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Correlation and Path Co-Efficient Studies in Tomato (*Solanum lycopersicum* L.)

Mahantagouda G. Rajolli[1*], H. B. Lingaiah[2], Ishwaree, R. Malashetti[3], Amruta S. Bhat[4] and Aravindkumar, J. S.[5]

Department of Vegetable Science, College of Horticulture, UHS campus, GKVK Bengaluru, Karnataka

*Corresponding Author E-mail: goudahort@gmail.com

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ABSTRACT

Evaluation of F_2 population of the cross IIHR-2201 X C-13-1-2-1 was carried out at experimental block, Department of Vegetable Science, College of Horticulture, UHS Campus, GKVK, Bengaluru during 2015-2016. Correlation study revealed that the parameters viz., plant height, number of branches per plant, number of fruits, average fruit weight, fruit length and fruit width have strong association with yield. Therefore, to increase the yield in tomato selection for above mentioned traits can be carried out. path analysis revealed that the number of fruits per plant followed by plant height, average fruit weight, number of branches per plant, pericarp thickness, fruit length, number of locules per fruit and ascorbic acid were showing direct positive effect on yield per plant while other parameters like fruit width followed by fruit firmness, total soluble solids, days to first anthesis and pH were showing direct negative effect. The characters showing high direct effect on yield per plant indicated that direct selection for these traits might be effective and there is a possibility of improving yield per plant through selection based on these characters.

Key words: *Tomato, Correlation, Path co-efficient analysis, Direct effect, Fruit yield*

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is an important remunerable vegetable of India and all over the world belongs to the family Solanaceae having diploid chromosome number of 24. It is grown for its edible fruit, which can be consumed, either raw or cooked or in the form of various processed products like juice, ketchup, sauce, pickle, pastes, puree and powder. It is universally referred as protective food and esteemed as an important source of minerals, organic acids and vitamins (A and C).

Yield is the resultant of combined effect of several component characters and environment. A crop breeding programme, aimed at increasing the plant productivity requires consideration not only of yield but also of its components that have a direct or indirect bearing on yield.

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Hence, a knowledge regarding the association of various characters among themselves and with economic characters is necessary for making indirect selection for improvement of economic traits. Character association is a measure of the degree of association between two characters. Though correlation analysis indicates the association pattern of component traits with yield, they simply represent the overall influence of a particular trait on yield rather than providing the cause and effect of relationship. The technique of path coefficient analysis developed by Wright[19] and demonstrated by Dewey and Lu[4] facilitates the partitioning of correlation coefficients into direct and indirect contribution of various characters on yield. It is standardized partial regression coefficient analysis. As such, it measures the direct influence of one variable upon other[14].

The present investigation was carried out to gather these information in F_2 segregating population of tomato which would be utilized for further improvement of tomato yield through an appropriate and sound breeding plan. Estimation of inter-relationship of yield with other traits would facilitate effective selection for simultaneous improvement for one or many yield contributing characters. Hence, an attempt has been made to study the character association and path analysis in segregating population of tomato.

MATERIAL AND METHODS

The study was conducted at the experimental block, Department of Vegetable Science, College of Horticulture, UHS Campus, GKVK, Bengaluru. The experimental material consisted of 305 plants of F_2 (IIHR-2201 X C-13-1-2-1) population, twenty plants of each F_1, parents and four commercial checks (Arka Rakshak, Arka Samrat, Arka Vikas and PTR-6) were planted in healthy plot to assess quality, yield and yield attributing traits. The experimental seed material was sown in protrays on 4th December 2015. Twenty eight days old seedlings were then transplanted to the main field with spacing of 75 cm x 60 cm. Before transplanting the plot was brought to fine tilth by ploughing and harrowing. The production aspects were followed as per the package of practices of UHS Bagalkot[2].

The traits studied in the experiment are provided in the table 1 and 2. The observations were recorded for each plant in F_2 population and five randomly selected plants in F_1 hybrid, parents and commercial checks. Correlation and Path analysis were computed with the help of computer software following the techniques described by Al-Jibourie *et al.*[1] and Dewey & Lu[4] respectively.

RESULTS AND DISCUSSION

To know the nature and magnitude of relationship existing between yield and its component characters as well as, the association among the component characters themselves, the correlation among the thirteen characters were estimated (Table 1). The results revealed that the plant height at first harvesting was positively and significantly (at p = 0.01) associated with fruit yield per plant (0.9163) followed by number of branches per plant (0.9068), number of fruits per plant (0.8495), fruit width (0.3105) and average fruit weight (0.2395). It also had positive and significant (at p = 0.05) correlation with fruit length (0.1131) whereas, number of branches at first harvesting had significant (at p = 0.01) positive association with fruit yield per plant (0.8730) followed by number of fruits per plant (0.8134), fruit width (0.3278), and average fruit weight (0.2519). It also had positive significant (at p = 0.05) association with fruit length (0.1275). Days to first anthesis had significant (at p = 0.01) and positive correlation with fruit length (0.2079) followed by fruit width (0.1880) and pericarp thickness (0.1606) whereas, correlation of fruit length was found positive and significant (at p = 0.01) with fruit width (0.7368) followed by average fruit weight (0.4856), pericarp thickness (0.4051) and fruit firmness (0.1546). It also had positive and significant (at p = 0.05) correlation with number of locules per fruit (0.1395) and fruit yield per plant (0.1182).

Fruit width was positively and significantly (at p = 0.01) associated with average fruit weight (0.5192) followed by pericarp thickness (0.3752), fruit yield per plant (0.3347) and number of fruits per plant (0.2393). It also had positive significant (at p = 0.05) association with fruit firmness (0.1312). Correlation of fruit firmness was found positive and significant (at p = 0.01) with pericarp thickness (0.2684) and (at p = 0.05) average fruit weight (0.1460). Number of fruits per plant was positively and significantly (at p = 0.01) associated with fruit yield per plant (0.9328) whereas, average fruit weight had significant (at p = 0.01) and positive correlation with fruit yield per plant (0.2800) and pericarp thickness (0.2141). Pericarp thickness was found.

Table 1: Correlation matrix between yield and yield attributing traits in F_2 population of IIHR-2201 X C-13-1-2-1

Characters	Number of branches /plant	Days to first anthesis	Fruit length (cm)	Fruit width (cm)	Fruit firmness (kg/cm^2)	Number of fruits /plant	Average fruit weight (g)	Pericarp thickness (mm)	Number of locules /fruit	TSS (^{0}Brix)	pH	Ascorbic acid (mg/100g)	Yield/plant (kg)
Plant height (cm)	0.9068**	-0.0071	0.1131*	0.3105**	-0.0015	0.8495**	0.2395**	0.0807	-0.0411	-0.0028	0.0505	0.0668	0.9163**
Number of branches/plant	1.0000	0.0207	0.1275*	0.3278**	-0.0119	0.8134**	0.2519**	0.0826	-0.0444	-0.0032	0.0832	0.0413	0.8730**
Days to first anthesis		1.0000	0.2079**	0.1880**	0.0412	-0.0345	0.0996	0.1606**	0.0613	-0.0483	-0.0556	-0.0143	-0.0112
Fruit length (cm)			1.0000	0.7368**	0.1546**	-0.0178	0.4856**	0.4051**	0.1395*	-0.0496	0.0322	-0.0553	0.1182*
Fruit width (cm)				1.0000	0.1312*	0.2393**	0.5192**	0.3752**	0.0881	0.0081	0.0470	0.0270	0.3347**
Fruit firmness (kg/cm^2)					1.0000	0.0006	0.1460*	0.2684**	0.0225	-0.0240	0.0476	-0.0492	0.0024
Number of fruits/plant						1.0000	0.1105	0.0480	-0.0575	-0.0087	0.0633	0.0155	0.9328**
Average fruit weight (g)							1.0000	0.2141**	0.0869	0.0566	0.0738	0.0290	0.2800**
Pericarp thickness (mm)								1.0000	0.0282	0.1096	-0.0126	-0.1372*	0.1194*
Number of locules/fruit									1.0000	0.0570	-0.0907	-0.0105	-0.0113
TSS (^{0}Brix)										1.0000	0.0099	-0.0914	-0.0166
pH											1.0000	-0.0094	0.0622
Ascorbic acid (mg/100g)												1.0000	0.0440

*Significant at 5% ** Significant at 1 %

Table 2: Path matrix of component traits on fruit yield of tomato in F_2 population of IIHR-2201 X C-13-1-2-1

Traits	Plant height (cm)	Number of branches/plant	Days to first anthesis	Fruit length (cm)	Fruit width (cm)	Fruit firmness (kg/cm^2)	Number of fruits/ plant	Average fruit weight (g)	Pericarp thickness (mm)	Number of locules/ fruit	TSS (^{0}Brix)	pH	Ascorbic acid (mg/100g)	r
Plant height (cm)	**0.3153**	0.0675	0.0001	0.0038	-0.0084	0.0000	0.5081	0.0267	0.0035	-0.0012	0.0001	-0.0001	0.0009	0.9163**
Number of branches/plant	0.2859	**0.0744**	-0.0002	0.0043	-0.0089	0.0003	0.4856	0.0280	0.0036	-0.0013	-0.0001	-0.0001	0.0005	0.8730**
Days to first anthesis	-0.0022	0.0015	**-0.0116**	0.0071	-0.0051	-0.0011	-0.0206	0.0111	0.0070	0.0018	0.0010	0.0001	-0.0002	-0.0112
Fruit length (cm)	0.0357	0.0095	-0.0024	**0.0340**	-0.0199	-0.0041	-0.0107	0.0541	0.0178	0.0040	0.0011	-0.0001	-0.0007	0.1182*
Fruit width (cm)	0.0979	0.0244	-0.0022	0.0250	**-0.0270**	-0.0035	0.1431	0.0578	0.0164	0.0025	-0.0002	-0.0001	0.0003	0.3347**
Fruit firmness (kg/cm^2)	-0.0005	-0.0009	-0.0005	0.0053	-0.0035	**-0.0263**	0.0004	0.0162	0.0118	0.0006	0.0005	-0.0001	-0.0006	0.0024
Number of fruits/plant	0.2679	0.0605	0.0004	-0.0006	-0.0065	0.0000	**0.5981**	0.0123	0.0021	-0.0016	0.0002	-0.0001	0.0002	0.9328**
Average fruit weight (g)	0.0755	0.0187	-0.0012	0.0165	-0.0140	-0.0038	0.0661	**0.1113**	0.0094	0.0025	-0.0012	-0.0001	0.0004	0.2800**
Pericarp thickness (mm)	0.0255	0.0061	-0.0019	0.0138	-0.0101	-0.0071	0.0287	0.0238	**0.0438**	0.0008	-0.0024	0.0000	-0.0018	0.1194*
Number of locules/fruit	0.0130	-0.0033	-0.0007	0.0047	-0.0024	-0.0006	-0.0344	0.0097	0.0012	**0.0286**	-0.0012	0.0002	-0.0001	-0.0113
TSS (^{0}Brix)	-0.0009	0.0002	0.0006	-0.0017	-0.0002	0.0006	-0.0052	0.0063	0.0048	0.0016	**-0.0216**	0.0000	-0.0012	-0.0166
pH	0.0159	0.0062	0.0006	0.0011	-0.0013	-0.0013	0.0378	0.0082	-0.0006	-0.0026	-0.0002	**-0.0018**	-0.0001	0.0622
Ascorbic acid (mg/100g)	0.0211	0.0031	0.0002	-0.0019	-0.0007	0.0013	0.0092	0.0032	-0.0060	-0.0003	0.0020	0.0000	**0.0128**	0.0440

*Significant at 5% ** Significant at 1 %

Diagonal indicates direct effect

positive and significant (at p = 0.05) with fruit yield per plant (0.1194) But it was negatively and significantly (at p = 0.05) associated with ascorbic acid (-0.1372). These results are in conformity with the findings of Mayavel *et al.* (2005), Mohanty[11], Mohanty[12], Veershetty[18], Raut *et al.*[15], Islam *et al*.[8], Reddy *et al*.[16] and Meena and Bahadur[10]. The correlation results obtained in the present study indicated that parameters *viz*., plant height, number of branches per plant, number of fruits, average fruit weight, fruit length and fruit width are the important components of yield. Therefore, to increase the yield in tomato selection for above mentioned parameters can be carried out.

The estimates of direct and indirect effects of different characters on the fruit yield per plant are presented character wise (Table 2). The results revealed that the path analysis of yield per plant with its component traits presented diagonally depicted direct effects of the characters towards their correlation with yield per plant, while all other off diagonal estimates showed indirect effects of the characters towards their correlation with yield per plant. The number of fruits per plant (0.5981) followed by plant height (0.3153), average fruit weight (0.1113), number of branches per plant (0.0744), pericarp thickness (0.0438), fruit length (0.0340), number of locules per fruit (0.0286) and ascorbic acid (0.0128) were showing direct positive effect on yield per plant while other parameters like fruit width (-0.0270) followed by fruit firmness (-0.0263), total soluble solids (-0.0216), days to first anthesis (-0.0116) and pH (-0.0018) were showing direct negative effect. The results are in accordance with the reports of Mohanty[11], Veershetty[18], Singh[17], Dhankhar and Dhankhar[6] and Raut *et al*[15].

CONCLUSION

The characters showing high direct effect on yield per plant indicated that direct selection for these traits might be effective and there is a possibility of improving yield per plant through selection based on these characters. So the emphasis for selection is need to be given to characters such as plant height, number of branches per plant, average fruit weight and number of fruits per plant which are easily observable characters at the field level during selection for fruit yield per plant is in accordance with the findings of Dhankar *et al.*[5], Mohanty[11], Veershetty[18], Ara *et al.*[3], Ghosh *et al*.[7] and Monamodi *et al*[13].

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