

Impact of front line demonstration on yield and economics of tomato (*Solanum lycopersicum* Mill.) in Mamit district of Mizoram

Authors' contributions

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

Abstract

The present study was undertaken to find the yield gap through FLDS on tomato crop. The Krishi Vigyan Kendra, Mamit District conducted Frontline demonstration during Rabi season 2019-20 and 2020-21 subsequently in different locations of Mamit district. There were 30 farmers selected for front line demonstrations on tomato conducted on 15ha by the active participation of the farmers with the objective of improved technologies of tomato production potential. The improved technologies consisting use of introduction of high yielding tomato variety Arka Samrat, application of fertilizer & manures base of soil test report and integrated pest and disease management etc. The results of demonstration showed that farmers could increase the tomato productivity notably by switching over to improved variety and adoption of good agriculture practices. The data of present study revealed that an average yield ranging from 434– 452 q/ha with a mean of 443 q/ha. The percentage increase in the yield over farmer's practice 15.89 was recorded. The extension gap and technology gap ranged between 55.0 to 66.0 and 348 to 366 q/ha, respectively, with the technology index of 80.66 per cent during the demonstration years. Besides this, the demonstrated plots gave higher gross return, net return with higher benefit cost ratio when compared to farmer's practice.

Key words Tomato, FLDs, Arka Samrat, Yield, Economics, Technology gap, Extension gap

Introduction

Tomato (*Lycopersicon esculentum* Mill.) is an important vegetable crop is a widely cultivated throughout the year in tropical, subtropical and temperate regions of the world. It is mostly used for both fresh market and processing. It is an important source of vitamin A, vitamin C and lycopene that imparts red colour to ripe tomatoes is reported to possess anticancerous properties. It also serve as a natural anti-oxidant as the Beta-carotene functions to help prevent and neutralize free radical chain reaction and ascorbic acid is an effective scavenger of superoxide, hydrogen peroxide, singlet oxygen and other free radicals (Dhaliwal, 2014). India ranks second in area (0.78 million ha) and production (19.37 million tonnes), next to China. However, in terms of productivity, India (25 t ha⁻¹) ranked in tenth position (FAOSTAT, 2020). In Mizoram tomato was cultivated in 1470 ha area with production of 11870t. (Horticulture Statistics Division, DAC&FW, 2018). There is lot of scope of tomato growing in Mamit district. The main objective of Front line Demonstration (FLD) is to introduce suitable agriculture practices like high yielding varieties, good agricultural practices to convincing farmers and also extension functionaries together about the potential of high yielding new varieties, improved production technologies to enhance yield of tomato for further wide scale diffusion

Materials and Methods

The frontline demonstrations were conducted by Krishi Vigyan Kendra, Mamit in Mamit district during 2019-20 and 2020-21, a total 30 farmers selected for front line demonstrations on tomato variety

Arka Samrat was conducted at farmer's field in the Mamit district. The critical inputs were supplied to farmers and applied as per the package of practices for Broccoli crop recommended by ICAR- IHR Bangalore. The information on demonstrated package of practices and farmers practices followed as mentioned in Table 1. Demonstrations at farmer's fields were regularly monitored by Subject Matter Specialists of Krishi Vigyan Kendra, Mamit from sowing to harvesting and marketing. Randomly 10 farmers from three villages were selected to making a total sample size of thirty. Basic data of the respondents were collected before and after frontline demonstration by personal interview with the help of well-structured interview schedule. The interview schedule was developed through discussion with experts, scientist and extension officers of horticulture department in the district. Before initiating the demonstration, the beneficiary farmers were given with skill training on various technological interventions to be followed in tomato cultivation Kumar et al. [4]. The details of technology demonstrated are as below (Table 1).

Table 1. Details of technological interventions followed under farmer's practices and demonstration

Crop operations	Frontline (Demonstrated Package)	Demonstration	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

The yield and economic performance of frontline demonstrations, the data on output were collected from FLDs as well as local plots and finally the head yield, cost of cultivation, net returns with the benefit cost ratio was worked out. Data collected on demonstrated plot yield was obtained using the data from frontline demonstrations conducted in the farmer's field under the close supervision of SMSs from Krishi Vigyan Kendra, Mamit in different locations of the district. Further, information on actual yield obtained by the farmers on their farms under their own management practices was collected. The gathered data were processed, tabulated, classified and analyzed in terms of mean percent score and ranks in the light of objectives of the study. Using these data the differences between potential yield and demonstration plot yield (Yield gap-I), difference between demonstration plot yield and actual yield or yield under existing practice (Yield gap- II) and difference between potential yield and actual yield

(Total yield gap) were worked out. The extension gap, technology gap and technology index were calculated using the formula as suggested by Samui et al., (2000).

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

The results obtained from the present investigation as well as relevant discussion have been summarized under following head:

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 less days taken to 50% flowering (36.14), days to first harvest (87.00), and higher number of fruit per plant (29.33), average fruit weight (83.60g) ,fruit length (5.92cm), fruit girth (5.56cm) (5.27) when compared to farmers practices which were days taken to 50% flowering (38.71), days to first harvest (92.00), number of fruit per plant (26.66), average fruit weight (76.50g) ,fruit length (5.64cm), fruit girth (5.32 cm) recorded in farmers practice Singh et al. [7], Choudhary et al. [8] and and Misra et al. [12] reported similar result.

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

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

3.2 Yield Gap

The yield gaps are presented in Table 3. The potential yield of tomato var. Arka Samrat was found to be 800.00 q/ha and the demonstration plot yield was sustainable higher than that in the local check in all the years of the study (2019-20 and 2020-21) which was recorded 434 q/ha & 452 q/ha by frontline demonstrations during 2019-20 and 2020-21 respectively. Whereas the actual yield obtained by the farmers on their farm with their own management practices was 368 q/ha & 397 q/ha during 2019-20 and 2020-21 respectively. It performed better in demonstration plots due to good management practices like Introduction of high yielding variety, integrated nutrient management, , weed management, irrigation management and IPM practices. Thus the FLD might have a positive impact on farming community in the district by enhancing yield to a tune of 66.00% during 2019-20 and 55.00 % during 2020-21 respectively, over the local check Kumar et al. [4]. The findings demonstrate that the front line demonstrations had a positive impact on the Mamit district farming community, as they were motivated by the the new high yielding variety and other good agricultural practises used in the FLD plots. This finding is in corroboration with the findings of Singh et al. [7], Choudhary et al. [8]; Sahoo et al. [9] Singh [10] and Misra et al. [12].

“Yield of the front line demonstration trials and potential yield of the crop was compared to estimate the yield gaps which were further categorized into technology and extension gaps” [14].

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

3.3 Technology Gap

“The technology gap is the difference or gap between the demonstration yield and potential yield and it was 6.85 and 6.48, 2018-19 and 2019-20 respectively (Table 4). The technological gap may be attributed to the dissimilarity in the soil fertility status, acidity to erratic rainfall and other vagaries of weather conditions” [15] (Table 4).

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

3.4 Extension Gap

“The extension gap is the difference or gap between demonstration yield and farmers practices (control). Extension gap ranged from 4.85 – 5.12 q/ha during the period under study (Table 4). This extension gap should be assigned to adoption of improved transfer technology in demonstrations practices resulted in higher head yield than traditional farmer practices. This emphasized the need to educate the farmers through various means for more adoption of improved high yielding varieties and newly improved agricultural technologies to bridge the wide extension gap [11, 16]. Kumar et al. [5] Farmers' increased use of new high-yielding varieties will help to reverse the alarming trend of a widening extension gap. Farmers will eventually ignore old varieties in favour of new technologies as a result of the new technologies. This finding is consistent with Hiremath and Nagaraju's findings [6].

3.5 Technology Index

The technology index indicates the feasibility of various and evolving technologies in farmer's fields, with a lower value indicating greater feasibility. The technology index was reduced from 84.33 to 76.99 per cent during 2019-20 to 2020-21 (Table 4) which shows the higher feasibility of the demonstrated technology. This finding corroborates results of Choudhary et al. [8]; Misra et al. [12] and Singh [10]

3.6 Economics of Cluster Front Line Demonstration

Economic assessment of yield performance demonstrated that during the research period, participating farmers in FLDs not only obtained higher output but also higher prices for their food compared to those in local markets Table 5 depicts the economics of tomato production under front-line demonstrations. The results of economic analysis of tomato production revealed that mean cost of cultivation increased in demonstration practice (Rs 1,14,750/ha) as compared to farmers practice plot check (Rs 109750 /ha) and it was recorded higher mean gross return (Rs. 5,31,600 /ha) and mean net returns (Rs. 4,16,850/ha) whereas in farmers practice the mean gross returns (Rs 4,59,000 /ha) and mean net returns (Rs 3.49,250 /ha). And with the average benefit: cost ratio of demonstration plot (4.63) compared to the farmers practice (4.18) over the study period. These results are in line with finding of Kumar et al.[4], Singh et al [7]; Choudhary et al. [8]; Singh. [10] and Misra et al. [12].

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

4. CONCLUSION

The study concluded that the FLD programme is an effective tool for increasing the production and productivity of tomato and changing the knowledge, attitude and skill of the farmers. The study concluded that the tomato variety Arka Samrat with good management practices management practices was found superior in term of increasing production and productivity, the mean increment in yield of was recorded. 15.89% over control The FLD programme is an effective tool for increasing the production and productivity of tomato and changing the knowledge, attitude and skill of the farmers. To quickly and widely disseminate the advised techniques to other farmers as well as to other crops, the concept of frontline demonstration can be used to all farmer categories, including progressive farmers.

COMPETING INTERESTS

Authors have declared that no competing interests exist

Reference

1. FAOSTAT. 2020. "Production – Crops – Area harvested / Production quantity – Tomatoes – 2018", *FAO Statistics online database*, Food and Agriculture Organization, Rome, www.fao.org/faostat/en (accessed on 28 July. 2021).
2. Horticulture Statistics Division, Department of Agriculture, Cooperation & Farmers' Welfare Ministry of Agriculture & Farmers' Welfare, Government of India (2018) *Horticultural Statistics at a Glance 2018*.pp 203 [https:// www.agricoop.nic.in](https://www.agricoop.nic.in)
3. Dhaliwal, M.S. 2014. Handbook of vegetables crops, Kalyani Publishers, Pp. 38-39.
4. Kumar S, Nongthombam J, Chaudhary KP, Prakash O, Swaroop J. Economics and impact of FLD on broccoli yield at farmers filed of Aizawl District Mizoram. *Agro-Economist*. 2018;5(2):81-86.
5. Samui SK, Maitra S, Roy DK, Mondal AK, Saha D. Evaluation on frontline demonstration on groundnut (*Arachis hypogaea* L.). *J. Indian Soc. Coastal Agric. Res.* 2000;18(2):180-183
6. Hiremath SM, Nagaraju MV. Evaluation of front line demonstration trials on onion in Haveri district of Karnataka. *Karnataka J Agric Sci.* 2009; 22(5):1092-1093
7. Singh N.K., Singh Mrigendra, Bisen Sharad, Bhandarkar A.P. Yield Gap Analysis, Economics, Adoption and Horizontal Spread of Tomato Cultivation through Front Line Demonstration in Seoni District of Madhya Pradesh, India. *Int.J.Curr.Microbiol.App.Sci.* 2018; 7(5): 2720-2726
8. Choudhary Madan Lal, Soni Rameshwar Lal ,Roat B.L Impact of front line demonstration on yield and economics of tomato (*Solanum lycopersicum* Mill.) in tribal area of Dungarpur district of Rajasthan. *The Pharma Innovation Journal* 2022; 11(6): 612-616

9. Sahoo B. B., Nayak A., Nayak B. S., Mohanty S. K., Mandi N., Prasad G., Das S. ,Khanda C. M. Effect of sowing dates on growth, yield and economics of tomato (*Solanum lycopersicum* L.) hybrids in western undulating zone of Odisha *Journal of Crop and Weed*, 2021;17(2): 98-105
10. Singh Dilip Impact of Front Line Demonstrations on the Yield and Economics of Tomato in Bharatpur District of Eastern Rajasthan, India *Int.J.Curr. Microbiol. App. Sci* 2017; 6(6): 1556-1561 1556
11. Sunitha CH1, Chinnam Naidu D2, Raja Kumar N3, Bhagya Lakshimi K4, Chitti Babu G Assessment of tomato (*Solanum lycopersicon* L.) hybrids for performance and adoptability at Srikakulam District, Andhra Pradesh *International Journal of Ecology and Environmental Sciences* 2020; 2(3): 317-319
12. Misra PK, Singh VP, Singh SN, Kumar Pardeep and Pandey MK Impact of front line demonstration in adoption extent and horizontal spread of tomato (*Lycopersicon esculentum* Mill.) cultivation in Tarai region of Siddharthnagar district, Uttar Pradesh, India *Journal of Pharmacognosy and Phytochemistry* 2019; 8(3): 4024-4028

UNDER PEER REVIEW