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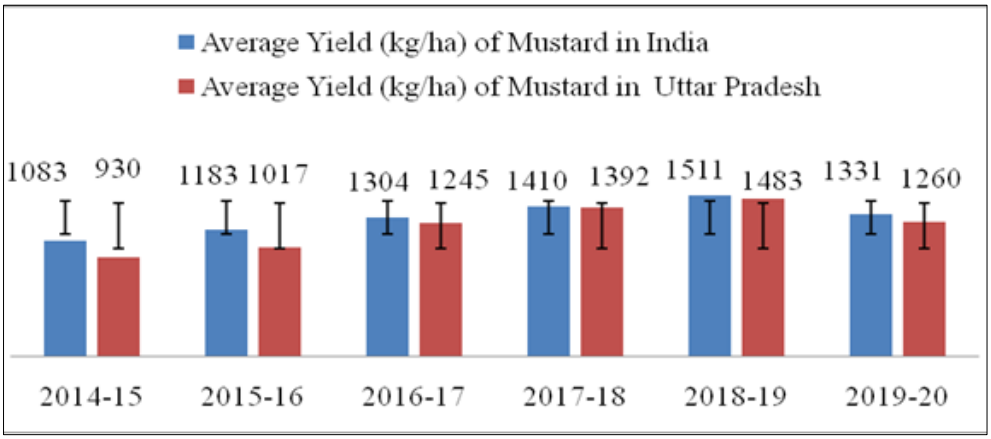
Showcasing and economics of Indian mustard varieties (*Brassica juncea*) under front line demonstration in eastern part of Uttar Pradesh

Kamlesh Meena, Rajneesh Srivastva, Ajay Tiwari and Neeraj Singh

Abstract
Mustard stands in second place among oil seed crops of India. The productivity of mustard in India is the lowest than the major rapeseed/mustard growing countries. Use of low productive traditional mustard varieties and poor management practices are the major constraints in production. It appears due to non-adoption of recommended high yielding varieties and advance production technologies by the farming community in eastern plains of Utter Pradesh. To replace this anomalous, we had conducted 153 front line demonstrations (FLDs) at farmer fields of various adopted villages by KVK, Deoria. Cultivation practices comprised under FLD *viz.* improved varieties, thinning, irrigation, date of sowing, seed treatment, spacing, balance use of fertilizers, intercultural operations and plant protection measures showed increase in yield of mustard varieties from 22.2 to 43.7% over farmers practice. Maximum net return was increased (78.29%) in Satabdi variety of mustard over farmer practice in the year of 2015-16 and lowest net return was increased in Pusa Mustard 27 (24.74%) compared to farmers practice in the year of 2014-15. The benefit-cost ratio of five years demonstrated technology was higher over farmer's practices. The analysis of data for extension gap showed that Satabdi had highest gap (631 kg/ha) and Pusa Mustard 27 had lowest gap (210 kg/ha). The higher value of the B:C ratio and extension gap indicates the more feasibly of the technology in eastern plain of Uttar Pradesh.

Keywords: Mustard, Front line demonstration, yield, technology gap, extension gap

Introduction
Rapeseed-Mustard belong to cabbage family *Brassicaceae* and second most important oil seed crop of India after Groundnut, contributing nearly 28 to 30% of the total oil seed production in the country. The oil content of seeds varied from 30-45%. Mustard oil is the main cooking medium in the northern India. The seed and oil are used as condiment in pickles preparation and for flavoring curries and vegetables. Oil cake mostly used as cattle feed (Shekhawat 2012) [15]. The leaves of young plants are used as green vegetables. Early Asian and European scripts mention use of seed and oil as medicinal remedies for stomach and skin problems (Rahman 2018) [11]. It is used in Ayurvedic medicated oil for massage in many paralytic diseases of nervous system. Its oil is also used in manufacturing, greases, lubricant and in soap-making industries. The crop is grown both in subtropical and tropical regions. The total production in the world is fluctuating from 68.74 (2015-16) to 74.03 (2017-18) million metric tons in last five years. The major rapeseed-mustard producing counties in the world are Canada, China, Germany and France. According to Agricultural Statistics at a Glance (2021) published by Government of India Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Directorate of Economics & Statistics, India producing 9.12 million tons mustard from an area of 6.86 million hectares with the average yield 1331 kg/ha. Uttar Pradesh producing 0.96 million tons mustard from an area of 0.76 million hectares with the average yield 1260 kg/ha. While Rajasthan is the largest producer of (4.20 million tons) rapeseed-mustard followed by Uttar Pradesh, Haryana, Madhya Pradesh, West Bengal, Gujarat and Assam. The other states with minor production are Orissa and Bihar. Rapeseed-mustard group of crops are also grown in northern and north-eastern state of the country. There has been tremendous increase in area and production of rapeseed-mustard during the last two decades mainly in the state of Rajasthan, Haryana, West Bengal and Gujarat. Growth in XII plan over XI plan in area, yield and production of rapeseed-mustard was recorded +0.23, +7.20 and +7.40, respectively (NFSM 2018). Off course the impact of FLDs was superior over traditional systems in chickpea (Bhati *et al.*, 2018) [4] and mustard (Meena *et al.*, 2012) [8] reported in some parts of Rajasthan.



Sources: Agricultural Statistics at a Glance from 2015 to 2021

Fig 1: Average Yield (kg/ha) of Mustard in India and Uttar Pradesh during study period from 2014-15 to 2018-19

2. Materials and Method

In present study performances of high yielding varieties of mustard namely Pusa Mustard 27, Satabdi, Pusa Tarak and RH 749 against traditional variety was evaluated through front line demonstrations (FLDs) at farmer´s field during Rabi season 2014-15 and 2018-19. The study was carried out by the Krishi Vigyan Kendra, Malhana, Deoria under Indian Institute of Vegetable Research, Varanasi, UP. A total of 153 FLDs were conducted of mustard varieties (Pusa Mustard 27, Satabdi, Pusa Tarak and RH 74) during study period from Rabi 2014-15 and 2018-19. Agronomical practices used for the present study with respect to FLDs and farmer practices are given table 1. The crop was sown in last week of October and harvested in first week of March. The five improved varieties (Mustard 27, Satabdi, Pusa Tarak and RH 749) were compared with traditional varieties grown by the farmers. The soils of the study area are very deep, loam to silt loam in texture and moderately well to well drained with ground water irrigation facility. Soils are medium in fertility status. Climate of the district is characterized by dry summer and cool winter with high rainfall during Kharif season. Critical inputs in the form of quality seeds of recommended high yielding varieties for FLDs was provided to the farmers. The farmers were facilitated by KVK subject matter specialist in performing field operation like sowing, thinning, irrigations, fertilizer application, weeding spraying, harvesting, threshing and storage *etc.* through training, course visit and field days. The demonstrated technologies in the fields are presented in table1 and compared with local practices. For evaluation of performance of different varieties, the growth and yield data were recorded and compared with traditional and local varieties, grown by the farmers. Data was calculated as per standard methods to find out the B: C ratio and extension gaps between demonstrated technology and farmers practices by using following formula as given below.

B:C ratio = Gross Return/ Cost of Cultivation x 100……(1)

Net Return = Gross Return - Cost of Cultivation…… (2)

Extension gap (B) = Yield of Demonstrated Technology - Yield of Farmers Practice……. (3)

Table 1: Agronomical practices used for mustard growing under FLDs and farmer practice

Practice	Demonstrated Technology	Farmers Practices
Farming situation	Irrigated and sandy loam	Irrigated and Sandy loam
Varieties	Pusa Mustard 27, Satabdi, Pusa Tarak and RH 749	Traditional Variety
Date of sowing	25 October to 05 November	05 to 12 Nov
Method of sowing	Line sowing	Broadcasting
Seed Rate (kg/ha)	04	5-6
Irrigation (No.)	01	01
Fertilizers (kg/ha)	80 N, 60 P and 40 K	80 N, 60 P and 40 K
Thinning	25 DAS	No thinning
Date of harvesting	10-20 March	10-20 March

3. Results and Discussions

3.1 Interpretations of crop yield

High yielding varieties of mustard Pusa Mustard 27, Satabdi, Pusa Tarak and RH 749 were evaluated against traditional variety through front line demonstration on selected farmer's field of Deoria district during rabi season 2014-15 and 2018-19. The results of demonstrated technologies compared with farmers practices are depicted in Fig. 2. The average yield of mustard variety Satabdi under FLDs was recorded at 2073 kg/ha in the years of 2015-16, which was 43.75% higher than the traditional variety used by the farmers. Further the average yield of mustard variety Pusa Tarak under FLDs was recorded at 2010 kg/ha in the years of 2017-18, which was 34% higher compared to traditional variety sown by the farmers (Fig.2). Furthermore, the increase in the yield of mustard varieties like Pusa Mustard 26, RH 749, and Pusa Mustard 27 was recorded at 21.6, 19.5 and 12.2% over the traditional races grown by the selected farmers of the Deoria district in the year 2016-17, 2018-19 and 2014-15 respectively. Yield gap analysis has been carried out by several workers (Mitra *et al.*, 2010, Meena *et al.*, 2010) [10, 5] in different parts of country and reported the superiority over local or traditional technologies. Similar yield enhancement through frontline demonstration in Indian mustard has also been reported by Meena *et al.*, (2018) [9], Hiremath *et al.*, (2007) [6], Dhaka *et al.*, (2010) [5], and Kumar *et al.*, (2010) [7]. Better performance and it's on farm showcasing over local varieties is enough to attracts farming community to grow mustard crop.

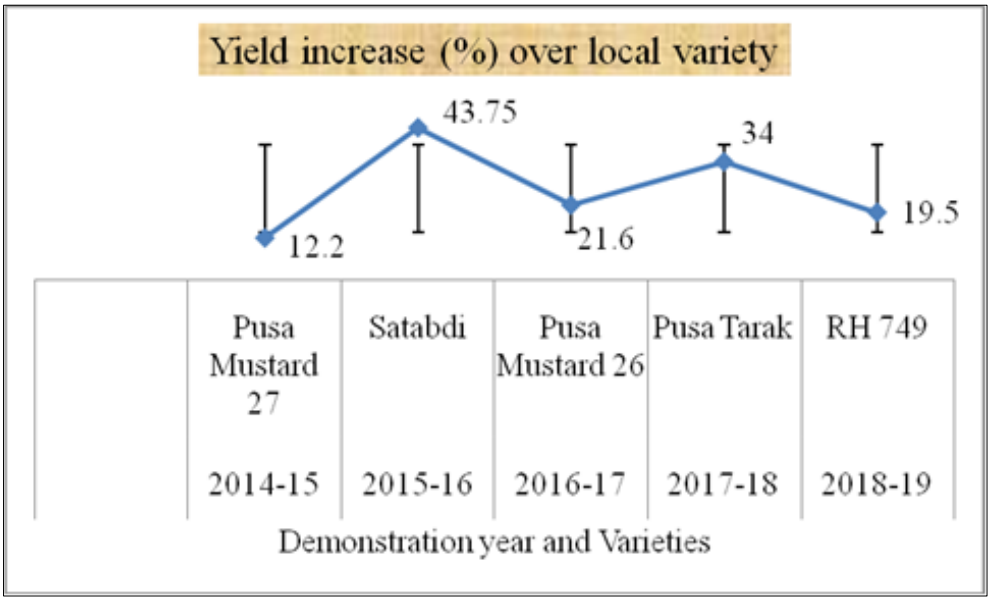


Fig 2: Yield increased under FLDs over traditional variety during 2014-15 to 2018-19

Further analysis of data showed that the yield of mustard for Pusa Mustard 27, Satabdi, Pusa Tarak and RH 749 varieties increased successively which clearly speaks of the positive impact of FLD over traditional varieties (Table 3) in this region. The results indicated that the FLDs has given a good impact among the farmers community of Deoria District as motivated by the recently introduced high yielding varieties in the farmer fields.

The extension gap ranging between 210 and 631 kg/ha (Table 4) during the study period emphasized the need to educate the farmers through various means for the adoption of HYV to reverse this trend of wide extension gap. Similar data presented by Meena *et al*. (2010) [5] reported an extension gap in mustard from 3.36 to 4.64q/ha in south-eastern part of Rajasthan. Moreover, extension gap in frontline demonstration of mustard has also been documented by Afzal *et al*., (2013) [17]. More and more use of latest released high yielding varieties with production technologies will subsequently change this alarming trend of galloping extension gap. The new technologies will eventually lead to the farmers to terminate of old varieties with the new technologies.

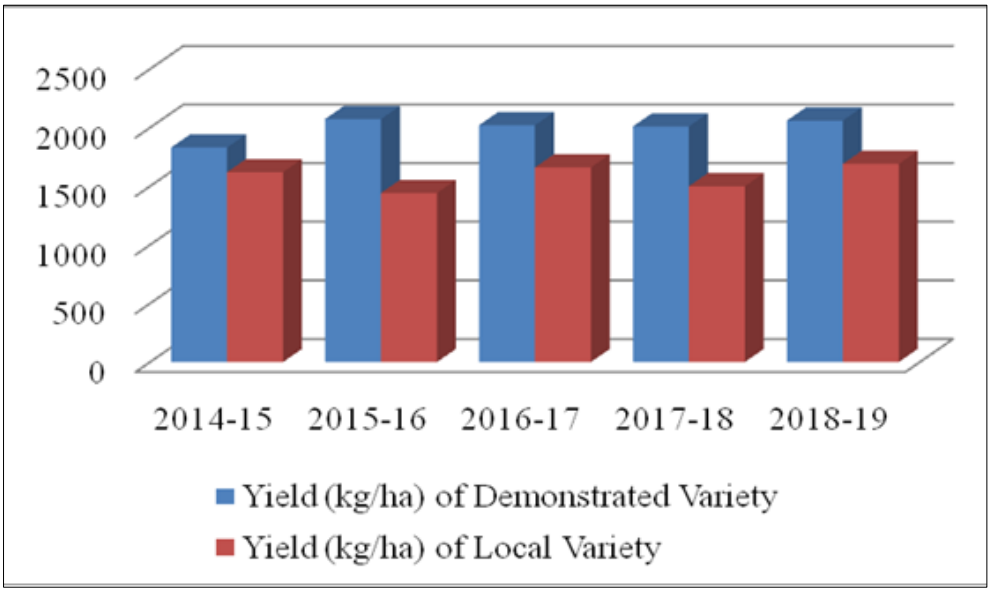


Fig 3: Average yield of demonstrated and tradition variety under FLDs during 2014-15 to 2018-19

4. Economic analysis

The data presented in Table 3 the gross return of demonstrated varieties was recorded highest as compared to grown traditional varieties during five year study period from 2014-15 to 2018-19. The average maximum gross return (Rs 84840) was found in RH 749 variety of mustard in the year 2018-19 followed by Rs 81054 in Satabdi variety of mustard in the year 2015-16. Further data showed in Figure 5 the demonstrated technology showed an increased net profit of 24.74 to 78.29% over the traditional varieties during the five year demonstration period. Similar results were reported by Singh *et al*. (2014) [16] in Chickpea. The highest net profit (Rs

53609) was obtained under front line demonstration of Satabdi variety of mustard in the year of 2015-16 and second highest Rs 53160 in RH 749 variety of mustard in the year of 2018-19. The lowest net profit was recorded Rs 32935 under front line demonstration of Pusa Mustard 27 variety of mustard in the year 2014-15. The increase net profit 78.29% under front line demonstration of Satabdi variety of mustard in the year of 2015-16 than the traditional variety of mustard.

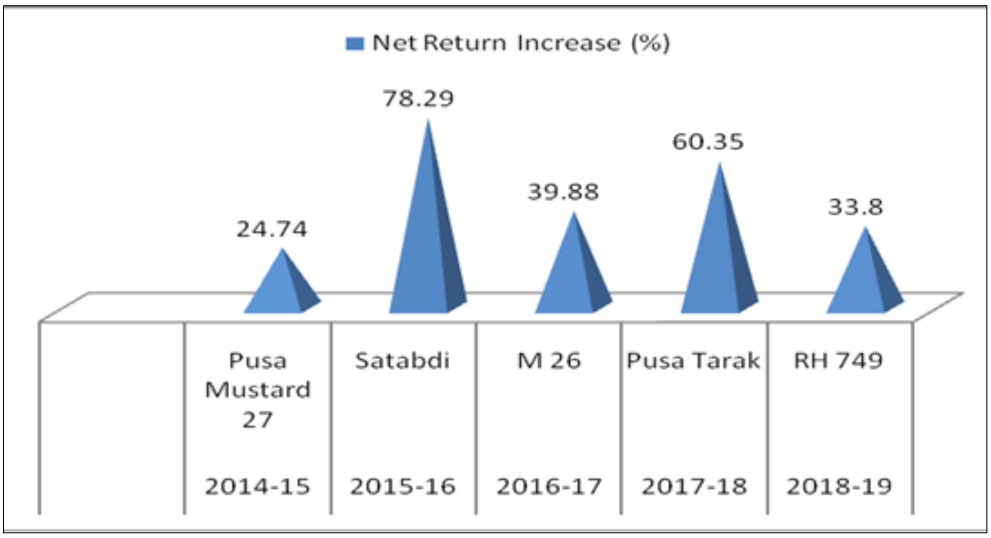


Fig 4: Net return increased of demonstrated technology over tradition variety under FLDs during 2014-15 to 2018-19

Therefore, the data (Table 3) indicated the maximum benefit-cost ratio (2.9:1) was obtained under front line demonstration of mustard varieties namely Satabdi and Pusa Tarak in the year 2015-16 and 2017-18 respectively. Similar findings were reported by Balai *et al*., (2012) [3] in mustard and Sharma (2003) [14] in Moth bean. All three varieties Satabdi, Pusa Tarak and R H 749 of mustard were found to be economically most beneficial in eastern uplands of Utter Pradesh. Thus, Progressive farmers should adopt these varieties with good agricultural practices for reduced cost of cultivation and gave more and more profit in the mustard production. The favorable benefit cost ratio proved the economic viability of the intervention made under demonstration and convinced to the farmers on the utility of intervention.

Table 3: Average gross return, net profit and B:C ratio of mustard varieties grown under FLDs and traditional varieties

Year	Variety	Economics of Demonstration (Rs/ha)				Economics of Farmers Practices (Rs/ha)			
		CC	GC	NR	B:C	CC	GC	NR	B:C
2014-15	PM 27	25625	58560	32935	2.2:1	25438	51840	26402	2.0:1
2015-16	Satabdi	27445	81054	53609	2.9:1	26315	56382	30067	1.2:1
2016-17	PM 26	26760	74740	47980	2.7:1	27120	61420	34300	2.2:1
2017-18	Pusa Tarak	27340	80400	53060	2.9:1	26910	60000	33090	1:2.2
2018-19	RH 749	31680	84840	53160	2.6:1	31250	70980	39730	2.2:1

CC= Cost of cultivation, GR- Gross Return, NT= Net Return, B:C= Benefit-Cost Ratio

5. Conclusion

Showcasing of proven technologies through FLDs increased the yield potential of mustard to a great extent in eastern eco-region of Utter Pradesh. The results of front line demonstration credibly brought out that the yield of mustard could be increased by 12.2 to 43.75% with the intervention on HYV, techniques of crop production and its better management. From the above findings it can also be concluded that use of scientific method of mustard cultivation reduced the extension gap to a considerable extent. This will substantially increase the income as well as the livelihood of the farming community. There is a need to adopt multi-pronged strategy that involves enhancing mustard production through HYV in eastern plains of UP. This should be brought to the access of farmers through transfer of technology center like KVKs and line departments.

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