Journal of Advances in Biology & Biotechnology

Volume 27, Issue 9, Page 1366-1370, 2024; Article no.JABB.122999
ISSN: 2394-1081

Assessment of Impact and Yield Economics of Tomato Hybrid Variety Arka Rakshak under High Hill Region of Arunachal Pradesh

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/jabb/2024/v27i91409

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/122999

Original Research Article

Received: 07/07/2024
Accepted: 10/09/2024
Published: 14/09/2024

ABSTRACT

A demonstration (FLD) was conducted by Krishi Vigyan Kendra Yachuli, Lower Subansiri district, Arunachal Pradesh under high hill region during *Summer* season of 2021-22 and 2022-23 to evaluate the impact of the demonstration of Tomato variety Arka Rakshak for yield and economics at the farmer's field of four different locations of region. An area of 3.2 ha was covered under FLDs on Tomato variety Arka Rakshak with active participation of 12 farmers during demonstration. The

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Cite as: *Chaturvedi, S. K., Abhimanyu Chaturvedi, Hage Munth, and Neha Sharma. 2024. "Assessment of Impact and Yield Economics of Tomato Hybrid Variety Arka Rakshak under High Hill Region of Arunachal Pradesh". Journal of Advances in Biology & Biotechnology 27 (9):1366-70. https://doi.org/10.9734/jabb/2024/v27i91409.*

average fruit yield was 372 q/ha during 2021-22 and 410 q/ha during 2022-23 with the increase in percentage of yield ranged between 53.71 to 52.98 during two years of the study. The extension gap ranging 130 to 142 q/ha and technology gap ranging between 308 and 270 q/ha. Decrease in technology index from 45.29 per cent during 2021-22 to 39.70 percent during 2022-23 show the practicality of the demonstrated technology in this region

Keywords: Impact; front line demonstration; yield; economics; extension gap; technology index; tomato.

1. INTRODUCTION

The tomato (*Solanum lycopersicum* L.) belongs to the family Solanaceae and originated in Mexico. It has second-most important vegetable crop in the world after potatoes [1]. It is an important source of essential nutrients and antioxidants. Due to its richness in vitamin A, vitamin C and lycopene [2] phenols and antioxidants [3] it has found preventing against so many diseases. India is the second-largest producer of tomatoes after China, with an area of 8.65 lakh ha and production of 210.56 lakh MT, with an average productivity of 24.3 t/ha [4]. The productivity of tomatoes is comparatively low in India compared to other producing countries in the world [5]. In India, Madhya Pradesh contributes the highest in area and production of tomatoes, accounting for about 11.89 and 14.11 percent, respectively. This is followed by Odisha (10.85), Tamil Nadu (9.59), Karnataka (7.74), and Andhra Pradesh (7.12%) in area. However, Tamil Nadu and Andhra Pradesh have the 2nd and 3rd rank in production after Madhya Pradesh [4].

However, Tomato is important crop under Lower Subansiri district of Arunachal Pradesh and summer season is very suitable for tomato cultivation. The productivity enhancement of tomatoes is a major concern for the farmers in the region. Due to lack of knowledge about high yielding, disease resistant, best suited cultivars to agro-climatic conditions, and incidence of diseases the potential of tomato not fully exploited. Disease resistant hybrid varieties of tomatoes with recommended management can enhance yield of tomato. Before commendation of any varieties to farmers it is being suitable to evaluate to cultivars on suitability for region and productivity in state. The temperature range of 10^0C to 30^0C with optimum range of temperature is 21-24^0C with well drained sandy loam soil are the ideal condition for its cultivation [6]. The production of tomato varieties differs with variation in climate and region. Taking into account all above facts, and felt to conduct a study as per need of region on performance of Arka Rakshak cultivar of tomato under Ziro-I block of Lower Subansiri district to recommend, the variety highly suitable under agro-climatic condition of the district. The dissemination of appropriate technologies at farmers field can enhanced the farmers yield as well as it may also bridge yield gap may up to a certain extent. In this context, KVK-Yachuli, Lower Subansiri conducted Front Line Demonstrations with objective to demonstrate disease resistant hybrid tomato variety Arka Rakshak on farmer's fields, and convince them to adopt the improved production technologies to enhance yield of tomato.

2. MATERIALS AND METHODS

A Front Line Demonstration (FLD) was caried out by Krishi Vigyan Kendra Yachuli, Lower Subansiri district, Arunachal Pradesh under high hill region during *Summer* season of 2021-22 and 2022-23 to evaluate the impact of demonstration of Tomato variety Arka Rakshak at farmer's field of four different locations of region. FLDs were demonstrated with full package of practices on farmer's field to prove the impact of technology and persuade the farmers to adopt in their farming practices. An area of 3.2 ha was covered under FLDs on Tomato variety Arka Rakshak with active participation of 12 farmers during demonstration.

Before starting the FLDs, farmers list was prepared from group meeting. The specific skill training was delivered to farmers group on scientific management practices. The field was prepared by well ploughing upto fine tilth and leveled for nursery sowing and planting. The seeds were sown in nursery under polyhouse in well prepared raised bed during February months. Traditional practices were worked out in control plots of local adopted variety Rocky, while the recommended management practices were adopted in demonstrated variety. The fruits were plucked at reddish-green (maturity) stage. The observations were recorded from each farmer on

package of practices demonstration and farmer's practices tabulated in Table 1. The following formulas viz. extension gap, technology gap, and technology index were implemented during the study [7].

Technology gap = Potential yield - Demonstrated yield
Extension gap = Demonstrated yield - Yield under existing practice

$$\text{Technology index} = \frac{\text{Potential yield} - \text{Demonstrated yield}}{\text{Potential yield}} \times 100$$

3. RESULTS AND DISCUSSION

It is clear from Table 2 that the yield of FLD of tomato variety Arka Rakshak superior consequently during both the years. The average fruit yield was 372 q/ha during 2021-22 and 410 q/ha during 2022-23 with the increase in yield percentage 53.71 and 52.98 respectively, during both years of evaluation. The findings proving the superiority over the existing practices as it enhanced the yield of tomato in Lower Subansiri district of Arunachal Pradesh.

The extension gap recorded from 130 - 142 q/ha; during the both year of study. It is proving that farmers are needed to educate about improved technologies through different dissemination methods.

Through this only the extension gap will be minimized.

The technology gap recorded from 308 - 270 q/ha. Here also need of scientific demonstrations at farmers field to educate the farmers. The technology gap noticed may be the result of dissimilarity in soil fertility status and weather condition. The similar findings also reported by Chapke [8] and Singh et al., [9].

Here the technology index proving that superiority of FLD over the farmer's practices. The lower value of technology index means it is more feasible. During the first year it was recorded 45.29 while it was minimized as 39.70 during the second's years of the study. This is proving that the study was positive at farmer's field. The Keshavareddy et al., [10] Dayanand [11] and Katare et al, [12] have also supporting this finding.

Table 1. Level of adoption and adoption gap of recommended technologies in Tomato under demonstration

Crop operations	Improved package of practices	Farmers practices	Gap
Variety	Arka Rakshak (F1 hybrid)	Rocky (F1 hybrid)	Full gap
Soil testing	Have been done in all locations	Not in practice	Full gap
Seed rate	150gm /ha	200gm /ha	Full gap
Seed treatment	Seed was treated with Captan@2- 3g/ kg seeds	Not in practice	Full gap
Time for Transplanting	25-30 Days after seed sowing	30 Days after seed sowing	No Gap
Transplanting method	Transplanting on raised bed Row to Row 75 cm & Plant to Plant 60 cm	Transplanting on Raised bed but Row to Row 50 cm & Plant to Plant 50 cm	Partial gap
Transplanting time	March	March	No Gap
FYM & Fertilizer dose	FYM 20-25 MT POP 250:250:250kg (N:P:K)	Small quantity Vermi-compost in near root zone of plant applied. Fertilizes Not in use	Partial gap
Stalking	Stalking with Bamboo stick and twine.	Nicely Adopted	No Gap
Micronutrient	Multiplex water soluble micronutrients (03 times)	Not aware of micronutrients	Full gap
Weed management	Hand weeding 3-4 times	Hand weeding (2 times)	Partial gap
Plant protection	Integrated pest and disease Management	Sometimes chemical spray	Partial gap
Marigold as intercrop	Thirty rows of tomato with one Row of marigold	Not in practice	Full gap

Table 2. Yield of Tomato, technology gap, extension gap and technology index as influenced by improved practices

Year	Fruit yield(q/ha)			% Increase	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
	Demo (q/h)	Check (q/ha)	Potential (q/ha)				
2021-22	372	242	680	53.71	308	130	45.29
2022-23	410	268	680	52.98	270	142	39.70

Table 3. Economics analysis of tomato demonstration

Year	Cost of Cultivation (Rs/ha)		Gross Return (Rs/ha)		Net Return (Rs/ha)		Benefit Cost ratio (B:C Ratio)	
	Demo	Check	Demo	Check	Demo	Check	Demo	Check
2021-22	145000	122000	5,58,000	363000	413000	241000	3.84	2.97
2022-23	152000	134000	6,15,000	402000	463000	268000	4.04	2.00

3.1 Benefit-Cost (B:C) Ratio

The economic parameters were also studies to justified the study viz. Cost of cultivation, net return and B: C ratio. The calculation of different variable costs and non -variable costs were done at the market price during the course of study (Table 3). Under FLD, cost of cultivation was Rs 145,000 /ha(during 1st years) and 1,52,000 /ha (during second year).

The cost of cultivation under FLD were higher over farmers practices due to the cost of balanced fertilizer, hybrid seeds and IPM practices. Similarly, the net return under FLD (Rs. 413000/ha and Rs. 463000/ha) were also higher over farmer practices (Rs. 241000/ha and Rs. 268000/ha). This finding is also supported by Mokidue et al. [13] and Keshavareddy et al. [10].

The FLD also superior higher in respect of B: C ratio (3.84 and 4.04) as compared to farmers practices (2.97 and 2.00 respectively). The application of scientific approaches at farmers field resulted better yield; which converted into better monetary value. By this the benefic cost ratio was higher. Thus, the need of moment to dissemination of improved technologies at farmers field with proper guidance; by which the productivity of farmers can be improved for their betterment of livelihood ness as well as their sustainable agriculture.

4. CONCLUSION

It can be concluded from above study that technology gap can be significantly minimized by using scientific methods of tomato cultivation, which will raise the district's tomato production and, in turn, improve the producers' economic situation. In direction to close the extension gap and improve the district's tomato production, extension institutions in the area must provide to farmers the required technical help using a variety of educational and extension methods. In conclusion, the study revealed that tomato growers' knowledge of disease-resistant and high yielding hybrid tomatoes. The great output of the demonstration plots over farmers' fields raised awareness among tomato growers and encouraged other farmers to implement suitable advancements in production and protection techniques.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/122999