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Yield and extension gap analysis through frontline demonstration in mustard crop of the district

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Abstract
In India among all the edible oilseeds crops rapeseeds - mustard immerse the foremost position reckoning nearly millions of hectare of land under cultivation. The trails for Front line Demonstrations were conducted to study the actual yield gap and extension gap among the small and marginal farmers of the adopted village. Seeking this demonstration was conducted during two consecutive years i.e. 2017-18 and 2018-19 for clear interpretation of the results. The comparisons were made between the improved practices and the farmer practice. In principal the control practices were nothing but the farmers practice. By using the formula yield gap, extension gap analysis, technology index and technology gap was thus calculated for interpretation of results of study conducted The result obtained revealed that the average yield of the demonstration thus obtained was 18.37 q/ha as compare to farmer practices which was 14.37 q/ha with an additional yield of 4.00 q/ha with an average percentage increase in production by 28.12 %. The average extension gap for two years was recorded to be 4.10 q/ha followed by technology gap and technology index which was reported to be 2.37 q/ha and 14.84 % respectively. The decreasing trend of extension gap and technology gap in the study clearly indicates the good education level of the small as well as marginal farmers of the concerned village and also the satisfactory rate of adoption of improved technologies regarding cultivation of rapeseeds - mustard crop of the district.

Keywords: Rapeseeds-mustards, small and marginal farmers, extension gap, technology gap, technology index and frontline demonstration

Introduction
Indian agriculture is subjected to significant contribution in terms of Edible oilseed crops production. After cereals, oilseeds form the second largest agricultural commodity in India sharing 14% of the gross cropped area and accounting for nearly three per cent of gross national product and 10% value of all agricultural products. After soybean and palm oil Rapeseed-mustard is the third essential edible oilseed crop of the world. Being mainly cultivated in the tropical and subtropical areas of the world. Major countries that produce mustard are China, Canada, India, Pakistan, Poland, Bangladesh, Sweden and France. India is the third largest rapeseed-mustard producer in the world and the fourth foremost mustard consuming Nation (Verma *et al*., 2012) [10]. In India it is grown on the 35 per cent area of the total cultivated area of the world with a 16 per cent share in production (Darekar and Reddy, 2018) [1] it is an important cooking medium and a source of dietary fat for majority of the population inhabiting northern, western and north-eastern states. A high yielding mustard variety, named, 'Pusa Jai Kisan' has been developed through tissue culture technique, called somaclonal variation. A popular commercially released variety, Varuna (Type 59) was used as a donor parent for generating somaclonal variation. As per nutritional benefits are concerned mustard seeds are rich in a nutrient called selenium, known for its high anti-inflammatory effects. The high source of magnesium in mustard seeds helps reducing the severity of asthma attacks and certain symptoms of rheumatoid arthritis and lowering blood pressure. Mustard seeds are very rich in calcium, manganese, omega 3 fatty acids, iron, zinc, protein and dietary fiber. Nearly 30.7% area under rapeseed mustard is under rain-fed farming. Despite the high quality of oil and meal and also its wide adaptability for varied agro-climatic conditions, the area, production and yield of rapeseed-mustard in India have been fluctuating due to various biotic and abiotic stresses coupled with India's domestic price support programme. Nevertheless, the crop has potential to ensure the nutritional security and contribute to livelihood security. Mustard is an important food crop of the district and has been considered as productively potential region of mustard crop due to assured irrigation facilities and favorable soil and climate conditions.

Technology gap is a major problem in increasing mustard production in the region of the State. So far, not much systematic effort was made to study the technological gap existing in various components of mustard cultivation. With the available improved latest technologies, it is possible to bridge the yield gap and increase the existing production level up to certain extent. Low productivity of local varieties is one of the major constraints in mustard cultivation. Krishi Vigyan Kendra, Seoni decided to conduct front line demonstration on mustard to replace the local varieties. The front line demonstration underlying the basic principle of extension education "learning by doing" and "seeing is believing" are the backbone of transfer of new/improved agricultural technology. Keeping the importance of FLDs, the KVK Seoni has been assigned the responsibility tolay out the FLDs on mustard with the objective to identify the yield gaps between farmer's practice and front line demonstration and workout the input cost and monetary return under front line demonstration and farmers methods.

Material and Methods

The present study was conducted at Krishi Vigyan Kendra, Seoni (Madhya Pradesh) during *Rabi* season from 2017-18 to 2018-19 (two consecutive year) in the villages of operational area of KVK. Every demonstration consisted of both improved and local variety having 0.5 ha area each and totally 10 demonstrations in 04 ha area was conducted. The procedure followed for selecting a list of farmers was group meeting, field survey and based on agro ecological situation and after that specific skill training was imparted to the selected farmers regarding different aspect of cultivation (Venkattakumar *et al.*, 2010) [11]. The difference between the demonstration package and existing farmers practices are given in Table 1. Usual farmer's practice were treated as a control for comparison with recommended package *i.e.* use of quality seeds of improved varieties, line of sowing, seed treatment and timely weeding, necessity of pesticide as well as balanced fertilizer were also emphasized. The data on production cost and monetary returns were collected from front line demonstration plots for working out the economic feasibility of improved variety. Moreover, the data on local practices commonly adopted by the farmers of this area were also collected. The technology gap and technology index were calculated as given by Samui *et al.* (2000) [7].

Technology gap = Potential yield - Demonstration yield

Extension gap = Demonstration yield - Farmers yield

$$\text{Technology index (\%)} = \frac{\text{Technology gap}}{\text{Potential yield}} \times 100$$

Table 1: Comparison between recommended practices and existing farmers practices under mustard crop of the district

Particulars	Farming situation		Variety used		Time of sowing		Method of sowing		Seed Treatment		Seed rate	
	RP	FP	RP	FP	RP	FP	RP	FP	RP	FP	RP	FP
Mustard Crop	Irrigated	Irrigated	Pusa Jai Kisan	Local	Last Week of October	Last Week of November	Line Sowing	Broadcasting	Thiram @2.5 g/kg of seed	Without seed treatment	4-6 kg/ha	7-9 kg/ha

Particulars	Doses of NPK used		Irrigation		Doses of Weedicide used		Use of pesticides		Harvesting	
	RP	FP	RP	FP	RP	FP	RP	FP	RP	FP
Mustard Crop	NPKS (60:40:20:15)	NPK (100:30:00:00)	Needs 2 irrigations, first at branching stage (30 DAS) and the second at pod formation stage (60-65 DAS)	Irrigation applied not taken in explanation of critical stages	hand weeding at 25 and 40 DAS or application of pre-em herbicide pendimethalin @ 1.00 kg/ha. If the weeds Emerge after planting, Isoproturon @ 0.75 kg/ha may be sprayed 30 days after sowing.	No Weeding	Methods of Integrated pest and disease management for the management of pest and diseases.	Injudicious use of pesticides and fungicides	Harvested as soon as the pods turn yellowish and moisture content of the seed is about 40%. Moisture content of the seed necessity is less than 8% at the storage time.	Harvested of over-matured crops causes shattering of grains. Not considered of seed moisture content at harvesting and storage

Results and Discussion

The data from the study revealed that (Table 2) the Grain yield in mustard crop has been altered sequentially over the years in demonstration plot. The maximum yield was reported to be (18.86 q/ha) during the year 2017-18 and minimum yield was reported in the year 2018-19 was (17.89 q/ha) following the average yield of over the two consecutive years was reported 18.37 q/ha over farmer's practice (14.37 q/ha). During two years of study, the per cent increase over farmer's practice was between 35.78 and 20.47. On an average, there was 28.12 per cent increase in yield under FLD plots over farmers' practices followed for cultivation of Mustard. The similar results were also reported earlier by Verma *et al.*, (2012) [10]; Tomer *et al.*, (2003) [9] and Tiwari *et al.*, (2003) [8].

The study signified a complementary effect of the allotted front line demonstration over the prevailing practices towards increasing the yield of mustard in Madhya Pradesh. During the period of study more insistence was given to educate the farmers through various techniques for adoption of improved agricultural production reverse the trend of wide extension gap. An extension gap between demonstrated technology and farmers practices ranges from 4.97 to 3.04 q/ha during two years and on average basis the extension gap was 4.10 q/ha (Table 2). This gap might be due to adoption of improved scientific technology in demonstrations which resulted in increased grain yield than the traditional and old farmers' practices. Greater use of latest production technologies along with more emphasis in the use of high yielding new variety will ultimately narrow this alarming trend of wider extension gap. The latest technologies will gradually lead to the farmers to discontinue the old technology and to adopt new technology. The similar results were also reported earlier by Goswami *et al.*, (1996) [2] and Hiremath and Nagaraju (2010) [3]. Wide technology gap were observed 2.86 and 1.89 q per hector during years 2017-18 and 2018-19, respectively with an average of 2.37 q/ha. The difference in technology gap during two years could be due to more feasibility of recommended technologies during the years. Technology gap imply researchable issues for realization of potential yield, while the extension gap imply what can be achieved by the transfer of existing technologies. Similarly, the technology index for all the demonstrations during different years were in accordance with technology gap. Higher technology index reflected the inadequate proven technology for transferring to farmers and insufficient extension services for transfer of technology. The technology index shows the feasibility of the evolved technology at the farmer's fields and the lower the value of technology index more is the feasibility of the technology. The similar results were also reported earlier by Jeengar *et al.*, (2016) [4]; and Mitra and Samajdar (2010) [6]. The probable reason that could be attributed to the high feasibility of mustard production technology was that the participant farmers were given opportunity to interact with the scientist and they were made to adopt recommended practices and skills during the process of front line demonstration.

Various variables like seed rate, dose of fertilizers, labourers and use of pesticides were considered as important inputs for accomplishing the front line demonstrations as well as farmers practice at local level. The inputs and outputs prices of commodities prevailed during the study of demonstrations were taken for calculating gross return, cost of cultivation, net return and benefit: cost ratio (Table 3). Economic returns as a function of grain yield and MSP sale price varied during the years. Maximum returns (Rs. 35,500/- ha) during the year 2017-18 was achieved due to increased grain yield and Minimum Support Prices sale rates as decided by Government of India. The greater additional returns and effective gain obtained under front line demonstrations could only be due to the use of effective proven technologies, nonmonetary factors, and timely operations of crop cultivation and scientific monitoring being conducted time to time of the farmer's field. The highest benefit: cost ratio (BCR) was 2.11 during the year 2017-18 and 2.19 under the recommended practices for the year 2018-19 which might be due to increased MSP and sale rate as declared by Government of India. The results confirm the findings of frontline demonstrations on oilseed and pulse crops by Verma *et al.*, (2012) [10]; Yadav *et al.*, (2004) [12] and Lathwal (2010) [5].

Table 2: Seed Yield, Extension Gap, Technology Gap and Technology index % analysis of FLD of mustard crop at farmer’s field

Year	Area	No. of farmers	Extension gap (q/ha)	Technology gap (q/ha)	Technology index %	% increase	Seed Yield (q/ha)	
							Demo	Control
2017-18	02	05	4.97	2.86	17.87	35.78	18.86	13.89
2018-19	02	05	3.04	1.89	11.81	20.47	17.89	14.85
Total /Average	04	10	4.10	2.37	14.84	28.12	18.37	14.37

Table 3: Gross return (Rs./ha), Cost of cultivation (Rs./ha), net return (Rs./ha) and B:C ratio as affected by improved and local Technologies

Year	2017-18		2018-19	
	RP*	FP**	RP*	FP**
Gross Return	35500	27610	33710	25300
Cost of cultivation	75245	50642	73950	49523
Net Return	39745	23032	40240	24223
B:C	2.11	1.83	2.19	1.95

*Recommended practices and **Farmer practices

Fig 1: Spray of chemical to control aphids in Mustard crop

Fig 2: View of Mustard crop at farmers field

Conclusion

It was thus, concluded that the adoption of improved package of practices and use of proven technologies in respect of Mustard cultivation can narrow the technological gap to a greater extent thus leading to increase productivity of mustard in Seoni district of Madhya Pradesh. From the present study it can be concluded that use of improved method of mustard cultivation can reduced the technology gap to a substantial extent thus leading to increase productivity of mustard in the area. The extension gap showed an increasing trend. Extension gap ranging between 4.97-3.04q/ha during the study period emphasizes the need to educate the farmers through various means for adoption of improved agricultural production technologies to reverse the trend.

Technology index which shows the feasibility of the technology demonstrated has depicted good performance of the intervention. The farmers where improved technology was demonstrated also acted as primary source of information for other farmers on the improved practices of mustard cultivation and also acted as source of good quality pure seeds in their locality for the next crop. The concept of front line demonstration may be applied to all farmer categories including progressive farmers for speedy and wider dissemination of the recommended practices to other members of the farming community.

It is concluded that, the cultivation of mustard with improved technologies has been found more productive and yield might be average increased up to 28.12 per cent. Technology and extension gap extended which can be bridges by popularity package of practices with emphasis of improved variety. Replacement of variety with newly released variety will increase the production and net income. Recommend technology was found to be suitable since it fits well to the existing farming situation and also it had been appreciated by the farmers.

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