1. Crop description:

Rapeseed-mustard is a group of crops comprising rapeseed (toria, brown sarson and yellow sarson) cultivar of *Brassica campestris;* Indian Mustard (*Brassica juncea*); black mustard (*Brassica nigra*) and taramira (*Eruca sativa*). Some exotic species of Brassicas like gobhi sarson (B. napus), Ethopian mustard or karan rai (B. carinata) and white mustard (Sinapis alba) have been brought into cultivation in India. The crops of rapeseed group are largely cross pollinated where as Indian mustard is largely self pollinated. Out of these cultivars Indian mustard fits well in cropping system of rainfed areas and accounts for >75% of the total area under rapeseed-mustard cultivation in India. Other cultivars like brown sarson and yellow sarson are under cultivation over a limited area in the Eastern part of the country including North-Easter States. Toria, a short duration crop is largely grown as a catch crop in tarai part of UP, Haryana, Assam and Odisha. Gobhi sarson is under cultivation over a limited areas in HP, J&K and Punjab under Irrigated ecologies.

Indian Mustard (*B. juncea*) at flowering stage

2. Centre of origin:

The genus *Brassica* is one of 51 genera of Brassiceae family. Brassica juncea (n = 18) is an amphidiploid species derived from inter specific crosses between B. nigra (n = 9) and B. rapa (n = 10). Wild forms of B. juncea have been found in the Near East, southern Iran and in India indicates about its centre of origin. It is also grown as a leafy vegetable in China. However, China cannot be considered as a centre of origin for *B. juncea* because the two parent species, *B. nigra* and *B. rapa*, were never found as wild species in that country. The Chinese *B. juncea* forms are yellow-seeded in contrast to the brown-seeded Indian types which also have a larger seed size. The yellow-seeded *B. juncea* types are grown as an oilseed in the Ukraine. Indian oilseed types contain primarily 3-butenyl glucosinolate in their seeds and vegetative tissue, while *B. juncea* from China contains only 2-propenyl (allyl) glucosinolate, and only trace amounts of 3-buteny glucosinolate.

3. Global scenario:

Rapeseed & Mustard is widely grown in majority of Continents with largest area of 8 million ha in Canada followed by China (7 million ha) and India (6 million ha). Majority of the countries grow rapeseed, whereas, India has largest area under mustard. The productivity of India is the lowest among the major rapeseed mustard growing countries. As against the World average of 2144 kg/ha, highest productivity of 3640 kg/ha of Europeon Union, the Indian average yield was only 1161 kg/ha during 2013-16. Longer crop duration and high carbon content in the soil are the major factors attributing to high productivity of rapeseed in Western part of the World. The status of area, production and productivity of top 10 R&M growing countries is given in **Table-1**

Table -01: Area, production and yield of R&M of top 10 Countries

Country	Area (Lakh ha)			Production (Lakh tonnes)			Yield (Kg/ha)		
	2013-14	2014-15	2015-16	2013-14	2014-15	2015-16	2013-14	2014-15	2015-16
Canada	80.09	80.75	83.20	179.55	155.55	183.80	2242	1926	2210
China	75.20	65.51	73.00	144.58	116.00	143.00	1923	1771	1950
France	14.38	15.04		43.70	55.23		3039	3673	
Germany	14.66	13.95		57.84	62.47		3945	4479	
Poland	9.21	9.52	67.5*	26.78	32.76	245.90*	2907	3442	3640
UK	7.16	6.76		21.28	24.60		2974	3641	
India*	**66.50**	**57.90**	**57.62**	**78.80**	**63.10**	**68.22**	**1185**	**1079**	**1184**
Australia	32.72	27.22	23.60	41.42	38.32	29.90	1266	1408	1270
Russia	11.09	10.62	10.60	13.93	14.64	13.20	1256	1378	1250
Ukraine	9.97	8.66	8.80	23.52	21.98	22.00	2360	2538	2500
WORLD	**369.55**	**365.90**	**355.20**	**733.75**	**716.42**	**714.50**	**1986**	**1958**	**2010**

*Pertains to Europeon Union ; **As per the estimates of DES, DAC&FW

4. National scenario:

Rapeseed-mustard is grown across the country, pre-dominantly in North, North-Western and North-Eastern Region of the county over an area of about 6 million ha. Among 09 oilseeds, irrigated area under mustard has increased more rapidly from 10% (1955-56) to 76% (2012-13). The area coverage under mustard is largely depends on the late Kharif rains. Rajasthan, MP, Haryana, UP and West Bengal contributes >80% of area and >85% of production of mustard in India. The State wise area, production and yield of mustard during last 03 year is given in **Table-2**:

Table-2: State wise area, production and yield of mustard during last 03 year

States	Area (Lakh ha)			Production (Lakh tonnes)			Yield (Kg/ha)		
	2013-14	2014-15	2015-16	2013-14	2014-15	2015-16	2013-14	2014-15	2015-16
Rajasthan	30.79	24.74	25.49	37.97	28.95	32.69	1233	1170	1282
Haryana	5.37	4.96	5.05	8.80	7.00	8.05	1639	1409	1594
MP	7.62	7.13	6.17	8.44	7.17	7.00	1108	1006	1134
UP	6.62	6.26	5.93	7.37	5.82	6.02	1113	930	1015
WB	4.49	4.52	4.58	4.78	4.90	4.99	1066	1084	1090

States	Area (Lakh ha)			Production (Lakh tonnes)			Yield (Kg/ha)		
	2013-14	2014-15	2015-16	2013-14	2014-15	2015-16	2013-14	2014-15	2015-16
Gujarat	2.82	1.84	1.90	4.80	3.06	3.06	1723	1663	1611
Assam	2.79	2.70	2.80	1.69	1.70	1.67	605	630	596
Jharkhand	2.17	2.01	2.02	1.36	1.26	1.39	629	625	686
Bihar	0.85	0.87	0.86	1.06	0.92	0.92	1245	1056	1081
J&K	0.60	0.61	0.55	0.56	0.42	0.38	935	693	697
Chhattisgarh	0.47	0.46	0.43	0.26	0.26	0.22	557	575	517
Others	**1.87**	**1.82**	**1.84**	**1.68**	**1.63**	**1.83**	**898**	**896**	**995**
All India	**66.46**	**57.92**	**57.62**	**78.77**	**63.09**	**68.22**	**1185**	**1089**	**1184**

5. Potential districts:

More than >85% production of Rapeseed-mustard comes from 05 States namely Rajasthan (48%), Haryana (12%), MP (10%), UP (9%) and West Bengal (7%). Fourty six districts of Rajasthan (22), MP (6), Haryana (5), UP (2), West Bengal (6), Gujarat (3) and Assam (2) contributes >70% of total production of R&M in the country. State wise detail of potential districts is given at ***Annexure-I***.

6. Scope for area expansion:

Approximately an area of about 8 million ha remain fallow during rabi season in Eastern States like Assam, Bihar, Chhattisgarh, Jharkhand, Odisha, West Bengal and Eastern Uttar Pradesh, after harvest of paddy. A number of short duration varities of mustard are now available, which could be cultivated under rice fallows. A new scheme “Targeting Rice Fallow Areas for cultivation of Pulses and Oilseeds” launched by the Ministry of Agriculture and Farmers Welfare from Rabi 2016-17 will help in utilization of rice fallow for mustard cultivation.

7. Yield gap:

Among the major rapeseed & mustard producing countries, an average (2013-16) yield of 1161 kg/ha of India as against the world average 2144 kg/ha and highest average yield of 3640 kg/ha of Europeon Union indicates a large gap of 85% over world average and 213% over highest yield of Europeon Union. However, the yield gap are much lower in case of States like Haryana and Gujarat, who have highest yield of 1639 kg/ha (Haryana) and 1723 kg/ha (Gujarat). Front Line Demonstrations (FLD) of mustard conducted by ICAR during Rabi 2013-14 indicates an average yield gap 44% given below in **Table –3**.

Table-3: State wise yield gap in Mustard

(Yield in kg/ha)

State	Mustard			
	Rabi 2013-14 (Irrigated)			
	SAY	FLD	Yield Gap (%)	Varieties
Gujarat	1723	2499	45	GDM-4
Haryana	1639	2264	38	RH-0749, R-8812
MP	1108	1472	33	RVM-2
Rajasthan	1233	1907	55	NRCDR-2. NRCHB-101, RGN-73, RGN-229, RGN-236
UP	1113	1943	75	NRCDR-2, NRCHB-101
West Bengal	1066	1261	18	Pitambari
All India	**1314**	**1891**	**44**	

The above yield gaps could be minimized by adoption of improved varieties/ technologies of mustard including use of protective irrigation.

8. Cropping system:

There has been a massive change in mustard cultivation during post green revolution period. Intercropping/mix cropping with early sown wheat/gram (October), which was in practice has been changed to pure crop of mustard. Delayed sown mustard also faces more disease and pest problems. Therefore, early sowing of mustard as a pure crop has been adopted over large area. However, in Eastern States delayed sowing of mustard (mid of November to mid of December) is still in practice mainly becaus of late harvesting of paddy. Normally fallow-mustard, fodder crop-mustard, toria-wheat and paddy-mustard crop sequences are more prevalent in Haryana, Punjab, Rajasthan and UP. Traditionally Taramira is grown under low moisture areas of Haryana, Rajasthan, Uttar Pradesh. Rapeseed-Mustard is also grown as an inter/mix crop with wheat, gram, lentil, potato and also with sugarcane.

9. Improved varieties:

All India Co-ordinate Research Project (AICRP) on Rapeseed & Mustard (R&M) later on upgraded into National Research Centre of R&M has now been converted into Directorate of Rapeseed & Mustard Research (DRMR) located at Bharatpur, Rajasthan is entrusted with development of new varieties and improved production technologies of R&M. After inception of AICRP >120 varieties of R&M have been released for different agro-ecological situations. Variety Aravali Mustard in Chhattisgarh, Rajasthan & UP; Sawarn Jyoti in Odisha, Rajasthan & UP; Pusa Agrani in Chhattisgarh, MP, Odisha, Rajasthan & UP; Pusa Mehak in Bihar, Chhattisgarh, MP, Odisha, UP & WB; JM-2 in Chhattisgarh & MP; Vasundhara in Chhattisgarh, MP & UP; Ashirwad in MP, Rajasthan & UP; RGN-48 in Rajasthan & UP; GUJ-3 in Gujarat;CS-54 in Gujarat, Rajasthan &UP have shown significant yield gains over local varieties under minikits programme. New varieties like GDM-4, RH-0749, R-8812, RVM-2, NRCDR-2. NRCHB-101, RGN-73, RGN-229, RGN-236 and Pitambari have

shown good yield gains under FLDs conducted during Rabi 2013-14. Detail of certified seed supplied during Rabi-2011-12 given in **Table-4** indicates that a number of old varieties are still under cultivation.

Table-4: Variety wise certified seed distribution of R&M during 2011-12

State	Variety	Year of release	2011-12
Bihar	B-9	1982	150
	Pusa Jai Kisan	1994	439
	Pusa Bold	1984	1484
Haryana	Swarn Jyoti	2003	200
	RH-30	1983	1512
	Varuna	1975	385
	Laxmi	1995	738
	T-9	1982	37
Gujarat	Pusa Jai Kisan	1994	60
	GUJ-1	1990	429
	GUJ-2	1997	474
	GUJ-3	2006	259
	Pusa Bold	1984	167
	Swarn Jyoti	2003	450
	JM-2	2005	462
	Vasundhra	2003	174
Rajasthan	Pusa Jai Kisan	1994	4323
	Pusa Bold	1984	4475
	Swarn Jyoti	2003	672
	Pusa Jai Kisan	1994	848
WB	B-9	1982	399
	Pusa Bold	1984	100

List of varieties of rapeseed and mustard, which are <15 year old and eligible for assistance under National Mission for Oilseeds and Oil Palm (NMOOP) is given in ***Annexure-II.***

10. Seed scenario

In view of low seed rate and choice of varieties, farmers preferr to buy fresh quality/certified seed every year, resulting into good Seed Replacement Ratio of 50 -70%. The year wise SRR is given in **Table-5**:

Table-5 Year wise SRR of Rapeseed-Mustard

Year	**Area sown (lakh ha)**	**Total seed required (lakh qtls.)**	**Seed supplied (lakh qtls.)**	**SSR (%)**
2012-13	63.60	3.18	1.88	59
2013-14	66.50	3.32	1.63	49
2014-15	57.90	2.89	2.13	74

11. Best practices:

Brassicas grow well under low temperature and average (day and night) temperature of 25^0C is required at the time of sowing for optimum germination. These crops are grown in almost all part of the country. However, best yield potential exist in North-West and North-East Region. Best practices for increasing the productivity of rapeseed-mustard are summarized as under:

11.1. **Time of sowing**: From August end to first half of September is best for sowing of toria, 25th September to 15th October for sarson, 30th September to 15th October for mustard.

11.2. **Method of sowing**: Line sowing with row-to-row distance of 30 cm and plant-to-plant distance of 10-15 cm. Use of ridge & furrow technique is beneficial in saline area and for moisture conservation. Thinning is necessary after three weeks of sowing for maintain optimum plant population.

11.3. **Seed treatment**: Seed treatment with Apron SD 35 @ 6 g/kg of seed is advised for White Rust and Downy Mildew endemic areas. For other seedling diseases, seed treatment with Carbendazim, Thiram or Captan @ 2 g/kg of seed is recommended.

11.4. **Irrigation:** Pre-sowing irrigation followed by protective irrigation at flowering and pod formation are beneficial. Sprinkler irrigation is advantageous in saline areas.

11.5. **Nutrient management:** Integrated nutrient management with 40 kg N per ha for rainfed situations and 40-80 kg of N per ha under irrigated situations is recommended.

11.6 Integrated Pest Management: Rapeseed mustard crop is affected by a number of pests which reduces the yield of rapeseed mustard. The major pests and diseases are given in **Table-6**

Table-6: Insects/Pest of Rapeseed-Mustard

Pests	Crop stage attacked	Period of activity
1. Insect – pest		
i. Mustard Aphid (*Lipaphis erysimi*)	Vegetative / flowering and pod formation	December-March
ii. Painted Bug (*Bagrada hilaris*)	Leaves	August – October
iii.Tobacco Caterpillar (*Spodoptera litura*)	i. Seedling ii. Maturity stage	i. October-November ii. March-April
iv. Mustard Sawfly (*Athalia proxima*)	Vegetative	October-December
v. Leafminer (*Chromatomyia horticola*)	Reproductive	February-March
2. Diseases		
i. White rust (*Albugo candida*)	i. Vegetative ii. Reproductive	i. November ii February-March
ii. Alternaria Leaf Spot (*Alternaria brassicae*)	Throughout crop growth	February-March
iii. Powdery Mildew (*Erysiphe cruciferarum*)	Reproductive	February-March

iv. Sclerotina rot (*Sclerotina sclerotiarum*)	i. Vegetative ii. Reproductive	i. October-November ii. February – March

11.7 Management of pest and diseases:

- Deep ploughing during peak summer months.
- Clean cultivation with regular weeding.
- Treat the seeds with Carbedazim 0.1% or Thiophanate Methyl against seedling diseases and Imidacloprid @ 5g/kg of seeds.
- Arrange for drainage of excess water from the field for painted bug.
- If the white rust mean disease severity is more than 3%, apply ridomil MZ 72 WP @ 3g/l.
- If the alternaria blight mean disease severity is more than 3%, spraying of Mancozeb 50 WP @ 2g/l needs to be taken up at 50 and 70 days after sowing. Disease affected plants should be uprooted and destroyed.
- If Powdery Mildew disease is observed, dusting of Sulphur @ 1.5 kg/ha or spraying of Sulfex 2 g/l may be used.
- Wherever the ETL level of Mustard Aphid (per plant) has been crossed, spray of systemic insecticides viz. Monocrotophos, Oxydemeton Methyl etc., may be done at recommended doses. If population of the beneficial insects in aphid infested field is sufficient, insecticide sprays may be avoided.

11.8 Harvesting & threshing: As soon as the crop begins to turn yellow, it can be harvested and left for drawing. In case of toria harvested crop is stagged into heaps, which facilitate easy threshing and better recovery of oil. Multicrop threshers are being used for threshing of mustard. Moisture content of less than 8% is suggested or storage. Mustard grain could be safely stored in open rooms.

12 Marketing support:

National Agricultural Cooperative Marketing Federation of India Ltd. (NAFED) is the Nodal agency to undertake procurement of rapeseed & mustard under Price Support Scheme (PSS). Purchases under PSS are undertaken when the prices fall below the declared support prices for a particular year. Year wise details of MSP and Average Market Price of R&M during peak seasons (April/May) of last three years given in **Table-7** indicates that the price of mustard normally remained above the MSP except in case of Haryana and Rajasthan during April/May 2014.

Table-7: MSP v/s Average Market Price (AMP) of Mustard.

State/MSP	Avg. Price of November and December		
	2013	**2014**	**2015**
MSP (Rs. / qtl.)	3000	3050	3100
Haryana	3090	2955	3375
MP	3050	3412	3154
Rajasthan	3038	2800	3600
UP	3100	3380	3550
West Bengal	3500	3363	3375

13 Nutritive values:

Products	2012-13		2013-14		2014-15	
	Qty	Value	Qty	Value	Qty	Value
Mustard seeds	31716	133.24	38524	143.53	31816	115.18
Mustard powder	2264	11.38	2051	10.14	1988	9.26
Mustard oil*	2178	34.65	2252	27.70	2378	28.27
Oil Cake	34789	62.43	128296	219.70	85060	144.45
Total	**70947**	**241.7**	**171123**	**401.07**	**121242**	**297.16**

Mustard oil is extracted at a low pressure & low temperature (40-60^{0}C). It contains 0.30-0.35% essential oil (Allyl-Iso-Thiocynate) which acts as preservative. The Kachchi Ghani Oil is nutritious oil commonly used in Eastern, North & North-Eastern region of the country. Mustard oil is a good source of Omega-3 (MUFA) and other fatty acids like linoleic and alpha lenolic acid respectively in good proportion close to 10:1, rarely found any other oil.

Unlike canola type of varieties with <2% erusic acid of rapeseed, recently a number of varieties of Indian mustard like Pusa Karishma, Pusa Mustard-21, Pusa Mustard-22, Pusa Mustard -24, RLC-1, LET-36 and LET-43 with low erusic acid (<2%) and varieties/hybrids of Gobhi sarson like Hyola-401, GSC-5, TERI-Uttam Jawahar, NUDB-26-11, GSC-101 with 0-2% erusic acid have also been developed.

14 Export demand:

Though, a sizeable quantity (0.35 million tonnes) of canola oil is being imported to meet the domestic demand, but the seed and the oil of Indian mustard are also in more demand in various countries primarily to meet the requirement of Indian population staying there. However, export of mustard oil is not allowed in bulk quantities. In addition, de-oiled meal of mustard is also exported to a number of countries like Thailand, Vietnam, Taiwan, Indonasea, South-Korea and Europe in bulk quantities for use as manure. The quantities and values of these exports during last 03 years is given in **Table-8.**

Table-16: Export of R&M and its products

(Quantity in tonnes and value Rs. in crores)

Products	2012-13		2013-14		2014-15	
	Qty	Value	Qty	Value	Qty	Value
Mustard seeds	31716	133.24	38524	143.53	31816	115.18
Mustard powder	2264	11.38	2051	10.14	1988	9.26
Mustard oil*	2178	34.65	2252	27.70	2378	28.27
Oil Cake	34789	62.43	128296	219.70	85060	144.45
Total	**70947**	**241.7**	**171123**	**401.07**	**121242**	**297.16**

Source: Oilseeds statistics – A compendium – 2015 from ICAR- IIOR
*** Includes mustard oil aroma**

15. Researchable issues.

- Short duration varieties of toria and mustard for Eastern Regions particularly for rice fallows.
- High yielding and thermo-insensitive varieties / hybrids both for pure crop and inter-cropping.
- Technology for control of broomrape (Orobanche) and sclerotinia rot emerging as a major threat for the crop.
- Development of canola type of high yielding varieties of Indian mustard.
- Improvement of heterosis / yield levels in Indian mustard.

****

Annexure-I

Potential Districts of Rapeseed &Mustard

Sl. No.	District	Area (hectares)			Production (tonnes)			Yield (kg/ha)		
		2009-10	2010-11	2011-12	2009-10	2010-11	2011-12	2009-10	2010-11	2011-12
Rajasthan										
1	Alwar	251375	252730	264822	392953	426074	339114	1563	1686	1281
2	Ganganagar	212656	281408	272238	313417	565310	287862	1474	2009	1057
3	Bharatpur	200126	202688	208018	346158	374189	340983	1730	1846	1639
4	Tonk	173695	181304	239290	133548	277740	318480	769	1532	1331
5	S. Madhopur	158433	151682	171164	175731	221220	195325	1109	1458	1141
6	Hanumangadh	89868	108061	88991	153655	222070	99310	1710	2055	1116
7	Jaipur	99209	130121	129440	101960	169984	129608	1028	1306	1001
8	Baran	114176	77635	65192	164496	122116	101185	1441	1573	1552
9	Kota	86065	55614	60738	126606	92662	104398	1471	1666	1719
10	Karoli	75293	74140	80521	104629	124837	111220	1390	1684	1381
11	Jhunjhunu	78412	93383	97634	101985	126198	71775	1301	1351	735
12	Dausa	78748	71186	77039	103626	117594	92377	1316	1652	1199
13	Dholpur	65931	60772	69037	95340	108787	107960	1446	1790	1564
14	Jalore	62612	105461	46496	80878	145588	46446	1292	1380	999
15	Jodhapur	74197	78487	63350	94360	85521	85417	1272	1090	1348
16	Sikar	59702	74672	68539	74181	96870	51569	1243	1297	752
17	Nagaur	46544	52924	29496	57654	71626	34668	1239	1353	1175
18	Chittore	39415	53119	40643	48215	71543	56770	1223	1347	1397
19	Bundi	63718	41701	53284	70656	48689	87821	1109	1168	1648
20	Jhalwar	39401	32622	32390	54250	38485	55637	1377	1180	1718
21	Jaisalmer	34680	69288	62909	22078	54207	35265	637	782	561
22	Bikaner	30279	42172	48242	19693	55065	38533	650	1306	799
Haryana										
	District	**2010-11**	**2011-12**	**2012-13**	**2010-11**	**2011-12**	**2012-13**	**2010-11**	**2011-12**	**2012-13**
23	Bhiwani	138000	169800	162400	238000	204000	265110	1727	1200	1640
24	M. Garh	94000	98300	96600	171000	81000	165000	1902	827	1699
25	Rewari	65000	64300	67400	125000	118000	145000	1979	1840	2157
26	Hisar	70000	59700	62000	141000	102000	102800	2012	1707	1678
27	Sirsa	42000	34900	43400	83000	59000	71000	1982	1678	1647

Cont….Annexure-I

Sl. No.	District	Area (hectares)			Production (tonnes)			Yield (kg/ha)		
		2011-12	**2012-13**	**2013-14**	**2011-12**	**2012-13**	**2013-14**	**2011-12**	**2012-13**	**2013-14**
Madhya Pradesh										
28	Bhind	172900	182800	180000	201300	312100	175500	1164	1707	975
29	Morena	134100	141900	153200	231400	246600	158300	1726	1738	1033
30	Sheopur Kalan	49500	47000	45000	68300	72100	73300	1381	1532	1629
31	Gwalior	53800	47500	47700	73400	54100	38400	1364	1139	806
32	Shivpuri	40100	36500	57400	34400	24700	36200	859	675	632
33	Mandsaur	32600	57300	34700	39800	98900	74000	1221	1727	2132
Uttar Pradesh										
	District	**2011-12**	**2012-13**	**2013-14**	**2011-12**	**2012-13**	**2013-14**	**2011-12**	**2012-13**	**2013-14**
34	Mathura	44464	48588	43331	75696	83700	65798	1702	1723	1518
35	Agra	51991	57422	53142	88939	109299	76094	1711	1903	1432
Gujarat										
	District	**2010-11**	**2011-12**	**2012-13**	**2010-11**	**2011-12**	**2012-13**	**2010-11**	**2011-12**	**2012-13**
36	Banaskantha	120000	112400	115300	184800	175400	206200	1540	1561	1788
37	Patan	35400	25400	27900	55300	41500	42400	1532	1634	1520
38	Mehsana	34800	24800	36200	55000	38500	53500	1582	1552	1478
West Bengal										
	District	**2011-12**	**2012-13**	**2013-14**	**2011-12**	**2012-13**	**2013-14**	**2011-12**	**2012-13**	**2013-14**
39	Murshidabad	81410	87110	87180	81180	94680	95890	997	1087	1100
40	Nadia	72220	86470	77150	65510	103180	90770	949	1193	1177
41	24 Parganas (N)	40110	45690	46870	41410	60760	67110	1032	1330	1432
42	Dinajpur (N)	43170	48440	49790	33680	41750	38420	780	862	772
43	Malda	32450	33650	35250	36600	35740	38300	1128	1062	1087
44	Birbhum	32280	31340	33500	29810	29270	34450	923	934	1028
Assam										
	District	**2010-11**	**2011-12**	**2012-13**	**2010-11**	**2011-12**	**2012-13**	**2010-11**	**2011-12**	**2012-13**
45	Lakhimpur	23830	25500	37900	21793	14300	26000	915	560	685
46	Kokrajhar	25667	25100	25100	17413	17100	16200	678	682	646

Annexure-II

Details of <15 years old varieties/hybrids of Rapeseed & Mustard

Indian mustard (*Brassica juncea*)

Variety/ hybrid	Year of release	Releasing Centre	Yield potential (kg/ha)	Oil content (%)	Recommended states/region/ situations	Specific features/traits
Geeta (RB 9901)	2003	CCSHAU,RRS, Bawal	1773	40-42	Delhi, Haryana, Punjab and South Rajasthan	Suitable for rainfed conditions
Kanti	2003	CSAUAT Kanpur	1458-2068	40-42	Uttar Pradesh	Tolerant to high temperature at seedling stage
Maya (RK 9902)	2003	CSAUA&T, Kanpur	2500-2900	39-40	Madhya Pradesh and Uttar Pradesh	Suitable for irrigated conditions, resistant to white rust
RGN 13	2003	RAU,ARSSriganganagar	2200	41-43	Rajasthan	Suitable for normal sown irrigated conditions
Swaran Jyoti (RH 9801)	2003	CCSHAU, Hisar	1377	39-43	Haryana, Madhya Pradesh, South Rajasthan and Uttar Pradesh	Suitable for irrigated late sown and frost conditions
Vasundhra (RH 9304)	2003	CCSHAU, Hisar	2109	38-40	Haryana, Madhya Pradesh, South Rajasthan, Uttar Pradesh and Uttranchal	Suitable for normal sown irrigated conditions
CS 54 (CS 614-4-1-4)	2005	CSSRI, Karnal	1932	39-41	Haryana, MP, Rajasthan, UP and Gujarat	For salt affected soils
Ashirwad (RK-01-03)	2005	CSAUA&, Kanpur	1450-2358	31- 41	Madhya Pradesh, Rajasthan, Uttar Pradesh, and Uttaranchal	Moderately resistant at leaf and pod stage for *alternaria* blight and resistant for White rust. Suitable for irrigated late sown conditions
Jawahar Mustard 2	2005	ZRS Morena	1632-2588	38-41	Madhya Pradesh and Chhattisgarh	White rust resistant
Jawahar Mustard 3	2005	ZRS Morena	1500-2500	40	Madhya Pradesh	Tolerant to A*lternaria* blight
Narendra Swarna Rai 8	2005	NDUAT Faizabad	1681-2211	36-45	Uttar Pradesh	Yellow seeded, high oil content

Cont....Annexure-II

Variety	Year of release	Releasing centre	Yield Potential (Kg/ha)	Oil content (%)	Recommended for (state/region)	Specific features
Pusa Karishma	2005	IARI, New Delhi	1731-2506	37-38	Delhi	Low erucic acid, yellow seeded
Pusa Mahak (JD-6)	2005	IARI, New Delhi	597-1049	39-44	Orissa, WB, Bihar, Jharkhand, Chhattisgarh, Assam	An early maturing, for rainfed areas
Shivani	2005	BAU Kanke	653-930	37-41	Jharkhand	Suitable for rainfed
Gujarat Mustard 3	2006	SDAU, SK Nagar	Rainfed :901-1362 Irrigated : 1673-2317	35-40	Gujarat	Tolerant to high temperature and salinity
RGN-48	2006	RAU, ARS, Sriganga nagar	1692-2924	39- 41	Haryana, Punjab and Rajasthan	Suitable for rainfed and frost conditions
Navgold (YRN-6)	2006	RAU, ARS, Navgoan	1253-1803	39-40	Punjab, Haryana	Yellow seeded and suitable for late sown condition
RRN 505	2006	RAU Navgaon	1200-1400	40	Rajasthan	Suitable for late sown conditions
PBR 210	2007	RSS, PAU Bathinda	2080-2532	38-39	Punjab	Early maturity in Punjab conditions
RLC 1(ELM 079)	2007	PAU Ludhiana	1600-2000	38	Punjab	Low erucic acid
NRCDR-2	2007	DRMR, Bharatpur	2213	39	Haryana, Punjab, Jammu, parts of Rajasthan and Delhi	Suitable for Irrigated conditions
Pusa Mustard-21 (LES 1-27)	2007	IARI, New Delhi	2111	34.0 – 40.0	Delhi, Haryana, Jammu & Kashmir (Plains) Punjab, Rajasthan, Western Uttar Pradesh	Low erucic acid (<2%)
RGN-73	2007	RAU, ARS, Sriganga nagar	2006	40	Uttar Pradesh, Uttaranchal, Madhya Pradesh and parts of Rajasthan	Suitable for Irrigated, frost conditions
Shatabdi (ACN 9)	2007	PDKV Akola	468-1291	32-40	Maharashtra	Suitable for timely and late sown conditions
TPM 1	2007	MPKV Jajgaon	1127-1682	34-39	Maharashtra	Yellow seeded

Cont....Annexure-II

Variety	Year of release	Releasing centre	Yield Potential (Kg/ha)	Oil content (%)	Recommended for (state/region)	Specific features
Pusa mustard 22 (LET 17)	2008	IARI, New Delhi	2007	35.5	Haryana, Punjab, Jammu, parts of Rajasthan and Delhi	Suitable for Irrigated conditions, low erucic acid variety
Pusa Vijay (NPJ 93)	2008	IARI, New Delhi	1870-2715	35-41	Delhi	High temperature tolerant at seedling stage and salinity
CS 56 (CS-234-2)	2008	CSSRI, Karnal	1170-1423	34.2-38.0	Haryana, Punjab and parts of Rajasthan	Suitable for late sown conditions, salt tolerant, 1000 seed weight more than 6 g.
Pusa mustard-24 (LET-18)	2009	IARI, New Delhi	1241-2904	32.0-39.7	Haryana, Punjab, New Delhi and parts of Rajasthan	Low erucic acid (<2%)
Dhara mustard hybrid 1 (DMH 1) Hybrid	2009	Dhara Vegetable Oils	1782-2249	38 – 42	Delhi, , Haryana ,Punjab,J & K and Rajasthan	High pod density, resistant to white rust
NRC HB 101	2009	DRMR, Bharatpur	1382-1491	35- 42	Madhaya Pradesh, Uttar Pradesh, Uttarakhand and Eastern Rajasthan	Suitable for late sown irrigated conditions
NRCHB506(Hybrid)	2009	DRMR, Bharatpur	1550-2542	39- 43	Madhaya Pradesh, Uttar Pradesh, Uttarakhand and Eastern Rajasthan	High adaptation
RB 50	2009	CCSHAU,RRS,Bawal	846-2425	39- 40	Delhi ,Haryana,Punjab, Jammu& Kashmir, Rajasthan	Suitable for rainfed conditions
RGN 145	2009	RAU,ARS, Sriganganagar	1448-1640	35- 39	Delhi ,Haryana,Punjab, Jammu& Kashmir, Rajasthan	Suitable for late sown irrigated conditions
Pusa Tarak	2009	IARI, New Delhi	1852-1996	38-42	Delhi	High temperature tolerant and bold seeded
Pusa mustard 25 (NPJ 112)	2010	IARI, New Delhi	1324-1654	36-41	Delhi ,Haryana,Punjab, Jammu& Kashmir, Rajasthan, Western Uttar Pradesh	Suitable for early sown irrigated conditions, high temperature tolerance at juvenile stage
Coral PAC - 432 (Hybrid)	2010	United Phosphorus, Bangalore	1831-2581	40-42	Uttar Pradesh, Uttarakhand and Rajasthan	

Cont....Annexure-II

Variety	Year of release	Releasing centre	Yield Potential (Kg/ha)	Oil content (%)	Recommended for (state/region)	Specific features
NRCDR 601 (DMR 601)	2010	DRMR, Bharatpur	1939-2626	39-42	Delhi, Haryana, Punjab, Jammu & Kashmir, Rajasthan	Tolerant to salinity and high temperature at sowing time
RH 0119	2010	HAU Hisar	1047-2156	38.5-39.8	Haryana	Thermo-tolerant
Pusa Mustard 26 (NPJ 113)	2011	IARI, New Delhi	1481-1895	30-41	J&K, Punjab, Haryana, Rajasthan, Delhi & U.P.	Suitable for late sown irrigated conditions in rabi season.
Pusa Mustard 27 (EJ 17)	2011	IARI, New Delhi	1437-1659	40-45	U.P., M.P., Uttarakhand & Rajasthan	Suitable for early sown irrigated conditions & for multiple cropping
PBR-357	2011	PAU Ludhiana	1373-3819	35.8-41.5	Delhi ,Haryana,Punjab, Jammu, Rajasthan	Timely sown irrigated conditions
PR 20061 (Pant rai 19)	2012	GBPUA&T Panth Nagar	1831-2511	40.9-41.8	Delhi ,Haryana,Punjab, Jammu, Rajasthan	Tolerant to high temperature at early stage
RLC-2 (ELM 123)	2012		2039-2342	36.3-38.9	Delhi ,Haryana,Punjab, Jammu, Rajasthan	Superior oil quality
Pusa Mustard 28	2012	IARI, New Delhi	1912-2098	40-42.8	Delhi, Haryana, J & K, Punjab, Rajasthan	Early sown
Coral 437	2012	United Phosporous Bangalore	1831-2581	39.2-41.2	Delhi, Haryana, Punjab, J & K, Rajasthan	White rust resistant
PBR-378	2012	PAU Ludhiana	1228-3484	37.7-41.9	Delhi ,Haryana,Punjab, Jammu, Rajasthan	Timely sown rainfed conditions
RGN 229	2013	RAU,ARS Sriganganagar	2162-2568	37.8-42.1	Delhi ,Haryana,Punjab, Jammu& Kashmir, Rajasthan	Tolerant to high temperature and salinity during seedling stage
RGN 236	2013	RAU,ARS Sriganganagar	1485-1808	36.3-40.8	Delhi ,Haryana,Punjab, Jammu& Kashmir, Rajasthan	Tolerant to high temperature and salinity during seedling stage
Pusa Mustard – 29 (LET-36)	2013	IARI	1927-2568	30-39.8	Delhi ,Haryana,Punjab, Jammu, Rajasthan	Low erucic acid content
Pusa Mustard – 30 (LET-43)	2013	IARI	1564-2238	36-39.4	UP, Uttarakhand, MP, Estern Rajasthan	Low erucic acid content
RH 0406	2013	HAU Hisar	2200-2300	38-40	Delhi ,Haryana,Punjab, Jammu, Rajasthan	Bold seeded lodging resistant

Cont....Annexure-II

Variety	Year of release	Releasing centre	Yield Potential (Kg/ha)	Oil content (%)	Recommended for (state/region)	Specific features
Raj Vijay Mustard-2 (JMWR 08-3)	2013	RAU Bikaner	1276-1874	37.1-41.2	Delhi ,Haryana,Punjab, Jammu, Rajasthan	Moderately resistant to white rust
Divya-33	2013		1699-3560	36-40.7	Delhi ,Haryana,Punjab, Jammu & Kashmir, Rajasthan	Tolerant to high temperature
RH 0749	2013	HAU Hisar	2400-2800	39-39.5	Delhi ,Haryana, Punjab, Jammu & Kashmir, Rajasthan	Timely sown irrigated condition
DRMRIJ - 31	2015	DRMR Bharatpur	2246-2757	38.7-42.5	Delhi ,Haryana,Punjab, Jammu, Rajasthan	High seed yield & bold seed size
Karan rai (*Brassica carinata*)						
Pusa Swarnim (IGC-01)	2003	IARI, Pusa, New Delhi,	1567	42-43	Delhi, Haryana, Himachal Pradesh and Punjab	Suitable for irrigated and rainfed conditions
Pusa Aditya	2006	IARI, Pusa, New Delhi,	1400	38.2-41.2	Delhi	Suitable for rainfed conditions
Taramira (Eruca sativa)						
Narendra Tara (RTM-2002)	2007	SKN College Jobner	1001-1115	37-38	Rajasthan	For rainfed areas
Vallabha Taramira1 (PUT 93-11)	2011	ZRS, Ujhani,	616-1133	38-40	Uttar Pradesh	Moderately resistant to alternate blight and aphid
Vallabha Taramira2 (PUT 93-1)	2011	ZRS, Ujhani,	500-1283	38-39	Uttar Pradesh	Resistant to white rust, moderately resistant to alternate blight and aphid

Cont....Annexure-II

Variety	Year of release	Releasing centre	Yield Potential (Kg/ha)	Oil content (%)	Recommended for (state/region)	Specific features
Toria (Brassica rapa)						
VL Toria-3	2007	VPKAS, Almora	769-1106	39- 41	Uttarakhand Hills	-
Uttara	2010	GBPUA & T, Pantnagar	1000	42	Uttarakhand plains	Moderately resistant to white rust, downey and powdery mildew
Yellow Sarson (*Brassica rapa* var yellow sarson)						
YSH 0401	2009	CCS HAU, Hisar	1273-1651	43-45	Bold seeded	Yellow sarson growing areas of the country
Pitambari (NRCYS-05-02)	2010	DRMR, Bharatpur	1239-1715	38.2-46.5	Early maturity, medium height and high oil content	Yellow sarson growing areas of the country
PYS-1 (Pant Pili Sarson)	2010	GBPUA&T, Pantnagar	1050-1163	42-44	For irrigated areas	Uttaranchal
Gobhi Sarson(*Brassica napus*)						
GSC-5	2005/ 2007	PAU, Ludhiana	1719-2390	37-43	Punjab	Low erucic (< 2%) and low glucosinolate (26-41 micromoles/g defatted seed meal)
TERI – Uttam-Jawahar [TERI (00) R 9903]	2007	TERI, New Delhi	1619-2685	43-45	Madhya Pradesh	Low erucic acid (< 2%) and low glucosinolate (12.2 micromoles/g defatted seed meal)
GSC-6 (OCN-3)	2008	PAU, Ludhiana	1795	39.0	Punjab, Haryana and Jammu	Irrigated areas
NUDB-26-11	2008	Mother Dairy Fruit & Vegetable Pvt Ltd, NOIDA, UP	984-1339	38-42	Himachal Pradesh, Jammu &Kashmir	Low erucic and low glucosinolate content, suitable for irrigated conditions.

Cont....Annexure-II

Variety	Year of release	Releasing Centre	Yield potential (kg/ha)	Oil content (%)	Recommended states/regions	Special features
Him Sarson 1 (ONK 1)	2008	SAREC, CSK HPKVV, Kangara	693-1789	38-42	Himachal Pradesh, Jammu &Kashmir	Low incidence of *Alternaria* leaf blight and *Sclerotinia* stem rot, resistance to white rust and moderate resistance to downy and powdery mildew, wider adaptability.
GSC 101	2013		1793-2190	38.6-42.0	Delhi ,Haryana, Punjab, Jammu & Kashmir, Rajasthan	Double low (Low erucic acid and low glucosinolate content)
Black mustard (*Brassica nigra*)						
Surya (LBM-428)	2003	ANGRAU, Lam, AP	1000-1200	40-41	Andhra Pradesh	-