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Impact of Front line demonstrations on yield and economics of Tomato in Chikkaballapur district of Karnataka

M. Shalini[1], Devaraja[2] and Manjunath Gowda[3]
[1,2] SMS (Horticulture), ICAR- Krishi Vigyan Kendra, Chikkaballapur, UAS, Bangalore, Karnataka,
[3] Programme Coordinator, ICAR- Krishi Vigyan Kendra, Chikkaballapur, UAS, Bangalore, Karnataka

ABSTRACT

Tomato is a major vegetable crop grown in Chikkaballapura district of Karnataka. One of the major constraints of low productivity of this vegetable may be due to partial adoption of recommended package of practices by the tomato growers. The present study was undertaken to address the yield gap through FLDs on Tomato crop. ICAR-Krishi Vigyan Kendra, Chintamani, Chikkaballapur (Karnataka) conducted 18 demonstrations on tomato since 2013-14 to 2015-16 in different locations of the districts. Prevailing farmers' practices were treated as control for comparison with recommended practices. In the three years data it was observed that mulching reduced weed count, labour required for weeding and frequency of irrigations. Adoption of IPM practices helped in managed the incidence of pest and diseases. Due to this an average yield of 708.50 q/ha was obtained in demonstrated plot over control (625.17 q/ha) with an additional yield of 83.33 q/ha and the increasing the average tomato productivity by 13.33 per cent. The extension gap and technology gap ranged between 76.75 to 88.75 and 82.25 to 98.25 q/ha, respectively, with the technology index of 11.44 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, FLD, Yield, Extension gap, Technology gap, Technology index and B:C ratio

I. INTRODUCTION

Tomato (*Solanum lycopersicon* (Mill.) Wettsd.) belonging to the family *Solanaceae* is one of the most important vegetable crop that is grown in India which contributes about 11.2 per cent to world production. Tomato is a rich source of antioxidants (mainly lycopene and β-carotene), Vitamin A, Vitamin C and minerals like Ca, P and Fe [1] and it is consumed throughout the world as a fresh vegetable as well as processed products like ketchup, juice, puree, sauce and whole canned fruit. In Karnataka, the crop is grown in an area of 64.25 thousand ha with a production of 20.34 lakhs MT at an average yield of 31.66 tonnes per ha during the year 2014-15 [2]. Tomato is a major commercial vegetable crop in Chikkaballapur district, cultivated in an area of 2,583 ha with a production of 67,546 tonnes and productivity of 26.15 tonnes / ha. Farmers of the district are facing problems due to climate change which has lead to drought-like situation, drying up of bore wells, scarcity of labour, etc. Besides this lack of knowledge on use of bio-control agents and other simple intercultural operations are predominant reasons in escalating the cost of production and reducing yield potential of tomato. Farmers are also affected by the fluctuations in market prices. These above constraints increases the risk of tomato cultivation and thereby keeping this in view Frontline demonstrations were conducted to reinforce the confidence of farmers in getting increased profitability with better productivity.

II. MATERIAL AND METHODS

The present study was carried out by ICAR-Krishi Vigyan Kendra, Chintamani, University of Agricultural Sciences, Bengaluru for three consecutive years from 2013-14 to 2015-16 in the farmers field in different locations of Chikkaballapur district through front line demonstration. Front

Line Demonstration is one such powerful tool for transfer of technology which practically exhibits the strength of new technologies in increasing yield and profit. Total 18 demonstrations were conducted in 18 farmer's fields. Each frontline demonstration was laid out on 0.2 ha area while adjacent 0.2 ha was considered as control for comparison (farmer's practice). By providing Mulching sheet (25 micron Silver & Black coated polyethylene sheet) as a critical input from the KVK, all the recommended package of practices like the use of bio control agents (*Trichoderma* & *Pseudomonas)* enriched FYM, recommended dose of fertilizers, inline drip irrigation, mulching and integrated pest management practices (growing maize as barrier crop, marigold as trap crop, use of yellow sticky cards, pheromone traps and timely application of plant protection chemicals) as prescribed by Indian Institute of Horticultural Research (IIHR), Hesaraghatta, Bengaluru [3] was demonstrated. Field days were also conducted in each cluster to show the results of front line demonstration to the farmers of the same village and neighbouring villages. In general, soils of the area under study were red sandy loam with medium to low fertility status and the average annual rainfall of this area is 742 mm. The data on weed count, frequency of irrigation, pest management, production cost and returns were collected by KVK, scientists with frequent field visits during 2013-14 to 2015-16 from front line demonstration plots and farmers practice plot and finally extension gap, technology gap, and technology index were calculated as given by [4].

$$\text{Per cent increase in yield} = \frac{\text{Demonstration yield - farmers practice yield}}{\text{Farmers practice yield}} \times 100$$

$$\text{Technology gap} = \text{Potential yield - Demonstration yield}$$

$$\text{Extension gap} = \text{Demonstration yield - Yield under existing practice}$$

$$\text{Technology index} = \frac{\text{Potential yield - Demonstration yield}}{\text{Potential yield}} \times 100$$

III. RESULTS AND DISCUSSION

The observations on weed count (no. /sq.m), labour required for weeding (mandays), frequency of irrigation, bacterial wilt incidence (%), late blight incidence (%), leaf curl incidence (%) and fruit borer incidence (%) are shown in table1.

A. Weed count & labour required for weeding

The data on weed count indicates that an average of 1.67 weeds were recorded per sq.mt in the demonstration plots where mulching sheet was used when compared to farmers practice (no mulching) where there was 27.33 weeds per sq.mt. Weed count ranged between 1 to 2 per sq.mt in FLD plot and between 24-32 per sq.mt in farmer's practice during 2013-14, 2014-15 and 2015-16. This was due to use of plastic mulches which reduced penetration of light into the soil and as such weeds could not survive under this condition. And silver/black plastic mulch blocked the weeds, except a few, which emerged through the planting holes. This result is consistent with the findings of [5] and [6]. For weeding an average of 20.0 mandays (lower) was recorded in demonstration plots and 75.33 mandays (higher) in farmers'practice plots from the years 2013-14 to 2015-16. This lower mandays required for weeding in demonstration plot was due to lower weed count.

B. Frequency of irrigation

In demonstration plot irrigation was done once in two days compared to farmer's practice where irrigation was done every day. This was due to the use of drip irrigation in conjunction with plastic mulch that reduced moisture evaporation from the mulched soil and decreases irrigation requirements [7]. Because of the high degree of impermiability of plastic mulches to water vapour, soil water evaporative loss is reduced. This has been related to water savings of 50 per cent compared to farmers practice.

C. Pest and Disease incidence

It was observed that there was low incidence of diseases and pests in demonstration plots compared to farmer's practice. An average of 4.43 per cent of bacterial wilt incidence was recorded in demonstration plot and 15.63 per cent in farmer's practice. For late blight disease, average incidence was 13.33 per cent in demonstration plot and 27.77 per cent in farmer's practice. The lower incidence of diseases in demonstration plot was due to use of bio control agents like *Trichoderma* & *Pseudomonas* and timely applications of plant protection chemicals during early crop growth period as per IIHR technologies.

It was observed that an average of 5.10 per cent of leaf curl disease incidence was also lowest in demonstration plot compared to farmer's practice (26.07 %). This may be due to reflective characteristic of plastic mulch that might have managed whitefly populations equal to that provided by treatment with imidacloprid [8] which is the vector for spreading of leaf curl disease and mulches may also protect the crop from insect pests or diseases [8] and [9]. An average incidence of fruit borer was lowest (2.77 %) in demonstration plot and highest (14.10 %) in farmer's practice. The lower incidence of fruit borer in demonstration plot was due to marigold grown as trap crop and use of pheromone traps against the pest.

A comparison of productivity levels in demonstration fields and farmers practice fields is shown in table 2.

D. Yield

The results revealed that due to front line demonstration on tomato yield ranged from 701.75 q/ ha to 717.75 q/ ha in demonstration plots and from 621.50 q/ ha to 629.00 q/ ha in farmer's practice plot in three years of demonstration. And average yield of 708.50 q/ ha was obtained under demonstration plots as compared to 625.17 q /ha in farmer's practice plots in same years. This results clearly indicated that the higher average yield in demonstration plots over the years compare to farmers practice due to knowledge and adoption of full package of practices i.e. use of bio fertilizer enriched FYM, recommended dose of fertilizers, preparation of raised beds, inline drip irrigation, mulching, growing maize as barrier crop, marigold as trap crop, use of yellow sticky cards, pheromone traps and timely application of plant protection chemicals. The average yield of tomato increased by 13.33 per cent. The yield of tomato could be increased over the yield obtained under farmers practices (lack of knowledge on use of bio fertilizers, no use of the balanced dose of fertilizer, no IPM practices) of tomato cultivation. The above findings are in similarity with the findings of [10] and [11].

The increment in yield ranged between 12.28 to 14.11 per cent. The per cent increase in yield over farmers practice was highest (14.11) during 2015-16. However variations in the yield of tomato in different years might be due to the variations in soil moisture availability, rainfall, and change in the location of demonstrations every year.

E. Extension gap

Extension gap of 76.75, 84.50 and 88.75 q/ha were observed during 2013-14, 2014-15 and 2015-16 respectively. On an average extension gap under three year FLD programme was 83.33 q/ha. This emphasized the need to educate the farmers through various techniques for the adoption of improved agricultural production technologies to reverse this trend of wide extension gap. More and more use of latest production technologies with high yielding variety will subsequently change this alarming trend of galloping extension gap [12].

F. Technology gap

The technology gap, the differences between potential yield and yield of demonstration plots was 98.25, 94.00 and 82.25 q /ha during 2013-14, 2014-15 and 2015-16 respectively. On an average technology gap under three year FLD programme was 91.50 q/ha. This may be due to the soil

fertility, managerial skills of individual farmer's and climatic condition of the area. Hence, location specific recommendations are necessary to bridge these gap [11].

G. Technology Index

The technology index shows the feasibility of the demonstrated technology at the farmer's field. The technology index varied from 10.28 to 12.28 (Table 1). On an average technology index of 11.44 per cent was observed during the three years of FLD programme, which shows the effectiveness of technical interventions. This accelerate the adoption of demonstrated technical interventions to increase the yield performance of tomato.

H. Economic returns

The input and output prices of commodities prevailed during the study of demonstrations were taken for calculating gross return, cost of cultivation, net return and benefit: cost ratio (Table 3). The cultivation of tomato under improved technologies gave higher net return of Rs. 3,33225 /ha, Rs. 3,83,180 /ha and Rs. 4,25,155 / ha in the year 2013-14, 2014-15 and 2015-16 respectively with an average net return of Rs. 3,80,520 /ha which was lower in farmer's practices. The benefit cost ratio of tomato ranged from 3.11 to 3.60 in demonstration plots and from 2.58 to 2.89 in farmer's practice plots during three years of demonstration with an average of 3.33 in demonstration and 2.74 under farmer's practices. This may be due to higher yield obtained and lower cost of cultivation under improved technologies compared to local check (farmers practice). This finding is similar with the findings of [11].

IV. CONCLUSION

The FLD produced a significant positive result and provided an opportunity to demonstrate the productivity potential and profitability of the latest technology (intervention) under real farming situation. This could circumvent some of the constraints in the existing transfer of technology system in the Chikkaballapur district of Karnataka. The productivity gain under FLD over existing practices of tomato cultivation has created greater awareness and motivated other farmers to adopt the demonstrated technologies for tomato production in the district.

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Table 1. Effect of mulching and integrated pest management practices on weed management, irrigation and pest management in tomato under FLD.

Year	Weed count (no. / sq.m)		Labour required for weeding (Man days)		Frequency of Irrigation		Bacterial wilt incidence (%)		Late blight incidence (%)		Leaf curl incidence (%)		Fruit borer incidence (%)	
	Demo.	FP*	Demo.	FP	Demo.	FP	Demo.	FP	Demo.	FP	Demo.	FP	Demo.	FP
2013-14	2 (92.30 %)	26	20	75	Once in two days	Every day	5.3	18.5	14.5	35.5	4.5	25.5	2.5	14.8
2014-15	1 (95.83 %)	24	22	73			3.8	12.8	12.5	22.8	4.2	28.4	2.0	15.0
2015-16	2 (93.75%)	32	18	78			4.2	15.6	13.0	25.0	6.6	24.3	3.8	12.5
Average	1.67	27.33	20.00	75.33			4.43	15.63	13.33	27.77	5.10	26.07	2.77	14.10

*FP- Farmer's practice

Table 2. Yield of tomato and technology gap, technology index and extension gap in tomato production under FLD

Years	Area (ha)	No. of FLDs	Demonstration Yield (q/ha)			Yield of Farmer's practice (q/ha)	Increased in yield (%)	Potential Yield (q/ha)	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
			Highest	*Lowest*	*Average*						
2013-14	1.6	8	725.5	678.0	701.75	625.00	12.28	800.00	76.75	98.25	12.28
2014-15	1.0	5	747.0	665.0	706.0	621.50	13.60	800.00	84.50	94.00	11.75
2015-16	1.0	5	753.5	682.0	717.75	629.00	14.11	800.00	88.75	82.25	10.28
Average	-	-	-	-	708.50	625.17	13.33	800.00	83.33	91.50	11.44

Table 3. Comparative economics of tomato production under FLD and farmers practice

Years	Cost of Cultivation (Rs./ha)		Gross Return (Rs./ha)		Net Return (Rs./ha)		B:C Ratio	
	Demo.	Farmers practice	Demo.	Farmers practice	Demo.	Farmers practice	Demo.	Farmers practice
2013-14	158000	165000	491225	425000	333225	260000	3.11	2.58
2014-15	167500	172250	550680	472340	383180	300090	3.29	2.74
2015-16	163400	172100	588555	496910	425155	324810	3.60	2.89
Average	162967	169783	543487	464750	380520	294967	3.33	2.74

