Original Research Article

Impact Analysis of Tomato through Front Lined Demonstration under Mid Plain Agro-Climatic Zone of Uttar Pradesh.

ABSTRACT

Aims: Tomatoes benefit local farmers because of their excellent storage and truck-gardening capabilities. Because of local demand, tomatoes are a prominent commercial vegetable production in the Bhadohi area. A Frontline demonstration was held to cover the aforementioned possibility and impact of increase farmer earnings.

Study design: NA

Place and Duration of Study: The current study was conducted by ICAR-IIVR - Krishi Vigyan Kendra, Bhadohi for five years in a row from 2018–19 to 2022–23 in the farmers' fields in various areas of the district using front-line demonstration.

Methodology: Over the investigation's five years, a total of 112 demonstrations were held at farmer fields on 5.0 ha of land. Each frontline demonstration was set up on 0.1 ha of land, with the nearby 0.3 ha serving as the comparison control (farmer's practice). KVK scientists gathered information on yield, production costs, and returns from farmers' practice plots (control plots) and front-line demonstration plots. Finally, the formulas proposed by Samui *et al*. (2000) was used to calculate the extension gap, technology gap, and technology index.

.**Results:** Under the five-year FLD program, the average extension gap was 140.9 q/ha, the technology gap was 184.74 q/ha, and the technology index was 30.79 percent. The benefit cost ratio of tomato ranged from 5.02 to 7.44 in demonstration plots and from 3.99 to 5.74 in farmer’s practice plots during five years of demonstration with an average of 2.60 in demonstration and 2.09 under farmer’s practices**.**

Conclusion: Front-line example shows how new technology may boost output and profit .The Bhadohi districts of Uttar Pradesh's mid plain have improved vegetable production, consumption, nutritional security, and overall livelihood security as a result of the productivity gain under FLD over existing tomato cultivation practices. This has increased awareness and inspired other farmers in the district to adopt the demonstrated technologies for tomato production.

Key word: Tomato , front line demonstration, yield, economic, technology index

1. INTRODUCTION

The tomato (Solanum lycopersicum L.), is a plant of the Solanaceae family that grown both outdoors and inside for its fruits. it is one of the most important vegetable crops in the world (Kaloo, 1986). Tomatoes can contribute significantly to a healthy diet and can be eaten raw in salads, cooked like vegetables, and as a component of other prepared dishes. A sizable portion of the world's tomato production is used by processing firms to make products including tomato juice, puree, paste, ketchup, and dried pulp. Lycopene, potassium, iron, folic acid, and vitamins are just a few of the phytochemicals and minerals that are rich in tomatoes. (Collins *et al*., 2022) It is renowned as a food that is both protective and productive. Since tomatoes provide better yields and may be grown in a variety of cropping systems as they have a high economic value. Tomatoes, a warm-season vegetable crop, are especially vulnerable to frost and are killed in subfreezing temperatures. Previously, tomatoes were only cultivated during specified seasons, but this has changed over the last few decades. Tomatoes are now grown all year long. Tomatoes are India's third most important crop, behind potatoes and onions. India is the world's second-largest tomato producer, producing over 21195 thousand MT of tomatoes each year on an area of approximately 813.00 million ha. In Uttar Pradesh, Tomatoes are grown on around one million hectares of land; yielding 951 thousand MT / ha sharing 4.68% of all tomatoes produced in India during the fiscal year 2021-2022 (NHB database 2023). Because of local demand, tomatoes are a prominent commercial vegetable production in the Bhadohi area. One such effective technology transfer technique that demonstrates how new technologies can boost yield and profit is front-line demonstration. Because tomatoes make great storage and truck gardening crops, they are advantageous to local growers. Frontline demonstrations were organized to cover the aforementioned possibility and boost agricultural income.

2. MATERIAL AND METHODS

One such efficient method of transferring technology is front-line demonstration, which demonstrates how new technologies may raise yield and profit. From 2018–19 to 2022–23, the ICAR–IIVR–Krishi Vigyan Kendra, Bhadohi, performed the current study employing front line demonstration in the fields of selected farmers in various parts of the Bhadohi district. The average temperature in this region is 31.4°C, and there is 700 mm of rainfall on average per year. In general, the sandy to sandy loam soils in the study area had medium to low fertility levels. Over the investigation's five years, a total of 112 demonstrations were held at farmer fields on 5.0 ha of land. Each frontline demonstration was set up on 0.1 ha of land, with the nearby 0.3 ha serving as the comparison control (farmer's practice). From 2018–19 to 2022–23, ICAR-IIVR – Krishi Vigyan Kendra, Bhadohi performed the present study employing front line demonstration in the fields of farmers in various parts of the district. Leaf curl resistant variety Kashi Aman was presented at ICAR-IIVR, Varanasi, incorporating all recommended practices like nursery management, raised bed planting, recommended fertilizer rate and integrated pest management to grow better crops. Traditional practices were taken as a control. Field days were also held in each cluster to exhibit farmers from the same village and other villages the outcomes of front-line demonstrations. Data on yield, production costs, and returns were recorded by KVK scientists from front-line demonstration and farmers' practice plots. Finally, data were computed for the extension gap, technology gap, and technology index according to the formulas given in Samui *et al*. (2000)

Increase in yield (%) = Demonstration yield - farmers practice yield X 100/Farmers practice yield

Technology gap = Potential yield of varieties -Demonstration yield

Extension gap = Demonstration yield - Yield under existing farmer practice

Technology index = Potential yield - Demonstration yield X 100 /Potential yield

Table 1: Distinctions between the demonstration package of practices and farmer practices.

Crop operations	**Demonstration**	**Farmer's practices**
Improved Variety	Tomato leaf curl resistant Var. Kashi Aman	Kajla (local)
Seed rate	200 gm/ha	400 gm/ha
Seed treatment	Seed was treated with Bovistin @ 2 gm/ kg seeds	Not in practice
Nursery Raising time	First week of August	Second Fortnight of September
Nursery Raising	Nursery Raising on ridge bed and line sowing	Nursery raising on flat bed and broadcast method
Transplanting method	Raised bed transplanting with plant spacing of 60 cm & 45 cm apart	Flat bed transplanting with plant spacing of 90 cm & 60 cm apart
Transplanting time	Last week of September	First week of October

Fertilizer dose	Recommended dose of fertilizers @ 100 Kg N, 80 Kg P_2O_5 and 100 Kg K_2O /ha	Imbalance application, generally no use of K_2O
Weedicide Application/ dose	Pendimethalin @ 3.2liter/ha was applied 48hrs within transplanting.	No weeding/Hand weeding
Pesticide Application/ dose	Need base use of pestiticide application at recommended dose	Injudicious and repeated spray of pesticides

3. RESULTS AND DISCUSSION

3.1. Yield Interpretations

According to the data in Table 3 and the graph in Figure 1, over the five-year research period, the average yield in farmer practice plots varied from 260.4 to 287.7 q/ ha whereas it ranged from 385.3 to 457.1 q/ ha in demonstration plots. Farmers' practice plots produced 274.36 q/ha whereas the subsequent five-year average yield of the demonstration plot was determined to be 415.26 q/ha. The increment in yield ranged between 33.92 to 67.0 percent. The percent increase in yield over farmers' practice was highest (67.0) during 2018-19. The increase above farmer practice in those same years was 51.82 percent. However, variations in the yield of tomato in different years might be due to variations in soil moisture availability, rainfall, and change in the location of demonstrations every year.

These results demonstrated that the full execution of the practices specified in Table 1 as well as the knowledge acquired through trainings and interactions with the scientist, had an impact on the demonstration plots' higher average yield over time compared to farmers' practices. As a result, the production of tomatoes might be enhanced compared to the yield gained using farmers' traditional methods of growing tomatoes. The result findings had shown here are comparable to those of Singh *et al*. (2011). Similar to this, Mishra *et al*. (2009), Kumar *et al*. (2010), Mishra *et al*., (2014), Meena *et al*. 2020, Srivastava *et al*., and Meena *et al*., 2022 documented yield increase in several crops in frontline demonstrations.

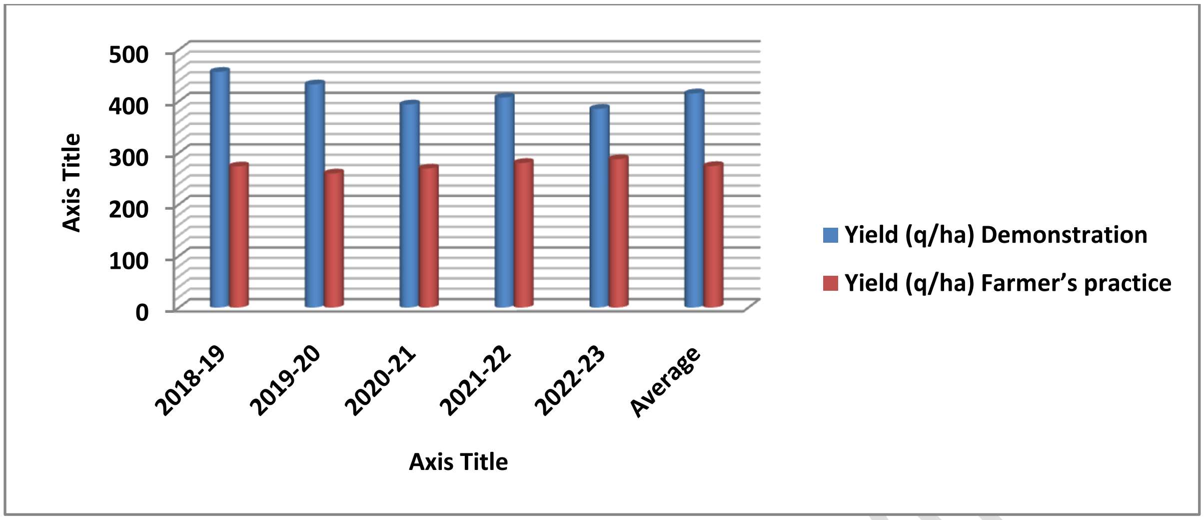

Fig 1. Bar graph showing Yield Interpretations

3.2. Economic Interpretations:

To assess the economic feasibility of the demonstration technologies over the control, a number of economic measures, including the cost of cultivation, net return, and B: C ratio, were determined. The economic viability of improved, tested technology over farmers' practice was calculated and expressed in the form of a B: C ratio (Table 2 and Figure2) based on the current price of inputs and outputs costs. During the five-year studies, the gross cost of cultivation varied from Rs. 71,650 to 83,900/ha and Rs. 68,600 to 80,200 in demonstration plots and farmer practice plots, respectively. In the same years, the average cost of cultivation for farmer practice was computed at Rs. 62,872; whereas, the average cost of cultivation for front-line demonstration was Rs. 78,710. The demonstration's increased cost was mostly brought on by the need to purchase extra fertilizer, seed, IPM techniques, and labor.

Tomato production employing improved technology produced higher net returns of Rs. 292910, 3,61,150, 3,90,260, 5,27,050, and 5,33,630 per ha in the years 2018-19, 2019-20, 2020, 2021, and 2022, respectively, with an average net return of Rs. 4,21,000/ha compared to farmer's practices (Rs. 1,12,768). The B: C ratio was recorded to be higher under demonstration against control during all the years of study. The benefit-cost ratio fluctuated from 5.02 to 7.44 in the demonstration plots and from 3.99 to 5.74 in the farmer's practice plots during the course of the five years of the demonstration, with an average of 2.60 in the demonstration and 2.09 under farmer's practices (Table 2 and Fig 2). This might be as a result of new technology producing higher yields and better marketing prices than traditional farming methods. The results of Singh *et al*. (2011), Mishra *et al*. (2014), and Meena *et al*. 2020, Srivastava *et al*. 2022, and Meena *et al*. 2022) in the case of tomatoes and other crops are comparable to this conclusion.

The scientific approach of tomato production can significantly minimize the technological gap, resulting in higher tomato yield in the area and, in turn, better economic conditions for the producers. Furthermore, extension organizations in the district must give sufficient technical assistance to farmers through various educational and extension approaches in order to close the extension gap for greater tomato production in Uttar Pradesh's mid-plain area.

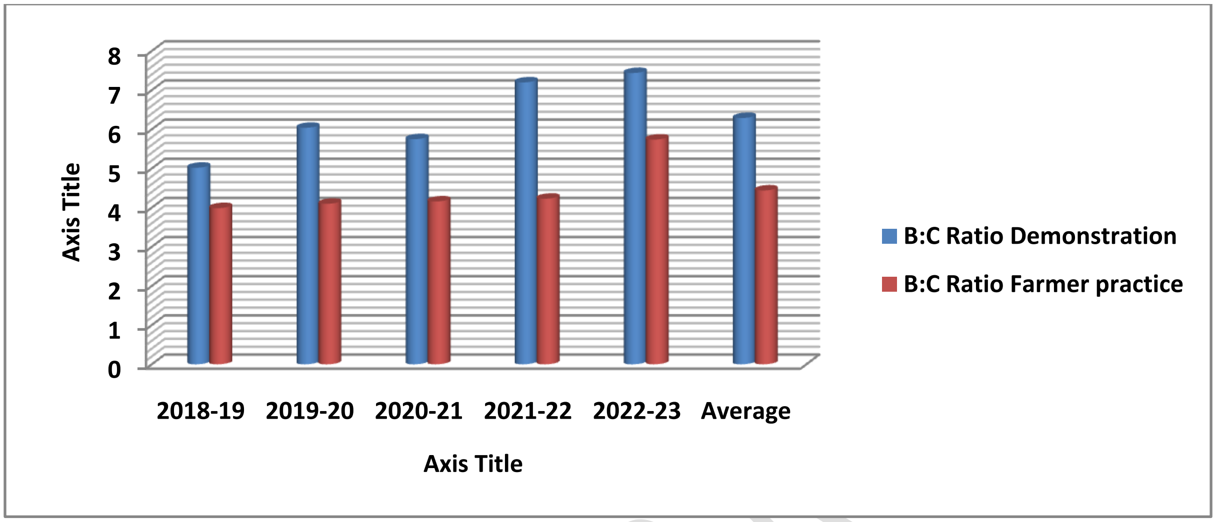

Fig 2. Bar graph showing economic interpretations

Table 2: Analysis of economics of tomato under FLD and farmers practice during 2018-19 to 2022-23

Year	Economic of Demonstration (Rs)				Economic of FP (Rs)			
	Gross Cost	Gross Return	Net Return	B:C	Gross Cost	Gross Return	Net Return	B:C
2018-19	72850	365760	292910	5.02	68600	273700	205100	3.99
2019-20	71650	432800	361150	6.04	69800	286440	216640	4.10
2020-21	82300	472560	390260	5.75	77850	323520	245670	4.16
2021-22	83900	610800	527050	7.20	79650	336480	256830	4.23
2022-23	82850	616480	533630	7.44	80200	460320	380120	5.74
Average	78710	499680	421000	6.29	62872	336092	260872	4.44

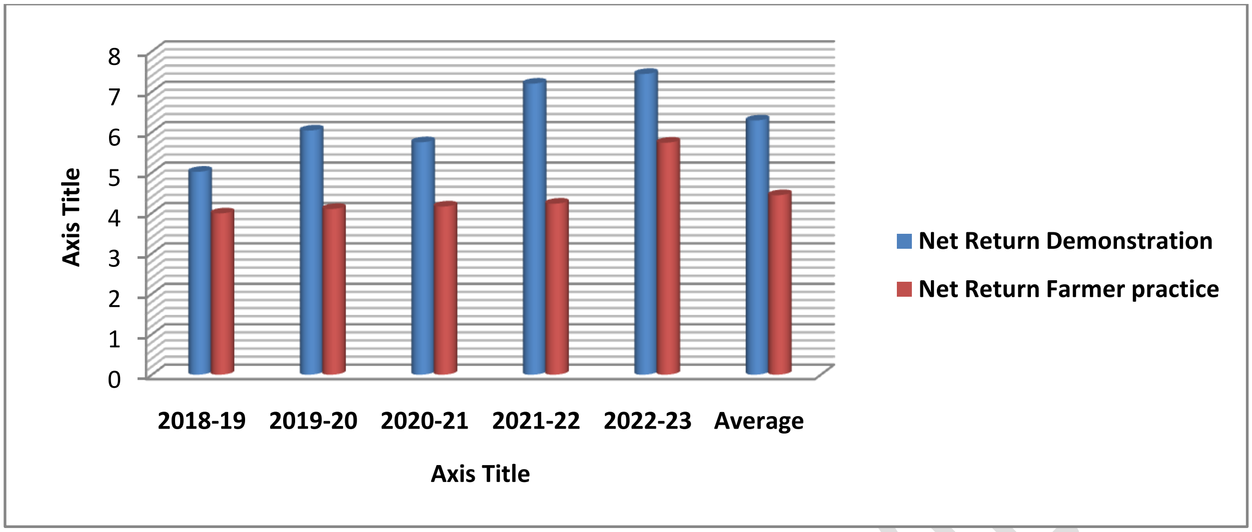

Fig 3. Bar graph showing net return demonstration and farmer practice

3.3. Extension gap:

During the years 2018–19, 2019–20, 2020–2021, and 2022, respectively, an extension gap of 183.4, 172.8, 129.2, 126.9, and 97.6 q/ha was noted. Under the five-year FLD program, the average extension gap was 140.9 q/ha (Table 3). This highlighted the necessity to inform farmers about the adoption of better agricultural production technology using a variety of strategies in order to counteract the trend of the vast extension gap. This frightening tendency of the galloping extension gap will be changed if the most recent production methods are used more and more in combination with high-yielding varieties.

3.4 Technology gap:

In the years 2018–19, 2019–20, 2020–2021–2022, respectively, the technology gap and the disparities between the potential yield and yield of demonstration plots were 142.9, 167.2, 206.2, 192.7, and 214.7 q/ha. Under the five-year FLD program, the average technology gap was 184.74 q/ha. Similar results have been reported by Singh *et al*. (2011) and Mishra *et al*. (2014). This can be a result of the region's meteorological circumstances, the productivity of the soil, and individual farmers' skills in management. Therefore, to close these gaps, location-specific suggestions are required.

3.5. Technology Index:

The technology index demonstrates the viability of the technology used in the farmer's field. According to Table 3, the technology index ranged from 23.81 to 35.70. During the FLD program's five years, an average technology index of 30.79 percent was noted, demonstrating the efficiency of technological interventions. This quickens the implementation of tried-and-true technological solutions to boost tomatoes' 23.81, 27.86, 34.36, 35.7, and 30.79 percent yield performance. According to Singh *et al*. (2011) and Mishra *et al*. (2014), these results are consistent.

Table 3: Productivity, technology gap, technology index and extension gap in tomato under FLD during 2018-19 to 2022-23

Year	Area (ha)	No. of farmers	Yield (q/ha)			% Increase in yield	Extension gap (q/ha)	Technology gap (q/ha	Technology Index %
			Potential	Demo	FP				
2018-19	1.0	32	600	457.1	273.7	67.0	183.4	142.9,	23.81
2019-20	1.0	23	600	432.8	260.0	66.21	172.8	167.2	27.86
2020-21	1.0	19	600	393.8	269.6	46.0	129.2	206.2	34.36
2021-22	1.0	25	600	407.3	280.4	46.0	126.9	192.7	32.11
2022-23	1.0	23	600	385.3	287.7	33.92	97.6	214.7	35.7
Average	1.0	24.4	600	415.26	274.36	51.82	140.9	184.74	30.79

4. CONCLUSION

The productivity and profitability gain reflected under FLD over existing tomato cultivation practices has raised awareness and motivated other farmers in the district to adopt the demonstrated technologies for tomato production, which helps to improve vegetable production consumption nutritional security, and overall livelihood security in the districts of Uttar Pradesh's mid plain belt. This should alleviate some of the limits in Uttar Pradesh's present technology transfer system in the Bhadohi district's mid-plain region. As a result, a targeted training program on enhanced vegetable production technology, as well as repeated demonstrations, are necessary to increase producers' knowledge and abilities, which aid in technology adoption.

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