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Impact assessment of front line demonstrations on Brown Sarson: Experience from temperate north-western Himalayan region of India

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This study investigates an impact of Frontline Demonstrations (FLDs) conducted by Indian Council for Agricultural Research (ICAR) on Brown Sarson through Krishi Vigyan Kendra's (Farm Science Centre's) from Rabi 2005 to 2011 in the Anantnag and Kulgam districts of north-western temperate Himalayan region of Jammu and Kashmir (J&K) India, in which 120 participant farmers and 120 non-participant farmers were selected through stratified random sampling method. Results reveal yield advantage up to 34.22% with incremental benefit: Cost ratio (ICBR) of 4.76 with increased knowledge level to the extent of 41.02% in case of participant farmers together with high (40.00%) to medium (39.17%) extent of adoption against low grain yield, low returns, low knowledge level and medium (54.17%) to low (36.67%) extent of adoption in case of non-participating farmers. Correlation suggests that education, farm size, farm power, adoption of improved practices. The results of regression analysis revealed that level of knowledge with some socio-personal, psychological and communication variables among respondent farmers have indeed helped in contributing to extent of adoption of improved technology amongst farming community. This can be seen as a positive indicator for formulating and disseminating, more extensive, technology specific and farmer centric FLD programme to improve overall knowledge and adoption amongst farmers in the region to boost oilseed production.

Key words: Brown Sarson, front line demonstration (FLD), yield gap analysis, economics, adoption.

INTRODUCTION

The Indian contribution to total oilseeds acreage, production and consumption in world is 12 to 15, 7 to 8 and 9 to 10%, respectively (Venkattakumar and Hegde, 2008). India has produced a record of nearly 30 million tonnes of oilseeds during 2007 to 2008 from an area of 26.7 million ha with productivity of 1115 kg/ha, which need to be increased to at least 1.5 tones per hectare by 2015 to meet huge demand for edible oil in the country (Venkattakumar and Padmaiah, 2010). Several initiatives viz., the Technology Mission on Oilseeds, adhoc project on Frontline Demonstrations in Oilseed Crops and All India Coordinated Research Project on Rapeseed-

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Mustard (AICRPRM) were taken already with an objective to enhance production and productivity of oilseeds to achieve self-reliance in oilseeds, which paved the way to meet different challenges and complexities in the oilseed sector (Hegde, 2009). Rapeseed-mustard is an important group of oilseed crops in India with area, production and productivity of 6.90 M. ha, 8.18 MT and 11.84 q/ha, respectively (Anonymous, 2011). During the period of 2001 to 2006, it has contributed 24.1 and 25.18% to the oilseeds acreage and production, respectively.

This crop commodity is the major source of income even to the marginal and small farmers in the several states of India including Jammu and Kashmir (Sachin et al., 2009). Brown Sarson (*Brassica rapa L.*), one of the important member of Rapeseed-mustard is major oilseed crop of Jammu and Kashmir which is grown in rabi season, due to its excellent combination with Rice based cropping system. In J&K state an area of 59.32 thousand hectares is under Brown Sarson crop with production and productivity of 40.4 thousand tones and 6.81 q/ha, respectively (Anonymous, 2009).

In the districts of Anantnag and Kulgam, productivity of Brown Sarsoon is 7.9 q/ha which is about 1.09 q/ha more than the state average, but still we are lagging far behind in achieving a breakthrough in Brown Sarson production and productivity, which is primarily due to the reason that it is cultivated on marginal and sub-marginal land and mostly without adoption of improved cultivation and management practices. With the aim to increase the productivity of Brown Sarson crop in the J&K, superior and high yielding varieties (HYV) of Brown Sarson having excellent characteristics like tolerance to Alternaria blight were developed with matching site-specific technologies for their cultivation under different agro-climatic conditions of the State.

In order to take these technologies at the farmer's field, a targeted and focused approach was initiated from 2005 by ICAR through proven Front Line Demonstrations in collaboration with Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST Kashmir) and KVK's. However, the adoption behaviour of general farmers towards these practices is not known and hardly any systematic research has done to explore these areas.

Therefore, it is very essential to conduct investigations on Front Line Demonstrations on Brown Sarson to assess their effectiveness and efficacy. Hence a research study was planned and conducted with the aim to analyse the impact of FLD of Brown Sarson on yield, socio-economic conditions, knowledge and extent of adoption on farmers in the districts of Anantnag and Kulgam, J&K under temperate agro-ecological conditions. The improved cultivation practices followed in the national demonstrations for oilseeds have already shown high yield potentials (Venkattakumar and Hegde, 2008; Haque, 2000).

MATERIALS AND METHODS

Study area

The study was conducted in twin districts of North-western Himalayan state of Jammu and Kashmir India viz., Anantnag and Kulgam (Figure 1). These districts were selected to cover high-altitude, temperate agro-ecological situation where the Brown Sarson cultivation is most suitable. Anantnag and Kulgam are situated in south and south western direction of the state, respectively.

As per Census 2011, Anantnag had a population of 1070144 with literacy rate of 54.15 and population density of 375 persons per square kilometre. Geographically the district is 72.14 thousand hectares, lying between 34°-03' north latitude and 74°-48' longitude and ranging between 2438 to 3048 masl. The district is having temperate climatic conditions and temperature ranges from -11 to 35°C with annual precipitation of about 800.9 mm in the form of rain and snow. Soils are mainly clay loam and sandy loam having potassium and phosphorus deficiency. The district is mainly irrigated, predominantly rural (77.15%) and the people of the districtis mostly engaged in agriculture (80%). Principal crops being rice, oilseed and maize cultivated on an area of 43590 ha.

Kulgam is located at the height of 1739 m and situated at 75°01' east longitude and 33°39' north latitude nestled in the lap of Peer Panchal, Himalayan Ranges. As per 2011 census, 81.23% population of the district lives in rural area with total population of 422786 persons having literacy rate of 60.35 and population density of 925 persons per square kilometre. The geographical area of the district is 47.64 thousand hectares out of which 30.68 thousand hectares are cultivable. Soils are mainly clay loam and sandy loam having potassium deficiency. The district is mainly irrigated and the people of the districts are mostly engaged in agriculture. Principal filed crops are rice, oilseed and maize. Temperate ranges from -9 to 35C with humidity of 68% and precipitation of 916 mm.

Sampling procedures and data collection

The FLDs on Browon Sarson were conducted during Rabi 2005 to 2011 by ICAR in collaboration with SKUAST Kashmir and KVK's in entire northern Indian temperate region of Himalayan State of Jammu and Kashmir but due to paucity of time and proximity, study was confined to the two districts viz., Anantnag and Kulgam purposively as they had vast and diverse oilseed cultivation resources ideally suited for taking up improved Brown Sarson production technologies. Eight representative villages were selected randomly in each district (Figure 2), within each village 15 farmer respondents were selected through stratified random sampling method to form a sampling size of 120 participant farmers, who participated in FLD Programme and 120 non-participant farmers who did not participate in FLD programme. The data on Frontline Demonstrations (FLDs) conducted under oilseed crops for the 6 years were used for calculation of grain yield, gap analysis and economics using different parameters as suggested by Yadav et al. (2004). Knowledge level of respondent farmers was calculated based on Client Satisfaction Index developed by (Kumaran and Vijayaragavan, 2005). The dependent variable adoption of Brown Sarson improved production practices was quantified by using adoption quotient developed by Sengupta (1967). Based on a thorough review of relevant literature and discussion with the experts in the subjects 16 independent variables comprising of socio-personal, socio-economic, psychological and communication variables, having some bearing on the dependent variables were identified for inclusion in the study. These independent variables represented age, education, family size, land size, farm implements used, socio economic status, occupation, achievement motivation, innovative proneness,

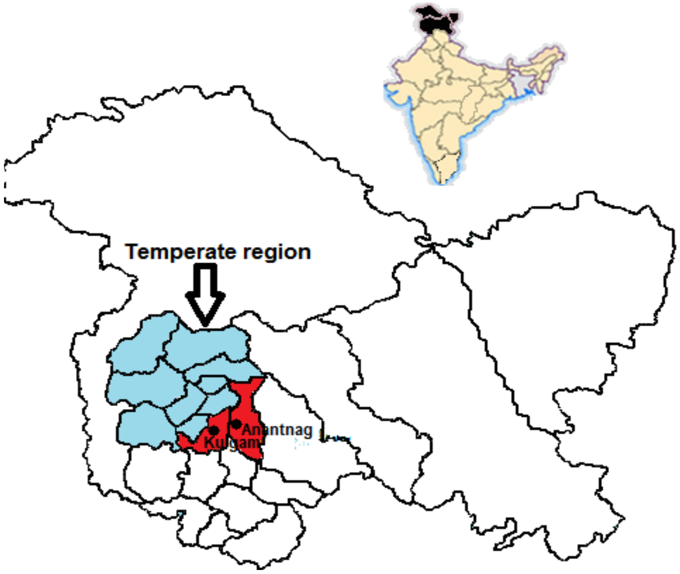

Figure 1. Study area.

Figure 2. Villages covered in the survey.

cosmo-politeness, scientific orientation, social participation, extension contact, exposure to media, extension contact, and mass media exposure and were empirically measured by procedures evolved for the purpose, using suitable scales and scoring procedures developed by earlier researchers. The data was collected through personal interviews and analysed using R Software.

RESULTS AND DISCUSSION

Grain yield

The increase in grain yield under demonstration varied from 27.07 to 54.60% than farmers own practices. The difference in grain yield during different years could be due to more feasibility of recommended technologies and variability in climatic conditions. On the basis of seven years, average demonstration yield was 1005.86 kg/ha as compared to 747.29 kg/ha in case of farmers traditional practice thereby recording yield advantage of 34.22% under demonstrations carried out with improved practices of Brown Sarson. Similar yield enhancement in different crops in front line demonstration has amply been documented in previous studies (Kumar et al., 2010).

Gap analysis

An extension gap of 180 to 440 kg per hectare was found between demonstrated technology and farmer's own practices during seven years and on average basis the extension gap was 258.57 kg/ha (Table 1). The extension gap was lowest (180 kg/ha) during 2007 to 2008 and was highest (440 kg/ha) during 2009 to 2010. Such gap might be attributed to adoption of improved technology in demonstrations which resulted in higher grain yield than the traditional farmer's practices. Wide technology gap were observed during different years and this was lowest (454 kg/ha) during 2009-10 and was highest (855 kg/ha) during 2007 to 2008. On seven years average basis the technology gap of total 83 demonstrations was found as 694.14 kg/ha. The difference in technology gap during different years could be due to more feasibility of recommended technologies and variability in climatic conditions. Similarly, the technology index for all the demonstrations during different years were in accordance with technology gap. Higher technology index reflected the insufficient extension services for transfer of technology. The results of yield gaps were in conformance with the earlier studies (Aggarwal et al., 2008).

Economic analysis

Different variables like seed, fertilizers, bio fertilizers and pesticides were considered as cash inputs for the demonstrations as well as farmer's practice and on an average an additional investment of Rs.1016.0 per ha was made under demonstrations. Economic returns as a function of grain yield and Maximum Sale Price(MSP) of Brown Sarson varied during different years. Maximum returns of Rs. 8404.0 ha^{-1} was obtained during the year 2009 to 2010 due to very high grain yield and higher MSP sale rates as declared by Government of India (GOI). The higher additional returns and effective gain obtained under demonstrations could be due to improved technology, non-monetary factors, timely operations of crop cultivation and scientific monitoring. The lowest and highest incremental benefit: cost ratio (IBCR) was 3.15 and 8.56 in 2007 to 2008 and 2009 to 2010, respectively (Table 2). Overall average IBCR was found as 4.76. The

Table 1. Grain yield Extension gap, technology gap and technology index of FLD on Brown Sarson.

Year	Variety	No. of FLDs	Potential yield (kg/ha)	Avg. demonstration yield (kg/ha)	Avg. farmers' practice yield (kg/ha)	Percentage Increase	Extension gap (kg/ha)	Technology gap (kg/ha)	Technology index
2005-06	Gulchin	99	1700	1046	760	37.63	286	654	38.47
2006-07	Gulchin	92	1700	860	660	30.00	200	840	49.41
2007-08	Gulchin	46	1700	845	665	27.07	180	855	50.29
2008-09	Gulchin	58	1700	935	707	32.24	228	765	45.00
2009-10	Gulchin	95	1700	1246	806	54.60	440	454	26.71
2010-11	Gulchin	123	1700	1029	793	29.40	236	671	39.47
2011-12	Gulchin	72	1700	1080	840	28.60	240	620	36.47
Overall average		**84**	**1700.00**	**1005.86**	**747.29**	**34.22**	**258.57**	**694.14**	**40.83**

Table 2. Economic analysis of Front Line Demonstrations on Brown Sarson.

Year	Cost of cash input (Rs./ha)		Additional cost in demonstrations (Rs./ha)	Sale price of grain (MSP) (Rs./q)	Total returns (Rs.)		Additional returns (Rs.)	Effective gain (Rs.)	IBCR
	FP	Demo			FP	Demo			
2005-06	1953	865	1088	1715	13034	17939	4905	3817	4.51
2006-07	1995	920	1075	1715	11319	14749	3430	2355	3.19
2007-08	2040	1011	1029	1800	11970	15210	3240	2211	3.15
2008-09	2088	1097	991	1830	12938	17111	4172	3181	4.21
2009-10	2110	1128	982	1910	15395	23799	8404	7422	8.56
2010-11	2160	1190	970	1980	15701	20374	4673	3703	4.82
2011-12	2187	1210	977	2000	16800	21600	4800	3823	4.91
Overall average	2076	1060	1016	1850	13880	18683	4803	3787	4.76

IBCR = Incremental benefit: Cost ratio; FP = farmers' practice; Demo = demonstration.

results confirm the findings of FLDs on oilseed and pulse crops (Dayanand et al., 2012; Sachin et al., 2009).

Knowledge about improved Brown Sarson production practices

Knowledge level of respondent farmers on various aspects of improved Brown Sarson production technologies was measured and compared by applying dependent 't' test. It could be seen from the Table 3 that farmers mean knowledge score had increased by 41.02 in participating farmers. The results were at par with the earlier studies (Malik et al., 2005; Singh et al., 2007). In other words there was significant increase in knowledge level of the farmers due to frontline demonstration. This shows positive impact of frontline demon stration on knowledge of the farmers due to the concentrated efforts made by the KVK scientists.

Extent of adoption of improved Brown Sarson production practices

The distribution of respondents based on their level of adoption towards improved practices of Brown Sarson cultivation revealed that in case of participating farmers, majority of respondents

Table 3. Comparison between knowledge levels of the respondent farmers about improved farming practices of Brown Sarson.

Mean knowledge score (N=120)			Calculated 't' value
Participating farmers	Non-participating farmers	Mean difference	
68.33	27.31	41.02	2.676*

Significant at 0.01 level of probability.

Table 4. Distribution of respondents on extent of adoption of improved practices of Brown Sarson.

Parameter	Participant farmers (N=120)		Non-participant farmers (N=120)	
Mean (%)	70.49		31.54	
Standard deviation	17.75		16.65	
Range	40.74 - 92.59		3.70 – 74.07	
Category	**No.**	**%**	**No.**	**%**
Low (<Mean - SD)	25	20.83	44	36.67
Medium (between mean ± SD)	47	39.17	65	54.17
High (> Mean + SD)	48	40.00	11	9.16
Total	120	100	120	100

(40.0%) belonged to high adoption category, 39.17% belong to medium category and the remaining 20.83% to low adoption category as compared to 36.67, 54.17 and 9.16% in case of non-participating farmers respectively (Table 4). Thus, it implied that majority of the participating farmers were belonging to high-medium adoption category as compared to medium adoption among non-participating farmers, which might have been due to the fact that most of the participating farmers had correct information and knowledge about improved technologies (Singh et al., 2010).

Extent of adoption of components of improved Brown Sarson production technology

An attempt was made here to analyse the level of adoption of individual components of improved Brown Sarson production technology by the farmer respondents. Some of the individual practices were adopted in full, or not adopted at all, while among some practices, partial adoption was recorded. The results are presented in Table 5.

Land preparation

Mustard crop requires fine, firm and moist seed-bed to ensure adequate moisture for germination and young seedlings. To achieve this, the field is supposed deep ploughing soon after the kharif crop in the middle of September. Improved land preparation practices were adopted fully by 84.17% participant farmers. Nearly 16% of them did not adopt this practice at all. Among non-participant farmers 73.33% were adopting the practice while 26.67% do not adopt this practice at all.

Use of high yielding varieties

Quality seed and nature of variety plays primary role for harvesting a good yield. Among the participant respondents, nearly 82% adopted use of high yielding varieties of Brown Sarson. About 12% of them adopted this practice partially and about 7% did not use them in their fields. Among non-participant farmers 40% had adopted this component of the technology while as 17.50% adoped this practice partially and 42.50% have not adopted this practice.

Sowing time

Sowing time is crucial for every crop as appropriate sowing time results in healthy and good crop. For Brown Sarson mid-September to mid-October has been recommended practice for sowing. Majority (75.83 %) of participant farmers had adopted the right time for sowing Brown Sarson in their fields and rest (24.17 %) did not adopt this practice. This may be due to non-availability of moisture content or lack of water for pre-sowing irrigation. Among non-participant farmers majority (55.83%) did not adopt this practice due to unawareness about the practice.

Sowing method

Line sowing with 30 and 10 cm gap between line-to-line

Table 5. Extent of adoption of various components of improved practices of Brown Sarson cultivation by farmers'.

S/N	Improved practices	Participant farmers (N=120)						Non-participant Farmers (N=120)					
		Fully adopted		Partially adopted		Not adopted		Fully adopted		Partially adopted		Not adopted	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	Land preparation	101	84.17	-	-	19	15.83	88	73.33	-	-	32	26.67
2	*Use of HYV	98	81.67	14	11.67	8	6.67	48	40.00	21	17.50	51	42.50
3	Sowing time	91	75.83	-	-	29	24.17	53	44.17	-	-	67	55.83
4	Sowing method	27	22.50	-	-	93	77.50	12	10.00	-	-	108	90.00
5	*Pre-sowing irrigation	74	61.67	14	11.67	32	26.67	44	36.67	14	11.67	62	51.67
6	*Plant density	53	44.17	23	19.17	44	36.67	33	27.50	23	19.17	64	53.33
7	Application of manures and fertilizers (dose)	58	48.33	-	-	62	51.67	28	23.33	-	-	92	76.67
8	Application of manures and fertilizers (Time)	64	53.33	-	-	56	46.67	46	38.33	-	-	74	61.67
9	Insect pest and disease management	42	35.00	-	-	78	65.00	38	31.67	-	-	82	68.33
10	Weed management	38	31.67	-	-	82	68.33	22	18.33	-	-	98	81.67
11	Drainage availability	24	20.00	-	-	96	80.00	16	13.33	-	-	104	86.67
12	Post-harvest management	112	93.33	-	-	8	6.67	100	83.33	-	-	20	16.67

and plant-to-plant, respectively is recommended practice for Brown Sarson. Only 22.50% of participant farmer respondents had adopted the recommended line sowing method, while majority of them (77.50%) were using broadcast method for sowing Brown Sarson. Out of non-participant farmers majority (90%) did not practice this component. This may be due to the involvement of additional labour and apprehension of more cost associated with the practice.

Pre-sowing irrigation

Moisture in the seed-bed is necessary for the germination of seed. To achieve this, one pre-sowing irrigation is recommended practice if soil does not contain enough moisture. Majority (61.67%) participant respondents were using pre-sowing while as 11.67% were adopting this practice partially based on availability of water and rest (26.67%) were not adopting this practice at all. Majority of the non-participant respondents (51.67%) are not using this practice. This may be due to the less availability of the water in the irrigation channels during beginning of Rabi season.

Plant density

Maintenance of optimum plant population plays a bid role for good harvests. In order to maintain plant density in Brown Sarson, thinning after 15 to 20 days of sowing has been recommended. Among participant farmers 44.17% were using hand thinning methods wherever necessary to keep plant density while 19.17% were using this practice partially. Among non-participant farmers majority (53.33%) did not maintaining planting density at all.

Manures and fertilizers

Brown Sarsoon respond well both to organic and inorganic manures. At the time of field preparation 15 to 20 tonnes/ha of FYM or compost is recommended practice besides N(60 kg/ha), P(30 kg/ha), K (20 kg/ha) and sulphur 20 kg/ha. Majority (53.33%) were using appropriate dozes of manures and fertilizers in their fields. But 51.67% of them were not using appropriate time for its application. Amongst non-participant farmers 76.67% also did not adopt the practice.

Insect and pest management

Alternaria blight, white rust and aphids have been

Table 6. Correlation coefficients of extent of adoption of improved practice of Brown Sarson.

Independent variable	Correlation co-efficient (r)	
	Participant farmers	Non- participant farmers
Age	-0.0623	-0.1830*
Education	0.4478 **	0.0664
Family size	-0.0839	0.2359**
Land size	0.3101 **	0.3363**
Farm power	0.4890**	0.0130
Socio-economic status	0.4628**	0.1732*
Achievement motivation	0.4836**	-0.0702
Innovative proneness	0.5230**	-0.0866
Scientific orientation	0.2964**	-0.0993
Annual income	0.0751	0.0030
Social participation	-0.0512	-0.1928*
Extension contact	0.8211**	0.0252
Media exposure	0.4784**	-0.1916*
Level of knowledge about improved methods of Brown Sarson cultivation	0.3647**	-0.0269

*, ** Significant at 0.05 and 0.01 level of probability, respectively.

observed as common insect pest of Brown Sarson. Seed is recommended to be treated with apron 355 D at 6 g/kg of seed and thiram or captan at 2.5 g/kg of seed before sowing to keep crop away from any seed borne disease. Majority of participant farmers (65%) and non-participating farmers (68.33%) did not apply any insecticides or pesticides. This may be due to higher cost associated with the adoption of practice.

Weed management

Uncontrolled weeds in Brown Sarson crop may cause 20 to 70% reduction in yield due to crop weed competition. Weeding is recommended soon after thinning. Only 31.67% among participant farmers and 18.33% among non-participant farmers were using weed management practices in their fields. The lukewarm response towards the practice may be due to demand of more labour.

Post-harvest management

Brown Sarson crop is recommended to be harvested once the pods turn yellow and moisture content of the seed is around 40%. Harvesting is done preferably in the morning hours, when the pods are slightly damp with night dew to minimize the shattering losses. Bundles of the harvested plants are staked and dried in the sun for a few days and threshed by usual methods of stick beating, bullocks or running tractors over the dried plants. Seeds are separated by winnowing. Moisture content of the seed must be less than 8% at the storage time. Majority of the respondent farmers irrespective of their participation in FLD programme farmers were using post-harvest management practices, respectively.

Drainage facility

Drainage facility in Brown Sarson fields remains important practice particularly in Kashmir as rain water and snow make the field water logged, posing a great threat to the emerged crop. Majority of the respondent farmers are not making drainage facility in their field irrespective of their participation. This may be due to utilization of more labour.

Correlates of extent of adoption of improved practices of Brown Sarson

A correlation analysis was done using statistical package (R Software) to identify the factors which are related to extent of adoption of improved production practices of Brown Sarson among the respondents (Table 6).

A cursory look at the correlation results revealed that all sets of independent variables except annual income included in the study were significantly associated with adoption of FLD Brown Sarson.

Among participant farmers education, land size, farm power, socio-economic status, achievement motivation, scientific orientation, innovative proneness, extension contact, media exposure and level of knowledge about improved methods of Brown Sarson cultivation were having positive and high significant correlation with the

Table 7. Regression Coefficients of extent of adoption of improved practice of Brown Sarson.

Variable	Participant farmers			Non-participant farmers		
Independent variable	**Partial 'b'**	**T**	**Sig.**	**Partial 'b'**	**T**	**Sig.**
Constant	2.90315	1.520	0.1315	5.09513	1.542	0.1261
Age	0.13339	0.415	0.6793	-1.02932	-1.639	0.1042
Education	0.47505	2.334	0.0215*	0.24878	0.873	0.3844
Family size	-0.0109	-0.086	0.9317	0.44444	2.604	0.0106*
Land size	0.20335	0.608	0.5448	1.49987	2.478	0.0148*
Farm Power	0.01560	0.057	0.9543	-0.25632	-0.625	0.5336
Socio-economic status	0.23143	1.146	0.2544	0.25080	0.654	0.5143
Achievement motivation	0.02128	0.306	0.7602	-0.03012	-0.344	0.7317
Innovative proneness	0.91097	2.854	0.0052*	-0.33015	-0.500	0.6183
Scientific orientation	0.15479	0.405	0.6867	-0.33526	-0.675	0.5009
Annual income	0.53827	1.622	0.1077	0.49254	1.020	0.3099
Social participation	0.33081	0.974	0.3324	-1.16368	-1.868	0.0646*
Extension contact	2.92543	9.061	7.8e-15*	0.27965	0.681	0.4973
Exposure to media	-0.01028	-0.029	0.9770	-1.17247	-2.016	0.0463**
Level of knowledge about improved practices of Brown Sarson cultivation	0.39798	1.941	0.0550*	-0.33969	-1.205	0.2308
R		0.703			0.1988	
R^2		0.7507			0.293	
F(14,105)		26.59*			3.109	

*, ** Significant at 0.05 and 0.01 level of probability, respectively.

dependent variable.

However, a strong positive correlation was found among non-participating farmers with land size and family size. This may be due to good family size (average 8 members) to support labour component and also land holding support (average 0.64 ha) amongst non-participating farmers.

Also a negative correlation was found in respect of non-participating farmers with the variables age, social participation and media exposure.

This may be due to the fact that majority of non-participating farmers were illiterate and middle to old aged, comprehending knowledge aspects differently from media and tend to participate in social meetings for entertainment and personal gains.

Regression analysis of extent of adoption of improved Brown Sarson production practices by farmers

In order to assess the contribution of various independent variables to the variation in the extent of adoption of improved Brown Sarson production practices by respondent farmers a regression model was used (Table 7). A perusal of the results presented in Table 7 indicates that 75 and 29% variation between participant farmers and non-participant farmers respectively exists with respect to extent of adoption of improved Brown Sarson production practices, which were explained by the independent variables included in the regression equation. F value at 14 and 105 degrees of freedom was 26.59 which is significant 0.05 level of probability. This indicated that the independent included in the study were appropriate as they could explain large variance in the dependent variable.

Also a cursory look at the table reveals that only four variables viz., education, innovative proneness, extension contact and level of knowledge of improved Brown Sarson production practices could contribute significantly to the variance and predicting extent of adoption of improved Brown Sarson production practices amongst participant farmers. Moreover, two variables family size, land size, could also contribute positively and significantly to the variance and predicating extent of adoption of improved Brown Sarson production practices amongst non-participant farmers. However, social participation and exposure to media could contribute negatively and significantly to the variance and predicating extent of adoption of improved Brown Sarson production practices amongst non-participant farmers. This may be due to good land holding, contribution of family labour in joint family system, useless social contact and good material possession like radio, TV, Computer, internet and mobile phones for personal entertainment in non-participant farmers. The results are in agreement with Patel et al. (2009). Thus it can be concluded that FLD on Brown Sarson has great influenced on the adoption level of the participant farmers than non-participant farmers.

Conclusion

Although Brown Sarson FLDs has been seen instrumental in increasing yield up to 34.22% with ICBR of 4.76 but extension and technology gap was still 258.57 and 694.14 kg/ha, respectively with technology index of 40.83. Knowledge dissemination through FLD programme has also increased level of knowledge among participant farmers as compared to non-participant farmers. Among participant farmers mean knowledge score was 68.33% as compared to 27.31% among non-participating farmers with mean difference of 41.02. Despite of the fact that mean score of adoption about improved practices amongst participant farmers was high (70.49%) only 40% of them had high level of adoption, nearly 39.17% of them had moderate level of extent of adoption, thereby indicating a overall medium-to-high level of adoption. Meanwhile the mean score of extent of adoption of improved practices amongst non-participant farmers was 31.54%, only 9.16% of them had high level of adoption, nearly 54 and 37% of them had moderate and lower extent of adoption, respectively, thereby indicating a general low to moderate level of adoption among them.

Majority of the participant farmers had fully adopted only a few components of improved practices such as land preparation, use of high yielding varieties, sowing time, pre-sowing irrigation and time of application of manures and fertilizers. However, joint families with sizable number of farm workforce and good land holding have contributing towards adoption of maximum improved practices. The results of regression analysis revealed that FLD programme had helped in contributing to the extent of adoption of improved Brown Sarson production practices viz-a-viz production enhancement and yield gap minimization. This can be seen as a positive indicator for formulating an adoption oriented and extensive FLD programme to educate farmers about improved Brown Sarson production practices and enrich their level of knowledge through 'working by doing' and 'doing by learning' for ensuring higher Brown Sarson production in this temperate region.

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