.4	39.8		72.9	48.7	42.1	
	CD (p=0.05)	NS	2.15	12.3		NS	0.986	6.3	

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

Entries	Code	Field condition							
		Seedling mortality (%)			DW/10 plants (g)	STI			SSTI
		Bharatpur	Ludhiana	Avg	Ludhiana	Bharatpur	Ludhiana	Avg	Ludhiana
Phy-21-1	DRMR1372	22.7	13.6	18.1	8.6	91.5	94.1	92.8	76.9
Phy-21-2	RH1999-14	13.3	18.5	15.9	10.9	93.5	81.7	87.6	73.6
Phy-21-3	BAUM-21-3	16.7	22.9	19.8	10.1	91.5	76.7	84.1	89.1
Phy-21-4	PRE-2018-9	19.7	20.7	20.2	10.1	62.2	79.7	70.9	81.8
Phy-21-5	RH1999-18	30.7	17.7	24.2	9.8	84.8	83.0	83.9	86.9
Phy-21-6	KMR(E)21-2	43.7	26.3	35.0	6.2	76.7	80.1	78.4	76.2
Phy-21-7	DRMRCI -141	25.0	17.0	21.0	10.4	85.6	83.3	84.4	80.0
Phy-21-8	Kranti	15.7	12.9	14.3	7.7	51.8	85.5	68.7	87.6
Phy-21-9	NPJ-248	24.3	14.2	19.3	6.7	82.7	86.7	84.7	85.6
Phy-21-10	DRMRSJ-364	44.3	16.5	30.4	9.6	93.2	83.5	88.3	85.8
Phy-21-11	PHR-8425	20.3	7.8	14.0	10.1	87.4	87.4	87.4	82.4
Phy-21-12	DRMRCI -145	26.3	4.6	15.5	11.6	94.7	95.2	94.9	76.9
Phy-21-13	ORM-2019-25	17.0	9.9	13.4	7.5	82.5	90.7	86.6	79.5
Phy-21-14	TM331	18.0	23.2	20.6	6.2	74.3	76.7	75.5	76.3
Phy-21-15	HUJM (E)20-4	32.7	6.4	19.6	9.2	78.4	93.6	86.0	83.9
Phy-21-16	DRMRHT13-13-5-4	50.7	17.0	33.8	9.5	92.5	86.0	89.2	76.2
Phy-21-17	RH1424	19.3	33.7	26.5	4.8	84.6	72.8	78.7	72.7
Phy-21-18	DRMRHT13-13-5-5	28.0	16.6	22.3	8.8	93.1	86.1	89.6	68.8
Phy-21-19	PM25	17.3	7.7	12.5	7.5	93.6	88.4	91.0	79.2
Phy-21-20	DRMR1167	32.3	4.3	18.3	8.3	71.1	95.7	83.4	80.6
Phy-21-21	RH1999-42	14.3	18.2	16.3	8.4	87.5	82.4	84.9	75.3
Phy-21-22	DRMRCI-133	23.0	8.9	15.9	10.3	83.9	91.4	87.6	81.7
Phy-21-23	DRMRHT-1712	19.0	31.6	25.3	11.4	88.1	75.3	81.7	70.7
Phy-21-24	KMR(E)21-1	20.0	9.2	14.6	5.8	93.3	76.2	84.8	67.4
Phy-21-25	PHR-8081	18.7	12.8	15.7	9.8	93.4	88.0	90.7	82.2
Phy-21-26	NPJ-249	24.7	20.3	22.5	8.0	94.1	81.1	87.6	72.6
Phy-21-27	DRMRIJ-16-9-7	42.0	10.2	26.1	5.7	92.3	89.8	91.0	78.6
Phy-21-28	RMX9310	16.0	7.8	11.9	8.0	32.1	92.2	62.1	83.6
Phy-21-29	ACN226	21.0	17.6	19.3	9.7	45.9	83.4	64.7	80.5
Phy-21-30	DRMRCI 128	15.0	14.1	14.5	8.7	83.9	85.9	84.9	82.1
Phy-21-31	PRE-2018-10	19.3	35.1	27.2	8.6	92.4	69.4	80.9	77.0
Phy-21-32	Pro 5111	20.0	20.4	20.2	9.3	89.3	80.4	84.9	73.4
Phy-21-33	DRMR1188	21.0	14.9	18.0	8.2	82.5	85.1	83.8	87.6
Phy-21-34	JD6	17.7	26.5	22.1	7.6	83.5	74.5	79.0	82.6
Phy-21-35	SVJH-69	24.7	19.3	22.0	11.2	94.2	83.8	89.0	77.4
	Mean	23.8	16.5		8.7	82.9	84.2		79.2
	CD (p=0.05)	8.78	2.93		0.99	3.24	5.70		3.86

Table 6.1.3 : Effect of high temperature at seedling stage on RWC and SPAD under field condition

Entries	Code	Field condition					
		RWC (%)			SPAD		
		Bharatpur	Ludhiana	Avg	Bharatpur	Ludhiana	Avg
Phy-21-1	DRMR1372	94.9	80.1	87.5	38.4	41.1	39.7
Phy-21-2	RH1999-14	97.6	90.5	94.0	39.2	39.5	39.3
Phy-21-3	BAUM-21-3	97.1	80.3	88.7	36.2	40.8	38.5
Phy-21-4	PRE-2018-9	93.4	84.3	88.8	41.7	40.5	41.1
Phy-21-5	RH1999-18	96.2	88.6	92.4	37.7	40.0	38.8
Phy-21-6	KMR(E)21-2	94.0	83.6	88.8	41.2	38.5	39.8
Phy-21-7	DRMRCI -141	96.5	63.4	79.9	41.6	38.8	40.2
Phy-21-8	Kranti	97.0	78.8	87.9	41.6	34.8	38.2
Phy-21-9	NPJ-248	90.7	90.1	90.4	41.1	40.6	40.9
Phy-21-10	DRMRSJ-364	97.3	87.1	92.2	41.0	37.0	39.0
Phy-21-11	PHR-8425	90.1	85.5	87.8	36.8	43.1	39.9
Phy-21-12	DRMRCI -145	95.2	90.7	92.9	39.0	36.6	37.8
Phy-21-13	ORM-2019-25	97.6	90.3	93.9	37.1	42.7	39.9
Phy-21-14	TM331	95.2	83.2	89.2	41.5	35.2	38.3
Phy-21-15	HUJM (E)20-4	91.6	89.8	90.7	40.4	37.9	39.2
Phy-21-16	DRMRHT13-13-5-4	97.2	85.2	91.2	40.5	43.2	41.8
Phy-21-17	RH1424	97.0	91.6	94.3	41.5	36.5	39.0
Phy-21-18	DRMRHT13-13-5-5	96.9	88.4	92.6	42.5	36.7	39.6
Phy-21-19	PM25	94.3	85.3	89.8	43.0	44.3	43.7
Phy-21-20	DRMR1167	93.1	91.2	92.1	40.1	44.0	42.0
Phy-21-21	RH1999-42	96.0	90.5	93.3	41.7	44.7	43.2
Phy-21-22	DRMRCI-133	93.1	86.6	89.8	39.5	36.8	38.1
Phy-21-23	DRMRHT-1712	62.5	80.5	71.5	41.2	41.0	41.1
Phy-21-24	KMR(E)21-1	82.2	85.9	84.1	39.3	39.5	39.4
Phy-21-25	PHR-8081	95.0	85.5	90.2	39.4	34.7	37.0
Phy-21-26	NPJ-249	96.6	86.8	91.7	41.2	39.6	40.4
Phy-21-27	DRMRIJ-16-9-7	97.5	90.6	94.1	41.9	38.6	40.3
Phy-21-28	RMX9310	95.9	89.5	92.7	40.4	45.4	42.9
Phy-21-29	ACN226	97.5	90.0	93.8	40.2	36.9	38.5
Phy-21-30	DRMRCI 128	97.9	89.1	93.5	39.4	45.1	42.2
Phy-21-31	PRE-2018-10	96.8	86.5	91.6	42.5	50.6	46.6
Phy-21-32	Pro 5111	94.5	90.8	92.6	39.5	39.6	39.6
Phy-21-33	DRMR1188	98.2	90.3	94.2	39.7	43.3	41.5
Phy-21-34	JD6	96.4	87.8	92.1	40.3	37.7	39.0
Phy-21-35	SVJH-69	92.1	84.7	88.4	40.1	39.9	40.0
	Mean	94.1	86.3		40.2	40.1	
	CD (p=0.05)	11.89	2.69		NS	2.98	

Table 6.2.1: Effect of low light stress on photosynthesis (μ mole/m²/s) at two stages of crop growth

Entries	Code	15 days of shading			10 days after removal of nets					
		Ludhiana			Hisar			Ludhiana		
		C	S	Red(%)	C	S	Red(%)	C	S	Red(%)
Phy-21-36	NRCBH101	27.9	19.5	30.1	6.03	4.59	24.0	29.3	22.7	22.5
Phy-21-37	PBR385	25.7	20.3	21.0	7.95	5.85	26.4	26.7	23.3	12.7
Phy-21-38	RH749	24.7	19.8	19.8	5.46	4.19	23.2	27.8	22.4	19.4
Phy-21-39	DRMRCI 96	27.8	22.6	18.7	4.38	3.64	16.9	28.4	23.1	18.7
Phy-21-40	RH-1676	26.3	20.9	20.5	8.19	6.32	22.9	29.5	24.8	15.9
	Mean	26.5	20.6		6.4	4.92		28.3	23.3	
CD (p=0.05)		S=0.428			S=0.335			S=0.634		
		G=0.122			G=0.212			G=0.176		
		SxG=NS			SxG=0.474			SxG=NS		

C=Control; S=30% shading

Table 6.2.2 : Effect of low light stress on chlorophyll content and chlorophyll stability index 10 days after removal of nets at Bharatpur

Entries	Code	Chl a			Chl b			Total Chl			Carotenoids			CSI
		C	S	Red (%)	C	S	Red (%)	C	S	Red (%)	C	S	Red (%)	
Phy-21-36	NRCBH101	1.30	1.21	6.8	0.266	0.233	12.2	1.57	1.45	7.7	0.316	0.286	9.36	0.92
Phy-21-37	PBR385	1.55	1.47	5.0	0.328	0.254	22.4	1.88	1.72	8.0	0.364	0.335	7.89	0.92
Phy-21-38	RH749	1.36	1.29	5.0	0.262	0.227	13.2	1.62	1.52	6.3	0.343	0.288	16.19	0.94
Phy-21-39	DRMRCI 96	1.49	1.34	10.3	0.337	0.260	23.1	1.83	1.60	12.7	0.376	0.294	22.03	0.87
Phy-21-40	RH-1676	1.32	1.27	4.1	0.253	0.225	11.3	1.58	1.49	5.3	0.325	0.300	7.61	0.95
	Mean	1.41	1.32		0.289	0.240		1.69	1.56		0.345	0.301	12.62	0.92
CD (p=0.05)		S=0.074			S=0.044			S=0.116			S=0.002			
		G=0.117			G=NS			G=0.184			G=0.004			
		SxG=NS			SxG=NS			SxG=NS			SxG=0.005			

C=Control; S=30% shading

Table 6.2.3 : Effect of low light stress on photosynthetic pigments (mg/g FW) and chlorophyll stability index 10 days after removal of nets at Hisar

Entries	Code	Chl a			Chl b			Total Chl			CSI
		C	S	Red (%)	C	S	Red (%)	C	S	Red (%)	
Phy-21-36	NRCBH101	1.92	1.57	18.2	0.359	0.247	31.2	2.28	1.82	20.1	0.80
Phy-21-37	PBR385	1.75	1.38	21.1	0.331	0.216	34.9	2.08	1.60	23.1	0.77
Phy-21-38	RH749	1.64	1.41	14.0	0.311	0.234	25.0	1.95	1.65	15.7	0.84
Phy-21-39	DRMRCI 96	1.75	1.58	9.7	0.316	0.257	18.7	2.06	1.84	10.8	0.89
Phy-21-40	RH-1676	1.75	1.57	10.3	0.333	0.263	21.1	2.09	1.83	12.0	0.88
	Mean	1.76	1.5		0.33	0.243		2.09	1.75		
CD (p=0.05)		S= NS			S=NS			S=NS			
		G=0.164			G=0.028			G=0.189			
		SxG=NS			SxG=NS			SxG=NS			

C=Control; S=30% shading

Table 6.2.4: Effect of low light stress on photosynthetic pigments (mg/g FW) and chlorophyll stability index 10 days after removal of nets at Ludhiana

Entries	Code	Chl a			Chl b			Total Chl			Carotenoids			CSI
		C	S	Red (%)	C	S	Red (%)	C	S	Red (%)	C	S	Red (%)	
Phy-21-36	NRCBH101	2.21	1.93	12.7	0.405	0.225	44.4	2.33	2.22	5.0	0.555	0.435	21.5	0.95
Phy-21-37	PBR385	2.04	1.62	20.8	0.289	0.252	12.8	2.75	2.30	16.4	0.537	0.331	38.3	0.84
Phy-21-38	RH749	2.24	1.91	14.9	0.185	0.144	22.2	2.34	2.09	10.4	0.479	0.460	3.9	0.90
Phy-21-39	DRMRCI 96	2.17	1.94	10.6	0.185	0.181	2.2	2.30	2.12	7.8	0.498	0.482	3.2	0.92
Phy-21-40	RH-1676	1.94	1.64	15.6	0.292	0.143	51.1	2.23	1.62	27.2	0.523	0.318	39.1	0.73
	Mean	2.12	1.81		0.238	0.189		2.39	2.07		0.518	0.405		
CD (p=0.05)		S=0.10			S=0.030			S=0.129			S=0.0125			
		G=0.245			G=0.074			G=0.317			G=0.0307			
		SxG=0.346			SxG=0.104			SxG=0.449			SxG=0.0434			

C=Control; S=30% shading

Table 6.2.5 : Effect of low light stress 10 days after removal of nets on physiological traits at Ludhiana

Entries	Code	LWR (%)			SLW (mg/cm2)		
		C	S	Red (%)	C	S	Red (%)
Phy-21-36	NRCBH101	75.9	68.7	9.4	3.4	3.2	5.3
Phy-21-37	PBR385	76.1	75.1	1.3	2.5	2.3	8.7
Phy-21-38	RH749	77.4	76.6	1.0	3.1	2.5	19.4
Phy-21-39	DRMRCI 96	76.1	70.1	7.8	3.6	2.9	19.4
Phy-21-40	RH-1676	79.0	75.8	4.1	2.9	2.6	8.6
	Mean	76.9	73.3		3.1	2.7	
CD (p=0.05)		S=0.856			S=0.147		
		G=2.09			G=0.360		
		SxG=2.97			SxG=0.510		

C=Control; S=30% shading

Table 6.2.6 : Effect of low light stress on siliquae on main shoot at 3 locations

Entries	Code	Siliquae on main shoot								
		Bharatpur			Hisar			Ludhiana		
		C	S	Red (%)	C	S	Red (%)	C	S	Red (%)
Phy-21-36	NRCBH101	51.7	37.4	27.5	54.0	40.0	25.9	33.3	23.7	29.0
Phy-21-37	PBR385	43.8	37.8	13.7	46.3	30.0	35.2	36.5	32.4	11.3
Phy-21-38	RH749	44.0	40.2	8.6	51.3	34.7	32.5	38.9	33.1	14.9
Phy-21-39	DRMRCI 96	46.7	33.7	27.9	48.0	39.0	18.8	32.3	23.1	28.3
Phy-21-40	RH-1676	54.6	32.2	40.9	50.3	40.0	20.5	47.5	32.1	32.4
	Mean	48.1	36.3		50.0	36.7		37.7	28.9	
CD (p=0.05)		S=4.19			S=NS			S=0.745		
		G=NS			G=5.872			G=1.82		
		SxG=NS			SxG=NS			SxG=2.52		

C=Control; S=30% shading

Table 6.2.7 : Effect of low light stress on total siliquae per plant at Bharatpur, Hisar and Ludhiana

Entries	Code	Total siliquae/plant								
		Bharatpur			Hisar			Ludhiana		
		C	S	Red (%)	C	S	Red (%)	C	S	Red (%)
Phy-21-36	NRCBH101	252.7	240.1	5.0	550.7	330.0	40.1	290.7	188.2	35.3
Phy-21-37	PBR385	251.0	248.3	1.1	453.3	262.0	42.2	251.7	243.9	3.1
Phy-21-38	RH749	221.6	173.0	21.9	370.7	264.0	28.8	292.8	173.3	40.8
Phy-21-39	DRMRCI 96	249.2	237.9	4.5	315.7	237.3	24.8	284.4	256.3	9.9
Phy-21-40	RH-1676	265.8	236.9	10.9	384.0	260.7	32.1	356.1	228.6	35.8
	Mean	248.0	227.2		414.9	270.8		295.1	218.1	
CD (p=0.05)		S=NS			S=89.8			S=10.5		
		G=NS			G=NS			G=25.8		
		SxG=NS			SxG=NS			SxG=36.58		

C=Control; S=30% shading

Table 6.2.8 : Effect of low light stress on seeds per siliqua at Bharatpur, Hisar and Ludhiana

Entries	Code	Seeds/siliqua								
		Bharatpur			Hisar			Ludhiana		
		C	S	Red (%)	C	S	Red (%)	C	S	Red (%)
Phy-21-36	NRCBH101	15.1	14.3	5.7	14.2	13.8	2.8	12.6	11.1	11.7
Phy-21-37	PBR385	14.1	12.6	10.8	14.7	12.1	17.7	12.5	11.3	9.7
Phy-21-38	RH749	15.0	12.5	16.9	13.6	11.3	16.9	10.0	9.8	2.0
Phy-21-39	DRMRCI 96	16.1	13.7	14.9	13.8	12.6	8.7	12.8	11.5	10.2
Phy-21-40	RH-1676	15.9	12.1	24.3	14.5	11.7	19.3	12.5	12.4	0.5
	Mean	15.3	13.0		14.2	12.3		12.1	11.2	
CD (p=0.05)		S=1.22			S= NS			S=NS		
		G=NS			G= NS			G=0.722		
		SxG=NS			SxG=NS			SxG=1.02		

C=Control; S=30% shading

Table 6.2.9 : Effect of low light stress on test weight (g) at Bharatpur, Hisar and Ludhiana

Entries	Code	Test weight (g)								
		Bharatpur			Hisar			Ludhiana		
		C	S	Red (%)	C	S	Red (%)	C	S	Red (%)
Phy-21-36	NRCHB101	5.8	5.1	11.9	5.4	5.0	7.4	6.5	5.5	15.7
Phy-21-37	PBR385	4.3	3.6	14.7	4.8	4.3	10.6	5.6	4.5	18.9
Phy-21-38	RH749	6.8	5.0	25.5	4.9	4.7	2.5	6.7	6.6	0.4
Phy-21-39	DRMRCI 96	5.1	4.3	16.2	5.1	4.7	8.4	5.6	5.5	1.8
Phy-21-40	RH-1676	6.1	5.0	16.9	4.8	4.6	3.2	6.0	5.5	6.8
	Mean	5.6	4.6		5.0	4.7		6.1	5.5	
CD (p=0.05)		S=0.519			S=NS			S=0.349		
		G=0.821			G=0.291			G=0.855		
		SxG=NS			SxG=NS			SxG=NS		

C=Control; S=30% shading

Table 6.2.10 : Effect of low light stress on biological yield at three locations

Entries	Code	Biological yield								
		Bharatpur (kg/ha)			Hisar (g/plant)			Ludhiana (kg/ha)		
		C	S	Red (%)	C	S	Red (%)	C	S	Red (%)
Phy-21-36	NRCHB101	17556	10000	43.0	0.701	0.272	61.2	5000	3111	37.8
Phy-21-37	PBR385	18000	10722	40.4	0.692	0.365	47.3	4333	2778	35.9
Phy-21-38	RH749	18389	8500	53.8	0.495	0.403	18.6	4111	2444	40.5
Phy-21-39	DRMRCI 96	18611	9500	49.0	0.411	0.254	38.2	3889	2889	25.7
Phy-21-40	RH-1676	15333	10444	31.9	0.537	0.357	33.5	4222	4000	5.3
	Mean	17578	9833		0.5672	0.3302		4311	3044	
CD (p=0.05)		S= 1915.3			S=0.121			S=165.2		
		G=NS			G=0.077			G=404.7		
		SxG=NS			SxG=NS			SxG=572.4		

C=Control; S=30% shading

Table 6.2.11 : Effect of low light stress on seed yield at three locations

Entries	Code	Seed yield								
		Bharatpur (kg/ha)			Hisar (g/plant)			Ludhiana (kg/ha)		
		C	S	Red (%)	C	S	Red (%)	C	S	Red (%)
Phy-21-36	NRCBH101	1315.6	887.8	32.5	0.132	0.072	45.5	1084	813	25.0
Phy-21-37	PBR385	1391.1	1241.1	10.8	0.111	0.063	43.2	960	724	24.5
Phy-21-38	RH749	1318.9	1317.8	0.1	0.087	0.057	34.5	1013	702	30.7
Phy-21-39	DRMRCI 96	1455.6	1301.1	10.6	0.083	0.053	36.1	987	744	24.5
Phy-21-40	RH-1676	1515.6	1325.6	12.5	0.117	0.068	41.9	907	660	27.2
	Mean	1399.3	1214.7		0.106	0.0626		990	729	
CD (p=0.05)		S=154.9			S=0.022			S=5.05		
		G=NS			G=0.014			G=12.38		
		SxG=NS			SxG=NS			SxG=17.5		

C=Control; S=30% shading

Table 6.3.1 : Effect of moisture stress on SPAD at 2 locations

Code	Entries	SPAD					
		Hisar			Ludhiana		
		IR	RF	Red (%)	IR	RF	Red (%)
Phy-21-41	RH1424	41.0	51.0	36.0	45.4	39.3	13.4
Phy-21-42	NPJ-254	34.8	28.8	17.1	43.5	36.5	16.1
Phy-21-43	RGH-519	39.4	33.7	14.5	41.2	39.4	4.4
Phy-21-44	DRMR1176	41.5	37.9	8.7	43.2	39.3	9.0
Phy-21-45	RH1928	48.8	35.7	26.8	42.9	41.0	4.4
Phy-21-46	PBR357	39.8	29.7	25.5	46.5	43.0	7.5
Phy-21-47	DRMRSJ 276	29.5	25.0	15.2	44.6	32.4	27.4
Phy-21-48	NPJ214	41.4	35.5	14.3	43.7	42.3	3.2
Phy-21-49	DRMR1222	41.1	30.2	26.4	47.2	39.3	16.7
Phy-21-50	JC36	37.3	27.7	25.7	40.2	38.5	4.2
Phy-21-51	DRMRCI-144	34.7	23.4	32.6	44.8	40.9	8.7
Phy-21-52	BAUM-21-2	39.6	29.0	26.7	45.5	43.6	4.2
Phy-21-53	RGH229	33.5	28.0	16.6	40.9	40.0	2.2
Phy-21-54	DRMR1188	43.5	35.9	17.5	43.0	41.1	4.3
Phy-21-55	CAU-RMM3	38.2	36.8	3.7	45.4	38.2	15.8
Phy-21-56	RH761	33.0	24.5	25.8	47.5	42.9	9.7
Phy-21-57	DRMRHT13-22-2	41.6	37.1	10.7	49.1	46.4	5.5
Phy-21-58	NPJ-225	42.4	37.4	11.6	50.8	38.7	23.8
Phy-21-59	RGH-510	39.1	33.0	15.5	48.6	43.7	10.2
Phy-21-60	DRMRHJ1117	36.8	31.3	15.1	44.7	43.2	3.4
Phy-21-61	NPJ-210	35.1	27.5	21.7	46.8	45.4	3.0
Phy-21-62	RH1930	43.1	36.4	15.5	46.3	45.7	1.3
Phy-21-63	PBR 552	42.8	29.9	30.1	49.1	40.7	17.1
Phy-21-64	DRMRCI-146	39.7	36.0	9.3	43.9	40.9	6.8
Phy-21-65	RH(OE)1807	38.9	34.0	12.5	44.5	44.1	0.9
Phy-21-66	Kranti(NC)	42.9	33.6	21.8	39.6	39.2	1.0
Phy-21-67	DRMRCI-148	46.7	44.7	4.3	43.2	37.3	13.7
Phy-21-68	RH725	47.4	37.0	21.9	46.4	39.6	14.7
Phy-21-69	DM-1521	42.0	37.8	10.0	41.4	40.5	2.3
Phy-21-70	DRMRCI 128	36.1	32.1	11.3	46.7	44.1	5.7
Phy-21-71	RB-110	41.4	36.9	10.7	43.0	42.9	0.2
Phy-21-72	PDG 15	40.5	34.7	14.3	39.9	39.0	2.3
Phy-21-73	DRMR 2019-7	34.6	29.4	15.0	46.1	41.1	10.8
Phy-21-74	LES 60	39.0	29.1	25.3	51.1	44.3	13.3
	Mean	39.6	33.3		44.9	41.0	
CD (p=0.05)		I=5.297			I=0.390		
		G=1.285			G=4.24		
		IxG=NS			IxG=5.99		

IR=Irrigated; RF=Rainfed

Table 6.3.2 : Effect of moisture stress on relative water content (RWC) at 3 locations

Code	Entries	RWC (%)								
		Bharatpur			Hisar			Ludhiana		
		IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)
Phy-21-41	RH1424	93.2	90.6	2.8	74.6	51.0	32.0	76.5	75.2	1.7
Phy-21-42	NPJ-254	93.8	91.6	2.4	66.3	51.7	22.0	78.2	76.7	1.9
Phy-21-43	RGN-519	93.4	92.2	1.3	76.4	62.7	17.9	78.6	68.1	13.4
Phy-21-44	DRMR1176	94.0	89.4	4.9	60.0	55.7	7.3	87.7	71.0	19.0
Phy-21-45	RH1928	93.9	90.3	3.8	70.9	50.9	28.3	79.7	75.1	5.8
Phy-21-46	PBR357	95.0	92.6	2.6	67.9	51.5	24.2	87.2	71.1	18.5
Phy-21-47	DRMRSJ 276	94.5	91.6	3.1	76.0	61.2	19.6	85.1	71.2	16.3
Phy-21-48	NPJ214	96.4	94.1	2.4	75.0	62.8	16.2	82.6	81.2	1.8
Phy-21-49	DRMR1222	92.9	91.8	1.1	71.4	51.2	28.3	78.2	73.8	5.6
Phy-21-50	JC36	94.2	92.9	1.4	73.3	54.9	25.1	87.6	76.5	12.7
Phy-21-51	DRMRCI-144	93.5	71.1	23.9	74.6	50.9	31.8	86.1	80.3	6.7
Phy-21-52	BAUM-21-2	94.2	93.0	1.3	73.5	53.8	26.8	75.9	72.3	4.7
Phy-21-53	RGN229	94.5	91.7	3.0	71.3	56.1	21.3	79.2	76.8	3.1
Phy-21-54	DRMR1188	96.0	93.4	2.8	80.7	62.4	22.6	75.2	71.5	4.9
Phy-21-55	CAU-RMM3	94.4	93.3	1.1	72.4	63.9	11.8	85.4	72.5	15.1
Phy-21-56	RH761	95.6	86.7	9.3	73.6	54.1	26.5	82.4	74.5	9.6
Phy-21-57	DRMRHT13-22-2	92.7	89.8	3.0	60.0	51.4	14.2	81.8	81.1	0.9
Phy-21-58	NPJ-225	96.4	93.4	3.2	76.1	64.5	15.2	84.5	79.8	5.5
Phy-21-59	RGN-510	95.6	94.1	1.6	69.2	55.5	19.9	88.6	79.1	10.7
Phy-21-60	DRMRHJ1117	94.9	93.8	1.1	78.2	63.1	19.3	84.0	81.6	2.9
Phy-21-61	NPJ-210	92.1	85.0	7.8	70.5	54.5	22.7	79.3	78.3	1.3
Phy-21-62	RH1930	92.9	87.1	6.3	70.3	55.7	20.8	86.1	76.3	11.4
Phy-21-63	PBR 552	94.8	89.5	5.6	77.2	55.7	27.8	84.0	67.7	19.4
Phy-21-64	DRMRCI-146	94.9	90.6	4.5	68.1	61.1	10.2	87.6	85.5	2.4
Phy-21-65	RH(OE)1807	95.0	90.4	4.8	70.6	59.7	15.4	88.9	83.8	5.7
Phy-21-66	Kranti(NC)	94.3	92.3	2.1	74.4	57.4	22.8	84.0	72.2	14.1
Phy-21-67	DRMRCI-148	96.4	93.0	3.4	70.8	65.8	7.1	85.6	74.0	13.5
Phy-21-68	RH725	96.3	95.2	1.1	72.3	55.1	23.8	85.5	77.3	9.5
Phy-21-69	DM-1521	94.2	90.7	3.8	62.7	57.0	9.1	91.4	76.2	16.7
Phy-21-70	DRMRCI 128	94.5	88.0	6.8	63.8	54.7	14.3	76.0	75.2	1.1
Phy-21-71	RB-110	93.2	88.4	5.2	64.1	55.6	13.3	79.2	74.7	5.6
Phy-21-72	PDG 15	93.9	90.8	3.3	74.1	61.4	17.1	85.3	83.1	2.6
Phy-21-73	DRMR 2019-7	92.6	89.6	3.2	69.6	56.8	18.4	82.9	74.3	10.4
Phy-21-74	LES 60	93.1	91.1	2.2	74.7	56.6	24.2	76.8	71.8	6.5
	Mean	94.3	90.56		71.3	57.0		82.8	75.9	
CD (p=0.05)		I=0.934			I=7.632			I=0.987		
		G=3.852			G=1.851			G=4.13		
		IxG=5.45			IxG=NS			IxG=5.84		

IR=Irrigated; RF=Rainfed

Table 6.3.3 : Effect of moisture stress on canopy temperature at 3 locations

Code	Entries	Canopy temperature (°C)					
		Bharatpur		Hisar		Ludhiana	
		IR	RF	IR	RF	IR	RF
Phy-21-41	RH1424	18.7	22.0	27.9	31.7	20.8	23.2
Phy-21-42	NPJ-254	20.7	20.3	27.4	29.2	20.3	20.9
Phy-21-43	RGH-519	19.6	19.9	28.3	28.8	17.8	21.6
Phy-21-44	DRMR1176	18.8	20.8	29.7	29.6	18.2	21.6
Phy-21-45	RH1928	18.0	21.9	27.7	30.4	21.0	26.6
Phy-21-46	PBR357	18.9	20.6	28.1	30.7	19.9	21.8
Phy-21-47	DRMRSJ 276	18.4	21.0	27.1	28.3	18.8	19.5
Phy-21-48	NPJ214	18.8	22.6	28.3	28.5	19.6	20.0
Phy-21-49	DRMR1222	19.4	21.2	27.2	30.0	19.1	20.9
Phy-21-50	JC36	19.4	20.3	27.7	30.3	19.5	18.5
Phy-21-51	DRMRCI-144	17.8	22.6	29.1	32.9	18.4	19.4
Phy-21-52	BAUM-21-2	19.4	21.5	29.2	32.0	19.8	20.1
Phy-21-53	RGH229	18.6	20.5	28.2	30.0	18.4	19.0
Phy-21-54	DRMR1188	17.6	20.7	28.4	30.3	18.8	19.5
Phy-21-55	CAU-RMM3	19.9	20.7	30.3	30.0	20.0	21.5
Phy-21-56	RH761	21.3	20.9	28.4	31.2	19.5	20.1
Phy-21-57	DRMRHT13-22-2	18.2	21.6	29.2	29.1	19.6	23.7
Phy-21-58	NPJ-225	18.7	22.8	28.6	28.6	18.7	21.3
Phy-21-59	RGH-510	18.8	20.7	28.5	29.9	18.7	19.7
Phy-21-60	DRMRHJ1117	19.3	19.6	27.8	29.0	18.8	22.3
Phy-21-61	NPJ-210	21.3	21.6	27.8	29.8	20.7	21.1
Phy-21-62	RH1930	19.8	21.4	27.9	29.4	19.6	20.3
Phy-21-63	PBR 552	19.7	22.0	26.8	29.5	18.1	23.7
Phy-21-64	DRMRCI-146	19.9	21.5	29.2	29.0	18.0	20.6
Phy-21-65	RH(OE)1807	19.2	23.1	28.9	29.0	18.2	19.3
Phy-21-66	Kranti(NC)	19.3	24.0	27.7	29.7	18.6	23.9
Phy-21-67	DRMRCI-148	19.0	22.9	29.1	28.8	20.5	24.1
Phy-21-68	RH725	17.7	20.3	27.5	29.6	18.7	22.2
Phy-21-69	DM-1521	18.3	23.9	30.6	30.5	18.2	22.8
Phy-21-70	DRMRCI 128	18.2	20.4	29.8	29.8	18.7	22.4
Phy-21-71	RB-110	18.7	20.6	30.4	29.7	18.6	21.5
Phy-21-72	PDG 15	19.3	21.6	29.5	30.0	17.3	20.7
Phy-21-73	DRMR 2019-7	19.1	20.4	29.1	29.7	18.6	22.8
Phy-21-74	LES 60	18.1	20.3	32.9	33.4	19.4	21.5
	Mean	19.0	21.3	28.4	31.7	19.1	21.4
CD (p=0.05)		I=0.451		I=0.815		I=0.432	
		G=NS		G=0.198		G=1.89	
		IxG=NS		IxG=1.153		IxG=2.67	

IR=Irrigated; RF=Rainfed

Table 6.3.4 : Effect of moisture stress on photosynthetic pigments (mg/g FW) at Bharatpur

Code	Entries	Photosynthetic pigments (mg/g FW)											
		Chl a			Chl b			Total Chl			Carotenoids		
		IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)
Phy-21-41	RH1424	1.40	1.10	21.6	0.278	0.227	18.4	1.68	1.32	21.0	0.360	0.265	26.3
Phy-21-42	NPJ-254	1.21	0.94	22.6	0.292	0.194	33.7	1.50	1.13	24.8	0.493	0.358	27.4
Phy-21-43	RGN-519	1.33	1.14	14.7	0.326	0.196	39.8	1.66	1.33	19.7	0.361	0.291	19.3
Phy-21-44	DRMR1176	1.48	1.10	25.9	0.387	0.332	14.2	1.87	1.43	23.5	0.404	0.361	10.6
Phy-21-45	RH1928	1.79	1.13	36.7	0.384	0.250	34.8	2.17	1.38	36.3	0.531	0.307	42.2
Phy-21-46	PBR357	1.30	0.93	28.2	0.359	0.172	52.1	1.66	1.10	33.4	0.546	0.319	41.6
Phy-21-47	DRMRSJ 276	1.19	1.00	15.5	0.308	0.233	24.4	1.49	1.23	17.3	0.297	0.266	10.4
Phy-21-48	NPJ214	1.70	1.19	29.9	0.330	0.173	47.7	2.03	1.45	28.3	0.551	0.324	41.2
Phy-21-49	DRMR1222	1.27	0.99	22.5	0.383	0.326	14.9	1.65	1.25	24.6	0.330	0.279	15.4
Phy-21-50	JC36	1.26	1.03	18.1	0.229	0.198	13.7	1.49	1.22	17.8	0.348	0.255	26.7
Phy-21-51	DRMRCl-144	1.24	1.01	19.1	0.346	0.203	41.2	1.59	1.21	23.5	0.380	0.317	16.4
Phy-21-52	BAUM-21-2	1.13	1.05	7.0	0.497	0.191	61.5	1.63	1.22	25.1	0.593	0.364	38.6
Phy-21-53	RGN229	1.50	1.01	32.8	0.321	0.167	48.0	1.82	1.28	30.1	0.332	0.250	24.5
Phy-21-54	DRMR1188	1.25	0.91	27.2	0.429	0.364	15.2	1.68	1.27	24.1	0.348	0.276	20.7
Phy-21-55	CAU-RMM3	0.99	0.87	12.0	0.348	0.185	47.0	1.34	1.06	21.1	0.355	0.258	27.5
Phy-21-56	RH761	1.45	0.96	33.4	0.349	0.244	30.1	1.80	1.21	32.8	0.335	0.264	21.1
Phy-21-57	DRMRHT13-22-2	1.40	0.87	37.9	0.289	0.208	28.0	1.69	1.08	36.2	0.275	0.238	13.3
Phy-21-58	NPJ-225	1.35	1.10	18.2	0.308	0.229	25.6	1.66	1.33	19.5	0.298	0.225	24.5
Phy-21-59	RGN-510	1.38	0.89	35.6	0.300	0.200	33.2	1.68	1.09	35.2	0.348	0.253	27.4
Phy-21-60	DRMRHJ1117	1.56	1.00	35.9	0.361	0.204	43.5	1.92	1.21	37.3	0.348	0.269	22.7
Phy-21-61	NPJ-210	1.37	0.90	34.0	0.321	0.277	13.9	1.69	1.18	30.2	0.407	0.320	21.4
Phy-21-62	RH1930	1.53	1.06	30.7	0.280	0.218	22.3	1.81	1.28	29.4	0.380	0.282	25.6
Phy-21-63	PBR 552	1.63	1.17	28.0	0.388	0.262	32.4	2.02	1.44	28.8	0.439	0.262	40.3
Phy-21-64	DRMRCl-146	1.61	0.95	40.8	0.344	0.245	28.8	1.95	1.20	38.7	0.380	0.268	29.3
Phy-21-65	RH(OE)1807	1.56	1.10	29.3	0.290	0.192	33.7	1.85	1.29	30.0	0.377	0.268	28.8
Phy-21-66	Kranti(NC)	1.49	1.16	22.3	0.383	0.264	31.0	1.87	1.42	24.1	0.374	0.293	21.5
Phy-21-67	DRMRCl-148	1.55	1.11	28.8	0.346	0.201	41.9	1.90	1.31	31.2	0.393	0.270	31.2
Phy-21-68	RH725	1.26	0.90	28.5	0.230	0.185	19.9	1.49	1.09	27.2	0.286	0.259	9.6
Phy-21-69	DM-1521	1.92	1.10	42.6	0.318	0.215	32.4	2.23	1.31	41.2	0.459	0.331	28.0
Phy-21-70	DRMRCl 128	1.48	0.93	37.6	0.347	0.232	33.1	1.83	1.16	36.8	0.358	0.266	25.5
Phy-21-71	RB-110	1.54	0.98	36.5	0.570	0.309	45.8	2.11	1.29	39.0	0.573	0.349	39.0
Phy-21-72	PDG 15	1.22	0.84	31.1	0.260	0.210	19.3	1.49	1.05	29.0	0.367	0.271	26.1
Phy-21-73	DRMR 2019-7	1.42	1.24	13.0	0.309	0.258	16.5	1.73	1.50	13.6	0.344	0.289	15.9
Phy-21-74	LES 60	1.59	1.01	36.2	0.347	0.262	24.4	1.93	1.27	34.1	0.392	0.286	27.1
	Mean	1.42	1.02		0.340	0.230		1.76	1.25		0.393	0.287	
CD (p=0.05)		I=0.048			I=0.018			I=0.052			I=0.001		
		G= 0.2			G=0.074			G=0.216			G=0.003		
		IxG=NS			IxG=NS			IxG=NS			IxG=0.004		

IR=Irrigated; RF=Rainfed

Table 6.3.5: Effect of moisture stress on photosynthetic pigments (mg/g FW) at Ludhiana

Code	Entries	Photosynthetic pigments (mg/g FW)											
		Chl a			Chl b			Total Chl			Carotenoids		
		IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)
Phy-21-41	RH1424	1.71	1.60	6.4	0.391	0.354	9.4	2.10	1.95	7.1	0.539	0.493	8.5
Phy-21-42	NPJ-254	1.45	1.35	6.9	0.332	0.330	0.5	1.78	1.68	5.6	0.449	0.441	1.8
Phy-21-43	RGH-519	1.43	1.25	12.5	0.361	0.301	16.4	1.79	1.56	13.3	0.450	0.333	26.0
Phy-21-44	DRMR1176	1.90	1.56	18.0	0.467	0.342	26.8	2.37	1.90	19.7	0.573	0.496	13.3
Phy-21-45	RH1928	2.06	1.61	22.1	0.391	0.365	6.6	2.43	2.00	17.7	0.528	0.468	11.4
Phy-21-46	PBR357	1.36	1.21	11.0	0.346	0.289	16.6	1.71	1.49	12.4	0.413	0.396	4.1
Phy-21-47	DRMRSJ 276	1.55	1.23	20.6	0.376	0.304	19.1	1.93	1.53	20.5	0.436	0.379	13.1
Phy-21-48	NPJ214	1.75	1.34	23.7	0.459	0.276	39.9	2.21	1.61	27.1	0.567	0.396	30.3
Phy-21-49	DRMR1222	1.83	1.47	19.7	0.395	0.360	8.9	2.23	1.83	17.8	0.575	0.500	13.0
Phy-21-50	JC36	1.45	1.36	6.2	0.378	0.331	12.6	1.78	1.74	2.3	0.488	0.443	9.2
Phy-21-51	DRMRCI-144	1.31	1.24	5.3	0.329	0.298	9.2	1.61	1.57	2.9	0.406	0.382	5.9
Phy-21-52	BAUM-21-2	1.08	1.03	5.0	0.330	0.232	29.8	1.41	1.26	10.8	0.334	0.320	4.1
Phy-21-53	RGH229	2.00	1.06	47.0	0.459	0.285	37.9	2.46	1.36	44.6	0.637	0.340	46.6
Phy-21-54	DRMR1188	1.76	1.34	23.9	0.404	0.382	5.3	2.15	1.75	18.6	0.531	0.422	20.6
Phy-21-55	CAU-RMM3	1.52	1.21	20.4	0.377	0.340	9.8	1.90	1.55	18.5	0.468	0.371	20.7
Phy-21-56	RH761	2.05	1.42	30.7	0.369	0.224	39.4	2.17	1.79	17.6	0.455	0.410	10.0
Phy-21-57	DRMRHT13-22-2	1.87	1.40	25.4	0.341	0.247	27.5	2.12	1.74	18.0	0.472	0.451	4.3
Phy-21-58	NPJ-225	1.94	1.43	26.1	0.410	0.254	38.1	2.10	1.85	12.0	0.447	0.423	5.4
Phy-21-59	RGH-510	2.21	1.32	40.3	0.160	0.112	30.0	2.27	1.44	36.7	0.454	0.304	33.0
Phy-21-60	DRMRHJ1117	2.26	1.89	16.5	0.355	0.199	43.9	2.44	1.44	41.1	0.492	0.371	24.6
Phy-21-61	NPJ-210	2.01	1.51	24.6	0.364	0.275	24.5	2.18	1.88	14.0	0.559	0.463	17.3
Phy-21-62	RH1930	1.95	1.35	30.8	0.270	0.220	18.5	2.22	1.57	29.3	0.477	0.414	13.2
Phy-21-63	PBR 552	2.16	1.57	27.2	0.373	0.255	31.4	2.21	1.55	29.9	0.488	0.428	12.3
Phy-21-64	DRMRCI-146	2.01	1.01	49.7	0.342	0.259	24.3	2.06	1.31	36.4	0.503	0.387	22.9
Phy-21-65	RH(OE)1807	2.66	1.45	45.4	0.162	0.145	10.5	2.72	1.59	41.5	0.532	0.389	26.8
Phy-21-66	Kranti(NC)	1.93	1.34	30.4	0.430	0.298	30.7	2.36	1.44	39.0	0.586	0.319	45.5
Phy-21-67	DRMRCI-148	1.68	1.27	24.0	0.226	0.127	43.8	1.88	1.38	26.7	0.388	0.296	23.7
Phy-21-68	RH725	1.72	1.31	23.7	0.239	0.182	24.0	1.96	1.40	28.9	0.403	0.345	14.5
Phy-21-69	DM-1521	2.08	1.26	39.4	0.184	0.164	10.9	2.26	1.42	37.1	0.464	0.403	13.2
Phy-21-70	DRMRCI 128	1.85	1.32	28.3	0.235	0.222	5.5	2.08	1.55	25.7	0.432	0.396	8.3
Phy-21-71	RB-110	1.59	1.27	19.7	0.332	0.281	15.2	1.92	1.55	19.0	0.472	0.403	14.6
Phy-21-72	PDG 15	1.32	1.17	11.7	0.261	0.165	36.7	1.47	1.43	3.0	0.362	0.361	0.3
Phy-21-73	DRMR 2019-7	1.55	1.36	12.4	0.310	0.292	5.8	1.84	1.67	9.5	0.490	0.403	17.7
Phy-21-74	LES 60	1.79	1.66	7.2	0.354	0.339	4.2	2.13	2.02	5.4	0.537	0.512	4.7
	Mean	1.79	1.36		0.339	0.266		2.07	1.61		0.483	0.402	
CD (p=0.05)		I=0.039			I=0.015			I=0.046			I=0.0124		
		G=0.163			G=0.064			G=0.193			G=0.0521		
		IxG=0.231			IxG=0.091			IxG=0.273			IxG=0.0737		

IR=Irrigated; RF=Rainfed

Table 6.3.6 : Effect of moisture stress on siliquae on main shoot (SMS) at 3 locations

Code	Entries	Siliquae on main shoot								
		Bharatpur			Hisar			Ludhiana		
		IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)
Phy-21-41	RH1424	52.7	47.3	10.1	50.3	44.1	12.2	34.3	32.1	6.4
Phy-21-42	NPJ-254	45.3	40.7	10.3	60.0	56.4	5.4	43.8	38.1	13.1
Phy-21-43	RGN-519	43.0	42.8	0.5	56.7	54.5	3.9	38.9	38.1	2.1
Phy-21-44	DRMR1176	42.4	41.1	3.1	53.0	52.1	1.3	35.3	33.5	5.3
Phy-21-45	RH1928	52.3	45.9	12.3	57.0	47.7	16.6	39.0	37.7	3.2
Phy-21-46	PBR357	49.0	45.3	7.5	58.7	52.1	11.4	37.4	34.8	7.0
Phy-21-47	DRMRSJ 276	49.6	47.2	4.7	51.0	49.5	3.5	36.2	36.1	0.4
Phy-21-48	NPJ214	47.0	40.3	14.2	51.0	48.4	4.7	34.7	34.3	1.3
Phy-21-49	DRMR1222	46.3	39.0	15.8	55.0	47.0	14.5	38.3	36.7	4.2
Phy-21-50	JC36	50.3	46.8	7.1	52.3	50.7	3.8	39.3	39.2	0.3
Phy-21-51	DRMRCI-144	49.4	42.3	14.4	52.7	45.1	14.3	32.8	32.6	0.6
Phy-21-52	BAUM-21-2	47.0	42.4	9.7	53.7	52.8	2.3	38.0	37.7	0.9
Phy-21-53	RGN229	44.3	43.1	2.8	54.0	52.3	3.5	43.9	37.5	14.6
Phy-21-54	DRMR1188	45.3	40.9	9.8	51.0	46.4	8.8	33.8	32.1	5.0
Phy-21-55	CAU-RMM3	45.6	40.9	10.2	47.0	45.8	2.0	32.4	28.8	11.1
Phy-21-56	RH761	48.4	45.4	6.2	57.7	51.2	11.8	44.8	37.9	15.5
Phy-21-57	DRMRHT13-22-2	44.6	41.8	6.2	51.7	49.3	4.5	32.9	32.1	2.4
Phy-21-58	NPJ-225	47.3	43.9	7.3	51.3	49.0	4.6	34.2	32.3	5.7
Phy-21-59	RGN-510	44.3	41.3	6.8	52.0	51.5	1.2	42.8	37.9	11.5
Phy-21-60	DRMRHJ1117	49.0	46.0	6.1	53.7	51.3	4.6	36.2	34.9	3.7
Phy-21-61	NPJ-210	45.9	39.0	15.0	47.3	44.8	5.4	37.3	32.5	12.9
Phy-21-62	RH1930	45.8	42.8	6.6	55.0	48.1	12.4	36.1	35.1	2.8
Phy-21-63	PBR 552	49.4	45.1	8.8	51.7	45.2	12.0	41.6	39.3	5.6
Phy-21-64	DRMRCI-146	47.1	44.6	5.4	49.3	45.9	6.4	38.7	33.3	13.9
Phy-21-65	RH(OE)1807	53.7	46.9	12.6	53.7	51.3	4.5	40.3	32.9	18.5
Phy-21-66	Kranti(NC)	44.3	40.9	7.8	50.7	47.7	6.3	38.5	36.1	6.2
Phy-21-67	DRMRCI-148	38.6	34.8	9.8	47.0	46.0	2.0	34.9	33.0	5.4
Phy-21-68	RH725	44.6	43.3	2.7	53.7	49.9	7.8	41.7	32.7	21.7
Phy-21-69	DM-1521	40.3	37.9	6.1	50.7	49.1	3.0	39.7	36.2	8.8
Phy-21-70	DRMRCI 128	46.3	44.7	3.6	56.3	50.9	10.0	36.3	32.3	11.0
Phy-21-71	RB-110	46.3	41.1	11.3	57.0	56.3	1.6	41.1	40.1	2.4
Phy-21-72	PDG 15	50.8	49.0	3.5	50.0	48.1	4.6	41.1	36.9	10.1
Phy-21-73	DRMR 2019-7	47.9	45.4	5.2	43.3	41.3	4.9	31.8	31.2	1.9
Phy-21-74	LES 60	45.2	41.1	9.1	45.0	42.6	5.3	51.1	37.2	27.1
	Mean	46.8	42.6		52.4	49.0		38.2	35.1	
CD (p=0.05)		I=1.45			I=1.505			I=0.583		
		G=5.978			G=6.206			G=2.44		
		IxG=NS			IxG=NS			IxG=3.45		

IR=Irrigated; RF=Rainfed

Table 6.3.7 : Effect of moisture stress on seeds per siliqua at 3 locations in Indian mustard

Code	Entries	Seeds/siliqua								
		Bharatpur			Hisar			Ludhiana		
		IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)
Phy-21-41	RH1424	15.3	13.7	10.9	15.2	12.7	16.9	14.4	11.5	20.1
Phy-21-42	NPJ-254	14.3	13.9	3.3	14.5	13.9	4.2	14.4	12.5	13.4
Phy-21-43	RGN-519	14.3	13.3	7.4	14.1	13.3	5.4	13.9	12.7	8.6
Phy-21-44	DRMR1176	13.0	12.8	1.5	12.9	12.8	0.8	12.5	12.4	1.2
Phy-21-45	RH1928	15.0	13.5	9.8	13.2	11.4	13.5	13.6	10.8	20.6
Phy-21-46	PBR357	13.7	13.0	5.3	13.4	12.2	9.1	13.2	11.3	14.0
Phy-21-47	DRMRSJ 276	13.9	13.6	2.1	12.4	12.2	1.8	11.7	10.0	14.8
Phy-21-48	NPJ214	13.5	13.2	2.0	12.0	11.7	2.0	12.2	11.7	4.0
Phy-21-49	DRMR1222	14.7	14.3	2.7	13.4	11.8	12.0	13.9	11.2	19.9
Phy-21-50	JC36	14.6	14.1	3.2	14.1	13.4	5.0	13.5	12.6	6.7
Phy-21-51	DRMRCI-144	15.9	13.7	13.8	13.5	11.7	13.5	13.9	12.6	9.4
Phy-21-52	BAUM-21-2	14.1	13.7	2.8	13.3	13.1	2.1	12.4	12.0	3.2
Phy-21-53	RGN229	14.5	12.9	11.0	12.2	11.3	7.3	12.5	12.4	1.2
Phy-21-54	DRMR1188	14.5	13.5	6.9	12.8	12.6	1.5	13.5	12.0	11.1
Phy-21-55	CAU-RMM3	14.9	12.8	14.3	13.7	13.6	0.6	14.9	11.4	23.8
Phy-21-56	RH761	14.1	12.4	11.8	13.8	13.6	2.0	13.7	10.8	20.9
Phy-21-57	DRMRHT13-22-2	16.2	14.4	11.1	13.4	12.2	8.7	12.7	9.9	21.7
Phy-21-58	NPJ-225	12.9	12.3	4.7	11.7	11.2	4.0	9.8	9.7	0.7
Phy-21-59	RGN-510	14.6	14.3	2.3	13.0	12.3	5.7	12.7	10.9	14.2
Phy-21-60	DRMRHJ1117	13.7	13.3	3.4	13.4	12.9	3.5	12.6	11.2	11.1
Phy-21-61	NPJ-210	15.9	15.0	5.9	13.6	13.2	2.8	15.1	12.2	19.3
Phy-21-62	RH1930	14.9	12.6	15.2	13.3	12.3	7.4	12.5	11.1	11.2
Phy-21-63	PBR 552	15.1	13.5	10.6	13.5	11.6	13.5	14.5	13.0	10.5
Phy-21-64	DRMRCI-146	15.6	14.8	5.1	12.6	12.5	0.8	12.9	11.6	10.1
Phy-21-65	RH(OE)1807	15.5	14.7	5.6	13.3	12.6	5.1	12.4	11.6	6.4
Phy-21-66	Kranti(NC)	15.7	15.0	4.7	13.6	13.3	2.3	12.5	11.7	6.4
Phy-21-67	DRMRCI-148	14.9	13.5	9.0	13.9	13.8	0.6	14.4	13.2	8.7
Phy-21-68	RH725	16.3	13.9	14.8	12.9	12.5	3.1	13.0	12.7	2.1
Phy-21-69	DM-1521	15.7	15.0	4.3	13.1	13.0	0.5	14.7	13.2	10.2
Phy-21-70	DRMRCI 128	14.8	14.0	5.4	12.8	12.2	4.8	15.0	11.8	21.4
Phy-21-71	RB-110	14.3	13.0	8.9	13.0	12.7	1.7	11.7	10.9	7.3
Phy-21-72	PDG 15	13.6	13.2	2.9	13.4	13.3	1.2	13.8	11.6	16.1
Phy-21-73	DRMR 2019-7	15.2	14.3	5.7	14.0	13.5	3.4	15.8	14.4	9.0
Phy-21-74	LES 60	14.5	12.1	17.0	12.5	11.7	6.7	12.7	12.5	1.5
	Mean	14.7	13.6		13.3	12.6		13.3	11.8	
CD (p=0.05)		I=0.297			I=0.231			I=0.125		
		G=1.225			G=0.952			G=1.19		
		IxG=NS			IxG=NS			IxG=1.68		

IR=Irrigated; RF=Rainfed

Table 6.3.8: Effect of moisture stress on Test weight at 3 locations in Indian mustard

Code	Entries	Test weight (g)							
		Bharatpur		Hisar			Ludhiana		
		IR	RF	IR	RF	Red (%)	IR	RF	Red (%)
Phy-21-41	RH1424	5.1	6.8	3.4	3.3	1.1	6.1	6.0	1.3
Phy-21-42	NPJ-254	5.4	5.7	2.8	2.5	7.8	5.8	4.9	15.5
Phy-21-43	RGN-519	5.9	6.0	3.2	2.9	10.3	4.9	4.4	10.2
Phy-21-44	DRMR1176	5.7	5.9	3.7	3.7	1.0	5.8	5.7	1.7
Phy-21-45	RH1928	5.2	5.8	2.6	2.3	14.5	6.0	4.4	27.5
Phy-21-46	PBR357	6.0	6.3	4.0	3.3	17.3	5.7	5.5	3.5
Phy-21-47	DRMRSJ 276	6.6	6.7	4.1	3.4	17.1	8.3	7.7	7.2
Phy-21-48	NPJ214	5.8	5.9	3.4	3.3	2.8	6.5	4.3	34.2
Phy-21-49	DRMR1222	3.9	5.0	3.1	3.0	2.2	5.0	4.7	7.3
Phy-21-50	JC36	3.1	4.5	3.1	2.3	25.2	4.8	3.6	25.0
Phy-21-51	DRMRCI-144	5.3	5.4	2.6	2.3	9.7	5.7	5.6	1.8
Phy-21-52	BAUM-21-2	4.3	4.7	3.6	2.7	24.7	4.9	4.2	13.7
Phy-21-53	RGN229	4.5	5.0	2.6	2.5	6.4	4.9	4.9	1.1
Phy-21-54	DRMR1188	4.5	5.7	3.0	2.9	2.0	4.5	4.4	2.2
Phy-21-55	CAU-RMM3	3.7	4.4	2.6	2.5	5.0	4.6	3.8	18.9
Phy-21-56	RH761	5.4	6.0	3.2	3.2	1.1	5.9	5.1	13.8
Phy-21-57	DRMRHT13-22-2	5.2	5.6	3.7	3.1	17.7	6.3	5.3	15.9
Phy-21-58	NPJ-225	6.9	8.0	3.1	3.0	1.7	7.4	6.1	17.6
Phy-21-59	RGN-510	5.0	5.7	4.3	3.7	13.3	6.4	5.1	20.4
Phy-21-60	DRMRHJ1117	4.5	5.6	2.5	2.4	3.9	5.4	4.2	21.0
Phy-21-61	NPJ-210	4.3	5.0	2.9	2.9	2.7	5.6	4.2	25.0
Phy-21-62	RH1930	6.3	7.0	2.6	2.6	2.7	6.9	6.7	2.9
Phy-21-63	PBR 552	4.2	4.8	4.1	3.4	17.2	4.4	4.3	2.3
Phy-21-64	DRMRCI-146	5.5	5.6	3.0	3.0	1.0	5.7	5.4	5.2
Phy-21-65	RH(OE)1807	3.9	5.1	2.7	2.6	3.4	4.7	3.7	19.8
Phy-21-66	Kranti(NC)	4.1	4.6	2.7	2.5	5.6	4.4	4.0	8.7
Phy-21-67	DRMRCI-148	4.9	5.6	3.3	3.2	3.1	5.2	4.6	12.1
Phy-21-68	RH725	5.8	6.0	3.2	2.9	10.2	5.9	5.7	3.4
Phy-21-69	DM-1521	7.3	7.7	3.9	3.6	7.0	7.4	7.2	2.6
Phy-21-70	DRMRCI 128	5.0	5.0	2.8	2.4	12.6	5.7	4.2	26.3
Phy-21-71	RB-110	5.5	6.2	3.4	3.3	2.2	7.0	6.6	5.7
Phy-21-72	PDG 15	5.0	5.0	2.3	2.1	7.4	6.0	4.9	18.3
Phy-21-73	DRMR 2019-7	3.6	6.1	3.6	3.4	7.2	6.7	4.1	38.1
Phy-21-74	LES 60	4.8	5.4	3.5	3.1	11.1	5.3	5.1	3.8
	Mean	5.1	5.7	3.2	2.9		5.8	5.0	
CD (p=0.05)		I=0.235		I=0.342			I=0.102		
		G=0.971		G=0.083			G=0.403		
		IxG=NS		IxG=NS			IxG=0.570		

IR=Irrigated; RF=Rainfed

Table 6.3.9 : Effect of moisture stress on biological yield at 3 locations in Indian mustard

Code	Entries	Biological yield								
		Bharatpur (kg/ha)			Hisar (g/plant)			Ludhiana (kg/ha)		
		IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)
Phy-21-41	RH1424	13259	6163	53.5	0.583	0.422	27.7	6667	5422	18.7
Phy-21-42	NPJ-254	11630	6770	41.8	0.658	0.469	28.8	7111	6844	3.7
Phy-21-43	RGN-519	15407	5556	63.9	0.517	0.426	17.6	6844	6311	7.8
Phy-21-44	DRMR1176	13259	8163	38.4	0.403	0.335	16.8	7422	5511	25.7
Phy-21-45	RH1928	13185	8148	38.2	0.667	0.372	44.3	6889	6756	1.9
Phy-21-46	PBR357	12370	4963	59.9	0.491	0.468	4.7	8978	8178	8.9
Phy-21-47	DRMRSJ 276	15259	9970	34.3	0.419	0.377	10.1	7400	5867	20.7
Phy-21-48	NPJ214	16000	8963	44.0	0.658	0.499	24.2	6089	5778	5.1
Phy-21-49	DRMR1222	10296	7259	29.5	0.675	0.471	30.3	7244	6844	5.5
Phy-21-50	JC36	8963	6978	22.1	0.63	0.405	35.7	6311	5111	19.0
Phy-21-51	DRMRCI-144	12815	5578	56.5	0.752	0.437	41.9	6622	6542	1.2
Phy-21-52	BAUM-21-2	11259	6237	44.6	0.755	0.405	46.4	6444	5333	17.2
Phy-21-53	RGN229	12222	9237	24.4	0.752	0.49	34.8	9511	8178	14.0
Phy-21-54	DRMR1188	13481	6859	49.1	0.655	0.419	36	7822	6622	15.3
Phy-21-55	CAU-RMM3	10519	4652	55.8	0.43	0.333	22.5	5378	4356	19.0
Phy-21-56	RH761	14963	6504	56.5	0.608	0.359	40.9	6578	5244	20.3
Phy-21-57	DRMRHT13-22-2	13481	4563	66.2	0.401	0.387	3.5	6222	6044	2.9
Phy-21-58	NPJ-225	14074	5481	61.1	0.487	0.463	4.8	6667	4578	31.3
Phy-21-59	RGN-510	9630	6607	31.4	0.46	0.398	13.5	8800	6400	27.3
Phy-21-60	DRMRHJ1117	15259	5644	63.0	0.407	0.394	3.2	7644	6667	12.8
Phy-21-61	NPJ-210	12444	9541	23.3	0.515	0.446	13.4	4889	3822	21.8
Phy-21-62	RH1930	11185	8222	26.5	0.56	0.388	30.7	6933	6489	6.4
Phy-21-63	PBR 552	14667	7630	48.0	0.433	0.342	21.2	8978	6400	28.7
Phy-21-64	DRMRCI-146	14148	6141	56.6	0.478	0.403	15.7	6756	6667	1.3
Phy-21-65	RH(OE)1807	12222	5481	55.2	0.403	0.4	0.8	6400	4978	22.2
Phy-21-66	Kranti(NC)	13778	6296	54.3	0.496	0.451	9.1	6178	5956	3.6
Phy-21-67	DRMRCI-148	13333	4563	65.8	0.542	0.452	16.5	6844	6178	9.7
Phy-21-68	RH725	10815	8519	21.2	0.468	0.366	21.8	6000	5422	9.6
Phy-21-69	DM-1521	11852	8281	30.1	0.528	0.455	13.8	6933	6222	10.3
Phy-21-70	DRMRCI 128	15556	6948	55.3	0.428	0.412	3.9	7644	7556	1.2
Phy-21-71	RB-110	16963	4207	75.2	0.493	0.456	7.5	8000	4889	38.9
Phy-21-72	PDG 15	14607	6815	53.3	0.483	0.458	5.1	6889	5778	16.1
Phy-21-73	DRMR 2019-7	14593	8000	45.2	0.523	0.459	12.4	7333	4622	37.0
Phy-21-74	LES 60	13630	4963	63.6	0.503	0.476	5.5	5889	5822	1.1
	Mean	13151	6656		0.537	0.481		7009	5982	
CD (p=0.05)		I=628.2			I=0.118			I=98.04		
		G=NS			G=0.029			G=410.1		
		IxG=3662.7			IxG=0.167			IxG=580.03		

IR=Irrigated; RF=Rainfed

Table 6.3.10 : Effect of moisture stress on seed yield at 3 locations in Indian mustard

Code	Entries	Seed yield								
		Bharatpur (kg/ha)			Hisar (g/plant)			Ludhiana (kg/ha)		
		IR	RF	Red (%)	IR	RF	Red (%)	IR	RF	Red (%)
Phy-21-41	RH1424	1720	1567	8.9	0.109	0.084	23.1	1441	1005	30.3
Phy-21-42	NPJ-254	1369	1055	22.9	0.123	0.104	15.7	1723	1123	34.8
Phy-21-43	RGN-519	1363	1307	4.1	0.129	0.111	13.9	1607	1389	13.6
Phy-21-44	DRMR1176	1726	1059	38.6	0.089	0.085	3.8	1371	1234	10.0
Phy-21-45	RH1928	1627	1135	30.2	0.139	0.11	21.1	1428	1384	3.1
Phy-21-46	PBR357	1367	1159	15.3	0.131	0.106	19.3	1747	1695	3.0
Phy-21-47	DRMRSJ 276	1452	1366	5.9	0.101	0.086	14.6	1517	1189	21.6
Phy-21-48	NPJ214	1230	926	24.7	0.146	0.126	13.7	1679	1255	25.2
Phy-21-49	DRMR1222	1396	1357	2.8	0.151	0.119	21.4	1533	1356	11.6
Phy-21-50	JC36	1206	760	37.0	0.116	0.093	20.1	1164	1004	13.7
Phy-21-51	DRMRCI-144	1902	1267	33.4	0.132	0.102	22.7	1374	1200	12.6
Phy-21-52	BAUM-21-2	1104	988	10.5	0.119	0.096	19.3	1149	989	13.9
Phy-21-53	RGN229	1610	1365	15.2	0.12	0.101	15.6	1638	1430	12.7
Phy-21-54	DRMR1188	1699	987	41.9	0.101	0.085	15.8	1498	1283	14.4
Phy-21-55	CAU-RMM3	761	723	5.1	0.074	0.071	4.5	1209	1020	15.7
Phy-21-56	RH761	2163	1530	29.2	0.118	0.093	20.9	1337	1068	20.1
Phy-21-57	DRMRHT13-22-2	1911	1237	35.3	0.104	0.093	10.9	1369	980	28.4
Phy-21-58	NPJ-225	1824	1520	16.7	0.115	0.101	12.2	1271	938	26.2
Phy-21-59	RGN-510	2225	1704	23.4	0.095	0.081	15.4	1706	1521	10.8
Phy-21-60	DRMRHJ1117	1836	1073	41.6	0.106	0.091	14.5	1481	1117	24.6
Phy-21-61	NPJ-210	1413	1404	0.6	0.12	0.101	15.9	1283	1145	10.7
Phy-21-62	RH1930	1927	1844	4.3	0.107	0.091	15.5	1502	1249	16.8
Phy-21-63	PBR 552	1724	1585	8.1	0.104	0.083	20.3	1623	1281	21.1
Phy-21-64	DRMRCI-146	1719	1508	12.2	0.103	0.094	9.1	1550	1495	3.5
Phy-21-65	RH(OE)1807	1719	1406	18.2	0.109	0.094	13.5	1356	1309	3.5
Phy-21-66	Kranti(NC)	1222	1192	2.5	0.107	0.09	16.1	1403	1236	11.9
Phy-21-67	DRMRCI-148	1554	1418	8.8	0.093	0.089	4.3	1367	1164	14.8
Phy-21-68	RH725	2033	1519	25.3	0.113	0.094	16.6	1266	1143	9.7
Phy-21-69	DM-1521	1460	1336	8.5	0.104	0.094	9.6	1399	1285	8.1
Phy-21-70	DRMRCI 128	1679	1570	6.4	0.106	0.094	11.3	1511	1294	14.3
Phy-21-71	RB-110	1390	1347	3.1	0.118	0.105	10.7	1549	1197	22.7
Phy-21-72	PDG 15	1421	1226	13.7	0.125	0.108	13.8	1535	1376	10.3
Phy-21-73	DRMR 2019-7	1570	1490	5.1	0.109	0.094	14.3	1651	1179	28.6
Phy-21-74	LES 60	1210	1156	4.5	0.119	0.098	17.4	1526	1307	14.3
	Mean	1574	1297		0.113	0.096		1464	1231	
CD (p=0.05)		I=65.6			I=0.006			I=23.5		
		G=270.6			G=0.025			G=98.4		
		IxG=NS			IxG=NS			IxG=139.2		

IR=Irrigated; RF=Rainfed

Table 6.3.11: Effect of moisture stress on harvest index and oil content in Indian mustard

Code	Entries	HI (%)						Oil content (%)			
		Bharatpur		Hisar		Ludhiana		Hisar		Ludhiana	
		IR	RF	IR	RF	IR	RF	IR	RF	IR	RF
Phy-21-41	RH1424	13.0	26.2	18.9	19.9	21.6	18.5	39.7	39.8	38.1	38.4
Phy-21-42	NPJ-254	10.4	15.9	18.9	22.4	24.2	16.4	39.5	39.7	37.4	37.5
Phy-21-43	RGN-519	8.8	27.0	24.8	23.3	23.5	22.0	39.3	39.4	36.6	36.9
Phy-21-44	DRMR1176	13.1	13.0	22.0	22.1	22.4	18.5	39.2	39.5	37.6	37.9
Phy-21-45	RH1928	11.6	14.3	21.4	29.9	20.7	20.5	39.4	39.6	37.8	38.0
Phy-21-46	PBR357	9.5	26.9	27.8	22.3	20.7	19.7	39.2	39.6	36.5	36.7
Phy-21-47	DRMRSJ 276	9.6	22.5	24.1	20.2	20.5	20.3	39.2	39.3	37.5	37.8
Phy-21-48	NPJ214	5.5	13.8	22.3	24.9	27.6	21.7	39.0	39.3	37.2	37.4
Phy-21-49	DRMR1222	13.1	19.7	23.0	26.6	21.2	19.8	38.9	39.4	36.6	36.8
Phy-21-50	JC36	7.7	17.6	18.5	23.0	19.6	18.7	39.0	39.5	36.9	37.1
Phy-21-51	DRMRCl-144	15.8	29.4	18.0	24.1	20.7	18.3	39.1	39.5	37.9	38.2
Phy-21-52	BAUM-21-2	7.8	18.8	17.2	24.6	17.8	18.5	39.1	39.6	36.6	36.8
Phy-21-53	RGN229	11.5	18.4	16.2	17.3	17.5	17.2	39.3	39.9	36.7	36.9
Phy-21-54	DRMR1188	11.7	16.1	16.2	17.3	19.4	19.2	39.2	39.3	37.4	37.6
Phy-21-55	CAU-RMM3	7.2	16.8	20.9	16.1	23.4	22.5	39.4	39.6	37.2	37.5
Phy-21-56	RH761	14.6	27.3	19.5	26.3	20.4	20.3	39.1	39.4	36.7	37.0
Phy-21-57	DRMRHT13-22-2	14.2	27.8	25.7	18.5	22.0	16.2	38.7	38.9	37.1	37.5
Phy-21-58	NPJ-225	11.9	43.4	23.8	18.5	19.1	20.5	38.8	39.0	36.1	36.4
Phy-21-59	RGN-510	23.8	28.1	20.8	18.0	23.8	19.4	38.6	39.3	37.3	37.6
Phy-21-60	DRMRHJ1117	12.3	20.4	25.8	21.6	19.4	16.8	38.4	39.0	37.9	38.3
Phy-21-61	NPJ-210	11.8	14.7	23.2	20.1	30.0	26.2	38.5	39.2	37.6	37.9
Phy-21-62	RH1930	18.4	22.6	19.1	23.6	21.7	19.2	38.8	39.2	37.1	37.3
Phy-21-63	PBR 552	11.1	27.1	23.8	22.6	20.0	18.1	39.1	39.3	36.9	37.3
Phy-21-64	DRMRCl-146	12.5	25.8	21.7	22.7	22.9	22.4	38.8	39.3	37.9	38.0
Phy-21-65	RH(OE)1807	11.8	33.3	26.5	23.0	26.3	21.6	38.3	39.0	36.4	36.6
Phy-21-66	Kranti(NC)	9.0	22.9	20.7	21.8	22.7	20.8	38.6	39.2	36.8	37.2
Phy-21-67	DRMRCl-148	9.5	35.2	17.3	18.1	20.0	18.8	38.5	39.3	38.5	38.7
Phy-21-68	RH725	17.2	19.1	24.3	25.5	21.1	21.1	38.8	39.6	37.2	37.3
Phy-21-69	DM-1521	12.3	17.6	20.4	21.7	20.7	20.2	37.9	38.5	37.4	37.6
Phy-21-70	DRMRCl 128	10.6	25.7	24.2	28.1	19.8	17.1	38.9	39.6	38.1	38.3
Phy-21-71	RB-110	8.2	29.7	23.9	19.8	24.5	19.4	39.0	39.1	38.2	38.3
Phy-21-72	PDG 15	9.6	18.6	25.6	18.8	23.8	22.3	38.8	39.3	36.9	37.0
Phy-21-73	DRMR 2019-7	11.4	18.6	21.3	21.6	25.5	22.5	38.3	39.1	37.9	38.0
Phy-21-74	LES 60	8.6	24.9	25.7	18.8	25.9	22.4	38.6	39.5	36.4	36.6
	Mean	11.6	22.9	21.9	21.9	22.1	19.9	38.9	39.3	37.2	37.5
CD (p=0.05)		I=1.827		I=1.937		I=0.570		I=0.190		I=0.115	
		G=7.533		G=NS		G=2.38		G=NS		G=0.481	
		IxG=NS		IxG=NS		IxG=3.37		IxG=NS		IxG=0.680	

IR=Irrigated; RF=Rainfed

Table 6.3.12: Effect of moisture stress on drought susceptibility and yield stability indices

Code	Entries	Drought susceptibility index (DSI)			Yield stability index (YSI)		
		Bharatpur	Hisar	Ludhiana	Bharatpur	Hisar	Ludhiana
Phy-21-41	RH1424	1.27	1.40	1.897	0.911	0.769	0.697
Phy-21-42	NPJ-254	3.28	0.95	2.183	0.771	0.843	0.652
Phy-21-43	RGN-519	0.59	0.84	0.850	0.959	0.861	0.864
Phy-21-44	DRMR1176	5.52	0.23	0.625	0.614	0.962	0.900
Phy-21-45	RH1928	4.32	1.27	0.195	0.698	0.789	0.969
Phy-21-46	PBR357	2.18	1.17	0.187	0.847	0.807	0.970
Phy-21-47	DRMRSJ 276	0.85	0.88	1.356	0.941	0.854	0.784
Phy-21-48	NPJ214	3.53	0.83	1.583	0.753	0.863	0.748
Phy-21-49	DRMR1222	0.40	1.29	0.725	0.972	0.786	0.884
Phy-21-50	JC36	5.28	1.22	0.862	0.630	0.799	0.863
Phy-21-51	DRMRCI-144	4.77	1.38	0.793	0.666	0.773	0.874
Phy-21-52	BAUM-21-2	1.50	1.17	0.873	0.895	0.807	0.861
Phy-21-53	RGN229	2.18	2.14	0.798	0.848	0.647	0.873
Phy-21-54	DRMR1188	5.99	0.96	0.902	0.581	0.842	0.856
Phy-21-55	CAU-RMM3	0.72	0.27	0.982	0.949	0.955	0.843
Phy-21-56	RH761	4.18	1.27	1.263	0.708	0.791	0.799
Phy-21-57	DRMRHT13-22-2	5.04	0.66	1.782	0.647	0.891	0.716
Phy-21-58	NPJ-225	2.38	0.74	1.642	0.833	0.878	0.738
Phy-21-59	RGN-510	3.35	0.93	0.680	0.766	0.846	0.892
Phy-21-60	DRMRHJ1117	5.94	0.88	1.542	0.584	0.855	0.754
Phy-21-61	NPJ-210	0.09	0.96	0.673	0.994	0.841	0.893
Phy-21-62	RH1930	0.61	0.94	1.056	0.957	0.845	0.832
Phy-21-63	PBR 552	1.16	1.23	1.320	0.919	0.797	0.789
Phy-21-64	DRMRCI-146	1.75	0.55	0.223	0.878	0.909	0.965
Phy-21-65	RH(OE)1807	2.60	0.82	0.218	0.818	0.865	0.965
Phy-21-66	Kranti(NC)	0.36	0.98	0.747	0.975	0.839	0.881
Phy-21-67	DRMRCI-148	1.25	0.26	0.930	0.912	0.957	0.852
Phy-21-68	RH725	3.61	1.00	0.610	0.747	0.834	0.903
Phy-21-69	DM-1521	1.21	0.58	0.510	0.915	0.904	0.919
Phy-21-70	DRMRCI 128	0.92	0.69	0.899	0.936	0.887	0.857
Phy-21-71	RB-110	0.44	0.65	1.423	0.969	0.893	0.773
Phy-21-72	PDG 15	1.96	0.84	0.647	0.863	0.862	0.897
Phy-21-73	DRMR 2019-7	0.73	0.87	1.794	0.949	0.857	0.714
Phy-21-74	LES 60	0.65	1.05	0.899	0.955	0.826	0.857
	Mean	2.37	0.938	0.990	0.834	0.845	0.842

Table 6.4.1: Effect of terminal heat stress on membrane stability index at Dholi, Hisar and Ludhiana

Code	Entries	Membrane stability index (%)								
		Dholi			Hisar			Ludhiana		
		NS	LS	Red (%)	NS	LS	Red (%)	NS	LS	Red (%)
Phy-21-75	DRMR1372	69.0	63.8	7.4	82.3	78.7	4.4	72.0	69.3	3.7
Phy-21-76	RGN520	64.7	59.0	8.7	73.9	52.2	29.4	82.9	68.0	18.0
Phy-21-77	KRM(L)21-6	73.4	63.7	13.2	48.3	38.3	20.7	84.1	76.0	9.6
Phy-21-78	RH(OE)1706	76.3	70.8	7.2	88.6	57.7	34.9	80.2	76.2	5.0
Phy-21-79	DRMR2018-19	80.5	75.1	6.7	77.0	65.1	15.5	81.6	73.7	9.7
Phy-21-80	JC36	-	-	-	72.1	54.7	24.1	83.8	77.0	8.1
Phy-21-81	NPJ 251	70.8	59.5	15.9	62.3	45.4	27.1	85.8	74.5	13.1
Phy-21-82	BAUM-08-15	60.8	56.8	6.6	82.4	64.9	21.2	81.8	76.1	6.9
Phy-21-83	DRMR-2017-27	78.6	62.2	20.8	69.3	68.7	0.9	84.1	74.2	11.8
Phy-21-84	JC32	-	-	-	66.0	45.3	31.4	84.9	73.8	13.1
Phy-21-85	LES60	72.8	67.2	7.7	67.7	64.7	4.4	85.5	74.3	13.0
Phy-21-86	Kranti(NC)	63.3	55.3	12.7	63.8	47.1	26.2	86.6	74.8	13.6
Phy-21-87	DRMR2546	74.7	59.2	20.7	78.3	53.0	32.3	86.7	72.2	16.7
Phy-21-88	PAB-2014-17	65.0	57.1	12.2	68.0	65.3	4.0	86.0	74.3	13.6
Phy-21-89	PDZ15	69.2	58.0	16.1	69.8	61.3	12.2	83.9	76.6	8.8
Phy-21-90	PM26	75.3	68.0	9.6	80.2	67.7	15.6	83.8	73.5	12.3
Phy-21-91	DRMRCI 140	79.1	67.7	14.4	84.2	79.0	6.2	85.3	73.3	14.1
Phy-21-92	RH2050	62.7	55.3	11.9	78.6	63.0	19.8	86.0	81.9	4.8
Phy-21-93	HUJM 20-6	76.4	69.7	8.8	62.3	59.7	4.2	79.8	75.8	5.0
Phy-21-94	KMR(L) 21-5	71.8	66.1	7.9	69.4	66.0	4.9	76.4	76.0	0.5
Phy-21-95	DRMRSJ272	80.4	74.7	7.1	74.6	72.1	3.4	79.5	77.1	3.0
Phy-21-96	JC16	-	-	-	76.3	61.7	19.1	83.0	74.3	10.4
Phy-21-97	PAB-2014-7	66.1	57.4	13.2	70.7	67.5	4.5	79.8	75.3	5.6
Phy-21-98	RH(OE)1807	77.6	62.0	20.1	78.3	71.9	8.2	79.0	77.2	2.3
Phy-21-99	DRMR1176	79.5	73.9	7.1	69.3	46.7	32.6	83.3	75.1	9.8
Phy-21-100	ACN237	62.9	57.9	8.0	67.7	62.0	8.4	81.6	74.9	8.2
Phy-21-101	NPJ250	74.0	61.6	16.8	77.3	71.7	7.2	81.9	72.1	12.0
Phy-21-102	RGN 522	75.7	65.6	13.4	69.3	47.4	31.6	81.5	74.7	8.4
Phy-21-103	JC 1	82.0	75.4	8.1	67.4	62.5	7.3	79.2	71.5	9.7
Phy-21-104	DRMRHT 13-7-113	68.5	64.3	6.2	82.3	55.7	32.3	80.2	74.6	7.0
Phy-21-105	RH1939	79.2	72.3	8.6	76.3	61.7	19.1	79.0	72.8	7.9
	Mean	64.9	57.3		72.7	60.6		82.2	74.6	
CD (p=0.05)		E=0.552			E=11.2			E=0.601		
		G=2.172			G=2.9			G=2.47		
		ExG=3.072			ExG=NS			ExG=3.54		

NS=Normal sown; LS =Late sown

No germination of entries JC36, JC32 and JC16 at Dholi

Table 6.4.2: Effect of terminal heat stress on canopy temperature (CT) and canopy temperature depression (CTD) in Indian mustard

Code	Entries	CT (°C)						CTD (°C)					
		Bharatpur		Hisar		Ludhiana		Bharatpur		Hisar		Ludhiana	
		NS	LS	NS	LS	NS	LS	NS	LS	NS	LS	NS	LS
Phy-21-75	DRMR1372	20.7	20.5	26.3	32.3	23.7	20.4	-5.3	-5.5	-6.4	-5.8	-1.9	-3.1
Phy-21-76	RGN520	20.5	19.7	26.2	31.7	22.3	17.5	-5.5	-6.3	-5.7	-4.6	-2.4	-4.4
Phy-21-77	KRM(L)21-6	20.2	19.2	27.7	31.6	22.2	18.8	-5.8	-6.8	-6.2	-4.3	-2.3	-4.6
Phy-21-78	RH(OE)1706	20.2	20.7	29.7	30.7	23.0	14.4	-5.8	-5.3	-7.6	-3.8	1.8	-3.7
Phy-21-79	DRMR2018-19	19.7	20.3	22.3	32.0	19.9	20.4	-6.3	-5.7	-5.9	-4.8	-3.0	-3.3
Phy-21-80	JC36	20.8	20.2	26.2	28.3	19.7	20.2	-5.2	-5.8	-5.3	-5.1	-2.2	-1.8
Phy-21-81	NPJ 251	20.5	20.3	23.6	27.3	23.5	19.5	-5.5	-5.7	-5.1	-4.1	-1.3	-2.1
Phy-21-82	BAUM-08-15	20.6	19.4	24.2	26.9	21.2	14.5	-5.4	-6.6	-6.9	-6.4	-2.4	-2.8
Phy-21-83	DRMR-2017-27	20.2	19.3	25.7	29.2	18.7	18.7	-5.8	-6.7	-6.0	-4.8	-2.4	-3.2
Phy-21-84	JC32	20.2	18.8	22.3	27.2	19.5	12.8	-5.8	-7.2	-7.5	-6.1	-2.9	-4.7
Phy-21-85	LES60	20.9	18.7	23.3	27.8	21.5	14.4	-5.1	-7.3	-7.6	-4.5	-3.3	-3.0
Phy-21-86	Kranti(NC)	20.1	20.1	24.2	29.8	22.0	18.3	-5.9	-5.9	-7.9	-6.5	-2.5	-4.8
Phy-21-87	DRMR2546	20.4	19.7	24.3	30.3	21.5	18.7	-5.6	-6.3	-6.2	-5.5	-2.4	-0.1
Phy-21-88	PAB-2014-17	19.6	19.8	26.3	28.3	21.0	23.1	-6.4	-6.2	-7.4	-4.3	-3.9	-0.2
Phy-21-89	PDZ15	20.4	19.5	26.2	28.3	21.4	17.6	-5.6	-6.5	-6.7	-3.9	-2.3	-0.8
Phy-21-90	PM26	20.7	19.5	26.6	28.9	18.9	21.8	-5.3	-6.5	-7.4	-4.1	-2.2	-2.3
Phy-21-91	DRMRCI 140	20.2	19.2	24.5	28.4	20.0	20.5	-5.8	-6.8	-6.0	-4.4	-2.2	-0.2
Phy-21-92	RH2050	19.7	19.8	27.4	30.6	18.3	21.8	-6.3	-6.2	-4.2	-3.7	-2.4	-0.1
Phy-21-93	HUJM 20-6	19.7	18.8	25.7	32.1	16.7	21.7	-6.3	-7.2	-5.8	-4.7	-3.0	-1.5
Phy-21-94	KMR(L) 21-5	20.5	18.6	26.5	31.8	18.3	21.6	-5.5	-7.4	-6.1	-5.2	-3.4	-2.4
Phy-21-95	DRMRSJ272	21.5	19.8	24.0	28.5	22.9	15.6	-4.5	-6.2	-5.9	-4.2	-3.3	-2.2
Phy-21-96	JC16	21.6	19.6	26.6	28.0	17.2	17.2	-4.4	-6.4	-5.2	-4.2	-3.1	-3.0
Phy-21-97	PAB-2014-7	20.6	18.9	24.6	27.4	17.4	19.5	-5.4	-7.1	-6.5	-5.4	-2.3	-1.1
Phy-21-98	RH(OE)1807	20.8	20.1	24.5	25.3	17.5	19.1	-5.2	-5.9	-6.6	-4.9	-3.3	-2.6
Phy-21-99	DRMR1176	20.2	18.9	21.7	26.0	19.8	16.3	-5.8	-7.1	-5.4	-4.2	-2.7	-1.8
Phy-21-100	ACN237	21.5	19.0	25.5	29.8	16.9	21.9	-4.5	-7.0	-6.0	-3.7	-1.8	-0.9
Phy-21-101	NPJ250	20.8	19.1	27.0	28.7	18.3	18.8	-5.2	-6.9	-5.3	-4.7	-2.8	-1.5
Phy-21-102	RGN 522	20.6	18.2	27.1	30.2	16.8	21.4	-5.4	-7.8	-5.9	-4.6	-4.1	-3.8
Phy-21-103	JC 1	21.0	18.2	27.4	30.5	19.2	18.4	-5.0	-7.8	-7.6	-4.6	-2.9	-3.2
Phy-21-104	DRMRHT 13-7-113	21.0	18.7	24.9	26.7	17.9	20.5	-5.0	-7.3	-6.5	-5.2	-4.8	-4.1
Phy-21-105	RH1939	20.4	18.8	22.9	29.7	17.9	19.4	-5.6	-7.2	-5.7	-3.5	-3.6	-2.6
	Mean	20.5	19.4	25.3	29.2	19.8	18.9	-5.5	-6.6	-6.2	-4.7	-2.6	-2.5
CD (p=0.05)		E=0.611		E=0.0574		E=0.467		I=0.661		E=0.188		E=0.571	
		G=NS		G=2.259		G=1.92		G=NS		G=0.739		G=2.35	
		ExG=NS		ExG=NS		ExG=2.97		ExG=NS		ExG=1.044		ExG=3.32	

NS=Normal sown; LS =Late sown

Table 6.4.3: Effect of terminal heat stress on seeds per siliqua at 4 locations

Code	Entries	Seeds/siliqua											
		Dholi			Bharatpur			Hisar			Ludhiana		
		NS	LS	Red (%)	NS	LS	Red (%)	NS	LS	Red (%)	NS	LS	Red (%)
Phy-21-75	DRMR1372	11.5	10.5	9.0	14.7	12.3	16.4	13.2	12.4	6.0	14.9	11.6	21.8
Phy-21-76	RGN520	11.0	10.0	8.8	15.2	11.8	22.4	12.5	11.0	12.0	15.8	15.1	4.3
Phy-21-77	KRM(L)21-6	12.1	9.6	20.9	12.8	11.9	6.8	13.5	10.8	20.4	13.7	11.0	19.7
Phy-21-78	RH(OE)1706	11.4	11.1	2.9	14.7	12.7	13.2	14.4	11.6	19.4	13.8	13.4	2.9
Phy-21-79	DRMR2018-19	10.9	10.2	6.4	16.0	15.4	3.8	14.8	13.9	5.9	13.4	12.5	6.7
Phy-21-80	JC36	-	-	-	16.4	15.7	4.1	15.0	13.0	13.1	14.5	12.3	14.8
Phy-21-81	NPJ 251	11.6	9.8	15.6	14.7	13.1	11.3	15.2	12.3	19.4	14.1	13.5	4.3
Phy-21-82	BAUM-08-15	12.5	11.1	11.0	13.4	13.0	3.0	13.2	12.2	7.6	13.2	12.9	2.3
Phy-21-83	DRMR-2017-27	11.4	8.3	27.5	15.8	13.6	13.9	14.8	14.2	3.8	15.8	11.8	25.4
Phy-21-84	JC32	-	-	-	14.1	12.9	9.0	14.3	13.7	4.5	13.1	10.7	18.3
Phy-21-85	LES60	11.5	10.9	5.2	13.2	12.4	6.1	12.4	11.1	10.4	14.3	12.8	10.7
Phy-21-86	Kranti(NC)	11.8	7.9	33.1	14.1	13.4	4.7	15.2	13.9	8.3	13.6	13.5	0.5
Phy-21-87	DRMR2546	11.8	11.5	3.1	14.5	13.7	6.0	12.7	11.6	8.5	13.2	12.6	5.1
Phy-21-88	PAB-2014-17	11.0	10.7	3.3	14.0	12.7	9.5	12.2	11.8	3.3	13.3	11.6	12.8
Phy-21-89	PDZ15	10.4	10.1	3.2	15.3	14.7	3.9	14.1	12.4	12.2	13.8	11.1	19.6
Phy-21-90	PM26	10.4	10.0	4.2	15.1	12.7	15.9	13.1	12.7	2.6	13.3	11.2	15.8
Phy-21-91	DRMRCI 140	10.6	10.2	3.5	15.1	13.5	10.2	14.1	13.4	4.8	13.0	12.9	0.8
Phy-21-92	RH2050	9.1	8.8	3.7	15.4	13.6	11.7	14.8	13.6	8.4	12.7	11.8	7.1
Phy-21-93	HUJM 20-6	10.1	9.6	5.0	16.3	12.1	26.1	14.9	14.4	3.2	13.0	12.8	1.5
Phy-21-94	KMR(L) 21-5	10.5	10.3	2.2	15.8	14.5	8.4	12.5	11.6	7.7	12.4	11.3	8.9
Phy-21-95	DRMRSJ272	10.2	10.1	1.3	13.7	13.3	3.4	15.4	12.8	16.4	14.5	9.4	35.2
Phy-21-96	JC16	-	-	-	15.5	13.2	15.0	13.2	12.2	7.3	13.5	13.1	3.1
Phy-21-97	PAB-2014-7	9.6	9.4	1.7	13.3	12.5	5.5	12.0	11.5	4.5	13.5	12.7	5.9
Phy-21-98	RH(OE)1807	11.7	9.1	22.3	14.1	13.0	8.0	12.6	11.3	9.9	13.2	12.6	4.5
Phy-21-99	DRMR1176	9.8	8.9	9.2	14.7	11.7	20.8	12.9	10.5	18.3	13.2	13.1	0.6
Phy-21-100	ACN237	10.3	10.0	3.2	15.3	13.8	10.0	13.9	13.1	6.0	13.9	12.3	11.5
Phy-21-101	NPJ250	11.0	10.3	6.7	17.4	13.5	22.2	15.7	10.7	31.9	13.8	13.7	0.7
Phy-21-102	RGN 522	11.2	10.2	9.2	13.6	12.3	9.3	14.6	12.5	14.3	13.0	12.7	2.2
Phy-21-103	JC 1	12.2	12.0	1.5	15.5	12.1	22.0	14.4	12.5	13.6	14.3	11.8	17.5
Phy-21-104	DRMRHT 13-7-113	11.8	9.6	19.2	15.1	12.7	15.5	13.8	13.4	2.6	15.2	12.0	20.9
Phy-21-105	RH1939	12.0	11.2	6.9	14.4	13.9	3.2	13.6	12.6	7.4	13.0	12.7	2.3
	Mean	9.9	9.0		14.8	13.1		13.8	12.4		13.7	12.3	
CD (p=0.05)		E=0.222			E=0.482			E=0.409			E=0.509		
		G=0.874			G=1.898			G=1.612			G=1.46		
		ExG=1.236			ExG=NS			ExG=NS			ExG=2.07		

NS=Normal sown; LS =Late sown

No germination of entries JC36, JC32 and JC16 at Dholi

Table 6.4.4: Effect of terminal heat stress on Test weight (g) at 3 locations

Code	Entries	Test weight (g)								
		Dholi			Hisar			Ludhiana		
		NS	LS	Red(%)	NS	LS	Red(%)	NS	LS	Red(%)
Phy-21-75	DRMR1372	4.9	4.4	8.8	4.4	3.0	31.6	6.3	4.6	27.0
Phy-21-76	RGN520	5.3	4.4	16.6	3.9	2.7	32.0	4.3	4.2	3.2
Phy-21-77	KRM(L)21-6	6.2	5.6	8.8	4.1	2.5	39.2	5.2	4.8	7.7
Phy-21-78	RH(OE)1706	7.5	5.3	29.6	4.2	2.9	31.4	4.6	4.2	9.3
Phy-21-79	DRMR2018-19	6.5	6.0	8.0	4.6	3.3	28.3	5.5	5.5	0.2
Phy-21-80	JC36	-	-	-	3.5	2.5	28.7	4.0	3.4	14.1
Phy-21-81	NPJ 251	6.6	5.5	16.3	4.0	3.0	26.0	5.8	3.6	38.4
Phy-21-82	BAUM-08-15	6.1	5.4	11.5	4.1	2.7	33.2	5.1	4.1	18.8
Phy-21-83	DRMR-2017-27	7.2	4.7	34.7	3.1	2.7	13.6	5.4	4.9	9.3
Phy-21-84	JC32	-	-	-	3.9	2.6	32.6	4.4	3.3	23.3
Phy-21-85	LES60	5.4	4.6	15.3	4.0	3.3	18.6	4.7	3.8	20.5
Phy-21-86	Kranti(NC)	5.5	4.6	15.2	3.9	2.5	35.5	4.3	4.2	2.3
Phy-21-87	DRMR2546	5.0	4.8	5.0	4.4	3.0	32.6	5.5	4.7	14.5
Phy-21-88	PAB-2014-17	5.6	4.2	24.7	4.1	3.1	24.7	5.6	4.1	27.9
Phy-21-89	PDZ15	6.1	5.1	16.6	3.7	2.5	32.0	5.0	3.3	32.5
Phy-21-90	PM26	7.0	4.9	29.4	3.6	2.8	20.8	4.8	4.6	4.2
Phy-21-91	DRMR CI 140	6.9	3.3	51.9	4.1	3.1	25.2	5.1	4.5	10.6
Phy-21-92	RH2050	6.3	5.0	19.7	4.4	2.8	36.0	7.4	4.6	37.7
Phy-21-93	HUJM 20-6	7.7	5.1	33.8	4.3	3.8	10.4	5.5	5.2	6.1
Phy-21-94	KMR(L) 21-5	5.4	4.8	10.0	4.2	3.1	25.5	5.8	3.7	35.5
Phy-21-95	DRMRSJ272	5.3	5.2	2.1	4.1	2.6	35.9	6.2	4.4	29.3
Phy-21-96	JC16	-	-	-	3.7	2.5	31.0	4.1	3.2	21.8
Phy-21-97	PAB-2014-7	4.9	4.4	10.9	3.8	2.6	32.6	4.3	4.1	5.6
Phy-21-98	RH(OE)1807	6.2	5.1	17.1	3.8	2.5	34.0	4.3	4.0	7.0
Phy-21-99	DRMR1176	5.8	5.7	2.3	4.1	3.1	26.1	6.3	4.3	31.2
Phy-21-100	ACN237	7.0	3.8	45.4	4.5	3.2	30.1	5.8	4.1	29.0
Phy-21-101	NPJ250	6.2	5.3	14.6	4.2	3.1	27.1	5.1	4.5	11.7
Phy-21-102	RGN 522	6.7	5.0	26.2	4.4	3.1	29.0	5.2	4.8	7.7
Phy-21-103	JC 1	6.1	5.6	8.8	4.2	2.7	37.0	4.3	3.5	18.6
Phy-21-104	DRMRHT 13-7-113	5.4	5.0	7.0	3.9	3.0	23.9	4.3	4.2	1.8
Phy-21-105	RH1939	5.0	4.8	4.1	4.8	3.6	24.8	6.7	6.4	5.0
	Mean	5.5	4.4		4.1	2.9		5.2	4.3	
CD (p=0.05)		E=0.057			E=0.052			E=0.263		
		G=0.225			G=0.204			G=1.1		
		E×G=0.319			ExG=0.289			ExG=1.56		

NS=Normal sown; LS =Late sown

No germination of entries JC36, JC32 and JC16 at Dholi

Table 6.4.5 : Effect of terminal heat stress on seed yield at Dholi, Bharatpur, Hisar and Ludhiana

Code	Entries	Seed yield											
		Dholi (kg/ha)			Bharatpur (kg/ha)			Hisar (g/plant)			Ludhiana (kg/ha)		
		NS	LS	Red (%)	NS	LS	Red(%)	NS	LS	Red (%)	NS	LS	Red (%)
Phy-21-75	DRMR1372	582.8	432.9	25.7	1591.1	493.3	69.0	24.6	14.7	40.2	1161.1	892.0	23.2
Phy-21-76	RGNS20	538.4	371.9	30.9	1565.6	551.1	64.8	23.5	17.1	27.2	1143.3	1080.0	5.5
Phy-21-77	KRM(L)21-6	388.5	249.8	35.7	1026.7	514.4	49.9	16.3	9.0	44.8	1514.4	983.3	35.1
Phy-21-78	RH(OE)1706	416.3	210.9	49.3	1072.2	634.4	40.8	23.8	15.8	33.6	1130.0	1008.9	10.7
Phy-21-79	DRMR2018-19	627.2	460.7	26.6	784.4	513.3	34.6	27.7	15.9	42.6	916.0	841.0	8.2
Phy-21-80	JC36	-	-	-	1108.9	530.0	52.2	20.1	13.2	34.3	1194.0	1099.0	8.0
Phy-21-81	NPJ 251	360.8	260.9	27.7	1225.6	623.3	49.1	25.0	15.0	40.0	1327.8	1270.0	4.4
Phy-21-82	BAUM-08-15	388.5	177.6	54.3	996.7	492.2	50.6	15.4	11.3	26.4	1452.2	1080.0	25.6
Phy-21-83	DRMR-2017-27	333.0	212.0	36.3	633.3	501.1	20.9	16.1	13.4	16.8	1678.9	1293.3	23.0
Phy-21-84	JC32	-	-	-	664.4	468.9	29.4	12.9	8.0	37.7	1250.0	873.3	30.1
Phy-21-85	LES60	388.5	122.1	68.6	2766.7	1154.4	58.3	24.8	12.6	49.2	1292.2	1032.2	20.1
Phy-21-86	Kranti(NC)	277.5	205.4	26.0	912.2	494.4	45.8	15.0	11.4	24.0	1343.3	1178.9	12.2
Phy-21-87	DRMR2546	499.5	249.8	50.0	1282.2	687.8	46.4	18.8	10.6	43.6	1382.2	1012.2	26.8
Phy-21-88	PAB-2014-17	499.5	283.1	43.3	1337.8	588.9	56.0	14.2	11.5	19.0	1407.8	1150.0	18.3
Phy-21-89	PDZ15	333.0	222.0	33.3	661.1	533.3	19.3	26.4	15.8	40.2	1615.6	1272.2	21.3
Phy-21-90	PM26	455.1	333.0	26.8	794.4	691.1	13.0	18.0	14.1	21.7	1330.0	991	25.5
Phy-21-91	DRMRCI 140	627.2	244.2	61.1	1378.9	507.8	63.2	17.0	11.1	34.7	1430.0	989.0	30.8
Phy-21-92	RH2050	299.7	222.0	25.9	921.1	576.7	37.4	21.4	15.0	29.9	1580.0	1091.0	30.9
Phy-21-93	HUJM 20-6	399.6	277.5	30.6	861.1	671.1	22.1	18.4	14.8	19.6	1346.7	1112.2	17.4
Phy-21-94	KMR(L) 21-5	588.3	416.3	29.3	863.3	477.8	44.7	17.8	11.0	38.2	1366.7	994.0	27.3
Phy-21-95	DRMRSJ272	638.3	516.2	19.1	1090.0	577.8	47.0	18.4	11.2	39.1	1313.3	1055.0	19.7
Phy-21-96	JC16	-	-	-	733.3	362.2	50.6	22.9	11.6	49.3	822.2	653.3	20.5
Phy-21-97	PAB-2014-7	388.5	149.9	61.4	1153.3	474.4	58.9	20.8	13.4	35.6	1872.2	1208.0	35.5
Phy-21-98	RH(OE)1807	555.0	416.3	25.0	1138.9	393.3	65.5	16.2	11.2	31.2	1122.2	850.0	24.3
Phy-21-99	DRMR1176	310.8	222.0	28.6	1057.8	553.3	47.7	27.7	14.0	49.5	1290.0	962.0	25.4
Phy-21-100	ACN237	693.8	222.0	68.0	1512.2	528.9	65.0	23.7	14.2	40.1	1687.8	1184.0	29.8
Phy-21-101	NPJ250	222.0	166.5	25.0	1290.0	535.6	58.5	27.0	14.5	46.5	893.3	704.4	21.1
Phy-21-102	RGN 522	693.8	371.9	46.4	1402.2	417.8	70.2	20.0	13.6	32.0	1657.8	1187.0	28.4
Phy-21-103	JC 1	721.5	555.0	23.1	995.6	808.9	18.8	22.4	16.6	25.9	1154.0	918.0	20.5
Phy-21-104	DRMRHT 13-7-113	954.6	405.2	57.6	912.2	456.7	49.9	20.2	15.6	22.8	982.2	838.9	14.6
Phy-21-105	RH1939	360.8	277.5	23.1	1305.6	641.1	50.9	26.8	16.2	39.6	1112.2	877.8	21.1
	Mean	421.6	261.1		1130.3	563.1		20.8	13.3		1315	1026	
CD (p=0.05)		E=16.25			E=9.375			E=0.516			E=38.9		
		G=63.99			G=351.8			G=2.033			G=160.4		
		E×G=90.50			ExG=497.6			ExG=2.875			ExG=226.8		

NS=Normal sown; LS =Late sown

No germination of entries JC36, JC32 and JC16 at Dholi

Table 6.4.6: Effect of terminal heat stress on heat and yield stability indices

Code	Entries	Heat stability index (HSI)				Yield stability index (YSI)			
		Dholi	Bharatpur	Hisar	Ludhiana	Dholi	Bharatpur	Hisar	Ludhiana
Phy-21-75	DRMR1372	0.743	1.374	0.840	0.594	0.590	0.310	0.598	0.768
Phy-21-76	RGN520	0.691	1.291	0.569	0.708	0.710	0.352	0.728	0.945
Phy-21-77	KRM(L)21-6	0.643	0.994	0.935	0.853	0.820	0.501	0.552	0.649
Phy-21-78	RH(OE)1706	0.507	0.813	0.702	0.653	1.130	0.592	0.664	0.893
Phy-21-79	DRMR2018-19	0.735	0.688	0.890	0.441	0.610	0.654	0.574	0.918
Phy-21-80	JC36	-	1.040	0.717	0.752	0.000	0.478	0.657	0.920
Phy-21-81	NPJ 251	0.723	0.979	0.835	0.966	0.630	0.509	0.600	0.956
Phy-21-82	BAUM-08-15	0.457	1.008	0.551	0.899	1.240	0.494	0.736	0.744
Phy-21-83	DRMR-2017-27	0.637	0.416	0.350	1.244	0.830	0.791	0.832	0.770
Phy-21-84	JC32	-	0.586	0.788	0.626	0.000	0.706	0.623	0.699
Phy-21-85	LES60	0.314	1.161	1.027	0.764	1.570	0.417	0.508	0.799
Phy-21-86	Kranti (NC)	0.740	0.912	0.501	0.908	0.590	0.542	0.760	0.878
Phy-21-87	DRMR2546	0.500	0.924	0.911	0.802	1.140	0.536	0.564	0.732
Phy-21-88	PAB-2014-17	0.567	1.115	0.397	0.928	0.990	0.440	0.810	0.817
Phy-21-89	PDZ15	0.667	0.385	0.840	1.178	0.760	0.807	0.598	0.787
Phy-21-90	PM26	0.732	0.459	0.452	0.679	0.610	0.870	0.783	0.670
Phy-21-91	DRMRCI 140	0.389	1.258	0.725	0.810	1.390	0.368	0.653	0.692
Phy-21-92	RH2050	0.741	0.745	0.624	0.988	0.590	0.626	0.701	0.691
Phy-21-93	HUJM 20-6	0.694	0.440	0.409	0.858	0.700	0.779	0.804	0.826
Phy-21-94	KMR(L) 21-5	0.708	0.890	0.798	0.778	0.670	0.553	0.618	0.727
Phy-21-95	DRMRSJ272	0.809	0.936	0.817	0.794	0.440	0.530	0.609	0.803
Phy-21-96	JC16	-	1.008	1.030	0.308	0.000	0.494	0.507	0.795
Phy-21-97	PAB-2014-7	0.386	1.173	0.743	1.296	1.400	0.411	0.644	0.645
Phy-21-98	RH(OE)1807	0.750	1.304	0.651	0.547	0.570	0.345	0.688	0.757
Phy-21-99	DRMR1176	0.714	0.950	1.033	0.711	0.650	0.523	0.505	0.746
Phy-21-100	ACN237	0.320	1.295	0.837	1.145	1.550	0.350	0.599	0.702
Phy-21-101	NPJ250	0.750	1.165	0.971	0.361	0.570	0.415	0.535	0.789
Phy-21-102	RGN 522	0.536	1.399	0.668	1.128	1.060	0.298	0.680	0.716
Phy-21-103	JC 1	0.769	0.474	0.541	0.607	0.530	0.813	0.741	0.795
Phy-21-104	DRMRHT 13-7-113	0.424	0.995	0.476	0.472	1.310	0.501	0.772	0.854
Phy-21-105	RH1939	0.769	1.014	0.826	0.559	0.530	0.491	0.604	0.789
	Mean	0.562	0.942	0.724	0.786	0.780	0.532	0.653	0.783

No germination of entries JC36, JC32 and JC16 at Dholi

Table 6.5.1: Effect of salinity on germination in Indian mustard genotypes

Code	Entries	Germination (%)								
		Bharatpur			Hisar			Ludhiana		
		Control	Saline	Red (%)	Control	Saline	Red (%)	Control	Saline	Red (%)
Phy-21-106	CS-2020-4	67.5	32.5	51.9	94.4	88.0	6.8	86.7	68.3	21.2
Phy-21-107	NPJ256	77.5	25.0	67.7	91.7	77.8	15.2	91.7	50.0	45.5
Phy-21-108	CS-2009-234	70.0	25.0	64.3	94.4	83.3	11.8	86.7	65.0	25.0
Phy-21-109	RH1928	85.0	35.0	58.8	94.4	86.1	8.8	80.0	65.0	18.8
Phy-21-110	CS2013-64	80.0	60.0	25.0	97.2	86.1	11.4	90.0	75.0	16.7
Phy-21-111	NPJ231	72.5	27.5	62.1	88.9	80.6	9.4	80.0	75.0	6.3
Phy-21-112	CS-54(NC)	87.5	60.0	31.4	83.3	69.4	16.7	88.3	76.7	13.2
Phy-21-113	RH-1927	89.0	30.0	66.3	94.4	83.2	11.9	83.3	75.0	10.0
Phy-21-114	CS 60(LR)	91.0	60.0	34.1	94.4	80.6	14.7	85.0	60.0	29.4
Phy-21-115	CS-2005-143	72.5	22.5	69.0	97.2	80.6	17.1	76.7	73.3	4.3
Phy-21-116	Kranti(NC)	75.0	25.0	66.7	88.9	77.8	12.5	70.0	61.7	11.9
Phy-21-117	CS-2020-10	87.5	35.0	60.0	86.1	77.8	9.7	78.3	66.7	14.9
	Mean	79.6	36.5		92.1	80.9		83.1	67.6	
CD (p=0.05)		T=9.746			T=3.5			T=1.15		
		G=NS			G=1.87			G=2.84		
		TxG=NS			TxG=4.95			TxG=4.01		

Table 6.5.2: Seedling length as influenced by salinity at 3 locations

Code	Entries	Seedling length (cm)								
		Bharatpur			Hisar			Ludhiana		
		Control	Saline	Red (%)	Control	Saline	Red (%)	Control	Saline	Red (%)
Phy-21-106	CS-2020-4	7.2	3.4	52.3	7.3	6.2	15.9	8.2	6.7	18.5
Phy-21-107	NPJ256	8.0	4.0	50.3	7.8	6.3	19.1	9.9	6.5	34.5
Phy-21-108	CS-2009-234	7.6	3.7	51.4	5.8	4.6	19.9	8.9	6.8	23.8
Phy-21-109	RH1928	8.7	4.5	49.0	5.4	4.9	9.5	9.4	5.7	39.7
Phy-21-110	CS2013-64	8.8	4.5	48.8	7.1	5.8	18.9	9.2	6.6	28.0
Phy-21-111	NPJ231	7.8	2.8	64.7	7.6	6.4	16.1	9.2	5.8	37.2
Phy-21-112	CS-54(NC)	8.8	4.5	48.7	7.0	4.6	33.7	8.9	7.1	20.6
Phy-21-113	RH-1927	9.6	5.1	46.8	6.2	4.5	27.7	9.8	6.9	29.2
Phy-21-114	CS 60(LR)	10.0	5.0	50.4	6.7	4.6	31.3	12.2	6.3	48.2
Phy-21-115	CS-2005-143	10.2	5.2	49.5	6.1	4.0	35.4	9.5	5.6	41.1
Phy-21-116	Kranti(NC)	6.3	3.3	48.7	6.5	4.7	27.7	7.7	5.6	27.5
Phy-21-117	CS-2020-10	8.1	4.0	50.1	6.6	5.8	11.6	10.8	4.7	56.0
	Mean	8.4	4.2		6.7	5.2		9.5	6.2	
CD (p=0.05)		T=0.293			T=NS			T=0.411		
		G=0.717			G=0.624			G=1.01		
		TxG=NS			TxG=NS			TxG=1.42		

Salinity@12ds/m

Table 6.5.3: Dry matter as influenced by salinity at Bharatpur, Hisar and Ludhiana

Code	Entries	Dry weight/10 seedlings (g)								
		Bharatpur			Hisar			Ludhiana		
		Control	Saline	Red (%)	Control	Saline	Red (%)	Control	Saline	Red (%)
Phy-21-106	CS-2020-4	0.120	0.082	31.8	0.110	0.089	19.1	0.517	0.363	29.7
Phy-21-107	NPJ256	0.118	0.075	36.5	0.120	0.090	25.0	0.557	0.500	10.2
Phy-21-108	CS-2009-234	0.113	0.070	38.1	0.088	0.068	22.7	0.653	0.363	44.4
Phy-21-109	RH1928	0.109	0.057	48.0	0.105	0.085	19.0	0.563	0.438	22.3
Phy-21-110	CS2013-64	0.105	0.068	35.4	0.101	0.079	21.8	0.693	0.413	40.4
Phy-21-111	NPJ231	0.124	0.107	13.6	0.098	0.076	22.4	0.507	0.487	3.9
Phy-21-112	CS-54(NC)	0.113	0.066	41.6	0.118	0.084	28.8	0.627	0.473	24.5
Phy-21-113	RH-1927	0.117	0.093	20.7	0.093	0.068	26.9	0.477	0.457	4.2
Phy-21-114	CS 60(LR)	0.115	0.069	39.7	0.110	0.082	25.5	0.617	0.457	25.9
Phy-21-115	CS-2005-143	0.116	0.066	42.8	0.096	0.070	27.1	0.453	0.420	7.4
Phy-21-116	Kranti(NC)	0.119	0.087	26.6	0.095	0.072	24.2	0.427	0.367	14.1
Phy-21-117	CS-2020-10	0.107	0.065	39.1	0.090	0.072	20.0	0.320	0.310	3.1
	Mean	0.115	0.075		0.102	0.078		0.534	0.421	
CD (p=0.05)		T=0.01			T=0.002			T=0.0482		
		G=NS			G=0.001			G=0.118		
		TxG=NS			TxG=.002			TxG=0.167		

Table 6.5.4: Seedling vigour index II as influenced by salinity at Bharatpur, Hisar and Ludhiana

Code	Entries	Seedling vigour index (SVII)								
		Bharatpur			Hisar			Ludhiana		
		Control	Saline	Red (%)	Control	Saline	Red (%)	Control	Saline	Red (%)
Phy-21-106	CS-2020-4	8.1	2.6	68.3	1.0	0.8	25.0	4.5	2.5	45.1
Phy-21-107	NPJ256	9.3	1.7	81.7	1.1	0.7	36.4	4.7	2.9	38.7
Phy-21-108	CS-2009-234	7.8	1.6	79.5	0.8	0.6	31.3	5.8	2.3	59.6
Phy-21-109	RH1928	9.3	1.9	79.8	1.0	0.7	26.3	4.5	3.0	32.4
Phy-21-110	CS2013-64	8.4	4.1	51.2	1.0	0.7	30.6	6.3	3.1	50.5
Phy-21-111	NPJ231	8.8	3.0	66.2	0.9	0.6	29.9	4.0	3.8	5.9
Phy-21-112	CS-54(NC)	9.9	4.0	59.9	1.0	0.6	40.8	5.5	3.9	29.6
Phy-21-113	RH-1927	10.5	2.7	74.0	0.9	0.6	35.2	4.0	3.5	12.5
Phy-21-114	CS 60(LR)	10.4	4.2	59.7	1.0	0.7	36.5	5.3	2.7	49.8
Phy-21-115	CS-2005-143	8.3	1.5	82.0	0.9	0.6	39.8	3.3	3.2	3.2
Phy-21-116	Kranti(NC)	9.1	2.1	77.2	0.8	0.6	33.3	3.0	2.3	24.9
Phy-21-117	CS-2020-10	9.4	2.3	76.0	0.8	0.6	28.2	2.5	2.1	17.4
	Mean	9.12	2.63		1.04	0.78		4.46	2.94	
CD (p=0.05)		T=1.018			T=0.013			T=0.153		
		G=NS			G=0.005			G=0.375		
		TxG=NS			TxG=0.009			TxG=0.531		

Salinity@12ds/m

Table 6.6.1: Effect of PGRs on RWC and LWR in Indian mustard

Treatments	RWC (%)			LWR (%)
	Bharatpur	Hisar	Ludhiana	Ludhiana
Control (No spray)	97.5	83.8	79.7	65.0
Water spray	96.3	82.9	79.9	77.0
Urea @1%	83.0	66.7	81.7	79.8
Urea @ 2%	89.7	79.2	85.0	81.3
Trehalose @ 10mM	86.5	71.0	83.3	79.7
Trehalose @20mm	96.1	67.4	85.5	83.9
Pot nitrae @ 1%	82.0	71.5	80.0	78.5
Pot.nitrate @ 2%	87.4	63.8	80.2	83.4
CD@5%	7.6	NS	3.14	10.8

Table 6.6.2: Effect of PGRs on photosynthetic pigments at 3 locations

Treatments	Photosynthetic pigments (mg/g FW)													
	Chl a			Chl b			Total Chl			Carotenoids		Chlorophyll stability index (CSI)		
	Bharatpur	Hisar	Ludhiana	Bharatpur	Hisar	Ludhiana	Bharatpur	Hisar	Ludhiana	Bharatpur	Ludhiana	Bharatpur	Hisar	Ludhiana
Control (No spray)	1.16	2.75	1.61	0.262	0.320	0.331	1.42	3.07	1.94	0.300	0.490			
Water spray	1.18	2.46	1.63	0.336	0.710	0.339	1.51	3.17	1.97	0.313	0.514	1.07	1.03	1.01
Urea @1%	1.22	2.88	1.63	0.332	0.430	0.365	1.55	3.31	1.99	0.366	0.494	1.09	1.04	0.99
Urea @ 2%	1.29	2.91	1.88	0.311	0.420	0.405	1.60	3.33	2.28	0.375	0.556	1.13	1.01	1.14
Trehalose @ 10mM	1.51	2.88	1.65	0.375	0.440	0.352	1.89	3.32	2.00	0.331	0.495	1.33	1.00	1.02
Trehalose @20mm	1.64	2.89	1.67	0.385	0.400	0.353	2.03	3.29	2.02	0.346	0.514	1.43	0.99	1.01
Pot nitrae @ 1%	1.44	2.62	1.66	0.302	0.680	0.342	1.74	3.3	2.00	0.340	0.495	1.23	1.00	0.88
Pot.nitrate @ 2%	1.34	2.82	1.73	0.402	0.650	0.354	1.74	3.47	2.08	0.387	0.523	1.23	1.05	1.04
CD@5%	NS	NS	0.138	0.066	NS	0.034	0.285	NS	0.106	0.004	0.0126			

Table 6.6.3: Effect of PGRs on siliquae on main shoot, total siliquae and seeds per siliqua at 3 locations

Treatments	Siliquae on main shoot			Total siliquae/plant			Seeds/siliqua		
	Bharatpur	Hisar	Ludhiana	Bharatpur	Hisar	Ludhiana	Bharatpur	Hisar	Ludhiana
Control (No spray)	44.1	63.0	29.7	208.9	102.0	212.0	13.9	15.6	11.4
Water spray	42.3	74.0	29.9	171.2	126.0	219.0	13.0	15.8	11.8
Urea @1%	42.9	87.0	32.5	196.2	150.0	266.0	13.8	15.9	12.9
Urea @ 2%	43.7	93.0	34.7	210.4	162.0	283.0	14.5	16.2	14.6
Trehalose @ 10mM	45.4	84.0	35.3	330.7	148.0	247.7	13.4	15.7	11.9
Trehalose @20mm	44.3	88.0	36.7	270.4	161.0	267.9	13.5	15.8	12.5
Pot nitrae @ 1%	43.6	95.0	31.2	196.6	168.0	281.0	14.7	16.0	12.8
Pot.nitrate @ 2%	41.1	91.0	32.7	307.2	156.0	286.0	13.7	15.9	13.7
CD@5%	NS	3.47	3.08	NS	40.74	41.7	NS	NS	1.72

Table 6.6.4: Effect of PGRs on test weight, biomass and seed yield at 3 locations

Treatments	Test weight (g)			Biomass			Seed yield		
	Bharatpur	Hisar	Ludhiana	Bharatpur (kg/ha)	Hisar (g/plant)	Ludhiana (kg/ha)	Bharatpur (kg/ha)	Hisar (g/plant)	Ludhiana (kg/ha)
Control (No spray)	4.93	5.40	3.40	12667	130.2	5888	1501	41.2	1159
Water spray	4.54	5.60	3.60	13481	150.5	5911	1444	49.1	1172
Urea @1%	4.26	5.61	3.90	16407	178.0	5888	1836	57.8	1207
Urea @ 2%	4.89	5.64	4.30	15778	190.6	6111	1741	61.2	1236
Trehalose @ 10mM	4.64	5.50	4.17	12404	173.5	5822	1450	56.3	1243
Trehalose @20mm	5.14	5.40	4.50	18889	189.6	6111	1372	60.7	1277
Pot nitrae @ 1%	4.21	5.70	4.49	17556	199.0	5044	1346	62.6	1287
Pot.nitrate @ 2%	4.67	5.65	4.60	16444	180.0	5756	1756	61.3	1371
CD@5%	NS	NS	0.339	2717.9	NS	257.3	NS	2.25	46.01

Table 6.7.1: Influence of microbes on physiological traits under moisture stress at Dholi

Treatment	Dholi											
	RWC (%)				SPAD				Total chlorophyll (mg/g FW)			
	I0	I1	I2	Avg	I0	I1	I2	Avg	I0	I1	I2	Avg
Control (No culture)	68.1	72.1	79.1	73.1	32.9	34.5	40.1	35.8	0.89	0.93	1.68	1.17
Biophos +Biophos	70.3	74.3	85.3	76.6	34.6	37.2	41.0	37.6	0.99	1.69	1.84	1.51
CRIDA MI -I	72.1	80.5	91.1	81.2	36.4	38.1	46.0	40.2	1.43	1.87	2.29	1.86
CRIDA MI-II	73.4	82.7	92.1	82.7	36.4	38.8	47.9	41.0	1.46	1.92	2.43	1.93
MKS-6	71.1	78.6	88.1	79.3	34.7	37.3	42.9	38.3	1.32	1.70	2.25	1.76
MRD-17	71.7	76.4	87.5	78.5	34.3	36.2	42.2	37.6	1.06	1.62	1.93	1.54
Mean	71.1	77.4	79.1		34.9	37.0	43.3		1.19	1.62	2.07	
CD (p=0.05)	I=0.831				I=0.594				I=0.166			
	T=0.491				T=0.993				T=0.224			
	IxT=1.122				IxT=NS				IxT=NS			

I0=No irrigation, I1=50% deficit irrigation, I2=Normal level of irrigation

Table 6.7.2 : Influence of microbes on physiological traits under moisture stress at Ludhiana

Treatment	RWC (%)				SPAD				Proline (mg/g DW)				Total sugars (mg/g DW)			
	I0	I1	I2	Avg	I0	I1	I2	Avg	I0	I1	I2	Avg	I0	I1	I2	Avg
Control (No culture)	70.1	79.3	84.7	78.0	33.8	36.6	40.1	36.8	9.13	9.10	8.90	9.04	208.0	221.1	241.0	223
Biophos+Biophos	88.1	88.2	90.1	88.8	38.2	40.1	49.6	42.6	11.36	9.13	9.05	9.85	248.6	269.8	340.0	286
CRIDA MI -I	83.1	87.8	88.1	86.3	35.5	39.6	43.7	39.6	12.72	12.30	9.25	11.42	273.0	308.7	373.0	318
CRIDA MI-II	81.1	81.5	85.9	82.8	39.4	40.8	46.9	42.4	10.52	11.41	11.20	11.04	227.0	238.5	291.0	252
MKS6	82.3	83.2	86.3	83.9	38.2	40.6	43.7	40.8	11.77	11.38	11.20	11.45	265.5	301.1	301.7	289
MRD17	86.5	87.8	88.1	87.5	35.1	40.2	46.3	40.5	10.81	11.40	11.40	11.21	241.0	251.2	412.0	301
Mean	81.9	84.6	87.2		36.7	39.6	45.1		11.05	10.79	10.17		243.9	265.1	326.5	
CD (p=0.05)	I=1.99				I=0.712				I=0.202				I=2.49			
	T=2.82				T=1.01				T=0.285				T=3.53			
	IxT=4.89				IxT=1.74				IxT=0.494				IxT=6.11			

I0=No irrigation, I1=50% deficit irrigation, I2=Normal level of irrigation

Table 6.7.3: Influence of microbes on photosynthetic pigments under moisture stress at Ludhiana

Treatment	Photosynthetic pigments (mg/g FW)															
	Chl a				Chl b				Total Chl				Carotenoids			
	I0	I1	I2	Avg	I0	I1	I2	Avg	I0	I1	I2	Avg	I0	I1	I2	Avg
Control (No culture)	1.22	1.38	1.49	1.36	0.185	0.251	0.264	0.233	1.48	1.66	1.72	1.62	0.373	0.442	0.507	0.441
Biophos+Biophos	1.24	1.46	1.61	1.44	0.237	0.265	0.281	0.261	1.68	1.73	1.89	1.77	0.509	0.456	0.537	0.501
CRIDA MI -I	1.26	1.58	1.72	1.52	0.221	0.280	0.327	0.276	1.55	1.83	1.94	1.77	0.393	0.543	0.555	0.497
CRIDA MI-II	1.43	1.48	1.59	1.50	0.235	0.260	0.274	0.256	1.52	1.70	1.85	1.69	0.396	0.536	0.567	0.499
MKS6	1.47	1.50	1.54	1.50	0.229	0.312	0.343	0.294	1.70	1.84	1.85	1.80	0.400	0.509	0.607	0.505
MRD17	1.38	1.45	1.61	1.48	0.248	0.277	0.304	0.276	1.66	1.76	1.86	1.76	0.467	0.521	0.523	0.504
Mean	1.33	1.48	1.59		0.226	0.274	0.299		1.60	1.75	1.85		0.423	0.501	0.549	
	I=0.0579				I=NS				I=0.04				I=0.033			
CD (p=0.05)	T=.0820				T=0.0195				T=0.057				T=0.047			
	IxT=0.142				IxT=0.339				IxT=0.0988				IxT=.081			

I0=No irrigation, I1=50% deficit irrigation, I2=Normal level of irrigation

Table 6.8.1: Relative water content as influenced by microbes in Indian mustard at 4 locations

Culture	Varieties	RWC (%)											
		Dholi			Bharatpur			Hisar			Ludhiana		
		NS	LS	Avg	NS	LS	Avg	NS	LS	Avg	NS	LS	Avg
No culture	Giriraj	76.5	62.7	69.6	94.7	92.1	93.4	75.2	55.6	65.4	85.8	83.3	84.6
	PBR357	72.3	59.0	65.6	92.4	90.2	91.3	78.6	57.2	67.9	88.8	87.2	88.0
	RH725	75.2	61.9	68.6	95.1	93.3	94.2	79.1	56.5	67.8	88.8	84.3	86.6
	Mean	74.7	61.2		94.1	91.9		77.6	56.4		87.8	86.8	
Microbial Formulation	Giriraj	93.7	80.5	87.1	95.5	93.4	94.5	82.5	67.4	75.0	87.6	85.8	85.6
	PBR357	87.1	73.0	80.1	93.8	91.1	92.5	83.5	64.0	73.8	87.9	87.2	87.6
	RH725	90.5	75.1	82.8	94.2	92.1	93.1	76.2	54.2	65.2	87.7	87.8	86.3
	Mean	90.4	76.2		94.5	92.2		80.7	61.9		87.7	86.9	
Pusa Sanjeevani	Giriraj	82.5	70.7	76.6	96.3	94.4	95.3	84.9	66.0	75.5	90.4	87.0	88.7
	PBR357	78.5	67.5	73.0	93.7	92.9	93.3	82.4	63.8	73.1	89.5	88.4	88.9
	RH725	80.7	68.2	74.4	93.6	91.6	92.6	90.4	61.4	75.9	90.0	89.1	89.6
	Mean	80.6	68.8		94.5	93.0		85.9	63.7		90.0	88.2	
	Overall Mean	80.7	68.7		94.4	92.4		81.0	60.4		88.5	87.3	
CD (p=0.05)		E=0.947			E=0.489			E=1.678			E=0.23		
		C=1.431			C=0.599			C=2.055			C=0.859		
		ExC=NS			ExC=NS			ExC=2.906			ExC=1.21		
		V=2.380			V=0.599			V=2.055			V=1.115		
		ExV=NS			ExV=NS			ExV=2.906			ExV=0.37		
		CxV=NS			CxV=1.037			CxV=3.559			CxV=0.22		
		ExCxV=NS			ExCxV=NS			ExCxV=NS			ExCxV=0.35		

Table 6.8.2: Membrane stability index as influenced by microbes at Dholi and Ludhiana

Culture	Varieties	MSI (%)						Total Chl (mg/g FW)		
		Dholi			Ludhiana			Dholi		
		NS	LS	Avg	NS	LS	Avg	NS	LS	Avg
No culture	Giriraj	74.5	64.3	69.4	68.0	67.0	67.5	1.99	1.59	1.79
	PBR357	66.2	60.2	63.2	69.2	64.5	66.9	0.98	0.83	0.90
	RH725	69.0	63.5	66.2	68.2	67.2	67.7	1.08	0.86	0.97
	Mean	69.9	62.6		68.5	66.2		1.35	1.09	
Microbial Formulation	Giriraj	84.8	81.3	83.0	70.8	67.4	69.1	2.36	2.16	2.26
	PBR357	76.5	74.1	75.3	68.8	65.8	67.3	2.25	1.95	2.10
	RH725	81.2	76.2	78.7	68.1	67.1	67.6	2.29	2.06	2.17
	Mean	80.8	77.2		69.2	66.8		2.30	2.06	
Pusa Sanjeevani	Giriraj	74.7	72.6	73.7	68.3	66.1	67.2	2.24	1.91	2.07
	PBR357	68.4	64.6	66.5	68.2	67.4	67.8	2.15	1.83	1.99
	RH725	71.7	69.8	70.8	71.3	69.5	70.4	2.20	1.85	2.03
	Mean	71.6	69.0		69.3	67.6		2.20	1.86	
	Overall Mean	74.1	69.6		69.0	66.9		1.93	1.65	
CD (p=0.05)		E=4.411			E=0.21			E=0.040		
		C=2.413			C=0.21			C=0.059		
		E×C=NS			E×C=0.33			E×C=NS		
		V=2.347			V=0.617			V=0.060		
		E×V=NS			E×V=0.872			E×V=NS		
		C×V=NS			C×V=1.068			C×V=0.104		
		E×C×V=NS			E×C×V=1.41			E×C×V=NS		

Table 6.8.3 : Photosynthetic pigments as influenced by microbes in Indian mustard at Bharatpur

Culture	Varieties	Photosynthetic pigments (mg/g FW)											
		Chl a			Chl b			Total Chl			Carotenoids		
		NS	LS	Avg	NS	LS	Avg	NS	LS	Avg	NS	LS	Avg
No culture	Giriraj	1.41	1.06	1.24	0.37	0.27	0.32	1.78	1.34	1.56	0.377	0.256	0.317
	PBR357	1.22	1.04	1.13	0.27	0.23	0.25	1.49	1.27	1.38	0.336	0.253	0.295
	RH725	1.20	1.00	1.10	0.28	0.26	0.27	1.48	1.26	1.37	0.285	0.256	0.271
	Mean	1.28	1.03		0.31	0.25		1.59	1.29		0.333	0.255	
Microbial Formulation	Giriraj	1.67	1.32	1.49	0.37	0.26	0.31	2.04	1.58	1.81	0.381	0.261	0.321
	PBR357	1.30	1.06	1.18	0.29	0.24	0.27	1.60	1.30	1.45	0.340	0.258	0.299
	RH725	1.26	1.14	1.20	0.38	0.27	0.32	1.64	1.40	1.52	0.330	0.258	0.294
	Mean	1.41	1.17		0.34	0.26		1.76	1.43		0.350	0.259	
Pusa Sanjeevani	Giriraj	1.50	1.32	1.41	0.40	0.31	0.36	1.91	1.63	1.77	0.378	0.266	0.322
	PBR357	1.26	1.09	1.18	0.33	0.26	0.30	1.59	1.35	1.47	0.343	0.275	0.309
	RH725	1.41	1.20	1.31	0.38	0.29	0.34	1.80	1.49	1.65	0.352	0.277	0.314
	Mean	1.39	1.21		0.37	0.29		1.77	1.49		0.357	0.272	
	Overall mean	1.36	1.14		0.34	0.27		1.70	1.40		0.347	0.262	
CD (p=0.05)		E=0.083			E=0.04			E=0.091			E=0.001		
		C=0.101			C=NS			C=0.111			C=0.002		
		E×C=NS			E×C=NS			E×C=NS			E×C=0.002		
		V=0.101			V=NS			V=0.111			V=0.002		
		E×V=NS			E×V=NS			E×V=NS			E×V=0.002		
		C×V=NS			C×V=NS			C×V=NS			C×V=0.003		
		E×C×V=NS			E×C×V=NS			E×C×V=NS			E×C×V=0.004		

Table 6.8.4: Photosynthetic pigments as influenced by microbes in Indian mustard at Ludhiana

Culture	Varieties	Photosynthetic pigments (mg/g FW)											
		Chl a			Chl b			Total Chl			Carotenoids		
		NS	LS	Avg	NS	LS	Avg	NS	LS	Avg	NS	LS	Avg
No culture	Giriraj	1.42	1.24	1.33	0.329	0.280	0.304	1.75	1.68	1.52	0.434	0.379	0.406
	PBR357	1.59	1.24	1.42	0.352	0.341	0.346	1.93	1.83	1.50	0.486	0.412	0.449
	RH725	1.59	1.26	1.42	0.425	0.401	0.413	1.99	1.77	1.54	0.517	0.454	0.485
	Mean	1.53	1.25		0.369	0.341		1.89	1.76	1.52	0.479	0.415	
Microbial Formulation	Giriraj	1.35	1.20	1.27	0.334	0.316	0.325	1.68	1.75	1.51	0.443	0.398	0.421
	PBR357	1.54	1.28	1.41	0.406	0.350	0.378	1.89	1.99	1.68	0.480	0.448	0.464
	RH725	1.46	1.21	1.34	0.332	0.308	0.320	1.77	1.98	1.69	0.451	0.426	0.438
	Mean	1.45	1.23		0.357	0.325		1.78	1.91	1.63	0.458	0.424	
Pusa Sanjeevani	Giriraj	1.45	1.14	1.29	0.319	0.266	0.293	1.77	1.77	1.40	0.486	0.389	0.437
	PBR357	1.59	1.14	1.36	0.402	0.360	0.381	1.99	1.99	1.59	0.514	0.382	0.448
	RH725	1.71	1.24	1.47	0.385	0.329	0.357	2.09	2.09	1.57	0.565	0.415	0.490
	Mean	1.58	1.17		0.369	0.318		1.95	1.95	1.52	0.521	0.395	
	Overall mean	1.52	1.22		0.365	0.328		1.87	1.87	1.56	0.486	0.411	
CD (p=0.05)		E=0.016			E=0.0093			E=0.033			E=0.0099		
		C=0.024			C=0.0086			C=0.0336			C=0.00986		
		ExC=0.034			ExC=0.0122			ExC=0.047			ExC=0.0139		
		V=0.021			V=0.0091			V=.0311			V=0.00821		
		ExV=0.036			ExV=0.0129			ExV=0.044			ExV=NS		
		CxV=0.375			CxV=0.0159			CxV=0.054			CxV=0.0142		
		ExCxV=NS			ExCxV=0.0224			ExCxV=0.076			ExCxV=0.02011		

Table 6.8.5: Canopy temperature (CT °C) as influenced by microbes at 3 locations

Culture	Varieties	CT (°C)								
		Bharatpur			Hisar			Ludhiana		
		NS	LS	Avg	NS	LS	Avg	NS	LS	Avg
No culture	Giriraj	19.0	19.5	19.3	28.3	31.4	29.8	25.6	25.7	25.7
	PBR357	18.4	19.9	19.2	27.4	30.7	29.0	25.0	23.2	24.1
	RH725	18.2	19.3	18.8	27.7	28.4	28.0	22.8	23.1	23.0
	Mean	18.5	19.6		27.8	30.2		24.5	24.0	
Microbial Formulation	Giriraj	16.7	20.1	18.4	28.5	28.8	28.6	24.6	23.7	24.2
	PBR357	17.1	20.9	19.0	27.2	30.9	29.0	24.8	25.6	25.2
	RH725	16.6	20.1	18.3	25.9	27.1	26.5	23.7	22.1	22.9
	Mean	16.8	20.4		27.2	28.9		24.4	23.8	
Pusa Sanjeevani	Giriraj	16.4	19.4	17.9	28.7	30.1	29.4	24.2	23.4	23.8
	PBR357	16.7	18.2	17.5	29.3	29.9	29.6	21.5	21.1	21.3
	RH725	17.1	18.5	17.8	27.5	29.8	28.6	23.8	25.5	24.6
	Mean	16.7	18.7		28.5	29.9		23.1	23.3	23.2
	Overall mean	17.4	19.6		27.8	29.7		24.0	23.7	
CD (p=0.05)		E=0.494			E=0.918			E=NS		
		C=0.604			C=NS			C=0.261		
		ExC=0.855			ExC=NS			ExC=0.369		
		V=NS			V=1.124			V=0.289		
		ExV=NS			ExV=NS			ExV=0.409		
		CxV=NS			CxV=NS			CxV=0.501		
		ExCxV=NS			ExCxV=NS			ExCxV=0.709		

Table 6.8.6: Canopy temperature depression (CTD °C) as influenced by microbes in Indian mustard

Culture	Varieties	CTD (°C)								
		Bharatpur			Hisar			Ludhiana		
		NS	LS	Avg	NS	LS	Avg	NS	LS	Avg
No culture	Giriraj	-7.0	-6.5	-6.7	-6.9	-5.4	-6.15	-3.1	-4.1	-3.6
	PBR357	-7.6	-6.1	-6.9	-5.8	-4.8	-5.3	-2.3	-5.3	-3.8
	RH725	-7.8	-6.7	-7.2	-3.8	-3.6	-3.7	-2.9	-4.4	-3.7
	Mean	-7.5	-6.4		-5.5	-4.6		-2.8	-4.6	
Microbial Formulation	Giriraj	-9.3	-5.9	-7.6	-4.4	-3.8	-4.1	-2.0	-2.2	-2.1
	PBR357	-8.9	-5.1	-7.0	-6.5	-5.3	-5.9	-1.3	-1.2	-1.3
	RH725	-9.4	-5.9	-7.7	-2.5	-2.8	-2.65	-3.4	-4.7	-4.1
	Mean	-9.2	-5.6		-4.5	-4.0		-2.2	-2.7	
Pusa Sanjeevani	Giriraj	-9.6	-6.6	-8.1	-4.9	-4.6	-4.75	-2.7	-3.1	-2.9
	PBR357	-9.3	-7.8	-8.5	-3.9	-4.6	-4.25	-1.1	-2.4	-1.8
	RH725	-8.9	-7.5	-8.2	-4.4	-4.3	-4.35	-1.8	-3.2	-2.5
	Mean	-9.3	-7.3		-4.4	-4.5		-1.9	-2.9	
	Overall mean	-8.6	-6.4		-4.8	-4.4		-2.3	-3.5	
CD (p=0.05)		E=0.494			E=0.103			E=1.13		
		C=0.604			C=0.126			C=0.307		
		ExC=0.855			ExC=0.178			ExC=0.434		
		V=NS			V=0.126			V=0.248		
		ExV=NS			ExV=0.178			ExV=0.350		
		CxV=NS			CxV=0.218			CxV=0.429		
		ExCxV=NS			ExCxV=0.308			ExCxV=0.607		

Table 6.8.7: Total siliquae per plant as influenced by microbes at 4 locations in Indian mustard

Culture	Varieties	Total siliquae /plant											
		Dholi			Bharatpur			Hisar			Ludhiana		
		NS	LS	Avg	NS	LS	Avg	NS	LS	Avg	NS	LS	Avg
No culture	Giriraj	230.2	213.0	221.6	111.9	188.8	150.3	271.5	209.3	240.4	130.3	112.7	121.5
	PBR357	221.0	205.6	213.3	270.8	171.6	221.2	314.5	224.4	269.5	198.5	118.6	158.6
	RH725	226.1	210.0	218.1	168.6	208.2	188.4	237.6	170.1	203.9	209.3	111.6	160.4
	Mean	225.8	209.5		183.7	189.5		274.5	201.3		179.4	114.3	
Microbial Formulation	Giriraj	258.1	231.0	244.6	106.1	196.0	151.1	203.0	163.3	183.2	136.9	114.5	125.7
	PBR357	248.0	226.6	237.3	153.9	198.3	176.1	325.7	271.8	298.8	209.4	124.5	167.0
	RH725	251.1	229.6	240.4	157.0	211.1	184.1	282.9	222.7	252.8	221.0	120.6	170.8
	Mean	252.4	229.1		139.0	201.8		270.5	219.3		189.1	119.9	
Pusa Sanjeevani	Giriraj	240.4	219.2	229.8	107.4	182.6	145.0	297.7	224.0	260.9	224.9	122.1	173.5
	PBR357	232.0	212.7	222.4	162.3	247.7	205.0	302.2	232.0	267.1	224.7	128.3	176.5
	RH725	235.2	212.8	224.0	190.0	197.9	193.9	346.7	254.0	300.4	209.9	127.0	168.5
	Mean	235.8	214.9		153.3	209.4		315.5	236.7		219.8	125.8	
	Overall Mean	238.0	217.9		158.7	200.2		286.9	219.1		202.1	120.7	
CD (p=0.05)		E=0.815			E=6.50			E=7.853			E=10.5		
		C=1.259			C= 6.402			C=9.618			C=3.01		
		ExC=1.781			ExC=NS			ExC=13.602			ExC=4.26		
		V=0.906			V= 5.22			V=9.618			V=3.83		
		ExV=1.282			ExV=NS			ExV=NS			ExV=5.41		
		CxV=NS			CxV= 9.04			CxV=16.659			CxV=6.63		
		ExCxV=2.220			ExCxV=NS			ExCxV=NS			ExCxV=9.38		

Table 6.8.8: Test weight as influenced by microbes at 4 locations in Indian mustard

Culture	Varieties	Test weight (g)											
		Dholi			Bharatpur			Hisar			Ludhiana		
		NS	LS	Avg	NS	LS	Avg	NS	LS	Avg	NS	LS	Avg
No culture	Giriraj	4.77	3.97	4.37	6.21	2.26	4.24	4.82	3.84	4.33	6.20	4.38	5.29
	PBR357	4.63	3.47	4.05	4.64	1.55	3.09	4.59	2.96	3.78	5.23	4.23	4.73
	RH725	4.23	3.53	3.88	5.73	1.68	3.71	4.61	2.79	3.70	6.52	4.46	5.49
	Mean	4.54	3.66		5.53	1.83		4.67	3.20		5.99	4.36	
Microbial Formulation	Giriraj	7.4	5.27	6.33	6.89	1.76	4.33	4.53	3.46	4.00	6.10	5.30	5.70
	PBR357	6.47	4.87	5.67	5.31	1.94	3.63	4.50	2.93	3.72	5.13	3.77	4.45
	RH725	6.67	4.73	5.70	6.05	1.56	3.81	4.70	3.35	4.03	4.87	3.97	4.42
	Mean	6.84	4.96		6.08	1.75		4.58	3.25		5.37	4.35	
Pusa Sanjeevani	Giriraj	6.1	4.47	5.28	6.47	2.66	4.56	4.31	3.16	3.74	6.58	4.29	5.43
	PBR357	5.13	4.13	4.63	5.07	1.93	3.50	4.53	2.79	3.66	5.06	3.84	4.45
	RH725	5.27	4.17	4.72	5.12	2.32	3.72	4.76	3.00	3.88	5.46	4.26	4.86
	Mean	5.50	4.26		5.55	2.30	3.93	4.53	2.98		5.70	4.13	
	Overall Mean	5.63	4.29		5.72	1.96		4.57	3.14		5.64	4.27	
CD (p=0.05)		E=0.186			E=0.373			E=0.136			E=0.150		
		C=0.273			C=NS			C=NS			C=.106		
		ExC=0.386			ExC=NS			ExC=NS			ExC=0.151		
		V=0.204			V=0.457			V=0.167			V=0.096		
		ExV= NS			ExV=NS			ExV=0.236			ExV=.135		
		CxV=NS			CxV=NS			CxV=0.289			CxV=0.166		
		ExCxV=NS			ExCxV=NS			ExCxV=NS			ExCxV=0.235		

Table 6.8.9: Biological yield as influenced by microbes in Indian mustard

Culture	Varieties	Biological yield								
		Bharatpur (kg/ha)			Hisar (g/plant)			Ludhiana (kg/ha)		
		NS	LS	Avg	NS	LS	Avg	NS	LS	Avg
No culture	Giriraj	7716	6902	7309	22.0	16.9	19.5	3833	2459	3146
	PBR357	7531	8223	7877	22.7	16.0	19.4	4389	2463	3426
	RH725	9136	10206	9671	25.3	17.8	21.6	3278	2296	2787
	Mean	8128	8443		23.3	16.9		3833	2406	
Microbial Formulation	Giriraj	7160	10720	8940	24.0	18.9	21.5	3833	2494	3164
	PBR357	8642	8517	8579	32.7	25.4	29.1	4444	3053	3749
	RH725	10185	9618	9902	23.3	17.2	20.3	4148	2548	3348
	Mean	8663	9618		26.7	20.5		4142	2698	
Pusa Sanjeevani	Giriraj	8148	9178	8663	24.0	18.7	21.4	4444	2537	3491
	PBR357	10741	8517	9629	26.0	19.1	22.6	4685	2815	2815
	RH725	9444	9545	9495	24.7	18.4	21.6	4019	2630	3324
	Mean	9444	9080		24.9	18.7		4383	2660	
	Overall Mean	8745	9047		25.0	18.7		4119	2588	
CD (p=0.05)		E= 115.1			E=0.928			E=203.1		
		C= 303.2			C=1.137			C=138.4		
		ExC=NS			ExC=NS			ExC=195.8		
		V=448.5			V=1.137			V=100.4		
		ExV=634.3			ExV=NS			ExV=142.1		
		CxV=776.8			CxV=1.969			CxV=174.0		
		ExCxV=1098.6			ExCxV=NS			ExCxV=246.1		

Table 6.8.10 : Seed yield as influenced by microbes in Indian mustard at 4 locations

Culture	Varieties	Seed yield											
		Dholi (kg/ha)			Bharatpur (kg/ha)			Hisar (g/plant)			Ludhiana (kg/ha)		
		NS	LS	Avg	NS	LS	Avg	NS	LS	Avg	NS	LS	Avg
No culture	Giriraj	494.5	411.5	453.0	869	781	825	88.3	56.6	72.4	1081	730	952
	PBR357	475.3	384.7	430.0	853	830	841	87.7	55.3	71.5	941	715	828
	RH725	478.3	388.9	433.6	935	1263	1099	89.6	53.9	71.8	1060	713	886
	Mean	482.7	395.1		886	958		88.5	55.3		1058	719	
Microbial Formulation	Giriraj	562.0	469.7	515.9	1123	1316	1220	89.2	61.2	75.2	1174	748	914
	PBR357	535.2	450.7	492.9	870	910	890	110.6	69.3	90.0	1041	802	922
	RH725	545.2	453.6	499.4	1119	852	985	94.7	73.9	84.3	1080	739	894
	Mean	547.5	458.0		1037	1026		98.2	68.1		1057	763	
Pusa Sanjeevani	Giriraj	526.3	430.9	478.6	1572	1066	1319	91.9	51.9	71.9	1255	791	1023
	PBR357	495.4	412.3	453.8	1107	1131	1119	98.2	63.5	80.8	1172	788	980
	RH725	517.6	419.7	468.6	1006	2492	1749	85.0	69.1	77.0	1184	767	975
	Mean	513.1	421.0		1228	1563		91.7	61.5		1203	782	
	Overall mean	514.4	424.7		1050	1182		92.8	61.6		1101	752	
CD (p=0.05)		E=10.01			E=134.2			E=0.537			E=59.6		
		C=5.43			C=58.14			C=0.658			C=35.3		
		V=5.43			ExC=NA			ExC=0.93			ExC=50.0		
		E×C=NS			V=43.4			V=0.658			V=24.4		
		E×V= NS			ExV=61.4			ExV=0.93			ExV=34.5		
		C×V=NS			CxV=75.2			CxV=1.139			CxV=42.2		
		E×C×V=NS			ExVxC=106.3			ExC×V=1.611			ExC×V=59.7		

7. Biochemistry

7.1 Evaluation of important breeding materials for nutritional quality index (NQI) of oil.

Parameters: Oil percent, Fatty acid profiling, $\omega 6/\omega 3$, Oil stability index, SFA: MUFA: PUFA, Saturated and unsaturated ratio.

Centres: Bharatpur, Ludhiana, Pantnagar and Hisar
PM-30 and PDZ-1 (Quality check)

7.1.1. Oil percent

Oil percentage of seventeen genotypes was analysed at four centers i.e. Bharatpur, Ludhiana, Pantnagar and Hisar. It ranged from 34% (LES-64) to 40% (DRMR Q143-9). (Table 1)

7.1.2 Oil Stability Index of Quality

Oil stability index which is the ratio of MUFA: PUFA was analyzed at four centres (Bharatpur, Pantnagar, Hisar and Ludhiana). On the basis of mean estimates, it ranged from 0.86 in DRMR Q143-9 to 1.70 in PDZM-31 (CV \leq 0.20). (Table 2).

7.1.3 Fatty Acid Profiling

Entries of IVT/AVT quality trials were analysed for fatty acid profile at Bharatpur, Pantnagar, Hisar and Ludhiana. LES-64, LES-65, PDZ-16, PDZ-17, RH (OE)-1612, RH (OE)-1808, DRMRQ 143-9, DRMRQ 4-3, PM-30, PM-32, RH (OE)-1807, PDZ-14, LES-60, RH (OE)-1706, PM-29, PDZ-15 and PDZM-31 ranged from

Palmitic acid: 2.86% (DRMRQ 143-9) to 5.13 % (PDZ-16). (CV \leq 0.17).

Stearic acid: 1.26 % (DRMRQ 143-9) to 2.73% (LES-60). (CV \leq 0.19).

Oleic acid: 13.02 % (DRMRQ 143-9) to 50.66 % (PDZM-31). (CV \leq 0.21).

Linoleic acid: 15.13 % (DRMRQ 143-9) to 42.11 % (PDZ-16). (CV \leq 0.20).

Linolenic acid: 10.36 % (LES-65) to 21.16 % (DRMRQ 143-9). (CV \leq 0.24).

Eicosanoic acid: 0.56 % (RH (OE)-1807) to 1.31 % (DRMRQ 143-9). (CV \leq 24).

Erucic acid: 0.33 % (PM-32) to 46.18 % (DRMRQ 143-9). (CV \leq 2.23)

$\omega 6:\omega 3$ ratio ranged from 0.72 (DRMRQ 143-9) to 3.97 (PDZ-16). (CV \leq 0.37).

Saturated Fatty Acid ranged from **4.36** (DRMRQ 143-9) to 7.61 (PDZ-16). (CV \leq 0.15)

SFA: MUFA: PUFA ratio ranged between 1:05:07 to 1:19:11.

Saturated and unsaturated ratio ranged between 1:12 to 1:30. (Table 3-13)

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

Parameters: Seed meal-protein content, Total antioxidant activity, β -carotene content and Total sinapic acid content

Centres: Bharatpur, Pantnagar, Hisar, Ludhiana
PM-30 and PDZ-1 (Quality check)

➤ **Total Protein:** 29.61 (PM-32) to 33.88% (PM-29) (CV \leq 0.05).

➤ **Total antioxidant capacity** ranged from 14.54 (PDZ-14) to 23.04 (LES-64) mg/g AAE (CV \leq 0.15).

➤ **β -carotene** ranged from 2.99% (LES-65) to 5.01% (LES-60) (CV \leq 0.13).

➤ **Total sinapic acid content** ranged from 1.25% (LES-60) to 2.23% (RH(OE)-1807) (CV \leq 0.15).

➤ **Mineral composition in seed meal of promising breeding materials (Center: Pantnagar)**

Seventeen genotypes obtained from DRMR, Bharatpur were analyzed for mineral composition. The copper content in meal was analyzed through AAS and range varies from 0.210 to 0.888 ppm. The promising genotypes having high copper content were PM-30 (0.89), DRMRQ 143-9 (0.86), LES-60

(0.82).The zinc content varies from 0.345 to 0.957ppm. The promising genotypes having high zinc content were Biochem-PDZ-15 (0.957), RH(OE)-1808 (0.854), LES-60 (0.845), PM-30 (0.833). The Iron content varies from 4.448 to 16.58ppm. The promising genotypes having high iron content were PM-30 (16.58), RH (OE)-1808 (15.48), PDZ-15 (13.38). The Mn content varies from 0.171 to 0.614ppm. The promising genotypes having high Mn content were PM-30 (0.614), RH (OE)-1612 (0.518). (Table: 14-18)

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

Parameters: Total Glucosinolates and Phytic acid

Centres: Bharatpur, Pantnagar, Hisar, Ludhiana

Entries of IVT/AVT quality trials were evaluated at Bharatpur, Ludhiana, Kangra, Kanpur, Pantnagar, and Hisar.

Total Glucosinolate mean values for five centres (Bharatpur, Pantnagar, Ludhiana, Hisar) were <30 $\mu\text{mol/g}$ in PDZ-16, PDZ-17, PDZ-14, PDZ-15 and PDZM-31 genotypes. **Glucosinolate** ranged from 15.93% (PDZ-16) to 62.02% (LES-60) ($\text{CV} \leq 0.34$).

Phytic acid content mean values were < 2.25% in LES-64, LES-65, DRMR Q 143-9, PM-30, PM-32, PM-29, PDZ-15 and PDZM-31 (Table 18-19($\text{CV} \leq 0.215$)).

Screening of different types of glucosinolates::

Glucosinolate profiling was carried out by UPLC/HPLC at Ludhiana and Bharatpur centers. Aliphatic glucosinolates were identified as sinigrin, tropeolinguconapin and few unknown peaks were unidentified. (table: 19-21)

Statistical analysis:

Data was statistically analysed using SPSS 2.0 software.

Table 1: Oil Percent

S.NO.	Code	Genotypes	BPR	HSR	LDH	PNT	Mean	STDEV	CV
1.	Biochem-1-21	LES-64	28	39	33	37	34	4.8	0.1
2.	Biochem-2-21	LES-65	33	39	34	38	36	2.9	0.1
3.	Biochem-3-21	PDZ-16	33	39	33	39	36	3.3	0.1
4.	Biochem-4-21	PDZ-17	38	39	38	36	38	1.1	0.0
5.	Biochem-5-21	RH (OE)-1612	38	39	38	37	38	0.8	0.0
6.	Biochem-6-21	RH (OE)-1808	41	39	37	39	39	1.3	0.0
7.	Biochem-7-21	DRMRQ 143-9	41	39	41	39	40	1.5	0.0
8.	Biochem-8-21	DRMRQ 4-3	39	40	39	40	39	0.3	0.0
9.	Biochem-9-21	PM-30	39	39	37	38	38	0.8	0.0
10.	Biochem-10-21	PM-32	37	40	39	39	39	1.0	0.0
11.	Biochem-11-21	RH (OE)-1807	39	39	36	38	38	1.5	0.0
12.	Biochem-12-21	PDZ-14	35	39	35	36	36	1.6	0.0
13.	Biochem-13-21	LES-60	34	39	35	37	36	2.3	0.1
14.	Biochem-14-21	RH (OE)-1706	41	39	37	38	39	1.5	0.0
15.	Biochem-15-21	PM-29	32	39	33	39	36	3.5	0.1
16.	Biochem-16-21	PDZ-15	37	39	36	37	37	1.3	0.0
17.	Biochem-17-21	PDZM-31	39	39	40	38	39	0.8	0.0

Table 2: Oil Stability Index (OSI)

S.NO.	Code	Genotypes	BPR	HSR	LDH	PNT	Mean	STDEV	CV
1.	Biochem-1-21	LES-64	1.41	1.36	1.42	1.54	1.43	0.08	0.05
2.	Biochem-2-21	LES-65	1.09	1.10	1.04	1.18	1.10	0.06	0.05
3.	Biochem-3-21	PDZ-16	0.92	0.88	0.89	1.02	0.93	0.06	0.07
4.	Biochem-4-21	PDZ-17	1.43	1.34	1.38	1.38	1.39	0.04	0.03
5.	Biochem-5-21	RH (OE)-1612	1.28	1.42	1.29	1.33	1.33	0.06	0.05
6.	Biochem-6-21	RH (OE)-1808	1.18	1.15	1.19	1.27	1.20	0.05	0.04
7.	Biochem-7-21	DRMRQ 143-9	0.93	0.86	0.83	0.82	0.86	0.05	0.05
8.	Biochem-8-21	DRMRQ 4-3	1.44	1.55	1.45	1.34	1.45	0.09	0.06
9.	Biochem-9-21	PM-30	1.76	1.68	1.73	1.56	1.68	0.09	0.05
10.	Biochem-10-21	PM-32	1.66	1.60	1.53	1.73	1.63	0.08	0.05
11.	Biochem-11-21	RH (OE)-1807	1.39	1.30	1.35	1.38	1.36	0.04	0.03
12.	Biochem-12-21	PDZ-14	0.98	0.95	0.97	1.05	0.99	0.04	0.04
13.	Biochem-13-21	LES-60	1.36	1.40	1.42	1.37	1.39	0.03	0.02
14.	Biochem-14-21	RH (OE)-1706	1.29	1.31	1.32	1.36	1.32	0.03	0.02
15.	Biochem-15-21	PM-29	1.23	1.34	1.22	1.21	1.25	0.06	0.05
16.	Biochem-16-21	PDZ-15	1.08	1.03	1.04	1.05	1.05	0.02	0.02
17.	Biochem-17-21	PDZM-31	1.68	1.66	1.76	1.69	1.70	0.05	0.03

Table 3: Palmitic acid (%)

S.NO.	Code	Genotypes	BPR	HSR	LDH	PNT	Mean	STDEV	CV
1.	Biochem-1-21	LES-64	4.31	3.98	4.34	3.73	4.09	0.29	0.07
2.	Biochem-2-21	LES-65	4.2	4.74	4.83	4.99	4.69	0.34	0.07
3.	Biochem-3-21	PDZ-16	4.77	5.09	5.14	5.51	5.13	0.30	0.06
4.	Biochem-4-21	PDZ-17	4.14	4.43	4.54	4.49	4.40	0.18	0.04
5.	Biochem-5-21	RH (OE)-1612	2.86	3.21	3.90	3.24	3.30	0.43	0.13
6.	Biochem-6-21	RH (OE)-1808	3.66	3.65	3.76	3.18	3.56	0.26	0.07
7.	Biochem-7-21	DRMRQ 143-9	4.28	1.95	3.02	2.19	2.86	1.05	0.37
8.	Biochem-8-21	DRMRQ 4-3	3.25	3.24	3.10	3.18	3.19	0.07	0.02
9.	Biochem-9-21	PM-30	3.34	3.59	3.60	3.57	3.53	0.12	0.04
10.	Biochem-10-21	PM-32	3.36	3.37	3.49	4.16	3.59	0.38	0.11
11.	Biochem-11-21	RH (OE)-1807	2.78	3.55	3.70	3.98	3.50	0.51	0.15
12.	Biochem-12-21	PDZ-14	5.7	4.69	5.10	4.26	4.94	0.61	0.12
13.	Biochem-13-21	LES-60	3.66	4.15	4.00	4.17	4.00	0.24	0.06
14.	Biochem-14-21	RH (OE)-1706	2.94	3.43	3.34	3.28	3.25	0.21	0.07
15.	Biochem-15-21	PM-29	4.12	4.45	4.69	3.37	4.16	0.57	0.14
16.	Biochem-16-21	PDZ-15	4.48	4.48	4.55	3.74	4.31	0.38	0.09
17.	Biochem-17-21	PDZM-31	3.43	3.69	3.66	4.19	3.74	0.32	0.09

Table 4: Stearic acid (%)

S.NO.	Code	Genotypes	BPR	HSR	LDH	PNT	Mean	STDEV	CV
1.	Biochem-1-21	LES-64	2.77	2.36	2.36	2.33	2.46	0.21	0.09
2.	Biochem-2-21	LES-65	2.76	2.66	2.66	2.74	2.71	0.05	0.02
3.	Biochem-3-21	PDZ-16	2.46	2.21	2.21	2.91	2.45	0.33	0.13
4.	Biochem-4-21	PDZ-17	2.39	2.17	2.17	2.65	2.35	0.23	0.10
5.	Biochem-5-21	RH (OE)-1612	1.32	1.87	1.87	1.81	1.72	0.27	0.16
6.	Biochem-6-21	RH (OE)-1808	1.98	1.89	1.89	1.67	1.86	0.13	0.07
7.	Biochem-7-21	DRMRQ 143-9	1.48	1.22	1.22	1.1	1.26	0.16	0.13
8.	Biochem-8-21	DRMRQ 4-3	1.87	2.13	2.13	1.91	2.01	0.14	0.07
9.	Biochem-9-21	PM-30	1.87	2.87	2.87	2.79	2.60	0.49	0.19
10.	Biochem-10-21	PM-32	2.54	2.17	2.17	1.73	2.15	0.33	0.15
11.	Biochem-11-21	RH (OE)-1807	1.92	2.11	2.11	2.01	2.04	0.09	0.04
12.	Biochem-12-21	PDZ-14	2.7	2.54	2.54	2.71	2.62	0.10	0.04
13.	Biochem-13-21	LES-60	2.79	2.64	2.64	2.84	2.73	0.10	0.04
14.	Biochem-14-21	RH (OE)-1706	2.48	2.04	2.04	1.96	2.13	0.24	0.11
15.	Biochem-15-21	PM-29	2.65	2.53	2.53	2.15	2.47	0.22	0.09
16.	Biochem-16-21	PDZ-15	2.68	2.39	2.39	2.92	2.60	0.26	0.10
17.	Biochem-17-21	PDZM-31	2.9	2.81	2.81	2.63	2.79	0.11	0.04

Table 5: Oleic acid (%)

S.NO.	Code	Genotypes	BPR	HSR	LDH	PNT	Mean	STDEV	CV
1.	Biochem-1-21	LES-64	46.89	46.31	46.15	48.76	47.03	1.20	0.03
2.	Biochem-2-21	LES-65	42.32	43.06	41.06	43.25	42.42	0.99	0.02
3.	Biochem-3-21	PDZ-16	40.11	38.51	38.07	39.17	38.96	0.89	0.02
4.	Biochem-4-21	PDZ-17	48.91	47.23	47.01	46.13	47.32	1.16	0.02
5.	Biochem-5-21	RH (OE)-1612	37.98	39.95	40.85	36.4	38.79	1.99	0.05
6.	Biochem-6-21	RH (OE)-1808	42.69	40.23	42.07	42.56	41.89	1.14	0.03
7.	Biochem-7-21	DRMRQ 143-9	14.12	11.91	12.26	13.81	13.02	1.10	0.08
8.	Biochem-8-21	DRMRQ 4-3	37.49	39.11	37.73	36.29	37.66	1.16	0.03
9.	Biochem-9-21	PM-30	48.97	48.47	49.32	44.02	47.69	2.47	0.05
10.	Biochem-10-21	PM-32	47.52	46.74	45.87	48.66	47.20	1.19	0.03
11.	Biochem-11-21	RH (OE)-1807	45.46	43.22	44.87	42.71	44.07	1.31	0.03
12.	Biochem-12-21	PDZ-14	41.48	39.19	40.09	40.54	40.32	0.95	0.02
13.	Biochem-13-21	LES-60	45.8	46.78	47.66	43.36	45.90	1.85	0.04
14.	Biochem-14-21	RH (OE)-1706	43.87	42.39	43.92	44.19	43.59	0.81	0.02
15.	Biochem-15-21	PM-29	44.13	45.61	43.93	44.65	44.58	0.75	0.02
16.	Biochem-16-21	PDZ-15	41.23	40.31	40.79	40.11	40.61	0.50	0.01
17.	Biochem-17-21	PDZM-31	50.04	51.05	52.81	48.72	50.66	1.72	0.03

Table 6: Linoleic acid (%)

S.NO.	Code	Genotypes	BPR	HSR	LDH	PNT	Mean	STDEV	CV
1.	Biochem-1-21	LES-64	33.24	34.15	32.40	31.65	32.86	1.08	0.03
2.	Biochem-2-21	LES-65	38.71	39.21	39.42	36.49	38.46	1.34	0.03
3.	Biochem-3-21	PDZ-16	43.65	43.61	42.84	38.32	42.11	2.55	0.06
4.	Biochem-4-21	PDZ-17	34.11	35.12	33.97	33.39	34.15	0.72	0.02
5.	Biochem-5-21	RH (OE)-1612	29.65	28.22	31.65	27.33	29.21	1.88	0.06
6.	Biochem-6-21	RH (OE)-1808	36.31	35.06	35.29	33.32	35.00	1.24	0.04
7.	Biochem-7-21	DRMRQ 143-9	15.26	13.91	14.69	16.65	15.13	1.16	0.08
8.	Biochem-8-21	DRMRQ 4-3	26.11	25.21	25.98	27.02	26.08	0.74	0.03
9.	Biochem-9-21	PM-30	27.87	28.77	28.43	28.04	28.28	0.40	0.01
10.	Biochem-10-21	PM-32	28.69	29.28	29.92	28.02	28.98	0.81	0.03
11.	Biochem-11-21	RH (OE)-1807	32.76	33.15	33.26	30.82	32.50	1.14	0.04
12.	Biochem-12-21	PDZ-14	42.19	41.29	41.26	38.43	40.79	1.63	0.04
13.	Biochem-13-21	LES-60	33.78	33.41	33.56	31.55	33.08	1.03	0.03
14.	Biochem-14-21	RH (OE)-1706	33.93	32.31	33.26	32.34	32.96	0.78	0.02
15.	Biochem-15-21	PM-29	35.79	34.08	36.12	36.69	35.67	1.12	0.03
16.	Biochem-16-21	PDZ-15	38.29	39.22	39.17	38.02	38.67	0.61	0.02
17.	Biochem-17-21	PDZM-31	29.85	30.81	30.00	28.8	29.86	0.83	0.03

Table 7: Linolenic acid (%)

S.NO.	Code	Genotypes	BPR	HSR	LDH	PNT	Mean	STDEV	CV
1.	Biochem-1-21	LES-64	12.94	11.43	13.50	10.8	12.17	1.26	0.10
2.	Biochem-2-21	LES-65	10.88	9.03	11.38	10.14	10.36	1.02	0.10
3.	Biochem-3-21	PDZ-16	11.19	9.24	11.05	11.37	10.71	0.99	0.09
4.	Biochem-4-21	PDZ-17	12.21	9.41	11.91	9.62	10.79	1.48	0.14
5.	Biochem-5-21	RH (OE)-1612	15.95	15.16	15.22	16.91	15.81	0.82	0.05
6.	Biochem-6-21	RH (OE)-1808	14.98	16.34	15.84	15.13	15.57	0.63	0.04
7.	Biochem-7-21	DRMRQ 143-9	22.18	21.24	21.24	19.96	21.16	0.91	0.04
8.	Biochem-8-21	DRMRQ 4-3	17.99	18.22	18.88	16.81	17.97	0.86	0.05
9.	Biochem-9-21	PM-30	15.32	13.46	13.92	17.38	15.02	1.76	0.12
10.	Biochem-10-21	PM-32	18.93	17.43	18.07	14.46	17.22	1.94	0.11
11.	Biochem-11-21	RH (OE)-1807	16.43	16.08	15.12	18.18	16.45	1.28	0.08
12.	Biochem-12-21	PDZ-14	11.54	10.26	10.40	11.46	10.92	0.68	0.06
13.	Biochem-13-21	LES-60	11.62	11.34	10.93	14.11	12.00	1.44	0.12
14.	Biochem-14-21	RH (OE)-1706	17.32	16.42	16.31	14.83	16.22	1.03	0.06
15.	Biochem-15-21	PM-29	11.79	12.22	11.91	11.3	11.80	0.38	0.03
16.	Biochem-16-21	PDZ-15	12.92	12.14	12.11	11.42	12.15	0.61	0.05
17.	Biochem-17-21	PDZM-31	10.39	10.05	9.36	12.18	10.49	1.20	0.11

Table 8: Eicosanoic acid (%)

S.NO.	Code	Genotypes	BPR	HSR	LDH	PNT	Mean	STDEV	CV
1.	Biochem-1-21	LES-64	0.83	0.93	0.20	1.13	0.77	0.40	0.52
2.	Biochem-2-21	LES-65	1.32	1.05	0.30	1.47	1.04	0.52	0.50
3.	Biochem-3-21	PDZ-16	0.42	0.82	0.29	1.11	0.66	0.38	0.57
4.	Biochem-4-21	PDZ-17	0.58	1.27	0.11	1.84	0.95	0.76	0.80
5.	Biochem-5-21	RH (OE)-1612	1.32	0.82	0.58	1.66	1.10	0.49	0.44
6.	Biochem-6-21	RH (OE)-1808	0.54	1.45	0.41	2.37	1.19	0.91	0.76
7.	Biochem-7-21	DRMRQ 143-9	1.5	1.05	1.86	0.84	1.31	0.46	0.35
8.	Biochem-8-21	DRMRQ 4-3	0.5	0.93	0.82	0.99	0.81	0.22	0.27
9.	Biochem-9-21	PM-30	0.71	0.88	0.37	1.51	0.87	0.48	0.55
10.	Biochem-10-21	PM-32	1.2	0.75	0.19	2.2	1.08	0.85	0.79
11.	Biochem-11-21	RH (OE)-1807	0.4	0.68	0.38	0.76	0.56	0.19	0.35
12.	Biochem-12-21	PDZ-14	0.96	1.12	0.30	0.94	0.83	0.36	0.44
13.	Biochem-13-21	LES-60	0.68	1.52	0.30	2.08	1.15	0.81	0.70
14.	Biochem-14-21	RH (OE)-1706	1.01	1.44	0.41	2.26	1.28	0.78	0.61
15.	Biochem-15-21	PM-29	0.64	0.95	0.26	1.01	0.71	0.35	0.48
16.	Biochem-16-21	PDZ-15	0.98	0.83	0.30	1.92	1.01	0.68	0.67
17.	Biochem-17-21	PDZM-31	0.79	1.07	0.22	2.31	1.10	0.88	0.80

Table 9: Erucic acid (%)

S.NO.	Code	Genotypes	BPR	HSR	LDH	PNT	Mean	STDEV	CV
1.	Biochem-1-21	LES-64	0.72	0.84	0.84	1.26	0.91	0.24	0.26
2.	Biochem-2-21	LES-65	0.51	0.25	0.26	0.82	0.46	0.27	0.58
3.	Biochem-3-21	PDZ-16	0.83	0.52	0.26	1.61	0.81	0.59	0.73
4.	Biochem-4-21	PDZ-17	0.17	0.37	0.06	1.78	0.60	0.80	1.35
5.	Biochem-5-21	RH (OE)-1612	6.12	10.77	5.57	12.65	8.78	3.48	0.40
6.	Biochem-6-21	RH (OE)-1808	1.48	1.38	0.24	1.72	1.20	0.66	0.55
7.	Biochem-7-21	DRMRQ 143-9	46.48	48.72	44.75	44.78	46.18	1.87	0.04
8.	Biochem-8-21	DRMRQ 4-3	10.67	11.16	11.36	13.61	11.70	1.31	0.11
9.	Biochem-9-21	PM-30	2.07	1.96	1.38	2.69	2.02	0.54	0.27
10.	Biochem-10-21	PM-32	0.14	0.26	0.17	0.74	0.33	0.28	0.85
11.	Biochem-11-21	RH (OE)-1807	0.81	1.21	0.46	0.68	0.79	0.32	0.40
12.	Biochem-12-21	PDZ-14	0.75	0.91	0.43	1.14	0.81	0.30	0.37
13.	Biochem-13-21	LES-60	1.2	0.16	0.23	1.89	0.87	0.83	0.95
14.	Biochem-14-21	RH (OE)-1706	0.68	1.97	0.56	1.12	1.08	0.64	0.59
15.	Biochem-15-21	PM-29	0.85	0.16	0.59	0.82	0.60	0.32	0.53
16.	Biochem-16-21	PDZ-15	1.01	0.63	0.39	1.31	0.84	0.41	0.49
17.	Biochem-17-21	PDZM-31	1.23	0.52	0.89	1.14	0.95	0.32	0.34

Table 10: $\omega 6$ and $\omega 3$ ratio

S.NO.	Code	Genotypes	BPR	HSR	LDH	PNT	Mean	STDEV	CV
1.	Biochem-1-21	LES-64	2.57	2.99	2.40	2.93	2.72	0.28	0.10
2.	Biochem-2-21	LES-65	3.56	4.34	3.46	3.59	3.74	0.41	0.11
3.	Biochem-3-21	PDZ-16	3.90	4.72	3.88	3.37	3.97	0.56	0.14
4.	Biochem-4-21	PDZ-17	2.79	3.73	2.85	3.47	3.21	0.46	0.14
5.	Biochem-5-21	RH (OE)-1612	1.86	1.86	2.09	1.61	1.85	0.19	0.10
6.	Biochem-6-21	RH (OE)-1808	2.42	2.15	2.23	2.2	2.25	0.12	0.05
7.	Biochem-7-21	DRMRQ 143-9	0.69	0.65	0.69	0.83	0.72	0.08	0.11
8.	Biochem-8-21	DRMRQ 4-3	1.45	1.38	1.38	1.6	1.45	0.10	0.07
9.	Biochem-9-21	PM-30	1.82	2.14	2.05	1.61	1.90	0.24	0.12
10.	Biochem-10-21	PM-32	1.52	1.68	1.66	1.93	1.70	0.17	0.10
11.	Biochem-11-21	RH (OE)-1807	1.99	2.06	2.20	1.69	1.99	0.22	0.11
12.	Biochem-12-21	PDZ-14	3.66	4.02	3.97	3.35	3.75	0.31	0.08
13.	Biochem-13-21	LES-60	2.91	2.95	3.08	2.23	2.79	0.38	0.14
14.	Biochem-14-21	RH (OE)-1706	1.96	1.97	2.04	2.18	2.04	0.10	0.05
15.	Biochem-15-21	PM-29	3.04	2.79	3.04	3.24	3.03	0.18	0.06
16.	Biochem-16-21	PDZ-15	2.96	3.23	3.24	3.32	3.19	0.15	0.05
17.	Biochem-17-21	PDZM-31	2.87	3.07	3.21	2.36	2.88	0.37	0.13

Table 11: Saturated Fatty Acid

S.NO.	Code	Genotypes	BPR	HSR	LDH	PNT	Mean	STDEV	CV
1.	Biochem-1-21	LES-64	7.08	6.34	6.96	6.06	6.61	0.49	0.07
2.	Biochem-2-21	LES-65	6.96	7.40	7.58	7.73	7.42	0.33	0.04
3.	Biochem-3-21	PDZ-16	7.23	7.30	7.505	8.42	7.61	0.55	0.07
4.	Biochem-4-21	PDZ-17	6.53	6.60	6.945	7.14	6.80	0.29	0.04
5.	Biochem-5-21	RH (OE)-1612	4.18	5.08	6.145	5.05	5.11	0.80	0.16
6.	Biochem-6-21	RH (OE)-1808	5.64	5.54	6.055	4.85	5.52	0.50	0.09
7.	Biochem-7-21	DRMRQ 143-9	5.76	3.17	5.22	3.29	4.36	1.32	0.30
8.	Biochem-8-21	DRMRQ 4-3	5.12	5.37	5.245	5.09	5.21	0.13	0.02
9.	Biochem-9-21	PM-30	5.21	6.46	6.605	6.36	6.16	0.64	0.10
10.	Biochem-10-21	PM-32	5.9	5.54	5.79	5.89	5.78	0.17	0.03
11.	Biochem-11-21	RH (OE)-1807	4.7	5.66	5.91	5.99	5.57	0.59	0.11
12.	Biochem-12-21	PDZ-14	8.4	7.23	7.535	6.97	7.53	0.62	0.08
13.	Biochem-13-21	LES-60	6.45	6.79	6.84	7.01	6.77	0.23	0.03
14.	Biochem-14-21	RH (OE)-1706	5.42	5.47	5.55	5.24	5.42	0.13	0.02
15.	Biochem-15-21	PM-29	6.77	6.98	7.2	5.52	6.62	0.75	0.11
16.	Biochem-16-21	PDZ-15	7.16	6.87	7.27	6.66	6.99	0.28	0.04
17.	Biochem-17-21	PDZM-31	6.33	6.50	6.73	6.82	6.60	0.22	0.03

Table 12: Saturated: Unsaturated fatty acid ratio

S.NO.	Code	Genotypes	BPR	HSR	LDH	PNT
1.	Biochem-1-21	LES-64	1:13	1:15	1:13	1:15
2.	Biochem-2-21	LES-65	1:13	1:13	1:12	1:12
3.	Biochem-3-21	PDZ-16	1:13	1:13	1:12	1:11
4.	Biochem-4-21	PDZ-17	1:15	1:14	1:13	1:13
5.	Biochem-5-21	RH (OE)-1612	1:22	1:19	1:15	1:19
6.	Biochem-6-21	RH (OE)-1808	1:17	1:17	1:15	1:20
7.	Biochem-7-21	DRMRQ 143-9	1:17	1:30	1:18	1:29
8.	Biochem-8-21	DRMRQ 4-3	1:18	1:18	1:18	1:19
9.	Biochem-9-21	PM-30	1:18	1:14	1:14	1:15
10.	Biochem-10-21	PM-32	1:16	1:17	1:16	1:16
11.	Biochem-11-21	RH (OE)-1807	1:20	1:17	1:16	1:16
12.	Biochem-12-21	PDZ-14	1:12	1:13	1:12	1:13
13.	Biochem-13-21	LES-60	1:14	1:14	1:13	1:13
14.	Biochem-14-21	RH (OE)-1706	1:18	1:17	1:17	1:18
15.	Biochem-15-21	PM-29	1:14	1:13	1:13	1:17
16.	Biochem-16-21	PDZ-15	1:13	1:14	1:13	1:14
17.	Biochem-17-21	PDZM-31	1:15	1:14	1:14	1:14

Table 13: SFA: MUFA: PUFA ratio

S.NO.	Code	Genotypes	BPR	HSR	LDH	PNT
1.	Biochem-1-21	LES-64	1:07:07	1:07:06	1:07:07	1:08:07
2.	Biochem-2-21	LES-65	1:06:07	1:05:10	1:05:07	1:06:06
3.	Biochem-3-21	PDZ-16	1:06:08	1:05:04	1:05:07	1:05:06
4.	Biochem-4-21	PDZ-17	1:08:07	1:07:04	1:07:06	1:07:06
5.	Biochem-5-21	RH (OE)-1612	1:11:11	1:10:19	1:07:07	1:10:09
6.	Biochem-6-21	RH (OE)-1808	1:08:09	1:07:08	1:07:08	1:10:10
7.	Biochem-7-21	DRMRQ 143-9	1:11:07	1:19:11	1:18:11	1:18:11
8.	Biochem-8-21	DRMRQ 4-3	1:10:09	1:09:08	1:09:08	1:10:09
9.	Biochem-9-21	PM-30	1:10:08	1:07:07	1:07:06	1:08:07
10.	Biochem-10-21	PM-32	1:08:08	1:08:08	1:08:08	1:09:07
11.	Biochem-11-21	RH (OE)-1807	1:10:10	1:07:09	1:07:08	1:07:08
12.	Biochem-12-21	PDZ-14	1:05:06	1:05:07	1:05:07	1:06:07
13.	Biochem-13-21	LES-60	1:07:07	1:07:07	1:07:07	1:07:07
14.	Biochem-14-21	RH (OE)-1706	1:08:09	1:08:00	1:08:09	1:09:09
15.	Biochem-15-21	PM-29	1:07:07	1:06:07	1:06:06	1:08:09
16.	Biochem-16-21	PDZ-15	1:06:07	1:07:07	1:06:07	1:07:07
17.	Biochem-17-21	PDZM-31	1:08:06	1:08:06	1:08:06	1:08:06

Table 14: Protein content (%)

S.NO	Code	Genotypes	BPR	HSR	LDH	PNT	Mean	STDEV	CV
1.	Biochem-1-21	LES-64	30.16	29.55	29.17	30.69	29.89	0.67	0.02
2.	Biochem-2-21	LES-65	30.69	30.51	30.33	31.86	30.85	0.69	0.02
3.	Biochem-3-21	PDZ-16	33.39	33.56	33.25	33.96	33.54	0.31	0.01
4.	Biochem-4-21	PDZ-17	31.29	31.69	30.92	32.91	31.70	0.87	0.03
5.	Biochem-5-21	RH (OE)-1612	32.81	31.92	32.67	32.67	32.52	0.40	0.01
6.	Biochem-6-21	RH (OE)-1808	31.97	32.77	32.08	32.87	32.42	0.46	0.01
7.	Biochem-7-21	DRMRQ 143-9	33.82	32.78	34.42	32.9	33.48	0.78	0.02
8.	Biochem-8-21	DRMRQ 4-3	31.19	30.93	31.50	30.86	31.12	0.29	0.01
9.	Biochem-9-21	PM-30	31.11	31.27	30.33	31.97	31.17	0.67	0.02
10.	Biochem-10-21	PM-32	29.59	29.38	28.58	30.88	29.61	0.95	0.03
11.	Biochem-11-21	RH (OE)-1807	28.78	30.11	29.75	29.94	29.64	0.59	0.02
12.	Biochem-12-21	PDZ-14	29.45	31.67	30.92	30.86	30.72	0.93	0.03
13.	Biochem-13-21	LES-60	29.86	30.21	30.92	28.79	29.94	0.89	0.03
14.	Biochem-14-21	RH (OE)-1706	32.89	32.81	34.42	32.91	33.26	0.77	0.02
15.	Biochem-15-21	PM-29	33.67	33.78	33.25	34.84	33.88	0.68	0.02
16.	Biochem-16-21	PDZ-15	29.56	30.67	30.33	28.83	29.85	0.82	0.03
17.	Biochem-17-21	PDZM-31	30.11	29.82	29.17	30.78	29.97	0.67	0.02

Table 15: Total antioxidant capacity (mg/g AAE)

S.NO.	Code	Genotypes	BPR	HSR	LDH	PNT	Mean	STDEV	CV
1.	Biochem-1-21	LES-64	23.04	20.47	21.94	17.72	20.79	2.30	0.11
2.	Biochem-2-21	LES-65	14.59	15.14	13.89	18.01	15.41	1.81	0.12
3.	Biochem-3-21	PDZ-16	8.31	10.07	9.04	17.54	11.24	4.26	0.38
4.	Biochem-4-21	PDZ-17	11.28	13.16	12.26	19.89	14.15	3.90	0.28
5.	Biochem-5-21	RH (OE)-1612	21.58	20.88	23.45	13.79	19.92	4.23	0.21
6.	Biochem-6-21	RH (OE)-1808	24.60	22.29	23.43	17.09	21.85	3.31	0.15
7.	Biochem-7-21	DRMRQ 143-9	20.45	19.94	19.47	15.63	18.87	2.20	0.12
8.	Biochem-8-21	DRMRQ 4-3	17.51	18.82	16.67	22.12	18.78	2.40	0.13
9.	Biochem-9-21	PM-30	18.15	16.47	17.29	20.6	18.13	1.79	0.10
10.	Biochem-10-21	PM-32	15.44	17.17	16.78	19.54	17.23	1.71	0.10
11.	Biochem-11-21	RH (OE)-1807	17.81	18.36	19.36	15.62	17.79	1.58	0.09
12.	Biochem-12-21	PDZ-14	8.94	10.15	9.72	15.8	11.15	3.14	0.28
13.	Biochem-13-21	LES-60	14.67	16.78	15.95	21.73	17.28	3.09	0.18
14.	Biochem-14-21	RH (OE)-1706	17.39	17.08	18.90	20.08	18.36	1.39	0.08
15.	Biochem-15-21	PM-29	18.40	16.44	17.52	21.33	18.42	2.10	0.11
16.	Biochem-16-21	PDZ-15	14.14	14.78	13.47	12.3	13.67	1.06	0.08
17.	Biochem-17-21	PDZM-31	11.06	10.16	10.53	13.73	11.37	1.62	0.14

Table 16: β -carotene (ppm)

S.NO.	Code	Genotypes	BPR	HSR	LDH	PNT	Mean	STDEV	CV
1.	Biochem-1-21	LES-64	3.98	2.37	4.12	4.5	3.74	0.94	0.25
2.	Biochem-2-21	LES-65	3.29	2.22	3.00	3.47	2.99	0.55	0.18
3.	Biochem-3-21	PDZ-16	3.56	3.67	3.88	4.04	3.79	0.22	0.06
4.	Biochem-4-21	PDZ-17	4.01	3.14	3.84	5.15	4.04	0.83	0.21
5.	Biochem-5-21	RH (OE)-1612	4.97	4.23	4.29	5.07	4.64	0.44	0.10
6.	Biochem-6-21	RH (OE)-1808	4.12	4.37	4.41	4.3	4.30	0.13	0.03
7.	Biochem-7-21	DRMRQ 143-9	4.31	3.36	3.09	3.39	3.54	0.53	0.15
8.	Biochem-8-21	DRMRQ 4-3	4.11	3.09	3.42	4.21	3.71	0.54	0.15
9.	Biochem-9-21	PM-30	4.87	3.88	4.16	4.46	4.34	0.42	0.10
10.	Biochem-10-21	PM-32	4.21	1.96	4.04	4.5	3.68	1.16	0.32
11.	Biochem-11-21	RH (OE)-1807	4.39	3.97	4.81	5.61	4.69	0.70	0.15
12.	Biochem-12-21	PDZ-14	4.99	2.09	5.30	6.49	4.72	1.87	0.40
13.	Biochem-13-21	LES-60	3.98	4.66	5.35	6.06	5.01	0.89	0.18
14.	Biochem-14-21	RH (OE)-1706	4.04	3.12	3.95	5.04	4.04	0.79	0.19
15.	Biochem-15-21	PM-29	4.69	2.21	4.28	4.1	3.82	1.10	0.29
16.	Biochem-16-21	PDZ-15	4.21	2.86	3.99	4.48	3.89	0.71	0.18
17.	Biochem-17-21	PDZM-31	4.16	4.47	3.80	4.62	4.26	0.36	0.09

Table 17: Total sinapic acid content (%)

S.NO.	Code	Genotypes	BPR	HSR	LDH	PNT	Mean	STDEV	CV
1.	Biochem-1-21	LES-64	2.01	1.97	1.55	2.39	1.98	0.34	0.17
2.	Biochem-2-21	LES-65	2.11	1.62	1.32	3.1	2.04	0.78	0.38
3.	Biochem-3-21	PDZ-16	2.37	1.24	0.85	2.99	1.86	0.99	0.53
4.	Biochem-4-21	PDZ-17	1.98	1.51	1.72	2.41	1.91	0.39	0.20
5.	Biochem-5-21	RH (OE)-1612	2.28	1.69	1.70	3.2	2.22	0.71	0.32
6.	Biochem-6-21	RH (OE)-1808	2.19	2.00	1.94	2.37	2.12	0.20	0.09
7.	Biochem-7-21	DRMRQ 143-9	2.11	1.78	1.88	2.43	2.05	0.29	0.14
8.	Biochem-8-21	DRMRQ 4-3	2.07	1.93	1.83	2.43	2.06	0.26	0.13
9.	Biochem-9-21	PM-30	2.39	1.23	1.15	2.48	1.81	0.72	0.40
10.	Biochem-10-21	PM-32	2	1.87	1.95	2.37	2.05	0.22	0.11
11.	Biochem-11-21	RH (OE)-1807	2.29	2.04	1.92	2.66	2.23	0.33	0.15
12.	Biochem-12-21	PDZ-14	1.86	0.85	0.70	2.22	1.41	0.75	0.53
13.	Biochem-13-21	LES-60	1.11	1.02	0.97	1.92	1.25	0.45	0.36
14.	Biochem-14-21	RH (OE)-1706	1.67	1.45	1.37	2.78	1.82	0.65	0.36
15.	Biochem-15-21	PM-29	2.04	1.37	1.22	3.2	1.96	0.90	0.46
16.	Biochem-16-21	PDZ-15	2.02	0.98	0.85	2.19	1.51	0.69	0.46
17.	Biochem-17-21	PDZM-31	1.98	1.33	1.22	2.14	1.67	0.46	0.28

Table 18: Mineral composition in seed meal of promising breeding materials**(Centre: PNT)**

S.No	Code no	Genotypes	Cu(ppm)	Zn(ppm)	Fe(ppm)	Mn(ppm)
1.	Biochem-1-21	LES-64	0.21	0.52	6.23	0.22
2.	Biochem-2-21	LES-65	0.35	0.59	7.22	0.37
3.	Biochem-3-21	PDZ-16	0.45	0.69	6.41	0.27
4.	Biochem-4-21	PDZ-17	0.23	0.35	4.45	0.17
5.	Biochem-5-21	RH (OE)-1612	0.69	0.73	13.50	0.52
6.	Biochem-6-21	RH (OE)-1808	0.62	0.85	15.48	0.50
7.	Biochem-7-21	DRMRQ 143-9	0.86	0.64	10.77	0.40
8.	Biochem-8-21	DRMRQ 4-3	0.32	0.55	8.97	0.35
9.	Biochem-9-21	PM-30	0.89	0.83	16.58	0.61
10.	Biochem-10-21	PM-32	0.60	0.58	11.99	0.41
11.	Biochem-11-21	RH (OE)-1807	0.53	0.48	8.15	0.23
12.	Biochem-12-21	PDZ-14	0.46	0.56	7.11	0.25
13.	Biochem-13-21	LES-60	0.82	0.85	9.55	0.42
14.	Biochem-14-21	RH (OE)-1706	0.50	0.79	10.71	0.35
15.	Biochem-15-21	PM-29	0.67	0.80	11.17	0.48
16.	Biochem-16-21	PDZ-15	0.60	0.96	13.38	0.46
17.	Biochem-17-21	PDZM-31	0.31	0.60	12.25	0.46

Table 19: Total glucosinolate ($\mu\text{mole/g}$)

S.NO.	Code	Genotypes	BPR	HSR	LDH	PNT	Mean	STDEV	CV
1.	Biochem-1-21	LES-64	52.99	87.05	93.23	49.33	70.65	22.70	0.32
2.	Biochem-2-21	LES-65	34.86	48.17	64.69	36.54	46.06	13.76	0.30
3.	Biochem-3-21	PDZ-16	13.29	14.43	20.97	15.04	15.93	3.44	0.22
4.	Biochem-4-21	PDZ-17	15.54	18.78	26.71	14.95	19.00	5.41	0.28
5.	Biochem-5-21	RH (OE)-1612	62.91	58.86	45.64	38.94	51.59	11.20	0.22
6.	Biochem-6-21	RH (OE)-1808	50.55	61.42	51.25	51.13	53.59	5.23	0.10
7.	Biochem-7-21	DRMRQ 143-9	51.92	55.31	38.42	35.09	45.18	9.92	0.22
8.	Biochem-8-21	DRMRQ 4-3	37.18	45.73	48.35	33.37	41.16	7.05	0.17
9.	Biochem-9-21	PM-30	73.19	43.75	66.04	50.88	58.47	13.52	0.23
10.	Biochem-10-21	PM-32	68.08	47.89	54.34	44.19	53.63	10.51	0.20
11.	Biochem-11-21	RH (OE)-1807	55.12	58.93	51.61	45.45	52.78	5.73	0.11
12.	Biochem-12-21	PDZ-14	17.56	23.27	22.22	15.19	19.56	3.83	0.20
13.	Biochem-13-21	LES-60	59.88	73.18	69.06	45.94	62.02	12.07	0.19
14.	Biochem-14-21	RH (OE)-1706	57.98	42.15	56.48	37.47	48.52	10.25	0.21
15.	Biochem-15-21	PM-29	52.27	58.75	70.06	47.01	57.02	9.93	0.17
16.	Biochem-16-21	PDZ-15	14.30	23.54	20.32	16.97	18.78	4.02	0.21
17.	Biochem-17-21	PDZM-31	28.02	22.72	26.68	23.64	25.27	2.50	0.10

Table 20: Phytic acid (%)

S.NO.	Code	Genotypes	DRMR	HAU	PAU	PNT	Mean	STDEV	CV
1.	Biochem-1-21	LES-64	1.59	2.52	2.55	2.33	2.25	0.45	0.20
2.	Biochem-2-21	LES-65	1.38	2.95	2.85	2.77	2.49	0.74	0.30
3.	Biochem-3-21	PDZ-16	2.41	3.14	3.04	3.42	3.00	0.43	0.14
4.	Biochem-4-21	PDZ-17	2.35	3.49	2.92	2.73	2.87	0.47	0.17
5.	Biochem-5-21	RH (OE)-1612	1.89	3.32	2.38	2.64	2.56	0.59	0.23
6.	Biochem-6-21	RH (OE)-1808	2.39	3.07	3.01	3.06	2.88	0.33	0.11
7.	Biochem-7-21	DRMRQ 143-9	2.37	2.98	2.87	2.76	2.75	0.27	0.10
8.	Biochem-8-21	DRMRQ 4-3	3.51	3.75	4.00	3.53	3.70	0.23	0.06
9.	Biochem-9-21	PM-30	1.03	2.86	3.44	2.62	2.49	1.03	0.41
10.	Biochem-10-21	PM-32	2.19	2.18	2.00	2.12	2.12	0.08	0.04
11.	Biochem-11-21	RH (OE)-1807	2.65	3.28	2.15	2.28	2.59	0.51	0.20
12.	Biochem-12-21	PDZ-14	2.59	3.54	2.99	2.99	3.03	0.39	0.13
13.	Biochem-13-21	LES-60	2.79	3.44	3.79	3.59	3.40	0.43	0.13
14.	Biochem-14-21	RH (OE)-1706	2.43	3.37	2.13	2.6	2.63	0.53	0.20
15.	Biochem-15-21	PM-29	2.36	2.93	2.13	2.39	2.45	0.34	0.14
16.	Biochem-16-21	PDZ-15	1.59	2.09	2.06	2.11	1.96	0.25	0.13
17.	Biochem-17-21	PDZM-31	2.21	1.99	2.02	2.21	2.11	0.12	0.06

Table 21: Profile of different glucosinolates ($\mu\text{mole/g}$ defatted seed meal) by UPLC in promising breeding materials (Centre: LDH)

Code	Genotypes	Sinigrin		Progoitrin		Gluconapin		Unknown		Total	
		Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
Biochem-1-21	LES-64	36.28	0.00	4.85	0.62	27.34	0.05	1.06	0.25	69.54	0.02
Biochem-2-21	LES-65	32.61	0.43	5.65	0.76	39.75	0.18	1.72	0.61	79.73	0.13
Biochem-3-21	PDZ-16	0.99	0.01	10.62	0.76	3.44	0.44	0.86	0.39	15.91	0.39
Biochem-4-21	PDZ-17	0.42	0.83	6.36	0.81	7.81	0.36	0.86	0.38	15.44	0.15
Biochem-5-21	RH (OE)-1612	24.73	0.04	5.73	0.58	80.62	0.09	0.82	0.44	111.91	0.10
Biochem-6-21	RH (OE)-1808	15.57	0.12	6.47	0.94	51.51	0.07	0.75	0.81	74.31	0.14
Biochem-7-21	DRMRQ 143-9	9.03	0.29	6.73	0.68	34.67	0.15	0.32	0.01	50.75	0.04
Biochem-8-21	DRMRQ 4-3	34.95	0.27	17.56	0.10	13.35	0.67	1.57	0.93	67.42	0.06
Biochem-9-21	PM-30	38.98	0.28	7.21	0.77	36.05	0.08	0.64	0.21	82.87	0.10
Biochem-10-21	PM-32	7.42	0.02	4.92	0.51	45.08	0.01	0.32	0.35	57.75	0.05
Biochem-11-21	RH (OE)-1807	12.90	0.12	8.96	0.32	40.33	0.06	0.20	0.52	62.39	0.11
Biochem-12-21	PDZ-14	1.44	0.14	8.82	0.89	14.88	0.06	0.34	0.07	25.49	0.26
Biochem-13-21	LES-60	55.86	0.13	6.63	0.65	29.59	0.21	0.26	0.19	92.34	0.10
Biochem-14-21	RH (OE)-1706	10.01	0.08	7.55	1.09	46.51	0.01	0.22	0.59	64.29	0.15
Biochem-15-21	PM-29	17.04	0.07	6.86	0.53	76.62	0.07	0.91	0.45	101.42	0.11
Biochem-16-21	PDZ-15	2.29	0.25	6.80	0.13	9.50	0.16	0.51	0.60	19.10	0.04
Biochem-17-21	PDZM-31	2.64	0.30	6.07	0.53	10.96	0.00	0.15	0.34	19.82	0.21

8. Frontline demonstrations

8.1 Distribution of frontline demonstrations

Under the scheme “Frontline demonstrations and other related activities of Oilseeds” funded under the NFSM-Oilseed by DAC&FW, Ministry of Agriculture and Farmers’ Welfare, Govt. of India, 36 cooperating centres of AICRPRM/ ICAR institutes/ Ag. Universities/NGOs/FPOs conducted 2534 frontline demonstrations (FLDs) against the allocation of 2200 FLDs under both irrigated as well as rainfed conditions on rapeseed (toria, yellow sarson, brown sarson gobhi sarson and taramira) and mustard (Indian mustard) in 85 districts across 16 states during 2021-22. Rajasthan had maximum (835) followed by Uttar Pradesh (398), Assam (359) Manipur (150) and Madhya Pradesh (122) FLDs. Out of 35 FLDs conducting centres, 9 were in Rajasthan, 8 in Uttar Pradesh, 2 each in Assam and Himachal Pradesh, Haryana, Jammu & Kashmir and Maharashtra and one each in rest of the 10 states. Maximum districts (18) were covered in Uttar Pradesh followed by 13 in Rajasthan, 7 each in Maharashtra and Punjab, 6 each in Haryana, Assam and Jammu & Kashmir, 4 each in Madhya Pradesh and Uttarakhand, 3 each in Odisha and Manipur, 2 each in Gujarat and Himachal Pradesh and one each in Telangana, Jharkhand and West Bengal (Table 8.1). The sowing time spread from Sept. 9, 2021 (Uttarakhand) for toria to Dec 28, 2021 (Assam) for Toria.

8.2 Types of demonstrations

The 629 FLDs on rapeseed and 1905 on mustard were conducted. Maximum 1905 FLDs were conducted on Indian mustard followed by toria (444), gobhi sarson (118), yellow sarson (26), brown sarson (21) and taramira (20). There were 2389 FLDs (94.27%) on the whole package (WP) and 145 (5.72%) on component technology (CT). All the demonstrations were conducted in two different situations viz., irrigated (1785) and rainfed (604). Variety-wise analysis under whole package demonstrations was also done to see the performance of demonstrated improved varieties. There were 12 varieties of Indian mustard followed by 4 of gobhi sarson and 3 each of toria and yellow sarson under irrigated condition. The 4 varieties each of toria and Indian mustard, 3 of taramira and one each of gobhi sarson and brown sarson were demonstrated under rainfed condition (Table 8.2). The results included the mean seed yield (kg/ha) for both the improved plot (IP) with improved technology and the farmers’ plot (FP) with farmers’ practice, besides yield superiority of improved technology (%), cost of cultivation (CoC), gross monetary return (GMR) and additional net monetary return (ANMR) in Rs/ha from the IP and benefit: cost (B:C) ratio for both the IP and FP.

8.3 Whole package FLDs of rapeseed-mustard under rainfed condition

Sriganganagar, DRMR and Jobner centres (Rajasthan); DoR (AAU), Jorhat & Shillongani (Assam); Khudwani (J&K); CAU, Imphal (Manipur) and CPU (Himachal Pradesh) conducted 604 FLDs on WP of rapeseed-mustard under rainfed condition (Table 8.3). The maximum demonstrations (307) were conducted in Assam on toria under rainfed condition with mean seed yield of 1,075 kg/ha in IP and 791 kg/ha in FP. IP had maximum yield advantage of 35.9% and maximum ANMR of Rs 15,712/ha under rainfed condition in Assam. 150 demonstrations were conducted in Manipur on Indian mustard (77) and toria (73) which recorded an yield advantage of 16.3% with 861 kg/ha average seed yield in IP and ANMR of Rs. 5,994/ha under rainfed condition.

Rajasthan with 38 FLDs observed maximum mean seed yield of 1,495 kg/ha in IP and 1,303 kg/ha in FP with lowest yield advantage of 14.7% from IP over the FP under rainfed condition. J&K with average mean seed yield of 1,166kg/ha in 21 FLDs on brown sarson observed yield advantage of 15.0% from IP with ANMR of Rs. 7,553/ha. Himachal Pradesh conducted 88 FLDs on toria that gave mean seed yield of 668 kg/ha in IP and 525 kg/ha in FP. IP had a yield advantage of 27.2% and ANMR of Rs 7,085/ha under rainfed condition in Himachal Pradesh.

The maximum (1,495 kg/ha) and minimum (668 kg/ha) mean seed yield from IP were observed in Rajasthan and Himachal Pradesh, respectively. The cost of cultivation of IP ranged from Rs. 12,690 /ha in Himachal Pradesh to Rs 39155 /ha in J&K under rainfed condition. The IP also had higher B:C ratio in all states than that of FP in rainfed condition. The highest B:C ratio for IP (5.9) in Rajasthan and lowest (1.63) in J&K were recorded.

8.4 Whole package FLDs of rapeseed-mustard under irrigated condition

The whole package technology demonstration included use of improved variety, balanced use of fertilizers, proper spacing, use of micronutrients and need based plant protection and scientific cultural practices in comparison to farmers' practices of crop cultivation. Bharatpur, KVK (Bansur), Jodhpur, Kota, Sriganganagar Lupin, Solidaridad and VMFPCL centres/NGOs in Rajasthan; Varanasi, Kanpur, Ag. University (Banda), Jhansi, Agrimitra, Amity University (Noida), Biozone, MB, Trust in Uttar Pradesh; Hisar and Bawal in Haryana; Morena and Jhansi in Madhya Pradesh; S K Nagar in Gujarat; DoR (AAU), Jorhat & Shillongani in Assam; Ludhiana in Punjab; Kangra in Himachal Pradesh; Chatha in J&K; Pantnagar in Uttarakhand; KVK, Kaneri (Kholapur) and Nagpur in Maharashtra; Kalyani in West Bengal; MASS, Jharkhand Bhubaneswar in Odisha and Jagtial in Telangana conducted 1785 FLDs on whole package of rapeseed-mustard under irrigated condition (Table 8.4).

The maximum FLDs (667) were conducted in Rajasthan where improved plot recorded average yield of 2,001 kg/ha with yield superiority of 16.8% and ANMR of Rs 18,186/ha.

Under irrigated condition, mean seed yield from IP ranged from 982 in Odisha to 2,462 kg/ha in Haryana, whereas from FP ranged from 627 in Odisha to 2,146 kg/ha in Haryana. The yield increase due to IP ranged from 8.2% in Punjab to 73.1% in J&K.

For IP, Haryana had the highest cost of cultivation (Rs 39697/ha), while Jammu & Kashmir had the lowest cost of cultivation (Rs 19,250/ha).

The maximum ANMR (Rs 30,019 /ha) was reported due to the improved WP of Indian mustard in Assam, while minimum was in Maharashtra (Rs 8,456 /ha). All IP had positive ANMR. The higher B:C ratio for the improved WP under irrigated condition in all the states. The highest B:C ratio of IP (4.96) was realized in Uttar Pradesh (Table 8.4).

8.5 Varietal performance in Whole package FLDs of rapeseed-mustard under irrigated condition

An effort was also made to see the performance of demonstrated varieties in whole package demonstrations in different states under irrigated and rainfed condition.

8.5.1 Indian mustard

A total of 12 improved varieties of Indian mustard namely Giriraj, RH-725, NRCHB-101, DRMR-1165-40, RH-749, Azad Mahak, GDM-4, RH-406, TAM-108-1, RCH-1, PM-30 and PM-31 were used in WP demonstrations covering 13 states under irrigated condition (Table 8.5). Improved variety RH 725 demonstrated in 96 FLDs in Uttar Pradesh recorded highest average yield of 2,648 kg/ha with a yield improvement of 26.4% over local (FP) practice and ANMR of Rs 31,358 /ha followed by NRCHB-101 demonstrated in 24 FLDs in Uttar Pradesh with average seed yield of 2,580 kg/ha. The maximum yield improvement 74.0% was recorded in Jammu & Kashmir with Giriraj variety. The minimum yield improvement of 7.0% was reported from RCH-1 variety in Punjab, while minimum average seed yield of 982 kg/ha was reported from NRCHB-101 variety in Odisha.

The Giriraj variety was demonstrated in 4 states which recorded highest mean seed yield of 2,530 kg/ha with 23.1% yield improvement in Uttar Pradesh (131 FLDs) followed by 2,239 kg/ha with 15.7% yield improvement in Madhya Pradesh (33 FLDs), 2,047 with 15.9% yield improvement in Rajasthan (479 FLDs) and 1,247 kg/ha with maximum yield improvement of 68.3% in Jammu and Kashmir (15 FLDs) over FP.

The RH 725 variety was demonstrated in 5 states which recorded highest yield improvement of 74.0% with maximum mean seed yield of 1,203 kg/ha in Jammu & Kashmir (66 FLDs) followed by 26.4% with mean seed yield of 2,648 kg/ha in Uttar Pradesh (96 FLDs), 21.5% with mean seed yield of 1,975 kg/ha in Rajasthan (117 FLDs), 14.0% with mean seed yield of 2,500 kg/ha in Haryana (55 FLDs) and 11.2% with mean seed yield of 2,051 in Madhya Pradesh (38 FLDs) over FP.

The improved variety RH 749 was demonstrated in 3 states which recorded highest yield improvement of 27.5% with mean seed yield of 1,530 kg/ha in Uttar Pradesh (23 FLDs) followed by 14.6% with mean seed yield of 2,141 kg/ha in Madhya Pradesh (34 FLDs) and 9.7% with mean seed yield of 1,621 kg/ha in Rajasthan over FP.

The improved variety NRCHB 101 was demonstrated in 6 states which recorded highest mean seed yield of 2,580 kg/ha with yield improvement of 22.3% in Uttar Pradesh (24 FLDs), followed by 1,821 kg/ha mean seed yield with 18.6% yield improvement in Rajasthan (25 FLDs), 1,244 kg/ha mean seed yield with 39.5% yield improvement in Telangana (20 FLDs), 1,184 kg/ha mean seed yield with 20.6% yield improvement in Maharashtra (50 FLDs), 1,109 kg/ha mean seed yield with 66.0% yield improvement in Assam (7 FLDs) and 982 kg/ha mean seed yield with 56.6% yield improvement in Odisha (20 FLDs) over FP.

In Uttar Pradesh, eight improved varieties viz. RH 749, Giriraj, NRCHB 101, RH 725, RH-406, PM-30, PM-31 and Azad Mahak were demonstrated in 383 FLDs by 8 centres under irrigated condition. Out of which, improved variety RH 725 demonstrated in 96 FLDs in Uttar Pradesh recorded highest yield of 2,648

kg/ha with yield improvement of 26.4% over FP. In Uttar Pradesh, the improved variety Giriraj was used in maximum demonstrations (131 FLDs), which recorded average seed yield of 2,530 kg/ha with yield improvement of 23.1%. The improved variety RH-406 was demonstrated in 50 FLDs, which recorded average seed yield of 1,323 kg/ha with yield improvement of 44.3%. The improved variety NRCHB 101 was demonstrated in 24 FLDs, which recorded average seed yield of 2,580 kg/ha with yield improvement of 22.3%. The improved variety RH 749 was demonstrated in 23 FLDs, which recorded average seed yield of 1,530 kg/ha with yield improvement of 27.5%. The improved variety PM-30 was demonstrated in 35 FLDs, which recorded average seed yield of 1,996 kg/ha with yield improvement of 16.8%. The improved varieties Azad Mahak (14 FLDs) and PM-31 (10 FLDs) recorded a yield improvement of 54.2 and 23.5%, respectively in Uttar Pradesh.

The five improved varieties viz. Giriraj, RH-725, NRCHB-101, DRMR-1165-40 and RH-749 were demonstrated in 667 FLDs by seven centres/FPOs in Rajasthan under irrigated condition. Out of which, improved variety Giriraj was demonstrated in maximum demonstrations (479 FLDs) conducted by Bharatpur, Lupin, Solidaridad, VMFPCL and Kota centres in Rajasthan recorded average yield of 2,047 kg/ha with yield improvement of 15.9% followed by RH 725 (117 FLDs), which recorded average seed yield of 1,975 kg/ha with yield improvement of 21.5% over FP. The improved variety RH 749 demonstrated in 42 FLDs, recorded 1,621 kg/ha average seed yield under IP with yield improvement of 9.7%. The improved variety NRCHB 101 demonstrated in 25 FLDs, recorded 1,821 kg/ha average seed yield under IP with yield improvement of 18.6%. The improved variety DRMR-1165-40 demonstrated in 4 FLDs, recorded highest average seed yield of 2,180 kg/ha under IP with yield improvement of 17.4%.

In Haryana, the improved variety RH 725 demonstrated in 55 FLDs by two centres recorded highest mean seed yield of 2,500 kg/ha with yield improvement of 14.0%.

In Madhya Pradesh, four improved varieties viz. Giriraj, RH 749, RH 725 and RH-406, were demonstrated in 122 FLDs by 2 centres under irrigated condition. Out of which, improved variety Giriraj demonstrated in 33 FLDs in Madhya Pradesh recorded highest yield of 2,239 kg/ha with yield improvement of 15.7% over FP. The improved variety RH-725 demonstrated in 38 FLDs recorded average seed yield of 2,051 kg/ha with yield improvement of 11.2%. The improved variety RH-749 demonstrated in 34 FLDs, which recorded average seed yield of 2,141 kg/ha with yield improvement of 14.6%. The improved variety RH-406 was demonstrated in 17 FLDs, which recorded average seed yield of 1,366 kg/ha with yield improvement of 13.8%.

The yield improvement of 12.7% with mean seed yield of 2,325 kg/ha from GDM 4 (50 FLDs) was recorded in Gujarat. In Jammu & Kashmir, the improved variety Giriraj (15 FLDs) recorded mean seed yield of 1,247 kg/ha with yield improvement of 68.3%, while variety RH 725 (66 FLDs) recorded mean seed yield of 1,203 kg/ha with maximum yield improvement of 74%. In Maharashtra, the improved varieties TAM 108-1 (50 FLDs) and NRCHB-101 recorded 985 kg/ha and 1,184 kg/ha average seed yield, respectively with 23.4% and 20.6% yield improvement, respectively over FP.

The other improved variety PM-30 (54 FLDs) in West Bengal recorded 1,331 kg/ha average seed yield under IP with yield improvement of 22.1%, while this variety in 50 FLDs in Jharkhand recorded 1,111 kg/ha average seed yield under IP with yield improvement of 32.5%.

The maximum ANMR (Rs 31,358 /ha) was reported from RH 725 variety in Uttar Pradesh, while minimum (Rs. 7,095/ha) was from RCH-1 variety in Punjab. All IP had positive ANMR. The higher B:C ratio for all improved varieties under irrigated condition in all the states. However, highest B:C ratio of IP (5.58) was realized from NRCHB-101 variety in Uttar Pradesh. (Table 8.5).

8.5.2 Yellow sarson

Pantnagar conducted 8 FLDs with PPS 1 and 3 FLDs with Pant Sweta varieties of yellow sarson. The IP with Pant Sweta and PPS 1 had the average yield of 1,495 kg/ha and 1,422 kg/ha, respectively with yield improvement of 16.2% and 17.3%, respectively. Kanpur centre conducted 15 FLDs with Pitambari variety which recorded average yield of 1,360 kg/ha with maximum yield improvement of 20.4% and maximum ANMR of Rs. 10,950/ha from IP in Uttar Pradesh (Table 8.5).

8.5.3 Gobhi sarson

Kangra and Ludhiana centres conducted 54 FLDs each using GSC 7 variety of gobhi sarson (Table 8.5). The IP recorded maximum average yield of 1,938 kg/ha with a yield improvement of 9.4% and an ANMR of Rs 9,292 /ha in Punjab, while average seed yield of 1,315 kg/ha with a yield improvement of 35.4% and an ANMR of Rs 15,096 /ha was recorded from IP in Himachal Pradesh. Ludhiana centre also conducted 6 FLDs with PGSH-1707 variety which recorded average yield of 1,809 kg/ha with yield improvement of 6.0% and ANMR of Rs. 6,132/ha from IP in Punjab. The improved variety AKMS-8141

demonstrated in 3 FLDs in Himachal Pradesh recorded average yield of 1,723 kg/ha with yield improvement of 37.0% and ANMR of Rs. 21,786/ha.

8.5.4 Toria

Pantnagar conducted 17 FLDs with PT-508 and 2 FLDs with Uttara varieties of toria. The IP with PT 508 and Uttara had the average yield of 1,451 kg/ha and 1,400 kg/ha, respectively with yield improvement of 17.7% and 17.6%, respectively. Shillongani centre and DoR (AAU), Jorhat conducted 45 FLDs with TS-38 variety which recorded average yield of 1,317 kg/ha with yield improvement of 66.7% and ANMR of Rs. 31,485/ha from IP in Assam. All demonstrated varieties had higher B:C ratio than that of FP (Table 8.5).

8.6 Varietal performance in Whole package FLDs of rapeseed-mustard under rainfed condition

8.6.1 Indian mustard

A total of 4 improved varieties of Indian mustard namely RGN 298, NRCHB 101 and DRMRIJ-1638 were used in WP covering 3 states under rainfed condition (Table 8.6).

Sriganganagar in Rajasthan conducted 13 FLDs with RGN 298 variety of Indian mustard under rainfed condition which showed highest average seed yield of 1,892 kg/ha with yield improvement of 9.4% in Rajasthan.

The improved variety NRCHB 101 was demonstrated (77 FLDs) in Manipur under rainfed situations, which recorded mean seed yield of 850 kg/ha with yield improvement of 14.7%.

The DRMRIJ-1638 was demonstrated in 5 FLDs, which recorded average seed yield of 1,745 kg/ha with yield improvement of 12.6% in Rajasthan, while the RCC-4 variety in 33 FLDs recorded average seed yield of 695 kg/ha with yield improvement of 32.4% in Himachal Pradesh over FP.

The maximum ANMR (Rs 13,548 /ha) was reported in Rajasthan from DRMRIJ-1638 variety, while minimum (Rs. 5,358 /ha) was in Manipur from NRCHB 101 variety. All IP had positive ANMR. The higher B:C ratio for all improved varieties under rainfed condition in all the states under IP was realized. The highest B:C ratio of IP (5.17) was realized from RGN 298 variety in Rajasthan. (Table 8.6).

8.6.2 Toria

The improved variety TS 38 of toria was demonstrated (169 FLDs) in 2 states under rainfed situations, which recorded mean seed yield of 1,093 kg/ha with yield improvement of 39.4% in Assam (96 FLDs) followed by 874 kg/ha mean seed yield with yield improvement of 18.3% in Manipur (73 FLDs) over FP. The improved varieties TS-36 (5 FLDs), TS-46 (15 FLDs), TS-67 (27) were demonstrated in Assam. The IP with TS-36 and TS-46 had the average yield of 1,296 kg/ha and 998 kg/ha, respectively with maximum yield improvement of 40.4% and 27.2%, respectively. The IP with TS-67 had the average yield of 1,012 kg/ha with yield improvement of 27.3% under rainfed condition of Assam. The maximum ANMR (Rs 20,259 /ha) from TS 36 variety was reported in Assam, while minimum (Rs. 6,750 /ha) from TS-38 variety was in Manipur. All IP had positive ANMR. (Table 8.6).

8.6.3 Gobhi sarson

Career Point University (CPU) used GSC 7 variety of gobhi sarson in 55 demonstrations conducted in Himachal Pradesh under rainfed condition (Table 8.6). The IP demonstrations with GSC 7 had an average seed yield of 650 kg/ha against 525 kg/ha in FP with a yield improvement of 23.8% and ANMR of Rs.6,250 /ha.

8.6.4 Brown sarson

Khudwani conducted 21 FLDs with Shalimar sarson 2 variety of brown sarson in rainfed situation of Jammu & Kashmir which recorded an average seed yield of 1,166 kg/ha with 15.0% yield improvement in IP. The demonstrated variety had higher B:C ratio than that of FP. (Table 8.6).

8.6.5 Taramira

Jobner centre conducted 20 FLDs using RTM-1355, RTM-1351 and RTM-1624 varieties of taramira under rainfed situation of Rajasthan (Table 8.6). The demonstrations with RTM -1624 (9FLDs) recorded maximum average seed yield of 1,210 kg/ha with maximum yield improvement of 22.5% and maximum ANMR of Rs 10,787 /ha, while demonstrations with RTM 1355 (5 FLDs) and RTM-1351 recorded an average seed yield of 1,157 kg/ha and 1,137 kg/ha, with a yield improvement of 20.3% and 22.1%, respectively.

8.7 Other component technology FLDs

8.7.1 Indian mustard

A total of 145 FLDs with 5 component technologies for Indian mustard were carried out by Bharatpur and Bansur (Rajasthan) Bawal (Haryana), and Bhubaneswar (Odisha). The sulphur and boron fertilization in 100 FLDs, Sclerotinia rot management in 30 FLDs, thinning in 3 FLDs, weeding in 2 FLDs and plant protection in 10 FLDs were demonstrated by four centres (Table 8.7).

Sulphur and boron fertilization: Bharatpur centre conducted 100 demonstrations on this component. The seed yield increase was up to 14.1% with additional cost of Rs 3,340/ha and net additional return of Rs 13,170/ha. The B:C ratio was 3.42 (IP) and 3.2 (FP).

Sclerotinia rot disease management: KVK, Bansur conducted 30 demonstrations on seed treatment with carbandazim @ 2 gm/kg of seed and one spray to control sclerotinia rot disease, showing an increase of 29.9% in seed yield, additional net return of Rs 24,690/ha with an additional cost of Rs 3350/ha. The B:C ratio for IP (3.35) was higher than that of the FP (2.86).

Thinning: Bawal centre conducted 3 demonstrations and reported yield increase of 15.0% with additional cost (Rs 3,000/ha) and additional net return (12,355/ha).

Weeding: Bawal centre conducted 2 demonstrations on this component. The seed yield increase was up to 19.0% with additional cost of Rs 3,000/ha and additional net return of Rs 16,125/ha. The B:C ratio was 3.27 (IP) and 3.14 (FP).

Plant protection: Bhubaneswar centre conducted 10 demonstrations. The seed yield increase was 58.0% with additional cost of Rs 7000/ha and an additional net return of Rs 14,960/ha. The B:C ratio was 1.83 (IP) and 1.47 (FP).

8.8 Exploitable yield reservoir in rapeseed-mustard

It is evident from the productivity potentials and profitability of improved rapeseed-mustard production technologies that there exists vast potential to improve the rapeseed-mustard productivity under real farm situations. An attempt was made to estimate the extent of such yield reservoir available for exploitation (Table 8.8). Yield gap-I as a result of demonstration of improved technology over farmers practices was ranging from 8.2% in Punjab to 57.5% in Jammu & Kashmir, whereas, the yield gap-II (between IP and three year from 2018-19 to 2020-21 state average productivity) was ranging from 1.77% in Manipur to as high as 247.70% in Odisha.

Exploitable production-I (EP-I is the sum of 3 year State average production and production increased over State average production by bridging yield gap-I) and exploitable production-II (EP-II is the sum of 3 year State average production and production increased over State average production by bridging gap-II) were also worked out as indicated in Table 8.8.

It can be understood from the Table 8.8 that rapeseed-mustard productivity at national level could be improved by 22.1 and 15.0% by bridging the yield gaps-I and II, respectively. Similarly, the national rapeseed-mustard production could be increased from 9.44 to 11.53 and 10.86 mt by bridging yield gaps I and II, respectively. This indicates the presence of significant yield reservoir which can be exploited through spread of appropriate technology among the farmers. Therefore, there is an urgent need for effective transfer of improved rapeseed-mustard production technologies to the rapeseed-mustard growers in order to convince them to adopt such technologies so that yield gaps can be bridged and rapeseed-mustard production in the country can be stepped up.

8.9 Training of field level extension workers and farmers under the programme of FLDs and other related activities

For upgrading the knowledge and skills of grass root extension workers of States Department of Agriculture and farmers about research developments in the field of rapeseed-mustard, 6 training programmes for extension workers of two days each and 5 training programmes of farmers of two days each were organized by ICAR-DRMR and AICRPRM centres during 2021-22 under this scheme.

In these training programmes, a total of 144 extension personnel from State Department of Agriculture and 170 farmers of Rajasthan, Uttar Pradesh, Madhya Pradesh, Gujarat and Jammu & Kashmir participated and they were made aware of the new technologies advances in rapeseed-mustard cultivation so that they communicate the same to the farmers in the field.

State of participants	Organizing Centre	Place of training	Dates	No. of participants
Training of Extension Personnel				
Uttar Pradesh	Kanpur	CSAUA&T, Kanpur	11-12 March 2022	20
Madhya Pradesh	KVK, Morena	KVK, Morena	24-25 Feb. 2022	25
	KVK, Shivpuri	KVK, Shivpuri	22-23 Feb. 2022	33
Gujarat	SK Nagar	CMRS, SDAU	20-21 Jan. 2022	20
Jammu & Kashmir	Chatha	Chatha, Jammu	3-4 March 2022	26
Rajasthan	Bansur	KVK, Bansur, Alwar	3-4 March 2022	20
Training of Farmers				
Madhya Pradesh	ZARS, Morena	ZARS, Morena	2-3 March 2022	30
	KVK, Morena	KVK, Morena	10-11 Feb. 2022	33
	KVK, Shivpuri	KVK, Shivpuri	22-23 Feb. 2022	47
Rajasthan	DRMR	DRMR	6-7 Oct. 2022	30
	Bansur	KVK, Bansur, Alwar	25-26 Feb. 2022	30

Note: Jhansi and Varanasi centres could not organized allotted training of extension workers due to unavoidable circumstances (late receipt of budget from DAC&FW). It will be organized during 2022-23.

Table 8.1 State wise FLDs on rapeseed-mustard conducted during 2021-22

State	Centre(s)	Total FLDs	Districts covered	Crops	Period of Sowing 2021
Assam (ASM)	DoR, (AAU)	300	Majuli, Tinsukia, Dhemaji, Morigaon, Nagaon, Jorhat	Indian mustard	Oct 28-Dec 28
	Shillongani (SHL)	59	Nagaon	Toria	Oct 25-Dec 20
Odisha	Bhubaneswar (BHU)	30	Mayurbhanj, Subarnpur, Koraput	Indian mustard	Nov 7-Dec 19
Gujarat (GUJ)	S K Nagar (SKN)	50	Banaskantha, Patan	Indian mustard	Oct 15-Nov 11
Haryana (HAR)	Hisar (HSR)	40	Bhiwani, Hisar, Sirsa Fatehabad, Mahendragarh	Indian mustard	Oct 5-30
	Bawal (BAW)	20	Rewari, Mahendragarh	Indian mustard	Oct 20-30
Himachal Pradesh (HP)	Kangra (KNG)	37	Kangra	Gobhi sarson	Oct 18- Nov 2
	CPU, Hamirpur	88	Hamirpur	Gobhi sarson Indian mustard	Nov 12-30
Jammu & Kashmir (J&K)	Chatha (CHT)	81	Jammu, Udhampur	Indian Mustard	Oct 20-Nov 10
	Khudwani (KHD)	21	Anantnag, Kulgam, Pulwama, Budgam	Brown sarson	Oct 16-Nov 7
Jharkhand (JHD)	MASS	50	Latehar	Indian mustard	Oct 25-Nov 10
Madhya Pradesh (MP)	Morena (MOR)	100	Morena, Bhind, Ashok Nagar	Indian mustard	Oct 20-Nov 26
	Jhansi (JHI)	22	Datia	Indian mustard	Oct 25-Nov 10
Maharashtra (MH)	Nagpur (NGP)	50	Nagpur, Washim, Amravati Gadchiroli, Wardha, Buldana	Indian mustard	Oct 10-Nov 15
	KLP (50)	50	Kolhapur	Indian mustard	Nov 1-Dec 1
Manipur (MAN)	CAU (IMP)	150	Imphal East, Bishnupur Thoubal	Indian mustard Toria	Nov 15-Dec 10
Punjab (PUN)	Ludhiana (LDH)	49	Bathinda, Fazilka, Mansa, Ferozepur, Hoshiarpur, Ludhiana, Sangrur	Gobhi sarson Indian mustard	Oct 27-Nov 30
Rajasthan (RAJ)	Bharatpur (BPR)	405	Bharatpur	Indian mustard	Oct 15-Nov 5
	Bansur (BAN)	100	Alwar	Indian mustard	Oct 25-Nov.10
	Jodhpur (JDH)	50	Jodhpur, Pali	Indian mustard	Oct 20-Nov 8
	Kota (KOT)	30	Kota	Indian mustard	Oct 15-30
	Jobner (JOB)	20	Jaipur	Taramira	Oct 10-30
	Sriganganagar (SGN)	30	Sriganganagar	Indian mustard	Oct 15-25
	Lupin	100	Karoli, Dholpur	Indian mustard	Oct 20-Nov 3
	Solidaridad	50	Baran, Kota, Tonk, Jhalawar, Bundi	Indian mustard	Oct 15-30
VMFPCL	50	Bharatpur	Indian mustard	Oct 10-30	
Telangana (TS)	Jagtial (JGT)	20	Jagtial	Indian mustard	Oct 25-Dec 25
Uttar Pradesh (UP)	Banda (BND)	50	Banda	Indian mustard	Oct 25-Nov 15
	Jhansi (JHI)	28	Jhansi	Indian mustard	Oct 25-Nov 10
	Kanpur (KPR)	70	Unnao, Fatehpur, Etawah, Kanpur Dehat, Auraiya, Kanpur Nagar, Pratapgarh	Indian mustard,	Oct3-Nov 2
	Varanasi (VAR)	100	Mirzapur, Chandauli, Bhadoi, Varanasi,	Indian mustard	Oct 15-Nov 10
	Amity University (AMT)	40	Gautam Budh Nagar Bulandshahar	Indian mustard	Oct 15-24
	Agrimitra	50	Mirzapur	Indian mustard	Oct 20-30
	Biozone	30	Deoria, Maharajganj	Indian mustard	Oct 20-Nov 22
	MB Trust	30	Sant Kabeer Nagar	Indian mustard	Oct 27-Nov 22
Uttarakhand (UK)	Pantnagar (PNT)	30	Haridwar, Nainital, Udhm Singh Nagar	Toria, Yellow sarson	Sept 9-Oct.15
West Bengal (WB)	Kalyani (KLN)	54	Paschim Medinipore	Indian mustard	Nov 1-15
16	36	2534	85	6	Sept 9-Dec 28

Table 8.2 Frontline demonstrations conducted on rapeseed-mustard during 2021-22

Crop	FLDs (No)	Distribution of FLDs				
		Whole package		Varietal distribution (total No. of Varieties)		Component
		Irrigated	Rainfed	Irrigated	Rainfed	Irrigated
Toria	444	64	380	03	04	00
Gobhi sarson	118	63	55	04	01	00
Yellow sarson	26	26	00	03	00	00
Brown sarson	21	00	21	00	01	00
Taramira	20	00	20	00	03	00
Indian mustard	1905	1632	128	12	04	145
Total	2534	1785	604	22	13	145

Abbreviations used in the text and table: WP: whole package; IR: Irrigated; RF: Rainfed; YIOFP: Yield increase over farmer's practice; CoC: Cost of cultivation; GMR: Gross monetary return; ANMR: Additional Net Monetary Return; IP: Improved practices; FP: Farmers' Practices; B:C : Benefit : Cost

Note: 1. Kalyani, Shillongani, Kangra and CPU centres conducted their allotted FLDs with more number of farmers due to small land holdings
2. Jhansi centre conducted FLDs in two states, viz. Uttar Pradesh and Madhya Pradesh

Table 8.3 Performance of whole package FLDs on rapeseed-mustard under rainfed condition during 2021-22

State	Centre	Crops	FLDs	Mean yield (kg /ha)		YIOFP (%)	COC (Rs/ha)		GMR (Rs/ha)		ANMR (Rs/ha)	B: C Ratio	
				IP	FP		IP	FP	IP	FP		IP	FP
RAJ	SGN (13) JOB (20) DRMR (5)	Indian mustard (18) Taramira (20)	38	1495 (1088-2200)	1303 (850-2200)	14.7	16196	15626	97175	84695	11830	5.9	5.4
ASM	DoR, AAU (262) SHL (45)	Toria (307)	307	1075 (938-1370)	791 (530-1020)	35.9	28117	25369	69875	51415	15712	2.4	2.02
J&K	KHD (21)	Brown sarson (21)	21	1166 (860-1380)	1008 (797-1154)	15.0	39155	38018	64130	55440	7553	1.63	1.45
MAN	CAU (150)	Indian mustard (77) Toria (73)	150	861 (630-1100)	740 (350-900)	16.3	22615	21349	51660	44400	5994	2.28	2.07
HP	CPU (88)	Gobhi sarson (55) Indian mustard (33)	88	668 (650-700)	525	27.2	12690	12625	33400	26250	7085	2.63	2.07

Figure in parenthesis is the number of FLDs conducted by the centre

Table 8.4 Performance of whole package FLDs on rapeseed-mustard under irrigated condition during 2021-22

State	Centre	Crops	FLDs	Mean yield (kg /ha)		YIOFP (%)	COC (Rs/ha)		GMR (Rs/ha)		ANMR (Rs/ha)	B: C Ratio	
				IP	FP		IP	FP	IP	FP		IP	FP
RAJ	BPR (300) BAN (70) JDH (50) KOT (30) SGN (17) Lupin (100) Solidaridad (50) VMFPCL (50)	Indian mustard (667)	667	2001 (850-2889)	1713 (810- 2680)	16.8	31433	30899	130065	111345	18186	4.13	3.60
UP	VAR (100) KPR (70) BND (50) Agrimitra (50) AMTI (40) JHI (28) Biozone (30) MB Trust (30)	Indian mustard (383) Yellow sarson (15)	398	2228 (1040-3845)	1770 (890-3156)	25.9	29157	25848	144820	115050	26461	4.96	4.45
MP	MOR (100) JHI (22)	Indian mustard (122)	122	2102 (1550-2696)	1835 (1200-2464)	14.6	31694	29318	136630	119275	14979	4.31	4.06
HAR	Hisar (40) Bawal (15)	Indian mustard (55)	55	2462 (1850-3400)	2146 (1550-2980)	14.7	39697	36836	160030	139490	17679	4.03	3.78
GUJ	SKN (50)	Indian mustard (50)	50	2325 (1537-2903)	2063 (1438-2476)	12.7	33312	30893	151125	134095	14611	4.53	4.34
ASM	DoR, AAU (38) SHL (14)	Indian mustard (7) Torja (45)	52	1289 (938-1550)	773 (580-990)	66.7	29521	26000	83785	50245	30019	2.83	1.9
PUN	LDH (49)	Gobhi Sarson (26) Indian mustard (23)	49	1882 (1250-2550)	1739 (1200-2200)	8.2	26964	26167	117362	108453	8909	3.35	3.22
HP	KNG (37)	Gobhi sarson (37)	37	1349 (988-1825)	994 (732-1355)	35.0	23385	21868	68124	50197	16410	2.91	2.29
J&K	CHT (81)	Indian mustard (81)	81	1203 (950-1450)	691 (575-840)	73.0	19250	14100	78715	45500	28065	4.08	3.22
UK	PNT (30)	Yellow Sarson (11) Torja (19)	30	1456 (1230-1750)	1243 (1045-1505)	17.1	25633	24342	73528	62772	9465	2.86	2.57

Cont. Table 8.4 Performance of whole package FLDs on rapeseed-mustard under irrigated condition during 2021-22

State	Centre	Crops	FLDs	Mean yield (kg /ha)		YIOFP (%)	COC (Rs/ha)		GMR (Rs/ha)		ANMR (Rs/ha)	B: C Ratio	
				IP	FP		IP	FP	IP	FP		IP	FP
MH	NGP (50) KLP (50)	Indian mustard (100)	100	991 (500-1321)	825 (420-1151)	20.0	23577	22903	54505	45375	8456	2.31	1.98
WB	KLN (54)	Indian mustard (54)	54	1331 (1020-1640)	1090 (885-1345)	22.1	30540	29500	79860	65400	13420	2.61	2.21
JHD	MASS (50)	Indian mustard	50	1111 (968-1477)	838 (669-971)	32.5	32400	28300	72215	54470	13645	2.22	1.9
ODH	BHU (20)	Indian mustard (20)	20	982 (904-1056)	627 (574-681)	56.6	32375	25482	58920	37620	14407	1.81	1.47
TS	JGT (20)	Indian mustard (20)	20	1244 (1025-1550)	892 (750-980)	39.5	23500	26250	62200	44600	20350	2.64	1.69

Table 8.5 Variety-wise performance in whole package FLDs on rapeseed-mustard under Irrigated conditions during 2021-22

State	Centre	Varieties	FLDs	Mean yield (kg /ha)		YIOFP (%)	COC (Rs/ha)		GMR (Rs/ha)		ANMR (Rs/ha)	B: C Ratio	
				IP	FP		IP	FP	IP	FP		IP	FP
Indian mustard													
RAJ	BPR (280) Lupin (100) Solidaridad (42) VMFPCL (50) KOT (7)	Giriraj	479	2047 (850-2750)	1766 (810-2680)	15.9	37470	37510	133055	114790	18305	3.5	3.0
RAJ	BAN (70) KOT (23) BPR (20) Solidaridad (4)	RH-725	117	1975 (1500-2912)	1626 (1345-2250)	21.5	33217	31170	128375	105690	20638	3.8	3.3
RAJ	JDH (25)	NRCHB-101	25	1821 (1665-1985)	1534 (1420-1645)	18.6	28800	25600	118365	99710	15435	4.1	3.8
RAJ	Solidaridad (4)	DRMR-1165-40	4	2180 (2015-2320)	1857 (1685-1951)	17.4	23688	24223	141700	120705	21530	6.02	5.0
RAJ	JDH (25) SGN (17)	RH-749	42	1621 (1120-2400)	1478 (970-2100)	9.67	24536	23500	105365	96070	8259	4.2	4.0
HAR	HSR 40) BAW (15)	RH-725	55	2500 (1850-3400)	2183 (1550-2980)	14.0	39656	36880	162500	141895	17829	4.09	3.84
GUJ	SKN (50)	GDM-4	50	2325 (1537-2903)	2063 (1438-2476)	12.7	33312	30893	151125	134095	14611	4.53	4.34

Cont. Table 8.5 Variety-wise performance in whole package FLDs on rapeseed-mustard under Irrigated conditions during 2021-22

State	Centre	Varieties	FLDs	Mean yield (kg /ha)		YIOF P (%)	COC (Rs/ha)		GMR (Rs/ha)		ANMR (Rs/ha)	B: C Ratio	
				IP	FP		IP	FP	IP	FP		IP	FP
Indian mustard													
UP	JHI (23)	RH-749	23	1530 (1330-1937)	1200	27.5	32375	28710	99450	78000	17785	3.07	2.71
UP	VAR (31) KPR (22) Agrimitra (50) Biozone (14) MB Trust (14)	Giriraj	131	2530 (1613-3845)	2055 (1222-3156)	23.1	30882	28977	164450	133575	28970	5.32	4.60
UP	VAR (45) KPR (19) Biozone (16) MB Trust (16)	RH-725	96	2648 (1828-3600)	2095 (1050-2067)	26.4	30859	26002	172120	136175	31358	5.57	5.23
UP	BND (50)	RH-406	50	1323 (1275-1370)	917 (890-945)	44.3	27050	21050	85995	59605	20390	3.17	2.83
UP	VAR (24)	NRCHB-101	24	2580 (2040-3010)	2110 (1800-2670)	22.3	30019	24792	167700	137150	25323	5.58	5.53
UP	AMT (30) JHI (5)	PM-30	35	1996 (1040-2260)	1709 (1200-1820)	16.8	29500	30600	129740	111085	19755	4.39	3.63
UP	AMT (10)	PM-31	10	1826 (1780-1870)	1478 (1390-1530)	23.5	29200	30500	118690	96070	23920	3.98	3.1
UP	KPR (14)	Azad Mahak	14	2098 (1975-2175)	1712 (1625-1800)	54.2	37721	33551	136370	111280	20920	3.61	3.31
MP	MOR (28) JHI (5)	Giriraj	33	2239 (1550-2696)	1935 (1200-2464)	15.7	30002	27986	145535	125775	17744	4.85	4.49
MP	MOR (34)	RH-749	34	2141 (1660-2390)	1868 (1450-2064)	14.6	30091	28326	139165	121420	15980	4.62	4.28
MP	MOR (38)	RH-725	38	2051 (1720-2350)	1844 (1580-2050)	11.2	30032	28274	133315	119860	11697	4.43	4.23
MP	JHI (17)	RH-406	17	1366 (1250-1550)	1200 (1020-1430)	13.8	29578	27857	88790	78000	9069	3.00	2.80
J&K	CHT (15)	Giriraj	15	1247 (1100-1400)	741 (650-840)	68.3	19250	14100	81055	48165	27740	4.21	3.41
J&K	CHT (66)	RH 725	66	1203 (950-1450)	691 (575-840)	74.0	19250	14100	78195	44915	28130	4.06	3.18
MS	NAG (50)	TAM-108-1	50	985 (500-1020)	798 (420-850)	23.4	19155	17807	54175	43890	8937	2.82	2.46
MS	KLP (50)	NRCHB-101	50	1184 (980-1321)	982 (767-1151)	20.6	28000	28000	65120	54010	11110	2.32	1.92

Cont. Table 8.5 Variety-wise performance in whole package FLDs on rapeseed-mustard under Irrigated conditions during 2021-22

State	Centre	Varieties	FLDs	Mean yield (kg /ha)		YIOF P (%)	COC (Rs/ha)		GMR (Rs/ha)		ANMR (Rs/ha)	B: C Ratio	
				IP	FP		IP	FP	IP	FP		IP	FP
Indian mustard													
ODH	BHU (20)	NRCHB 101	20	982 (904-1056)	627 (574-681)	56.6	32375	25482	58920	37620	14407	1.81	1.47
WB	KLN (54)	PM 30	54	1331 (1020-1640)	1090 (885-1345)	22.1	30540	29500	79860	65400	13420	2.61	2.21
JHD	MASS (50)	PM-30	50	1111 (968-1477)	838 (669-971)	32.5	32400	28300	72215	54470	13645	2.22	1.9
TS	JGT (20)	NRCHB 101	20	1244 (1025-1550)	892 (750-980)	39.5	23500	26250	62200	44600	20350	2.64	1.69
PUN	LDH (23)	RCH-1	23	1852 (1525-2200)	1721 (1500-2500)	7.0	26852	26218	109268	101539	7095	4.06	3.87
ASM	DoR, AAU (7)	NRCHB-101	7	1109 (938-1300)	668 (580-780)	66	38276	29929	72085	43420	20318	1.9	1.4
Yellow sarson													
UP	KPR (15)	Pitambari	15	1360 (1250-1450)	1130 (1050-1200)	20.4	34359	30339	88400	73450	10950	2.57	2.42
UK	PNT (8)	PPS-1	8	1495 (1260-1750)	1288 (1110-1425)	16.2	26110	24476	75498	65019	8845	2.89	2.66
UK	PNT (3)	Pant Sweta	3	1422 (1290-1625)	1215 (1080-1425)	17.3	25463	24138	71794	61358	9112	2.82	2.54
Gobhi sarson													
PUN	LDH (6)	PGSH-1707	6	1809 (1605-2000)	1698 (1550-1875)	6.0	25958	25208	112158	105276	6132	4.32	4.17
PUN	LDH (20)	GSC-7	20	1938 (1250-2550)	1772 (1200-2200)	9.4	27395	26395	120156	109864	9292	4.38	4.16
HP	KNG (34)	GSC-7	34	1315 (988-1825)	971 (732-1348)	35.4	23254	21788	66407	49035	15096	2.85	2.25
HP	KNG (3)	AKMS-8141	3	1723 (1675-1775)	1250 (1237-1355)	37.0	24867	22767	87011	63125	21786	3.49	2.77
Toria													
UK	PNT (2)	Uttara	2	1400 (1250-1550)	1193 (1045-1340)	17.6	25315	24225	70700	60221	9388	2.79	2.49
UK	PNT (17)	PT-508	17	1451 (1230-1750)	1233 (1070-1505)	17.7	25475	24328	73270	62278	9844	2.88	2.56
ASM	DoR, AAU (31) SHL (14)	TS-38	45	1317 (1120-1550)	790 (615-900)	66.7	28159	25389	85605	51350	31485	3.04	2.02

Table 8.6 Varietal performance in Whole package FLDs of rapeseed-mustard under rainfed condition during 2021-22

State	Centre	Varieties	FLDs	Mean yield (kg /ha)		YIOFP (%)	COC (Rs/ha)		GMR (Rs/ha)		ANMR (Rs/ha)	B: C Ratio	
				IP	FP		IP	FP	IP	FP		IP	FP
Indian mustard													
RAJ	SGN (13)	RGN 298	13	1892 (1200-2200)	1730 (1200-2200)	9.4	17000	17000	87978	80445	7533	5.17	4.73
RAJ	BPR (5)	DRMRIJ-1638	5	1745 (1625-1875)	1550 (1400-1600)	12.6	38179	39052	113425	100750	13548	2.9	2.5
MAN	CAU (77)	NRCHB 101	77	850 (685-1100)	741 (650-900)	14.7	22420	21238	51000	44460	5358	2.27	2.09
HP	CPU (33)	RCC 4	33	695	525	32.4	12372	12200	34750	26250	8328	2.80	2.15
Toria													
ASM	SHL (5)	TS-36	5	1296 (1250-1370)	923 (865-980)	40.4	25886	21900	84240	59995	20259	3.25	2.73
ASM	DoR, AAU (58) SHL (38)	TS-38	96	1093 (895-1350)	784 (530-1020)	39.4	27835	24958	71045	50960	17208	2.55	2.04
ASM	DoR, AAU (15)	TS-46	15	998 (941-1039)	784 (754-844)	27.2	29186	26966	59880	47040	10620	2.05	1.74
ASM	DoR, AAU (25) SHL (2)	TS-67	27	1012 (938-1046)	795 (716-840)	27.3	28941	26590	65780	51675	11754	2.53	1.94
MAN	CAU (73)	TS 38	73	874 (630-1100)	739 (350-900)	18.3	22816	21466	52440	44340	6750	2.2	2.06
Gobhi sarson													
HP	CPU (55)	GSC 7	55	650	525	23.8	12880	12880	32500	26250	6250	2.52	2.03
Brown sarson													
J&K	KHD (21)	Shalimar sarson -2	21	1166 (860-1380)	1008 (797-1154)	15.0	39155	38018	64130	55440	7553	1.63	1.45
Taramira													
RAJ	JOB (5)	RTM 1355	5	1157 (1088-1225)	961 (879-1036)	20.3	10044	8726	62709	52086	9311	6.24	5.9
RAJ	JOB (6)	RTM 1351	6	1137 (1056-1213)	931 (850-1050)	22.1	10212	8928	61625	50460	9881	6.03	5.6
RAJ	JOB (9)	RTM-1624	9	1210 (1136-1256)	987 (895-1032)	22.5	10229	8929	65582	53495	10787	6.41	6.0

Table 8.7 Component performance in FLDs of rapeseed-mustard condition during 2021-22

Component	Centres	FLDs	Mean yield (kg /ha)		YIOFP (%)	CoC (Rs/ha)		GMR (Rs/ha)		ANMR (Rs/ha)	B: C Ratio	
			IP	FP		IP	FP	IP	FP		IP	FP
Indian mustard												
Sulphur & Boron fertilization	BPR (100)	100	2052 (1500-2520)	1798 (1350-2200)	14.1	38940	35600	133380	116870	13170	3.42	3.2
Sclerotinia rot mgt.(seed treatment+Foliar Spray of Carbendazim @ 2% at 60-70DAS	BAN (30)	30	1766 (1580-1950)	1360 (1320-1450)	29.9	34200	30850	114790	88400	23040	3.35	2.86
Thinning	BAW (3)	3	2034 (1950-2100)	1767 (1700-1850)	15.0	40157	37157	132210	114855	12355	3.29	3.09
Weeding	BAW (2)	2	2025 (2000-2050)	1700 (1700)	19.0	40157	35157	131625	110500	16125	3.27	3.14
Seed + Plant Protection	BHU (10)	10	987 (889-1041)	621 (587-646)	58.0	32275	25275	59220	37260	14960	1.83	1.47

Table 8.8 Exploitable yield reservoir of rapeseed-mustard in major states during 2021-22

State	No. of FLDs	FLDs Mean yield (kg /ha)		Yield gap- I (%)	Three year State average yield (Kg/ha) (2018-19 to 2020-21)	Yield gap- II (%)	Three year State average production (000 tonnes) (2018-19 to 2020-21)	Expected production (000 tonnes)	
		IP	FP					EP-I	EP-II
RAJ	835	1978	1694	16.76	1568	26.14	4268.61	4984	5384.4
HAR	60	2462	2146	14.7	1958	25.74	1238.90	1421	1557.8
MP	122	2102	1835	14.6	1589	32.2	1128.38	1293	1491.6
UP	398	2228	1770	25.9	1392	60.05	1027.15	1293	1644
WB	50	1331	1090	22.1	1209	10.09	729.21	890.37	802.79
GUJ	50	2325	2063	12.7	1899	22.43	368.74	415.57	451.46
ASM	359	1132	786	44.0	636	77.99	182.12	262.25	324.15
PUN	49	1882	1739	8.2	1534	22.69	47.61	51.51	58.41
JHD	50	1111	838	32.5	771	44.10	246.58	326.72	355.32
J&K	102	1202	763	57.5	900	33.56	42.23	66.51	56.40
MAN	150	861	740	16.3	846	1.77	23.87	27.76	24.29
UK	30	1456	1243	17.13	927	57.07	14.84	17.38	23.31
HP	125	869	664	30.9	644	34.94	5.45	7.13	7.35
MS	100	991	825	20.0	353	180.74	5	6.00	14.04
ODH	30	984	625	57.4	283	247.70	1.87	2.94	6.50
All India	2510	1678	1374	22.1	1459	15.0	9448.89	11537.1	10866.2

New Abbreviations used in FLDs report_2021-22

- **Agrimitra** : Agrimitra, Farmers Producer Company Limited, Mirzapur, Uttar Pradesh
- **AMT**: Amity University, Noida, Uttar Pradesh
- **CPU**: career Point University, Hamirpur, Himachal Pradesh
- **KLP**: Kolhapur KVK, Kaneri, Kolhapur, Maharashtra
- **MASS**: Mobile Agricultural School and Services, Ranchi, Jharkhand
- **Lupin**: Lupin Human Welfare & Research Foundation, Bharatpur, Rajasthan
- **Solidaridad** : Solidaridad Regional Expertise Centre, New Delhi
- **VMFPCL**: Veeresh Multipurpose Farmers Producer Company Limited, Bharatpur, Rajasthan
- **MASS**: Mobile Agricultural School and Services, Ranchi, Jharkhand

Achievements of AICRP-RM coordinating centers (2021-22)

Varieties notified by SVRC of respective states:

Centre	Crop	Variety	Year of notification	State	Condition
Karnal	Mustard	CS 61	2021	Uttar Pradesh	salt tolerant mustard variety
	Mustard	CS 62	2021	Uttar Pradesh	salt tolerant mustard variety
IARI	Mustard	Pusa Double Zero Mustard 33	2021	-	-
Chatha	Gobhisarson	JGS 12-3	2022	J&K	-
	Mustard	JM 13-5	2022	J&K	-
Varanasi	Mustard	HUJM-10-6	2021	-	-
	Mustard	HUJM-17-6	2021	-	-
	Mustard	HUJM-17-15	2021	-	-
Kalyani	Mustard	TAM108-1 (Trombay Akola Mustard 108-1)	2022	Vidarbha region of Maharashtra	less incidence of powdery mildew in early to normal sowing
	Mustard	THPM-1(Trombay Him Palam Mustard -1)	2022	Himachal Pradesh	-
	Mustard	BBM1(BirsaBhabha Mustard-1)	2022	Zharkhand	Drought tolerant, Moderately tolerant to Alternaria, white rust and powdery mildew
Pantnagar	Yellow Sarson	Pant Pili Sarson-2 (PYS-2016-8)	2022	Suitable for plains of Uttarakhand	White rust immune reaction.
	Mustard	Pant Rai-22 (PRL-2013-17)	2022	Suitable for plains of Uttarakhand	Moderately resistance to Alternaria blight and white rust

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Research paper published:

Chatha

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121. Dr. M.S. Yadav, Pr. Scientist (Plant. Pathology.), NCIPM, New Delhi 110 012

ICAR- CENTRAL SOIL SALINITY RESEARCH INSTITUTE, KARNAL (HARYANA)

122. Dr. Joginder Singh, Scientist, CSSRI, Karnal 132 001

ICAR- INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE, NEW DELHI

123. Dr. Rajendera Prasad, Head, Division of Design of Experiments, IASRI, Library Avenue, Pusa, New Delhi-110 012

ICAR-VIVEKANANDA PARVATIYA KRISHI ANUSANDHAN SANSTHAN, ALMORA (UTTARAKHAND)

124. Dr. Lakshmi Kant, Head, Crop Improvement Division, VPKAS, Almora 263 601

PRIVATE ORGANISATIONS

125. Dr. Bhupesh Vaid, Pioneer Hi-Breed, Pioneer Hybrid Pvt. Ltd. Company, Gahlot Farm, Adjoining Sector-47, Opp. House No. 525, Gurugram (Haryana)

126. Dr. Nilasis Ghosh Dastidar, Namdhari Seed Pvt. Ltd., 104, 1st Floor, Block 5, Erore Garden, Faridabad (Haryana)

127. Dr. M.C. Gupta, Sr. Breeder (Mustard), Rasi Seeds (P) Ltd., Plot No. 126, Sector-8, IMT Manesar, Dist. Gurgaon-122 051 Haryana

128. Dr. R.K. Arora, Director, Mustard & Millet Research, Tierra Agrotech Pvt. Ltd, Gurugram

129. Mr. S.U. Baig, Breeder, M/s. Nath Seeds Ltd., P B No.318, Nath House, Nath Road, Aurangabad

130. Mr. C.H. Mruthunjaya, Pr. Scientist, Mustard Crop, Hytech Seed India Pvt. Ltd. Alwar (Raj.)

131. Dr. Vijay P. Hande, Plant Breeder, Nirmal Seeds Pvt. Ltd, Pachora, Dist. Jalgaon 424201 (MS)

132. Dr. E. Selvarani, Crystal crop Protection Ltd., F-1/104, South end Apartment, Charmood Village, Erore Garden, Faridabad-121001 (Haryana)

133. Dr. Rajender Singh, Mustard Breeder, Crystal crop Protection Ltd., F-1/104, South end Apartment, Charmood Village, Erore Garden, Faridabad-121001 (Haryana)

134. Mr. Saurabh Goel, Kamadgiri Seeds, Agra 282 004

135. Dr. Ved Prakash, M.D., Shakti Vardhak Hybrid Seeds Pvt. Ltd. Tilak Bazar, Hisar

136. Dr. Bhojraj Singh, Breeder, -Mustard, Kaveri Seeds, Alwar, Rajasthan

137. Dr. R.S. Mahala, Director, Mustard & Millet Research, Seed Works Pvt. Ltd. Shri Krishana house, 3rd Floor, Banjara Hills, Hyderabad -500 034 (Telangana)

138. Dr. Shankar Yadav, Sr. Breeder (Mustard) Seed Works International Pvt. Ltd. 8-2-626/2, Road No 10 Shri Krishana house, 3rd Floor, Banjara Hills, Hyderabad -500 034 (Telangana)

139. Mr. Sushil Goenka, President, The Solvent Extractors' Association of India, 142, Jolly Maker Chambers No. 2, 14th Floor, 225, Nariman Point, Mumbai 400 021

140. Dr. Rajarshi Kundu, Managing Director, Mali Agri Tech Pvt Ltd, Subhas Avenue, Ranaghat-741201, Dist. Nadia, West Bengal

141. Dr. Avanes Kumar Singh, Dept. Gen. Manager Dayal Seeds (P) Ltd. Delhi Road, Partapur, Meerut - 250103 (UP)

142. Dr. Rajarshi Kundu, Managing Director, Mali Agri Tech Pvt Ltd, Subhas Avenue, Ranaghat-741201, Dist. Nadia, West Bengal

143. Dr. U.S. Singh, Breeder (Wheat & Mustard), Nuziveedu Seeds Limited, 905, 9th Floor, Kanchan Junga Bulding, Barakhambha Road, Connaught Place, New Delhi

144. Mr. Sushil Karwa, Managing Director, Krishdhan Seeds Pvt. Ltd., "Krishidhan Bhavan" D3 to D6, Addln. MIDC, Aurangabad Road, JALNA 431 213 Maharashtra

Zone-wise research centres for multi-location testing

Zone I

Himachal Pradesh : Kangra, Dhaula Kuan*, Bajaura*, Una*

Zone II

Jammu & Kashmir : Chatha
 Punjab : Ludhiana, Abohar*
 Haryana : Hisar, Bawal, Karnal*, Palwal (Sohna)*, Mahendragarh*
 Rajasthan : Sriganganagar, Alwar*
 Delhi : IARI New Delhi*

Zone III

Uttar Pradesh : Kanpur, Jhanshi, Varanasi, Lucknow*, Agra*, Modipuram*, Faizabad*
 Uttarakhand : Pantnagar
 Madhya Pradesh : Morena
 Rajasthan : Kota, Bharatpur, Bikaner*, Fatehpur Shekhawati*
 Bihar : Dholi, Sabour*

Zone IV

Rajasthan : Mandor*, Pali*
 Gujarat : S.K. Nagar, Junagarh*
 Maharashtra : Nagpur, Washim*

Zone V

Chhattisgarh : Jagdalpur
 Jharkhand : Kanke
 West Bengal : Kalyani*
 Odisha : Bhubaneswar
 Asom : Shillongani
 Manipur : Imphal

Zone VI

Karnataka : Raichur*, Dharwad*
 Telangana : Hyderabad* Jagtial*

* Voluntary Centre :

Abbreviations used in the report

Zone I		Zone III		Zone IV	
KNG	Kangra	BPR	Bharatpur	WSM	Washim
DLK	Dhaulta Kuan	KOT	Kota	SKN	S.K. Nagar
UNA	Una	DOL	Dholi	NGP	Nagpur
BJR	Bajaura	BKR	Bikaner	MDR	Mandore
				PLI	Pali
Zone II				Zone V	
CHT	Chatha	VAR	Varanasi		
MOD	Modipuram			KLN	Kalyani
MDG	Mahendragarh	LKW	Lucknow	KNK	Kanke
LDH	Ludhiana	PNT	Pantnagar		
ABR	Abohar	MOR	Morena	BHU	Bhubaneswar
HSR	Hisar	SBR	Sabour	JAG	Jagdalpur
		AGR	Agra	IMP	Imphal
BAW	Bawal	KPR	Kanpur	SHL	Shillongani
KAR	Karnal	JHS	Jhanshi	Zone VI	
NDH	New Delhi	FTP	Fatehpur Shekhawati	RAI	Raichur
PAL	Palwal	FZB	Faizabad	DWD	Dharwad
SGN	Sriganganagar	ALW	Alwar	JGT	Jagtial
				HYD	Hyderabad

Zone wise FLD's Centres

1. JHD : Jharkhand
2. CAU : Central Agriculture University, Imphal
3. RLBCAU : Rani Laxmi Bai Central Agriculture University, Jhanshi
4. AMT : Amity University, Noida
5. JGT : Jagtial Centre
6. AMT : Amity University, Noida
7. KLP : Kolhapur KVK, Kaneri
8. VMFPCL : Veeresh Multipurpose Farmers Producer Company Limited, Bharatpur
9. Lupin : Lupin Human Welfare & Research Foundation, Bharatpur
10. Solidaridad : Solidaridad Regional Expertise Centre, New Delhi
11. Agrimitra : Agrimitra, Farmers Producer Company Limited, Mirzapur, Uttar Pradesh



Annual Group Meeting held online August 06-07, 2021



DDG (CS) Field Visit at ICAR-DRMR , Bharatpur