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

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ABSTRACT

The climate and soil in tribal areas of Alluri Sitarama Raju District of Andhra Pradeshwas ideal and well suited for tomato cultivation. The cultivating varieties were less yielders and highlysuccumb 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 Abedh (multiple disease resistant) and Arka Samrat (triple disease resistant) for ascertaining and recommending the cultivarsbestsuitedfor the region. The farmer practice i.e. cultivation of commercial tomato hybrid INDAM - Rashmi was considered as local check. The results showed thattomatohybrid ArkaAbhed (528.23 q/ha, 564.65 q/ha and 589.78 q/ha) proved tobethe best in yield followedbyArkaSamrat (501.24 q/ha, 538.67 q/ha and 558.75 q/ha) and INDAM - Rashmihybrid (402.72 q/ha, 434.55 q/ha and 455.45 q/ha) for the three consecutive years of thestudy from 2019-20 to 2021-22. AnExtensiongapwas recorded between125.51to134.33 q/haand 98.52 to 103.30q/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 trails, Arka Abedh, 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). Atpresent India rankssecondinareanexttoChinabyproducing 19.37milliontonnesoftomatofromanareaof 0.78millionha.However,intermsofproductivity, 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].

Tomatoisgrownoversome parts inAlluri 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 susceptibleto 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, integratednutrientmanagementandplant protection measures. It is imperative to advisethe tomato growers for high yielding cultivarsand 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 inAlluri Sitarama Raju District of Andhra Pradeshwith the principal objective of varietal assessment of high yielding tomato hybrids for ascertaining and recommending the cultivarsbestsuitedfor the region. There were eighteen participantfarmersselectedfromfourvillages 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- IIHR, 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. MATERIALSANDMETHODS

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 seedlingswere 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 stalking 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 calculatedbyformulaesuggestedby(Singh etal. 2016)and [6] tostudythe impact of on farm trails over the selected farmers.

- Extension gap = Demonstrated yield - Yieldunder existing practice
- TechnologyIndex= $\frac{\text{Potential Yield – Demonstrated Yield}}{\text{Potential Yield}} \times 100$

3. RESULTSANDDISCUSSION

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 Abedh recorded a percent increase of 31.16%, 29.93%and29.49% whereas Arka Samrat recorded an increase of 18.65%, 18.43% and 17.51% in yieldoverthefarmers'practice(INDAM-Rashmi)during 2020-21, 2021-22 and 2022-23 respectively. This could be due tomultiple 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 effectsof 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 recordedhigher costs of cultivation which might be due to increased costs ofinputs like seed, fertilizers,more number of labour days required for harvesting.A similar results was reported by Sahoo et al., [14] The cost of cultivation per hectare for the 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 fromRs. 1,06,500 /-

in 2019-20 to Rs. 1,23,000 /- in 2021-22.The net returns too increased steadily in the demonstration plots rangedfromRs.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 substantiallyhigher in the demonstration plots over thecontrol with farmers' practice plots i.e. Rs. 1,75,404/- (2019-20) to Rs. 2,41,360/-(2021-22). The results corroboratethoseBabu et al., [4], Kaleetal.[8],Mokidueetal., [10] and Keshava reddyet 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 Samratrangedbetween125.51to134.33and 98.52 to 103.00 q/ha during the years 2019-20 and 2021-22 of the study (Table 2). Thus there is aneed to educate the farmers for the adoption of improved varieties along withmodern 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 patternin both the tomato hybrids i.e. Arka Abedh (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 byBabu et al., [4], Kale et al., [8], Keshavareddyetal.,[11],Katare et al.[12],andDayanand& Mehta [13]inmustard.

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 superiorityof the tomatohybrids ArkaAbhed and ArkaSamratoverthefarmers'practicein yield, net returnsand 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 provedtobethepromising totheAlluri Sita Rama Raju district of Andhra Pradesh.

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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

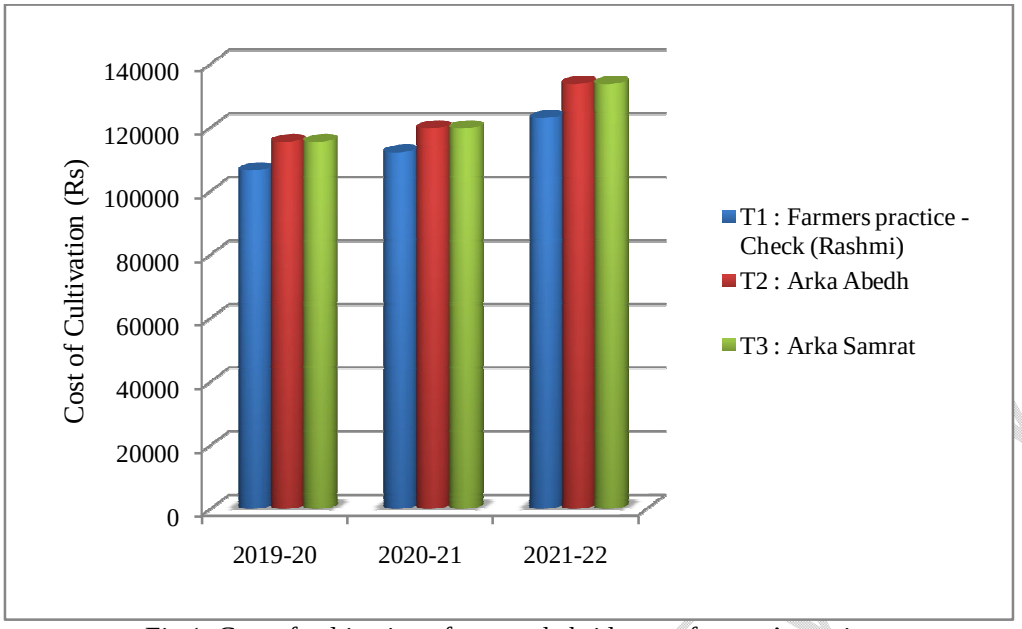


Fig 1: Cost of cultivation of tomato hybrids over farmers' practice

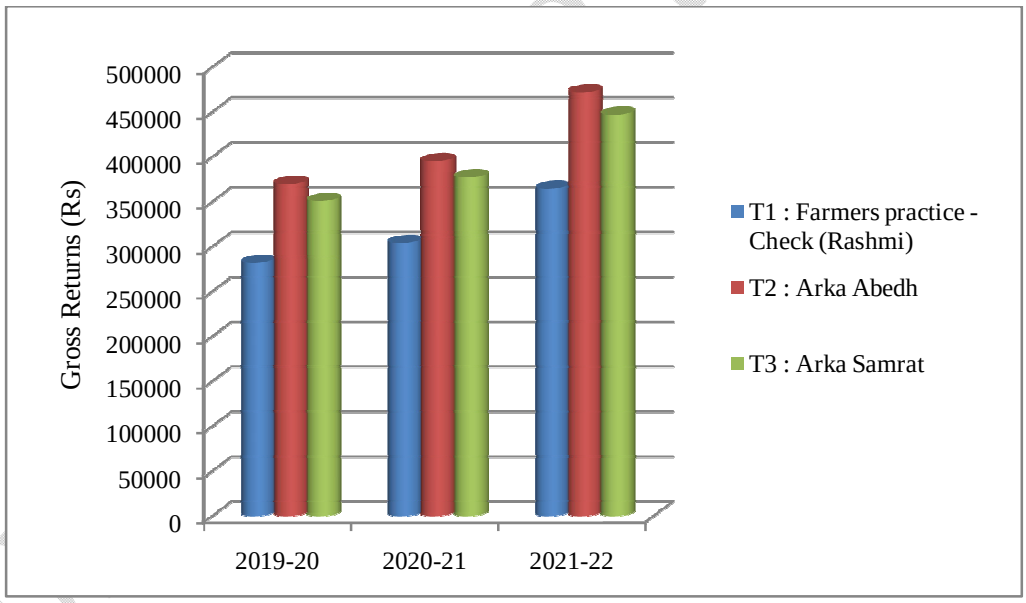


Fig 2: Gross returns of tomato hybrids over farmers' practice

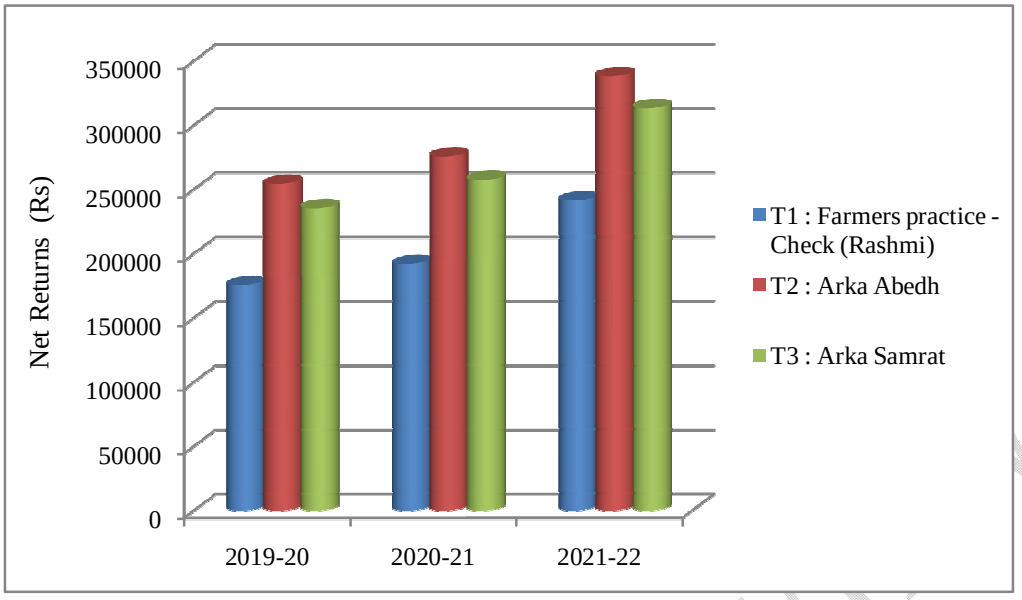


Fig 3: Net returns of tomato hybrids over farmers' practice

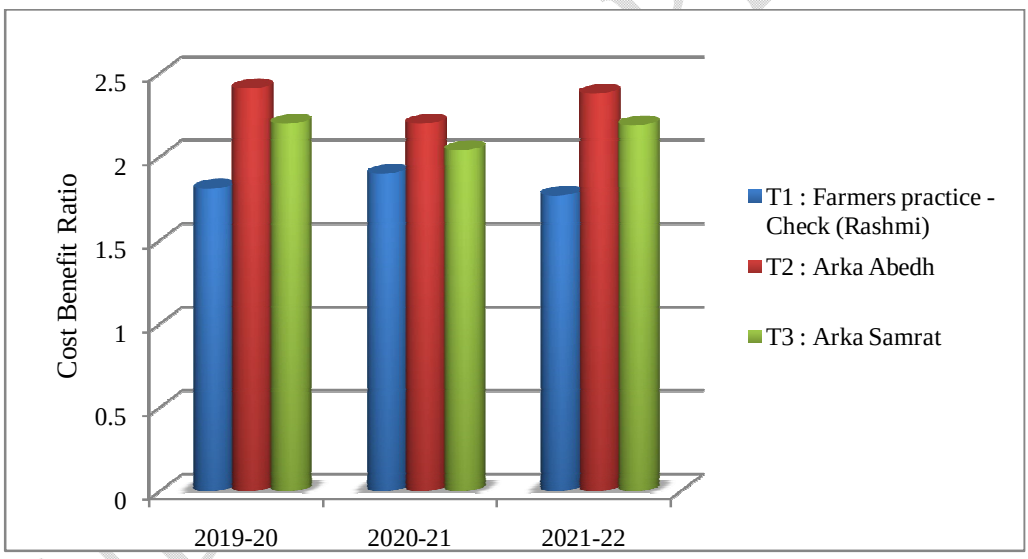
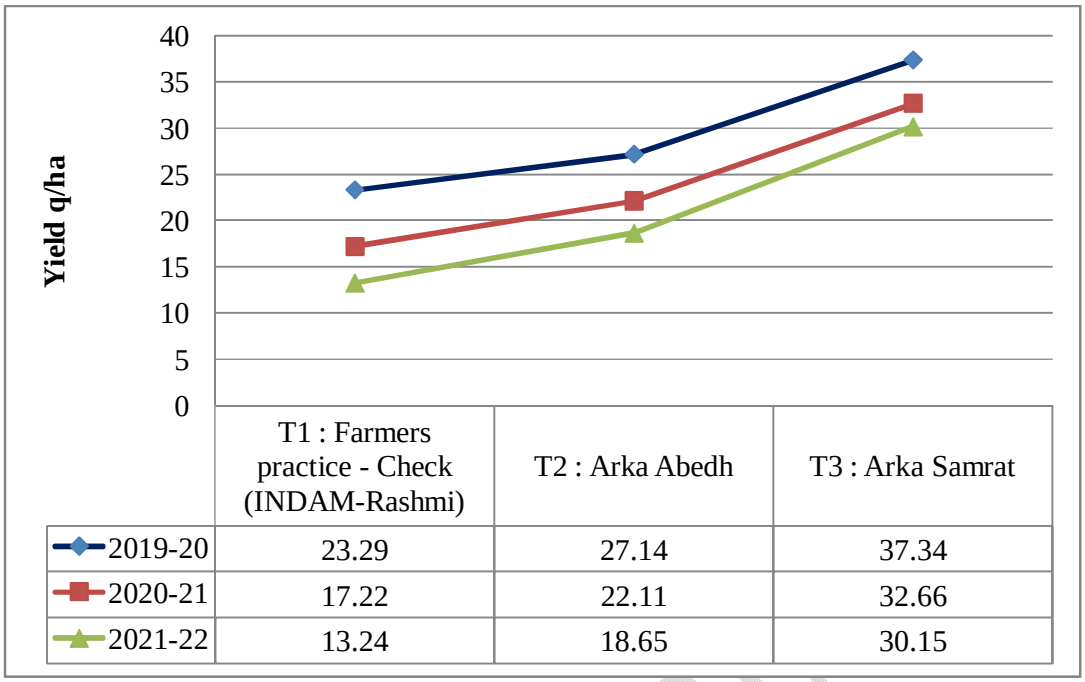


Fig 4: Cost benefit ratio of tomato hybrids over farmers' practice



	T1 : Farmers practice - Check (INDAM-Rashmi)	T2 : Arka Abedh	T3 : Arka Samrat
2019-20	23.29	27.14	37.34
2020-21	17.22	22.11	32.66
2021-22	13.24	18.65	30.15

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

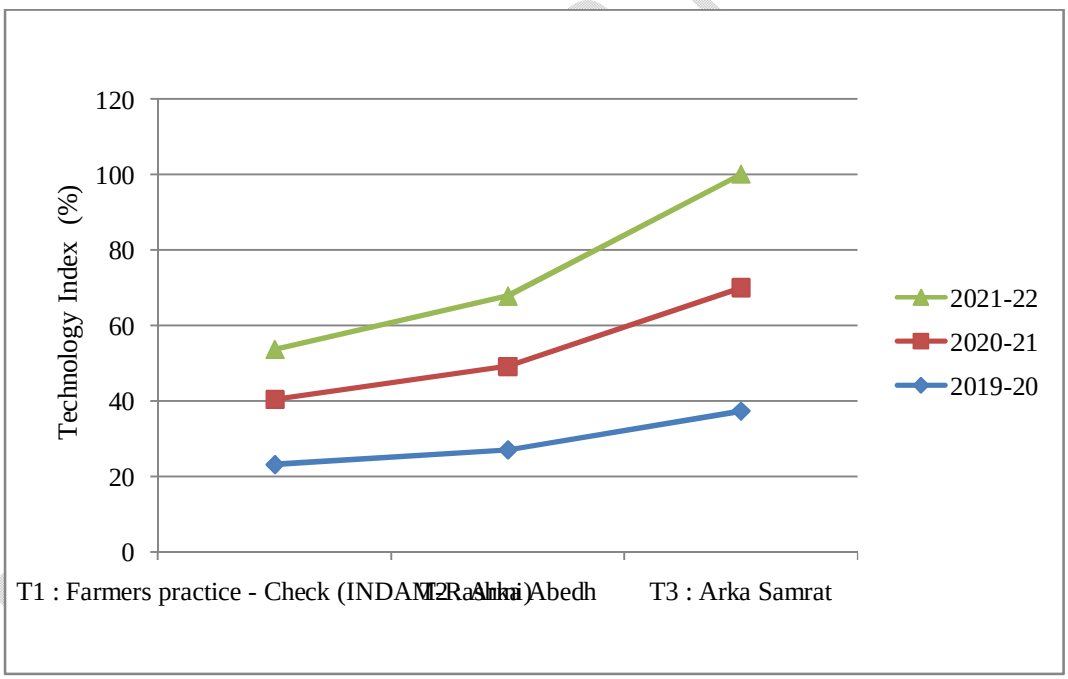
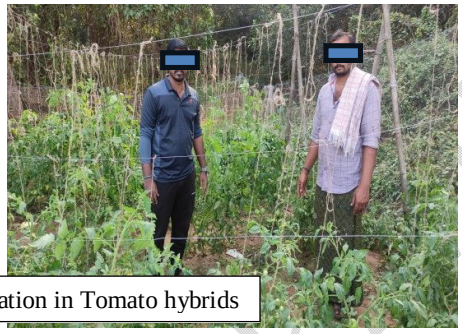


Fig 6: Technology Index (%) of tomato hybrids over farmers' practice


Inputs provided to beneficiaries

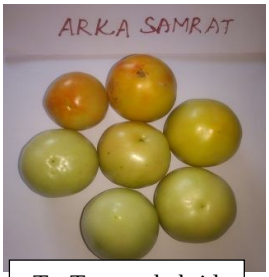
Staking operation in Tomato hybrids


Fruits ready for harvesting

Harvested Yield

T_1: Farmers Check Tomato var. INDAM - Rashmi

T_2: Tomato hybrid Arka Abedh



T_3: Tomato hybrid Arka Samrat