Assessment of Impact and yield economics of Tomato hybrid variety Arka Rakshak under high hill region of Arunachal Pradesh

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 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*

Introduction:

The tomato (*Solanum lycopersicum* L.) belongs to the family Solanaceae and originated in Mexico. It is the second-most important vegetable crop in the world after potatoes (Quinet, 2019). It is an important source of essential nutrients and antioxidants. It has been found to be effective in preventing several diseases due to rich source of vitamin A, vitamin C and lycopene (Anonymous, 2018) phenols and antioxidants (Ntonifor *et al*., 2013). 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 (Anonymous, 2022).The productivity of tomatoes is comparatively low in India compared to other producing countries in the world (Singh *et al.,* 2023). 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 (Anonymous, 2022).

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. Tomato plants thrive well in temperature 10^0C to 30^0C with optimum range of temperature is 21-24^0C and Well drained sandy loam soil with high level of organic contents is best suitable for tomato cultivation. (Kale *et al.* ,2020). Performance of tomato varieties varies with climate to climate and region to 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. Front line demonstration can enhanced by adopting cost and input efficient technologies, and the bridge in yield gap may be level up to certain extent. Therefore, 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.

Materials and Methods:

A Front Line Demonstration 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 demonstration of Tomato variety Arka Rakshak for yield and economics at farmer's field of four different locations of region. Frontline demonstrations were conducted in a scientific way on farmer's field to show the impact of improved practices 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.

List of farmers were prepared before conducting demonstrations from group meeting and 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. Observations were recorded from each farmer on package of practices demonstration and existing farmer's practices tabulated in Table -1. Study on extension tools i.e. extension gap, technology gap, and technology index were worked out as suggested by (Suthar *et al.*,2016) to evaluate impact of front-line demonstrations among selected farmers in paddy crop.

Technology gap = Potential yield - Demonstrated yield

Comment [SK1]: well

Comment [SK2]: check the font size

Comment [SK3]: month

Comment [SK4]: demonstrated

Extension gap = Demonstrated yield - Yield under existing practice

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

Comment [SK5]: Type the formula instead of copying

Results and Discussion

Observations tabulated in Table-2 shows that the yield of tomato variety Arka Rakshak increased consequently during two years in demonstrated plots. 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 result revealed the positive effects of FLD over the existing practices as it enhanced the yield of tomato in Lower Subansiri district of Arunachal Pradesh.

The extension gap ranging between 130 and 142 q/ha during the period of study point out the need to teach the farmers through different means for the adoption of improved agricultural production to fill the trend of wide extension gap. The trend of technology gap ranging between 308 and 270 q/ha consider the farmer's cooperation in carrying out such demonstration with encouraging results in coming years. The technology gap noticed may be attributed to the dissimilarity in soil fertility status and weather condition. Close findings were also reported by both Chapke (2012) and Singh *et al.*,(2016).

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	**Partial gap**

		Not in use	
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

Comment [SK6]: All should start with capital letter

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

The technology index showed the practicality of the advance technology at the farmer's field. The lower the value of technology index, the more is the feasibility of the technology. By itself, the reduction in technology index from 45.29 per cent during 2021-22 to 39.70 per cent during 2022-23 exhibited the feasibility of the demonstrated technology in this region. Similar observations were found by Keshavareddy *et al.,* (2018), Dayanand (2012) and Katare *et al.*,(2011).

Benefit-Cost (B:C)ratio:

To find out the economic feasibility of the demonstration technologies over and above the control, some economic factors like cost of cultivation, net return and B: C ratio was worked out. The economic viability of improved demonstrated technology over farmers practice was computed on

the basis of prevailing price of inputs and output cost and represented in term of B: C ratio (Table 3). It was found that the cost of production of tomato under demonstration varied from Rs 145,000 to 1,52,000 /ha.

The extra cost raised in the demonstration was mainly due to additional cost involved in balanced fertilizer, procurement of improved hybrid and IPM practices. The present finding shows that the net return from the demonstration were substantially higher than control plots. The findings of Mokidue *et al.* (2011) and Keshavareddy *et al.* (2018) supports to this finding.

B: C ratio was recorded to be higher 3.84 and 4.04 under demonstration against control 2.97 and 2.00 during both the years of study. Scientific method of tomato cultivation can reduce the technology gap to a considerable extent, thus leading to increased productivity of tomato in the district which in turn will improve the economic condition of the growers. Moreover, extension agencies in the district need to provide proper technical support to the farmers through different educational and extension methods to reduce the extension gap for better tomato production in the district.

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.

References:

1. Anonymous. Indian Horticulture Database 2018. National Horticulture Board, Ministry of Agriculture, Government of India. 2019, Pp. 203

2. Anonymous.(2022). Agricultural Statistics at a Glance. Government of India Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Directorate of Economics & Statistics; c2022. p. 159-169.

3. Chapke, R.R. (2012). Impact of Frontline Demonstrations on Jute (*Corchorus olitorius*). *J. Human Eco*, 38 (1): 37-41.

4. Dayanand, VRK. and Mehta, S.M (2012). Boosting mustard production through front line demonstrations. *Indian Res. J. Ext Edu* 12 (3): 121-123.

5. Kale, S.M., Barikar Umesh and Mahesh, C. (2020). Popularization of Tomato Hybrid (Arka Rakshak) for Yield and Economic Analysis in Kalyan Karnatka Region. *Int.J.Curr.Microbiol.App.Sci.* 9(06): 1675-1679.

6. Katare, Subhash,Pandey, S.K. and Mustafa, Mohd. (2011).Yield gap analysis of rapeseed mustard through front line demonstration. *Agric. Update* 6: 5-7.

7. Keshavareddy G., S. Kamala Bai, K. H. Nagaraj and Hanumantharaya B. G. (2018). Integrated Crop Management - A Way for Doubling the Income of Tomato Growers in Ramanagara District of Karnataka, India. *Int.J.Curr.Microbiol.App.Sci.*7 (06):2161-2168.

8. Mokidue, I., A. K. Mohanty and Sanjay, K. (2011). Correlating growth yield and adoption of Urdbean technology.Indian. J. Extn. Edu. 11(2): 20-24.

9. Ntonifor NN, Nsobinenyui DN, Fokam EB, Fontem LA.(2013). Developing an integrated management approach for the fruit fly *Dacus punctatifrons* on tomatoes. American J Expt. Agri.;3:470-481.

10. Quinet M, Angosto T, Yuste-Lisbona FJ, Blanchard-Gros R, Bigot S, *et al.* (2019).Tomato Fruit Development and Metabolism. Front Plant Sci. 2019;10:1554. DOI:10.3389/fpls.2019.01554.

11. Singh.,D.V., Mukhi, S.K. and Mohapatra, M.R. (2016). Yield Gap Analysis of Toria (*Brassica campestris*) through Front Line Demonstration in Kandhamal District of Odisha, *Indian J. Ext. Edu*, 52 (3& 4), 167-17.

12. Singh, Pushpraj; Patel VK, Desai, CK and Chaudhari, AT (2023).Evaluation of tomato hybrid Arka Rakshak for growth and yield at farmer's field. The Pharma Innovation Journal; SP-12(9): 2297-2300

13. Suthar, J. V., Chawda, S. K., Patel, A. T. Pastagia, J. J and Patel, B. B., (2016).Impact of front line demonstration the yield of poha rice (Oryza sativa) in Surat district. J. Bio. Innov. 5 (4): 588-593.