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## Impact of Frontline demonstration on yield and economy of tomato in Varanasi district of Uttar Pradesh

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### ABSTRACT

Tomato is a major vegetable crop of Varanasi district of Uttar Pradesh. But the productivity of tomato are very low in this district due to lack of knowledge and partial adoption of recommended package of practice by tomato cultivators. The present study was undertaken to found the yield gap through FLDS on tomato crop. The Krishi Vigyan Kendra, Varanasi conducted Frontline demonstration on 10 farmers for each year since 2010-11, 2011-12 & 2012-13 in different locations of Varanasi district. 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 643.83 q/ha was obtained in demonstrated plot over control (522.66 q/ha) with an additional yield of 121.16 q/ha and the increasing the average tomato productivity by 23.18 per cent. Besides this, the demonstrated plots gave higher gross return, net return with higher benefit cost ratio when compared to farmer's practice.

**Keywords:** tomato cultivation, mulching, FLD, yield, and economy, B: C ratio, etc.

### 1. Introduction

Tomato, (*Lycopersicon esculentum* Mill.), flowering plant of the nightshade family (Solanaceae), cultivated extensively for its edible fruits. Labelled as a vegetable for nutritional purposes, tomatoes are a good source of vitamin C and the phytochemical lycopene. The fruits are commonly eaten raw in salads, served as a cooked vegetable, used as an ingredient of various prepared dishes, and pickled. Additionally, a large percentage of the world's tomato crop is used for processing; products include canned tomatoes, tomato juice, ketchup, puree, paste, and "sun-dried" tomatoes or dehydrated pulp. It is known as productive as well as protective food. Tomato is short duration crop and it is fitted in different cropping system of cereals, grain, pulse and oilseeds and gives higher yields hence is of high economic value.

Tomato is one of the most important vegetable crops grown throughout the world under field and greenhouse conditions (Kaloo, 1986) <sup>[1]</sup>. In India tomato is the third largest vegetable next to only potato and brinjal with the production of about 7.60 Mt (FAO, 2007) <sup>[2]</sup>, India ranks third in area and production after China and Japan. The major tomato growing countries are USA, Italy, Spain, Portugal and Turkey. The cultivated tomato was originated in the Peru –Ecuador-Bolivia is of the Andes (South America). The tomato is a warm season vegetable crop that is the sensitive to frost and is killed by freezing temperatures. Previously tomatoes were grown only in season-wise, but the picture has been changed since last 10-12 years. Now day's tomatoes are grown round the year.

Tomato is one of the mostly widely grown solanaceous vegetable crops which is grown worldwide under outdoor and indoor condition. It is cultivated for freshly fruits. Due to its nature of being short duration and high yield crop, it is becoming an important crop from economic point of view; therefore the area under its cultivation is increasing day by day. The area, production and productivity of tomato in India were 90.70 m/ha, 18653 Mt and 20.56 t/ha during 2012 (GoI, 2013). Tomato is an important vegetable crop of the Uttar Pradesh and influences the economic condition of farmers of eastern Uttar Pradesh. The area, production and productivity of tomato during 2010 were 6.40 m/ha, 2520 Mt and 39.51 t/ha, respectively

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(Indian Horticulture Data base 2011).

India contributes about 11.2 per cent to world tomato production with Andhra Pradesh is highest tomato producer followed by Madhya Pradesh with sharing percentage of 12.94 and 11.68 (Source : Food grains and economics and statistics). Total production is India 4.25 percentage followed by Uttar Pradesh production is 831.16 m ton. Tomato is a major commercial vegetable crop in Varanasi district. Farmers of the district are facing problems due to climate change which has led to drought-like situation, drying up of bore wells, scarcity of labour, etc in summers. 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.

## 2. Material and Methods

The present study was carried out by Krishi Vigyan Kendra Varanasi, Narendra Dev University of Agriculture and Technology, Kumarganj, Faizabad for three consecutive years from 2010-11 to 2012-13 in the farmers field in different locations of Varanasi 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 25 demonstrations were conducted in 25 farmer's field in three years. 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 District horticulture department, Varanasi, all the recommended package of practices like the use of bio control agents (Trichoderma & Pseudomonas) enriched FYM, recommended dose of fertilizers, mulching and IPM practices (growing maize as barrier crop, marigold as trap crop, pheromone traps and timely application of plant protection chemicals) as prescribed by IVRI, Varanasi 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 neighboring villages. In general, soil of the area under study were sandy to sandy loam with medium to low fertility status and the average annual rainfall of this area is 1055 mm and temperature varies from 15 to 45°C. The data of yield, frequency of irrigation, pest management, production cost and returns were collected by KVK, scientists with frequent field visits during 2010-11 to 2012-13 from front line demonstration plots and farmers practice plot (control plot).

## 3. Results and discussion

The observations on weed count (no. /sq.m), labour required for weeding (man days), frequency of irrigation, bacterial wilt incidence (%), late blight incidence (%), leaf curl incidence (%) and fruit borer incidence (%) are shown in table 1.

**Weed count & labour required for weeding:** The data on weed count indicates that an average of 2.67 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 30.0 weeds per sq.mt. Weed count ranged between 2 to 3 per sq.mt

in FLD plot and between 22-34 per sq.mt in farmer's practice during 2010-11, 2011-12 and 2012-13. 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 Schonbeck, M. W., (1999) and Ashrafuzzaman *et al.* (2011). For weeding an average of 27.66 man days (lower) was recorded in demonstration plots and 76.33 man days (higher) in farmers practice plots from the years 2010-11 to 2012-13. This lower man days required for weeding in demonstration plot was due to lower weed count.

### 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 Hanlon and Hochmuth (1989) [8]. Because of the high degree of impermeability of plastic mulches to water vapor, soil water evaporative loss is reduced. This has been related to water savings of 50 per cent compared to farmers practice.

**Disease and pest incidence:** It was observed that there was low incidence of diseases and pests in demonstration plots compared to farmers practice. An average of 5.27 per cent of bacterial wilt incidence was recorded in demonstration plot and 18.25 per cent in farmer's practice. For late blight disease, average incidence was 15.88 per cent in demonstration plot and 29.67 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 IIVR technologies. It was observed that an average of 5.86 per cent of leaf curl disease incidence was also lowest in demonstration plot compared to farmer's practice (26.64 %). This may be due to reflective characteristic of plastic mulch that might have managed whitefly populations equal to that provided by treatment with imidacloprid which is the vector for spreading of leaf curl disease and mulches may also protect the crop from insect pests or diseases which has similarity with findings of Summers *et al.* (2002) [9] and Ngouajio *et al.* (2008). An average incidence of fruit borer was lowest (3.75 %) in demonstration plot and highest (16.84 %) 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.

### Yield

The results revealed that due to front line demonstration on tomato yield ranged from 630.50 q/ ha to 656.50 q/ ha in demonstration plots and from 511.00 q/ ha to 535.00 q/ ha in farmer's practice plot in three years of demonstration. And average yield of 643.83 q/ ha was obtained under demonstration plots as compared to 522.66 q /ha in farmers 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 is increased by 23.18 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 Singh *et al.*, (2011) <sup>[11]</sup> and Balai *et al.*, (2013). Similarly yield enhancement in different crops in frontline demonstrations were documented by Hiremath *et al.*, (2007) <sup>[12]</sup>, Mishra *et al.* (2009) <sup>[13]</sup>, Kumar *et al.*, (2010) <sup>[14]</sup>, Surywanshi and Prakash (1993) <sup>[15, 18]</sup> and Dhaka *et al.* (2010) <sup>[16]</sup>. The increment in yield ranged between 22.71 to 23.46 per cent. The per cent increase in yield over farmers practice was highest (23.46) during 2010-11. 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.

**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. 1,45,600/ha Rs. 1,58,300/ha and Rs. 1,63,500 / ha in the year 2010-11, 2011-12 and 2012-13 respectively with an average net return of Rs. 1,55,800/ha which was lower 1,12,766.67 in farmer's practices. The benefit cost ratio of tomato ranged from 2.61 to 2.65 in demonstration plots and from 2.06 to 2.13 in farmer's practice plots during three years of demonstration with an average of 2.60 in demonstration and 2.09 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 Singh *et al.*, (2011) <sup>[11]</sup>. Similar findings are also reported by Chapke (2012) <sup>[19]</sup> in case of jute.

**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
2010-11	2	29	27	76	Every IIInd day	Per day	6.3	23.56	16.25	39.23	5.3	28.65	3.9	19.23
2011-12	3	27	34	74			3.9	14.96	13.65	23.65	4.8	27.31	2.67	16.35
2012-13	3	34	22	79			5.6	16.23	17.75	27.00	7.5	23.95	4.68	14.95
Average	2.67	30	27.66	76.33			5.27	18.25	15.88	29.96	5.86	26.64	3.75	16.84

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

Year	Area (ha)	No. of FLD	Demo. Yield (q/ha)			Yield of FP* (q/ha)	% Increase in yield
			H	L	Average		
2010-11	1.0	05	665.50	612.0	630.50	511.00	23.38
2011-12	2.0	10	677.0	623.5	644.50	522.0	23.46
2012-13	2.0	10	692.50	632.5	656.50	535.0	22.71
Average	-	-	-	-	643.83	522.66	23.18

**Table 3:** Comparative economic of tomato under FLD and farmers practice

Year	Cost of Cultivation		Gross return (Rs./ha)		Net Returns (Rs./ha)		B:C Ratio	
	Demo.	FP*	Demo.	FP*	Demo.	FP*	Demo.	FP*
2010-11	56900	51300	202500	159000	145600	107700	2.55	2.09
2011-12	59600	53400	217900	167500	158300	114100	2.65	2.13
2012-13	62500	56500	226000	173000	163500	116500	2.61	2.06
Average	59666.67	53733.33	215465.66	166500	155800	112766.67	2.60	2.09

FP\*= Farmers practice use as control

#### 4. 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 Varanasi district of Uttar Pradesh. 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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