



Research Article

IMPACT OF FRONTLINE DEMONSTRATIONS ON THE YIELD AND ECONOMICS OF TOMATO (*Lycopersicon esculentum* Mill.) IN BHARATPUR AND ALWAR DISTRICT OF EASTERN RAJASTHAN

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Abstract: Present study was carried out during Kharif season 2019-20 at Bharatpur and during 2021-22 at Alwar district of Eastern Rajasthan. Front line demonstrations were conducted on tomato by the active participation of the farmers with the objective of improved technologies of tomato production potential. The improved technologies consist F1 hybrid variety (Arka Samrat), balanced fertilizers (soil test based) application and integrated pest and disease management etc. Tomato is one of the most important vegetable crops of the country. All the recommended practices were provided to the selected farmers. The data related to the cost of cultivation, production, productivity, gross return & net return were collected as per schedule and analyzed. Result of the present study revealed that higher yield in the demonstrations was recorded (500 q/ha) as compared to farmers practice (431 q/ha) traditionally adopted by the farmers. The percentage increase in the yield over farmers practice 16.00 was recorded. The extension gap, technology gap and technology index were computed 69 q/ha, 50 q/ha and 9.09 % respectively. The demonstrated field gave higher net return Rs.294375 and B:C ratio 1:4.32. The result of the study indicated the gap existed in the potential yield and demonstration yield is due to soil fertility and weather conditions. Present results clearly show that the yield and economics of tomato can be boost up by adopting recommended technologies.

Keywords: Tomato, Front Line Demonstration, Farmer's practices, Yield

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Introduction

Tomato is an important vegetable crop grown almost throughout the world including tropical and temperate regions. It is cultivated both in the green houses on protective structures as well as under natural conditions. It ranks first among processed vegetables. It is consumed fresh in salad, fried in culinary preparations, and processed in various forms viz. ketchup, sauces, puree, paste, powder, juice soup and chutney etc. The fast foods such as pizza, burger, noodles etc. will not taste the same without addition of tomato sauces. Tomato is a rich source of vitamins A and C and is referred to as "poor man's orange". It adds variety of colours to the food. Tomato is a very good appetizer and its soup is said to be a good remedy for patients suffering from constipation. Lycopene that imparts red colour to ripe tomatoes is reported to possess anti-cancerous properties. It also serve as a natural anti-oxidant as the Beta-carotene functions to help prevent and neutralize free radical chain reaction and ascorbic acid is an effective scavenger of superoxide, hydrogen peroxide and other free radicals [5].

It is one of the most sensitive vegetable crops and fails miserably if growing conditions are too harsh. It is highly sensitive to frost. Dry and hot weather results in flower drops and poor fruit set. It can be grown in almost all states of India except in higher altitudes. Bihar, Karnataka, Uttar Pradesh, Orissa, Andhra Pradesh, Maharashtra, Madhya Pradesh, Punjab, Haryana, and Assam are important tomato growing states in India. In India during 2021-22 it was cultivated in 0.84 million hectare area with a production of 21.18 million tonnes and 24.21 tonnes/ha., productivity [1]. In Rajasthan its area and production were 20138 hectare and 238393 tonnes/ha tonnes respectively. In Rajasthan the productivity of tomato was recorded 11.83 t/ha. Which was almost two time lower than the India's productivity i.e., 24.21 t/ha.[2]. Average productivity of tomato crop is quite low and there exists a good scope to improve its average productivity in Rajasthan as well as in India to fulfil both domestic and national needs.

The growth, yield and fruit quality of tomato are largely dependent on number of interacting factors. Zinc is an essential component of a number of enzymes i.e., dehydrogenase, aldolase, isomerase, proteinase, peptidase and phosphohydrolase [10]. It is directly involved in the synthesis of Indole Acetic Acid and proteins. The principal function is a metal activator of enzymes in plants. Zinc deficiency may be related to weather conditions, as it increases in cold and wet weather, which might be due to the limited root growth in cool soils, or reduced activity of microorganisms and release of zinc from organic material. Due to Zinc deficiency leaves are small and distorted, the shoot length become shorten, giving the leaves a clustered arrangement near the growing tip. Its deficiency symptoms appear generally on younger leaves starting with interveinal chlorosis as well as an overall paleness of the whole plant. Flowers may drop off and fruit fail to set. Its deficiency occurs at soil pH above 7.5 and below 5.0. Boron plays a vital role in meristem development, pollen germination, and the metabolism of carbohydrates. It is also involved in the nucleic acid synthesis and calcium transfer. The first sign of boron deficiency in tomatoes is a terminal chlorosis on the younger leaves. In severe cases, the young leaves are grossly misshapen and the growing points die. The stems are short and thick. Failure to set fruit is common and the fruit may be ridged, show corky patches, and ripen unevenly. Iron is required for nitrate and sulfate reduction and is associated with chlorophyll formation and photosynthesis.

Nutrients can be applied either by conventional methods or by foliar application but the major advantage of foliar application is the instant availability of nutrients to plants. Tomato high yielding F1 hybrid Variety Arka Samrat developed by Indian Institute of Horticultural Research, Bangalore, Karnataka (Govt. of India). It is triple disease resistance to tomato leaf curl virus (ToLCV), bacterial wilt and early blight. Plants are semi-determinate with dark green foliar cover.

Table-1 Yield, technology gap and technology index of demonstration

Variables	Yield (q/ha)	Increase (%) over farmers practice	Technology gap (q/ha)	Extension Gap (q/ha)	Technology index (%)
Farmer's Practice	431	-	-	-	-
Demonstration F ₁ Hybrid Arka Samrat	500	16	50	69	9.09

Table-2 Economics of front-line demonstrations

Variables	Yield q/ha.	Cost of cultivation (Rs/ha.)	Gross return (Rs/ha.)	Net return (Rs/ha.)	Benefit: cost ratio
Farmer's practice	431	85700	330700	245000	01:03.9
Demonstration	500	88750	383125	294375	01:04.3
Additional in demonstration	36	3050	52425	49375	16.19*

Fruits are oblate-round with light green shoulder. Fruits are large size 9100-120 g), deep red, firm with good keeping quality (15-20 days) and long transportability. Seeds can be purchased online by registering at seed portal of IIHR.

A field trial was carried out at the 10 farmer's field both at Bharatpur and Alwar districts of Rajasthan comes in Agro-climatic zone of Rajasthan III B Flood Prone Eastern Plane. Here, generally in winters minimum temperature goes to 2-3°C and in summer maximum temp. reaches to 47°C, annual rainfall is 600-650 mm per year. There is lot of scope of tomato growing in this area.

The main objective of FLD is to introduce suitable agriculture practices like high yielding varieties, seed treatment, spacing, timely sowing, nutrient management including micronutrients, growth hormones, pest, and disease management etc. among the farmers accompanied with organizing extension programmes (field day) for horizontal dissemination of the technologies. Front line demonstration were conducted in a systemic manner, to show the genetic potential of high yielding new varieties, to convince them to about the potential of improved production technologies to enhance yield of tomato.

It is need of the hour to reduce the technological gap between the agricultural technology recommended by the scientists or researchers and its acceptance by the farmers on their field. In view of the above facts, front-line demonstrations were undertaken in a systematic manner on farmer's field to show the worth of improved practices and convince the farmers to adopt in their farming system.

Materials And Methods

The present study was conducted during Kharif season 2019-20 at Bharatpur and during 2021-22 at Alwar district of Eastern Rajasthan. The genuine seeds of tomato F₁ hybrid Variety Arka Samrat were procured from IIHR, Bangalore and distributed to selected farmers. All the participating farmers were trained on various aspects of tomato production technologies. The field was prepared by deep ploughing and harrowing. Raised nursery beds were drenched with Copper oxychloride 50 % W.P.(3g/l) 3-4 days before seed sowing, 12 days after sowing and one day before transplanting for the protection of seedlings by damping off disease. The seeds were sown in well prepared raised bed during first week of July. Seeds were treated by fungicide Carbendazim 50 % W.P. @ 2g/kg seed. In main fields raised beds of 90 cm width with 30 cm spacing between two beds are prepared. Transplanting of one month old seedlings at the center of these beds were done maintaining row spacing of 120 cm and 30 cm spacing with in rows. Recommended dose of manure and fertilizers (10 tonnes FYM, N:P:K 60:60:60 kg/ha. respectively) as basal application before transplanting and remaining 60 kg nitrogen by three split doses 30, 45 and 60 days after transplanting. Zinc sulphate, Boric acid and Ferrous sulphate were applied @ 50 mg each/liter of water at 45 and 75 days after transplanting. The data on output were collected from technologies demonstrated as well as local plots from all selected farmers and finally the grain yield, cost of cultivation, net returns with the benefit cost ratio was worked out as average of both Bharatpur and Alwar districts. An average of cost of cultivation, yield, net returns of different farmers was analyzed by the formula.

$$\text{Average} = [F_1 + F_2 + F_3 + \dots + F_n] / N$$

F₁ = Farmer

N = No. of Farmers

The following formula [11,12] were used.

$$\text{Technology Gap} = P_i (\text{Potential Yield}) - D_i (\text{Demonstration Yield})$$

$$\text{Extension Gap} = D_i (\text{Demonstration Yield}) - F_i (\text{Farmers yield})$$

$$\text{Technology index} = [(\text{Potential Yield} - \text{Demonstration yield} / \text{potential yield}) \times 100].$$

Result and Discussion

Performance of FLD

A comparison of productivity levels between demonstration and farmers practice is shown in [Table-1]. It is evident from results that under the demonstrated plots, performance of tomato (yield) was sustainable higher than in the local check at both districts. During the period of study, it was recorded that front line demonstrations on tomato F₁ hybrid variety Arka Samrat with all recommended package of practices recorded the higher yield (500 q/ha) than farmers practice (431q/ha). The Percentage increase in the yield (16.00) over farmers practice was recorded. Similarly, yield enhancement in different crops in front line demonstrations were documented by [3,4,7,8,9,14]. From these results it is evident that the performance of the technology demonstrated was found to be better than the farmers practice under same environment conditions. The farmers were motivated by seeing the results in term of productivity and they are adopting the technologies.

The potential yield of the variety is 550 q/ha. The Technology gap 50 q/ha was recorded [Table-1]. The FLDs were laid down under the supervision of Krishi Vigyan Kendra specialists at the farmers field, there exist a gap between the potential yield and demonstration yield. This may be attributed to dissimilarities in soil fertility, salinity and to erratic rainfall and other vagaries of weather in the demonstration area. Hence, location specific recommendations may become necessary to narrow down the gap. These findings are similar to the findings[13] in oil seeds at Baran District of Rajasthan.

Comparative high Extension gap (69) [Table-1] emphasizes the need to educate the farmers and help them for optimizing the yield by adopting improved practices. Greater use of the latest improved production technologies can subsequently bridge this extension gap between demonstration yield and farmer's yield. New technologies, may, eventually lead farmers into discontinuing obsolete varieties.

Technology index shows the feasibility of the variety/technology at the farmer's field. The lower the value of technology index (17 %), more is the feasibility of the technology [Table-1]. It means the technology is suitable for the Bharatpur district of Eastern Rajasthan. The result of the present study is in consonance with the findings of [4,6]

Economics of front-line demonstrations

The results of the study presented in [Table-2] revealed that technology demonstrated recorded higher gross return and net return Rs.383125/ha. and Rs.294375/ha. respectively with higher benefit cost ratio (1:4.32) as compared to farmer's practice. These results are in accordance with findings of [4,6,7]. Further, additional cost of Rs.3050/ha. in demonstration has increased additional net return Rs. 49375/ha. With incremental benefit cost ratio 16.19 suggesting it's higher profitability and economic viability of the demonstration. More and less similar results were also reported by [3,6]. On the basis of above finding in present study, it is concluded that front line demonstrations of improved technology reduces technology gap to a considerable extent, thus leading to increased productivity of tomato in both Bharatpur and Alwar districts of Eastern Rajasthan. This also improved linkages between farmers and scientists, and built confidence for adoption of the improved technology.

Conclusion

Under diversified agro-climatic conditions, tomato F₁ hybrid variety Arka Samrat with recommended package of practices including application of micronutrients like zinc, boron and ferrous has given encouraging results over farmer's practice

of using private sector variety without recommended package of practices for the crop tomato and have potential to perform well with timely management practices in Eastern Rajasthan. This variety released by government institute may be popularized with full package of practices to explore the potential in field conditions and mitigate the extension gap, simultaneously efforts need to be made to reduce the technology gap described in this paper. In economic view, an additional cost mainly for inputs was increased slightly in front line demonstration over local check. However, it was recovered by increasing gross and net return substantially and resulted in more benefits cost ratio than the local check. The use of latest production technologies with timely systematic management would increase productivity of tomato and income of the farmers who are mainly associated with this crop. There is need to implement multi-pronged strategy, which includes vertical and horizontal productivity growth through better adoption.

Application of research: There is continuous demand for High yielding hybrid variety with diseases resistance capacity with full package of practices the vegetable crop like tomato. Farmers are getting profit by growing this crop because of suitability of the crop in their locality. But by making them aware about the improved technologies like improved varieties and their availability, package of practices, farmers will be able to increase their profit.

Research Category: Front line demonstration

Abbreviations: FLD-Front line demonstration

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Study area / Sample Collection: Bharatpur and Alwar in Rajasthan, India

Cultivar / Variety / Breed name: F1 Hybrid Arka Samrat

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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