
CORRELATION STUDIES OF DIFFERENT GROWTH, QUALITY AND YIELD ATTRIBUTING PARAMETERS OF TOMATO (*Solanum lycopersicum* L.)

Shubhashree Priyadarshinee Das^{1*}, Durga Prasad Moharana², Tarique Aslam¹, Niharika J. Nayak¹, A.R. Mandal¹

1. Department of Vegetable Crops, BCKV, Mohanpur

2. Department of Horticulture, IAS, BHU, Varanasi

Email id: shubhashree23@gmail.com

ABSTRACT

The present investigation was carried out at Horticultural Research Station, Mondouri, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya during rabi season of 2013-14 and 2014-15. Correlation study showed that number of flower clusters per plant, number of flowers per cluster, number of fruits per cluster, number of fruits per plant had positive significant correlation with fruit yield per plant and number of flower clusters per plant, number of fruits per cluster, number of flowers per cluster, number of fruits per plant, fruit yield, polar diameter, equatorial diameter, TSS, ascorbic acid and germination percentage of seed had positive significant correlation with seed yield per plant.

Keywords: Tomato, Correlation, yield, quality

Introduction

Tomato (*Solanum lycopersicum* L., $2n=2x=24$) is one of the most important edible and nutritious vegetable of the world. It belongs to the family Solanaceae and native of Peru Ecuador region [1]. It is also one of the most popular and widely grown crops of commercial and dietary significance in the world. Firmly ripe tomato fruits are consumed fresh as salad, after cooking and also utilized in the preparation of value added products, such as juice, puree, paste, powder, ketchup, sauce, soup and whole canned fruits. Unripe green fruits are used for the preparation of pickles and chutney. Tomato tops in the list of processed vegetables and occupies a distinct place in the realm of vegetables because of its large-scale utilization and high nutritive value as it contains a good amount of vitamin A and C and minerals, therefore, in many countries, it is considered as *poor man's orange* [2], [3] and [4]. Due to its high consumption rate in developed and developing countries, it is often referred to as a luxury crop. In England, it is popularly known as *Love Apple* and is grown in all home gardens and by a large number of market and truck growers. Popularity of tomato has increased rapidly from the middle of nineteenth century

to the present time. As a cash crop, it has great demand in the international market [5]. Hence, now, it has become a good source of income to small and marginal farmers. The scope of improvement in tomato is mainly based on the variety having desirable characters. Knowledge in respect of the nature and magnitude of associations of yield with various component characters is a prerequisite to bring improvement in the desired direction.

Materials and method

The present investigation was carried out at Horticultural Research Station, Mondouri, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya during *rabi* season of 2013-14 and 2014-15. The experiment consisted of four tomato varieties namely Pusa 120 (V1), Pant T 3 (V2), Arka Vikash (V3) and Patharkuchi (V4) and five flower flushes (F1, F2, F3, F4 and F5) of each variety. The experiment was laid out in Randomized Block Design with three replications. Different growth parameters like plant height (cm), number of primary branches; yield attributing parameters like days to first flowering, days to first fruit harvest, number of flower clusters/plant, number of flowers/cluster, number of fruits/cluster, % of fruit set/cluster, number of fruits per plant, fruit weight (g), pericarp thickness (cm), polar diameter (cm), equatorial diameter (cm), number of locules/fruit, fruit yield (kg/plant), and quality parameters like TSS content (^o Brix), sugar content (%), ascorbic acid content (mg/100g), lycopene content (mg/100g) and β -carotene content (mg/100g) were studied. Analysis of data was done by using appropriate statistical methods over pooled data of both the years. The pooling of data for all the characters done for the both years by using the standard method suggested by Cochran and Cox [6]. Data obtained for different parameters were subjected to statistical analysis following the Randomized Block Design as suggested by Panse and Sukhatme [7] and Gomez and Gomez [8]. Correlation study of different parameters was done by the method of Pearson.

Result and Discussion

Plant height showed positive significant correlation with fruit weight (0.597), pericarp thickness (0.426), equatorial diameter (0.285), number of locules per fruit (0.307), test weight (0.603) and germination percentage of seeds and negative significant correlation with beta carotene content and number of seeds per fruit. Primary branches per plant showed positive significant correlation with pericarp thickness of fruit (0.316), equatorial diameter (0.315), whereas it showed negative significant correlation with days to first flower and days to first fruit harvest.

Days to first flower showed positive significant correlation with days to first harvest while significant correlation with number of flower clusters per plant, number of flowers per cluster, number of fruits per cluster, number of fruits per plant, fruit yield per plant, fruit weight, pericarp thickness, polar diameter, equatorial diameter, vitamin C, lycopene content, beta

carotene content, germination % and seed yield per plant. Number of flower clusters per plant showed positive significant correlation with number of flowers per cluster, number of fruits per cluster, number of fruits per plant, fruit yield, polar diameter, equatorial diameter, vitamin C, beta carotene content and seed yield and negative significant correlation with days to first fruit harvest. Number of flowers per cluster showed positive significant correlation with number of flower clusters per plant whereas negative significant correlation with days to first flower. Number of fruits/cluster showed positive significant correlation with number of flower clusters/plant and number of flowers/cluster while negative significant correlation with days to first flowering. Percentage of fruit set per cluster showed positive significant correlation with number of fruits/cluster while negative significant correlation with number of flowers/cluster. Days to first fruit harvest showed positive significant correlation with days to first flowering and negative significant correlation with number of primary branches, number of flower clusters/plant, number of flowers/cluster and number of fruits/cluster.

Number of fruits per plant showed positive significant correlation with number of flower clusters per plant (0.950**), number of flowers per cluster (0.590**), number of fruits per cluster (0.733**) and negative significant correlation with days to first flower (-0.451**) and days to first fruit harvest (-0.566**). Fruit weight showed positive significant correlation with plant height, number of flowers per cluster, fruit yield while negative significant correlation with days to first flower and days to first fruit harvest. Polar diameter showed positive significant correlation with number of flower clusters/plant, number of flowers/ cluster, number of fruits/cluster, number of fruits/plant, fruit yield and negative significant correlation with days to first flower and days to first fruit harvest. Equatorial diameter showed positive significant correlation with plant height, number of primary branches, number of flower clusters per plant, number of flowers per cluster, number of fruits per plant, fruit yield, fruit weight, pericarp thickness whereas negative significant correlation with days to first flower and days to first fruit harvest. This result was earlier corroborated by Ravindra *et al.* [9].

Fruit yield showed positive significant correlation with number of flower clusters per plant (0.935**), number of flowers per cluster (0.580**), number of fruits per cluster (0.717**), number of fruits per plant (0.977**) whereas showing negative significant correlation with days to first flower (-0.473**), days to first fruit harvest (-0.565**). The results were confirmed with the findings of Shiferaw *et al.* [10], Ramanaet al [11], Prashanth *et al.* [12], Meseret *et al.* [13], Dharminder *et al.* [14] and Mahapatra *et al.* [15]. Direct selection on the basis of number of fruits per plant and number of fruits per cluster was reliable for yield improvement. Pericarp thickness showed positive significant correlation with plant height, number of primary branches, fruit weight while negative significant correlation with days to first flower and days to first fruit harvest. Number of locules/fruit showed positive significant correlation with plant height,

pericarp thickness and negative significant correlation with polar diameter. The result was supported by the findings of Ravindra *et al.* [9].

Positive significant correlation with pericarp thickness, number of locules/fruit, TSS content, sugar content and negative significant correlation with polar diameter, lycopene content, β -carotene content was shown by number of seeds per fruit, whereas test weight showed positive significant correlation with plant height, days to first fruit harvest, fruit weight, pericarp thickness, number of locules per fruit, TSS content and negative significant correlation with polar diameter, lycopene content and β -carotene content. Seed yield per plant showed positive significant correlation with number of flower clusters per plant (0.910**), number of fruits per cluster (0.658**), number of flowers per cluster (0.556**), number of fruits per plant (0.937**), fruit yield (0.878**), polar diameter (0.364**), equatorial diameter (0.344**), TSS (0.370**), ascorbic acid (0.322*) and germination percentage of seed (0.297*). But it rendered negative significant correlation with days to first flower (-0.435**) and days to first fruit harvest (-0.542**). Germination % of seeds showed positive significant correlation with plant height, number of flowers per cluster, number of fruits per cluster, fruit weight, fruit yield, pericarp thickness, equatorial diameter, number of locules per fruit, TSS content, sugar content, beta carotene content and number of seeds per fruit and negative significant correlation with days to first flower and days to first fruit harvest.

TSS content of fruit showed positive significant correlation with number of flowers per cluster, fruit weight, pericarp thickness and number of locules per fruit. Positive significant correlation with number of flower clusters/plant, number of flowers/cluster, number of fruits/cluster, number of fruits/plant, fruit yield/plant, polar diameter whereas negative significant correlation with plant height, days to first flower, days to first fruit harvest, fruit weight, pericarp thickness and number of locules/fruit had been shown by ascorbic acid content of fruit. Sugar content of fruit showed positively significant correlation with pericarp thickness, equatorial diameter, number of locules per fruit, TSS content while negative significant correlation with polar diameter and ascorbic acid content. Lycopene content of fruit showed positive significant correlation with number of flowers per cluster, number of fruits per cluster, number of fruits per plant, polar diameter, ascorbic acid content and showed negative significant correlation with plant height, days to first flower, days to first fruit harvest, pericarp thickness, number of locules per fruit, TSS content, β -carotene content. This results were inconformity with the findings of YaDong *et al.* [16]. β carotene content of fruit showed positive significant correlation with number of flower clusters per plant, number of flowers per cluster, number of fruits per cluster, number of fruits per plant, fruit yield, polar diameter, ascorbic acid content, lycopene content while negative significant correlation with plant height, days to first flower, days to first fruit harvest, number of locules per fruit and sugar content.

Conclusion

Results showed that number of flower clusters per plant, number of flowers per cluster, number of fruits per cluster, number of fruits per plant had positive significant correlation with fruit yield per plant and number of flower clusters per plant, number of fruits per cluster, number of flowers per cluster, number of fruits per plant, fruit yield, polar diameter, equatorial diameter, TSS, ascorbic acid and germination percentage of seed had positive significant correlation with seed yield per plant.

References

1. Rick CM (1969). *Origin of cultivated tomato, current status of the problem*. Abstract XI International Botanical Congress. pp. 180.
2. Sainju MU, Dris R, Singh B (2003). Mineral nutrition of tomato. *Food Agriculture and Environment* **1**(2): 176-183.
3. Singh JK, Singh JP, Jain SK, Joshi A (2004). Correlation and path coefficient analysis in tomato. *Progressive Horticulture* **36**(1): 82-86.
4. Naika S, de Jeude JL, de Goffau M, Hilmi M, van-Dam B (2005). *Cultivation of Tomato: Production, processing and marketing*. Agromisa Foundation and CTA, Wageningen pp. 92.
5. Solieman THI, El-Gabry MAH, Abido AI (2013). Heterosis, potence ratio and correlation of some important characters in tomato (*Solanum lycopersicum* L.). *Scientia Horticulturae* **150**: 25-30.
6. Cochran WG, Cox GM (1957). *Experimental designs*. (Ed. 2nd). John Wiley and Sons, New York 553-566.
7. Panse VG, Sukhatme PV (1978). *Statistical methods for agricultural workers*. ICAR publications. New Delhi, India pp. 68-75.
8. Gomez KA, Gomez AA (1984). *Statistical Procedures for Agricultural Research*. (Ed.2nd). John Wiley and Sons, New York pp. 680.
9. Ravindra M, Aravindakumar JS (2003). Influence of environments on the association of growth, earliness and quality parameters in tomato. *Indian Journal of Horticulture* **60**(1):75-78.
10. Shiferawet N, Krishnappa KS, Raju TBP (2002). Correlation coefficient analysis in tomato. *Current Research University of Agricultural Sciences Bangalore* **31**(7/8): 127-130.
11. Ramana CV, Shankar VG, Kumar SS, Rao PV (2007). Trait interrelationship studies in tomato (*Lycopersicon esculentum* Mill.). *Research on Crops* **8**(1): 213-218.

12. Prashanth SJ, Jaiprakashnarayan RP, Mulge R, Madalageri MB (2008). Correlation and path analysis in tomato (*Lycopersicon esculentum* Mill.). Asian Journal of Horticulture **3**(2): 403-408.
13. Meseret DR, Ali M, Bantte K (2012). Evaluation of Tomato (*Lycopersicon esculentum* Mill.) Genotypes for Yield and Yield Components. The African Journal of Plant Science and Biotechnology **6**(1): 45-49.
14. Dharminder K, Kumar R, Kumar S, Bhardwaj ML, Thakur MC, Kumar R, Thakur KS, Dogra BS, Vikram A, Thakur A, Kumar P (2013). Genetic variability, correlation and path coefficient analysis in tomato. International Journal of Vegetable Science **19**(4): 313-323.
15. Mahapatra AS, Singh AK, Vani VM, Mishra R, Kumar H, Rajkumar BV (2013). Inter-relationship for various components and path coefficient analysis in tomato (*Lycopersicon esculentum* Mill). International Journal of Current Microbiology and Applied Sciences **2**(9): 147-152.
16. YaDong S, Liang Y, Wu JMW, Lei L Wang XJ (2010). Correlation analysis on quantitative traits of tomato germplasm resources. China Vegetables (**6**): 74-76.

Table: 4.25 Correlation studies of different parameters of Tomato

	NPB	D1F	NFCPP	NFPC	NFrPC	FrPC	D1FrH	NFrPP	Fruit wt.	PoD	ED	FrYPP	PT	NLPFr	NSPFr	Test wt.	SYPP	GP	TSS	Vit. C	Sugar	Lycopene	β-carotene
Plant height	0.113	-0.168	-0.117	-0.085	0.055	0.129	-0.030	-0.106	0.597**	-0.132	0.285	0.004	0.426**	0.307	-0.169	0.603**	-0.112	0.493**	0.250	-0.417**	0.134	-0.300*	-0.331**
NPNB		-0.335**	0.149	-0.049	0.061	0.118	-0.341**	0.115	0.034	0.225	0.315	0.080	0.316*	0.093	0.219	0.019	0.245	0.195	0.163	0.201	0.041	0.148	0.176
D1F			-0.451**	-0.655**	-0.475**	0.158	0.976**	-0.451**	-0.461**	-0.527**	-0.371**	-0.473**	-0.369**	0.081	-0.068	0.193	-0.435**	-0.584**	-0.205	-0.459**	0.110	-0.503**	-0.561**
NFCPP				0.562**	0.547**	-0.011	-0.567**	0.950**	0.246	0.426**	0.439**	0.935**	0.117	0.034	0.040	-0.009	0.910**	0.215	0.217	0.349**	-0.091	0.225	0.302*
NFPC					0.618**	-0.385**	-0.672**	0.590**	0.352**	0.336**	0.267	0.580**	0.119	0.116	0.009	-0.147	0.556**	0.485**	0.341**	0.281*	-0.119	0.332**	0.376**
NFrPC						0.466**	-0.514**	0.733**	0.235	0.371**	0.191	0.717**	0.169	0.112	-0.153	0.002	0.658**	0.337**	0.225	0.288*	-0.231	0.333**	0.343**
FrSP							0.134	0.163	-0.137	0.050	-0.095	0.155	0.064	-0.017	-0.162	0.133	0.116	-0.115	-0.115	0.050	-0.132	0.047	0.009
D1FrH								-0.566**	-0.355**	-0.614**	-0.361**	-0.565**	-0.264*	0.148	-0.059	0.289*	-0.542**	-0.468**	-0.132	-0.588**	0.183	-0.593**	-0.659**
NFrPP									0.229	0.463**	0.367**	0.977**	0.089	0.029	-0.049	0.012	0.937**	0.203	0.192	0.383**	-0.186	0.299*	0.357**
Fruit wt.										0.039	0.570**	0.398**	0.420**	0.221	-0.252	0.474**	0.145	0.632**	0.361**	-0.335**	0.109	-0.201	-0.203
PoD											0.222	0.438**	-0.100	-0.370**	-0.291*	-0.308*	0.364**	-0.048	-0.054	0.759**	-0.562**	0.686**	0.734**
ED												0.446**	0.440**	0.104	0.070	0.177	0.344**	0.356**	0.154	-0.160	0.294*	-0.211	-0.161
FrYPP													0.148	0.037	-0.141	0.113	0.878**	0.266*	0.213	0.305*	-0.189	0.253	0.302*
PT														0.312*	0.268*	0.364**	0.122	0.574**	0.352**	-0.331**	0.418**	-0.288*	-0.247
NLPFr															0.292*	0.499**	0.166	0.443**	0.544**	-0.447**	0.317*	-0.419**	-0.430**
NSPFr																-0.046	0.245	0.262*	0.399**	-0.142	0.757**	-0.373**	-0.284*
Test wt.																	0.057	0.396**	0.505**	-0.571**	0.220	-0.529**	-0.567**
SYPP																		0.297*	0.370**	0.322*	0.027	0.169	0.242
GP																			0.689**	-0.240	0.322*	-0.159	-0.134
TSS																				-0.220	0.317*	-0.281*	-0.257*
Vit. C																					-0.654**	0.916**	0.946**
Sugar																						-0.804**	-0.737**
Lycopene																							0.985**

** significant at 1% and * significant at 5%. NPB-No of primary branches, D1F-days to f1st flower, NFCPP-No of flower clusters/plant, NFPC-No of flowers/cluster, NFrPC-No of fruits/cluster, FrSP-fruitset%, D1FrH-days to 1st fruit harvest, NFrPP-No of fruits/plant, PoD-polar diameter, ED-equatorial diameter FrYPP-fruit yield/plant, PT-pericarp thickness, NLPFr-No of locules/fruit, NSPFr-No of seeds/fruit, SYPP-seed yield /plant, GP-germination % of seed