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Impact of Technological demonstration on yield and economics of Tomato (*Lycopersicon esculentum* L.) in different Agroclimatic Zone of Madhya Pradesh

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Abstract: Frontline demonstration (FLD) is an appropriate tool to demonstrate recommended technologies among the farmers because farmers, in general are driven by the perception that seeing is believing. The main objective of FLD is to demonstrate the high yielding varieties with integrated crop management practices (ICM) in the farmers field under different agroclimatic region and farming situations.

The average yield 30 demonstration of tomato crop for three consecutive years 2009-10 to 2010-11 was found 486 q/ha whereas for farmers practice, it was found 289 q/ha. There was 64.74.% increase in demonstration yield over local practices. The farmers have incurred average higher returns of Rs. 180500 per ha. through these demonstration over farming practice net return of Rs 113400. The comparative results of the demonstration highlight the cost benefit ratio 3.89 against the local farmers practice 3.03 which recorded respectively. Hence, the result of demonstration technologies had shown that the use of improve package and practices as integrated crop management (ICM) resulted in higher productivity and profitability for tomato growers.

Keywords: Improved Variety, ICM, FLD, B:C ratio, Yield, Economic impact.

Introduction

Tomato (*Lycopersicon esculentum* L) is one of the most remunerative and widely grown and consumed in India. It is belonging to the family Solanaceae. Tomato is a rich sources of Vitamin A, Vitamin C, minerals likes Ca, P, Fe and antioxidants mainly *lycopene* and *beta carotene*. So, due to have these quality it is known as protective food and famous for its medicinal value like blood purifier, anti cryogenic properties and save from intestine infections when used as raw or as cooked. Several processed items likes juice, ketchup, sauce, puri, paste and powder are also made from tomatoes and open door for generation of employment for rural people. Being a remunerative cash crop its commercial cultivation is widely adopted by progressive farmers in India an area of 0.599 million hectare with production of 11.5 million tonnes and productivity in India 18 t/ha. The area under tomato cultivation in Madhya Pradesh is 0.03 million hectares with the production of 0.45 million tonnes with the productivity of 15t which is very low as compare to various state of India as well as from national productivity during the year of 2009 (NHB data base 2009).

The Tomato crop is available through out the year at steady and stable market price and sometimes fetches higher price as compared to other commonly available vegetables. Hence, the mostly tomato crop growers in the Dindori and Hoshangabad District obtained low productivity attributed to the number of yield affecting factors such as, lack of knowledge on improved technologies, less adoption of recommended production technologies regarding selection of improved variety, use of balanced dose of fertilizers, nursery management, planting techniques specially in rainy season planting on raise bed with use of stacking, integrated pest management as well as integrated crop management etc. Farmers are also facing the problems of due to fluctuation in market price. Seeking the problems emphasis on integrated crop management were made through trainings, group discussion and Gosthi but the concerned farmers communities were not very aware about the improved technologies. The major reason of non adoption of these technologies are non participation of farmers in technologies development, assessment and demonstration. These above point of constraints increase the risk

of tomato cultivation and there by keeping this in view Frontline demonstration were conducted to reinforce the confidence of farmers in getting increased profitability with better productivity.

Materials and methods

The present study were carried out by Krishi Vigyan Kendra, Dindori and Hoshangabad (M.P.) during rainy and winter season for three consecutive years from 2009-10, 2010-11 and 2011-12 in the 30 farmers field in an area of 12 ha in different location of both district through frontline demonstration. These district Dindori and Hoshangabad comes under different agroclimatic zones of Northern Hills of Chhattisgarh and Central Narmada Valley respectively.The climatic conditions of both district have more vary in term of rainfall, temperature humidity and soil conditions etc.

Technological gap between improved management package practices and farmers were studied based on survey, field visit and group discussion with farmers interactive group (FIC) of tomato growers in the 09 selected villages. The tomato growers of these villages had small land holdings. Total 30 Farmers were choose randomly from selected village and discussion were made on nine improved management packages to study the technological gap in terms of yield and its contributing characters of tomato crop and economic impacts. A list of constraints experiences by farmers was prepared and shortlisted. It was observed that majority of problems were directly or indirectly related with us improper crop management practices specially use of low yielding variety, imbalance dose of fertilizer application, no use of staking, planting in flat bed system and indiscriminate use of insecticides and fungicides etc.

Under Integrated crop management (ICM) technologies adopted use of improved high yielding variety NH-5005 F1 (Laxmi) and Kashi Anupam (DVRT 2), seeds and seedling treatment with Trichoderma and Azotobactor before sowing and transplanting, Insect and disease free seedlings grown on raised bed system, application of balance dose of fertilizer in the ration of N:P:K 150:100:80 Kg/ha with 10 ton FYM, transplanting of seedlings on raised bed with proper distance 60x75 cm with stacking of crops with bamboo and rope (*sutali*) in rainy season specially. Apart from those, integrated pest management also applied as and when required. All the participants raised their nurseries on raised with following improved nursery raising techniques jointly. The hybrid variety NH-5005 (Laxmi)and Kashi Anupam (DVRT 2) were selected for the demonstration. The area of each demonstration was 2000 meter^2 .Recommended basal dose of FYM, one third part of nitrogen and full dose of phosphorus and potash were applied before the last ploughing in the soil and making of layout and scientific cultivation practices were followed for the raising of good crops. Top dressing of remaining nitrogen @ 100 Kg/ha was applied in three split doses at 20 and 40 and 60 DAT. As plant protection measure leaf curl virus, early and late blight and fruit borer infestation percentage were also recorded strictly over farmer practices.

The data were recorded on different parameters i.e. average plant height in cm.,no. of primary branches, days to 50 % flowering, no. of fruits per plant, average weight of fruit in gram and yield in q. Per ha. recorded accordingly. The percent increase in yield over farmers practices and B:C ratio with economic performance were also calculated using following formula as given below :-

(1) Percent increase yield = $\frac{\text{Demo Yield – Farmers Yield}}{\text{Farmers Yield}} \times 100$

Result and discussion

The data presented in Table 1, revealed that the farmers involved into tomato production didn't aware about recommended integrated crop production technology i.e., high yielding improved variety, seed and seedling treatment, optimum use of seed rate, nursery raising, sowing and transplanting techniques on raise bed with staking, optimum planting distance, balance nutrients management and plant protection measures. They were use low yielding and highly insect pest and disease susceptible variety along with use of high seed rate, (500-600 g/ha) practiced conventional method for seedling raising, imbalance use of fertilizers application (200 kg urea or 200 kg DAP only), seedling transplanted as in close spacing (45 x 60 cm in flat bed), no staking specially in Kharif season and use of higher dose of insecticides and fungicides without any proper diagnosis of crop conditions. Hence, ultimately these activitieswere not affected only reduce the proper development of plants and its potentiality to provide quality yield, but also invite higher incidence of disease and pest resulting in reduced marketable yield and economics also.To control the incidence of disease and pest, farmers were use higher dose of pesticides in injudicious way which adversely affects the farmers economy, ecology and environment. The lack of knowledge and skill about integrated crop management technology and proper plant protection measures in tomato crop were the import reason behind it.

Table 1: Technological differences between improved production technologies and farmers practices

S.No.	Particulars	Technological intervention	Farmers Practice
1.	Climatic conditions	Rainy and Winter Season	Rainy and Winter Season
2.	Farming situations	Light to medium black soil, irrigated	Light to medium black soil, irrigated
3.	Variety	High yielding improved and Hybrid varieties Kashi Anupam (DVRT -2) and Laxmi F1 (NP-5005)	Use Generally open pollinated low yielding variety S-22, Sel-7, S-120 etc.
4.	Seed & Seedling Treatment	With Trichoderma and Azotobacter	No seed treatment adopted
5.	Seed rate	150-160 g/ha	500-600 g/ha
6.	Nursery raising technique	Raised bed techniques, Line sowing, disease and insect free healthy seedling treatment with Azotobacter, Trichoderma and PSB before transplanting	Conventional flat bed techniques and seed scattered in bed, No seedling treatment before transplanting affected by disease and insect pest.
7.	Fertilizers application	Integrated nutrients management as 10 ton FYM, 150:100:80 kg NPK	Indiscriminate use of fertilizer @ 200 kg urea or 200 kg DAP. No use of potassic fertilizer.
8.	Planting techniques	On raised bed system with stacking of the plants at the distance of 60x75 cm	Planting in flat bed with 45x60 cm distance
9.	Plant protection major	Need base insecticides and fungicide along with bio pesticides i.e., Imidachloprid @ 1ml/3 ltr. of water, Neem Oil @ 5%, Mancozeb @ 0.25% and Trizophos @ 0.2%	Use of higher dose of insecticides and fungicides as indiscriminate manner.

The result of 30 frontline demonstrations conducted during the year 2009-10 to 2011-12 in 12 hectares area on farmer's field in various locations of different agroclimatic zone in the district of Hoshangabad & Dindori. These years of average data (Pooled data) summarized in Table 2.

Table 2:Impact of improved technology (FLD) on yield and its contributing characters as compared with farmers practices during the year of 2009-10 to 2011-12 (Pooled data).

Treatment	Area (ha)	Total no. of demo	Average (pooled data) on various parameters							Percent increase in yield	Major diseases & pest in per cent		
			Plant height (cm)	No. of primary branches	Days to 50% flowering	First picking of fruit (days)	No. of fruits /plants	Weight of fruits (g)	Yield (q/ha)		LCV	Blight	Fruit Borer
T1 (Farmers Practices)	*12*	30	72.50	5.30	56.85	80.45	34.25	56.50	295	-	12.65	18.45	16.30
T2 (Improved Practices)	12	30	76.55	6.50	52.50	72.30	45.62	60.07	486	64.74	3.65	8.75	4.05

The result indicated that improved practices as integrated crop management (ICM).given a good impact over farming practice (Table 1). Growth parameters like average plant height (76.55 cm) and average no. of primary branches (6.50 cm) were recorded maximum over farmers practice i.e., (72.50 cm) and (5.30 cm) respectively.,

whereas days to 50% flowering (52.50 days) and first picking of fruit (72.30 days) over farmer practice (56.85 days) and (80.45 days)respectively were recorded minimum over improved practices. These result indicated that the flowering and picking of fruits started earliest under adopted improved technologies as integrated crop management (ICM), specially its due to use of balance dose of fertilizer application and nature of improved variety which were favour of tomato growers to get the more price in the market.

Similarly, the yield attributing parameters like average no of fruits/ per plant (45.62), and average weight of fruit (60.07 g) recorded maximum over farmers practice (34.25) and (56.50) respectively owing to adoption of improved technology management practices (ICM).Similar findings were also reported by (*Singh and Singh*;1978);(*Mane et al*;1989); (*Banker et al*;1993); and (*Khan et al*., 2010).

Three years pooled data on yield and its attributing characters also shown in Table 2. It is evident from result that under the demonstration plots, performance of tomato yield was sustainable higher than the farmers practice. The yield of tomato of 486 q/ha was obtained more in improved technologies and the same was lowest in farmers practices 295 q/ha. These result also showed that in improved practice increased the yield by 64.74% over farmers practice. This increase in yield may be due adopted integrated crop management (ICM) with improved and hybrid varieties of tomato crops, specially on raised bed system technology with stacking in tomato crop to obtained the good quality of fruits. Similarly yield enhancement in different crops in FLD were also documented by (*Suryvansi and Prakash* ;1993); (*Singh et al*; 2002); (*Hiremath et al*; 2007); (*Mishra et al*; 2009); (*Kumar et al*; 2010); and (*Dhaka et al*; 2010).

It was also observed that there were low incidence of disease and pest in demonstration plots as compared to farmers practice. An average 3.65% of leaf were virus (LCV); Bligh 8.75% and fruit borer 4.05% recorded in demonstration plot over famous practice i.e., 12.65%, 18.45% and 16.30% respectively. It was due to use of insecticides and fungicides in integrated manners.

Table 3: Economic performance of tomato production during the year of 2009-10 to 2011-12

Years	Treatments	Yield (q/ha)	Gross cost of cultivation	Gross return (Rs.)	Net return (Rs.)	B:C ratio
2009-10 to 2011-12	T1 (Farmers Practices)	295	55600	15900	113400	3.03
	T2 (Improved Practices)	486	62500	243000	180500	3.89

The benefit cost ratio of the FLD (Table 3) revealed that B:C ratio from recommended practices were subsequently higher than the local cheek (farmer practice) during the three consecutive years of the demonstration. Average net return per hectare from the demonstration was Rs. 180500/- while from the local cheek (farmer practice) Rs. 113400/-. The B:C ratio of demonstration and local cheek was observed 3.89 and 3.03 which was also higher over farmer practice. Theses results are in accordance with finding of (*Hiremath et al*; 2007) and (*Hiremath and Nagarjun*;2009).

Conclusion

The farmers were agreed after application of improved technology as integrated crop management (ICM) on their own fields in terms of increase yield (64.74%) productivity potential (486 q/ha) and net profitability (Rs. 180500 /ha) with B:C ratio (3.89) of tomato crop on an average in both the agroclimatic region.The 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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