Research Article

Yield Gap Analysis of Mustard Crop: A Case Study of Village Chomakot in Kota District

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Abstract

The study was carried out in NICRA village Chomakot of Kota district during 2011-12 to 2015-16. Total 200 front line demonstrations were conducted on mustard in 100 ha by the active participation of the farmers with the objective of improved technologies of mustard production. The improved technologies consist improved varieties (BIO-902, Maya, NRCDR-2 and NRCHB-101), balanced fertilizers (soil test based) application and integrated disease and pest management, etc. The demonstrated recorded an average yield ranging from 1680 kg to 2060 kg/ ha with a mean of 1938 kg/ha. The per cent increase yield in demonstration ranged from 14.10% to 23.29% in the respective years with a mean of 19.2%. The average extension gap, technology gap and technology index were 315.71 kg/ha, 354.28 kg/ha and 15.06 %, respectively. The demonstrated field gave higher net return Rs 38600/- to Rs 49560/ ha with mean Rs 45589/ha and B: C ratio 2.91 to 3.81 and with a mean 3.42, respectively. Present results clearly show that the yield and economics of mustard can be boost up by adoption of recommended technology.

Keywords: Mustard production technology, frontline demonstration, Economics and yield

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Introduction

Indian mustard (*Brassica juncea* L.) is a member of the Brassicaceae family and has become one of the most important sources of oil production in the mustard in India is 5.80 million ha, 6.2 million ton with productivity 1089 kg/ha, respectively during the 2015-16 [1]. In Rajasthan is 2433.70 thousand ha, 2878930 t with productivity of 1183 kg/ha during 2014-15 [2].

The importance and potential of rapeseed-mustard crop is well known as it is the key oilseed crop that can help in addressing the challenge of demand - supply gap of edible oil in India. It is world's third most important source of edible oil after soybean and oil palm. Each and every part of the plant is of importance in the human livelihood. It is also utilized for flavouring, medicinal and preservative purpose since time immemorial. The brassica oilseeds have the oil content of 30-48% in air dried seeds. Colour of the oil is yellow to brown. Rapeseed and mustard oils have anti nutritional factors like erucic acid. However, varieties are now being developed with reduced erucic acid (<2%). The cultivars with <2% of erucic acid in oil and < 30 micromoles/gram of glucosinolates in oil meal are called as Conola varieties suitable for edible purpose. It is also desirable to have less linolenic acid (<3%) and higher linoleic acid (>30%) for prolonged cooking and higher shelf life. But brassicas destined for industrial purpose should contain higher erucic acid (>60%) as it has high heat stability and used as lubricating oil, fossil fuel and additive to diesel [1]. Frontline Demonstration (FLD) is the new concept of field demonstration evolved by the Indian Council of Agricultural Research with the inception of the technology mission on oilseed crops during mid eighties. The field demonstrations conducted under the close supervision of scientists of the National Agriculture Research System is called front-line demonstrations because the technologies are demonstrated for the first time by the scientists themselves before being fed into the main extension system of the state department of agriculture. Frontline demonstration (FLD) is one of the most powerful tools of extension because farmers, in general, are driven by the perception that '*Seeing is believing*' the main objective of frontline demonstrations is to demonstrate newly released crop production and protection technologies and its management practices in the farmers' field under different agro-climatic regions and farming situations. While demonstrating the technologies in the farmers' field, the scientists are required to study the factors contributing higher crop production; field constrains of production and thereby generate production data and feedback information. Frontline Demonstrations are conducted in a block of two or four hectares land in order to have better impact of the demonstrated technologies on the farmers and field level extension functionaries [3]. The production potential of mustard crop depends on a number of interacting factors such as cultural, sowing time, fertilizers, insects-pests, crop management, pesticides and agronomic condition prevailed at the particular crop season [4].

Material and Methods

The frontline demonstrations were conducted by several institutes or organizations in Rajasthan but due to paucity of time and proximity, study was confined to FLDs conducted by KVK Borkhera, Kota district of Rajasthan. During 2011-12 to 2015-16, a total 200 front line demonstrations on mustard varieties (BIO-902, Maya, NRCDR-2 and NRCHB-101) was conducted at farmer's field in the NICRA village Chomakot. The yield and economic performance of frontline demonstrations, the data on output were collected from FLDs as well as local plots and finally the grain yield, cost of cultivation, net returns with the benefit cost ratio was worked out. For the purpose of investigation, Chomakot villages of Kota district, where FLDs were conducted during 2011-12 to 2015-16. For selection of beneficiary farmers, a list of farmers where FLDs on mustard were conducted during Rabi 2011-12 to 2015-16 was prepared and taking equal representation. The data were collected through personal contacts with the help of well-structured interview schedule. The gathered data were processed, tabulated, classified and analysed in terms of mean present score and ranks in the light of objectives of the study. More than 14 percent difference between beneficiary and non-beneficiary farmers' was considered as significant difference. The extension gap, technology gap and technology index were calculated using the formula as suggested by [5, 6]

$$\text{Extension gap } (qha^{-1}) = \text{Demonstration yield} - \text{Farmer's yield}$$
$$\text{Technology gap } (qha^{-1}) = \text{Potential yield} - \text{Demonstration yield}$$
$$\text{Technology index } (\%) = [\text{Potential yield} - \text{Demonstration yield} / \text{Potential yield}] \times 100$$

Result and Discussions

Yield in front line demonstration were 2060 kg/ha, 1930 kg/ha, 2060 kg/ha, 2020 kg/ha, 2040 kg/ha, 1680 kg/ha and 1780 kg/ha during 2011-12 (Bio-902 & Maya), 2012-13, 2013-14(Bio-902 & NRCDR-2), 2014-15 and 2015-16, respectively (**Table 1**) with an average production was 1938 kg/ha. A comparison of the productivity level between front line demonstrations and local checks is shown in Table 1. It is evident from results that under the demonstrate plot, performance of mustard (yield) was sustainable higher than that in the local check in all the years of the study (2011-12 to 2015-16). Yield in mustard under demonstration ranged from (1680-2060 kg/ha) during the period under study. Technological intervention, thus, enhanced yield to a tune of 23.29%, 13.95%, 22.62%, 21.68% 22.90%, 15.86% and 14.10%, respectively, over the local check. Fluctuations in yield observed over the years were mainly on account of variation in soil moisture availability, rainfall, sowing time and pest and disease attack. Similar enhancement in yield in mustard and other crops under front line demonstrations was documented by [4, 5, 7-10].

Table 1 Yield and yield difference of mustard under frontline demonstrations

Year	Variety	No. of FLD	Yield kg/ha LC	Yield kg/ha FLD	Potential yield Kg/ha	Yield difference Kg/ha	Per cent increase yield over LC
2011-12	BIO-902	20	1675	2060	2650	385	23.29
	Maya	20	1675	1930	2420	255	13.95
2012-13	BIO-902	40	1680	2060	2200	380	22.62
2013-14	BIO-902	20	1660	2020	2400	360	21.68
	NRCDR-2	20	1660	2040	2350	380	22.90
2014-15	NRCDR-2	40	1450	1680	2110	230	15.86
2015-16	NRCHB-101	40	1560	1780	1920	220	14.10
Mean			**1622.86**	**1938.57**	**2292.85**	**315.71**	**19.20**

Yield in front line demonstration and potential yield of the crop was compared for estimating yield gaps. These gaps were further categorised as technology and extension gaps. Technology gap indicates a gap in demonstration yield over the potential yield, and this was 590, 490, 140, 380, 310, 430and 140 kg/ha during 2011-12 (Bio-902 & Maya), 2012-13, 2013-14(Bio-902 & NRCDR-2), 2014-15 and 2015-16, respectively (**Table 2**). The technology gap observed may be attributed to dissimilarities in soil fertility, salinity and to erratic rainfall and other vagaries of weather in the demonstration areas. Hence, to narrow down the gap between the two types of yield in different varieties, location specific recommendation may become necessary.

Table 2 Yield gap and technology index in mustard frontline demonstrations

Year	Variety	No. of FLD	Technology gap (Kg/ha)	Extension Gap (Kg/ha)	Technology Index
2011-12	BIO-902	20	590	385	22.2
	Maya	20	490	255	20.24
2012-13	BIO-902	40	140	380	6.36
2013-14	BIO-902	20	380	360	15.83
	NRCDR-2	20	310	380	13.19
2014-15	NRCDR-2	40	430	230	20.37
2015-16	NRCHB-101	40	140	220	7.29
Mean			**354.28**	**315.71**	**15.06**

Extension gap 385 kg/ha, 255 kg/ha, 380 kg/ha, 360 kg/ha, 380 kg/ha, 230 kg/ha and 220 kg/ha during 2011-12 (Bio-902 & Maya), 2012-13, 2013-14(Bio-902 & NRCDR-2), 2014-15 and 2015-16, respectively with ranged from 220 to 385 kg/ha during the period under study (Table 2). A wide extension gap emphasizes the need to educate farmers using various means to facilitate adoption of improved production technologies, to reverse this trend. Greater use of the latest, improved production technologies applied to high yielding varieties can subsequently bridge this extension gap between demonstration yield and farmer's yield. New technologies, may, eventually lead farmers into discontinuing obsolete varieties. Technology index refer to the feasibility of variety at farmers field. It comprises 22.2%, 20.24%, 6.36%, 15.83%, 13.19%, 20.37% and 7.29% during 2011-12 (Bio-902 & Maya), 2012-13, 2013-14(Bio-902 & NRCDR-2), 2014-15 and 2015-16, respectively with mean 15.06 % (**Table 3**). A lower the value of technology index more is the feasibility. This finding corroborates results of [4, 5, 7-10].

Table 3 Economics of Mustard fronline demonstrations

Year	Variety	Cost of Cultivation		Gross return		Net return		B:C ratio	
		FLD	LC	FLD	LC	FLD	LC	FLD	LC
2011-12	BIO-902	17020	15800	64928	53440	44908	37600	3.81	2.38
	Maya	17020	15800	61440	53440	44420	37600	3.61	2.38
2012-13	BIO-902	19000	18000	65920	53120	46120	35120	3.46	2.95
2013-14	BIO-902	19800	18300	68660	56440	48880	38140	3.47	3.08
	NRCDR-2	19800	18300	69360	56440	**49560**	38140	3.50	3.08
2014-15	NRCDR-2	20200	19750	58800	50750	38600	31000	2.91	2.57
2015-16	NRCHB-101	21500	20500	67640	59280	46640	38780	3.22	2.90
Mean		**19191**	**18064.3**	**65249**	**54701**	**45589**	**36625**	**3.42**	**2.76**

Figure 1 General view of mustard crop under demonstration at NICRA Village Chomakot

The economics of growing mustard under front line demonstrations were estimated and results are presented in Table 3. Economic analysis of yield performance revealed that besides higher production, participating farmers in FLDs realized a higher price of than produce compared to that in the local checks during the period under study.

This was so because of a better quality of the produce. Front line demonstrations recorded higher mean gross return (Rs 65249/ha) and mean net returns (Rs 45589/ha) with average benefit: cost ratio (3.42) compared to the local checks in our study. These results are in line with finding of [4, 5, 7-10].

Recommendations

- Yield gaps exist in mustard cropping pattern at all trial. It is, therefore, recommended to explore the scope to promote yields of the crops by minimizing the yield gaps using HYVs and improved management practices.
- Frequent interaction between researchers and extension personnel of the trial sites is essential for minimizing yield gaps in these crops. The researchers should develop appropriate technology package and extension personnel at the same time ensure adoption of such technology package by the farmers.
- Results of the on-farm trial conducted at different locations reveal that the farmers apply low and imbalanced doses of fertilizers and pesticides due mainly to resource constraints, It is, therefore, suggested that the farmers are supported by adequate credit facility in time from different institutional sources with easy terms and conditions.
- Farmers should be offered training on the importance of the use of balanced fertilizers, especially micronutrient in mustard for higher yield. They should as well be given training on different areas of pest and water management of the crops.
- It is also essential that adequate funds are released in time for organizing farmer’s training programmes and field days on the production technology of the crops.

Conclusions

On the basis of above finding in present study, it is concluded that front line demonstrations of improved technology reduces technology gap to a considerable extent, thus leading to increased productivity of mustard in Kota district of Rajasthan. This also improved linkages between farmers and scientists, and built confidence for adoption of the improved technology. Productivity enhancement under FLDs over farmer practices of mustard cultivation created a greater awareness, and motivated other farmers not growing mustard to adopt improved technologies in this seed spice crop I. rape seed and mustard. Therefore, it can be concluded that frontline demonstration conducted under the close supervision of scientists is one of the most important tools of extension to demonstrate newly released crop production and protection technologies and its management practices in the farmers’ field under different agro-climatic regions and farming situations. Front line demonstrations are playing important role in motivating the farmers for adoption of improved agriculture technology resulting in increasing their yield and profits. Keeping in view of importance in transfer of technology, FLDs should be designed and conducted carefully and effectively and provisions should be made for other supportive extension activities such as field days, interaction meeting, *etc.* for speedy dissemination of demonstrated technology among farming community.

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