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Impact of Front Line Demonstration on Yield and Economics of Tomato (*Solanum lycopersicum* Mill.) in Mamit District of Mizoram

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The goal of the current study was to determine the yield gap on the tomato crop using FLDS. During the Rabi seasons 2019–20 and 2020–21, the Krishi Vigyan Kendra, Mamit District, held frontline demonstrations in various parts of the district. With the aim of advancing technology for increased tomato production potential, 30 farmers were chosen to participate in front-line demonstrations of tomato production on 15 hectares. The use of the high-yielding tomato variety Arka Samrat, the application of fertiliser and manures based on a report from a soil test, integrated pest and disease management, etc. are some examples of the improved technology. Prior to and following the frontline demonstration, the respondents' basic information was gathered through personal interviews using a well-structured interview questions. Data on output was gathered from FLDs and local plots regarding the yield and economic performance of frontline demonstrations. Finally, the total yield, percentage increase in the yield, extension gap, technology gap, technology index, and cost of cultivation, as well as net returns and benefit cost ratio, were calculated. The demonstration's outcomes demonstrated that farmers may significantly boost tomato yield by switching to a better variety and implementing sound farming methods. The findings from the current study showed that the mean yield, which ranged from 434 to 452 q/ha, was 443 q/ha. The yield increased by 15.89 percentage points over the farmer's usual practise. The extension gap and

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technology gap, with a technology index of 80.66% over the demonstration years, ranged from 55.0 to 66.0 and 348 to 366 q/ha, respectively. In addition, compared to the farmer's practise, the displayed plots provided a higher gross return, net return, and benefit-cost ratio.

Keywords: Tomato; FLDs; Arka Samrat; yield; economics; technology gap; extension gap.

1. INTRODUCTION

A significant vegetable crop grown all year long in tropical, subtropical, and temperate regions of the world is the tomato (Lycopersicon esculentum Mill.). It is mostly employed in processing as well as fresh markets. It is a significant source of vitamins A, C, and lycopene, which gives ripe tomatoes their red colour and is thought to have anti-cancer qualities. Additionally, it operates as a natural antioxidant since ascorbic acid effectively scavenges superoxide, hydrogen peroxide, singlet oxygen, and other free radicals, while beta-carotene functions to help prevent and neutralise free radical chain reactions. In Dhaliwal [1]. India is behind China in terms of both output and area (0.78 million acres) (19.37 million metric tonnes). However, India (25 t ha-1) was in tenth place in terms of productivity according to FAOSTAT [2]. Tomatoes were grown in Mizoram on 1470 ha of land, yielding 11870 t. [3]. The Mamit district offers numerous opportunities for tomato farming. Front Line Demonstration's (FLD) primary goal is to introduce suitable agricultural practises, such as high-yielding varieties and good agricultural practises, in order to persuade farmers and extension agents of the potential of high-yielding new varieties and improved production technologies to increase tomato yield in preparation for further widespread dissemination.

2. MATERIALS AND METHODS

Thirty farmers were chosen for frontline demonstrations on the tomato variety Arka in the Mamit district for the years 2019–2020 and 2020–21 by Krishi Vigyan Kendra, Mamit. In the Mamit district, samrat was done in a farmer's field. Farmers received the essential inputs and used them in accordance with the package of tomato crop management practises advised by ICAR-IIHR Bangalore. According to Table 1, the details on the demonstrated set of activities and farmer's practises were followed. Subject Matter Experts from Krishi Vigyan Kendra, Mamit, regularly observed demonstrations at farmers' farms, from seeding to harvesting and sale. A total of 30 farmers were included in the sample, chosen at random from three villages (Darlak, Lengte, and Lengpui). Prior to and following the frontline demonstration, the respondents' basic information was gathered through personal interviews with the use of a carefully planned interview schedule. The district's horticulture department's extension officers, scientists, and specialists were consulted in order to design the interview schedule. The beneficiary farmers received skill training on a variety of technology interventions to be used in tomato farming before the demonstration commenced [4,5].

Data on output was gathered from local plots as well as FLDs regarding the yield and economic success of frontline demonstrations. Finally, the benefit-cost ratio was used to calculate the overall yield, cultivation costs, and net returns. Data on exhibited plot yield was gathered utilising frontline demonstrations conducted in farmer fields while being closely supervised by SMSs from Krishi Vigyan Kendra, Mamit in several districts. Additionally, data on the actual yield that the farmers on their farms under their own management strategies achieved was gathered. The acquired information was organised, collated, categorised, and evaluated in terms of a mean percent score and rank in relation to the goals of the study. These data were used to calculate the yield gaps between prospective yield and demonstration plot yield (Yield gap-I), actual yield or yield under current practise (Yield gap-II), and total yield gap (the difference between potential yield and actual yield). Using the formula proposed by Samui et al. [6], the extension gap, technology gap, and technology index were computed.

Table 1. Details of the technical actions taken in support of agricultural practises and demonstration

Crop management	FLD (Demonstrated Package)	Farmers Practice (Local Check)	Gap
Variety	Arka Samrat	Samruddhi	Full gap
Soil testing	Have been done in all locations	Not in practice	Full gap
Seed rate	100 g/ha	200 g /ha	Partial gap
Transplanting method	Transplanting in raised bed distance Row to Row 120 cm & Plant to Plant 90 cm	Flatbed transplanting Row to Row 60 cm & Plant to Plant 30 cm	Partial gap
Transplanting time	First Fortnight of November	First Fortnight of November	No gap
Fertilizer dose	Application of manure and fertilizer base on soil test report	without recommendation	Partial gap
Weed management	Pendimethaline @ 1.0 Kg/ ha was applied immediately after transplanting.	Hand weeding/rarely used	Partial gap
WSF Spray	Foliar spray of 2% N:P:K 19:19:19 20,40,60 DAT	No application	Full gap
Plant protection	IPM	application of chemicals without knowledge	Partial gap

Technological gap (yield gap-I) = Potential yield - Demonstration plot yield
Extension gap (yield gap- II) =Demonstration - Actual yield (Farmers plot yield practice)
Total yield gap = Potential yield - Actual yield.
Technology index (%) = Technology gap/Potential yield x 100

3. RESULT AND DISCUSSION

The following topic is a summary of the findings from the current study and appropriate discussion.

3.1 Growth Attributes and Yield

A comparison of growth attributes and yield performance between demonstrated practices and local checks is shown in Table 2. Results indicated that the FLD recorded fewer days taken to 50% flowering (36.14), fewer days to first harvest (87.00), and a higher number of fruits per plant (29.33), average fruit weight (83.60 g), fruit length (5.92 cm), and fruit girth (5.56 cm) (5.27), when compared to farmers' practices, which were days taken to 50% flowering (38.71), fewer days to first harvest (92.00), number of fruits per plant (26.66), average fruit weight (76.50g), fruit length (5.64 cm), and fruit girth (5.32 cm) recorded in farmers' practices Singh et al. [7], Choudhary et al. [8], Misra et al. [9] and Chanthini et al. [10] reported similar results.

Table 2. Pooled data (2019-20 & 2020-21) of FLD on growth attributes and yield of tomato

Sl. No.	Parameter	Demonstration	Farmers Practices
	Days to 50% flowering	36.14	38.71
	No. of fruit per plant	29.33	26.66
	Days to first harvest	87.00	92.00
	Average fruit weight (g)	83.60	76.50
	Fruit length (cm)	5.92	5.64
	Fruit girth (cm)	5.56	5.32

3.2 Yield Gap

In Table 3, the yield gaps are presented. The potential yield of the tomato variety Arka Samrat was determined to be 800.00 q/ha, and the yield from the demonstration plot was consistently higher than that of the local check in both of the study's years (2019-20 and 2020-21), which were measured at 434 q/ha and 452 q/ha, respectively. In contrast, the farmers' actual yield from their farm in 2019–20 and 2020–21, using their own management techniques, was 368 q/ha and 397 q/ha, respectively. Due to good management methods like the introduction of high-yielding varieties, integrated fertiliser management, weed management, irrigation management, and IPM practises, it performed well in demonstration plots. Accordingly, the FLD may benefit the local farming community by increasing yield by 66.00% in 2019–20 and 55.00% in 2020–21, respectively, over the local check, according to Kumar et al. [4]. The results show that the frontline demonstrations benefited the farming community in the Mamit district, as they were inspired by the new, high-yielding variety and other beneficial agricultural techniques used in the FLD plots. The results of Singh et al. 8], Choudhary et al. [9], Sahoo et al. [10], Singh [11], and Misra et al. [9] are in agreement with this finding. Identifying the yield gaps, which were further divided into technological and extension gaps, involved comparing the yield of the front line demonstration trials and the potential yield of the crop [12].

3.3 Technology Gap

The demonstration yield vs potential yield gap, which was 6.85 and 6.48 in 2018–19 and 2019–20, respectively, is known as the technological gap (Table 4). The disparity in soil fertility, irregular rainfall, and other weather phenomena could be to blame for the technological divide [13] (Table 4).

3.4 Extension Gap

The variation or gap between farmer practises and the demonstration yield is known as the extension gap (control). The extension gap during the study period was 4.85 to 5.12 q/ha (Table 4). This extension gap should be attributed to the demonstration practises' use of enhanced transfer technology, which produced a larger head yield than what traditional farmer practises would have produced. This highlighted the requirement for farmers to be better educated via a variety of channels for increased adoption of enhanced high yielding varieties and recently upgraded agricultural technologies to close the substantial extension gap. Kumar et al. [4] and Sunitha et al. [12] The troubling trend of a rising extension gap will be reversed if farmers utilise new, high-yielding varieties more frequently. The new technology will eventually cause farmers to disregard existing varieties in favour of new technologies. This result is in line with that of Hiremath and Nagaraju [13].

Table 3. Yield and yield difference of Field pea under front line demonstrations

Year	No. of FLDs	Yield (q/ha)		Additional yield over local check (q/ha)	Per cent increase yield over local check
		FLD	Local Check		
2019-20	30	434.00	368.00	66.00	17.93
2020-21	30	452.00	397.00	55.00	13.85
Mean	30	443.00	382.50	60.50	15.89

Table 4. Yield gap and technology index in front line demonstrations

Year	No. of FLDs	Technology gap (q/ha)	Extension Gap (q/ha)	Technology Index (%)
2019-20	30	366	66	84.33
2020-21	30	348	55	76.99
Mean	30	357	60.50	80.66

Table 5. Economics of cluster front line demonstration:

Year	Cost of cultivation (Rs/ha)		Gross Return (Rs/ha)		Net Return (Rs/ha)		B: C Ratio	
	FLD	Local Check	FLD	Local Check	FLD	Local Check	FLD	Local Check
2019-20	113000	108000	520800	441600	407800	333600	4.61	4.09
2020-21	116500	111500	542400	476400	425900	364900	4.66	4.27
Mean	114750	109750	531600	459000	416850	349250	4.63	4.18

3.5 Technology Index

A lower rating on the technology index suggests better feasibility of varied and developing technologies in agricultural fields. Between 2019–20 and 2020–21, the technology index decreased from 84.33 to 76.99% (Table 4), demonstrating the higher viability of the exhibited technology. This result supports the findings of Singh [11], Misra et al. [8], and Choudhary et al. [7].

3.6 Economics of Cluster Front Line Demonstration

Economic analysis of yield performance showed that, compared to farmers selling their produce in local marketplaces, FLD participants during the research period earned higher output and higher prices for their produce. The economics of tomato production under active demonstrations are shown in Table 5. The results of the economic analysis of tomato production showed that the mean cost of cultivation increased in the demonstration practise (Rs 1,14,750 per hectare) in comparison to the farmer practise plot check (Rs 1,09,750 per hectare), and higher mean gross returns (Rs 5,31,600/ha) and mean net returns (Rs 4,16,850/ha) in contrast to the farmer practise (Rs 4,59,000/ha) and mean net returns (Rs 3.49,250/ha).

Furthermore, over the duration of the study, the demonstration plot's average benefit-to-cost ratio was higher (4.63), compared to the farmer's practise (4.18). These results are in line with the findings of Kumar et al. [4], Singh et al. [6], Choudhary et al. [7]; Singh. [11], Misra et al. [8]. and Yao et al. [14].

4. CONCLUSION

The study came to the conclusion that the FLD programme is a useful instrument for boosting tomato production and productivity as well as altering farmers' knowledge, attitudes, and abilities. According to the study's findings, the tomato variety Arka Samrat was determined to be superior in terms of enhancing production and productivity; a mean increase in yield was noted. 15.89% outside of bounds The FLD programme is a powerful instrument for improving farmer knowledge, attitude, and skill while also increasing tomato yield and productivity. The idea of frontline demonstration can be applied for all farmer categories, including progressive farmers, in order to promptly and broadly distribute the advised approaches to other farmers as well as to other crops.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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