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Yield gap and economic analysis of mustard through front line demonstration in Panna district of Madhya Pradesh

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Abstract
Mustard is one of the most important oilseeds crop in India. Which plays a major role in supplementing the income of small and marginal farmers of Panna district. This crop is primarily raised for its edible oil. Its Seeds contain 35-40 Percent oil and 16-22 percent protein and high level of essential amino acids. Cultivation of mustard has increased several fields as in oilseed crop in recent years. Panna district occupies 6839 ha of land and average productivity of 933 kg/ha. Of mustard crop. Krishi vigyan kendra Panna has conducted 353 front line demonstration on mustard in 148 ha. Area under real farming situation in the farmers' fields during the six years of study. The required inputs were supplied and regular visits to the demonstration field by the KVK scientists ensured proper guidance to the farmers. The yield of mustard increased successively over the years in demonstration plots. Result revealed that the highest yield in the demonstration plot and farmers plot was noted during 2017-18, 1702 kg/ha and 1380 kg/ha, respectively. The average FLD yield and farmers practice was recorded to 1247 kg/ha and 969 kg/ha respectively the increase in percentage of yield was ranging between 23.33 to 35.05 during the study years. The trend of technology gap (ranged 48 kg to 79 kg/ha) reflected the farmers cooperation in carrying out such demonstrations with encouraging results in subsequent years. average extension gap of 290 kg/ha was recorded in mustard technology index showed the feasibility of the evolved technology at the farmers' fields and the lower is the value of technology demonstrated as such reduction of technology index from 45 percent to 3 percent exhibited the feasibility demonstrated the economics of mustard is concerned average gross return, net return and benefit cost ratio were Rs 41775/ha, 21283/ha and 1:2.0 respectively under FLD plots. However Rs. 32534/ha gross return, Rs 13609/ha. Net return with 1:1.7 benefit cost ratio observed under farmer's practices. It can be concluded that use of latest technologies of mustard cultivation can reduce the technology gap to a considerable extent resulting in to increased productivity of mustard in the district.

Keywords: Rapeseed-mustard, %increased of yield, extension gap, technology index and B:C.

Introduction
Rapeseed-mustard group of crops are the major rabi oilseed crops of India. The group is mainly constituted by *Brassica juncea* (L.) *B. napus (*L.*) B. rapa* (L.) Czern and Coss *and B. carinata* Braun. These four species of *Brassica* commonly known as Indian mustard is being grown mainly as source of vegetable oil. Oil content varies between 28.6 to 45.7 per cent. The area, production and productivity of rapeseed-mustard in the country was 5.8 million ha, 6.3 million tonnes and 1083kg/ha, respectively (Anon. 2016) [2]. Panna district occupies 6839 ha of land and average productivity of 933 kg/ha. Of Mustard crop. (Anon. 2017) [1]. Out of these the most important is Indian mustard occupying more than 80% of the total rapeseed-mustard cultivated area of the country. Major mustard growing states of the country are Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Karnataka and Andhra Pradesh. *B. juncea* is the most important oilseed crop of Northern Madhya Pradesh comprising Morena, Bhind, Gwalior, Sheopur and Datia districts contributing more than 80% share in the production of this crop in the state. Rapeseed mustard is the major source of income specially even to the marginal & small farmers in rainfed areas. Because of its low water requirement (80-240 mm), rapeseed-mustard crops fit well in the rainfed cropping system. Among the oilseed crops, rapeseed –mustard ranked next to ground nut (*Arachis hypogeal*) and soybean (*Glycine max* (L) in contribution to the oilseed production.
Oil and fats comprises vital components of human diet as these are good sources of energy and act as carrier of fat soluble vitamins, oil cake or meal has high nutritional values for animals.

The leaves of young plants are used in human diet as a green vegetable. The oilseed Brassica usually contain 38 to 57 % of erucic acid, 4.7 to 13 % linolenic acid and 27 % of oleic acid and linolenic acid, which are of high nutritive value required for human health (Kumar *et al.* 2012). The Indian mustard have nutritional value viz., carbohydrates 4.51g,sugar 1.41g,dietary fibre 2g,fat 0.47g and protein 2.56g per 100g (3.5oz).

The improved technology packages were also found to be financially attractive. Yet, adoption levels for several components of improved technology were low, emphasizing the need for better dissemination (Kiresur *et al.* 2001). Several biotic, abiotic and socio-economic constraints inhibit exploitation of the yield potential and these needs to be addressed. Panna district has sizeable area under mustard cultivation but the productivity level is very low. Keeping the above points in view. The FLD on mustard using new crop production technology was started with the objectives of showing the productive potentials of the new production technology under real farm situation over the locally cultivated mustard crop.

Methodology

Krishi vigyan kendra Panna has conducted 353 front line demonstration on rapeseed-mustard in 148 ha area under real farming situations between 2012-13 and 2017-18 in the farmer's fields of thirty six village of five blocks viz. Panna, Ajaygarh, Gunor, Pawai and Shah nagar. The demonstration of improved technology was taken in an area of 0.4 to 0.8 ha. Of each farmer. Before conducting front line demonstrations a list of farmers was prepared from group meeting and specific skill training was imported to the selected farmers regarding different aspects of cultivation etc. were followed as suggested by Chaudhary 1999. The required inputs were supplied and regular visits to the demonstration fields by the KVK scientists ensured proper guidance to the farmers. Field day and group meeting were also organized to provide the opportunities for other farmers to witness the benefits of demonstrated technologies. In the demonstration, one control plot was also kept were farmers practices was carried out. The improved package of practices viz, improved & recommended varieties, biofertilizer based on STV, and plant protection management were demonstrative on the farmer's field through front line demonstration at different locations. Materials for the present study with respect to FLD & Farmers practice are given in table 1.

The yield dat**a** were collected from both the demonstration and farmers practice and their technology gap, extension gap and technology index were worked out Samui *et al.* (2000) [9] as given below.

% increased yield = Demonstration yield – farmers yield × 100/farmers yield.

Technology gap = Potential yield – Demonstration yield.

Extension gap = Demonstration yield- Farmers yield.

Technology Index = Technology gap × 100/potential yield.

Table 1: Detail of mustard growing under FLD & Farmers Practices.

Operation	Farmers practices	Technology Interntions under FLD
Seed	old varieties (pusa bold & varuna)	new variety- Pusa Tarak & RVM 2
use of fertilizer	use of DAP (50 kg/area) and urea (30 kg/ acre)	Use of urea (30 kg/acre) ssp (75 kg/acre) MoP-8kg/acre with biofertilizer azosprillum (211), PSB (250 ml) and P*seudomonas fluoresces.* (2ct/acre) (Row to Row)
Sowing method	Broad cast	Line showing (40 c.m.)
water manage ment	One irrigation before flowering	One Irrigation after 30 days of sowing
Plant protection	not application proper insecticide & dose for control of aphid	Need based application of imidacloprid17.8 % sl @ 100 ml/acre for control of aphid.

Result and discussion

The data in the table 2 showed that the yield variations were quite large during the year 2012-2013 to 2017-18. In total 353 front line demonstrations on mustard were conducted during period on improved technology (IT) V/S Farmers Practices (FP). The Yield of mustard increased successively over the years in demonstration plots Result revealed that the highest yield in the demonstration plot and farmer plot was noted during 2017-18, 1702 kg /ha and 1380 kg/ha, respectively. The average FLD yield and farmer practice was recorded to 1247 kg/ha and 969 kg/ha respectively the increase in percentage of yield was ranged 23.33 to 35.05 during the six years of study and the average percentage increased in the yield over farmers practices was 28.68 the result clearly speak of the of the positive effect of front line demonstration over existing practice towards enhanced the yield of mustard in Bundelkhand region of Madhya Pradesh. The similar results of yield enhancement in rapeseed mustard crop in front line demonstration has been documented by Mitra and Samajdar (2010) [7].

The trend of technology gap (ranged 48 kg to 790 kg/ha) reflected the farmers cooperation. In carrying out such demonstrations with encouraging results in subsequent years. The technology gap observed may be attributed to the dissimilarity in soil fertility status and weather conditions. This finding is in corroboration with the finding by Balai *et al.* (2012)

The average extension gap of 290 kg/ha was recorded in mustard. This emphasized the need to educate the farmers through various means for the adoption of improved agricultural production to reverse the trend of wide extension gap. This finding is in corroboration with the finding by Ahmad *et al.* (2013) [3]

The technology index showed the feasibility of the evolved technology at the farmers fields and the lower is the value of technology index, more the feasibility of the technology demonstrated as such reduction of technology index from 45 percent (2013-14) to 3 percent (2017-18) exhibited the feasibility of technology demonstrated

Table 2: Productivity, % Increase yield over Farmers practice, Technology gap, Extension gap and Technology Index of Mustard under FLDS during 2012-13 to 2017-18.

FLD conducted year	Crop	variety	no. of Beneficires	FLD Area (ha)	YIeld (kg/ha)			% increased yield over farmers practices	technology gap (kg/ha)	Extension gap (kg/ha)	Technology Index (%)
					potentialial of variety	FLD yield	farmers practices				
2012-013	Mustard	Pusatarak	17	8	1750	1100	860	27.90	65	240	37
2013-014	Mustard	Pusatarak	50	20	1750	9600	725	32.41	790	310	45
2014-15		RVM	55	20	1750	11200	872	28.44	630	248	36
2015-16		RVM	75	30	1750	1290	1010	27.72	460	280	26
2016-17		RVM	63	30	1750	1310	970	35.05	340	340	19
2018-18		RVM	93	40	1750	1702	1380	23.33	480	322	03
Average			353	148	1750	1247	969	28.68	5580	290	32

Table 3: Cost of cultivation Gross return, Net Return and B.C. ratio as compared by FLD and farmers practices of Mustard crop.

FLD conducted year	cost of cultivation (Rs/ha)		Gross return (Rs/ha)		Net Return (Rs/ha)		B.C. Ratio	
	Farmers Practices	Technology under FLD	Farmers Practices	Technology under FLD	Farmers Practices	Technology under FLD	Farmers Practices	Technology under FLD
2012-013	16490	18880	24080	30800	7590	11920	1:1.4	1:1.6
2013-014	16920	19630	21750	28800	4830	9170	1:1.3	1:1.5
2014-15	17840	20100	27904	35840	10064	15740	1:1.5	1:1.8
2015-16	19260	20220	32320	41280	13060	21060	1:1.7	1:2.00
2016-17	20160	22840	33950	45850	13590	26140	1:1.7	1:2.00
2017-18	22680	24410	55200	68080	32520	43670	1:2.4	1:2.8
Average	18925	21013	32534	41775	13609	21283	1:1.7	1:2.00

The data of table 3 reveals that as far as economics of mustard is concerned, average gross return, net return and benefit cost ratio were Rs. 41775, Rs 21283 and 1:2.0 respectively during study years under FLD plot. However, Rs 32534/ha gross return, Rs 13609/ha net return with 1:1.7 benefit cost ratio observed during study year under farmers practices. The superiority of recommended package of practices under front line demonstration over farmers practice was also reported by Chaudhary *et al*. (2018) [5].

Conclusion

From the findings of present study, it can be concluded that use of latest technologies of mustard cultivation can reduce the technology gap to a considerable extent resulting in to increased productivity of mustard in the district. It requires collaborative extension efforts to enhance adoption level of location and crop Specific technologies among of the farmers for bridging these gaps. Therefore, extension agencies in the district need provide proper technical support to the farmers through various education and extension methods for better mustard production in the district.

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