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Praveenakumar R
ICAR-Krishi Vigyan Kendra, Chintamani, University of Agricultural Sciences, Bangalore, Karnataka, India

Papireddy M
ICAR-Krishi Vigyan Kendra, Chintamani, University of Agricultural Sciences, Bangalore, Karnataka, India

Ranjeetha R
College of Sericulture, Chintamani, Karnataka, India

Swathi B
ICAR-Krishi Vigyan Kendra, Chintamani, University of Agricultural Sciences, Bangalore, Karnataka, India

Corresponding Author:
Praveenakumar R
ICAR-Krishi Vigyan Kendra, Chintamani, University of Agricultural Sciences, Bangalore, Karnataka, India

Impact of front line demonstration in adoption of production technology and economics of tomato at farmers field of Chikballapura district

Praveenakumar R, Papireddy M, Ranjeetha R and Swathi B

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Abstract
The studies were conducted to analyse the impact of front line demonstrations in adoption of production technology and economics of tomato at farmer's field of Chikballapura district, Karnataka state during the year 2022-23 to 2023-24. The main objective of front line demonstrations (FLDs) was to demonstrate newly released crop production and protection technologies and its management practices at the farmer's field under different agro-climatic regions and farming situations. The results revealed that the total yield gap between potential yield and actual yield of tomato was 41.42 percent, in which 16.59 percent of yield gap was between demonstration plot and actual farmers plot yield and 26.94 percent of technological gap. The maximum number of farmers adopted recommended seedling treatment with bio fertilizers (81.23%) followed by training of plants at right stage (79.25%). The adoption percent of important package of practices were found to be more in application of vegetable special (43.01%), training of plants at right stage (42.37%), raising and selection of quality seedling from nursery (41.58%) and timely irrigation (30.58%). Less adoption percent was found for plant protection measures (11.67%), recommended dose of fertilizer application (12.73%) and weed management (22.62%). There was significant difference in tomato yield before and after conduct of front line demonstrations, the yield of tomato per hectare was increased by 27.10 percent in demonstrated plots that farmers practice plots. Net return and B:C ratio were found to maximum in demonstrated plot as compared to farmers practice. The adoption of different package of practices after FLD programme, shows positive impact of FLD on adoption of demonstrated production technology.

Keywords: Adoption, front line demonstration, impact, production technology and tomato

Introduction
The main aim of the Krishi Vigyan Kendra is to reduce the time lag between generation of technology at the research institution and its transfer to the farmers for increasing productivity and income from the agriculture and allied sectors on sustained basis. KVKs are grass root level organizations meant for application of technology through assessment, refinement and demonstration of proven technologies under different 'micro farming' situations in a district (Das, 2007) [4]. The technologies developed at the agricultural universities and research stations through research activities are demonstrated in farmer's field through FLDs. This is one of the most powerful tools of extension because farmers in general are driven by the perception that 'seeing is believing'. The main objective of FLDs is to demonstrate newly released crop production and protection technologies and its management practices at the farmer's field under different agro-climatic regions and farming situations. Tomato (*Solanum lycopersicum* L. Solanaceae.) is an important commercial vegetable crop occupies an area of 8.82 lakh hectares in India with production of 187.36 lakh tones. Andhra Pradesh, Karnataka, Madhya Pradesh, Odisha, Gujarat, West Bengal and Bihar are leading states in tomato cultivation in India. In Karnataka, tomato is cultivated in an area of 0.61 L ha with the production of 19.98 L tones during 2022-23 (Anonymous, 2021) [1]. The tomato is cultivated year round in Chikballapura district, which gives good returns to the farmers. Krishi Vigyan Kendra, Chintamani has conducted front line demonstrations at farmers field with the objectives of convincing farmers and extension functionaries together about tomato production technologies for further wide scale

diffusion. Keeping in view of an effective extension approach of front line demonstrations for dissemination of tomato production technology, its impact of FLDs conducted to be assessed.

The present study was conducted with the specific objectives to evaluate the FLD in terms of adoption of recommended production technology in tomato and to know the impact of FLD on tomato growing farmers.

Materials and Methods

The front line demonstrations were conducted on integrated crop management (ICM) in tomato at farmer's field of Chikballapura District, Karnataka state during the year 2022-23 to 2023-24. Twenty tomato growing farmers covering an area of 8 ha were selected for demonstrating the ICM in tomato through FLDs at Chintamani, Sidlaghatta, Gauribidanur and bagepalli taluks of Chikballapura district. The critical inputs were supplied to farmers and applied as per the package of practices for tomato crop recommended by University of Horticultural Sciences, Bagalkot and Indian Institute of Horticultural Science, Hessaraghatta, Bengaluru. Demonstrations at farmer's fields were regularly monitored by scientists of Krishi Vigyan Kendra, Chintamani from planting to harvesting and marketing. Basic data of the respondents were collected by the KVK. The data were collected after FLD by personal interview technique with the help of interview schedule developed for the study. The interview schedule was developed through discussion with experts, scientists and extension officers working in the district. The information on demonstrated package of practices and farmers practices followed as mentioned in Table A. The data were analysed with appropriate statistical procedures. Data were collected on absolute maximum potential yield of the tomato in a given situation. Besides this, demonstrated plot yield was obtained using the data from front line demonstrations conducted in the farmers field under the close supervision of scientists from KVK 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. Using these data, the differences between potential yield and demonstration plot yield (Yield gap-I), difference between Demonstration plot yield and actual yield (Yield gap- II) and difference between potential yield and actual yield (Total yield gap) were worked out.

Potential yield - Demonstration plot yield = Technological gap (yield gap-I)

Demonstration plot yield - Actual yield = Extension gap (yield gap- II)

Potential yield - Actual yield = Total yield gap

Results and Discussion

The findings of the present study as well as relevant discussion have been presented under following heads:

Yield gap in tomato production

The realized yield and estimated yield gaps are presented in Table 1. The potential yield of tomato was found to be 74.00 t/ha and the demonstration plot yield obtained through front line demonstrations was 54.12 t/ ha. The actual yield realized by the farmers on their farm with their own resources and management practices was 42.58 t/ha. The magnitude of technological gap (yield gap-I) was 19.88 t/ha, which was 26.94 percent less than the maximum attributable yield. Extension gap (yield gap-II) refers to the difference between demonstration plot yield and actual yield and it was 12.54 t/ha. There was 16.59 percent reduction in yield compared to demonstration plots yield. A sizable total yield gap of 31.42 t/ha was observed and it accounted for 41.42 percent. These findings are in agreement with that of Kaur *et al.* (2013) [7] and Mitra and Samajdar (2010) [12]. The causes for large total yield gap may be attributed to environmental differences between research stations, extension worker and farmers fields and non adoption of production technology (Mishra *et al*., 2007 and Kiran, 2003) [11, 8]. It could be reduced through considerable co-ordination between researchers, extension workers and farmers. These findings are within line those of Hiremath and Hilli (2012) [5] and Jadav and Solanki (2009) [6].

Adoption of recommended package of practices

The data presented in Table 2 indicated that more number of farmers adopted recommended spacing (81.54%), seed treatment (81.23%) followed by training of plants at right stage (79.25%) and harvesting at proper stage (76.20%).Whereas lesser adoption was recorded for plant protection measures (31.00%), growing trap crops (36.00%) and recommended dose of fertilizer application (43.27%). This is because the farmers adopted the simple production technology compared to complicated technology. Similar results were reported by Singh *et al*. (2013) [7]. The increase in adoption percent of important package of practices were found to be more for application of vegetable special (43.01%) followed by training of plants at right stage (42.37%), raising and selection of quality seedling from nursery (41.58%) and timely irrigation (30.58%). The adoption percent after FLD was less for package of practices *viz*., plant protection measures (11.76%), recommended dose of fertilizer application (12.73%) and weed management (22.62%). This is the cause for reduction in yield, majority number of farmers adopted simple production technology compared to complicated technology (Mehta *et al*., 2012) [10] and high cost of inputs such as fertilizers, and pesticides and non-availability of labour. These findings are in conformity with the results reported by Meena and Gupta (2015) [9]; Thakor and Patel (2006) [17] and Aski *et al*. (2010) [2].

Impact of FLD on yield of tomato

The information regarding the impact of FLD on yield has been presented in Table 3. The data revealed that the yield of tomato per hectare has increased by 27.10 percent in FLD plots. This indicates, the significant difference in yield before and after conduct of FLD. It means that even after FLD, there was wider adoption of demonstrated technologies. These findings are in line with research of Yadav *et al.* (2004) [18].

Impact of FLD on economic of tomato production:

The economic impact of demonstrated tomato production technology was worked out by calculating total cost of cultivation, gross return, net return and B:C ratio (BCR) of before FLD and after FLD. Total cost of cultivation was calculated by the total sum of expenditure of land preparation, seed, manure and fertilizers, plant protection measures, irrigation and labour component. The data in Table 4 revealed that, before FLD the yield of tomato obtained was 42.58 t/ha and yield after FLD was 54.12 t/ha. The tomato was sold at farmer field at Rs. 600 per quintal and profitability was calculated (Balaji *et al.*, 2013 and Samui *et al.*, 2000) [3 & 14]. This shows that net returns from tomato before FLD was Rs. 1,57,880/ha and the net returns from tomato after FLD was Rs. 2,97,132/ha.

The B:C ratio for before FLD was 2.42, which was increased to 3.93 after FLD. It is evident from the results that B:C ratio of tomato FLD is higher than before FLD. This might be due to higher adoption of all the package of practices recommended for tomato crop production in the region (Yadav *et al.*, 2004) [18] and good relationship between FLD farmers, scientists and extension workers. Similar results were reported by Patel and Patel (2014) [13]; Shinde (2011) [16] and Sharma *et al.* (2004) [15].

Table A: Demonstrated package of practices and farmers practice for ICM in tomato

Sl. No	Package of practices (Technology intervention)	Frontline demonstration (Demonstrated package)	Farmers practice (Local/check)
1.	Selection of variety /hybrid	Arka Rakshaka – Triple disease resistant hybrid variety, resistance to leaf curling, bacterial wilt and blight disease	Local or unknown private hybrid/variety, no information.
2.	Seed treatment	Seedlings are treated with biocontrol agents tricoderma	Seed treated with fungicide Carbendizim
3.	Spacing	90 cm x 45 cm (High plant population per unit area)	120 cm x 45 cm (Low plant population per unit area)
4.	Growing trap crops	Transplanting 16:1 ratio of tomato and marigold	Not grown any trap crops
5.	Application of FYM (Approximately)	Applied FYM 38 t/ha before 3 week of transplanting	Applied FYM 3 tractor load or 15 t/ha during ridges and furrow p
6.	Application of recommended dose of fertilizer	250 kg N + 250 kg P2O5 + 250 kg K2O per ha (50% N + 100% PK at the time of transplanting and remaining 50% N applied at 4 week after transplanting)	After transplanting, applied 17:17:17 NPK + 20:20:0 NPK mixed chemical fertilizer (Approx. 10-12 g/plant) 2- 3 times during crop period
7.	Application of vegetable special/ micro-nutrient	Foliar spray of vegetable special 75 g + 15 lit. water + 1 lemon + 1 shampoo (Rs.1)	Not applied any micro-nutrient
8.	Irrigation	Drip or furrow method of irrigation at once in a 4-7 days interval depend upon soil condition	Once/twice in a week
9.	Weed management	Pre-emergence herbicide butachlor @1.5 lit./ha, followed by hand weeding depend upon weed intensity	Hand weeding 3 to 4 times
10.	Training of plants	Stake the plants 30 days after planting with 1.2 - 1.5 m tall stakes. Remove the side branches upto 30 cm from ground level.	Stake the plants at the flowering stage and not removed the side branches upto 30 cm
11.	Plant protection measures for control of insect pest and diseases	Need based application for control: Whitefly, thrips and sucking pest - spraying with diamethoate (30 EC) 1.7 ml/lit. of water. Fruit borer: Spay BT(2g/ltr) and spinosid (0.25 ml/ltr) Control of leaf curling – spraying with imidaclopride 0.3 ml/lit. of water for vector control. Early blight – spraying of mancozeb 2g/lit. of water. Fussarium wilt – Drunching with biocontrol agents like tricoderma and pusdomonoas (5 ltr/ acre)	Not followed, irrespective of disease and pest used plant protection chemical combined together without compatibility of chemicals and not identified pest and disease for spraying.
12.	Harvesting	Manual	Manual

Table 1: Yield gap identified in tomato production

Particulars	Yield (t/ha)	Percentage gap
Potential yield	74.00	--
Demonstration plot yield	54.12	--
Actual yield (Farmers practice)	42.58	--
Technological gap (Yield gap I)	19.88	26.94
Extension gap (Yield gap II)	12.54	16.59
Total yield gap	31.42	41.42

Table 2: Extent of adoption of recommended package of practices in tomato before and after front line demonstration (FLD)

Sl No	Package of practices (Technology intervention)	Adoption No.	(Before FLD) Percent	Adoption No.	(After FLD) Percent	Increased in No.	Adoption Percent
1.	Selection of high yielding variety/ hybrid with pest and disease resistance/tolerance	19	29.36	39	62.32	20	32.96
2.	Seed treatment	32	57.69	48	81.23	16	23.54
3.	Raising and selection of quality seedling from nursery	17	27.62	42	69.20	25	41.58
4.	Recommended spacing	35	59.21	47	81.54	12	22.42
5.	Growing trap crops	03	3.48	23	36.00	20	32.52
6.	Recommended quantity of FYM application (Approx.)	16	24.29	28	47.00	12	22.71
7.	Recommended dose of fertilizer application	19	30.54	27	43.27	8	12.73
8.	Application of vegetable special /micro-nutrient	05	11.20	32	54.21	27	43.01
9.	Timely irrigation	20	39.42	44	72.00	24	30.58
10.	Weed management	28	45.20	41	67.82	13	22.62
11.	Training of plants at right stage	22	36.88	48	79.25	26	42.37
12.	Plant protection measures to control pest and diseases	11	19.24	19	31.00	8	11.76
13.	Harvesting at proper stage	36	56.64	47	76.20	11	19.54

Table 3: Yield of tomato before and after front line demonstration (FLD)

Average yield of green tomato (t/ha)		Percent increase over local
Before FLD (Farmers practice)	After FLD (Demonstrated production)	
42.58 t/ha	54.12 t/ha	27.10%

Table 4: Economics of tomato production before and after front line demonstration

Sl No	Items	Before FLD	After FLD
1	Cost of cultivation (Rs./ha)	1,10,900	1,01,320
2	Yield of tomato (t/ha)	42.58	54.12
3	Gross return (Rs./ha)	2,68,780	3,98,452
4	Net return (Rs./ha)	1,57,880	2,97,132
5	B:C ratio	2.42	3.93

Conclusion

Front line demonstration programme was effective in changing of farmers towards the adoption of production technology. Most of the farmers became aware about recommended production practices of tomato after conducting the front line demonstration on farmers field. The adoption percent of important package of practices such as application of vegetable special /micro-nutrient, training of plants at right stage and raising and selection of quality seedling from nursery after FLD was more as compared to before FLD. Yield of tomato, net return and B:C ratio were found to be increased in demonstrated plot as compared to farmers practice. The adoption of different package of practices after FLD programme shows positive impact of FLD on adoption of demonstrated technology. The concept of Front line demonstration can be applied to all farmer categories including progressive farmers for speedy and wider dissemination of the recommended practices to other members of the farming community.

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