

Performance of Tomato hybrids Arka Samrat and Arka Abhedhin Alluri Sitarama Raju District of Andhra Pradesh, India

ABSTRACT

The climate and soil in tribal areas of Alluri Sitarama Raju District of Andhra Pradesh was ideal and well suited for tomato cultivation. The cultivating varieties were less yielders and highly succumb to pests and diseases. The farmers were in a dire need of best performing and high yielding tomato varieties. So, Krishi Vigyan Kendra (KVK), Pandirimamidi, DR.YSRHU conducted on farm trials from 2019-20 to 2021-22, in four selected villages involving eighteen farmers covering an area of 4.5 acres. The principal objective of this study was varietal assessment of high yielding tomato hybrids i.e. Arka Abhedh (multiple disease resistant) and Arka Samrat (triple disease resistant) for ascertaining and recommending the cultivars best suited for the region. The farmer practice i.e. cultivation of commercial tomato hybrid INDAM - Rashmi was considered as local check. The results showed that tomato hybrid Arka Abhed (528.23 q/ha, 564.65 q/ha and 589.78 q/ha) proved to be the best in yield followed by Arka Samrat (501.24 q/ha, 538.67 q/ha and 558.75 q/ha) and INDAM - Rashmi hybrid (402.72 q/ha, 434.55 q/ha and 455.45 q/ha) for the three consecutive years of the study from 2019-20 to 2021-22. An extension gap was recorded between 125.51 to 134.33 q/ha and 98.52 to 103.30 q/ha in Arka Abhed and Arka Samrat respectively. Technology Index for tomato hybrids i.e. INDAM - Rashmi (farmers' practice), Arka Abhed and Arka Samrat observed as 13.24%, 18.65% and 30.15% respectively.

Keywords: On farm trials, Arka Abhedh, Arka Samrat, Yield, Extension gap, Technology Index

1. INTRODUCTION

Tomato, scientifically known as *Solanum Lycopersicon* L., has attained the esteemed status of being the world's most popular vegetable crop due to its remarkable adaptability to a wide range of agro-climatic conditions. Tomatoes are highly regarded as a protective food crop due to their rich content of essential minerals, vitamins, and organic acids. They serve as a vital source of lycopene, ascorbic acid, and carotene, all prized for their contributions to color, flavor, and antioxidant properties. Lycopene presence in plasma in tomato is valued for its anti-cancer property (1). At present India ranks second in area next to China by producing 19.37 million tonnes of tomato from an area of 0.78 million ha. However, in terms of productivity, India (25 t ha⁻¹) stands in tenth position, whereas India is the fourth largest tomato producer in the world after China, USA and Turkey accounting for about 6.5% of the world tomato production (2). Tomato is grown extensively throughout India including Andhra Pradesh, where the total area under the crop is 54160 ha with a production of 24.37 MT third largest producer of tomato, behind Madhya Pradesh and Karnataka. The rising consumption of tomatoes has elevated its status to that of a high-value crop, providing a significant income source for farmers. It holds great importance from both

production and industrial perspective, necessitating the need to enhance productivity per unit area in order to meet the growing demand within limited arable land [3], [4].

Tomato is grown over some parts in Alluri Sitarama Raju District of Andhra Pradesh including tribal areas where the climate and soil are ideal for the crop. However, yields are poor because the cultivating varieties became susceptible to several diseases and also lacking knowledge among the tomato growing farmers regarding the selection of the high yielding and multiple disease resistant varieties, proper seed treatment, nursery raising, integrated nutrient management and plant protection measures. It is imperative to advise the tomato growers for high yielding cultivars and demonstrate the right technology for a higher yield, net returns right in their own fields and through their own hands. In the light of all such aspects, an on-farm trial (OFT) was undertaken in farmers' fields of selected villages by Krishi Vigyan Kendra, Pandirimamidi, Dr. YSRHU in Alluri Sitarama Raju District of Andhra Pradesh with the principal objective of varietal assessment of high yielding tomato hybrids for ascertaining and recommending the cultivars best suited for the region. There were eighteen participant farmers selected from four villages viz. Rajampalem, Indukurupeta, Gangavaram and Parimithadaka. The field area was 4.5 acres and the tomato hybrids were multiple disease resistant 'Arka Abhed' and triple disease resistant 'Arka Samrat' (released by ICAR- IHR, Bengaluru). The OFTs were conducted for three consecutive years from 2019-20 to assess the performance of the cultivars with improved practices and convince the farmers for adopting improved farming practices for enhancing their economic livelihood.

2. MATERIALS AND METHODS

Before conducting the field trial, the list of the participant farmers was prepared very meticulously. The skill training focused on the selection of quality of seeds, seed treatment, nutrient management, irrigation schedule, plant protection measures and right harvesting methods.

Tomato hybrids of Arka Abhed, Arka Samrat and INDAM-Rashmi (farmers' practice - Check) were selected as treatments for assessing the yield and economic analysis. The seeds were sown in pro trays for ensuring better germination and 25 days old seedlings were transplanted in the main field at a spacing of 90 x 60 cm. The spacing so used facilitated easy intercultural operations. Seed treatment for preventing fungal diseases was done with carbendazim @ 2g/kg of seed [3]. The fields received FYM @ 6 tonnes/acre well before the sowing time. N, P and K @ 48, 24 and 24 kg/acre were applied through commercial

fertilizers [4]. Proper staking practices were followed. At maturity stage, picking was done at five days interval. Performance and yields of Arka Abhed (multiple disease resistant) and Arka Samrat (triple disease resistant) were compared against INDAM-Rashmi (farmers' practice - check).

The parameters such as extension Gap and technology Index were calculated by formulae suggested by (Singh et al. 2016) and [6] to study the impact of on farm trials over the selected farmers.

- Extension gap = Demonstrated yield - Yield under existing practice

- Technology Index =

$\frac{\text{Potential Yield} - \text{Demonstrated Yield}}{\text{Potential Yield}} \times 100$
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3. RESULTS AND DISCUSSION

Results on yield (Table 1) revealed that all the three varieties recorded the highest yield in 2021-22 (455.50, 589.50 and 558.75 q/ha for INDAM-Rashmi, Arka Abhed and Arka Samrat respectively). Tomato hybrid Arka Abhed recorded a percent increase of 31.16%, 29.93% and 29.49% whereas Arka Samrat recorded an increase of 18.65%, 18.43% and 17.51% in yield over the farmers' practice (INDAM-Rashmi) during 2020-21, 2021-22 and 2022-23 respectively. This could be due to multiple disease resistance (Early leaf blight, late leaf blight, bacterial blight and leaf curl) of tomato hybrid Arka Abhed and triple disease resistance (Early leaf blight, Bacterial blight and leaf curl) of Arka Samrat. Similar results were reported by Babu et al., [4], Surendra et al., [2], Mishra et al., [7], Kale et al., [8] and Prasanna Lakshmi et al., (2021). The results revealed the positive effects of Arka Abhed and Arka Samrat over the existing farmers' practice viz. INDAM-Rashmi.

The outcomes of the economic analysis of Arka Abhed and Arka Samrat over the farmers' practice are shown in Table 1. Economic variables such as the cost of cultivation, net return and B:C ratio were calculated to determine the demonstration technologies' economic viability relative to the control (farmers' practice - check). In comparison to farmers' practice (INDAM-Rashmi), demonstration plots of tomato hybrids Arka Abhed and Arka Samrat recorded higher costs of cultivation which might be due to increased costs of inputs like seed, fertilizers, more number of labour days required for harvesting. A similar result was reported by Sahoo et al., [14] The cost of cultivation per hectare for both the tomato hybrids Arka Abhed and Arka Samrat ranged from Rs. 1,15,500/- in 2019-20 to Rs. 1,33,750/- in 2021-22 whereas the demonstration plots ranged from Rs. 1,06,500/-

in 2019-20 to Rs. 1,23,000 /- in 2021-22. The net returns too increased steadily in the demonstration plots ranged from Rs. 2,54,261/- to Rs. 3,38,074/- from 2019-20 to 2022-23 in tomato hybrid Arka Abhed, whereas tomato hybrid Arka Samrat recorded Rs. 2,35,368/- to Rs. 3,13,250/- from 2019-20 to 2021-22. The net returns were substantially higher in the demonstration plots over the control with farmers' practice plots i.e. Rs. 1,75,404/- (2019-20) to Rs. 2,41,360/- (2021-22). The results corroborate those of Babu et al., [4], Kale et al. [8], Mokidue et al., [10] and Keshava reddy et al., [11]. Cost benefit ratio was recorded higher in the demonstration plots than farmers' practice in all the three years of study (Table 1 and Fig 4).

The extension gap with Arka Abhed and Arka Samrat ranged between 125.51 to 134.33 and 98.52 to 103.00 q/ha during the years 2019-20 and 2021-22 of the study (Table 2). Thus there is a need to educate the farmers for the adoption of improved varieties along with modern technology through various extension methodologies viz. front-line demonstrations, cluster frontline demonstrations, field days and convergence meeting with line departments. It was evident from (Table 2 and Fig 6) that Technologies Index showed a decrease pattern in both the tomato hybrids i.e. Arka Abhedh (27.14% to 18.65%) and Arka Samrat (37.34% to 30.15%) respectively from 2019-20 to 2021-22. The lower the value of Technology Index, the more is the feasibility of the technology. The results make it amply clear for the feasibility of the demonstrated technology in this region for improving the yield of tomato. Similar results were reported by Babu et al., [4], Kale et al., [8], Keshava reddy et al., [11], Katare et al. [12], and Dayanand & Mehta [13] in mustard.

4. CONCLUSION

Tomato hybrids Arka Abhed (multiple disease resistant) and Arka Samrat (triple disease resistant) recorded substantially higher yields than farmers' practice (INDAM - Rashmi). The net returns in demonstration plots of the hybrids were also higher over the farmers' cultivating variety. The results of the on farm trials amply demonstrated the superiority of the tomato hybrids Arka Abhed and Arka Samrat over the farmers' practice in yield, net returns and cost: benefit ratio. The participant farmers realized the superiority of hybrids over the check variety and adopted the technology in the cultivation of tomato. Hence, the two tomato hybrids namely Arka Abhed and Arka Samrat were proved to be promising to the Alluri Sita Rama Raju district of Andhra Pradesh.

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UNDER PEER REVIEW

Table 1: Economic analysis of tomato hybrids Arka Abhed and Arka Samrat over farmers' practice (INDAM -Rashmi)

Particulars	Cost of cultivation (Rs/ha)				Gross Returns (Rs/ha)				Net Returns (Rs/ha)				Cost Benefit ratio			
	2019-20	2020-21	2021-22	Mean	2019-20	2020-21	2021-22	Mean	2019-20	2020-21	2021-22	Mean	2019-20	2020-21	2021-22	Mean
T ₁ : Farmers practice - Check (INDAM-Rashmi)	106500	112250	123000	113917	281904	304185	364360	316816	175404	191935	241360	202900	1:1.65	1:1.71	1:1.96	1:1.77
T ₂ : Arka Abedh	115500	119750	133750	123000	369761	395255	471824	412280	254261	275505	338074	289280	1:2.20	1:2.31	1:2.53	1:2.34
T ₃ : Arka Samrat	115500	119750	133750	123000	350868	377069	447000	391646	235368	257319	313250	268645	1:2.04	1:2.15	1:2.34	1:2.17

Table 2: Yield, Technology Gap, Extension Gap and Technology Index of tomato hybrids Arka Abhed, Arka Samrat over farmers' practice (INDAM -Rashmi)

Particulars	Yield (q/ha)			Potential Yield (q/ha)	% increase in yield over farmers practice			Extension gap (q/ha)			Technology Index (%)		
	2019-20	2020-21	2021-22		2019-20	2020-21	2021-22	2019-20	2020-21	2021-22	2019-20	2020-21	2021-22
T ₁ : Farmers practice - Check (INDAM-Rashmi)	402.72	434.55	455.45	525	-	-	-	-	-	-	23.29	17.22	13.24
T ₂ : Arka Abedh	528.23	564.65	589.78	725	31.16	29.93	29.49	125.51	130.10	134.33	27.14	22.11	18.65
T ₃ : Arka Samrat	501.24	538.67	558.75	800	18.65	18.43	17.51	98.52	104.12	103.30	37.34	32.66	30.15

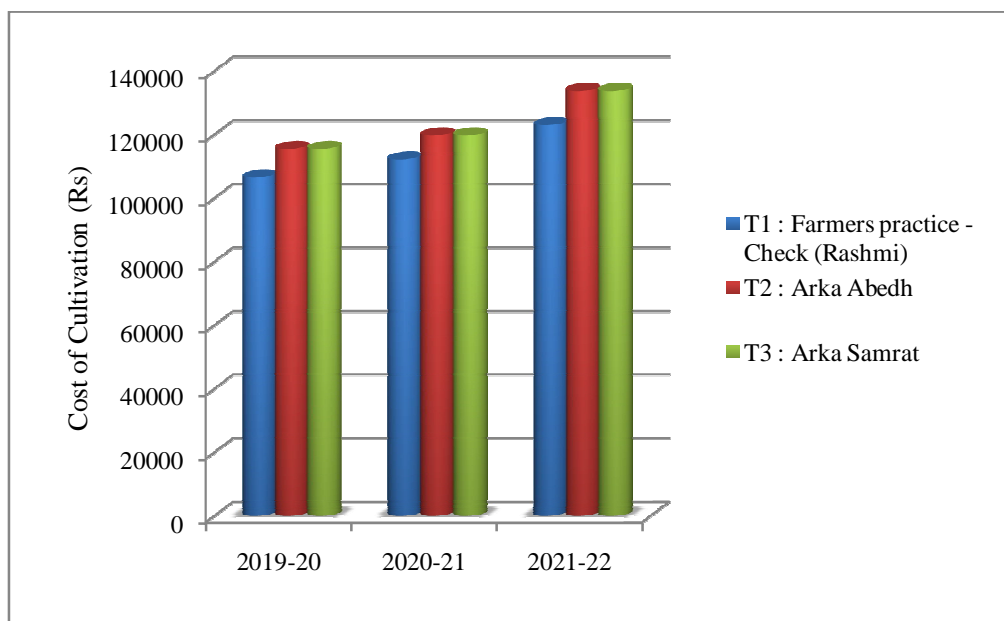


Fig 1: Cost of cultivation of tomato hybrids over farmers' practice

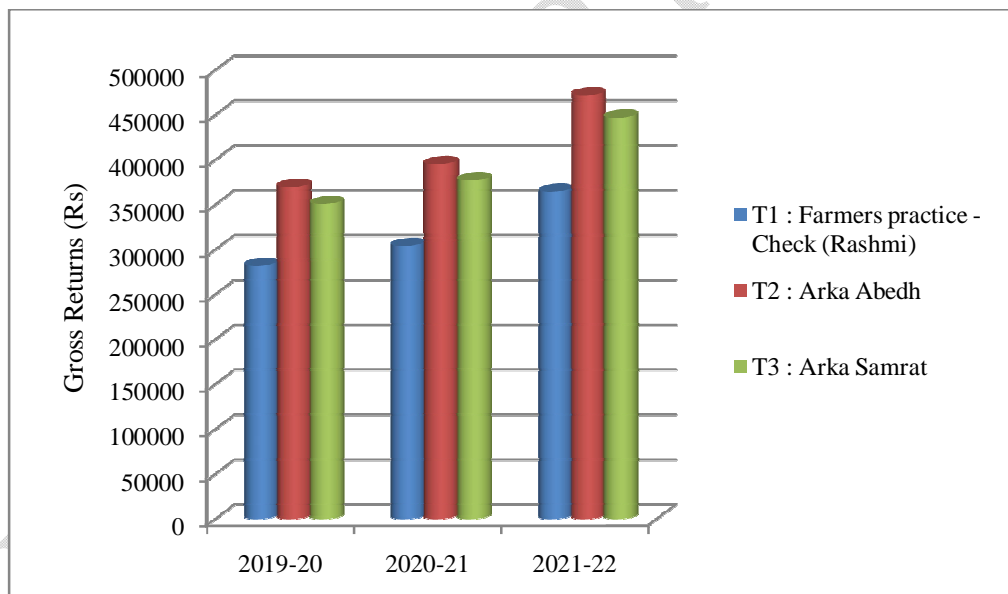


Fig 2: Gross returns of tomato hybrids over farmers' practice

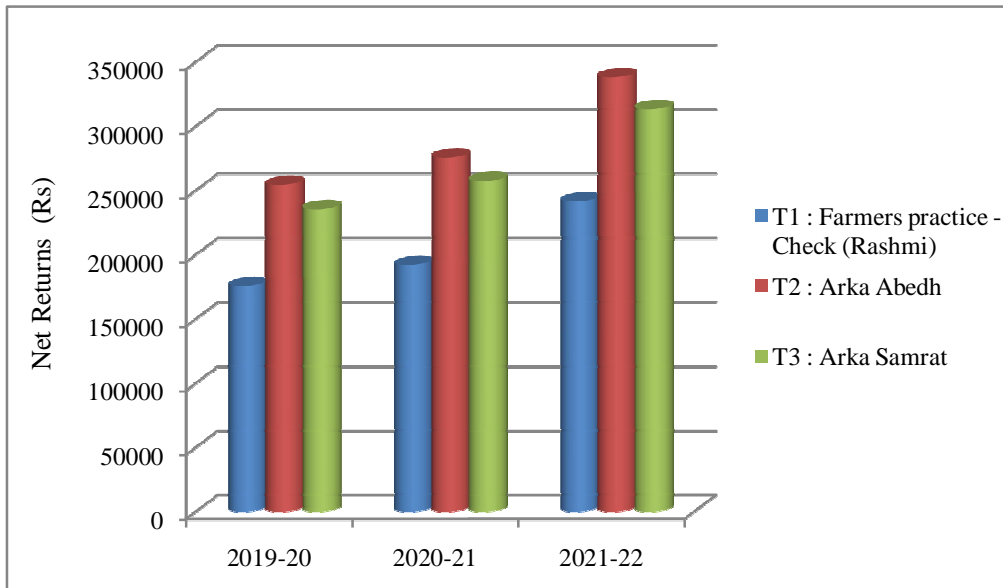


Fig 3: Net returns of tomato hybrids over farmers' practice

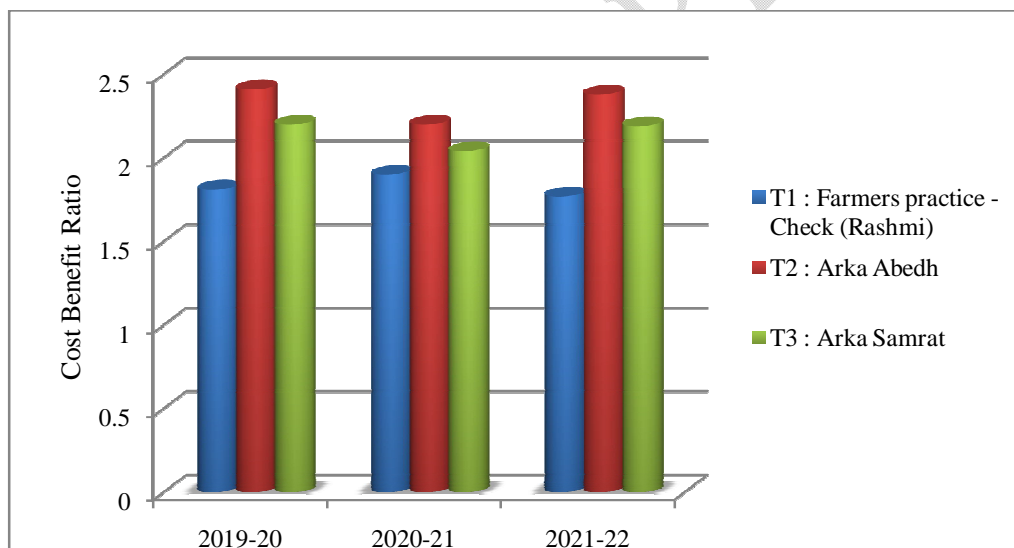


Fig 4: Cost benefit ratio of tomato hybrids over farmers' practice

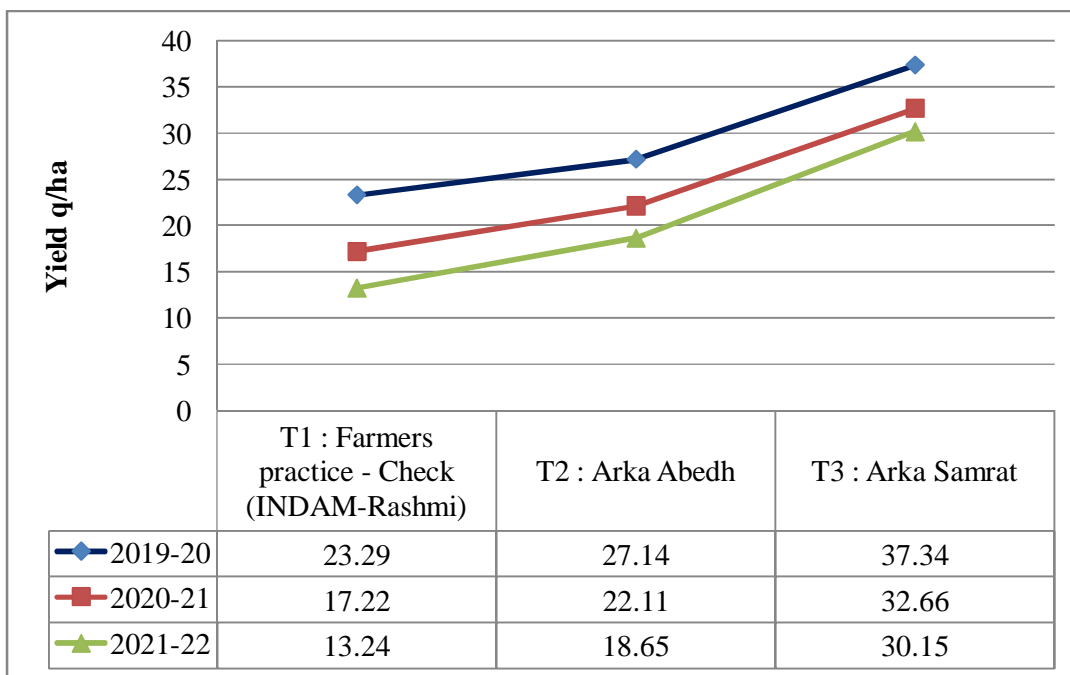


Fig 5: Yield details of tomato hybrids over farmers' practice

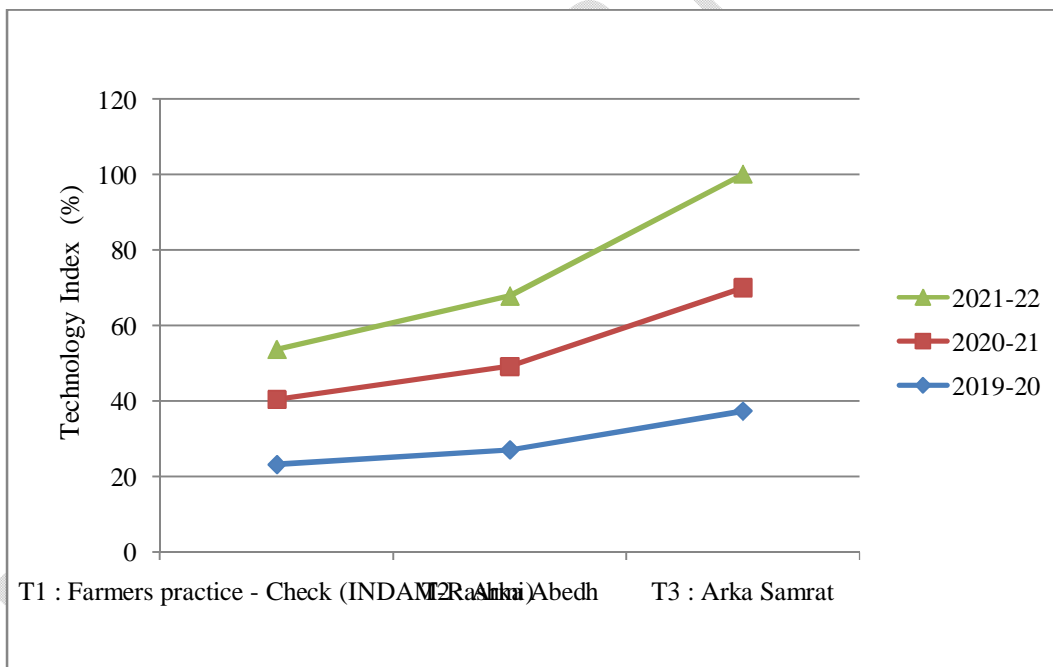


Fig 6: Technology Index (%) of tomato hybrids over farmers' practice



Inputs provided to beneficiaries



Staking operation in Tomato hybrids



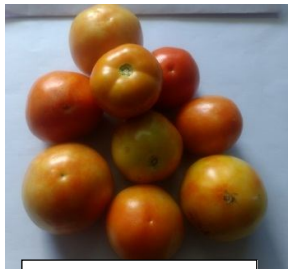
Fruits ready for harvesting



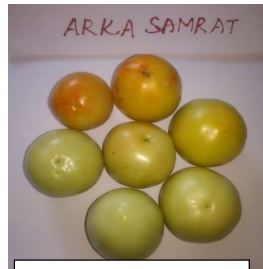
Harvested Yield



T₁: Farmers Check Tomato var. INDAM - Rashmi



T₂: Tomato hybrid Arka Abedh



T₃: Tomato hybrid Arka Samrat