

Evaluation of tomato hybrids for yield and attributing traits under agroclimatic conditions of Kokrajhar district, Assam

Puja Basumatary^{1*} • Shourov Dutta² • Manoj Kumar Bhuyan³ • Manoranjan Neog⁴

^{1,3}Krishi Vigyan Kendra, Kokrajhar, Assam Agricultural University, Gossaigaon-783360, Assam, India

²Krishi Vigyan Kendra, Karbi Anglong, Assam Agricultural University, Diphu-782462, Assam, India

⁴Directorate of Extension Education, Assam Agricultural University, Jorhat-785013, Assam, India

ARTICLE INFO

Article history:

Received: 03 August, 2022

Revision: 22 August, 2022

Accepted: 25 August, 2022

Key words: Tomato, Kokrajhar, hybrid, yield and yield attributing characters

DOI: 10.56678/iahf-spl2022.15

ABSTRACT

A field investigation was conducted to study the performance of four tomato varieties for growth, yield and yield attributing characters under agro-climatic condition of Kokrajhar district, during the year 2019-20 and 2020-21 at seven (07) different locations. Four tomato varieties namely Arka Abhed, Arka Samrat, Arka Rakshak and farmer's variety Trishul 1458 (check) were studied under the present experiment. The trial was laid out in randomized complete block design with four replications. Results revealed the superiority of Arka Abhed in terms of yield and growth and produced firm, oblate round fruits with average weight of 111.10g and average yield of 162.80 q/ha. Parameters like plant height (111.7 cm), number of fruits per plant (73.4) and average fruit weight (111.10g) were observed highest in Arka Abhed whereas farmer's variety Trishul 1458 (check) was found with lowest values for all the parameters. Arka Abhed was also found to have the highest gross returns of Rs. 9,76,800.00 with a Benefit cost ratio of 6.94 with the lowest values in the check variety Rs. 4,04,400.00 and 3.06 respectively. Hence, the farmers of the district were convinced to go for variety Arka Abhed in lieu of their existing varieties to yield more returns and productivity.

1. Introduction

Tomato (*Solanum lycopersicum* Mill), is one of the most common, important as well as remunerative vegetable of India belonging to the family Solanaceae. It is used in almost every Indian cuisine either as salad, raw, cooked vegetables, or as processed forms. It is considered as one of the important commercial and dietary vegetable crops (Singh *et al.*, 2014). It is adaptable to a wide range of climatic conditions. However, the plant thrives best in well drained soils and the optimum night temperature of 15°-20°C for fruit setting (Anon., 2020). In Assam, tomato occupies 18.28 thousand ha area with a production of 396.024 thousand MT (Anon., 2018). Tomatoes consist of around 90% of water, soluble and insoluble solids (5-7%), citric and other organic acids along with other vitamins and minerals (Pedro and Ferreira, 2007). Palop *et al.*, 2010 reported that tomato is helpful for health *viz.* vitamins, carotenoids, lycopene and phenolic compounds. In addition, raw tomatoes help in reducing the

risk of cancer and cardiovascular diseases (Radzevicius *et al.*, 2009).

Kokrajhar is one of the districts that come under the Lower Brahmaputra Valley Zone of Assam. The average annual rainfall is 5166.5 mm with maximum temperature of 29.63 °C and minimum temperature of 18.55 °C which makes it suitable for cultivation of tomatoes. Well drained sandy loam soil with a pH range from 5.0 - 7.0 rich in organic matter favours most for its optimum growth and development. An area of 437 ha is covered under the Kokrajhar district of Assam with 9216 tonnes of production (Anon., 2015). Some of the potential Tomato growing pockets in the district are Khoyragutu, Joyma no. 1, Joyma no. 2, Bajugaon, Mongaljhora, Jaraguri, Gurufella, Basbari, Dotma *etc.*

Most of the farmers grow traditional varieties with lesser yield and are susceptible to various pest and diseases. Only few progressive farmers are aware of hybrids available in the market, its performance and yield potential.

*Corresponding author: poojabasumatary149@gmail.com

Many high yielding tomato hybrids varying widely in respect of their yield potential, adaptability and response to inputs have been released for open field conditions (Kaddi *et al.*, 2014). Hybrids have shown greater potential to counter the challenge of high demand of fresh and processed products along with higher yield, tolerance to diseases, high adaptability to adverse environment, uniformity of produce and greater plant vigour (Dhillon *et al.*, 2019). Lack of availability of improved tomato hybrids, use of non descriptive seed, poor seed quality, poor soil fertility, disease and insect pest, poor management are some of the bottle necks for tomato production faced by the farmers. However, continuous research and evaluation studies should be done to provide better variety choosing options for the farmers during the season (Chapagain *et al.*, 2011). In this context, Krishi Vigyan Kendra (KVK), Kokrajhar conducted On Farm Testing (OFT) programmes on three major Tomato varieties to evaluate the performance in yield and yield attributing characters along with the economics in Kokrajhar.

2. Materials and Methods

The study was carried out in farmers' fields at seven (07) number of locations of Gossaigaon Subdivision of Kokrajhar district to evaluate the performance and to select the outstanding tomato variety in the region during *Rabi* season of 2019-20 and 2020-21. Three tomato hybrids, Arka Abhed, Arka Samrat, Arka Rakshak along with a popular tomato hybrid variety Trishul 1458 grown by the farmers as check were selected for the study.

The farming situation is irrigated and the soil texture is sandy loam. The treatments involved in this study were T₁: Arka Abhed, T₂: Arka Samrat, T₃: Arka Rakshak and T₄: Trishul 1458. The trial was laid out in a randomized complete block design and the 07 (seven) number of villages is used as replications. Before conducting the experiment, the farmers were well imparted with trainings on scientific management practices of the crop. Regular monitoring and frequent field visits were conducted to provide instant solution to the problems reported from the study plot.

Observations on parameters like plant height (cm), number of branches per plant, days to 50 per cent flowering (days), number of fruits per cluster, number of fruits per plant, average single fruit weight (g), average fruit length (cm), average fruit diameter (cm), yield per plant (kg), yield per ha (q/ha), net income (Rs.), B:C ratio and farmers and market ability were recorded. The statistical analysis were done as per Panse and Sukhatme, 1967.

3. Results and Discussion

Among the four Tomato hybrids Arka Abhed recorded the maximum values in growth, yield as well as the highest benefit cost ratio comparative to other hybrids.

Growth Parameters

From the data presented in Table 1 it is clearly evident that amongst all the four (04) hybrids of tomato, Plant height was recorded highest in Arka Abhed (111.7 cm) followed by Arka Samrat (102.4 cm) and Arka Rakshak (99.7cm), whereas the check variety Trishul 1458 recorded the lowest plant height of 90.8 cm. The variation in plant height in hybrids may be due to the effects of inherent genetic difference of the hybrids which is in line with the findings of Hazarika and Phookan, 2005. Premalakshmi *et al.* 2017 stated that plant height is an important trait which determines growth and vigour of the plants. The maximum number of primary branches was found to have a significant effect among all the treatments. It was highest in Arka Abhed (14.0) whereas, the least number of primary branches was found in Trishul 1458 (11.0). The average value for days to 50 percent flowering of tomato hybrids revealed that Arka Abhed was the earliest to 50 percent flowering (33.2 days) followed by Arka Samrat (34.6 day) and Arka Rakshak (36.2days), whereas, longest days taken for flowering was observed in Trishul 1458 (39.2 days). Early flowering signifies early yield of the cultivars (Wang, 2004). This earliness might be due to its higher ability to avail assimilates up to the apex portion during the sensitive phases of the plant before initiation of flowers (Dieleman and Henvelink, 1992).

Table 1. Performance evaluation of tomato varieties for growth parameters (pooled data)

Treatments	Plant height (cm)	Number of branches (nos.)	Days to 50 % flowering (days)
T ₁	111.7	14.0	33.2
T ₂	102.4	13.4	34.6
T ₃	99.7	11.6	36.2
T ₄	90.8	11.0	39.2
Mean	101.15	12.50	35.80
SE_d	2.285	0.804	0.920
CD (5%)	4.784	1.683	1.925

Fruit and yield parameters

The fruit size is a very determining character in case of tomatoes which decides the marketability of the produce. From Table 2, it is evident that in case of fruit length, highest recorded data was found in Arka Rakshak (6.04cm) followed by Arka Samrat (5.82cm) and Arka Abhed (5.43cm) with lowest fruit length of 5.33 cm was exhibited in check variety Trishul 1458. Genetic makeup of the hybrids might be the reason in variability of fruit length (Ali et al., 2012; Saleem et al., 2013; Shankar et al., 2013 and Said et al., 2014) and fruit diameter (Singh et al. 2020). Here, the highest diameter was found in Arka Abhed (6.14cm) followed by Arka Samrat (5.93cm) and Arka Rakshak (4.71cm) with the lowest fruit diameter of 4.66 cm in check (Trishul 1458).

Number of fruits per plant is the most important character which is directly related to fruit yield per plant and therefore, this trait should be given due importance while selecting any cultivar. The number of fruits per plant varied significantly among all the varieties. The highest number of fruits per plant was recorded in Arka Abhed (73.4), followed by Arka Samrat (62.1) whereas the Arka Rakshak and local check recorded lowest number of fruits per plant with 58.9 and 48.1 respectively. This might be probably due to the

climatic conditions of the locality suited the best for the Arka Abhed variety. Fruit weight is another prime factor which has a positive impact directly on the overall crop yield. Pertaining to the data, single fruit weight was recorded highest in hybrid Arka Abhed (111.10g) followed by Arka Samrat (100.07g) and showed significant superiority over other hybrids of tomato (Table 2). Earlier studies done by Hussain *et al.*, 2001 also reported variations in fruit weight by different tomato cultivars.

Significant difference was found statistically for yield per plant in case of all the hybrids. It was found maximum in Arka Abhed (8.14kg) followed by Arka Samrat (6.17kg) and Arka Rakshak (5.37kg) whereas the local check variety Trishul 1458 recorded the lowest yield per plant of 3.37kg. Variation in yield per plant between hybrids may be due to genetic makeup of the plant, vigorous and healthy plants, and higher flower numbers, higher number of flower clusters per plant and more fruit set percent. Agro-climatic conditions might have also suited to this variety as compared to the other with respect to fruit production. Similar observations on genetic differences for marketable fruit yield and other plant characters in tomato hybrids had also been reported by Jindal *et al.*, 2018.

Table 2. Performance evaluation of tomato varieties for fruit and yield parameters (pooled data)

Treatments	Fruit length (cm)	Fruit Diameter (cm)	No. of fruits per plant	Average fruit weight (g)	Yield/plant (kg)
T ₁	5.43	6.14	73.4	111.10	8.14
T ₂	5.82	5.93	62.1	100.07	6.17
T ₃	6.04	4.71	58.9	90.47	5.37
T ₄	5.33	4.66	48.1	70.06	3.37
Mean	5.65	5.36	60.62	92.92	5.76
SE _d	0.183	0.325	2.168	2.826	0.229
CD (5%)	0.383	0.680	4.539	5.916	0.480

Table 3. Economics of tomato hybrid varieties (pooled data)

Treatments	Gross Income	Cost of cultivation	Net return	B:C ratio
T ₁	976800	145754	831046	6.94:1
T ₂	740400	135754	604646	5.45:1
T ₃	644400	135754	508646	4.75:1
T ₄	404400	132142.5	272258	3.06:1

Economics

Data pertaining to economics (Table 3) indicated that the cost of cultivation for the cultivar Arka Rakshak and Arka Samrat are same (Rs. 135754.00) whereas, it was Rs. 145754.00 in case of Arka Abhed and the check (Trishul 1458) was recorded with the lowest gross cost. It was found that cultivation of Arka Abhed (T_1) gave higher net returns of Rs. 831046.00 per ha as compared to varieties Arka Samrat (T_2), Arka Rakshak (T_3) and Trishul 1458 (T_4) which are found to have net returns of Rs. 604646.00, Rs. 508646.00 and Rs. 272258.00 respectively. Similarly, Arka Abhed (T_1) was recorded with highest benefit cost ratio of 6.694:1 in comparison to T_2 (5.45:1), T_3 (4.75:1) and T_4 (3.06:1).

4. Conclusion

From all the discussion and results obtained, finally it can be inferred that the variety Arka Abhed obtained higher values for plant height, number of fruits per plant, fruit weight, yield, returns *etc.* as well as it is the best hybrid of Tomato with Arka Samrat as the second best option for the prevailing climatic and soil conditions of this district. Therefore, farmers were realized to achieve enhanced productivity and returns by cultivating Arka Abhed against the local and existing varieties practised generally by them in Kokrajhar district of Assam, India.

5. Acknowledgement

The authors would like to thank all the members involved in the research and for their timely suggestion and help.

6. References

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