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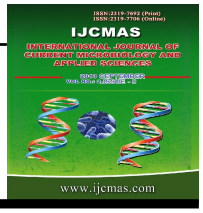

Original Research Article

Inter-relationship for Various Components and Path Coefficient Analysis in Tomato (*Lycopersicon esculentum* Mill)

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A B S T R A C T

The correlation and path coefficient studies were conducted for 68 genotypes of tomato at Vegetable Research Farm, Department of Horticulture, Institute of Agricultural Sciences, B.H.U., Varanasi during rabi season 2009-10. There are highly significant differences among the genotypes for all the characters studied as per the analysis of variance. Fruit yield had positive and significant correlation with plant height, number of primary branches per plant, number of flower clusters per plant, number of fruits per plant, fruit length, fruit width, pericarp thickness, number of locules per fruit, average fruit weight and fruit yield per plant. It was observed that with increase in plant height, there was corresponding increase in number of primary branches per plant, days to 50 % flowering and number of flower clusters per plant. The association recorded significant improvement in yield. The traits like number of primary branches per plant, number of flower clusters per plant, number of fruits per plant, fruit length, fruit width, pericarp thickness, average fruit weight and number of seeds per fruit exhibited positive direct effects towards yield and these traits also recorded positive significant correlation with yield. This suggested that direct selection based on these traits will be rewarded for crop improvement.

Keywords

Tomato; *Lycopersicon esculentum;* locules per fruit*;* correlation; path analysis.

Introduction

Tomato is one of the most nutritive vegetables which are very rich in Vitamin A and Vitamin C, proteins, fats and carbohydrates, food energy calories as well as other essential minerals and food elements. It is also rich in medicinal value. The study of inter relationship among various characters in the form of correlation is one of the important aspects in the selection programme for the breeder to make an effective selection based on the correlated and uncorrelated response. The direct selection for fruit yield is not sufficiently effective, as yield is polygenetically controlled and associated with number of related traits. Therefore, indirect selection is desirable for improvement of yield. A knowledge of

association between yield and its component traits and inter relationship among themselves may provide information fruitful for planning an effective and successful breeding programme. The estimation of correlation indicates only the extent and nature of association between yield and its components, but does not show the direct and indirect effects of different yield attributes on yield. Fruit yield is dependent on several characters which are mutually associated; these will in turn impair the true association existing between a component and fruit yield. A change in any one component is likely to disturb the whole network of cause and effect. Thus, each component has two paths of action viz., the direct influence on fruit yield, indirect effects through components which are not revealed from correlation studies. Thus the present investigation was initiated to study both correlation and path coefficient analysis in different tomato genotypes, thereby; it is possible to recognize the relationship among various characters of tomato.

Materials and Methods

The studies on tomato were carried out at Vegetable Research Farm of the Horticulture Department, Institute of Agricultural Sciences, B. H. U., Varanasi in rabi season 2009-10 using Randomized Block Design with three replications. The experimental material consists of 68 genotypes which were sown in two rows of 3m length at 60 × 45cm of spacing accommodating 12 plants in each replication. All the recommended package of practices was followed for raising a healthy crop.

The observations were recorded on five randomly selected plants in each genotype per replication for various characters using standard procedures. The phenotypic and genotypic coefficients of correlation were computed by following Al-Jibouri *et al.*, (1958). The path coefficient analysis was carried out using phenotypic correlation values of yield components on yield as suggested by Wright (1921) and illustrated by Dewey and Lu (1959).

Results and Discussion

There are highly significant differences among all the genotypes for all the characters studied as per the analysis of variance. As yield is a complex polygenic character influenced by contributions from different component traits, which are under separate genetic control, thus, it is essential to have a clear picture of the contributions of each of the component characters towards the ultimate yield. The correlation between yield and its components is indispensable when it is required to amalgamate high yield potential with other desirable traits in a single genotype. The phenotypic and genotypic correlation coefficients were worked out in all possible combinations (Table 1).

In general it was found that genotypic correlation coefficients were higher in magnitude than their corresponding phenotypic values. Basically yield is the main character with which all other characters are positively or negatively correlated. Fruit yield per hectare had positive and significant correlation with plant height, number of primary branches per plant, number of flower clusters per plant, number of fruits per plant, fruit length, fruit width, pericarp thickness, number of locules per fruit, average fruit weight and fruit yield per plant.

Table.1 Phenotypic (P) and Genotypic (G) correlation coefficient among yield and yield attributes in 68 genotypes for 14 characters in tomato**.**

Characters	P/G	Plant height (cm)	No. of primary branches Per plant	No. of flower clusters per plant	No. of fruits per plant	Fruit length(cm)	Fruit width(cm)	Pericarp thickness (mm)	No. of locules per fruit	Avg. fruit weight(g)	No. of seeds per fruit	Fruit yield per plant	Fruit yield per hectare	Shelf life (days)
Days to 50% flowering	P	-0.078	-0.026	-0.091	-0.194	-0.035	-0.140	-0.056	0.005	-0.080	-0.053	-0.196	-0.196	-0.271
	G	-0.094	-0.037	-0.118	-0.236	-0.059	-0.0181	-0.072	-0.007	-0.088	-0.064	-0.229	-0.229	-0.316*
Plant height (cm)	P	--	0.758**	0.693**	0.540**	0.203	0.240	0.131	0.089	0.108	-0.057	0.452**	0.452**	0.060
	G	--	0.842**	0.738**	0.544**	0.211	0.247	0.133	0.090	0.121	-0.060	0.455**	0.455**	0.064
No. of primary branches per plant	P		--	0.834**	0.564**	0.132	0.267	0.184	0.220	0.143	-0.005	0.499**	0.499**	0.013
	G		--	0.858**	0.595**	0.157	0.265	0.214	0.261	0.224	-0.015	0.575**	0.576**	0.017
No. of flower cluster per plant	P			--	0.700**	0.159	0.245	0.227	0.152	0.148	-0.160	0.599**	0.599**	-0.062
	G			--	0.712**	0.190	0.232	0.248	0.166	0.223	-0.181	0.660**	0.660**	-0.066
Number of fruits per plant	P				--	0.041	0.142	-0.025	-0.078	-0.055	-0.178	0.591**	0.592**	-0.120
	G				--	0.045	0.147	-0.028	-0.092	-0.019	-0.186	0.605**	0.606**	-0.127
Fruit length(cm)	P					--	0.264	0.548**	0.235	0.600**	0.222	0.522**	0.522**	0.045
	G					--	0.254	0.568**	0.252*	0.626**	0.230	0.537**	0.537**	0.051
Fruit width (cm)	P						--	0.729**	0.566**	0.725**	0.256*	0.675**	0.675**	0.210
	G						--	0.747**	0.599**	0.753**	0.264*	0.692**	0.692**	0.223
Pericarp thickness(mm)	P							--	0.567**	0.931**	0.204	0.725**	0.725**	0.210
	G							--	0.589**	0.953**	0.206	0.731**	0.731**	0.226
No of locules per fruit	P								--	0.602**	0.244	0.404**	0.403**	0.109
	G								--	0.635**	0.253*	0.415**	0.414**	0.109
Av. Fruit weight(gm)	P									--	0.199	0.748**	0.748**	0.217
	G									--	0.203	0.761**	0.760**	0.234
No of seeds per fruit	P										--	0.041	0.041	0.149
	G										--	0.041	0.041	0.158
Fruit yield per plant	P											--	0.999**	0.070
	G											--	0.999**	0.075
Fruit yield per hectare	P												--	0.071
	G												--	0.079

***, ** Significant at 5% and 1% probability level respectively**

Table.2 Phenotypic and Genotypic path of 68 genotypes of tomato for 14 characters.

Characters	P/G	Days to 50% flowering	Plant height (cm)	No. of primary branches Per plant	No. of flower clusters per plant	No. of fruits per plant	Fruit length(cm)	Fruit width(cm)	Pericarp thickness (mm)	No. of locules per plant	Avg. fruit weight(g)	No. of seeds per fruit	Shelf life (days)	Correlation with yield
Days to 50% flowering	P	**-0.025**	0.000	0.000	-0.007	-0.018	-0.001	-0.004	-0.003	0.000	-0.057	0.000	0.009	-0.196
	G	**-0.039**	0.005	-0.002	-0.011	-0.124	-0.002	-0.003	-0.007	0.000	-0.057	0.000	0.011	-0.229
Plant height (cm)	P	0.002	**0.005**	0.004	0.050	0.302	0.004	0.007	0.007	-0.004	0.078	0.000	-0.002	0.452**
	G	0.004	**-0.050**	0.052	0.068	0.286	0.007	0.004	0.013	-0.005	0.079	0.000	-0.002	0.455**
No. of primary branches per plant	P	0.001	0.004	**0.006**	0.061	0.315	0.003	0.009	0.010	-0.010	0.103	0.000	0.000	0.499**
	G	0.001	-0.042	**0.061**	0.079	0.312	0.005	0.006	0.021	-0.014	0.145	0.000	-0.001	0.576**
No. of flower cluster per plant	P	0.002	0.003	0.005	**0.073**	0.391	0.003	0.009	0.012	-0.007	0.106	0.000	0.002	0.599**
	G	0.005	-0.037	0.053	**0.092**	0.374	0.007	0.005	0.025	-0.009	0.145	-0.001	0.002	0.660**
Number of fruits per plant	P	0.005	0.003	0.003	0.051	**0.559**	0.001	0.004	-0.001	0.003	-0.039	-0.001	0.004	0.592**
	G	0.009	-0.027	0.036	0.065	**0.525**	0.002	0.002	-0.003	0.005	-0.012	-0.001	0.004	0.606**
Fruit length(cm)	P	0.001	0.001	0.001	0.012	0.023	**0.019**	0.017	0.029	-0.011	0.431	0.001	-0.002	0.522**
	G	0.002	-0.011	0.010	0.017	0.023	**0.035**	0.010	0.057	-0.013	0.407	0.001	-0.002	0.537**
Fruit width (cm)	P	0.004	0.001	0.002	0.022	0.079	0.012	**0.028**	0.038	-0.025	0.520	0.001	-0.007	0.675**
	G	0.007	-0.012	0.023	0.032	0.077	0.022	**0.015**	0.075	-0.031	0.489	0.001	-0.008	0.692**
Pericarp thickness(mm)	P	0.001	0.001	0.001	0.016	-0.014	0.010	0.020	**0.052**	-0.025	0.668	0.001	-0.007	0.725**
	G	0.003	-0.007	0.013	0.023	-0.015	0.020	0.011	**0.100**	-0.031	0.620	0.001	-0.008	0.731**
No of locules per plant	P	0.000	0.000	0.001	0.011	-0.044	0.005	0.016	0.030	**-0.045**	0.432	0.001	-0.004	0.403**
	G	0.000	-0.005	0.016	0.015	-0.048	0.009	0.009	0.059	**-0.052**	0.413	0.001	-0.004	0.414**
Av. fruit weight(g)	P	0.002	0.001	0.001	0.011	-0.031	0.011	0.020	0.049	-0.027	**0.718**	0.001	-0.007	0.748**
	G	0.003	-0.006	0.014	0.020	-0.010	0.022	0.011	0.095	-0.033	**0.650**	0.001	-0.008	0.760**
No of seeds per fruit	P	0.001	0.000	0.000	-0.012	-0.100	0.004	0.007	0.011	-0.011	0.143	**0.003**	-0.005	0.041
	G	0.002	0.003	-0.001	-0.017	-0.098	0.008	0.004	0.021	-0.013	0.132	**0.005**	-0.005	0.041
Shelf life (days)	P	0.007	0.000	0.000	-0.004	-0.067	0.001	0.006	0.011	-0.005	0.155	0.000	**-0.034**	0.071
	G	0.012	-0.003	0.001	-0.006	-0.067	0.002	0.003	0.023	-0.006	0.153	0.001	**-0.034**	0.079

Number of flower clusters per plant had positive significant correlation with number of fruits per plant. Similar kinds of results were reported by Sharma *et al.* (2006), Singh *et al.,* (2007) and Singh (2007). Plant height had positive significant correlation with number of primary branches per plant, number of flower clusters per plant and number of fruits per plant. Number of primary branches per plant had positive significant correlation with number of flower clusters per plant, number of fruits per plant. Similar report on tomato for different components viz., association of fruit yield with number of branches by Narolia *et al.,* (2012) and plant height with number of branches per plant by Narolia *et al,*. (2012) has been reported.

It was observed that with increase in plant height, there was corresponding increase in number of primary branches per plant, days to 50 % flowering and number of flower clusters per plant. The association recorded significant improvement in yield. Similar results obtained in tomato by Rajaguru *et al.* ,(2010), Narolia *et al.,* (2012).

Fruit length was positively significantly correlated with pericarp thickness and fruit weight. Fruit width exhibited positive significant correlation with pericarp thickness, number of locules per fruit, average fruit weight and number of seeds per fruit. Pericarp thickness had significant positive correlation with number of locules per fruit and average fruit weight. Number of locules per fruit showed significant positive correlation with average fruit weight. Similar results were reported earlier in tomato by Prashanth *et al*., (2008), Singh (2005) and Singh (2007).

Although correlation studies are helpful in determining the components of yield but it does not provide a clear picture of nature and extent of contributions made by number of independent traits. Path coefficient analysis techniques devised by Dewey and Lu (1959) used to partition the correlation coefficient into direct and indirect effects of different characters on seed yield. Such information provides a realistic basis for allocation of appropriate weightage of various attributes while designing a pragmatic breeding programme for improvement of yield. The traits like number of primary branches per plant, number of flower clusters per plant, number of fruits per plant, fruit length, fruit width, pericarp thickness, average fruit weight and number of seeds per fruit exhibited positive direct effects (Table 2) on yield and these traits also recorded positive significant correlation with yield. This suggested that direct selection based on these traits will be rewarded for crop improvement and similar results in tomato reported by Prashanth *et al*., (2008), Singh *et al.,* (2008) and Singh *et al.,* (2007).

At both phenotypic and genotypic level number of primary branches per plant had negligible positive direct effect on fruit yield per plant. Number flower clusters per plant showed negligible positive direct effect at phenotypic level whereas at genotypic level it showed low positive direct effect on the fruit yield. At both phenotypic and genotypic level number of fruits per plant recorded high positive direct effect on fruit yield and the average fruit weight showed high positive direct effect on fruit yield per plant. Similar reports were also reported by Rani *et al*., (2010).

Number of fruits per plant showed positive indirect effect through the characters like plant height, number of primary branches

per plant, number of flower clusters per plant and fruit width. Similarly, number of flower clusters per plant showed positive indirect effect towards yield through number of primary branches per plant and number of fruits per plant. Again fruit length showed high positive indirect effect through average fruit weigh on fruit yield. Fruit width also exhibited high indirect positive effects on fruit yield. Pericarp thickness showed high positive indirect effects via, average fruit yield at both phenotypic and genotypic level respectively for fruit yield. This suggests that indirect selection based on fruit length, fruit width, pericarp thickness and average fruit weight of fruit will be effective on yield components. The residual effect in phenotypic and genotypic path was 0.329 and 0.0272 respectively. It predicted that 67.10 and 72.80 per cent at phenotypic and genotypic level respectively had been determined.

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