Performance of Tomato varieties Arka Rakshak and Arka Samrat in Naturally Ventilated Polyhouse and Its Economic Returns

Abstract

In Bishnupur, Manipur, tomato cultivation can generate a steady income that supports farmers' welfare and livelihood security. Most of the farmers of Bishnupur are under the category of marginal and sub-marginal farmers. Bishnupur's tomato is an important high-value crop with high yield and economic potential. Most farmers in the Bishnupur district of Manipur are growing wide varieties of tomatoes in open fields and a few in low-cost polyhouses. The seeds of two tomato varieties, Arka Rakshak and Arka Samrat, are new varieties in Manipur. A comparison of the yield potential of two tomato varieties and their economic returns, the varietal performance testing was conducted in a naturally ventilated Polyhouse of area 135 m2 at an instructional farm of Krishi Vigyan Kendra, Bishnupur district, Manipur, during 2017-18. The adopted package of practices was Seed rate – 3.5g , Spacing- 45cm x 45cm, FYM-400 kg, NPK 4:10:2.5 g/plant. The study revealed that tomato var. Arka Rakshak resulted in a yield of 367 kg with C:B ratio (1:7.8), whereas Arka Samrat could obtain 285 kg with C:B ratio (1:6), which shows that both the two varieties are suitable for polyhouse cultivation. However, the tomato variety Arka Rakshak has superior performance in every parameter than Arka Samrat.

Keywords: Arka Rakshak, Arka Samrat, economic, tomato, polyhouse, yield.

Introduction

In many countries, tomato (*Solanum lycopersicum* L.) ranks second in importance to potato as one of the world's most popular and widely grown vegetables. It is one of the major vegetable crops cultivated in India. It is one of the most popular and widely grown vegetables in the Bishnupur district of Manipur. It has high nutritional values and is an excellent source of vitamins A, B and C. The fruits are eaten raw or cooked. The presence of lycopene imparts red colour to ripe tomatoes is reported to possess anti-cancerous properties. It also serves as a natural antioxidant for Beta-carotene functions, which prevent and neutralize free radical chain reactions and is a scavenger of superoxide, hydrogen peroxide, singlet oxygen, and other free radicals. It is an essential low-volume, high-value crop in India. And also a valuable cash crop that supports livelihood security for farmers of Bishnupur district, Manipur. In Bishnupur district of Manipur, tomato is being cultivated throughout the year. The farmers of Bishnupur who are under the category of marginal and sub-marginal farmers where the farmers are low land holding type of farmers where facing the problems in cultivation of tomato and other vegetables throughout the year. Thus, the demonstration of tomato cultivation methods was taken up to solve the problems of farmers. Krishi Vigyan Kendra is a Farm Science Centre that plays a vital role in solving the problems of the farmers by conducting Method demonstrations, On Farm Testings/Trials and implementing Front Line Demonstrations on various technologies. By the principle of seeing and believing, method demonstration could play a key role in transferring technologies to the farming community and a better platform for disseminating new technologies. The performance of

tomato varieties Arka Rakshak and Arka Samrat under naturally ventilated poly houses and their economic returns were demonstrated to solve marginal and sub-marginal farmers' problems. Tomato varieties Arka Rakshak and Arka Samrat are the high yielding F1 hybrid with triple disease resistance to tomato leaf curl virus, bacterial wilt and early blight and semi-indeterminate type in growth which were suitable for polyhouse cultivation. Demonstrating the method helped convince farmers about the potential of improved production technologies to enhance the yield of tomato and thereby get higher returns. Thus, keeping the importance, demonstrations of new technologies were undertaken in the KVK instructional farm in order to show the worth of new technologies and convince the farmers to adopt them in their limited farmland.

Materials and Methods

A naturally ventilated polyhouse established at Krishi Vigyan Kendra Demonstration/Instructional Farm in Bishnupur district, Manipur, was used to conduct an investigation of the performance and economic return of the varieties Arka Rakshak and Arka Samrat tomato varieties. An investigation was conducted between August 2017 and March 2018. A yield performance and economic return study was conducted on the tomato varieties Arka Rakshak and Arka Samrat. Neither of these varieties is available from Manipur's authorized seed dealers. So, the seeds were procured from Odisha. The investigation was conducted under the polyhouse of size 135m2.The area was divided into two parts for planting the two selected tomato varieties, Arka Rakshak and Arka Samrat. The soil analysis was done before starting the experiment. The soil sample was collected from the experimental site at a depth of 20 cm before starting the investigation to determine the soil's inherent fertility status and physio-chemical properties (Jackson 1973).The collected soil from the experimental plot showed that soil pH was 5.5 and the available N, P, K and organic carbon were 406.12 /ha, 18.20 kg /ha, 301.23 kg / ha and 2.5 %, respectively. Seedlings were raised on the two nursery beds of size 1 m in width with 15 cm in height and 1.5 m in length each. Vermicompost @ 3kg each was applied during nursery beds preparation. All the clods, stones and weeds from the nursery beds were removed and proper leveling was done. Line sowing was done in the nursery beds. Lines were marked parallel to the width at the distance of 10 cm from line to line. The seeds were sown on 7th September 2017 on the marked lines on well prepared raised nursery beds. Seeds were covered immediately after light application with vermicompost. Then the nursery beds were covered by gunny bags for better and quick germination. The nursery beds were given light irrigation with the help of water can after covering till the seeds get germinated. When the seeds started germination, removed the mulch carefully to avoid any damage to the nurseries. Watering was done once in a day with the help of Watercan. The watering was continued till the seedlings got ready to transplant. The seedlings were ready to transplant at 20 days after sowing. Twenty (20) days old seedlings were transplanted on 27th September 2017 in the polyhouse. The adopted package of practices for the experimental plot was Seed rate – 3.5g, Spacing- 45cm x45cm, FYM-400kg, NPK 4: 10: 2.5g/plant.FYM were applied during final land preparation. Nitrogen, phosphorus and potassium were applied in the form of Urea, SSP and MOP. Urea half-doses and SSP and MOP full doses were applied as basal applications, with 1/4th of the remaining Urea applied at 30 days after transplanting and the remaining 1/4th at 45 days after

transplanting. Staking with bamboo sticks was practiced to keep the foliage and fruits off the ground. These intercultural operations help to increase the size and fruit yield. This practice could help to reduce the rotting of fruits and also other intercultural operations including harvesting can be done easily. Average number of days to 1st germination, number of days to first flowering, 50% flowering, days to 1st fruit set, days to 1st harvest, individual fruit weight (g), and yield per divided plot (kg) of both the varieties were recorded. Picking of the fruits of tomato was done at weekly intervals and continued till last week of February 2018. Accumulative yield for the duration of five months was calculated for both varieties. Economic parameters include: cost of production, gross return, net return, and cost-benefit ratio. In order to know the performance of the two tomato varieties, Arka Rakshak and Arka Samrat, under the naturally ventilated poly house and its economic value, different parameters were undertaken.

Result and Discussion

The tomato varieties Arka Rakshak and Arka Samrat were grown successfully in the naturally ventilated polyhouse condition as both are semi-indeterminate plant type suitable for cultivation under polyhouse conditions. This observation is in conformity with the report of Pavani *et al.*(2020) that indeterminate growing hybrids are ideal for greenhouse cultivation. Incidence of insect -pests and diseases were not found during the different stages of the cropping period as these two varieties are triple disease resistant varieties. This finding is conformity with the publication of IIHR- (2014). Singh *et al*. (2017) reported that crop inside poly house was comparatively free from pest and disease incidence. The seed of both varieties could be germinated within 5 -7days after seed sowing. This observation agrees with Gupta *et al.*(2012) observed that tomato seedlings could emerge in 7days at 30^0C when the study was carried out on the Modeling of Tomato seedling growth in the Greenhouse. The two varieties could be observed that the first flowering and 50% was taken at 25-35 DAT which could observe early flowering within short period of time after transplanting. This observation is also agreement with the investigation on tomato cultivation by Kumar and Arumugam (2010) that cultivation of Tomato in open field could be recorded the first flowering at 31 DAT (Misra *et al*. 2019). SL and Celine (2015) also reported that Tomato hybrids showed early flowering under polyhouse conditions and was the earliest to flower at 26.27 days. Sahoo *et al.* (2021) also reported that the mean number of days from transplanting to 50% varied from 28.3 days to 35.6 days. The Tomato variety Arka Rakshak was found early fruit set and harvested with higher fruit weight than Arka Samrat, and this finding conforms with Sahoo *et al*.(2021) that the tomato hybrid Arka Rakshak succeeded upon Arka Samrat with the maximum number of fruits per plant (25) and heavier fruit weight (82.1g) .

The yield of the Tomato variety Arka Rakshak could obtain 367 kg/67.5 m^2, whereas Arka Samrat obtained 285kg/67.5 m^2 which showed that Arka Rakshak was found to have a higher yield than Arka Samrat. This may be due to the increased length and breadth of fruit. Similar result was obtained by Yellavva (2008) under polyhouse. The yield of tomato varieties varied in their reactions under polyhouse conditions than in open field conditions, as supported by the experiment conducted by Singh *et al*. (2005) and Cheema *et al*.(2013). The higher in yield per plant of tomato hybrids was due to higher fruit set and higher retention of matured fruits per plant. Genotypic materials also play a primary role in the development of size and

weight of fruits (Lekshmi *et al*., 2015). Similar findings also reported by Munshi and Kumar (2000), and Choudhury and Bhuyan(1992) under control environment. The study also revealed that the fruit weight and yield varied among the two varieties ie. Arka Rakshak and Arka Samrat. This observation is in conformity with the report of Arora *et al*. (2006) and Cheema *et al*. (2013) that variations for fruit characters under protected cultivation. The reason for higher yield may also be due to the lack of incidence of insect, pests and diseases during the different stages of cropping. Similar results was also reported by Monica *et al*. (2014) and Shah and Shukla (2014). The result on yield clearly revealed that the tomato variety Arka Rakshak obtained higher yield than Arka Samrat.This result agrees that 103% more crop yield was recorded with the assesses hybrid "Arka Rakshak" than other hybrids (Misra *et al*. 2019).

Table 1. **Performance on growth, yield and economic impact of Tomato vars. Arka Rakshak and Arka Samrat under naturally ventilated Polyhouse**

Sl.No.	**Character**	**Tomato var. Arka Rakshak**	**Tomato var. Arka Samrat**
1.	Days to 1st germination of seeds	3-7 DAS	3-7 DAS
2.	Days to 1st flowering	25- 27DAT	27-29DAT
3.	Days to 50% flowering	32-35 DAT	34-35DAT
4.	Days to 1st fruit set	31-37 DAT	33-39DAT
5.	Days to 1st harvest	43-45 DAT	45-50DAT
6.	Fruit weight (g)	77- 83g	73-81 g
7.	Yield (kg /67.5 m2)	367 kg	285 kg
	Cost of cultivation(Rs)	3,070	3,070
	Gross return (Rs)	23,885	18,525
	Net return (Rs)	20,815	15,455
	C : B ratio	1:7.8	1:6

Sale @ Rs 65 per kg

Economics

Table 1 shows that the cost of cultivation of the two varieties Arka Rakshak and Arka Samrat, are similar as the cost of the seed of the two varieties are the same and the two varieties has adopted under same agronomic practices. The Tomato variety ArkaRakshak could obtain a net return of Rs. 20,815 with cost benefit ratio 1: 7.8 however, the variety Arka Samrat could obtain Rs. 15,455 only as net income with a benefit-cost ratio 1:6. The variation in net return and the benefit-cost ratio was due to difference in yield. The Gross

return, Net return and Cost: Benefit ratio were found to be higher in Arka Rakshak. This result may be due to the higher yield in Arka Rakshak than Arka Samrat. This finding complies with the observation of Devi *et al*. (2020) that the wide variation in net return and benefit-cost ratio in chilly cultivation was due to high yield differences. And, also reported that a higher yield and 15% higher return was found with the tomato variety Arka Rakshak than Arka Samrat (Sahoo *et al*.2021).

Conclusion

The tomato variety ArkaRakshak was found to be superior to ArkaSamrat both in yield and economic return. However, both the tomato varieties ArkaRakshak and ArkaSamrat were found suitable under polyhouse cultivation. These two varieties could be considered promising for cultivation under low-cost polyhouse which will help the farmers' economic upliftment. Thus, the Tomato varieties Arka Rakshak and Arka Samrat could be selected for off-season cultivation under the naturally ventilated poly house to get a higher return and could help uplift the income for marginal and submarginal type of farmers.

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Fig.1. Raising of Tomato var. Arka Rakshak seedlings

Fig.2. Raising of Tomato var. Arka Samrat seedlings

Fig.3. Transplanting of Tomato vars. Arka Rakshak & Arka Samrat in naturally ventilated polyhouse

Fig.4. Care and management of Tomato vars. Arka Rakshak & Arka Samrat cultivation in naturally ventilated polyhouse

Fig. 5. Harvesting of Tomato vars. Arka Rakshak & Arka Samrat

Fig. 6. Method demonstration on cultivation of Tomato vars. Arka Rakshak & Arka Samrat in naturally ventilated polyhouse for income generation of unemployed youths.