2. Genetics & Plant Breeding

2.1 Varietal Improvement

Fourteen centres spread over 11 states carried out the varietal development activities as per the approved technical programme. The salient achievements during the year 2019-20 in toria (*Brassica rapa* var toria), yellow sarson (*B. rapa* var yellow sarson), gobhi sarson (*B. napus*), Indian mustard (*B. juncea*), karan rai (*B. carinata*) and taramira (*Eruca sativa*) are discussed below:

2.1.1 Genetic Resource Management

A total of 7029 accessions comprising toria (508), Indian mustard (4,600), yellow sarson (548), gobhi sarson (146), brown sarson (108), karan rai (232), taramira (67), *B. caudatus* (04), *R. caudatus* (01), *B. rugosa* (30), *B. nigra* (22) S. Alba (01), Crambe sp (02), and Lapidium sp (02) were maintained through appropriate mating system at Bhubneshawar, Dholi, Hisar, Pantnagar, Ludhiana, Kanpur, Sriganganagar, IARI, New Delhi, Jobner, Morena, Pannagar, Chatha-Jammu and SK Nagar (Table 2.1.1). In addition, 30 new accessions comprising Indian mustard (22), toria (03), and taramira (05) were collected. Further, 790 accessions consisting of 438 Indian mustard, 84 toria, 174 yellow sarson, 17 gobhi sarson, 41 brown sarson, 06 Karan rai, and 30 taramira 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 and Chatha-Jammu.

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, 99 crosses were attempted in toria, 26 in yellow sarson at Pantnagar and Kanpur and 933 in Indian mustard at Chatha, Hisar, IARI New Delhi, Ludhiana, Kanpur, Pantanagar, SK Nagar, Morena, Sriganganagar, Jhansi 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 selection from segregating generations were attempted at Kanpur and Pantnagar. However, few of the centres reported that due to spread of COVID 19 in an across the region, the single plant selection could not perform. In Indian mustard, 3581 single plants were selected at New Delhi, Jhansi, Pantnagar, Ludhiana, SK Nagar and Morena. In Indian mustard, about 887 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. 56 strains of toria were tested at Kanpur, Chatha, Ludhiana and Dholi. The yield superiority in toria was up to 17.18 % over the check (Tapeshwari) at Kanpur. In yellow sarson, 45 strains were tested at Kanpur and Dholi. The yield superiority up to 16.66 % over the check Pitambari was recorded at Kanpur. In Indian mustard, 467 strains were evaluated at 07 centres; Chatha, Hisar, Ludhiana, Kanpur, Dholi, Varanasi and Sriganganagar in 24 trials. Seed yield superiority up to 14.67 % over the check Kranti was recorded at Kanpur. Ten strains at Hisar, 32 strains at Ludhiana and 09 strains at Chatha of gobhi sarson were evaluated for seed yield and its component

characters. In addition, 26 strains of Karanrai were also evalauted at Ludhiana for Seed yield and oil content under irrigated condition.

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 A total of thirty six experimental hybrids including each 8 from DRMR, 12 from IARI, 9 from PAU PAU Ludhiana and 07 from Hisar were evaluated in three multilocation trials; early maturity group and medium to late maturity group, conducted at each of four centres. Under early maturity trial (MLT 1), 9 early maturing hybrids were tested against three checks. All experimental hybrids were late in maturity than earliest maturing check Keshri but matured at par with NRCHB 101, hence, these were compared with NRCHB 101 for seed yield. Fifteen experimental hybrids were evaluated under timely sown normal maturity (CRPMLT 2) group against three checks. In MLT 2, Three hybrids, RHH1903, RHH 1904 and RHH 1905 out yielded the best check Pioneer 45S46 (2445 kg/ha) by a margin of 9.1, 8.6 and 8.5 percent, respectively. In MLT 3, one hybrid PHR 3328 out yielded the best check Pioneer 45S46 by a margin of 5.3% only. Seventy-six F_1 crosses comprising 22, 20, 19 and 15 from DRMR, PAU, HAU and IARI, respectively were evaluated at all four centres in MLT 4. Five crosses DRMREH 19-10, RHH 1915, DRMREH 19-3, RHH 1927, DRMREH 19-7 expressed >15% seed yield heterosis over best check Giriraj. Eighty-eight genotypes were evaluated for agronomic traits for second year to study the genetic diversity. These genotypes are being genotyped also with SSR markers. 256 experimental hybrids including 44, 21, 16 and 175 at DRMR, IARI, PAU and HAU respectively were evaluated by each centre in their own station trial. Each centre identified promising hybrids on the basis of >10 percent seed yield heterosis. Eight hybrids were inducted to All India Coordinated Research Project for multilocation evaluation. Out of eight 2 were evaluated in early mustard trial and remaining 6 hybrids in initial hybrid trial. 380 F_1 crosses were evaluated in station trials and each centre identified F_1 crosses with > 10 percent heterosis. 38, 68, 40, 33 backcrosses for advancing the generation of CMS line and 22, 1, 5 and 50 backcrosses for advancing the generation of R line were attempted at DRMR, HAU, PAU and IARI, respectively. 104, 269, 100 and 39 F_1 crosses were attempted at DRMR, HAU, PAU and IARI, respectively. Efforts continued to develop new inbred lines as well as to improve parental lines for white rust resistance, canola quality and for yield components at all four centres. Eighty eight germplasm/inbred lines along with two checks i.e. Giriraj and Pusa Mustard 25 were evaluated at all four centres to evaluate their agronomic performance for second consecutive year. Seed of 45, 48, 50 and 43 new experimental hybrids was produced at DRMR, CCSHAU, PAU Ludhiana and IARI, respectively. 19 A along with respective B lines and 8 R lines were characterized for agronomic and morphological traits.

2.2 Breeder seed production

Indents of 76.02 q breeder seed of 54 rapeseed-mustard varieties were received from Department of Agriculture and Cooperation (DAC), Ministry of Agriculture and Farmer Welfare, Govt. of India for production during 2019-20. The allocation was made to 18 centres for the production of **76.00** q breeder seed of 54 varieties during the 26th annual group meeting held at BAU, Ranchi (Jharkhand). Against the indent of 76.02 q, 258.64 q breeder seed was produced, indicating a surplus availability of 164.20 q. Breeder seed of 02 varieties including rajendra Suphlam of Indian mustard and Benoy (B 9) of yellow sarson could not be produced . Further, less quantity of Sushree of toria; DRMR 601 of Indian mustard and Tapeshwari of Toria was produced. In addition, 116.19 q breeder seed of 24 varieties was also reported from 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**
Toria	Bhubaneswar	3	156	153		
	Dholi	--	84	84	IGT-2, IGT-64 , IGT-91, RAUDT-62, RAUDT-15, RAUDT-7 ,RAUDT-67, RAUDT-36,RAUDT-16,RAUDT-74, RAUDT-79,RAUDT-7,DC9401 , TH-9802,Dwarf Toria, Satha local	Yield , Earliness , Yield components, Thermo-tolerant(Early and Terminal stages) ; Resistance/Tolerance to Diseases –Pests,and Quality traits like Oil Content.
	Kanpur	-	255	-	-	-
	Pantnagar		11		-	-
	Chatha-Jammu	-	41		-	Earliness , high seed yield, resistance/tolerance to diseases-pests and quality
	Morena		31			
Total		**03**	**578**	**237**	**-**	-
Indian mustard	Bhubaneswar	2	137	135	-	-
	Chatha-Jammu		76	48	-	-
	Dholi		390	390	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, RAURDA 09-32, 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.
	Hisar	-	100	-	-	-
	IARI, New Delhi		288			
	Kanpur	-	1465		-	-

	Pantnagar	-	43		-	-
	Sri Ganganagar	22	816	-	-	Yield, disease
	Morena		161			
	Ludhiana		400+70			
	Varanasi	-	331	--	--	
Total		**22**	**4277**	**573**		
Yellow sarson	Dholi	-	174	174	RAUDYS-89-111, RAUDYS-9701; RAUDYS-9702 ; RS-1; Pendent Local	Yield , Earliness , Yield components , Thermo-tolerant(Early and Terminal stages) ; Resistance/Tolerance to Diseases –Pests,and Quality traits like Oil Content.
	Hisar	-	12	-	-	-
	Pantnagar	-	33	-	-	-
	Kanpur	-	155	-	-	-
Total		-	**374**	**174**		
Gobhi sarson	Dholi	-	17	17	Tower, HNS 0004 and HYOLA 401	-
	Hisar	-	39	-	-	-
	IARI, New Delhi	-	16	-	-	-
	Ludhiana		25			
	Chatha-Jammu	-	32	-	-	-
Total		-	**129**	**17**		
Brown Sarson	Dholi	-	41	41	BSH-1	-
	Pantnagar	-	26	-	-	-
Total		-	**67**	**41**		
Karan rai	Dholi	-	06	06	Kiran, PBN-2001, PBN-2002, PBN9501, PBC9221	-
	Hisar	-	10	-	-	-
	IARI, New Delhi	-	170	-	-	-
	Ludhiana		40			

Total		-	**226**	**06**	-	
B rapa	IARI, New Delhi	-	27	-	-	-
	Ludhiana		150			
Total		-	**177**	-		
Taramira	Jobner	05	30	30		Seed yield
	IARI, New Delhi		2			
Total		**05**	**32**	**--**		
R. caudatus	IARI, New Delhi	-	04	-	-	-
Total		**-**	**04**	**-**		
B. nigra	IARI, New Delhi	-	07	-	-	-
B. nigra	Pantnagar		05			
B. nigra	Ludhiana		10			
Total		-	**22**	-		
B. rugosa	Pantnagar	-	30			-
Total			**30**			
S. Alba	IARI, New Delhi		01			
Total			**01**			
Crambe sp	IARI, New Delhi		02			
Total			**02**			
Lapidium sp	IARI, New Delhi		02			
Total			**02**			
Grand Total		**30**	**5921**	**1078**		

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	Breeding for dwarf, early maturity, high seed & oil yield strains of Toria suitable for rice-fallows	Fresh Cross	Tapeswari x Sushree, Anuradha x PT 303, Parbati x Tapeswari, PT 303 x TS-38, TKM 18-1xAnuradha, Bhawani x Tapeswari, RAUDT 14-9 x Anuradha, PT 303 x TKM 18-2, Uttara x Sushree, CAU-Toria1 x Parbati			
		F3 to F5	Derived by hybridization between Sushree x PT303, Anuradha x TS-38			
		F5 to F9	Advanced generation lines derived from Sushree x PT303, PT303 x Panchali, TS-29 x Panchali			
		Population Improvement	**Populatio1:** PT 303, Tapeswari, RAUDT 14-09, TS-38, Parbati, CAU-Toria1, Anuradha			
			Population2: TKM 18-2, PT-2015-10, JT-90-1, Tapeswari, Bhawani, Pant Hill Toria-1, Uttara, PT-508, RAUDT 14-09, Parbati			
			Population3: CAU Toria1, Bhawani, Tapeswari, PT-2013-7, PT 303,TKM 18-2, RMT 10-15, T-9, PT-141			
Chatha-Jammu	Early and high yield	Fresh cross	Six single crosses using parents RSPT-6, Bhawani,Uttara,PT-303,TL-15&RSPT-9.	06		
		F_1	PT-2013-5,PT-2013-8,TS-38,TRS-79,TKM-16-1 With Bhawani, PT-303 & Tapeswari	15		
		F_4	Open pollination (Early and late populations)	07		
		F_5	RSPT-1, RSPT-2 , RSPT- 6 cross with PT-303 , PTC-2009-3, RAUDT-10 , TL15 ,TL-21 lines.	10		
Dholi	To develop early and high yielding strains of toria	9 advanced generation Station Materials (bulks) evaluated in Advanced Varietal Station Trials	Derived by hybridization between Varieties, namely RAUTS-17, PT-303 and T_9 (three) with sources of earliness (four) namely Satha local, IGT-2, IGT-64 and IGT-91.	CSVT(TORIA)	09	

	To develop yellow seeded high seed and oil yield in toria	4 advanced generation Station Materials (bulks) evaluated in Advanced Varietal Station Trials	Derived by hybridization between RAUTS-17 / 89-115, PT 303 / 89-115, T_9 / 89-115	CSVT (TORIA)	04	
	Development of high yielding Strains of Toria	13 advanced generation Station Materials (bulks) evaluated in Advanced Varietal Station Trials	Derived by hybridization (Details already given above)	CSVT (TORIA)	Total:16	
Hisar	Early, high seed yield	Fresh crosses	JD 6, PM 25 and PM 28 as agronomically superior backgrounds and RH 1999-23, RH 1999-25, RH 1999-27, RH 1999-34, RH 1999-35, MCN(E) 19-08 and MCN(E) 19-20 as donor sources for earliness.	21		
		F_2	Four F_2 populations were grown in larger plots and desirable single plants have been selected from each F_2.	4	✓	
			BC_1 was attempted in 24 F_1 crosses; besides, F_2 seed of these crosses was also harvested.			
		BC_3 and BC_2	BC_3 and BC_2 were attempted in 55 and 25crosses, respectively.	55 and 25		
		Intermating	First cycle of intermating was attempted in 60 BC_3 crosses.			
		Intermating	Third and second cycle of intermating was attempted in 15 and 14 BC_3 crosses, respectively and their seeds have been harvested.	15 and 14		
		Intermating	The 8 third intermate progenies were selfed and seed was multipled.	08		
	Early and late populations		The early and late populations of toria were grown in isolation and open pollination was allowed. The early and late maturing plants have been selected		✓	
	Component traits		Forty two progenies of early raya were evaluated in Progeny Row Trial against two check varieties viz., PM 25 and PM 28 for seed yield and component traits. Single plants possessing desirable traits have been selected.	42	✓	
Kanpur	Early, high yielding	Population Improvement	Population – 1 : TK 01-1, TK 01-2, PT-303, TK 02-1, TK 9901, PT-507, T_9, Bhawani, ORM (M) 21-1, ORM (M) 7-1, Parbati, Anuradha and ORT-11.	37		✓

			Population- 2 : TK 9902, PT-303, TK-9801, TK-9802, PT-507, T_9, Bhawani, ORM (M) 21-1, ORM (M) 7-1, Parbati, Anuradha and ORT-11.			✓
			Population- 3 : TK-950, TK-9302, PT-303, TK-9702, PT-507, T_9, Bhawani, ORM (M) 21-1, ORM (M) 7-1, Parbati, Anuradha and ORT-11.			✓
		Fresh crosses	Six single crosses using parents TKM 14-1 x T-9 TKM 15-1 x Tapeshwari, TKM 16-1 x Bhawani, TKM 17-1 x PT-303, TKM 18-1 x PT-507 and TKM 18-2 x Azad chetna were attempted F_1 seed of six crosses were procured which will be grown in coming next season to raise F_2 populations.	6		
		F_3	PT-303 x T9, PT-303 x Bhwani , PT-303 x Tapeswari , PT-303 x ORT-11, PT-303 x PT507, PT-303 x Anuradha , T9 x Bhwani , T9 x Tapeswari , T9 x ORT-11, T9 x PT507, T9 x Anuradha , Bhwani x tapeswari , Bhwani x ORT-11, Bhwani x PT507, Bhwani x Anuradha , Tapeswari x ORT-11, Tapeswari x PT507, Tapeswari x Anuradha , ORT-11 x PT507, ORT-11 x Anuradha, and PT-507 x Anuradha	21	Selection was not performed due to lockdown.	✓
Morena	Identification of good combiners for seed yield and quality	Fresh crosses	18 fresh crosses were made during rabi 2019-20	18		
	Earliness, high seed yield bold seed and quality	F_1	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	53		
		F_2	JT-1 x (BAUT-08-01, RMT-15-2, TKM 17-1, TH 1603, RAUDT-14-9, Tapeswari, RAUDT—14-09, PT-2015-03, TKM 17-2, JT-11-9, PT-2015-11, Th 1602), (BAUT-08-01, RMT-15-2, TKM 17-1, TH 1603, RAUDT-14-9, Tapeswari, Bhawani, RAUDT—14-09, PT-2015-03, PT-303, TKM 17-2, JT-11-9, PT-2015-11, Th 1602) x JT-1	26		
		F_3	JT-1 x TS-36, JT-1 x TRL-79 (ASR), JT-1 x PT-303, JT-1 x RMT-10-9-1, JT-1 x TH-1502, JT-1 x TH-1402, PT-303 x JT-1, TKM-16-2 x JT-1, PT-2013-8 x JT-1, RAUDT-10-33 x JT-1	10	25	
		F_4	JT-1 x PT-303, JT-1 x RAUDT-10-33, TKM-15-1 x JT-1, Tapeswari x JT-1	4	15	
		F_6	RMT-10-11 x JT-1, RMT-10-9 x RMT-02-6, RMT-10-13 x JT-1, RMT-10-13 x B-85, JM-3 x JT-1	5	20	
		F_7	JMT-02-6 x JMT-04-5, JT-1 x JD-6	2	-	
		F_8	RMT-08-6 x JM-1, JM-2 x RMT-10-10, JM-3 x JT-1	3	5	
		F_{10}	RMT-02 x JT-1, RMT-0-2-6 x RMT-10-6, RMT-0-2-6 x JD-6, RMT-0-16 x RMT-10-6, RMT-0-4-1 x RMT-10-10, RMT-10-11x JT-1, RMT-10-2 x RMT-10-10	7	8	
		F_{12}	PT-2004-3 x TH-0302, Bhawani x TL-2013, Bhawani x RMT-016, JT-1 x TL-2013	4	10	

Pantnagar	Breeding for early maturing & high yielding varieties Breeding for early maturing & high yielding varieties	Fresh crosses	PT-2016-16 × PHT-1,PT-2016-16×Tapeswari,PT-2018-5×PT-30,PT-2018-5×PT-508,PT-2018-1×PHT-1,PT-2018-1×Uttara,PT-2018-9×Uttara,PT-2018-9×PHT-1, TCN-19-1×PT-508,TCN-19-1×PHT-1,TCN-19-4×PT-508,TCN-19-4×PHT-1, TCN-19-7×PT-508,TCN-19-18 ×PT-30,Tapeswari × TCN-19-15,PT-30×TCN-19-9	16		
		F_1 to F_2	PT-15-3×PT-16-6,PT-15-3×TKM-17-1,PT-15-3×PT-16-9,TCN-18-2×PT-16-6,TCN-18-2×TKM-17-1,TCN-18-2×PT-16-9,TCN-18-2×PT-17-3,PT-17-2× PT-16-6,PT-17-2× TKM-17-1,PT-17-2× PT-16-9,PT-17-2× PT-17-3, PT-12-5×PT-16-6,PT-12-5×TKM-17-1,PT-12-5× PT-16-9,PT-12-5× PT-17-3,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,PT-15-7 × KBS-49,PT-15-7 × PHT-1,PT-15-7 × PTHC-10-1,(PT-15-7 × PT-16-24) × PT-30,(PT-15-6 × PT-16-24) × PT-141,(PT-15-6 × PT-16-24) × PT-30,(Tapeswari × PT-30) × RAUDT-10-33,(PT-145× TL-15) ×Uttara	29	26	
		F_2 to F_3	TL-15×× Uttara,TL-15×PT-30,PT-15-7 × RAUDT-10-33,PT-15-7 × Uttara,PT-16-11 × PT-16-2,PT-16-11 × PT-16-4PT-15-4×PT-303,PT-16-11 × PT-16-3,(KBS – 49 × Uttara) × PT-141,PT-15-10 ×PT-16-10,(KBS-49 × PHT-1) × PT-30,(KBS-49 × Uttara) × PT-30,PT-15-4×Tapeswari,PT-15-7×PT-16-2,PT-15-6 × TH-1402,PT-15-10×PT-17-3,(KBS 49×PHT-1×Uttara,Tapeswari×PT-30,	18	14	
		F_3 to F_4	Bhawani × PT-141,PRT-1 × PT-145,RSPT-2 × PT-141,RSPT-2 × Bhawani,Uttara × PT-508,Uttara × PHT-1,KBS-49 × PHT-1,Tapeswari × PT-15-3,PHTC-2010-1 × KBS-48,(PT-16-4 × TKM-16-1) × PT-2012-5	10	09	
Ludhiana	RIL populations developed/ maintained	Productivity related traits	EC3390101 x Sunbean	01		
Crop: Yellow sarson						
Bhubaneswar	Bold seeded, Earliness & High seed yield suitable for rice fallows	Fresh crosses	Pitambari x YSH 04-01, NRCYS 05-02 x YSKM 18-2, NRCYS 05-02 X Pitambari NRCYS 05-02 x YSH 0401 Pitambari x Pant Sweta	5		
		M2-generation (EMS-induced mutation breeding)	Seeds of NRCYS 05-02 variety was treated with 0.5% EMS for 6hr and grown in the field. M2-seeds have been harvested and will be grown in the next rabi season for undertaking single plant selection.			
Dholi	Development of high yielding Strains for various condition	10 advanced generation Station Materials (bulks)	Derived by hybridization RS-1 / Pendent local, RS 1 /EMYS Local, Pendant local / EMYS Local	AVST (14)		

Kanpur	Early and high yield	Fresh crosses	Six single crosses using parents YSKM 15-2 x YSH - 401, YSKM 16-2 x Benoy, YSKM 17-2 x Pitambari, YSKM 18-1 x Benoy and YSKM 18-2 x Pitambari were attempted F_1 seed of six crosses were procured which will be grown in coming next season to raise F_2 populations.	06		
		F_3	YSC-63 x NRCYS-05-02, YSC-63 x YSH-401, YSC-63 x Benoy, YSC-63 x Pitambari, YSC-41 x NRCYS-05-02, YSC-41 x YSH-401, YSC-41 x Benoy, YSC-41 x Pitambari, YSC-09 x NRCYS-05-02, YSC-09 x YSH-401, YSC-09 x Benoy, YSC-09 x Pitambari, YSC-71 x NRCYS-05-02, YSC-71 x YSH-401, YSC-71 x Benoy, YSC-71 x Pitambari, YSKM11-02 x NRCYS-05-02, YSKM11-02 x YSH-401, YSKM11-02 x Benoy, YSKM11-02 x Pitambari, YSC-76 x NRCYS-05-02, YSC-76 x YSH-401, YSC-76 x Benoy, YSC-76 x Pitambari, YSKM-10-1 x NRCYS-05-02, YSC -10-1 x YSH-401, YSKM-10-1 x Benoy, YSKM-10-1 x Pitambari, YSKM-11-1 x NRCYS-05-02, YSKM-11-1 x YSH-401, YSKM-11-1 x Benoy, YSKM-11-1 x Pitambari , YSC-75 x NRCYS-05-02, YSC-75 x YSH-401, YSC-75 x Benoy, YSC-75 x Pitambari, YSKM-10-2 x NRCYS-05-02, YSKM-10-2 x YSH-401, YSKM-10-2 x Benoy , YSKM-10-2 x Pitambari , YSK9-01 x NRCYS-05-02, YSK9-01 x YSH-401, YSK9-01 x Benoy, YSK9-01 x Pitambari, YSC-80 x NRCYS-05-02, YSC-80 x YSH-401, YSC-80 x Benoy, YSC-80 x Pitambari, K88 x NRCYS-05-02, K88 x YSH-401, K88 x Benoy, K88 x Pitambari, YSC-15 x NRCYS-05-02, YSC-15 x YSH-401, YSC-15 x Benoy, YSC-15 x Pitambari, T42 x NRCYS-05-02, T42 x YSH-401, T42 x Benoy, T42 x Pitambari, YSC-18 x NRCYS-05-02, YSC-18 x YSH-401, YSC-18 x Benoy, YSC-18 x Pitambari, YSK-03 x NRCYS-05-02, YSK-03 x YSH-401, YSK-03 x Benoy, YSK-03 x Pitambari , YSC-21 x NRCYS-05-02, YSC-21 x YSH-401, YSC-21 x Benoy, YSC-21 x Pitambari, YSC-92 x NRCYS-05-02, YSC-92 x YSH-401, YSC-92 x Benoy, YSC-92 x Pitambari, YSC-45 x NRCYS-05-02, YSC-45 x YSH-401, YSC-45 x Benoy, YSC-45 x Pitambari, YSC-30 x NRCYS-05-02, YSC-30 x YSH-401, YSC-30 x Benoy, YSC-30 x Pitambari, YSC-95 x NRCYS-05-02, YSC-95 x YSH-401, YSC-95 x Benoy, YSC-95 x Pitambari, YSC-40 x NRCYS-05-02, YSC-40 x YSH-401, YSC-40 x Benoy, YSC-40 x Pitambari, YSC-46 x NRCYS-05-02, YSC-46 x YSH-401, YSC-46 x Benoy, YSC-46 x Pitambari, YSC-84 x NRCYS-05-02, YSC-84 x YSH-401, YSC-84 x Benoy, and YSC-84 x Pitambari	100	Selection was not performed due to lockdown.	
		F_4	YST-151 x T-44, YST-151 x K88, YST-151 x T-3, YST-151 x T-4, YST-151 x B-9, YST-151 x YSK-1, T-44 x K88, T-44 x T-3, T-44 x T-4, T-44 x B-9, T-44 x YSK-1, K-88 x T-3, K-88 x T-4, K-88 x B-9, K-88 x YSK-1, T-3 x T-4, T-3 x B-9, T-3 x YSK-1, T-4 x B-9, T-4 x YSK-1, and B-9 x YSK-1	21	Selection was not performed due to lockdown.	

		F_5	YST-151 x YSK-3, YST-151 x YSK-24, YST-151 x YSK-28, YST-151 x YSK-42, YST-151 x K88, YST-151 x YSK-2, YST-151 x YSK-4, YSK-3 x YSK-2, YSK-3 x YSK-28, YSK-3 x YSK-42, YSK-3 x K88, YSK-3 x YSK-2, YSK-3 x YSK-4, YSK-24 x YSK-28, YSK-24 x YSK-42, YSK-24 x K88, YSK-24 x YSK-2, YSK-24 x YSK-4, YSK-28 x YSK-42, YSK-28 x K88, YSK-28 x YSK-2, YSK-28 x YSK-4, YSK-42 x K88, YSK-42 x YSK-2, YSK-42 x YSK-4, K88 x YSK-2, K88 x YSK-4, and YSK-2 x YSK-4.	28	Selection was not performed due to lockdown.	
Pantnagar	Breeding for high yield	Fresh crosses	B-9×PYS-2018-4,B-9×PYS-2017-6,B-9×PYS-2017-8,PPS-1×PYS-2018-4,PPS-1×PYS-2017-6,PPS-1×PYS-2017-8,Pant Swata × PYS-2018-4,Pant Sweta × PYS-2017-6,Pant Girija × PYS-2018-4,Pant Girija × PYS-2017-6,Pant Girija × PYS-2017-8,NRCYS-0502×PYS-2018-4,NRCYS-0502×PYS-2018-6, NRCYS-0502×PYS-2017-8,Pitambari × PYS-2018-4,Pitambari × PYS-2017-6,Pitambari × PYS-2017-8,YSH-401×PYS-2018-4,YSH-401×PYS-2018-6,YSH-401×PYS-2017-8	20		
		F_1 to F_2	YS-89-7×PYS-16-7,YS-89-7×NDYS-107,YS-89-7×NDYS-2018,YS-89-7×NDYS-123,YS-89-7× PYS-2016-15,Pitambari × PYS-16-7,Pitambari × NDYS-107,Pitambari × NDYS-2018,Pitambari × NDYS-123,Pitambari × PYS-2016-15,NDYS-842× PYS-16-7,NDYS-842× NDYS-107,NDYS-842× NDYS-2018,NDYS-842× NDYS-123,NDYS-842× PYS-2016-15,PYS-17-6× PYS-16-7, PYS-17-6× NDYS-107,PYS-17-6× NDYS-2018, PYS-17-6× NDYS-123,PYS-17-6× PYS-2016-15,PYS-17-11× PYS-16-7,PYS-17-11× NDYS-107,PYS-17-11× NDYS-2018,PYS-17-11× NDYS-123,PYS-17-11× PYS-2016-15,PYS-17-13× PYS-16-7,PYS-17-13× NDYS-107,PYS-17-13× NDYS-2018,PYS-17-13× NDYS-123,PYS-17-13× PYS-2016-15,	30	23	
		F_2 to F_3	PYSC-68-6 × NDYS-115,PYSC-14-3 × YS-897,PYS-58-13 × NRCYS-05-02,PYSC-21-6 × YS-89-7,PYSC-41-3 × NDYS-123,PYSC-40-4 × PYS-842,PYSC-41-3 × NRCYS-05-02,PYSC-40-4 × RAUDYS-14-9, PYSC-68-6 × PYS-842,NDYS-115 × Ragini,PYS-6 × Ragini,PYS-842 × NRCYS-05-02,,PYS-841 × RAUDYS-14-9,PYSC-64-5 × RAUDYS-14-9,PYSC-53-5 × RAUDYS-14-9,(PYS-2016-6 x PYS-6) × B-9,(PYS-2016-6 x PYS-6) × RAUDTYS-14-9,(PYS-2016-6 x PYS-6) × NDYS-115,(PYS-2016-8 x B-9) × YS-89-7,(PYS-2016-8 x B-9) × (PYS-6 x NDYS-137),{(IC-317444x IC-444231) × PYS-2012-6 } x YS-897	21	16	
		F_3 to F_4	PYS-6 × NDYS-137,PYS-6 × NDYS-123,PYS-6 × NDYS-115,PYS-6 × NDYS-115,DRMRYS-2016-42 × YSH-842,PYS-2016-9 × PYSC-11-4,PYS-2016-9 × PYS-2011-43,PYS-2016-6 × PYS-6,PYS-2011-43 × NDYS-137,PYS-2011-43 × PYS-2012-4, PYS—6 (ML) × NDYS-115,(PYSC-2011-43 × YSH-0401) × Ragini	12	163	**12**

		F_4 to F_5	NDYS-2018 × YSH-401,NDYS-115 × PYS-2015-5,NDYS-137 × NRCYS-0502,NDYS-117 × B-9,PYSC-11-43 × YSH-401,Apetalus × YSH-0401,NDYS-123 × Sweta-401,NDYS-123 × PPS-1	08	101	06
		F_5 to F_6	PYS-841 x PYSC-11-47,PYS-6 x PYSC-11-47,NRCYS-502 x PYSC-11-47,NRCYS-502 x PYSC-11-43,PYSC-11-31 x PYSC-11-43	05	65	05
		F_6 to F_7	PYSC-11-43 x PYSC-13-12,PYS-7 x PYS-11-1	02	08	01
		F_7 to F_8	PYSC-11-20 x B-9,PYSC-11-20 x YSWB-2014-3-12,PYS-2011-16 x PYS-2011-2	03	21	07
Crop: Indian mustard						
Bhubaneswar	Breeding for early, bold seeded, high seed & oil yield strains of mustard	Fresh Crosses	Pusa Bold x Kranti,RMM-10-1-1 x NRCHB 101, Pusa Bold x RMM 10-1-1, Rajendra Suphala x NPJ 226, NRCHB101 x NDRE 7, NDRE 7 x RMM 10-1-1, Pusa Bold x NDRE 7, Pusa Bold X RMM 10-1-1, Rajendra Suphala x NDRE 7, NDRE 7 x Kranti, RMM 10-1-1 x NPJ 226	10		
		F3 to F9	Derived from the hybridization between NRCHB 101 x Kranti, Pusa Bold X JD 6	11	20	
	To develop bold, yellow seeded high-yielding genotypes having terminal thermotolerance using EMS-induced mutagenesis	M2-generation	Parents: Pusa Bold, Kranti, NRCHB101, Rajendra Suphala, Dosage: 0.4% EMS, 8hr and 0.7% for 6hr			
Chatha-Jammu	Seed yield & for rainfed condition	Fresh crosses	Attempted using agronomically superior 15 genotypes with RH-761, RB-24& RH725.	45		
		F_1	RSPR-69,RSPR-5,RSPR-1,RSPR-3,RH-1209,RH-0923,SKJM-5,SKJM-3 With NRCHB-101, RH-406 & RH-749	24		
		F_2	RGN-400,DRMRIJ-16-1,PRE-2013-10,DRMRCI-55,NRCHB-101,RH-1207 WITH RH-406,PM-25&RH-1573	16		

		F_3	RSPR-01, RH-30, RSPR-03, RH-749,RSPR-69 & RB-24 with RH-406,RB-50, RH-819 & DRMR 541-44	20		
		F_4	NRCDR-2, NRCHB-101, NPJ-112, DRMRIJ-31, PUSA BOLD, RB-50, RH-749 with RSPR-69 , RSPR-01& RSPR-03	12		
		F_5	Early and late populations	05		
		F_6	RH-30, Pusa Agrani , Pusa Mahak , RB-24 with RSPR-01, RSPR-03 & RSPR-69	09		
		F_7	Pusa Karishma x RSPR-01, PM-21 x RSPR-03 , PM24 x RSPR-01 , PM24 x RSPR-69 .	03		
Dholi	Resistance/ tolerance to diseases high yield and other attributes	18 advanced generation Station Materials (bulks) evaluated in Advanced Varietal Station Trials.	Derived by Interspecific hybridization involving Kranti, Pusa Bold, Varuna, & RAURDL 02-1 of *B. juncea* and PBC9221 (*B. carinata*), EC 339000, EC 338997, ONK-1, HNS 0004 and HYOLA 401 (*B. napus*)	AVST (22)		
Hisar	Breeding for component characters	Fresh crosses	Twenty four new crosses were attempted using agronomically superior genotypes viz., RB 50, RH 0119, RH 406, RH 1903, RH 1799-59, RH 1986 and RH 1550-1 as base population and RC-320, RH 1938, MCN-19-1 and DRMR 13-13 as donor sources.	24		
		F_2	F_2 populations were grown in larger plots and desirable single plants have been selected from each F_2.	18		
		Generation advancement; BC_{1s}	F_{1s} were grown for generation advancement; BC_{1s} were attempted in these crosses and F_2 seed of these crosses was also harvested and threshed.	43		
		BC_3 and BC_2	BC_3 and BC_2 were attempted in 122 and 62 crosses, respectively.	122 and 62		
		inter mating	Third, second and first cycle of inter mating was attempted in 18, 52 and 93 BC_3 progenies, respectively	18, 52 and 93		✓
		BC_3	Nine BC_3 progenies after third intermate were selfed and seed was multipled for further testing in Small Scale Trials.			✓
		PRTs	Seven Progeny Row Trials comprising 42 progenies each were evaluated against two check varieties viz., RH 725 and RH 0749 for seed yield and component traits. Single plants possessing desirable traits have been selected.	42		✓
	Breeding for disease resistance	Fresh crosses	Seven new crosses were attempted using agronomically superior genotypes viz., RB 50, RH 0119, RH 406, RH 1903, RH 1799-59, RH 1986 and RH 1550-1 as base population and SIJ-1110 as donor source for white rust resistance.	07		
		F_2	Populations were grown in larger plots and desirable single plants have been selected from each F_2	4		

	Breeding for component characters	Fresh crosses	Twenty four new crosses were attempted using agronomically superior genotypes viz., RB 50, RH 0119, RH 406, RH 1903, RH 1799-59, RH 1986 and RH 1550-1 as base population and RC-320, RH 1938, MCN-19-1 and DRMR 13-13 as donor sources.			
		F_2	F_2 populations were grown in larger plots and desirable single plants have been selected from each F_2.	18		
		BC_1 F_1	F_{1s} were grown and BC_1 was attempted in these crosses. Besides, F_2 seed of these crosses have also been harvested.	08		✓
		BC_3 and BC_2	BC_3 and BC_2 were attempted in 20and 16 crosses, respectively	20 and 16		✓
		Inter mating	Third, second and first cycle of inter mating was attempted in 12, 13 and 17 BC_3 crosses, respectively and their seeds were harvested.	12, 13 and 17		✓
		PRTs	Forty two progenies were evaluated against two checks (RH 725 and RH 0749) in one Progeny Row Trial for seed yield and disease tolerance. Single plants possessing desirable traits have been selected.	42		✓
	Breeding for '0' and '00' varieties	Fresh crosses	Seven new crosses were attempted using agronomically superior genotypes viz., RB 50, RH 0119, RH 406, RH 1903, RH 1799-59, RH 1986 and RH 1550-1 as base population and RLC-4 as donor source for '00' traits.	07		✓
		F_2	Populations were grown in larger plots and desirable single plants have been selected and these will be subjected to fatty acid analysis.	02		✓
		BC_1 F_1	Sixteen F_{1s} were grown and BC_1 was attempted in these crosses. Besides, F_2 seed of these crosses have also been harvested.	07		✓
		BC_3 and BC_2	BC_3 and BC_2 were attempted in 09 and 16 crosses, respectively	09 and 16		✓
		Inter mate	Second and first inter mate was attempted in 05 and 12 low erucic acid BC_3 progenies respectively and seed was multiplied.	05 and 12		✓
		LST/SST	One Large Scale Trial (Q) having 14 strains for low erucic acid and two checks was conducted and results are being compiled.	14 and 02		✓
	Development of hybrids in Indian mustard	F_1	245 and 109 new F_1 hybrids based upon *Ogura* and *Mori* CMS systems, respectively were developed for evaluation.	245 and 109		✓
		Diversification of A and R lines	06 and 07 new agronomical superior genotypes were used for diversification of A and R lines, respectively in *Ogura* CMS system.	06 and 07		✓
			Generations were advanced for incorporation/diversification of *Ogura* CMS system into 61 different genetic backgrounds	61		✓
		A and R line Maintenance	39 R lines of *Mori* CMS and 91 R lines for *Ogura* CMS system were maintaine	39		✓
			13 A lines of *Mori* and 14 A lines of *Ogura* CMS system were maintained	13		✓

		Evaluation of hybrids	89 new test hybrids based upon *Ogura* CMS system and 73 hybrids based upon *Mori* CMS system were evaluated against three checks. The data analysis is in progress.	89		✓
		SST	One Small Scale Trial comprising nine experimental hybrids was conducted and results are being compiled.	13		✓
IARI, new Delhi	Development of Indian mustard varieties/hybrids suitable for timely sown conditions	Fresh single crosses attempted	Improved Genotypes/varieties	50	-	-
		Fresh multiple crosses attempted	F_1 x F_1 and F_1 x Promising Genotypes	63	-	-
		A x R (F_1s) and B line x B line	EC 27-2, TN 3, LET 17, EJ 17, P Tarak, LES 39, NPJ 112, M-34, RC 273, NRCDRIJ 31	40	-	-
		F_1	Improved Genotypes with medium to long duration and ILs x ILs (*B. carinata* derived x *B. juncea* Introgression lines)	354	100	-
		Synthetic *B. juncea* lines (First generation)	NRCPB rapa 8 x *B. nigra*	53	16	-
		F_2	Improved Genotypes with medium to long duration	48	104	-
		MCF_2 (alien introgression)	Conventional crosses; *D. erucoides/B. rapa (DDAA)//B. juncea// B. juncea;* *B. juncea//*Turnip*/B. juncea///B. juncea*	168	63	-
		F_3	Conventional crosses; *B. juncea*/ Resynthesised *B. juncea; B. juncea*/ *B. juncea chinensis*	119	72	-
		F_4/BC_1F_3	Improved x Improved *B. juncea*	23	13	-
		MCF_4	Improved x Improved *B. juncea*	74	33	-

		F_5	Improved x Improved *B. juncea*	29	32	2
		F_6	Improved x Improved *B. juncea*	55	18	8
		F_6	*B. carinata* derived *B. juncea* Introgression lines (ILs) for WUE	191	-	-
		F_4-F_7	White Rust Resistance	12	11	-
		F_7	Improved x Improved *B. juncea*	38	18	8
		BC_2-BC_{11}	CMS lines development and evaluation	66	61	-
		BC5-BC6	Development of fertility restorers	72	6BC_ + 66$BC_{5/6}F_1$	-
	Enhancement of oil and meal quality in Indian mustard	Direct crosses attempted	Various improved single zero (0), double zero (00) and conventional genotypes/varieties	36	-	-
		Backcrosses(BC1 F1)		11	-	-
		Multiple crosses		16	-	-
		F1		39	-	-
		F2		18	241	-
		F3	-	41(0)+5(00)	39(0)+38(00)	-
		F4	-	36(0)+4(00)	18(0)+25(00)	-
		F5	-	54(0)+13(00)	53(0)+63(00)	-
		F6	-	32(0)+12(00)	9(0)+22(00)	7(0)+4(00)

		F7	-	25(0)	-	6(0)
		Direct crosses attempted	Various improved single zero (0), double zero (00) and conventional genotypes/varieties	36	-	-
		Backcrosses(BC1 F1)		11	-	-
		Multiple crosses		16	-	-
		F1		39	-	-
		F2		18	241	-
		F3	-	41(0)+5(00)	39(0)+38(00)	-
		F4	-	36(0)+4(00)	18(0)+25(00)	-
		F5	-	54(0)+13(00)	53(0)+63(00)	-
		F6	-	32(0)+12(00)	9(0)+22(00)	7(0)+4(00)
		F7	-	25(0)	-	6(0)
	Breeding material evaluated and advanced for short duration (Early and Late sown):					
	Short duration high yielding genotypes suitable for early sown conditions and possessing thermotolerance	F1	Advanced fixed genotypes, entries from AICRP-RM trials and exotic germplasm.	22	-	

	Early Sown	F2		39	89	
		F3		97	50	
		F4		41	16	
		F5		30	21	
		F6		31	11	2
	Late Sown	F2		22	91	
		F3		47	54	
		F4		38	66	
		F5		27	29	
		F6		24	4	9
		F7		29	7	11
	0/00 trait with white rust resistance	BC	Pusa Mustard 22 (0) P. Jagannath, NPJ198, NRCHB101, DMRIJ31, Donskaja, Heera, PDZ 1, RLC3	21		
	Pre-breeding	F_1s	*B. juncea, B. carinata , B. napus, B. rapa*	6		
Jhansi	Breeding for High seed yield	Fresh Crosses	Improved genotypes or varieties	15		
		F_2	HB 9925 x RGN 73, HB 9925 x RH 749, DRMR-IJ-31 x RGN- 73, DRMR-IJ-31 x EH_2 , DRMR-IJ-31 x DRMR-IJ-17-40, DRMR-IJ-31 x RH- 749, MJB-10 x EH_2 , MJB-10 x DRMR-IJ-17-40, MJB-11 x RGN-73, MJB-5 x RH-749	10	30-35 plants from each cross	
Ludhiana	Productivity and oil content. To improve genetic diversity for enhanced heterosis	Fresh crosses	Crosses	131		

		F_1	115	115		
		F_2	115	115		
		F_3	330	330		
		F_4	125	125		
		F_5	25	25		
	Aphid resistance	F_1	6	6		
	Disease resistance (Alternaria blight)	F_1	6	6		
	White rust	F_1	5	5		
	Brassica juncea (Quality) To enhance variability in canola quality germplasm for higher yield and oil content	Fresh crosses	115			
		F_1	120			
		F_2	100			
		F_3	60			
		F_4	76			
		F_5	24			
		Advanced lines (0/00)	250			

	Mutation breeding for biotic stress	M1 M3	Gamma rays= 250 EMS=400			
	Hybrid development	CMS lines developed/ maintained		100		
		Restorer lines developed/maintained		5		
	Hybrid (Quality)	CMS lines developed/ maintained		100		
		Restorer lines developed/maintained		2		
	RIL populations developed/ maintained	Quality characters	NUDHYJ-4 x RL 1359 RL1359 x CBJ001	Two		
Kanpur	To evolve early maturing, high yielding, bold/medium, brown/yellow seeded varieties	Fresh crosses	Set – I: Twenty one crosses (7 Parental diallel excluding reciprocals) using TM-108, TM-179, TM-106, TM-108, TM-117, Varuna and Rohini were attempted F_0 seeds of 21 crosses were procured which will be grown in coming next season to raise F_{1s} populations. Set – II: Forty five crosses (10 Parental diallel excluding reciprocals) using RH-749, Varuna, NRCDR-2, Urvashi, IJ-31, Maya, RH-406, Azad Mahak, KMR17-3 and KMR17-4 were attempted F_0 seeds of 45 crosses were procured which will be grown in coming next season to raise F_{1s} populations. Set – III: Forty five crosses (10 Parental diallel excluding reciprocals) using Basanti, Varana, Urvashi, NRCDR-2, KMR-19-1, KMR19-2, RH-749, IJ-31, RH-406 and Azad Mahak were attempted F_0 seeds of 45 crosses were procured which will be grown in coming next season to raise F_{1s} populations. Set – IV: Twenty one crosses (7 Parental diallel excluding reciprocals) using Urvashi, PM-27 Pusa agrani, RH-749, KMR15-2, Pusa bahar and Durgamani were	153		

			attempted F_1 seeds of 21 crosses were procured which will be grown in coming next season to raise F_2 populations. Set –V: Twenty one crosses (7 Parental diallel excluding reciprocals) using Maya, Basanti, PM-28, PM-29, PM-30, Rohini and Kanti were attempted F_1 seeds of 21 crosses were procured which will be grown in coming next season to raise F_2 populations.			
		F_2	Set I : Varuna x NDR-8501 , Varuna x RH-30 , Varuna x Durgamani , Varuna x Lotani Gota , Varuna x PR-15 ,Maya x NDR-8501, ,Maya x RH-30 ,Maya x Durgamani , Maya x Lotani Gota ,Maya x PR-15 ,NDR-8501 x RH-30, NDR-8501 x Durgamani ,NDR-8501 x Lotani Gota, NDR-8501 x PR-15, RH-30 x Durgamani , RH-30 x Lotani Gota ,RH-30 x PR-15 ,Durgamani x Lotani Gota, Durgamani x PR-15, Lotani Gota x PR-15 (Set II): NRCDR-2 x NRCHB-101,NRCDR-2 x Pusa mustard-2, NRCDR-2 x RLM-198, NRCDR-2 x KMR-13-4, NRCDR-2 x KMR-14-4, NRCDR-2 x Pusa bold , NRCHB-101 x Pusa mustard-21, NRCHB-101 x RLM-198, NRCHB-101 x KMR-13-4, NRCHB-101 x KMR-14-4, NRCHB-101 x Pusa bold, Pusa mustard-21 x RLM-198, Pusa mustard-21 x KMR-13-4, Pusa mustard-21 x KMR-14-4, RLM-198 x Pusa bold, RLM-198 x KMR-13-4, RLM-198 x KMR-14-4, KMR-13-4 x KMR-14-4, KMR-13-4 x Pusa bold, KMR-14-4 x Pusa bold.	21 20		
		F_3	Set I: Kranti x NDR8501 , Kranti x Maya , Kranti x Sej-2 , Kranti x Pusa Agarni, Kranti x Varuna, Kranti x Pusa Bold , Kranti x JM-2 , Kranti x JM-3 , Kranti x J.M-4, NDR8501 x Maya, NDR8501 x Sej-2, NDR8501 x Pusa Agarni, NDR8501 x Varuna , NDR8501 x Pusa Bold , NDR8501 x JM-2, NDR8501 x JM-3 , NDR8501 x JM-4 , Maya x Sej-2, Maya x Pusa Agarni , Maya x Varuna, Maya x Pusa Bold, Maya x JM-2, Maya x JM-3, Maya x JM-4 , Sej-2 x Pusa Agarni, Sej-2 x Varuna, Sej-2 x Pusa Bold, Sej-2 x JM-2, Sej-2 x JM-3 , Sej-2 x JM4, Pusa Agrani xVaruna , Pusa Agrani x Pusa Bold, Pusa Agrani x JM-2, Pusa Agrani x JM-3, Pusa Agarani x JM-4, Varuna x Pusa Bold, Varuna x JM-2, Varuna x JM-3, Varuna x JM-4, Pusa Bold x JM-2, Pusa Bold x JM-3 , Pusa Bold x JM-4, JM-2 x JM-3 JM-2 x JM-4, JM-2 x JM-4	45		

			Set II: NRCDR-2 x Pusa jai kisan, NRCDR-2 x JM-2, NRCDR-2 x Geeta, NRCDR-2 x Urvashi, NRCDR-2 x RGN-73, NRCDR-2 x Maya, NRCDR-2 x CS-52, Pusa jai kisan x JM-2, Pusa jai kisan x Geeta, Pusa jai kisan x Urvashi, Pusa jai kisan x RGN-73, Pusa jai kisan x Maya, Pusa jai kisan x CS-52, JM-2 x Geeta, JM-2 x Urvashi, JM-2 x RGN-73, JM-2 x Maya, JM-2 x CS-52, Geeta x Urvashi, Geeta x RGN-73, Geeta x Maya, Geeta x CS-52, Urvashi x RGN-73, Urvashi x Maya , Urvashi x CS-52, RGN-73x Maya, RGN-73x CS-52, Maya x CS-52	28		
		F_4	Set I: Varuna x Kanti, Varuna x sej-2 , Varuna x NDRE-4, Varuna x M rai, Maya x Kanti, Maya x sej-2, Maya x NDRE-4, Maya x M rai , NDR8501 x Kanti, NDR8501 x sej-2, NDR8501 x NDRE-4, NDR8501 x M rai, Kranti x Kanti, Kranti x sej-2, Kranti x NDRE-4, Kranti x M rai, RLM-198 x Kanti, RLM-198 x sej-2, RLM-198 x NDRE-4, RLM-198 x M rai, RH-30 x Kanti, RH-30 x sej-2, RH-30 x NDRE-4, RH-30 x M rai, Pusa Bold x Kanti, Pusa Bold x sej-2, Pusa Bold x NDRE-4, Pusa Bold x M rai, Urvashi x Kanti , Uvashi x sej-2, Urvashi x NDRE-4, Urvashi x M rai, Pusa jaganath x Kanti , Pusa jaganath x sej-2, Pusa jaganath x NDRE-4, Pusa jaganath x M rai, Pusa bahar x Kanti, Pusa bahar x sej-2, Pusa bahar x NDRE-4, Pusa bahar x M rai, Arawali x Kanti, Arawali x sej-2, Arawali x NDRE-4, Arawali x M rai, RK-9808 x Kanti, RK-9808 x sej-2, RK-9808 x NDRE-4, RK-9808 x M rai, RK-9903 x sej-2, RK-9903 x NDRE-4, RK-9903 x M rai , RK2000-1 x Kanti, RK2000-1 x sej-2, RK2000-1 x NDRE-4, RK2000-1 x M rai, RK2000-2 x Kanti, RK2000-2 x sej-2, RK2000-2 x NDRE-4, RK2000-2 x M rai, RK-2005-1 x Kanti, RK-2005-1 x sej-2, RK2006-1 x NDRE-4, RK2006-1 x M rai , RK2006-1 x Kanti, RK2006-2 x sej-2, RK2006-2 x NDRE-4, RK2006-2 x M rai, RK2007-2 x Kanti , RK2007-1 x sej-2, RK2007-1 x NDRE-4, and RK2007-1 x M Rai	80		
			Set II: Varuna x Pusa bold, Varuna x RLM 198, Varuna x Rajat, Kranti x Rajat, Pusa bold x RLM 198, Pusa bold x Maya, Vardan x Pusa bold, Vardan x NDR-8501, Vardan x Laha-101, Vaibhav x Pusa bahar, Vaibhav x Pusa bold, Vaibhav x NDR-8501, Vaibhav x Laha-101, Pusa bahar x Pusa bold, Pusa bahar x NDR-8501, Pusa bahar x Laha-101, Pusa bold x NDR-8501, Pusa bold x Laha-101, NDR-8501 x Laha -101,	19		
		F_5	Set I: Varuna x Kranti, Varuna x Krishna, Varuna x Pusa basant, Varuna x RLM-198, Varuna x Ashirwad, Varuna x Sej-2, Kranti x Krishna, Kranti x Pusa basant, Kranti x RLM-198, Kranti x Sej-2, Pusa basant x RLM-198, Pusa basant x Ashirwad, Pusa basant x Sej-2, RLM-198 x Sej-2, Krishna x RLM-198, Krishna x Pusa basant, and Ashirwad x Sej-2	21		
			Set II: Varuna x Pusa bold, Varuna x RC-781, Varuna x RH-198, Varuna x Pusa Jagannath, Varuna x Jawahar mustard-1, NUDH x Pusa bold, NUDH x RC-781, NUDH x RH-198, NUDH x Pusa Jagannath, and NUDH x Jawahar mustard-1	10		

		F_6	Set I: Varuna x Pusa Jai kisan, Kranti x Pusa jai kisan, Urvashi x Pusa jai kisan, NDR-8501 x Pusa jai kisan, Rohini x Pusa jai kisan, Varuna x Sej-2, Kranti x Sej-2, Urvashi x Sej-2, NDR-8501 x Sej-2, Rohini x Sej-2, Basanti x Sej-2, Pusa bold x Sej-2, Maya x Kranti, Ashirwad x Kranti, Urvashi x Kranti, Vaibhav x Kranti, Vardan x Kranti, Basanti x Kranti, RH-30 x Kranti, Pusa bold x Kranti	20		
			Set II: Varuna x Urvashi, Varuna x Maya, Varuna x Kranti, Varuna x NDR-8501, Varuna x Pusa bold, Varuna x Aravali, Urvashi x Maya, Urvashi x Kranti, Urvashi x NDR-8501, Urvashi x Pusa bold, Urvashi x RH-30, Maya x Kranti, Maya x NDR-8501, Maya x Pusa bold, Maya x RH-30, Kranti x NDR-8501	16		
		F_7	Kranti x Pusa bold, Seeta x Varuna, Seeta x Pusa bold, Seeta x Aravali Seeta x Sej-2, Pusa bold x Sej-2, Pusa bold x Durgamani , Pusa bold x Aravali , Ashirwad x Varuna , Ashirwad x Maya , Ashirwad x Kanti , Ashirwad x Jawahar-1, Ashirwad x Vaibhav , Rohini x Vardan , Rohini x Basanti , Rohini x Maya, Rohini x Pusa bold , and Rohini x Pusa basant.	19		
		F_8	Varuna x Rohini, Varuna x NDR 8501, Varuna x RH-30, Varuna x RLM -198, Varuna x KR-5610, Varuna x CSR-1017, Varuna x Pusa basant, , Rohini x B-85, Rohini x Mathura Rai, Rohini x NDR-8501, Rohini x RH-30, Rohini x RLM-198, Rohini x KR-5610, Rohini x CSR-1017, Maya x Urvashi, Maya x Basanti, Maya x RC-781, Pusa bold x Urvashi, Vardan x Maya, Vardan x Basanti, Vardan x Kranti, Pusa basant x Kranti, Pusa basant x NDR-8501, Vaibhav x Jawahar mustard-1, and Vaibhav x Basanti	21		
	Breeding for late sown situation	Fresh crosses	a) (10 parental diallel excluding reciprocals) using DRMRC-98, DRMRC-96, KRMRL-15-5, KRMRL-19-3, KRMRL-19-4, KRMRL-18-3, Azad Mahak, Urvashi, Maya and KRMRL-17-4. (b) (7 parental diallel excluding reciprocals) using Varuna, Pusa bold, RH-30, RLM-198, PR-15, Urvashi and B-85 were attempted F_1 seeds of 21 crosses were procured which will be grown in coming next season to raise F_2^s populations.	45+21		
		F_4	RK03-01 x Varuna, RK-9903 x Vardan, Kranti xVardan, Rohini x Varuna, Varuna x Vardan, and RK9807xVardan	6		
		F_5	Urvashi X RH-30, Urvashi x Pusa Bold, Urvashi x Pusa Basant, Urvashi x Rohini, Urvashi x R K 9803, Urvashi x Vardan, Urvashi x R L M 198, Urvashi x Seeta, Urvashi x Varuna, RH-30 x Pusa Bold, RH-30 x Pusa Basant , RH-30 x Rohini, RH-30 x RK9803, RH-30 x Vardan, RH-30 x RLM-198, RH-30 x Seeta, RH-30 x Varuna, Pusa Bold x Pusa Basant, Pusa Bold x Rohini, Pusa Bold x RK9803, Pusa Bold x Vardan, Pusa Bold x RLM-198, Pusa Bold x Seeta, Pusa Bold x Vardan, Pusa Basant x Rohini, Pusa Basant x RK9803, Pusa Basant X Vardan, Pusa Basant x RLM-198, Pusa Basant x Seeta, Pusa Basant31 x Varuna,	45		

			Rohini x RK9803, Rohini X Vardan, Rohini x RLM-198, Rohini X Seeta, Rohini x Varuna, RK-9803 x Vardan, RK-9803 x RLM-198, RK-9803 X Seeta, RK-9803 x Varuna, Vardan x RLM-198, Vardan x Seeta, Vardan x Varuna, RLM-198 x Seeta, RLM-198 x Varuna and Seeta x Varuna.			
		F_6	MK(L)13-301 x MK(L)13-308, MK(L)13-301 x MK(L)13-303, MK(L)13-301 x MK(L)13-305, MK(L)13-301 x MK(L)13-310, MK(L)13-301 x Ashirvad, MK(L)13-301 x Vardan, MK(L)13-301 x MK(L)13-303, MK(L)13-301 x MK(L)13-305, MK(L)13-301 x MK(L)13-310, MK(L)13-301 x Ashirvad, MK(L)13-301 x Vardan, MK(L)13-303 x MK(L)13-305, MK(L)13-303 x MK(L)13-310, MK(L)13-303 x Ashirvad, MK(L)13-303 x Vardan, MK(L)13-305 x MK(L)13-310, MK(L)13-305 x Ashirvad, MK(L)13-305 x Vardan, MK(L)13-310 x Ashirvad, MK(L)13-310 x Vardan, and Vardan x Ashirvad.	21		
		F_7	MK(L)14-403 x MK(L)14-404, MK(L)14-403 x MK(L)14-405, MK(L)14-403 x MK(L)14-406, MK(L)14-403 x MK(L)14-407, MK(L)14-403 x Ashirvad, MK(L)14-403 x Vardan, MK(L)14-403 x MK(L)14-405, MK(L)14-403 x MK(L)14-406, MK(L)14-403 x MK(L)14-407, KM(L)14-404 x Ashirvad, KM(L)14-404 x Vardan, KM(L)14-405 x MK(L)14-406, KM(L)14-405 x MK(L)14-407, KM(L)14-405 x x Ashirvad, KM(L)14-405 x Vardan, KM(L)14-406 x MK(L)14-407, KM(L)14-406 x Ashirvad, KM(L)14-406 x Vardan, KM(L)14-407 x Ashirvad, KM(L)14-407 x Vardan and Vardan x Ashirvad	21		
		F_8	Set-I: Pusa bold x Pusa Jagannath, Pusa bold x Pusa jai kisan, Pusa bold x Pusa bahar, Pusa bold x Krishna, Pusa bold x Urvashi, , Pusa basant x Jawahar mustard -1, Pusa basant x Vaibhav, Pusa bold x Rohini, Pusa bold x Varuna, Pusa bold x Vardan, Pusa bold x Maya, Varuna x Durgamani, and Pusa basant x Durgamani	13		
		F_8	Set-II: Varuna x RK 9808, Varuna x RK 9807, Varuna x RK 9803, Varuna x VSL-5, Varuna x RH-30, Varuna x RK 9801, Varuna x RK 9802, Varuna x RK 9803, Varuna x RK 9804, Varuna x Mathura rai , Urvashi x RK 9807, Urvashi x RK 9803, Urvashi x RK 9808, Urvashi x Durgamani, Urvashi x RK 9801, Pusa bahar x RK 9901 , Pusa bahar x RK 9807, Pusa bahar x RK 9808, Pusa bahar x Durgamani, and Pusa bahar x Mathura rai.	20	Selection was not performed due to lockdown.	

	Breeding mustard varieties for quality	F_7/F_8	15 F_1's developed through single crosses using parents *viz;* Varuna x EC287711, Varuna x EC322090, Rohini x EC287711, Rohini x EC322090, Kanti x EC287711, Kanti x EC322090, Varuna x NUDH YJ-3, Rohini x NUDHYJ-3, Basanti x NUDHJ-3, Maya x NUDH YJ-3, Vardan x NUDHYS-3, Basanti x EC287711, Basanti x EC322090, Maya x EC287711 and Maya x EC322090 were grown and seed were collected for growing them in coming rabi season again in F_8 generation.	15		
Morena	Identification of good combiners for seed yield and WRR quality	Fresh crosses	80 fresh crosses were made during rabi 2019-20	80		
	High seed yield and quality	F_1	Crosses among NRCDR-2, Pusa Jagannath, JM-1, JM-2, JM-3, DRMRIJ-31, NRCHB-101, NRCHB-506, RB-50, RH-406, RVM-1, RVM-2, RVM-3	29		
		F_2	RH-749 x RVM-3, JM-3 x RH-749, RVM-2 x RVM-1, RVM-3 x JM-3, RVM-3 x RVM-2, JMM-09-3 x RVM-3, JMM-09-1-1 x Kranti	7	20	
		F_3	RVM-2 x RDZ-6, RVM-2 x DRMRIJ-15-85, JMM-927 x RGN-73, RDZ-6 x MRNJ-77, DRMRIJ-15-85 x JM-4, DRMRIJ-15-85 x MRNJ-77,	6	15	
		F_4	44 S 31 x Kranti,, 44 S 31 x RGN-73, PM-28 x Pusa Mustard- 25, RH-1134 x RGN-73, RH-3601 x NRC-HB-506, Pusa Mustard- 25 x PM-28, Pusa Mustard- 25 x RVM-2	7	20	
		F_5	MRNJ-90 x JM-3, MRNJ-90 x RVM-1, MRNJ-91 x JM-2, MRNJ-92 x JM-2, MRNJ-96 x JM-3, MRNJ-96 x JM-4, MRNJ-97 x JM-3, MRNJ-98 x JM-1, MRNJ-98 x JM-4, MRNJ-98 x RVM-1, MRNJ-99 x JM-2, MRNJ-100 x JM-3, MRNJ-70 x JM-1, MRNJ-73 x JM-4, MRNJ-70 x JM-2, MRNJ-73 x RVM-1, MRNJ-73 x RVM-2, MRNJ-77 x JM-2, MRNJ-78 x JM-1, MRNJ-83 x JM-2, MRNJ-84 x RVM-1, MRNJ-85 x JM-1, MRNJ-87 x JM-3,	23	55	
		F_6	JM-1 x MRNJ-1, JM-1 x MRNJ-101, JM-2 x MRNJ-1, JM-2 x MRNJ-137, JM-2 x MRNJ-131, JM-3 x MRNJ-101, JM-3 x MRNJ-84, JM-4 x MRNJ-101, JM-4 x MRNJ-137, JM-4 x Rohini, RVM-1 x MRNJ-101, RVM-2 x MRNJ-101, RVM-2 x MRNJ-84, RMM-09-3 x MRNJ-1, RMM-09-3 x MRNJ-137, RMM-09-3 x MRNJ-84, RMM-09-3 x MRNJ-131, JMWR-945-2-2,75 kr.x PusaBold	18	30	
		F_7	PussaBold x Rohini, PussaBold x Varuna, JM-1 x Sej-2, RVM-2 x B-85, JM-4 x Divya-33, JM-4 x JD-6, RMM-09-2 x L-4, RMM-09-2 x L-6, RMM-09-2 x B-85, RMM-09-2 x Sej-2, RMM-09-3 x Rohini, RMM-09-3 x L-4, RMM-09-3 x Kranti, RMM-09-3 x B-85, JMWR-945-2-2,75 kr. x Rohini, JMWR-945-2-2,75 kr. x L-4,	19		

			JMWR-945-2-2,75 kr. x L-6, JMWR-945-2-2,75 kr. x B-85, JM-2 x Rohini			
		F_8	JM-1 x JMM-927, JM-1 x L-4, JM-1 x L-6, JM-1 x Rohini, JM-2 x JMM-927, JM-2 x B-85, JM-2 x NRC-HB-101, JM-3 x L-4, JM-3 x MRNJ-137, JM-4 x JMM-927, JM-4 x MRNJ-101, JMM-05-6 x L-6, RMM-09-1 x PusaBold, RVM-2 x MRNJ-1, RVM-2 x MRNJ-84, RVM-2 x MRNJ-131	16		
		F_9	JM-4 x Kranti, JM-4 x B-85, JM-4 x NDRE-4, RVM-2 x NDRE-4	4		
		F_{10}	PRQ-2005-31 x RVM-1, MJA-3 x HUJM-0201, Swarnjyoti x MJA-3	3		
		F_{11}	JM-1 x RGN-73, JM-3 x Krishna, LET-14 x JM-2, Rohini x RH-7846, Varuna x ELM-134, Kranti x NDR-06-3, JM-2 x RK-06-05, PusaKarishma x Rohini	8		
		BC_2F_7	{MJA-3 x Varuna} x {Varuna x NRC-HB-101}, {MJA-3 x JM-2} x {JM-2 x NRC-HB-101}, {MJR x JMM-927} x {JMM-927 x JMM-927}, {MJR x JM-4} x {JM-4 x NRC-HB-101}, {MJR x Kranti} x {Kranti x Kranti}	5		
		BC_2F_8	{RH-7846 x Varuna } x Varuna, {EJ-17 x RVM-1 } x RVM-1, {ELM-134 x Rohini } x Rohini, {ELM-169 x Rohini } x Rohini	4		
Pantnagar	Early Sowing	Fresh crosses Single cross	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-101×CRP-1,NRCHB-10×PRHC-14-5-4,PR-16-4×CRP-3,PR-16-4×PRHC-14-1-1,PR-21CRP-1,PM-27×CRP-8,PM-27×PRHC-14-10,PM-28×CRP-3,PM-28×PRHC-14-5,DRMRIJ-16-51×PR-19,DRMRIJ-16-15×CRP-5,DRMRIJ-16-15×PRHC-14-1-1,DRMRIJ-16-15×PM-25,PRE-17-2×PM-27,PRE-17-2×DRMRIJ-16-51,PRE-17-1×PM-25,PRE-17-1×DRMRIJ-16-51,PRE-18-1×PM-25,PRE-18-1×DRMRIJ-16-51,PRE-18-3×PM-27,PRE-18-7×PM-25,PRE-18-12×DRMRIJ-16-51,PRE-18-9×DRMRIJ-16-51,PRE-18-13×DRMRIJ-16-51,PRE-18-13×PM-25,PRE-17-1×PM-25	35		

		F_1 to F_2	NDRE-4×DRMR-IJ-16-51,NDRE-4×DRMR-IJ-16-56,PM-28×DRMR-IJ-16-51,PM-28×DRMR-IJ-16-56,DRMR-IJ-16-51×PR-19,DRMR-IJ-16-51×PM-25,DRMR-IJ-16-51×NDRE-4,RH-1656×PR-19,RH-1656×PM-25,RH-1656×NDRE-4,PRE-16-2×DRMR-IJ-16-51,PRE-16-2×RH-16-56,PRE-16-2×PM-27,PRE-2017-2×DRMR-IJ-16-51,PRE-2017-2×PM-25,PRE-2017-2×RH-16-56, PRE-2017-8×PR-19,PRE-2017-8×NDRE-4,PRE-2017-8×NPJ-112,PRE-2017-7×NPJ-112,PRE-2017-7×PR-19,PRE-2017-7×NDRE-4,(RH-1209×GP1-8)×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,(RH-1209×GP-1-4)×PR-19,(RH-1209×GP-1-7)×NPJ-112,(PR-2015-1×CRP-3)×PR-19,(PR-2015-1×CRP-3)×PR-20,(PR-2015-1×CRP-3)×Albeli,(RH-1209×CRP-3) ×(RH-1209×PR-20),(RH-1209×CRP-3) ×(RH-1209×Albeli),(Giriraj×GP-I-123)×Albeli,(Giriraj×GP-I-123)×PR-20,(Giriraj×GP-I-123)×RH-749,(PRHC-13-7×CRP-1)×Albeli,(PRHC-13-7×CRP-1)×PR-20,(NPJ-203×GP-I-7)×Albeli,(PRE-10-7×CRP-1)×PR-20,(PRE-10-7×CRP-1)×RH-749,(PRE-10-7×CRP-1)×NPJ-112,(PRE-13-13×PR-20)×NDRE-4,(PRE-13-13×PR-20)×NPJ-112,(PRHC-13-7×PRE-10-7)×PR-20,(PRHC-13-7×PRE-10-7)×NPJ-112,(PRE-12-4×GP-I-3)×NDRE-4,(PRE-12-4×GP-I-3)×NPJ-112,(PR-2012-4×CRP-3)×JD-6,(PR-2012-4×CRP-3)×PR-20,(PR-19×CRP-1)×Albeli,(PR-19×CRP-1)×JD-6,(PR-19×CRP-1)×PR-20,(PR-19×CRP-1)×Albeli	53		46
		F_2 to F_3	PR-15-1 × GP-1-3,RH-1209 × GP-1-3,Giriraj × GP-1-12,RH-1209 × GP-1-23,RH-1209 × GP-1-8,RH-1209 × GP-1-14,RH-1209 × GP-1-7,PR-15-1 × GP-3,PR-15-1 × GP-1-5,Giriraj × GP-I-22,Giriraj × GP-I-7,Giriraj × GP-I-14,Giriraj × GP-I-5,Giriraj × GP-I-8,PR-21 × GP-I-7,PR-2015× GP-I-8,RH-1209 × GP-I-3,RH-1209 × GP-I-22,Giriraj × GP-I-3,Giriraj × GP-I-23,RH-1209 × GP-I-12,RH-1209 × GP-I-5,PR-19 × EJ-17,JD-6 × GP-I-3,NPJ-203 × GP-I-7,PRE-10-7 × CRP-1,JD-6 × GP-I-8,PR-21 × GP-I-5,NPJ-203 × GP-1-3,NPJ-203 × GP-1-22,PR -21 × GP-I-3,NPJ-203 × CRP-3,PR -21 × GP-I-12,PR -21 × GP-I-23,PRE-12-4 × GP-I-3,NPJ-203 × GP-1-5,PR-21 × GP-I-8,PR-2012-4 × CRP-I-7,NPJ-203 × GP-1-14,NPJ-203 × GP-1-12,PR-2012-4 × GP-I-14,JD-6 × CRP-3,PR-21 × GP-I-22,NPJ-203 × GP-1-23,RH-406 ×PRE-2013-13,PR-21 × CRP-3,Griraj × CRP-3,JD-6 × GP-1-14,JD-6 × GP-1-22,RH-406 × EJ-7,R-12-4 × GP-I-5,PR-12-4 × GP-I-12,PR -19 × CRP-I,PR-2015-1 × GP-I-7,PR-2015-1 × GP-I-22,PR-2015-1 × GP-I-23,PR-2015-1 × GP-I-14,PR-12-4 × GP-I-7,NPJ-203 × GP-1-8,PR-12-4 × GP-I-22,PR-12-4 × GP-I-22,PR-21 × GP-I-4,(PRB-13-19 x Divya-88) x EJ-17,(PRE-13-10 x Krishna) x CRP-1-14,392 From conversion,Rohini × PRHC-13-7-10,PR-2013-2 × PRHC-14-10,PR-2013-2 × PRHC-13-7-10	68		43

		F_3 to F_4	PRE-13-19 × PBML-2,PRE-13-10 × Krishna,PRE-13-19 × Divya-88,PR-2016-5 × IC-427689,PRHC-13-7 (MH) × PRHC-13-7(DH),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)	10		10
		F_4 to F5	Albeli × NPJ-112 ,PR-21 × NDRE-4,PRE-11-6 × Albeli ,PRE-12-11 × Albeli ,PRE-11-6 × Raj Vijay	05		5
		F_5 to F_6	PRE-2011-15 x RRN-778,PRE-2011-15 x Maya,Divya 55 x NPJ-112,DRMR-675-39 x NPJ-112,Maya x NPJ-112,RB-57 x NPJ-112	6	119	5
		F_6 to F_7	(PRE-2010-19×EJ-17)×Maya,(PRE-2010-19×NDRE-4)×Maya,(PRE-2010-19×EJ-17)×Albeli,NPJ-112 x PRE-2010-15,PRE-2010-19 x PRE-2010-15,NDRE-4 x (PRE-2010-15× RGN-73,PRB-08-5x PRE-2010-15,Albeli x PRE-2010-15	8	115	29
		F_7 to F_8	PRE-2010-15 × NDRE-4,PRE-2010-19 × PR-19,PRE-2009-9 x Kranti,Vardan × PR-19,Bhagirathi x PRE-2007-6,PRB-2008-5 x PRE-2007-6,RGN-145 x NDYR-8,RH-919 x NPJ-112,Divya Sel	9	33	18
	Timely sowing	Fresh crosses	PM-26×Albeli, PM-26×Rajvijay, PM-26×PR-18-6, PR-12-4×PR-18-5, RH-749×Rajvijay,RH-749×Albeli,Krishna × Rajvijay,Krishna × Albeli,Krishna×RH-749,PR-19-11×Rajvijay,PR-19-11×RH-749,PR-19-9×Rajvijay,PR-19-9×RH-749,PR-19-10×Rajvijay,PR-19-10× RH-749,PR-19-2× Rajvijay,PR-19-2×RH-749,PR-18-6×PM-25,PR-18-6×CRP-5,PR-13-2×Rajvijay,PR-13-2×NASP II-22,PR-18-5×RH-749,PR-18-5×PR-12-4,PR-17-2×RGN-73,RH-1599-41×Albeli,RH-1599-41×Rajvijay,RH-1599-41×PR-18-6	27		
		F_1 to F_2	PM-26×Albeli,PM-26×Rajvijay,PM-26×PR-18-6,PR-12-4×PR-18-5,RH-749×Rajvijay, RH-749×Albeli, Krishna × Rajvijay,Krishna × Albeli, Krishna×RH-749,PR-19-11×Rajvijay,PR-19-11×RH-749,PR-19-9×Rajvijay,PR-19-9×RH-749,PR-19-10×Rajvijay,PR-19-10× RH-749,PR-19-2× Rajvijay,PR-19-2×RH-749,PR-18-6×PM-25,PR-18-6×CRP-5,PR-13-2×Rajvijay,PR-13-2×NASP II-22,PR-18-5×RH-749,PR-18-5×PR-12-4,PR-17-2×RGN-73,RH-1599-41×Albeli,RH-1599-41×Rajvijay,RH-1599-41×PR-18-6,Rohini ×PRHC-13-7-10×PR-20,Rohini ×PRHC-13-7-10×Albeli,Rohini ×PRHC-13-7-10×RH-749,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×RH-1585,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,RGN-73 × Kranti,KMR-17-3×	23	16	

			Kranti,RH-1585× Kranti,PR-15-7× Kranti,PR-15-7× PR-19,RH-749× PR-20,RH-749× PR-12-4,RB-57× PR-12-4,RH-749× PR-17-2,PR-17-5× RH-749,PR-17-8× Albeli			
		F_2 to F_3	NPJ-208 x NPJ-113,PR-13-2 × PRHC-14-9,PR-2015-5 × EJ-17,PR-2015-5×Divya-22,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 x Divya) x PRHC-14-9	10		10
		F_3 to F_4	NPJ-208 x NPJ-113,PR-13-2 × PRHC-14-9,PR-2015-5 × EJ-17,PR-2015-5×Divya-22,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 x Divya) x PRHC-14-9,PRE-2013-19 x PBML-1,PRE-2013-10 x PR-2012-12,PRE-2013-10 x RH-749,PRE-2013-19 x Maya,PRE-2013-10 x PBML-2,PR-2015-1 × Maya,PR-2015-1 × RGN-73,PR-2016-4 × Rajvijay,PR-2016-3 × Giriraj,PR-2015-1 × Giriraj,PR-2016-5 × Maya,PR-2012-12 x PBML-1,PR-2016-6 × Giriraj,PR-2016-1 × Maya,PR-12-12 x IC-355934,PR-2016-6× IC 520478,PR-20 x IC-355931,F_1 x PR-2012-12,RRN-9-11 x RH-749,Giriraj x NDYR-8, (PRE-2011-6 x Rajvijay) x RH-1209,(PR -21 x NDRE-4) x RH-749,(PR -21 c) x Divya-88,(KMR-2013-14 × Albeli) × Krishna,(TM-1061 × CAN-83) × PR-2012-12,(Albeli × NPJ-112) × PR-2012-12,(PYR-2012-5 x NDYR-8) × PR-2012-12,(Novgold x NDYR-8) × CS-56,(PYR-2012-5 x NDYR-8) × NPJ-112	29		29
		F_4 to F_5	ACN-83 × PR-21,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	08		07
		F_5 to F_6	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	8	157	8
		F_6 to F_7	PR-2009-6 × PR-20,PBR-423 × Albeli,PR-2009-6 × NDYR-8,RH-0923 × Albeli,PR-2009-6 × RGN-73,PBR-04-23 × RGN-73,PR-2009-6 × Albeli	7	156	54
		F_7 to F_8	RGN-291 x Urvashi ,PRE-2010-15 × RGN-73,PRB-2006-5 x Bhagirathi,PRB-2006-5 x RGN-74,PRE-2013-19 × Maya,PR-2015-1 × Giriraj,(PRKS-28 x PRHC-11-15) x PRKS-28	29		16

	Late sowing	Fresh crosses	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-17-3×DRMRIJ-2017-15,PRL-17-6×NRCHB-101,PRL-17-6×Rajvijay,PRL-17-6×RH-1599-41,NPJ-216×Albeli,NPJ-216×PR-18-6	13		
		F_1 to F_2	PRL-2013-9×DRMR-2017-5,PRL-2016-6× DRMR-2017-5,PRL-2016-5× DRMR-2017-5,PRL-2018-5×PRL-2018-19,PRL-2018-14×PRL-2018-19,PRL-2016-5×MCN-2013-9,PRL-2016-5×MCN-2018-5,PRL-2017-1×MCN-2018-5,PRL-2017-1×NRCHB-101,PRL-2017-2×MCN-2018-14,PRL-2017-2×NRCHB-101,Albeli×MCN-15-21,Rajvijay×MCN-15-1,PJ-112×MCN-15-21,RS-57×PR-13-7,RS-57×PR-13-2	16		13
		F_2 to F_3	PR-20 × NRCHB-101,KMRL-15-5 × NPJ-113,RH-1599 × NRCHB-101,PRB-417 × NPJ-113,PRL-2013-17 × Ashirwad,DRMR-2035 × NRCHB-101,NPJ-208 × PRL-2013-15,NPJ-208 × PR-2012-12,RH-1599 × NPJ-113,NRCHB-101× PRHC-14-8,NPJ-208× Ashirwad,RH-1599 × Ashirwad,PR-2015-1× GP-1-7,PR-2015-1× GP-1-7,PR-2015-1× GP-1-7	15		12
		F_3 to F_4	PRD-2013-6 × NPJ-113,PRD-2013-6 × NRCHB-101,NPJ-113 × NRCHB-101,PR-2016-3 x PAB-9511,PR-2016-5 x PWR-2013-8,(PRD-13-9 × Albeli) × NPJ-113,(NRCHB-101x Vardan) × NRCHB-101,(NRCHB-101x Vardan) × NPJ-113	8		6
		F_4 to F_5	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	7		7
		F_5 to F_6	PRB-2013-7 × NRCHB-101,PRL-2012-6 × Raj Vijay,FS-13-8 × KMRL-14-6,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	11	10	110
	Yellow seeded	F_7 to F_8	NPJ-170× RGN-73,KMRL-12-1 × Ashirvad,NRCHB-101× Ashirvad,NRCHB-101× RGN-73,Kranti × RGN-73,PR2009-6 × Albeli	6	55	31
		Fresh Crosses	NPJ-170× RGN-73,KMRL-12-1 × Ashirvad,NRCHB-101× Ashirvad,NRCHB-101× RGN-73,Kranti × RGN-73,Pr2009-6 × Albeli,PR-20×NDYR-8,PR-20×PYS-9-5,RH-749×NDYR-10,RH-749×PYR-12-5,DRMR-61-106×NDYR-8,DRMR-61-106×PYR-12-5,RGN-73×PYR-95,NDYR-10×Maya,NDYR-10×RH-749,NDYR-10×PR-20	10		
		F_1 to F_2	NDYR-10 × Maya,NDYR-10 × RH-749,NDYR-10 × PR-20,NDYR-10 × NRCHB-101	4	3	

		F_3 to F_4	(NDYS-12-5 × NDYR-8) × DRMR-101,(NDYR-10 × PRY-2009-8) × PR-2012-12,(PYR-2012-5 × NDYR-8) × PR-2012-12,(Navgold × NDYR-8) × CS-56,(PYR-2012-5 × NDYR-8) × NPJ-112,(NDYS-8 × PYS-2009-5) × PR-19,Griraj x NDYR-8	7	7	
		F_4 to F_5	NDYR-8 × PYR-2009-5,PYR-2012-5 × NDYR-8,Navgold × NDYR-8,(PRE-11-6 x Raj Vijay) x RH-1209	4	3	
		F_5 Advanced to F_6	RH-0923 × NDYR-8,PR-2009-6 × NDYR-8,(PYR-2009-13 × Novgold) × (PYR-2009-13 × Pro-0306)	2	31	9
	Disease resistance	F_7Advanced to F_8	PYR-2009-8 × NDYR-8,PYR-2009-13 × NDYR-8,PYR-2009-13 × NDYR-10,PR-2009-6 × Navgold	4	21	11
		Fresh crosses	Alternaria Blight (23) & White rust/Downy Mildew (05)	28		
		F_1	Alternaria Blight (50) & White rust/Downy Mildew (26)	76		
		F_2	Alternaria Blight (19) & White rust/Downy Mildew (18)	37		
		F_3	Alternaria Blight (03) & White rust /Downy Mildew (22)	25		
	HYBRID BREEDING: CMS conversion	Advanced lines	Alternaria Blight (47) & White rust/Downy Mildew (19)	66		
		Fresh crosses		10		
		BC_1		16		
		BC_2		15		
		BC_3		27		
		BC_4		13		
		BC_5		14		
		BC_6		05		
	Conversion of restorers	BC_7		02		
		BC_8		04		
		Fresh crosses		10		
		BC_1		10		
		BC_2		08		
		BC_3		05		
		BC_4		09		
		BC_5		06		
		BC_6		01		
	Advanced line under testing	Toria	Station trial I (12), Station trial II (12), State varietal trial (09)	33		

		Yellow sarson	Station trial(18), State varietal trial (07)	25		
		Mustard	Station trial (Early-23), Station trial (Timely sown-24), Yellow Rai (11), Station trial (Late sown-20) and State varietal trial- (07)	85		
S.K.Nagar	Seed yield, boldness, earliness and heat tolerance suitable for late sown conditions	Fresh crosses	SKM 1328, SKM 1746, NPJ 112, PM 25, NPJ 203, SKM 1621, KP 9905,SKM 1319, ANDM 14-9, DRMR 659-49, RH 8812, Ranasan 2, LES 44, RS 1,GDM 4, GM 3, GM 1	90		
	High Yield	F_2 to F_4			230+364	43
	High Yield & Bold seed	$F_{5\ to}\ F_7$			57+65	30+47
	High Seed Yield and Quality	$F_{5\ to}\ F_6$			-	47+12
	Early and Temp. tolerance	$F_{2\ to}\ F_4$			160+435	65
	Interspecific	$F_{2\ to}\ F_4$			14+19	-
	Heterosis Breeding: CMS conversion	$BC_{13}F_1$			05	
		$BC_{12}F_1$			20	
	Conversion of restorers	$BC_{10}F_1$			09	
		BC_5F_1			03	
		BC_4F_1			13	
	Restorer study	F_1		51		
	Promising entries identified			35		
Varanasi	Seed yield	Fresh crosses		30		
		New F_1 developed		46		
		New BC developed		32		

		F_2 Material		268		
		Advanced Lines		13		
Srigang anagar	High yield, white rust and alternaria blight resistance, high oil content, quality improvements, earliness and salt tolerance	Fresh crosses		235		
		F_1		142		140
		F_2		200	105	
		F_3		95	91	
		F_4		130	99	
		F_5		124	81	
		F_6		84	-	24
Crop: Gobhi sarson						
Chatha-Jammu.	High seed yield	Fresh crosses	Improved breeding lines/varieties	12		
		F_1	Advanced fixed genotypes with GSC-6,GSL-1&RSPN-25	18		
		F_3	GSL-1 x RSPN-28 , GSL-1x RSPN-29 , DGS-1 x GSC-101, , RSPN-25 x RSPN-28 , RSPN-25 x GSC-101.	05		
Ludhiana	To enhance variability in canola quality germplasm for yield and early maturity	Fresh crosses	Sixteen crosses were made	16		
		F_2		6		
		Advanced lines		250		
	Determinate, early maturity and high productivity	F_1		15		
		F_2		10		
	Determinate, early maturity and high productivity	F_1		15		
		F_2		10		
	Hybrid Development	CMS lines developed/ maintained		50		
		Restorer lines developed/maintained		2		

	RIL populations developed/ maintained	Quality, productivity and earliness	GSL1x Rivette GSL1x Monty	02		
Crop: Karan rai						
Ludhiana	RIL populations developed/ maintained	Earliness and productivity	AR29 X PC 5	01		

Table 2.1.3 Evaluation of advanced breeding lines at different centres.

Centre	Name of trials	No. of trials	No. of strains tested	Name of best strain excelling the check	Yield (kg/ha)	Check	Superiority over the check (%)	Specific objective
1	2	3	4	5	6	7	8	9
Crop: Toria								
Kanpur	PYT (set I)	01	15	TKM 18-103	1582	Tapeshwari (1350 Kg/ha).		High seed yield
				TKM 18-104 & TKM 18-107	1505			
				TKM 18-101	1427			
				TKM 18-102	1389			
	PYT (set II)	01	10	TKM 19-1088	1543	Tapeshwari (1350 Kg/ha)		High seed yield
				TKM 19-111 & TKM 19-113	1466			
				TKM 19-112	1427			
	SVT	01	10	TKM 19-1 & 19-2	1659	Tapeshwhwari (1350 Kg/ha).		High seed yield
				TKM 17-1	1582			
				TKM 17-2 & TKM 18-2	1505			
Chatha-KS	Station trial	01	08					
Ludhiana	Local Trial	01	06	ST-2,ST-3,ST-4		TL-17		Productivity Assessment
Dholi	CSVT	01	07 (3+4)	RAUDT-14-09		Tapeshwari,		Toria -Irrigated

				RAUDT-14-04		PT-303, Bhawani, RAUTS-17		Toria -Irrigated
Crop: Yellow Sarson								
Dholi	CSVT (YS)	01	7	RAUDYS-14-09		Pitambari, YSH-0401, NRCYS -05-02 & Swarna		Yellow Sarson - Irrigated
				RAUDYS-14-15				Yellow Sarson - Irrigated
Kanpur	PYT (Set I)	01	15	YSKM 18-113	1890	Pitambari (1620 Kg/ha)		Early maturity, hig seed yield
				YSKM 18-104	1775			
				YSKM 18-105	1736			
	PYT (Set II)	01	15	YSKM 19-111 (kg/ha) and (Kg/ha)	1852	Pitambri (1620 Kg/ha)		Early maturity, hig seed yield
				YSKM 19-101 & YSKM 19-105 ,	1736			
	SVT	01	08	YSKM 18-1	1890	Pitambari (1620 Kg/ha)		Early maturity, hig seed yield
				YSKM 17-1	1775			
Crop: Indian Mustard								
Chatha	Station trial	01	22					
Hisar	FYT	02	195			RH 0749, RH 725, PM 26 and RVM 2		Seed yield and its component characters
	LST	3						
	SST	9						
Ludhiana	MLT		12	JC-33, JC-21 and PBR-507		PBR-357 RCH-1 RLC-3		Productivity Assessment
	MLT-Rainfed		5	PBR-385 and PBR 450		PBR-97		Productivity Assessment

	MLT-Late sown		3	PBR-396 and PBR-422		RLM-619 GIRIRAJ		Productivity Assessment
	Local Trial-1		22	PBR-931 and PBR 962		PBR-357 PHR-126		Productivity Assessment
	Local Trial-2		10	PBR-758-1 and PBR-788-1		PBR-357 RLM-619		Productivity Assessment
	Quality hybrid trial		60	RCH-12		DMH-1 PHR-126 RCH-1		High yield and quality
	Local Trial		24	JC-1 and JC-36		RLC-3 RCH-1		High yield and quality
Kanpur	PYT (Set I)	01	12	(1852 kg/ha.), KMR (E) 18-102 & 18-110 () and KMR (E) (kg/ha)	1813 Kg/ha	Kanti (1581 kg/ha)		Early Sown
				KMR (E) 18-101 & 18-104	1736			
	PYT (Set II)	01	12	KMR (E) 19-103	1929 Kg/ha	NDRE-4 and Kanti		Early sown
				KMR (E) 19-105	1852 kg/ha			
	SVT	01	10	KMR (E) 18-1	1929 kg/ha	Kanti and NDRE-4		Early sown
				KMR (E) 16-1	1813 kg/ha			
Dholi	CSVT	01	7	RAURD-214		PM-25, Pusa Mahak, Kranti, Varuna & RGN-73		Indian mustard-Irrigated
				RAURD-14-18				Indian mustard-Irrigated
Varanasi	Station Trail I	1	24					Timely Sown
	Station Trail II	1	24					Late Sown
Sriganganagar	Station trial	03	22	RGN-491and RGN-483				Timely sown irrigated

				RGN-500, RGN-486 and RGN-487				Timely sown rainfed
				RGN-494 and RGN-488				late sown irrigated
Crop: Gobhi sarson								
Hisar	LST	01	10					Seed yield and its component characters
Chatha	Station trial	01	09					--
Ludhiana								
	Hybrid State Trial	01	10	GSH-1711, GSH 1707 and GSH-2000		GSC-7 Hyola-405		High yield and quality
	DT-napus Trial	01	22	SKIPTON NCC-4 DT-15-11 and SKIPTON NCC-4 DT-6-31		GSC-6 GSC-7 Hyola-405		Early maturity and determinate type
Crop: Karan rai								
Ludhiana	Local Trial	01	26	PDC-99-1 and PDC-14-1		PC-6		High yield and oil content

Table 2.2. Breeder Seed Production of indented Rapeseed-mustard varieties during 2019-20

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 BSB-1 Target
1	Assam	AAU, Shillongani	Toria	M -27	1978	1.00	1.00	2.45	1.45
2	Assam	AAU, Shillongani	Toria	TS-36		1.00	1.00	1.69	0.69
3	Assam	AAU, Shillongani	Toria	TS-38		1.00	1.00	5.50	4.50
4	Bihar	RPCAU, Dholi,	Indian mustard	Rajendra Sublam		1.00	1.00	0.00*	0.00
5	Chhattisgarh	IGKVV Jagdalpur	Indian mustard	Chhattisgarh Sarson	2010	6.50	6.50	6.60	0.10
6	Gujarat	SDAU, SKNagar	Indian mustard	Gujarat Mustard -3	2016	0.02	0.02	0.60	0.58
7	Gujarat	SDAU, SKNagar	Indian mustard	Gujarat Dantiwada Mustard -4	2015	0.02	0.02	0.90	0.88
8	H.P.	Kangra	Gobhi sarson	ONK-1 (Him Sarson)	2019	1.20	1.20	1.20	0.00
9	Haryana	CCS HAU Hisar	Indian mustard	RH-725	2018	3.96	3.96	14.00	10.04
10	Haryana	CCS HAU Hisar	Indian mustard	RH 406	2013	0.73	0.73	4.75	4.02
11	Haryana	CCS HAU Hisar	Indian mustard	RH 0749	2013	0.85	0.85	0.87	0.02
12	Haryana	CCS HAU Hisar	Indian mustard	RH-761		0.05	0.05	0.20	0.15
13	Haryana	CCS HAU Hisar	Yellow Sarson	YSH 0401	2009	0.36	0.36	0.85	0.49
14	Haryana	ICAR-CSSRI Karnal	Indian mustard	CS-58	2017	0.55	0.55	10.00	9.45
15	Haryana	ICAR-CSSRI Karnal	Indian mustard	CS-60	2018	0.65	0.65	10.00	9.35
16	Haryana	IARI, RS, Karnal	Indian mustard	Pusa Double Zero Mustard-31 (PDZ-1)	2016	2.00	2.00	3.50	1.50
17	Haryana	IARI, RS, Karnal	Indian mustard	Pusa Mustard-25 (NPJ112)	2010	4.89	4.89	7.50	2.61
18	Haryana	IARI, RS, Karnal	Indian mustard	Pusa Mustard-26 (NPJ113)	2011	3.06	3.06	5.50	2.44
19	Haryana	IARI, RS, Karnal	Indian mustard	Pusa Mustard-27 (EJ17)	2011	4.32	4.32	6.00	1.68
20	Haryana	IARI, RS, Karnal	Indian mustard	Pusa Mustard 28 (NPJ124)	2012	6.56	6.56	9.00	2.44
21	Haryana	IARI, RS, Karnal	Indian mustard	Pusa Mustard-30 (LES-43)	2013	6.81	6.81	7.00	0.19
22	Haryana	IARI, RS, Karnal	Indian mustard	Pusa Tarak	2009	0.10	0.10	1.00	0.90
23	Haryana	IARI, RS, Karnal	Indian mustard	Pusa Mahak (JD-6)	2004	0.40	0.40	3.00	2.60
24	Haryana	IARI, RS, Karnal	Indian mustard	Pusa Vijay (NPJ 93)	2008	2.25	2.25	3.00	0.75
25	Madhya Pradesh	ZARS, Morena	Indian mustard	RVM-1	2016	0.04	0.04	36.00	35.96
26	Madhya Pradesh	ZARS, Morena	Toria	Raj Vijay Toria-1	2017	0.05	0.05	8.00	7.95
27	Orissa	OUAT Bhubaneswar	Toria	Sushree	2015	2.00	2.00	1.35	-0.65
28	Punjab	PAU, Ludhiana	Indian mustard	PBR- 357	2013	0.03	0.03	0.10	0.07
29	Punjab	PAU, Ludhiana	Indian mustard	RLC-3	2016	0.03	0.03	0.20	0.17
30	Punjab	PAU, Ludhiana	Toria	TL-17	2016	0.02	0.02	0.20	0.18
31	Punjab	PAU, Ludhiana	Toria	TL-15	1982	0.05	0.05	0.10	0.05
32	Punjab	PAU, Ludhiana	Gobhi sarson	GSC-7	2014	0.05	0.05	0.40	0.35
33	Rajasthan	DRMR, Bharatpur	Indian mustard	Giriraj (DRMRIJ 31)	2013	6.93	6.93	17.0	10.07
34	Rajasthan	DRMR, Bharatpur	Indian mustard	DRMR 601	2010	0.50	0.50	0.40	-0.10

				(NRCDR 601)					
35	Rajasthan	DRMR, Bharatpur	Indian mustard	NRCHB-506	2009	0.02	0.00	0.00	0.00
36	Rajasthan	DRMR, Bharatpur	Indian mustard	NRCDR 2	2007	0.20	0.20	0.30	0.10
37	Rajasthan	DRMR, Bharatpur	Indian mustard	NRCHB 101	2009	4.60	4.60	17.45	12.85
38	Rajasthan	DRMR, Bharatpur	Yellow sarson	NRCYS 05-02	2009	0.20	0.20	0.40	0.20
39	Rajasthan	SK RAU, Sriganganagar	Indian mustard	RGN-229	2013	0.05	0.05	2.20	2.15
40	Rajasthan	SK RAU, Sriganganagar	Indian mustard	RGN-298	2014	0.20	0.20	1.22	1.02
41	Rajasthan	SK RAU, Sriganganagar	Indian mustard	RGN-236	2011	0.05	0.05	2.57	2.52
42	Rajasthan	SK NAU, Jobner	Taramira	RTM-1351	2018	0.02	0.02	0.81	0.79
43	Rajasthan	SK NAU, Jobner	Taramira	RTM-1355 (Jwala Tara)	2017	1.02	1.02	4.10	3.08
44	Rajasthan	JK Agri Genetics Ltd, Jaipur	Yellow Sarson	JK Pukhraj (JKYS-2)	2016	0.02	0.02	0.04	0.02
45	Tripura	ICAR RC For NEH Region Tripura Centre Lembuchera	Toria	Tripura Toria-1	2018	0.05	0.05	0.50	0.45
46	Uttar Pradesh	CSAUA&T Kanpur	Toria	Bhawani	1986	0.01	0.01	2.81	2.80
47	Uttar Pradesh	CSAUA&T Kanpur	Toria	Tapeshvari TK 06-1	2014	2.85	2.85	2.50	-0.35
48	Uttar Pradesh	CSAUA&T Kanpur	Yellow sarson	Pitambari (RYSK-05-02)	2010	0.97	0.97	19.38	18.41
49	Uttarakhand	GBPUAT, Pantnagar	Indian mustard	Pant Rai-21	2017	0.25	0.25	4.00	3.75
50	Uttarakhand	GBPUAT, Pantnagar	Toria	PT-508	2016	0.05	0.05	4.00	3.95
51	Uttarakhand	GBPUAT, Pantnagar	Yellow sarson	Pant Pili Sarson -1	2010	0.01	0.01	20.00	0.19
52	Uttarakhand	GBPUAT, Pantnagar	Yellow sarson	Pant Sweta (PYS 2007-10)	2017	1.81	1.81	2.00	0.19
53	Uttarakhand	GBPUAT, Pantnagar	Toria	Uttara (PT-2002-25)	2010	4.30	4.30	5.50	1.20
54	West Bengal	BCKV, Kalyani	Yellow sarson	Benoy (B 9)	1980	0.36	0.36	0.00**	0.00
	Total					**76.02**	**76.00**	**258.64**	**164.20**

*Not notified; ** Not reported

Additional Breeder Seed Produced

S. No.	State	Crop	Name of variety	Actual Production (q)
	Gujarat			
1.	SDAU SK Nagar	Indian mustard	GM 1	0.50
2.			GM 2	0.40
3.			GM 3	0.60
4.			GDM 4	0.90
5.			GDM 5	0.20
	New Delhi			
6.	IARI, RS, Karnal, New Delhi		Pusa Mustard 21	0.10
7.			Pusa Mustard 22	0.10
8			Pusa Mustard 24	1.25
9.			Pusa Bold	4.56
10.			Pusa Agrani	0.83
11.			Pusa Jaikisan	1.85
	Uttar Pradesh			
12.	CSAUA&T Kanpur	Indian mustard	Varuna	10.80
13.			Rohini	8.40
14.			Azad Mahak	9.50
15.			Vardan	6.30
16.			Vaibhav	5.00
17.			Urvashi	8.60
18.			Basanti	5.50
19.			Maya	9.00
20.			Kanti	10.40
21			Ashirwad	6.00
22.			Type-9	8.00
	M.P.			
23.	ZARS, Morena	Indian mustard	RVM-2	7.00
24.		Indian mustard	RVM-3	10.40
	Rajasthan			
	Total			**116.19**

Coordinated Trials

Performance of 163 strains including 16 of toria, 129 of Indian mustard, 15 of gobhi sarson and 03 of taramira was tested in thirty two performance evaluation trials consisting of toria (03), gobhi sarson (02), taramira (01) and Indian mustard (26) at 45 locations across the 6 agro-climatic zones of the country. On the basis of superiority for seed/ yield/ earliness/quality over the best check, 25 strains comprising taramira (01), gobhi sarson (05) and Indian mustard (19) were promoted for advanced stage evaluation. s

Trial	NC	ZC	LR
Toria	PT 303	Bhawani	Tapeswari
Indian mustard			
Early mustard	Pusa Mustard 25	JD 6, PM 27, NRCHB 101	Pusa Mustard 27, Pusa Mustard 28, NRCHB 101
Timely sown irrigated	Kranti	Maya, BIO 902, RCC 4, RH 749	RGN 73, GDM 4, Giriraj
Rainfed	Kranti	RGN 229, NRCHB- 101	DRMR 150-35, RH 725
Late sown	Kranti	PM 26, NRCHB 101	RGN 236, RVM- 2, CS 56
Hybrid	Kranti	RGN 73, RH 749, GDM- 4	DMH 1, 45S46
Quality	Kranti	RGN 73, RH 749	Pusa Mustard 29, Pusa Mustard 30, PDZ- 1
Salinity	Kranti	RH 749	CS 54, Giriraj, CS 60
Gobhi Sarson	Kranti	GSL 1	GSC 6
Taramira	T 27	RTM 314	RTM 1351