

Original Research Article

<https://doi.org/10.20546/ijcmas.2020.910.396>

Evaluation of Tomato Genotypes for Growth, Yield and Quality Attributes in Northern Agro Climatic Zone

Komandla Sindhu*, Devi Singh, Vijay Bahadur and Deepanshu

Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, India

*Corresponding author

ABSTRACT

Keywords

Tomato, Genotypes, Growth, Yield and Quality

Article Info

Accepted:
26 September 2020
Available Online:
10 October 2020

An experiment on Tomato Genotypes was conducted during November, 2019 to March, 2020 in Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) India. The results of the present investigation, regarding the evaluation of tomato for plant growth, fruit yield and quality of Tomato Hybrids, have been discussed and interpreted in the light of previous research work done in India and abroad. The experiment was conducted in Randomized block design with 11 Genotypes of Tomato obtained from different sources, were each genotype replicated thrice. From the present experiments it is found that the genotypes G₁ (Arka Rakshak) found suitable genotypes in terms of growth and yield parameters followed by G₂ (Arka Vikas), genotype G₃ (Pusa Ruby) found best for TSS content and minimum vegetative growth, yield and quality was recorded in genotype G₈ (Navodaya).

Introduction

Vegetables are rich and comparatively cheaper source of vitamins. The importance of vegetable crops in India can be judged from the fact that the majority of Indian population is vegetarian. India produces the largest variety of vegetables. Consumption of vegetable provides taste, palatability, increases appetite and provides fiber for digestion and prevents constipation.

Tomato botanically *Solanum lycopersicum* belongs to Solanaceae family originated in South America, grows in vast sort of

environment ranging from tropical to sub tropical areas. Tomato is one of the world's largest cultivated vegetable and known as protective food because of its versatility, special nutritive values and export economy.

Tomato production is affected with various factors like insects, diseases, low yields, crop failures, heat complexes and salinity that need systematic breeding effort. Considering the importance of tomato as a potential vegetable both as domestic consumption as well as export market, it is important to increase its productivity along with desirable attributes through genetic manipulation (Iregna Tasisa

et al., 2011). In this context it is necessary to identify plant characters or traits important to the development programme.

The present research is conducted to assess the genotypes for growth, yield and quality attributes under northern agro climatic zone. Yield is a complex character controlled by a large number of contributing characters and their interactions. A study of varietal evaluation between different growth and yield characters provides an idea of association that could be effectively exploited to formulate selection strategies for improving yield components. For any effective selection program, it would be desirable to consider the relative magnitude of association of various characters with yield, therefore proper understanding of the genotypes helps in identifying the best genotype for a particular area.

Materials and Methods

The present Experiment was conducted in Randomized Block Design (RBD), with eleven treatments (Genotypes), replicated thrice with, in the Research field, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during November, 2019 to March, 2020. Total number of treatments (Genotypes) were eleven *viz.* G₁ (Arka Rakshak), G₂ (Arka Vikas), G₃ (Pusa Ruby), G₄ (PH - 4), G₅ (Pusa rohini), G₆ (Arka Abhay), G₇ (CO - 3) and G₈ (Navodaya), G₉ (AVTO - 9802), G₁₀ (Arka Samrat) and G₁₁ (AVTO - 1314).

Climatic condition in the experimental site

The area of Prayagraj district comes under subtropical belt in the south east of Utter Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46°

C- 48° C and seldom falls as low as 4°C- 5°C. The relative humidity ranges between 20 to 94 %. The average rainfall in this area is around 1013.4 mm annually. However, occasional precipitation is also not uncommon during winter months.

Results and Discussion

The present investigation entitled “Evaluation of Tomato genotypes for growth, yield and quality attributes in Northern Agro climatic zone” was carried out during November, 2019 to April, 2020 in Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) India. The results of the present investigation, regarding the evaluation of different genotypes of Tomato for for growth, yield and quality parameters, have been discussed and interpreted in the light of previous research work done in India and abroad.

The results of the experiment are summarized below.

Growth parameters

In terms of Plant Height, maximum significant plant height (39.34, 44.35, 50.56 and 58.30 cm) at 30, 60, 90 and 120 DAS, was recorded in G₁ (Arka Rakshak) followed by G₂ (Arka Vikas) with (36.98, 42.05, 47.04 and 54.06 cm) whereas minimum (26.95, 31.11, 34.55 and 39.04 cm) was recorded in G₈ (Navodaya). The variability in plant height in different genotypes is due to the suitability of genotypes in climatic condition of Prayagraj and growth characters of genotypes of tomato, these findings correlates with the findings of Nares *et al.*, (2000), Ahmad *et al.*, (2007) and Asati *et al.*, (2008) in Tomato.

In terms of Number of branches/plant, maximum branch at (7.35, 8.56, 10.52 and

12.71) at 30, 60, 90 and 120 DAS, was recorded in G₁ (Arka Rakshak) followed by G₂ (Arka Vikas) with (6.72, 7.63, 9.54 and 11.64) whereas minimum (3.57, 4.61, 6.35 and 8.57) was recorded in G₉ (AVTO – 9802). Variability in number of branches in tomato Genotypes is due to the suitability of particular Genotypes in agro climatic conditions and high growth characters of Genotypes, similar findings also reported by Naresh *et al.*, (2000) and Ahmad *et al.*, (2007) in Tomato.

In Plant spread, maximum Plant spread (2574.59, 2876.94, 3131.51 and 3745.06 cm²) at 30, 60, 90 and 120 DAS, was recorded in G₁ (Arka Rakshak) followed by G₂ (Arka Vikas) with (2305.31, 2565.26, 2792.31 and 3349.09 cm²) whereas minimum (1215.88, 1321.03, 1448.67 and 1641.74 cm²) was recorded in G₆ (Arka Abhay). Variability in Plant spread in tomato Genotypes is due to the suitability of particular Genotypes in agro climatic conditions and high growth characters of Genotypes, similar findings also reported by Naresh *et al.*, (2000) and Ahmad *et al.*, (2007) in Tomato.

In earliness parameter like, Days to first flowering and days to 50% flowering, minimum (40.68 and 46.94 days respectively) was found in genotype G₁ (Arka Rakshak), followed by G₂ (Arka Vikas) with (42.27 and 48.32 days) and maximum days to first and 50% flowering (52.26 and 59.67 days) was recorded in genotype G₁₀ (Arka Samrat). Variability in days to first and 50% flowering is due to the earliness of the tomato Genotypes; similar findings also reported by Neiraja *et al.*, (2004), Yama *et al.*, (2006), Gautam, *et al.*, (2013) and Debela *et al.*, (2016) in Tomato.

In early fruit picking for different genotypes minimum (59.30 days) was found in G₁ (Arka Rakshak), followed by G₂ (Arka Vikas) with

(61.16 days) and maximum days to first Fruit picking (74.32 days) was recorded in G₁₀ (Arka Samrat).

Variability in days to first picking of tomato Genotypes is due to the early fruit settings and maturity of the tomato Genotypes; similar findings previously also reported by Naresh *et al.*, (2000), Yama *et al.*, (2006), Ahmad *et al.*, (2007) and Gautam *et al.*, (2013) in Tomato.

Yield Parameters

In terms of Fruits /cluster and Number of fruits/plant for different genotypes Statistically significant variation was recorded maximum Fruits/cluster and Number of fruits/plant (5.44 fruit/cluster and 26.52 fruits/plant) was found in genotype G₁ (Arka Rakshak), followed by G₂ (Arka Vikas) with (5.26 fruit/cluster and 23.75 fruits/plant) and minimum fruit/cluster (3.38) and fruits/plant (9.56) was recorded in genotype G₈ (Navodaya).

Variability in number of fruit/cluster and per plant of Tomato Genotypes is due to the maximum number of fruit set/plant in a particular tomato Genotypes similar findings previously also reported by Naresh *et al.*, (2000), Shivakumar (2000), Mohanty and Prusti (2002) and Sureshkumara *et al.*, (2017) in Tomato.

In Average fruit weight, maximum fruit weight (97.40 g) was found in G₇ (CO - 3), followed by G₂ (Arka Vikas) with (86.67 g) and minimum average fruit weight (57.32 g) was recorded in G₈ (Navodaya).

Variability in average fruit weight is due to the different fruit size of tomato Genotypes; similar findings previously also reported by Naresh *et al.*, (2000), Shivakumar (2000) and Mohanty and Prusti (2002) in Tomato.

Table.1.1 Plant height, number of primary branches, plant spread, days to first flowering and days to 50% flowering of different genotypes of tomato

Genotype symbol	Genotype Name	Plant height (cm)				Number of Primary Branches/plant				Plant spread (cm ²)				Days to first flowering	Days to 50% flowering
		30 DAP	60 DAP	90 DAP	120 DAP	30 DAP	60 DAP	90 DAP	120 DAP	30 DAP	60 DAP	90 DAP	120 DAP		
G ₁	Arka Rakshak	39.34	44.35	50.56	58.30	7.35	8.56	10.52	12.71	2,574.59	2,876.94	3,131.51	3,745.06	40.68	46.94
G ₂	Arka Vikas	36.98	42.05	47.04	54.06	6.72	7.63	9.54	11.64	2,305.31	2,565.26	2,792.31	3,349.09	42.27	48.32
G ₃	Pusa Ruby	30.52	35.10	39.20	44.18	6.13	7.07	8.67	10.44	2,025.10	2,187.71	2,377.94	2,786.68	44.97	52.12
G ₄	PH - 4	29.67	34.24	38.25	43.92	6.40	7.43	9.02	10.89	1,855.91	2,055.91	2,245.03	2,623.83	46.94	53.93
G ₅	Pusa Rohini	35.66	39.80	41.36	45.95	6.02	7.08	8.72	10.93	1,818.52	2,006.79	2,175.62	2,578.88	48.21	55.58
G ₆	Arka Abhay	31.32	35.30	38.95	44.49	5.65	6.80	8.60	10.72	1,215.88	1,321.03	1,448.67	1,641.74	44.37	51.60
G ₇	CO - 3	33.42	37.75	41.13	46.60	4.52	5.49	7.25	9.44	1,664.01	1,854.36	2,045.07	2,417.25	43.49	50.43
G ₈	Navodaya	26.95	31.11	34.55	39.04	4.97	6.08	7.53	9.67	1,488.36	1,622.31	1,779.48	2,104.12	56.67	65.62
G ₉	AVTO - 9802	32.38	36.71	40.14	45.87	3.57	4.61	6.35	8.57	1,856.94	1,996.43	2,131.54	2,439.82	45.35	53.47
G ₁₀	Arka Samrat	34.15	37.88	42.26	48.05	6.03	7.07	8.91	11.04	2,067.41	2,271.01	2,446.49	2,864.32	52.26	59.67
G ₁₁	AVTO - 1314	31.51	35.29	38.82	43.79	5.08	6.08	7.76	9.89	1,706.82	1,830.07	1,959.49	2,233.27	50.31	42.67
F-Test		S	S	S	S	S	S	S	S	S	S	S	S	S	S
SE(d)		0.853	0.985	0.945	0.898	0.195	0.186	0.204	0.202	68.880	73.249	74.670	82.049	1.510	1.536
C.V.		3.175	3.240	2.815	2.352	4.197	3.388	2.965	2.347	4.509	4.369	4.100	3.840	3.947	3.565
C.D. at 5%		1.791	2.069	1.985	1.886	0.409	0.390	0.429	0.424	144.693	153.871	156.856	172.356	3.172	3.226

Table.1.2 Days to first picking, fruit length, fruit width, fruit diameter, number of fruits/cluster, number of fruits/plant, avg. fruit weight (g), yield/plant, yield/plot, yield/ha and Total soluble solids of different genotypes of Tomato

Genotype symbol	Genotype Name	Days to first picking	Fruit length (cm)	Fruit width (cm)	Fruit diameter (cm)	Number of fruits/cluster	Number of Fruits/plant	Average fruit weight (g)	Yield/plant (kg)	Yield per plot (kg)	Yield tones/ha	Total Soluble Solid (°Brix)
G ₁	Arka Rakshak	59.30	6.16	5.43	14.68	5.44	26.52	83.25	2.20	66.00	61.60	5.24
G ₂	Arka Vikas	61.16	5.87	6.19	17.08	5.26	23.75	86.67	2.05	61.50	57.40	3.92
G ₃	Pusa Ruby	66.09	4.25	5.15	10.98	4.61	16.74	64.12	1.07	32.10	29.96	5.93
G ₄	PH - 4	68.09	4.22	4.29	12.85	4.27	21.33	71.52	1.52	45.60	42.56	4.90
G ₅	Pusa Rohini	70.66	5.31	5.37	14.09	4.66	17.11	67.18	1.14	34.20	31.92	5.24
G ₆	Arka Abhay	66.45	5.02	5.19	11.90	4.51	11.18	70.21	0.78	23.40	21.84	5.39
G ₇	CO - 3	65.99	5.49	6.50	19.53	4.43	19.78	97.40	1.92	57.60	53.76	4.88
G ₈	Navodaya	81.10	4.15	4.79	10.72	3.38	9.56	57.32	0.54	16.20	15.12	5.54
G ₉	AVTO - 9802	68.54	5.60	6.01	14.26	4.23	15.35	80.84	1.23	36.90	34.44	4.80
G ₁₀	Arka Samrat	74.32	5.18	5.67	13.35	3.74	20.25	81.52	1.64	49.20	45.92	4.30
G ₁₁	AVTO - 1314	57.27	5.21	5.48	13.74	4.29	16.94	71.37	1.20	36.00	33.60	5.40
F-Test		S	S	S	S	S	S	S	S	S	S	S
SE(d)		1.625	0.098	0.097	0.523	0.177	1.110	4.517	0.096	2.878	2.686	0.352
C.V.		2.962	2.333	2.178	4.600	4.875	7.535	7.319	8.453	8.454	8.453	8.543
C.D. at 5%		3.413	0.205	0.204	1.099	0.371	2.332	9.489	0.202	6.047	5.643	0.740

Fruit yield/plant, fruit yield/plot and per hectare for different genotypes, maximum fruit yield (2.20 kg/plant, 66.00 kg/plot and 61.60 tonnes/ha) respectively was recorded in G₁ (Arka Rakshak), followed by G₂ (Arka Vikas) with (2.05 kg/plant, 61.50 kg/plot and 57.40 tonnes/ha), whereas minimum fruit yield/plant, per plot and per hectare (0.54 kg, 16.20 kg and 15.12 tonnes/ha) respectively, was observed in genotype G₈ (Navodaya). Variability in fruit yield in tomato Genotypes is due to the maximum number fruit/plant and maximum average fruit weight of Tomato Genotypes; similar findings previously also reported by Naresh *et al.*, (2000), Shivakumar (2000) and Mohanty and Prusti (2002) in Tomato.

Fruit length for different genotypes, maximum fruit length (6.16 cm) was found in genotype G₁ (Arka Rakshak), followed by G₂ (Arka Vikas) with (5.87 cm) and minimum fruit length (4.15 cm) was recorded in G₈ (Navodaya). Variability in fruit length of tomato Genotypes is due to the different shapes and sizes of tomato Genotypes; similar findings previously also reported by Asati *et al.*, (2008) in Tomato.

Fruit width for different genotypes, maximum fruit width (6.50 cm) was found in G₇ (CO - 3), followed by G₂ (Arka Vikas) with (6.19 cm) and minimum fruit width (4.29 cm) was recorded in G₄ (PH - 4). Variability in fruit length/width of tomato Genotypes is due to the different shapes and sizes of tomato Genotypes; similar findings previously also reported by Asati *et al.*, (2008) in Tomato.

Fruit diameter for different genotypes, maximum fruit diameter (19.53 cm) was found in G₇ (CO - 3), followed by G₂ (Arka Vikas) with (17.08 cm) and minimum fruit diameter (10.72 cm) was recorded in G₈ (Navodaya). Fruit diameter and fruit length jointly contribute to fruit size which

ultimately is related to fruit yield. Existence of variability among the Genotypes for fruit size factors (fruit length and diameter) may provide opportunity to select a genotype with desirable fruit size. Variability in fruit diameter of Tomato Genotypes is due to the different shapes and sizes of different Genotypes of Tomato; similar findings previously also reported by Asati *et al.*, (2008) in Tomato.

Quality parameters

In terms of Total Soluble Solids (TSS) for different treatment combinations, maximum TSS (5.93 °Brix) was found in G₂ (Pusa Ruby), followed by G₈ (Navodaya) with (5.54 °Brix) and minimum Total Soluble Solids (3.92 °Brix) was recorded in G₂ (Arka Vikas). Variability in Total Soluble Solids in different Genotypes of tomato is previously also reported by Shivakumar (2000), Singh and Cheema (2005), Singh *et al.*, (2014) and Kumar and Rana (2018) in tomato.

From the present experimental findings it is concluded that the genotypes G₁ (Arka Rakshak) found suitable genotypes in terms of growth and yield parameters followed by G₂ (Arka Vikas), genotype G₃ (Pusa Ruby) found best for TSS content and minimum vegetative growth, yield and quality was recorded in genotype G₈ (Navodaya).

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How to cite this article:

Komandla Sindhu, Devi Singh, Vijay Bahadur and Deepanshu 2020. Evaluation of Tomato Genotypes for Growth, Yield and Quality Attributes in Northern Agro Climatic Zone. *Int.J.Curr.Microbiol.App.Sci*. 9(10): 3432-3438. doi: <https://doi.org/10.20546/ijcmas.2020.910.396>