RESEARCH NOTE

A Study on Impact of Integrated Nutrient Management on Yield and Soil Health in Tomato

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ABSTRACT

The major constraint for low productivity of tomato in the tribal areas of west Godavari district of Andhra Pradesh is non adoption of recommended package of practices and lack of awareness about the Integrated Nutrient Management in tomato cultivation. To replace the conventional practices, Krishi Vigyan Kendra, Dr.YSR Horticultural University, West Godavari conducted 20 field demonstrations on Integrated Nutrient Management and improved production technologies with high yielding variety (Arka Vikas) during rabi season 2015 and 2016. Cultivation practices under demonstration comprises of soil test based fertiliser recommendation, use of improved high yielding variety, maintained recommended plant population, recommended dose of organic, inorganic and bio fertilisers, bio pesticides and control of pest and disease. An average yield of tomato in demonstration fields ranged from 194.50 to 215.55 q/ha whereas in local practice it is 161.85 and 172.65 q/ha during 2015 and 2016, respectively. It was recorded that the percentage increase in yield with high yielding variety over local variety was recorded in range of 20.17 to 24.84 %. Similarly, the extension gap ranged between 32.65 to 42.90 q/ha and enhanced the soil quality index during the years 2014 and 2015, respectively.

Key words : *Tomato; Extension gap; Technology gap; Technology index;*

Tomato (*Lycopersicon esculentum*) is one of the most important vegetable crops of India. It is used as a vegetable, soup, salad, pickle, ketchup, puree, sauce and in many other ways. It is a good source of vitamin A, B and C. Tomato has acquired the status of world's most popular vegetable crop due to its wider adaptability to various agro climatic conditions. At present, tomatoes rank second, next to potato. The optimum day temperature for its better growth is between 25°C to 40°C and that of night is over 22°C. It thrives in all kinds of soils but does well in well drained medium black and light clayey soils, rich in organic matter and favorable soil pH ranges from 6.0 to 6.8. Integrated Nutrient Management refers to the maintenance of soil fertility and of plant nutrient supply at an optimum level for sustaining the desired Productivity through optimization of the benefits from all possible sources of organic, inorganic and biological components in an integrated manner (*Kumar et al., 2009*). The yield per hectare is very low in agency areas as compared to other parts of the district. Low yield per unit area can be attributed to the number of yield affecting factors such as low fertility of land, lack of knowledge on integrated nutrient management in tomato growers and ultimately low adoption of improved production technologies.

One of the objectives of this demonstration was to make aware of the tomato growers about its scientific cultivation right from integrated nutrient management, to the adoption of high yielding variety to overcome the low productivity. Selecting appropriate hybrids or varieties based on location specific requirements and agro-climatic conditions are one of the simple and yet more efficient way to improve productivity of targeted crop (*Singh et al., 2008*).

METHODOLOGY

In the present study on performance of integrated nutrient management in tomato with variety Arka Vikas

was evaluated through field demonstration conducted in farmer's fields during *rabi* season 2015 and 2016. The study was carried out by the Krishi Vigyan Kendra, Dr YSR Horticultural University, West Godavari. Total 20 demonstrations were conducted on the selected farmer's field of five adopted villages covering an area of 8.0 ha. The transplantation was done during 2nd fortnight of October. Other critical inputs such as soil test based fertilizer application by distribution of individual soil health cards by site specific nutrient management, staking with bamboo sticks (locally available), agrochemicals and rest of the agronomical practices were did similar. The demonstration farmers were facilitated by KVK scientists in performing field operations i.e. sowing, spraying, weeding, harvesting, grading etc. during the course of training and visits. The technologies demonstrated are maintained and compared with local variety.

The technology gap, extension gap and technological index (*Samui et al., 2000*) were calculated by using following formula as below equations.

$$\text{Ext. gap} = \frac{\text{Demo. yield} - \textit{Farmers yield}}{\textit{Farmers yield}} \times 100$$

$$\textit{Techno. gap} = \textit{Potential yield} - \textit{Demo. yield}$$

Ext. gap = Demo. yield – Yield under existing practice

$$\text{Ext. gap} = \frac{\textit{Potential yield} - \textit{Demo. yield}}{\textit{Potential yield}} \times 100$$

Quantitative evaluation of changes in soil quality: by introducing the concept (*Karlen and Stott 1994*) of Relative soil quality index (RSQI), the nine indicators were combined into an RSQI. The equation for calculating RSQI value is given below:

$$RSQI = \frac{SQI}{SQI_m} \times 100$$

Where, SQI = Soil quality index

SQI_m = Maximum value of SQI.

RESULTS AND DISCUSSION

In the present evaluation study, the data on output of tomato cultivation were recorded from demonstration plots, besides the data on local variety adopted by the farmers of this region were also collected. The soil test results revealed that in general soil has slightly acidic to neutral pH. Electrical conductivity is normal. Organic carbon, nitrogen and phosphorus contents of the soil were low to medium whereas, Potassium content is high and DTPA extractable micro nutrients (Copper, Zinc, Iron and Managanese) found above critical limit. So, overall, the soil fertility indices were good in agriculture point of view. The difference between demonstration yield and farmers practice was the adoption of integrated nutrient management in tomato.

Results of 20 field demonstrations conducted during *rabi* 2015 and 2016 in 8.0 ha area on farmers field of five villages of West Godavari district indicated that the cultivation practices i.e high yielding variety (Arka Vikas) recommended spacing (60 cm x 30 cm), soil test based fertiliser application, timely inter-cultur operations like weeding, staking, foliar application of neem and pongamia formulations 5% NSKE, micro nutrients and need based application of pesticides at economic threshold level.

The average demonstration yield recorded was 194.50 and 215.55 q/ha during 2015 and 2016 respectively, which was found to be 20.17 and 24.84 per cent increased over local check. Data further shows that the yield of tomato in the year 2016 was increased successively which clearly speaks of the positive impact of demonstrations conducted in farmers fields over control (Table 2).

Application of organic manures would have helped in enhancing the metabolic activity through the supply of such important micronutrients in the early growth phase which in turn must have encouraged the overall growth *Dubey et al. (2012)* in garden pea and *Kumar et al (2012)* in aswagandha have also reported the highest plant growth due to the combined application of organic manures and chemical fertilizers. This confirms the significance of conjunctive use of chemical and organic fertilizers than the individual one which might be due to the solubilization effect of plant nutrients by the addition of FYM and Vermicompost leading to increased uptake of NPK (*Bahadur et al 2004*).

The results indicated that the demonstrations have a good impact over farming communities of West Godavari district as they were motivated by Improved Production Technologies in *rabi* tomato. Moreover, from first year onwards, farmers cooperated enthusiastically in carrying out the field demonstrations which led to encouraging results in the second year. The similar results of yield enhancement in chick pea in front line demonstration had also documented by (*Singh et al 2014*).

The technological gap 56.05 and 35.00 q/ha in the

Table1. Details of Soil quality parameters in study area before and after demonstration

Soil analysis	Chemical Analysis											
	PH (dsm-1)	EC Car (%)	Org (%)	CaCO3	Available Macro Nutrients (Kg/ha)			Available Sec & Micro Nutrients				Biological Indicator (ppm)
					N	P	K	S	Bo	I	Z	De hydrogenase Activity (µgTPF g^{-1} soil 24 h^{-1})
Initial	7.61	0.091	0.447	2.625	189	2.52	435	6.25	1.980	4.71	0.87	39
Final (after harvest)	7.09	0.301	0.496	2.55	194	5.48	413	12.96	0.989	4.44	8.04	67

Physical properties			
Bulk Density c.c	1.31	Porosity %	49.8
Particle Density c.c	2.64	Cation Exchange Capacity (c.mol p + kg-1)	22-31
Mechanical properties			
% Sand	63.55	% Clay	19.35
% Silt	17.10	Textural class	Sandy Loam
Change in Relative Soil Quality			
2015	61	2016	63

Table 2. Productivity, Technology Gap, Technology Index, and Extension Gap of tomato yield

Year	Area	No.of FLDs	Demonstration Yield (q/ha)			Farmer yield (q/ha)	Potential yield (q/ha)	Increased Yield (%)	Ext gap (q/ha)	Techno gap (q/ha)	Techno Index (%)
			Highest	Lowest	Average						
2015	4.0	20	215.55	186.35	194.50	161.85	250.50	20.17	32.65	56.05	22.37
2016	4.0	20	228.25	195.45	215.55	172.65	250.50	24.84	42.90	35.00	13.96

Table 3. Economic Impact of Tomato as yield under demonstration and farmers practice (traditional package of practices)

Year	Cost of Cultivation (Rs./ha)		Gross Return (Rs./ha)		Net Return (Rs./ha)		B:C Ratio	
	Demo.	Local check	Demo.	Local check	Demo.	Local check	Demo.	Local check
2015	50120	48623	233400	194220	183280	145597	4.65	3.99
2016	51550	49560	258660	207180	207110	157620	5.01	4.18Table

year 2015 and 2016, respectively, reflected the farmer's cooperation, in carrying out such demonstrations with encouraging results in subsequent year. The technology gap observed may be attributed to variability in the soil fertility status and agro climatic conditions. The extension gap which ranged from 32.65 to 42.90 q/ha during the period of study emphasized the need to educate the farmers through various means for the adoption of improved agricultural technologies to reserve this wide extension gap.

More adoption of recent production technologies with integrated nutrient management will subsequently change this alarming trend galloping the extension gap. The lowest value of technology index which indicate the more feasibility of the technology at the farmer's field. As such, decreased the technology index from 22.37 to 13.65 per cent indicated that the demonstrated technology was feasible (Table 2).

The benefit cost ratio of the demonstration (Table 3) revealed that B:C ratio from recommended practice were subsequently higher than the local check i.e. farmers practices during both the years of the demonstration. Average net return per hectare from the demonstration was *Rs.* 1,83,280 and *Rs*. 2,07,110, while from the local check *Rs*1,45,597 and *Rs*. 1,57,620 during the 2015 and 2016, respectively. The benefit cost ratio of demonstration and local check were observed as 4.65, 5.01, 3.99 and 4.18 during the demonstration year 2015 and 2016, respectively. Similar finding was reported by *Sharma (2003)* in moth bean.

CONCLUSION

The present study on impact of integrated nutrient management on yield and soil health in tomato has a significant positive result and gives researchers an opportunity to demonstrate the productivity potential and profitability of the recently developed technology under real farming situation, which they are advocating for long time.

The results of the study convincingly brought out that the yield of tomato could be increased from 20.17 per cent to 24.84 per cent with the intervention on integrated nutrient management and improved production technologies in tomato. Tomato cultivated soils which require good management practices to improve the soil quality which is evident with slight improvement in relative soil quality index from 61 to 63 during two years of adoption of INM practices. Soils which are within the critical limits indicate potential problems and few limitations require little management practices to further improve soil quality. From the above findings it can also be concluded that use of integrated nutrient management has reduced the extension and technology gap to a great extent. This could sustainably increase the income as well as the livelihood of tribal farmers in the district.

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