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Influence of front line demonstration of integrated crop management (ICM) in tomato on yield and economics in Adilabad district of Telangana

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Abstract

Tomato is a dominant vegetable crop grown in Adilabad district of Telangana. The KVK, Adilabad had conducted the study to popularize the Integrated Crop Management (ICM) in Tomato for efficient use of natural resources and minimizing the pest and disease for harvesting bumper yields and income. The cultivation of tomato by Flat bed transplanting without sustainable staking in the region leads to poor drainage, more pest and disease incidence and recording low yields. In order to disseminate the improved production technologies for reaping higher returns from tomato cultivation conducted Front Line Demonstrations during 2019-20 to 2020-21 in different villages of Adilabad district of Telangana. The proven extension strategic approaches (focused group discussion, method demonstration, off and on campus training programmes, field visits, exposure visits) and need based package of practices (timely sowing, seed treatment, raised bed dimensions, Trellising, different plant protection measures etc.) resulted higher yield in demonstrations (352.23 qha^{-1}) over check (272.6 qha^{-1}). There is an average of 29.21% increased yield was observed in demonstrations over farmers practice during both the seasons. Then the high benefit cost ratio was recorded with demonstration as 1.71 and 1.94 as compared to 1.29 and 1.21 under farmers practice during both the years of front line demonstration. The knowledge level and adoption level were too higher between beneficiary and non- beneficiary farmers and further, expanded the area under raised bed with sustainable staking cultivation of tomato.

Keywords: Tomato, trellising, black cotton soils, drainage, yield, economics

Introduction

Tomato (*Solanum lycopersicum* L.) is one of the most regularly consumed vegetables and widely used in various foods preparations all over the world. Tomato is a rich source of various nutrients due to presence of greater number of bioactive components that are important for the human body such as micronutrients, sugars, vitamins and many organic acids. Tomato pulp and other value added products are also an essential source of antioxidants such as phenols, flavonoids chlorophyll carotenoids lycopene and lutein (Dannehl *et al*., 2021) [5]. It is one of the major producing vegetables in India after potato and onion with the production of 20.57 million tonnes from an area of 0.81 million hectors and contribute 10.7% to the country's vegetables basket (NHB, 2022) [12]. The Telangana state accounts for 4.28% (0.88 million tonnes) of the total India production from an area of 25591 hectares and the major contributing districts are Rangareddy (24.8%), Vikarabad (9.3%), Siddipet (8.5%), Sangareddy (6.7%) and Adilabad (4.5%). The erstwhile Adilabad district producing 65602 tones of Tomato from an area of 4495 ha and contributing 7.4% of state production. The production of Tomatoes in tribal agency areas *viz* Indravelly, Gudihathnoor, Thalamadugu and Ichoda mandals of Adilabad district (Praveen Kumar *et al*., 2018) [14]. 'The average tomato yield in Adilabad district is 272 quintals per hectare which is far less than the potential yield of 400 quintals per hectare. The major constrains contributing to the low productivity in Tomato in Adilabad is the practicing of conventional farming or low adoption of improved management practices such as inadequate use of recommended fertilizers and plant protection measures against various physiological, pest and disease management etc in a integrated crop management (ICM) approaches including use of sustainable staking and pruning.

Majority of the farmers are cultivating Tomato in black cotton soils by conventional flat bed method which leads to poor drainage and recording low yields. Adilabad district receives high amount of rainfall during July and august month (kharif season) leads to water logging, flood, landslides, soil erosion, and loss of crop. Excess rains also promote fruit rots thereby reducing the quality of fruits. Then the cultivation of Tomato by traditional methods without staking and pruning leads to poor drainage, more pest and disease incidence and leading to lower yields and economic returns. Alternatively, trellising of tomatoes can address the problem of pest and disease incidence to a great extent. Further, the problem of lower yields and low productivity of tomato in this district is mainly attributed to many biotic and abiotic factors.

Therefore there is a need to demonstrate the improved technologies in integrated crop management (ICM) mode for boosting of production and productivity of tomato and raising the income level of the farming community. Keeping the micro-farming situation (crop damage, low yield and low economic returns) and high amount of rainfall during

July and August month in mind, front line demonstration of ICM in Tomato coupled with trellis method of tomato cultivation was popularized in the Adilabad district of Telangana state, India.

Materials and Methods

The present study was carried out by Krishi Vigyan Kendra, Adilabad (working under the administrative control of Professor Jayashankar Telangana State Agricultural University) for two consecutive years from 2019-20 to 2020-21 in the farmers field in different locations of Adilabad district. The front line demonstration had begun with a benchmark survey in different villages of the district. Diversified information was collected through structured personnel interviews of practicing tomato growers in the tribal hamlets. Secondary information was collected from mandal horticultural officers, experienced tomato growers and other key stakeholder in Tomato value chain (A. Poshadri *et al*., 2020) [1]. The following problems were identified 1. Traditional method of cultivation 2. Non adoption of staking (Trellis Method of Cultivation) 3. Inadequate use of recommended fertilizers 4. Inadequate use of plant protection measures. Then the KVK, Adilabad under taken the study to popularize the Integrated Crop Management (ICM) in Tomato by adopting the technology trellising on tomato along with along with drip and mulching for harvesting bumper yields and income. The cost of production, yield and economic indicators of front line demonstration, the data on output were collected from demo farmers as well as other practicing farmer plots as check and finally the yield, cost of cultivation, net returns with the benefit cost ratio was calculated to assess the impact of front line demonstration (Chaitanya, V *et al*., 2020; A Ramadevi *et al*., 2020) [4, 2]. A sample of 100 practicing farmers was taken comprising 50 demo farmers (from 10 villages) and 50 check (non beneficiary) farmers. Frontline demonstrations on integrated crop management in tomato were conducted during Kharif 2019-20 to 2020- 21 with full package and practices (Table 1 and Table 2) and taken equal representation for data analysis and interpretation. In FLD on ICM in tomato, technology index was operationally indicated as the technical feasibility obtained due to conducting of Cluster Frontline Demonstrations. Assessed the technology gap, extension gap and technology index as well as add on cost, additional returns and effective gain according the previous studies conducted by researchers (M. Raghuveer *et al*., 2020; Misra, *et al*., 2019) [8, 11].

Table 1: Frontline Demonstration on Integrated Crop Management (ICM) in Tomato

S. No.	Particulars	Details	
1	Crop & Season	Tomato & Vanakalam (kharif)	
2	Farming situation	Irrigated Black soils	
3	Problem diagnosed	Low yields are attributed to high incidence of fruit rots due to excess rainfall, non adoption of staking and use of micronutrients.	
4	Title of the FLD	Integrated Crop Management in Tomato	
5	No. of locations	05	Area: 2.0 ha
6	Treatments	**Check** 1. Without Seed treatment 2. Flat bed transplanting Row to Row 60 cm & Plant to Plant 30 cm 3. No staking and pruning 4. Imbalanced application of NPK (80:40:45 kg/acre) fertilizers 5. Unaware of micronutrient sprayings **Demo** 1. Seed was treated by carbendazim @1gm/ kg of seed Transplanting in raised bed distance Row to Row 90 cm & Plant to Plant 60 cm 2. Mulching, Using of power weeder between the rows 3. Fertilizer @ 200 Kg N, 120Kg P_2O_5 and 120 Kg K_2O/ha 4. 2nd week after transplanting, every 10-15 days weave the plants with string 5. Spraying of micronutrients and need based chemicals.	

Results and Discussion

The data obtained from FLD on ICM in Tomato indicates that yield of demonstration plots was higher as compared to check (farmers practice) may be attributed to ICM and raised bed cultivation practice with Trellising after 2nd week of transplanting. The results of yield performance between demonstration fields and farmers practices are given in Table 2. The average percentage of increase in the yield of demonstration was 29.21 per cent when compared to farmers practice. Similar yield enhancement in tomato crop in frontline demonstrations has been reported by S. Lamptey and E. Koomson (2021) [15]. Shalini *et al*. (2016) [16] reported that 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 with the adoption of improved practices in FLDs during study period. Yield of the frontline demonstration trials and potential yield of the crop was compared to estimate the yield gaps which were further categorized into technology and extension gaps (Dilip Singh (2017) [6] reported that selection of quality seeds and seed treatment is necessary for achieving higher yields in onions. The technology gap is the difference or gap between the demonstration yield and potential yield. A critical analysis of data (Table 2) revealed that the average technology gap was 47.77 q ha-1. The technology gap observed may be attributed to variation in the soil fertility status, crop failure due to water logging

conditions, low awareness on pest and disease control measures. Hence, location specific and micro farming situations recommendations may become necessary to narrow down the gap. These findings are similar to the finding of M. Sunil Kumar *et al*., 2021 [10] in Turmeric at Adilabad District of Telangana.

Table 2: Productivity, Technology gap, Technology index and extension gap in Integrated Crop management in Tomato

Year	Area (ha)	No. of Farmers	Yield (q ha^{1})			% Increase in yield	Extension gap (q ha^{-1})	Technology gap (q ha^{-1})	Technology index (%)
			Potential	Demonstration	Control				
2019-20	4	10	400	372	306	21.57	66	28	7.00
2020-21	4	10	400	332.46	239.2	38.99	93.26	67.54	16.89
	4	10	400	352.23	272.6	29.21	79.63	47.77	11.94

Table 3: Comparative C: B analysis of Integrated Crop management in Tomato

Year	Cost of cultivation		Gross Returns (Rs. ha)		Net Returns (Rs. ha)		B:C Ration	
2019-20	Demo	Check	Demo	Check	Demo	Check	Demo	Check
	198525	152513	341000	197440	142475	44927	1.71:1	1.29:1
2020-21	205150	157639	398952	191736	193802	34097	1.94:1	1.21:1
	201838	155076	369976	194588	168138.5	39512	1.83	1.25

Table 4: Impact of Front - Line Demonstration (FLDs) on Integrated Crop management in Tomato

Technology	Area (ha)			
	Before demonstration	After demonstration	Change in area (ha)	Impact (% change)
	1300	1975	675	51.92

The average extension gap (table 2) between demonstration and farmers practice was recorded 79.63 q ha^{-1}. The extension gap in the tomato cultivation indicates that there is a need to popularize the modern technologies and encouragement of mass adoption of improved production technologies in participatory approach over age old existing practices is the need of the hour. The refinement in the local farmer's practices for higher adoption of local specific generated farm technology for sustaining crop productivity is another option for the research scientists (S. Lamptey and E. Koomson, 2021) [15] and (Chaitanya, *et al*., 2020) [4]. Extension yield gaps are the indicators of lack of awareness for the adoption of improved farm technologies by the farmers (M. Raghuveer *et al*., 2020) [9]. The researchers Dilip Singh (2017) [6] also reported that, location specific problems and the interventions may have greater role in the enhancement of crop productivity in green gram.

From the data it was also found that the average technology index reported was 11.94 per cent (Table 2). This number indicates that there is a gap present between technology developed and technology adopted at farmer's field and represents the feasibility in conducting a demonstration. However, farmer perception towards the technology involving high initial costs and adverse climatic conditions resulted in the increasing trend of technology index values during the demonstration years. The socio-economic environment in terms of irrational attitude, illiteracy and impassive behaviors towards the adoption of new technologies are the major constraints in the improvement of agricultural productivity (Dilip Singh, 2017; Aklade *et al*., 2018) [6, 3]. This in a long run over the years and with more penetration at field level may result in decreasing trend of the technology index with précised use of demonstrated technologies in the field and suitable climatic conditions during demonstration period. As technology index denotes he gap between technology generated at research farm and farmer's field, lower the technology index more feasible will be the technology (Shalini *et al*., 2016) [16].

The effect of front line demonstration on farm income (Table 3) indicates that the average cost of cultivation involved in demonstration was Rs. 201837.5 ha^{-1}, which is lower than the farmers practice (Rs. 155076 ha^{-1}). The data concluded that the higer gross monetary returns (Rs. 369976 ha^{-1}) as well as net monetary returns (Rs.168138.5 ha^{-1}) were obtained with the adoption of technology over farmers practice during the course of trial. Likewise, the average benefit cost ratio of demonstration plot was 1.84 which was more than the farmers practice (1.25). The increase in the yield and monetary returns with demonstration might be attributed to the i) selection of suitable variety, ii) seed treatment with carbendazim @ 1gm/ kg of seed, iii) transplanting in raised bed distance Row to Row 90 cm & Plant to Plant 60 cm iv) trellising 2nd week after transplanting, every 10-15 days weave the plants with string and v) timely application of fertilizers as well as integrated pest management practices. In demonstration fields the following observations were made such as i) vigorous vegetative growth in-terms of plant height and number of tillers/plant, ii) low incidence of leaf spot, leaf blotch due to timely spraying of need based chemicals, iii) very low incidence of fruit rot due to good drainage facility for excess rainfall water, iv) crop duration was 7-8 months. The higher additional returns and higher benefit cost ratio obtained under demonstration might be due to improved technology, non-monetary factors and timely operations of crop cultivation as well as scientific monitoring. Similar results were also reported by Misra *et al*., 2019 and Shalini, M., Devaraja and Manjunath Gowda (2016) [11, 16].

Conclusion

Frontline demonstrations on ICM in tomato during 2019- 20 and 2020-21 resulted that average yield of 372 q ha^{-1} and 332.46 q ha^{-1} obtained with demonstration followed by 306 q ha^{-1} and 239.2 q ha^{-1} with farmers practice. Then this yield difference clearly demarked the monetary returns in

between demonstrations and farmers practice. The per cent increment in yield of Tomato to the extent of 29.21 per cent in demonstration over the check created greater awareness and motivated the fellow farmers for adoption the improved package of practices for Tomato. Further, the results in these demonstrations built the science-backed solutions for higher productivity and better management of natural resources. It is concluded that the FLD programme is an effective tool for increasing the area under horticulture crops and productivity of Tomato and changing the knowledge, attitude and skill set of the farmers. This has not only resulted in socio-economic up-liftment and also minimized the crop failure due to poor drainage and improved the moisture conservation in black cotton soils.

Conflict of interest: Authors have declared that no conflict of interests exist

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