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Oilseed Brassica crop in Bharatpur eastern district of Rajasthan- A case study

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India is the second largest rapeseed mustard growing country in the world contributing 25.6 and 14.7per cent, respectively to World's acreage and production. The crop is the second most important oilseeds crop in India after groundnut accounting for 26 per cent of the total oil seed production, and 23.7 per cent of the gross cropped area in the country. Oil seed sector as a whole, and rapeseed mustard in particular, has witnessed significant increase in production in the last decade. The production and yield of rapeseed mustard increased from 6.66 million tonne (mt) and 1017 kg/ha in 2000-01, to 7.66 mt and 1185 kg/ha in 2010-11.

The major rapeseed-mustard (*Brassica* spp.) growing states are Haryana, Madhya Pradesh, Rajasthan, Gujarat, West Bengal and Uttar Pradesh together contributing 90.0 and 94.0 per cent to the total national acreage and production, respectively. Of the total rapeseed mustard cropped area and production, Rajasthan accounts to about 45.5 and 48.6 per cent, respectively.

Bharatpur, eastern district of Rajasthan is the largest mustard growing division covering about 48 per cent of the total production of state. Indian mustard crop plays a vital role in improving economic status of the farming community of Bharatpur district. Since inception of Krishi Vigya Kendra (KVK), Kumher during 2000-01, it has initiated training, demonstration and other extension programme with an aim to increase acreage, production, and productivity of mustard crop in Bharatpur district.

Genesis of programme

The results presented here include various extension activities of Krishi Vigyan Kendra, Kumher including training and demonstration on mustard crop from 2001 to 2012. The KVK trained 1499 farmers and conducted 336 demonstrations in eighty farmers selected randomly from four villages. Pre-structured questionnaire were used to collect data from the beneficiaries, and the result of the survey revealed the following facts:

- Both soil salinity and draught adversely affected mustard production.
- Majority of farmers used local varieties due to non-availability and unawareness of improved, high yielding varieties which are low yielding, late maturing, small size seed, reddish in colour, and susceptible to pests and diseases.
- Higher seed rate i.e. 6.00 kg/ha compared to low recommended rates; Thinning was not practiced by most farmers.
- Most farmers used own-produced previous year impure seeds or purchased uncertified seeds from local market.
- Farmers lacked knowledge and operational skill regarding plant protection measures.
- Lack of technical 'know-how' about seed treatment, and seed treatment was mostly not practiced.
- Most farmers applied only urea and di-ammonium phosphate (DAP) but sulphur fertilizers were not used.
- Farmers did not used bio-fertilizer and gypsum.
- The mono-cropping of mustard was very common, and the soil was found to be very deficient in micronutrients.

- Delayed /non-availability of input to farmers.
- Constraints related to natural calamities including diseases, insect pests, frost, cold spell, fog, and lack of timely rains adversely affected production of mustard crop.

Intervention of KVK

Considering the above facts, KVK has initiated several programme to enhance the production of mustard under conserved soil moisture and irrigated conditions. The main objectives of the programme were as follows:

- Multiplications of seeds of high yielding varieties of mustard for irrigated and conserve soil moisture conditions. The aim was to popularize the high yielding varieties by providing pure seeds to the farmers on regular basis, and there by increasing the area and productivity of mustard crop in the area.
- Demonstration of improved varieties with package of technology at Instructional KVK farm and farmers' field to provide first hand knowledge, of yield benefits, and operational skills to farmers.
- Organizating training camps for farmers, and showing benefits of improved high yielding varieties, proper time of sowing, scientific cultivation of mustard crop, fertilizer application, mixed cropping seed treatment, plant protection measures, gypsum application, and increase nutritional value of oil and oilseed meal.

The programme covered about 60 per cent of the mustard-cultivated area in the surrounding villages.

Extension strategies

Training and extension activities

Results in Table-1 show that 54 training programme were organized during 2000-2010 on scientific cultivation of mustard crop regarding use of high yielding varieties, fertilizer application, and plant protection measures, and more than 1500 farmers and farm women of several villages in different panchayat samities were trained. The training helped in increasing scientific knowledge regarding cultivation of mustard which led in increasing production. Many extension activities included exhibition, Kishan Gosthi, Field days, and film show (Table 2).

Table 1. Details of mustard crop production technology training camps organized by KVK, Kumher, Bharatpur during 2000-10, and numbers of male and female farmers trained.

Year	On Campus				Off Campus				Total			
	No.	M	F	T	No.	M	F	T	No.	M	F	T
00-01	3	59	12	71	2	50	0	50	5	109	12	121
01-02	2	42	0	42	3	64	13	77	5	106	13	119
02-03	4	91	0	91	2	39	7	46	6	130	7	137
03-04	2	48	7	55	2	66	10	76	4	114	17	131
04-05	2	72	0	72	2	64	0	64	4	136	0	136
05-06	3	67	11	78	3	102	19	121	6	169	30	199
06-07	2	38	9	47	3	82	17	99	5	120	26	146
07-08	3	73	10	83	3	30	18	48	6	103	28	131
08-09	2	42	0	42	3	143	5	148	5	185	5	190
09-10	3	48	21	69	5	82	36	118	8	130	57	187
TOTAL	26	580	70	650	28	722	125	847	54	1302	195	1497

M- Male, F- Female, T- Total

Demonstration

Total of 336 field demonstrations of improved high yielding varieties of mustard suitable for Bharatpur

Table 2. Details of extension activities organized by KVK, Kumher, Bharatpur on transfer of mustard crop production technology

Year	Field Days				Agri. Exhibition				Film Show				Kishan Gosthi			
	No.	M	F	T	No.	M	F	T	No.	M	F	T	No.	M	F	T
04-05	2	60	12	72	-	-	-		2	20	30	50	-	-	-	-
05-06	2	250	50	300	-	-	-	-	1	25	-	25	2	61	11	72
06-07	2	72	22	94	-	-	-	-	2	46	15	61	3	79	16	95
07-08	2	112	25	137	1	164	71	235	3	98	43	141	2	38	7	45
08-09	2	80	21	101	-	-	-	-	2	44	21	65	21	6037	25-	8537
09-10	2	78	33	111	-	-	-	-	-	-	-	-	21	18631	8014	26645
00-01	1	41	11	52	1	175	100	275	3	75	31	106	21	9525	4010	13535
01-02	5	329	13	342	1	146	56	202	3	39	16	55	1	175	75	250
02-03	2	57	24	81	1	78	42	120	2	60	27	87	2	83	16	99
03-04	5	201	85	286	-	-	-	-	3	69	5	74	-	-	-	-
Total	25	1280	296	1576	4	563	269	832	21	476	188	664	10	436	125	561

M- Male, F- Female, T- Total

district were also conducted on farmers' fields to show evidence of high yield potentialities. Demonstrations of the best suitable high yielding varieties, supplied by different seed agencies and Agricultural Universities, were also conducted on instructional farm of KVK (Table 3).

Table 3. Front Line Demonstration during 2000-10

Year	No. of FLD	Variety	Area(ha)	Yield (q/ha)			% Increase
				Max.	Av.	Local Av.	in yield
00-01	12	RL-1359	5	20.0	18.5	15.0	23.4
01-02	52	Bio-902	20	21.0	20.3	16.5	23.5
02-03	35	Bio-902	15	20.5	19.3	16.3	18.3
03-04	22	Bio-902	10	22.0	20.5	17.7	20.2
04-05	40	Bio-902	20	25.0	21.0	17.2	22.0
05-06	40	Laxmi	20	23.0	19.7	16.7	18.0
06-07	40	Bio-902	20	27.0	22.8	18.8	21.5
07-08	40	Rohini	20	20.0	19.1	15.8	21.7
08-09	40	Rohini	20	24.8	22.5	18.4	22.4
09-10	15	Rohini	8	28.9	22.0	18.6	18.6

FLD - Front Line Demonstration

Percentage of farmers adopting recommended package of practices before and after Front Line Demosntrations

Attempts were also made to determine extent of adoption of various packages of practices before and after FLD. Results in Table 4 showed that before front line demonstrations only 40 per cent of farmers were using improved high yielding varieties, recommended seed rate, basal fertilizer, pest control irrigation, seed treatment, sequence of seed treatment, time of sowing and use of sulphur (gypsum); 55 per cent farmers weeded their crop manually. It was very encouraging to note that after FLD, 75-90 per cent of farmers surveyed adopted recommended scientific practices for mustard crop production including improved high yielding

Table 4. Per cent adoption of recommended package of practices in mustard crop before and after Front Line Demonstration (FLD)

N=80

Practice	Adoption of Recommended Package			
	Before FLD		After FLD	
	No.	Per cent	No.	Per cent
Improved Varieties	25	32	75	94
Soil Treatment	5	6	35	44
Seed Treatment	12	15	65	81
Seed Rate	30	38	70	88
Sequence of Seed**Treatment (F.I.R.)**	8	10	45	56
Time of Sowing	16	20	62	78
Plant Geometry (Spacing)	35	44	65	81
Use of FYM	16	20	48	60
Use of basal Fertilizer	22	28	76	95
Use of top dressed fertilizer	12	15	72	90
Use of Sulphur (Gypsum)	5	6	40	50
Spray of Thio-urea	0	0	18	23
Weed Control	44	55	60	75
Irrigation	34	43	65	81
Disease Control	17	21	59	74
Pest Control	24	30	66	83

Table 5. Percentage of farmers in Bharatpur district with knowledge and adoption of mustard crop production technologies.

N=80

Particular	Knowledge				Adoption					
	Yes		No		Fully		Partial		No	
	No.	%	No.	%	No.	%	No.	%	No	%
Summer Ploughing	80	100	0	0	52	65	20	25	8	13
Improved Varieties	80	100	0	0	65	81	5	6	10	40
Soil Treatment	40	50	40	50	20	25	28	35	32	43
Seed Treatment	42	53	35	48	22	28	24	30	34	30
(a) Fungicide	44	55	36	45	32	40	24	30	24	45
(b) Insecticides	387	48	42	53	18	23	26	33	36	53
(c) Culture	42	53	38	48	16	20	22	28	42	55
Sequence of seed	32	40	60	48	22	28	14	18	44	00
Treatment (FIR)										
Seed Rate	60	75	20	25	62	78	18	23	0	0
Plant Geometry (Spacing)	35	43	45	57	58	73	22	28	0	0
Manure (FYM)	80	100	0	0	39	49	41	51	0	0
Fertilizers	59	74	21	26	53	66	127	34	0	50
Use of sulphur(Zypsum)	60	75	20	25	28	35	12	15	40	0
Weed Control(Manual)	80	100	0	0	57	71	23	29	0	65
Weed Control(Chemical)	25	31	55	69	18	23	10	13	52	25
Plant Protection	57	71	23	29	23	29	37	46	20	8
Irrigation Management	80	100	0	0	61	76	13	16	6	

varieties, seed treatment, time of sowing, plant spacing, use of basal fertilizer dose, top dressed fertilizer, weed control, irrigation, and pest control. However, the soil treatment, sequence of seed treatment, application of gypsum was adopted by only half of the selected farmers of FLD; spray of thio-urea was adopted only by 23 per cent farmers of FLD. Therefore results of Table 4 show clearly that training and demonstration organized by KVK encouraged farmers to adopt improved varieties with improved package and practices of Mustard crop production technology. The survey also revealed that before KVK intervention, the selected farmers grew mustard crop on an average of 1 ha and the average production was only 12 q/ha. After intervention, there was an increase of 56 per cent in the area and 40 per cent in, production. Results in Table 3 revealed percent yield increase in all 8 treatments and varieties Rohini and Laxmi ranged from 18 to 23. Some farmers also reported use of gypsum, sulphuric acid and thio-urea spray for increasing size of pod, number of seeds per silqua, oil percentage and protecting crop from effect of cold, and insect infestations.

By conducting frontline demonstrations of proven technologies, yield potential of mustard can be increased to a great extent (Singh *et al*., 2007). This will substantially increase the income as well as the livelihood of the farming community. There is a need to adopt multi-pronged strategy that involves enhancing mustard production through improved technologies in Bharatpur district. This should be brought to the access of farmers through transfer of technology centers like KVKs.

Impact assessment of mustard crop production technology

Knowledge of trained farmers regarding mustard crop production technology was measured in terms of package of farm practices used and it was found that more than 60 per cent farmers have fair to good knowledge regarding recommended technology. Less than 50 percent farmers were found to have poor knowledge regarding seed treatment from insecticide, sequence of seed treatment, spacing, and chemical weed control (Table 5).

The impact assessment of trained farmers under mustard crop production technology revealed that 95% of the respondent had fully adopted the basal fertilizer, followed by 94% high yielding varieties, 90% top dressing fertilizer, 88% seed rate, 83% pest control and 81% seed rate, geometry and irrigation; use of time of sowing, weed control and disease control were adopted by 78%, 75% of farmers, respectively (Table 4). These findings matched with the earlier reports in wheat crop (Dubey and Srivastava, 2007; Lakhera and Sharma, 2002).

The study further shows that nearly 70 to 80 per cent farmers had fully adopted the harvesting, plant geometry and inter culture operations. The farmers had given very little importance to weedicide soil treatment, seed treatment, and only 50 per cent farmers partially adopted plant protection measures. Performance of the crop increased by adopting the improved technologies in mustard crop matched with earlier studies by Patel *et al*. (2009).

Technological Economics

The economics of the technology was also calculated before and after FLD. It is evident from table 6 that after FLD, high yielding varieties and improved practices increased yield nearly 50 per cent from Rs. 23688 to Rs. 35685. It shows that KVK training and FLD programme had very positive impact in increasing areas under production and yield/ ha.

Trends in mustard area, production and productivity in last decade of Bharatpur

The annual growth in cultivated area, total net production, and production/ ha during last decade (2000-01 to 2009-10) attained significant increase in yield in Bharatpur district, as crop is economical, remunerative and helped to improve socio economic status of farmers (Table 7).

Table 6. Details of production cost and benefits before and after front Line Demonstrations (FLDs)

Particular	Before FLD	After FLD
Cost of Inputs (Rs/ha)	16312	18390
Yield of Mustard (q/ha)	20	27
Market Prices (Rs./qt.)	2000	2100
Gross Income (Rs./ha)	40000	54075
Net Profit (Rs./ha)	23688	35685

Table 7. Year wise Area, production and productivity of Indian mustard in Bharatpur district of Rajasthan, India

Year	Area 000 ha	Production 000 tonne	Yield (kg/ha)
2000-01	124	145.97	1171
2001-02	189	199.4	1053
002-03	193.	201.23	1042
2003-04	218	263	1210
2004-05	209	303	1450
2005-06	224	329	1470
2006-07	212	325	1530
2007-08	205	330	1610
2008-09	222	358	1612
2009-10	224	376	16802

Conclusion and Major Impact of the KVK Programme

1. Average yield of Mustard per unit area increased significantly.
2. During last decade productivity increase from 1171 in 2000-01 to 1680 Kg/ha in 2009-10 (Table 7).
3. During the last decade, Front Line Demonstration have helped popularizing, among farmers, improved high yielding and high oil content varieties with built-in resistance to diseases and pests. As a result, the present survey revealed that the average oil content of the mustard crop during this period in Bharatpur district increased from 36 to 43.5 per cent.
4. Field demonstrations and training camps have helped convience farmers to adopt high yielding varieties of mustard including BIO-902, Laxmi and Rohini.
5. The mustard crop is gaining wide acceptance among farmers because of :
   A. Adaptability for both irrigated and rainfed areas.
   B. Suitability as a sole as well as mixed cropping.
   C. Higher return with low cost of production and low soil moisture requirement.
   D. High net return on investment.
   E. Seed meal source of income.
6. Results showed that reduced seed rate, use of plant protection measures and gypsum, green manuring (Sasbenia crop) and use of Thio urea will reduce input cost of production by 30 per cent.
7. Field demonstrations and on-site training have helped many farmers to start cultivation of foundation and certified seed on their own, or under the guidance and supervision of KVK Scientists. This will help not only in increasing the area under high yielding varieties at faster rate, but also in producing cheaper foundation and certified seeds than the Private Seed Agencies.

Conclusion

It is concluded that KVK is able to bring significant changes in the level of knowledge and adoption of mustard production technologies among trainees. Training and guidance given to trainees have played prime role in influencing technological changes, besides management orientation. Therefore, there is need give thrust of these factors with suitable changes in training curriculum and time by the scientists for fulfilling the objective of KVK training programmes.

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