

Assessment of tomato (*Lycopersicum esculentum*) varieties for yield and resistance to diseases under Tripura condition

Subhra Shil^{1*}, Manoj Singh Sachan² and Pabitra Adhikary³

ICAR-IARI, Dirpai Chapori, Gogamukh, Dhemaji, Assam 787 035, India

ABSTRACT

An on- farm trial was conducted by Krishi Vigyan Kendra, Khowai in Khowai district of Tripura during 2021-22 and 2022-23 to study the morphological parameter, yield potential and resistance to tobacco leaf curl virus (TLCV), bacterial wilt (BW) and early blight (EB) on four varieties of tomato (*Lycopersicum esculentum* Mill.), viz. Arka Rakshak, Arka Samrat, Arka Abhed and Trishul (Local check) at farmers' fields. The observations were recorded on plant height (cm), branches/plant, days to first harvesting, number of fruits/plant, average fruit weight (g), fruit length (cm), fruit breadth (cm), and fruit yield/ plant (kg), yeild / ha area, economics and diseases incidence (%). The mean data of all two years were statistically analyzed. The results revealed that maximum number of fruits/plant (40.0) was found in Arka Rakshak and the lowest (36.8) in local check (Trishul). The maximum average fruit weight (75.37 g) and fruit yield (3.03kg/ plant) was recorded in Arka Rakshak compared to other tomato varieties. The maximum fruit yield (61.06 t/ha) was recorded in Arka Rakshak. The incidence of diseases like tobacco leaf curl virus (0.5 %), bacterial wilt (0%) and early blight (0.97%) were also very negligible in Arka Rakshak. The maximum net profit (Rs. 12,20,000 per ha), B:C ratio (5.5) were recorded in Arka Rakshak as compared to other varieties

Key words: Growth, Yield potential, Resistance, Tobacco leaf curl virus, Bacterial wilt, Early blight

Tomato (*Lycopersicum esculentum* Mill.) is one of the most important Solanaceous vegetables crops after potato. The productivity of tomatoes is comparatively low in India compared to other producing countries in the world (Keshava Reddy *et al.*, 2018). In India, Madhya Pradesh contributes the highest in area and production of tomatoes, accounting for about 11.89 and 14.11 per cent, respectively. This is followed by Odisha (10.85), Tamil Nadu (9.59), Karnataka (7.74), and Andhra Pradesh (7.12%) in area. In Tripura, favorable agroclimatic condition allows the growers to cultivate tomato extensively in *rabi* season owing to huge market demand. This crop is equally grown both in the plains and hills of north-eastern region of India. In Tripura, tomato cultivation covers an extensive area of 2.01 Thousand hectares, resulting in an annual production of approximately 67.92 thousand tonnes with an impressive yield of 33.79 t/ha. In region, major constrains faces by famers is severe yield losses due to Tobacco Leaf Curl Virus (TLCV), bacterial wilt, and early blight. Keeping in view, an on-farm testing was conducted in farmers fields of Khowai district of Tripura during 2021-22 and 2022-23 to assess the performance of some resistant tomato varieties.

MATERIALS AND METHODS

The experiment was conducted in Krishnapur, an adopted village of Krishi Vigyan Kendra, Khowai, located in the Teliamura sub-division of the Khowai district, is centered at approximately 23°75'44" N latitude and 91°66'81" E logitude. Krishnapur (Teliamura, Tripura) features a warm, humid subtropical climate. It receives an average annual rainfall of about 2,200 mm, heavily concentrated during June-September. The annual average temperature ranges between a minimum of 24° to 25° C and a maximum of 31-33°C. The soil is medium in organic carbon content (0.67 %) and the available nutrient status is low in nitrogen, medium range of phosphorus and potassium status. Five farmers were selected for this study and comprise a total of 20 treatments.

Four varieties, viz. Arka Rakshak, Arka samrat, Arka Abhed and Trishul, a private hybrid (Local check) were taken for the experiment. Arka Rakshak and Arka Samrat are known as triple resistant hybrid, resistant to tomato leaf curl virus (ToLCV), bacterial wilt (BW), early blight (EB), whereas, Arka Abedh is a multiple disease resistant hybrid.

The 30-days-old seedlings of were supplied to the farmers for planting. The transplanting was done in the first week of November during both the years at a spacing of 90 x 60cm, which gives a plant population of around 18,500/ ha. Well-rotten FYM @ 25 MT and NPK @ 80:60:80 kg per ha were incorporated to enrich the soil. Half of the dose of N and K, full dose of P was applied

*Corresponding author : subhrasmily@gmail.com

²Krishi Vigyan Kendra, Khowai (Tripura), Chebri, Dist.: Khowai, Tripura

³North 24 Parganas Krishi Vigyan Kendra Ashokenagar, P.O- Haripur, West Bengal

as basal dose at the time of transplanting, whereas other half of N and K were applied as topdressing during flower initiation. Other intercultural operations like weeding, hoeing, staking, irrigation were done as and when required. Various traits, including plant height (cm), branches/plant, days to first harvest, number of fruits/plant, average fruit weight (g), fruit length (cm), fruit breadth (cm) and fruit yield, economics and disease incidences for bacterial wilt (BW), early leaf blight (EB), and tomato leaf curl virus (TLCV) were observed during the assessment. The data were subjected to statistical analysis.

RESULTS AND DISCUSSION

Screening of varieties were conducted for two consecutive years for growth, yield and yield attributes. The data revealed that maximum plant height was in Arka Rakshak (122.34 cm), followed by Trishul (120.51 cm), Arka Samrat (119.21) and Arka Abhed (117.33) respectively. Maximum no. of branches were observed in Arka Rakshak (9) and lowest was in Arka Abhed (7). Minimum days to first harvest was recorded in Arka Abhed (140 days) whereas Trishul, the local check took maximum days to first harvest (148 days). The number of fruits plant was higher in Arka Rakshak (40.0) and lower was in local check (36.8). Significantly higher average fruit weight was noted in Arka Rakshak (75.37g) followed by Arka Samrat (70.5), whereas lowest was in Trishul (53g). Similarly, maximum fruit length and fruit breath was noticed in Arkra Rakshak. Data demonstrated that maximum yield per plant (3.0kg) and yield per unit area (61.06 t/ha) was in Arka Rakshak followed by Arka Samrat, Arka abhed respectively. In contrast, local check recorded minimum yield per plant (2.4kg) and yield per unit area (52.05t/ha).

The result revealed that higher yield primarily associated with number of fruits plant and the average fruit weight. A positive relation was observed among yield and yield attributing parameters. The better performance of Arka Rakshak could be the suitable agro climatic condition of Tripura. The present findings corroborate those of Singh et al. (2021), who also reported superior

yield performance, reduced bacterial wilt incidence and better economic returns of Arka Rakshak under tropical island conditions. The variation in yield among varieties may be due to genetic makeup of different variety (Kumar et al., 2022; Olaniyi and Fagbayide, 1999) as they were grown in the same agro climatic condition with same recommended package of practice. Variation in the different morphological parameter, yield and yield attributes of were also recorded by Rangnamei *et al.*, 2017; Mishra et al., 2024; Reddy et al., 2022; Remzeena *et al.*, 2023; Siva *et al.*, 2023; Singh *et al.*, 2023.

Table 2: Disease incidence percentage:

Treatment	Blight (%)	TLCV (%)	Bacterial wilt (%)
T ₁	0.97	0.50	0
T ₂	1.17	1.70	0
T ₃	2.03	3.10	5.10
T ₄ (Local check)	18.88	7.20	10.20
SEm ±	0.31	0.38	0.64
CD (P=0.05)	0.96	1.17	1.97

Arka Rakshak shows minimum incidence of early blight where as the local check variety Trishul shows up to 18.88% of this disease incidence. Tobacco leaf curl virus was as low as only 0.5% in Arka Rakshak followed by Arka Samrat (1.7%) as compared to the incidence in Local check (7.2%). Similarly, there was no incidence of bacterial wilt in Arka Rakshak and Arka Samrat whereas 5.1 % of incidence was recorded in Arka Abhed, while maximum was in local check (10.2%). These findings coincide with the study of Mishra *et al.*, 2019, Singh *et al.*, 2023, Reddy *et al.*, 2022.

Highest net income (₹1,220,000) was recorded in Arka Rakshak (T₁), followed by Arka Samart (₹ 1,160,000). Further, net income and B:C ratio were found maximum (₹1,220,000 ha and 5.5) in Arka Rakshak. Similarly in Arka Abhed Net income of ₹ 1,160,000 and B:C ratio of 5.2 were observed. Whereas, lowest net income and B:C ratio (₹1,040,000/ha and 4.7) was in to the local check. This could be because the Arka Rakshak tomato hybrid had more branches, more fruits plant, more pickings, and a higher yield compared to Local/check (Table 3).

Table 1: Growth and yield attributes of tomato varieties:

Variety	PH (cm)	BPP	DFH (d)	NFPP	AFW (g)	FL (cm)	FBr (cm)	YPP (kg)	YH (t ha ⁻¹)
T ₁	122.34	9.00	144.00	40.00	75.37	6.50	7.00	3.03	61.06
T ₂	119.21	8.00	146.00	39.00	70.50	5.50	6.30	2.80	57.20
T ₃	117.33	7.00	140.00	38.50	65.00	5.80	5.90	2.60	55.22
T ₄	120.51	8.00	148.00	36.80	53.00	5.60	5.80	2.40	52.05
SEm ±	0.58	0.22	0.95	0.48	1.05	0.12	0.11	0.07	0.82
CD (P=0.05)	1.80	0.67	2.94	1.48	3.25	0.38	0.33	0.28	2.53

PH = Plant height; BPP = branches per plant; DFH = days to first harvest; NFPP = number of fruits/plant; AFW = average fruit weight; FL = fruit length; FBr = fruit breadth; YPP = yield/plant; YH = Yield/ha.

Table 3: Economics of tomato hybrids (1 ha):

Treatment	Gross cost (Rs)	Gross income (Rs)	Net income (Rs)	B:C ratio
T ₁	271,111	1,491,111	1,220,000	5.5
T ₂	276,190	1,436,190	1,160,000	5.2
T ₃	278,049	1,418,049	1,140,000	5.1
T ₄ (Local Check)	281,081	1,321,081	1,040,000	4.7

CONCLUSION

Thus, it can be concluded that tomato var. Arka Rakshak was found suitable in terms of various yield and yield-attributing parameters, followed by Arka Samrat under the agroclimatic condition of Khowai District of Tripura. Moreover, Arka Rakshak shows less incidence of major diseases and thus contributes to higher B:C ratio. Hence, Arka Rakshak variety can be adopted by the farmers.

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Conflict of Interest Statement

The authors declare no conflicts of interest

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Author Contributions

Author 1 conceived and conducted the study, collected and analyzed the data, and prepared the manuscript. Author 2 provided overall guidance, supervised the research activities, and reviewed and approved the final manuscript. All authors have read the manuscript and agreed to its content. Author 3 has done the statistical analysis of the raw data. They have also approved the final version of manuscript and consent to its submission

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