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Research Article

Impact of improved technologies and pest-disease management on productivity of Indian mustard

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SUMMARY : To study the impact of pest-disease management and improved technologies on mustard crop, a series of front line demonstration's (FLD,s) and on farm testing (OFTs) were conducted at farmer's fields (126) starting from 2005-06 to 2009-10 in Rajsamand district of Semi Arid Zone IVa of Rajasthan state during *Rabi* seasons in irrigated farming situation. Four technologies *viz*., improved variety Bio-902/ Vasundhara (T_1), aphid management by early sowing (up to 15th October) and one spray of malathion 50 EC @ 1.25 l/ha or dimethoate 30 EC @ 875 ml/ha (T_2), disease (Alternaria blight and rust) management by seed treatment with mencozeb @ 2.5 g/ kg seed and one spray of mencozeb @ 2.0 kg/ha at 45 days after sowing (T_3) and fertilizers application @ 60 kg N, 40 kg P_2O_5 and 250 kg gypsum/ ha.(T_4). The results revealed that aphid management over rest of the technologies with highest increase in grain yield (34.37 %) followed by use of improved variety, fertilizers management and disease management with an increase of 31.90, 24.90 and 16.04 per cent, respectively. The use of improved variety had highest cost benefit ratio (4.19) followed by aphid management (3.22), fertilizer management (2.03) and disease management (1.55). The productivity of mustard per unit area could be increased by adopting feasible scientific and sustainable management practices with suitable sustainable technologies.

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KEY WORDS :
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BACKGROUND AND OBJECTIVES

Edible oilseeds are an important part of Indian agriculture and contribute more than 10 per cent to agriculture GDP. India is second largest producer of oilseeds in the world. Indian mustard [*Brassica juncea* (L.) Czern & Coss] is the major oilseed grown in Rajasthan during *Rabi* season. The average productivity is very low as compared to world productivity. The reasons for low productivity are due to poor insect-pests management, lack of improved varieties and use of imbalanced fertilizers. Among the insect-pests, mustard aphid, *Lipaphis erysimi* Kalt causes yield loss ranged from 35.4 to 91.3 per cent and is the most serious pest (Singh and Sachan, 1994). In Rajasthan, the productivity of rapeseed-mustard was 1266 kg/ha during 2008-09 and 27.37 lakh ha area under cultivation and total production was 34.65 lakh tons (2009-10). The yield levels also have been variable ranging from 854 (2002-03) to 1142 kg/ha (2009-10) during the past eight years. Though rapeseed-mustard group of crops occupy prominent position in the state oilseeds scenario but vast yield gap exists between potential yield and yield under real farming situations.

The available agricultural technology does not serve its purpose till it reaches and adopted by its ultimate users, the farmers. Technology transfer refers to the spread of new ideas from originating sources to ultimate users (Prasad *et al.*, 1987). Conducting of front line demonstrations on farmer's field help to identify the constraints and potential of the rapeseed –mustard in specific area as well as it helps in improving the economic and social status of the farmers. The aim of the front line demonstration is to convey the scientific technical message to farmers that if they use recommended package and practices then the yield of this crop can be easily doubled than their present level.

The main objective of front line demonstrations is to demonstrate newly released crop production and protection technologies and its management practices in the farmer's fields under different agro-climatic region farming situations. Yet, adoption levels for several components of the improved technologies are low, emphasizing the need for better dissemination (Kiresur *et al*., 2001 and Sharma, 2003). Rajsamand district has the sizeable area under mustard cultivation but the productivity level is very-very low. The reasons for low productivity are due to poor knowledge about newly released crop production and protection technologies and its management practices in the farmer's fields under different micro-climatic situations. Keeping the above point in view, FLD on mustard using new crop production technology was started with the objectives of showing the productive potentials of the new production and protection technologies under actual farm situation over locally cultivated mustard crop.

RESOURCES AND METHODS

The present study was carried out by the Krishi Vigyan Kendra, Rajsamand during *Rabi* season from 2005-06 to 2009-10 in the farmers' fields of Rajsamand district in agro climatic zone IVa of Rajasthan. Before conducting FLDs, a list of farmers was prepared by group meeting and specific skill trainings were imparted to the selected farmers regarding different aspects of cultivation were followed as suggested by Choudhary (1999) and Venkattakumar *et al.* (2010). In case of local check plots, existing practices being used by farmers were followed. In general, soils of the area under study were sandy loam to loamy sand from low to medium in fertility.

In demonstration plots, use of quality seeds of improved varieties namely Bio-902/ Vasundhara considered as technology 1, aphid management by early sowing (up to 15th October) and one spray of malathion 50 EC @ 1.25 l/ha or dimethoate 30 EC @ 875 ml/ha considered as technology 2, disease (Alternaria blight and rust) management by seed treatment with mencozeb @ 2.5 g/kg seed and one spray of mencozeb @ 2.0 kg/ha at 45 days after sowing as technology 3 and fertilizers application @ 60 kg N, 40 kg P_2O_5 and 250 kg gypsum/ ha considered as technology 4 as suggested by Chattopadhyay *et al*. (2003) was used as technical interventions. For the control of aphid (*Lipaphis errysimi*), methyl parathion 2 per cent dust was also used in demonstrated plots which is suggested in package and practices for the Rajsamand region were emphasized and comparison has been made with the existing practices. The data output were collected from both technological plots as well as control plots (farmers practices) and finally the extension gap, technology gap, technology index along with the benefit cost ratio were worked out (Samui *et al*., 2000) as given below:

$$\text{Technology gap} = \text{Potential yield} - \text{Demonstration yield}$$

$$\text{Extension gap} = \text{Demonstration yield} - \text{Farmers yield}$$

$$\text{Technology index} = \frac{\{(\text{Potential yield} - \text{Demonstration yield})}{\text{Potential yield}\}} \text{x100}$$

Knowledge level of the farmers about improved production and protection technologies of mustard before and after demonstration implementation was measured and compared by applying dependent 't' test. Further, the satisfaction level of respondent farmers about extension services provided was also measured based on various dimensions like training of participating farmers, timeliness of services, supply of inputs, solving field problems and advisory services rendered, fairness of scientists, performance of variety demonstrated and over all impact of various technologies. The selected respondents were interviewed personally with the help of a pre-tested and well structured interview schedule. Client satisfaction index was calculated as developed by Kumaran and Vijayaragavan (2005).

The individual obtained score

$$\text{Client satisfaction index} = \frac{\text{The individual obtained score}}{\text{Maximum score possible}}$$

The data thus collected were tabulated and statistically analyzed to interpret the FLDs results.

OBSERVATIONS AND ANALYSIS

The results of the present study as well as relevant discussions have been presented under following sub heads:

Constraints in mustard production :

Farmer's mustard production problems were documented and preferential ranking technique was utilized to identify the constraints faced by the respondent farmers in mustard production, the ranking given by the different farmers are given in Table 1. A perusal of table indicates that lack of suitable HYV (86.67%) was given the top most rank followed by low technical knowledge (74.67%), pest and disease problems (64.00%), low soil fertility (61.33%). Based on the ranks given by the respondent farmers for the different constraints revealed that lack of suitable HYV, low technical knowledge, pest and disease are the major constraints to mustard production and followed by low soil fertility. Other constraints such non-availability and higher cost of fertilizers, non-availability of bullocks and plough, non availability of plant protection appliances and shortage of labour were found to reduce mustard production. Among all constraints, low soil fertility got least concerns. Other studies (Hassan *et al*., 1998; Ouma *et al*., 2002; Joshi *et al*., 2005) have also reported similar problems in other crop production.

Table 1: Ranks given by farmers for different constraints **(n=75)**

Sr. No.	Constraints	Percentage	Ranks
1.	Lack of suitable HYV -Non availability of seed at proper time	86.67	I
2.	Pest and disease problems -Aphid, Alternaria blight and rust	64.00	III
3.	Low technical knowledge	74.67	II
4.	Low soil fertility	61.33	IV
5.	Non availability and higher cost of fertilizers	57.33	V
6.	Non availability of bullocks and plough	50.67	VII
7.	Non availability of plant protection appliances	54.67	VI
8.	Wild animals	30.67	IX
9.	Shortage of labours	42.67	VIII

Performance of FLDs technologies (Fig. 1 to 6) :

Results of different adopted technologies under 126 front line demonstrations conducted during 2005-06 to 2009-10 in 50.4 ha area on farmer's fields of fifteen villages of Rajsamand district indicated that cultivation practices with various technologies comprised under FLD *viz.*, use of improved varieties like Bio-902/ Vasundhara (T_1), aphid management by early sowing (up to 15th October) and one spray of malathion 50 EC @ 1.25 l/ha or dimethoate 30 EC @ 875 ml/ha at economic threshold level (T_2), disease (Alternaria blight and rust) management by seed treatment with mencozeb @ 2.5 g/kg seed and one spray of mencozeb

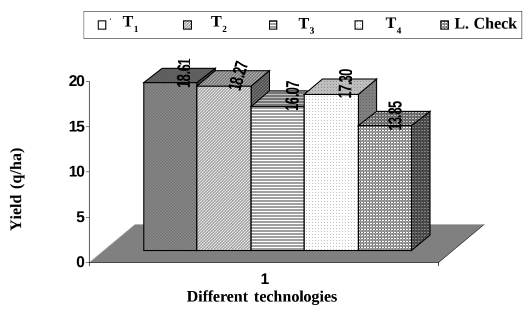

Fig. 1 : Yield of different technologies under FLDs during 2005-06 to 2009-10

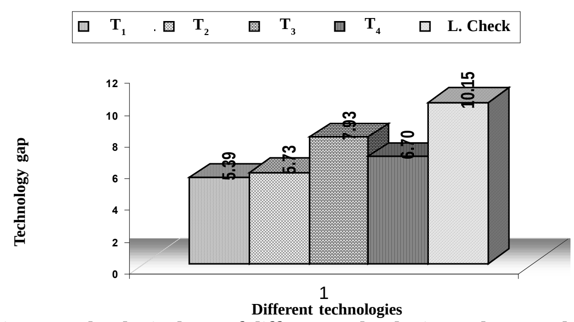

Fig. 4 : Technological gap of different technologies underFLDs during 2005-06 to 2009-10

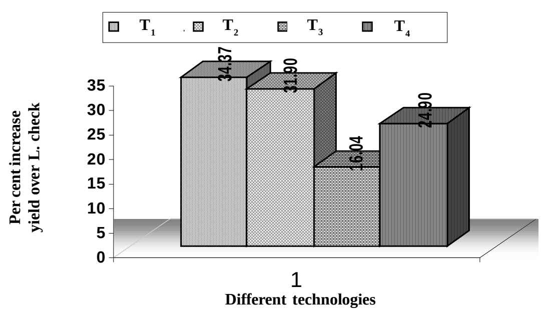

Fig. 2 : Per cent increase in yield of different technologies underFLDs during 2005-06 to 2009-10

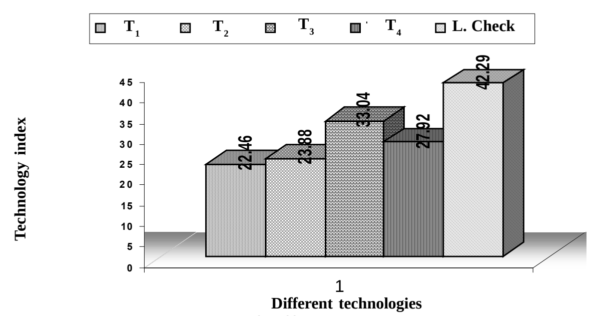

Fig. 5 : Technological index of different technologies under FLDs during 2005-06 to 2009-10

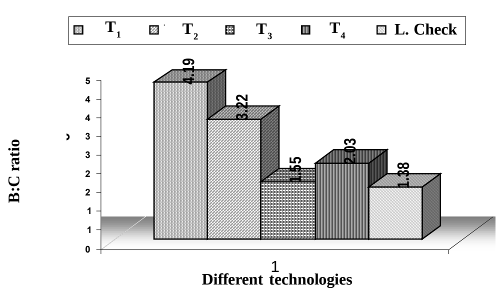

Fig. 3 : B:C ratio of different technologies under FLDs during 2005-06 to 2009-10

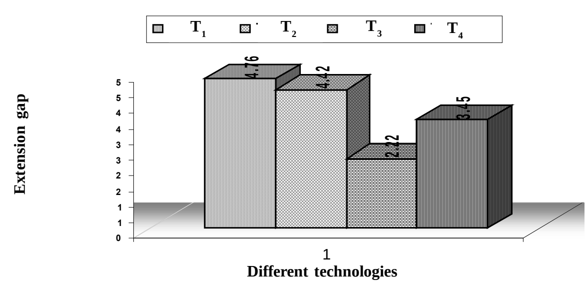

Fig. 6 : Extension gap different technologies under FLDs during 2005-06 to 2009-10

@ 2.0 kg/ha at 45 days after sowing as (T_3) and fertilizers application @ 60 kg N, 40 kg P_2O_5 and 250 kg gypsum/ ha (T_4) produced on an average ranged from 16.04 to 34.37 per cent more yield of mustard as compared to local check (13.85 q/ha). The maximum (18.61q/ha) and minimum (16.07q/ha) yield was recorded under improved varieties and disease management technology, respectively during study period. Similar results of yield enhancement in rapeseed-mustard crop in front line demonstration has been documented by Mitra and Samajdar (2010) in *tarai* zone of West Bengal. The results are also in close conformity with the findings of Tiwari and Saxena (2001), Tiwari *et al.* (2003), Tomer *et al.* (2003), Singh *et al.* (2007) and Katare *et al.* (2011). The results indicate that the front line demonstration has given a good impact over the farming community of this district as they were motivated by the new agricultural technologies applied in the front line demonstration plots. The results clearly indicate positive effects of FLDs over the existing practices towards enhancing the yield of rapeseed-mustard in zone of Rajsamand, with its positive effect on yield attribute higher benefit-cost ratio was recorded under demonstration's technologies against control during all the years of study. These results are also supported by Singh *et al.* (2008) who found that improved technologies of mustard were significantly effect to increase the productivity of mustard. The findings revealed that a gap exists between the actual farmer's yield and realizable yield potential of the variety. Use of improved variety carry potential to enhance the present level of mustard productivity which is not percolating down at desired pace due to lack of confidence among the farmers. Hence, to exploit the potential of improved production and protection technologies efforts through FLDs ought to be increased considerably to create awareness among the farmers.

The extension gap showed an increasing trend. The extension gap ranging between 3.45–4.76 q/ha during the period of study emphasizes the need to educate the farmer through various means for adoption of improved agricultural production technologies to reverse the trend of wide extension gap. The trend of technology gap (ranging between 5.39 – 6.70 q/ha) reflects the farmers cooperation in carrying out such demonstrations with encouraging results in subsequent years. The technology gap observed may be attributing to the dissimilarity in soil fertility status and weather conditions. Mukharjee (2003) has also opined that depending on identification and use of farming situation, specific interventions may have greater implications in enhancing system productivity. Similar findings were also recorded by Mitra and Samajdar (2010) and Katare *et al.* (2011). The technology index showed the feasibility of evolved technology at the farmer's fields. The lower value of technology index, the more is the feasibility of technology. As such fluctuation in technology index (ranging between 22.46 – 33.04) during the study period in certain region, may be attributed to the dissimilarity in soil fertility status, weather condition, non-availability of irrigation water and insect-pests attack. The benefit cost ratio of front line demonstrations with various technologies clearly revealed that use of improved variety had highest cost benefit ratio (4.19) followed by aphid management (3.22), fertilizer management (2.03) and disease management (1.55). Hence, favourable benefit cost ratios proved the economic viability of the intervention made under demonstration and convinced the farmers on the utility of intervention. Similar findings were reported by Sharma (2003) in moth bean and Gurumukhi and Misra (2003) in sorghum.

Knowledge adoption :

Knowledge level of respondent farmer's on various aspects of improved mustard production and protection technologies before conducting the frontline demonstration and after implementation was measured and compared by applying dependent 't' test. It could be seen from the Table 2 that farmers mean knowledge score had increased by 30.80 after implementation of frontline demonstrations. The increase in mean knowledge score of farmers was observed significantly higher. As computed value of 't' (7.98) was statistically significant at 5 per cent probability level. The results are at par with Narayanaswamy and Eshwarappa (1998), Singh and Sharma (2004), Singh *et al.* (2007) and Dhaka *et al.* (2010). It means, there was significant increase in knowledge level of the farmers due to frontline demonstration. This shows positive impact of frontline demonstration on knowledge of the farmers that have resulted in higher adoption of improved farm practices. The results so arrived might be due to the concentrated educational efforts made by the scientists.

Table 2 : Comparison between knowledge levels of the respondent farmers about improved farming practices of mustard

(n=75)

Mean score			Calculated 't' value
Before FLD implementation	After FLD implementation	Mean difference	
34.60	65.40	30.80	7.98*

* Indicate significance of value at P=0.05

Farmer's satisfaction :

The extent of satisfaction level of respondent farmers over extension services and performance of demonstrated technologies were measured by client satisfaction index (CSI) and results are presented in Table 3. It is observed that majority of the respondent farmers expressed medium (45.33 %) to high (32.00 %) level of satisfaction for extension services and performance of technologies under demonstrations. Whereas, very few (22.67%) of respondents

Table 3 : Extent of farmers satisfaction of extension services rendered (n=75)

Satisfaction level	Number	Per cent
Low	17	22.67
Medium	34	45.33
High	24	32.00

expressed lower level of satisfaction. The results are in close conformity with the results of Narayanaswamy and Eshwarappa (1998), Kumaran and Vijayaragavan (2005) and Dhaka *et al*. (2010). The medium to higher level of satisfaction with respect to services rendered, linkage with farmer's and technologies demonstrated *etc*. indicate stronger conviction, physical and mental involvement in the frontline demonstration which in turn would lead to higher adoption. This shows the relevance of frontline demonstration. It indicates that mustard grown with low yield are identified by low knowledge, unfavourable attitude towards high yielding varieties, low risk bearers with negative perception of mustard production technology. In other words, it may also due to then socio -economic status, lower holdings and unavailability of inputs and credit facilities and to some extent supply and marketing problems. This is a point of concern for research and extension functionaries to disseminate improved mustard production technologies for raising the productivity of mustard at all the levels.

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