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Appraisals of technical interventions to boost okra [*Abelmoschus esculentus* (L.) Moench] productivity in eastern Uttar Pradesh

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Abstract
In the next years, it will be crucial to increase vegetable output to meet the growing population's nutritional needs. The major goal of using enhanced technologies is to boost production and farmer's income. The emergence of high yielding cultivars that are resistant to the Okra Leaf Curl and Yellow Vein Mosaic viruses is one example of this. The Krishi Vigyan Kendra (ICAR-IIVR), Deoria, front-line demonstrations on okra Leaf Curl Virus and Yellow Vein Mosaic Virus resistant variety Kashi Kranti with improved technologies were carried out throughout Zaid season of 2019–20 and 2020–21. 40 front-line demonstrations in total were held on 3.2 ha. of land at certain farmer's fields in the Eastern Uttar Pradesh district. Data on output from demonstrated techniques, as well as farmer practices, were gathered. Okra pod yield, cultivation costs, net returns, and benefit-cost ratios were calculated for the aim of the investigation upon the yield and economic performance of frontline demonstrations. Results indicate that the yield of okra ranged from 132.2 to 138.6 q/ ha in demonstration plots against 104.6 to 113.7q/ ha in the farmer's practice plot in both years of demonstration. An average yield of 135.4 q/ ha was obtained for demonstration plots as compared to109.15q/ha in farmers' practice plots in the same years. The benefit cost ratio of tomatoes ranged from 4.44 to 4.75 in demonstration plots and from 3.88 to 4.04 in farmer's practice plots during both years of demonstration, with an average of 4.60 in demonstration and 3.96 under farmer's practices. On average, a technology index of 3.28 percent was observed during both the years of the FLD programme, which shows the effectiveness of technical interventions.

Keywords: Technical interventions, boost okra, *Abelmoschus esculentus* (L.) Moench

Introduction
Vegetables are utilized in our everyday diets and can be eaten as food or as part of spicy snacks. They also play an essential role in human nutrition. India is the world's second largest vegetable grower in the world. To ensure the nutritional security of the country's expanding population in the upcoming years, it is necessary to increase the output and productivity of vegetable crops. Okra (*Abelmoschus esculentus* L.) or lady's finger, a member of the Malvaceae family, is popular in India for its tender and immature green fruits, which are usually consumed as vegetables. Dhaliwal (2010) [2]. Okra fruits are rich in iron, phosphate, calcium, protein, and the vitamins A, B, and C. Because of the high iodine content, it is used to treat goiter. Prior to the manufacturing of jaggery and sugar, cane juice is also cleaned using the root and stem of the okra plant (Kumar *et al*., 2013) [3]. In several nations throughout the world, coffee is replaced by roasted okra seeds. Due to the enough fiber, the developed fruits and stem are used in the paper industry.

The world's largest producer of okra is India. Okra was produced in India on 0.521 million ha, yielded 6212 MT, and had a productivity of 119.27 q/ha (NHB, 2020). Due to its substantial export proportion of fresh vegetables, okra has a considerable potential for generating foreign currency. Vegetable producers love it because it can handle a broad range of growing conditions, but because they don't know about new technology, they don't use the best production procedures. Farmer perceptions of "seeing and believing" in general make front line demonstration one of the most effective extension techniques. The use of high yielding varieties resistant to the okra leaf curl virus (OLCV) and the yellow vein mosaic virus (YVMV) as well as adaptation of suggested packages and practices with the use of more or less expenditure that resembles farmers' practices are just a few of the improved technologies that have been adopted. It was believed that the impact of FLD performed by KVK (ICAR-

IIVR) Deoria over two consecutive years from 2019–20 to 2021–2022 would be assessed in order to successfully extend FLD and disseminate okra production technology. Therefore, the current study was done with the particular goals of evaluating technological performance in terms of acceptance of suggested Okra production technology and learning about the effects of FLD on farmers that cultivate vegetables.

Materials and Methods

The current study was carried out by Krishi Vigyan Kendra (ICAR-IIVR), Deoria district, during the Zaid (summer) seasons 2019–20 and 2020–21 to illustrate how new improvements may increase production and profit. In this regard, forty front-line demonstrations of the recommended production methods for the Kashi Kranti variety of Okra were carried out on 3.2 ha. of land at a farmer's field in the Deoria region of Eastern Uttar Pradesh. The soil types of the demonstrated plots ranged from medium to good fertile sandy loam in irrigated conditions. A list of farmers who participated in FLDs on the okra vegetable during the summers of 2019–20 and 2020–21 was developed in order to choose the benefit farmers. The applied production technologies in demonstrated and farmer practices plots are described in Text box 1 were gathered Data on okra green pod yield, gross cultivation costs, net returns, and benefit-cost ratios were calculated for the objective of the investigation subsequent to the yield and economic performance of frontline demonstrations. From the data recorded, the percent increase in yield, extension gap, technology gap, technology index was calculated using the formula as suggested in Papnai *et al*., (2017) [8].

Increase in yield (%) = Yield of demonstration plot - yield farmer's practice plot x 100 / yield farmer's practice plot

Technology gap = Potential yield of the variety - Yield of demonstration plot

Extension gap = Demonstration yield - yield farmer's practice plot

Technology index = Potential yield of the variety - Demonstration yield x 100 / Potential yield of the variety

Text Box 1: Level of use and gap in adoption of Okra technologies during 2019-20 to 2020-21

Crop operations	Improved package of practices	Farmers practices	Gap
Variety	Kashi Kranti	Parbhini Kranti	-
Seed Rate	12 kg/ha	16 kg/ha	-
Seed Treatment	Seed was treated by imidacloprid 70 SL@ 0.3 gm/ kg seeds	Not in practice	Full gap
Sowing Method	Sowing on ridges 60 cm x 20 cm apart	Sowing without spacing maintain	Partial gap
Sowing Time	Third week of February	March-April	Partial gap
Fertilizer Dose	Fertilizer @ 100 Kg N, 50Kg P_2O5 and 50Kg K_2O/ha	Imbalance application of feriliser	Partial gap
Weed control	Pendimethalin @ 1 liter a.i./ ha was applied within 48 hrs after sowing. + I hand weeding	No ues of herbicide /Hand weeding	Partial gap
Plant Protection	Need base application of pesticide in recommended dose	Improper dose and frequent application of pesticides	Partial gap

Results and Discussion

Yield Interpretations

Data presented in Table-1 and depicted in Fig. 1 clearly indicate that the high average yield in demonstration plots over the years compare to farmer's practice due to implementation of full package of practices i.e. use of high yield yielding resistant variety, recommended dose of fertilizers, seed treatment, sowing time and method, timely application of plant protection measures and weed control. The increment in yield ranged 26.4 to 21.89 percent. The percent increase in yield over farmers practice was highest (26.04) during 2019-20. The average yield of okra is recorded from demonstration plots (13.4 q/ ha) against farmer's practice (109.15 q/ ha) which is enhanced by 24.15 percent.

Table 1: Yield gap analysis of the okra under demonstrated technologies

Year	Yield (q/ha)			% Increase in yield	Extension gap (q/ha)	Technology gap (q/ha)	Technology Index (%)
	Potential	Demo	F P				
2019-20	140	132.2	104.6	26.42	27.6	7.8	5.57
2020-21	140	138.6	113.7	21.89	24.9	1.4	1.00
Average	140	135.4	109.15	24.15	26.25	4.6	3.28

The above findings are in similarity with the findings of Bhati *et al*., (2021) [1] in vegetable crops. Similarly yield enhancements in frontline demonstrations were documented by Mishra *et al*. (2014) [6], Meena *et al*., 2020 [4], Srivastava *et al*., 2022 [9], and Meena *et al*., (2022) [5] in other crops. However, the variations in the yield of okra in different years might be due to the variations in environmental factors like soil fertility, moisture availability, rainfall, etc, and the change in the location of demonstrations every year. The results indicated that The farmers were generally not adopted technologies to get the maximum yield and profit due lack of knowledge and awareness.

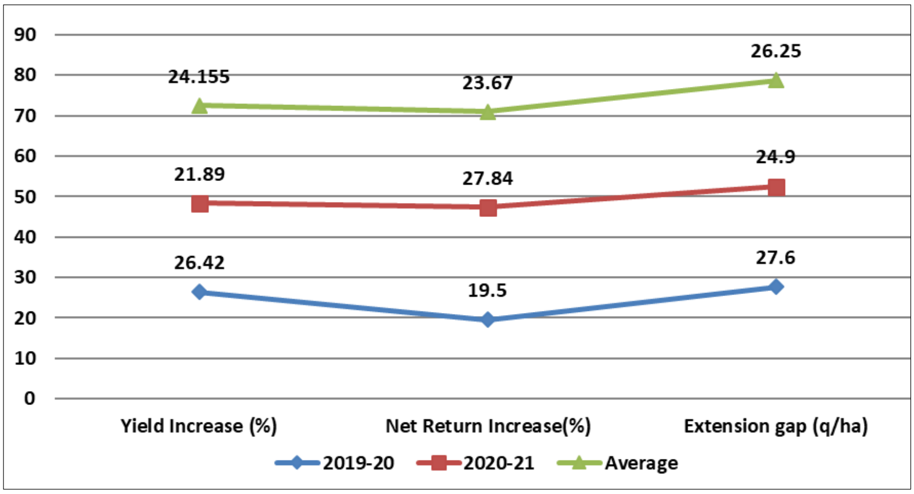

Fig 1: Increase in Yield and net return (%) and yield gap q/ha in Demonstration

Extension gap

Extension gaps of 27.6 and 24.9 q/ha were noted in the years 2019–20 and 2020–21, respectively, while the average extension gap under both years of the FLD program was 26.25 q/ha (Table 1). This highlighted the need to educate the farmers through a variety of techniques for the adoption of improved agricultural production technologies to reverse this trend of wide extension gaps.

Technology gap

The shown variety's potential yield and the yield differential in the demonstration indicate the technological gap. In 2019–20 and 2020–21, the technology gap was 7.1 and 1.4 q/ha, respectively. Under both FLD programs, the average technology gap was 4.6 q/ha. Similar findings have been obsered by Singh *et al*. (2011) [10] and Mishra *et al*. (2014) [6]. This could be caused by the area's climatic conditions, the productivity of the land, and the management abilities of certain farmers. Therefore, to close these gaps, location-specific suggestions are required.

Technology index

The technology index reflects the potential of a farmer's field-tested technology from an economic standpoint. According to Table 3, the technology index ranged from 5.57 to 1.0. During the two years of the FLD program, an average technology index of 3.28 percent was seen, demonstrating the efficacy of technological interventions. The utilization of high yielding variety awareness package of practice during the study time may be the cause of the increased range of technology. This expedites the deployment of tried-and-true technological approaches to boost okra's 26.42 and 21.89 percent yield performance. According to Singh *et al*. (2011) [10] and Mishra *et al*. (2014) [6], these results are consistent.

Economic interpretations

Some economic indicators, such as the cost of cultivation, net return, and B: C ratio, have been calculated to determine the financial feasibility of the demonstration technologies irrespective of farmer practice. The economic feasibility of enhanced proven technology over farmers' practices was assessed based on current input and output costs and expressed in terms of the B: C ratio (Table 2). The cost of producing okra under demonstration ranged from Rs 48,000 to 48,200/ha, with an average of Rs. 48,100, as opposed to Rs 48,000 to 46,450, with an average of Rs. 47,225 under Farmer's practice. The greater cost of the demonstration was mostly due to the increased cost of fertilizers, procurement of better seed, and other expenses.

Table 2: Analysis of economics of okra under FLD and farmers practice during 2019-20 to 2021-22

Year	Yield (qt/ha)		Economic of Demonstration (Rs)				Economic of FP (Rs)			
	FLDs	F P	Gross Cost	Gross Return	Net Return	B:C	Gross Cost	Gross Return	Net Return	B:C
2019-20	132.2	104.6	48000	213300	165300	4.44	48000	186330	138330	3.88
2020-21	138.6	113.7	48200	228900	180700	4.75	46450	187800	141350	4.03
Average	135.4	109.15	48100	221100	173000	4.60	47225	187065	139840	3.96

Okra farming using upgraded technology generated higher net returns of Rs. 1,65,300, 1,80,700/ha in 2019-20, 2020-21, respectively, with an average net return of Rs. 1,73,000/ha, compared to 1,39840/ha in farmer's practices. During both years of demonstration, the benefit cost ratio of okra varied from 4.44 to 4.75 in demonstration plots and from 3.88 to 4.04 in farmer's practice plots, with an average of 4.60 in demonstration and 3.96 in farmer's practices (Table 2). This might be attributable to increased yields and reduced cultivation costs under enhanced technology compared to farmers' practices. This finding is consistent with Singh *et al*., (2011) [10] and Mishra *et al*. (2014) [6] in tomato and Meena *et al*., 2020 [4], Srivastava *et al*., 2022 [9], and Meena *et al*., (2022) [5] in other crops. During both years of research, the B:C ratio was shown to be greater during demonstrations against Farmer's practice. Scientific okra production methods can significantly minimize the technological gap, resulting in higher okra yield in the area and, in turn, better economic conditions for producers. Furthermore, local extension offices must give adequate technical assistance. the farmers through different educational and extension methods to reduce the extension gap for better okra production in the Estern Uttar Pradesh.

Conclusion

The FLD resulted in a major positive outcome and gave a chance to show the productivity potential and profitability of the most recent technology (Intervention) in a real-world agricultural context. As a result of the findings, the research finds that FLDs done by KVK, Deoria had a substantial influence on the horizontal spread of this technology. As a result, a targeted training program on enhanced okra production technology, as well as repeated demonstrations, are necessary to increase producers' knowledge and abilities, which aid in technology adoption.

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