

Correlation and path analysis in tomato, *Solanum lycopersicon* L

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ABSTRACT

Twenty genotypes of tomato, *Solanum lycopersicon* L were evaluated for yield and yield component characters in RBD with three replications. Fruit yield per plant was positively and significantly associated with number of fruits per plant and yield per plot. Path coefficient analysis revealed that average fruit weight had the highest direct positive effect on fruit yield per plant followed by plant height, days to first fruit set and number of flowers per cluster. Hence this character may be simultaneously selected to develop the high yielding varieties.

Keywords: Correlation; path analysis; direct effect; indirect effect; volume of fruit; ascorbic acid; tomato

INTRODUCTION

Tomato is self-pollinated solanaceous vegetable crop which is originated from Peru Ecuador region (Rick 1969). It is widely consumed vegetable crop throughout the world both for fresh fruit market and the processed food industry. It is grown at farm and kitchen garden for slice,

soup, sauce, ketchup, cooked vegetable etc. It is a rich source of vitamins A, B and C. In India it occupies 0.85 million hectares area and 16.52 MT production with productivity of about 19.6 tons per hectare (Anon 2010). Correlation coefficient is statistical measure which is used to find out the degree and direction of relationship between two or more variables.

Correlation coefficient measures the mutual relationship between various plant characters and determines the component characters on which selection can be based for generic improvement in yield while the path analysis splits the correlation coefficient into the measures of direct and indirect effect of a set of dependent variables on independent variables. The present study was carried out to get the information for character association for grain yield in twenty improved genotypes of tomato.

MATERIAL and METHODS

The experiment was conducted at the research farm of SKRAU, Bikaner. Twenty genotypes of tomato were grown in randomized block design in three replications during Rabi 2011-12. Plot size was 3.6 x 1.20 meters with spacing of 40 x 60 cm plant to plant and row to row. All the standard agricultural practices were followed to raise the good and healthy crop in normal condition. Ten plants were tagged for recording both quantitative and qualitative characters. The genotypic and phenotypic correlation coefficient of yield and its contributing characters were estimated as described by Singh and Choudhary (1985). The direct and indirect effect was estimated as per the method of Wright (1921) and elaborated by Dewey and Lu (1959).

RESULTS and DISCUSSION

The correlation studies provide information about association between any two characters. The degree of association between fruit yield and its contribution can be estimated by correlation coefficient at genotypic and phenotypic levels. All possible phenotypic and genotypic correlation coefficient between fruit yield and its components was calculated and is given in Tables 1 and 2. For most of the characters genotypic correlation coefficient was found higher than phenotypic correlation coefficient indicating a strong inherent association among various characters. Similar findings were observed by Mohanty (2003) and Singh (2009). The genotypic association of days to first flowering showed significant positive association with days to 50 per cent flowering and first fruit setting. Similarly a significant and positive correlation of days to 50 per cent flowering was found with days to first fruit setting. Plant height exhibited significant positive association at phenotypic level with number of branches and fruits per plant while significantly negative correlation was found with average fruit weight, diameter and volume of fruit as earlier reported by Singh (2009) and Ara et al (2009) while studying correlation with number of fruits per plant. Significant negative correlation was found with average fruit weight, diameter and volume and the

Table 1. Phenotypic correlation coefficients between different characters in tomato

Character	DFF	50% F	PH	NB	F/C	FFS	FS (%)	F/P	FW	Y/P	Y/PT	DF	VF	TSS	AD	AA
DFF	1.000	0.863**	0.056	0.129	0.041	0.762/**	-0.270	-0.195	0.015	-0.196	-0.213	-0.112	-0.121	-0.214	0.219	0.090
50% F		1.000	0.137	0.205	0.101	0.716**	-0.143	-0.132	-0.152	-0.111	-0.071	-0.210	-0.234	-0.095	0.248	0.153
PH			1.000	0.761**	0.013	0.215	0.141	0.542**	-0.154**	0.213	0.311	-0.420**	-0.535**	-0.272	-0.091	-0.138
NB				1.000	0.010	0.232	0.158	0.362**	-0.382**	0.078	0.157	-0.380*	-0.420**	-0.136	-0.183	-0.041
F/C					1.000	0.080	-0.169	-0.022	-0.021	0.129	0.104	0.034	0.010	0.308	0.194	0.150
FFS						1.000	-0.110	0.049	-0.064	0.075	0.071	-0.153	-0.206	-0.219	0.043	-0.001
FS (%)							1.000	0.074	-0.078	0.121	0.094	-0.022	-0.023	-0.082	-0.084	-0.015
F/P								1.000	-0.598**	0.541**	0.668**	-0.541**	-0.716**	0.082	-0.082	-0.280
FW									1.000	0.076	-0.257	0.734**	0.796**	-0.049	0.036	0.118
Y/P										1.000	0.815**	-0.079	-0.196	0.111	0.040	0.042
Y/PT											1.000	-0.400	-0.426	0.259	0.033	0.063
DF												1.000	0.774**	-0.148	-0.132	0.130
VF													1.000	-0.170	-0.042	0.065
TSS														1.000	0.182	0.056
AD															1.000	-0.124
AA																1.000

DFF= Days to first flowering, 50% F= Days to 50% flowering, PH= Plant height, NB= # branches, F/C= Flowers/cluster, FFS=Days to first fruit set, FS= Fruits set, F/P= Fruits/plant, FW= Fruit weight, Y/P = Yield/plant, Y/PT = Yield/plot, DF= Diameter of fruit, VF= Volume of fruit, AD= Acidity, AA= Ascorbic acid

Table 2. Genotypic correlation coefficients between different characters in tomato

Character	DFF	50% F	PH	NB	F/C	FFS	FS (%)	F/P	FW	Y/P	Y/PT	DF	VF	TSS	AD	AA
DFF	1.000	0.925**	0.060	0.200	0.080	0.84**	-0.374*	-0.265	0.035	-0.226	-0.230	-0.204	-0.115	-0.217	0.568**	0.190
50% F		1.000	0.159	0.329*	0.148	0.867**	-0.359*	-0.126	-0.070	-0.115	-0.076	-0.279	-0.277	-0.087	-0.518**	0.211
PH			1.000	0.892**	0.059	0.246	0.205	0.620**	-0.608**	0.211	0.342*	-0.27**	-0.604	-0.274	-0.291	-0.244
NB				1.000	-0.030	0.320*	0.040	0.513**	-0.582**	0.060	0.173	-0.500**	-0.628	-0.373*	-0.235	-0.196
F/C					1.000	-0.082	-0.350*	0.046	-0.035	0.183	0.204	0.000	-0.047	0.354*	0.990*	0.320*
FFS						1.000	-0.156	0.013	-0.030	0.095	0.033	-0.222	-0.208	-0.251	0.399*	-0.108
FS (%)							1.000	0.206	-0.111	0.166	0.121	0.046	-0.067	-0.112	-0.212	-0.144
F/P								1.000	-0.723**	0.588**	0.761**	-0.751**	-0.805	0.084	-0.154	-0.388*
FW									1.000	0.075	-0.279	0.971**	0.898	-0.081	-0.103	0.177
Y/P										1.000	0.863**	-0.101	-0.210	0.135	-0.168	0.051
Y/PT											1.000	-0.446*	-0.461*	0.276	0.068	-0.089
DF												1.000	0.962**	-0.183	-0.002	0.231
VF													1.000	-0.168	-0.183	0.129
TSS														1.000	0.581**	0.079
AD															1.000	-0.257
AA																1.000

DFF= Days to first flowering, 50% F= Days to 50% flowering, PH= Plant height, NB= # branches, F/C= Flowers/cluster, FFS= Days to first fruit set, FS = Fruits set, F/P= Fruits/plant, FW= Fruit weight, Y/P= Yield/plant, Y/PT= Yield/plot, DF= Diameter of fruit, VF= Volume of fruit, AD= Acidity, AA= Ascorbic acid

Table 3. Direct (diagonal) and indirect effect of different characters on yield per plant in tomato at genotypic level

Character	DF	50%F	PH	NB	F/C	FFS	FS(%)	F/P	FW	Y/PT	DF	VF	TSS	AD	AA
DF	-0.164	-9.379	0.325	-1.084	0.248	3.800	0.068	1.751	0.476	0.333	1.496	1.543	0.560	-0.208	0.006
50%F	-0.166	-9.236	0.858	-1.789	0.457	3.895	0.065	0.833	0.950	0.110	2.046	3.716	0.224	-0.190	0.011
PH	-0.010	-1.472	5.381	-5.641	0.179	1.105	-0.037	-4.102	-8.210	-0.494	4.958	8.112	0.707	0.107	-0.013
NB	-0.033	-3.041	5.588	-5.420	-0.093	1.440	-0.007	-3.390	-7.859	2.251	3.670	8.432	0.961	0.086	-0.011
F/C	-0.103	-1.367	0.312	0.164	3.086	-0.368	0.064	-0.302	-0.477	-0.295	0.002	0.367	-0.913	-0.362	0.017
FFS	-0.138	-8.005	1.323	-1.741	-0.253	4.494	0.028	-0.088	-0.398	-0.048	1.625	2.799	0.648	-0.146	-0.006
FS (%)	0.061	3.317	1.101	-0.220	-1.079	-0.710	-0.182	-1.365	-1.504	-0.175	-0.009	0.893	0.289	0.078	-0.008
F/P	0.043	1.164	3.338	-2.785	0.141	0.060	-0.037	-0.613	-9.756	-1.101	5.510	10.800	-0.215	0.056	-0.021
FW	-0.006	0.650	-3.274	3.164	-0.109	-0.133	-0.020	4.781	1.349	0.403	-7.121	-12.050	0.209	0.038	0.009
Y/PT	0.038	0.699	1.838	-0.941	0.629	0.149	-0.220	-5.034	-3.762	-1.447	3.272	6.190	-0.712	-0.025	-0.018
DF	0.003	2.576	-3.373	2.718	-0.001	-0.996	-0.008	4.967	13.090	0.645	-7.335	-12.910	0.479	0.001	0.012
VF	0.019	2.556	-3.252	3.412	-0.146	-0.937	0.012	5.322	12.110	0.667	-7.054	-13.420	0.433	0.067	0.007
TSS	0.036	0.803	-1.475	2.204	1.093	-1.128	0.020	-0.522	-1.093	0.399	1.343	2.254	-2.580	-0.213	0.004
AD	-0.093	-4.785	-1.562	1.277	3.054	1.791	0.039	1.016	-1.388	-0.098	0.011	2.450	-1.499	-0.036	-0.014
AA	-0.018	-1.950	-1.311	1.066	0.987	-0.487	0.026	2.566	2.383	0.274	-1.696	-1.730	-0.203	0.095	0.054

DFF= Days to first flowering, 50% F= Days to 50% flowering, PH= Plant height, NB= # branches, F/C= Flowers/cluster, FFS= Days to first fruit set, FS = Fruits set, F/P= Fruits/plant, FW= Fruit weight, Y/P= Yield/plant, Y/PT= Yield/plot, DF= Diameter of fruit, VF= Volume of fruit, AD= Acidity, AA= Ascorbic acid

Table 4. Direct (diagonal) and indirect effect of different characters on yield per plant in tomato at phenotypic level

Character	DFF	50%F	PH	NB	F/C	FFS	FS(%)	F/P	FW	Y/PT	DF	VF	TSS	AD	AA
DFF	0.006	-0.071	0.003	-0.014	0.005	0.059	1.024	-0.068	0.008	-0.144	-0.006	0.022	0.023	0.011	0.011
50%F	0.005	-0.082	0.008	-0.022	0.016	0.055	-0.012	-0.046	-0.002	-0.050	-0.012	0.043	0.012	-0.013	0.018
PH	0.000	0.011	0.058	-0.082	0.002	0.017	0.013	0.817	-0.278	0.211	-0.024	0.097	0.035	0.005	-0.017
NB	0.001	-0.017	0.044	-0.107	0.001	0.018	0.014	0.125	-0.206	0.106	-0.022	0.076	0.040	0.009	-0.005
F/C	0.000	-0.008	0.001	-0.100	0.132	-0.006	-0.015	-0.008	-0.012	0.071	0.002	-0.002	-0.039	-0.010	0.018
FFS	0.004	-0.059	0.012	-0.025	-0.011	0.077	-0.010	0.017	-0.034	0.048	-0.009	0.037	0.028	-0.002	0.000
FS(%)	-0.002	0.012	0.009	-0.017	-0.022	-0.099	0.085	0.026	-0.042	0.064	-0.009	0.004	0.010	0.004	-0.002
F/P	-0.001	0.011	0.038	-0.039	-0.003	0.004	-0.006	0.346	-0.323	0.495	-0.031	0.130	-0.010	0.001	-0.034
FW	0.000	0.004	-0.030	-0.041	-0.003	-0.005	-0.007	-0.207	0.540	-0.175	0.042	-0.145	0.006	-0.002	-0.014
Y/PT	-0.001	0.006	0.018	-0.017	0.014	0.006	0.008	0.231	-0.139	0.677	-0.023	0.077	-0.033	-0.002	-0.008
DF	-0.001	0.017	-0.024	0.041	0.044	-0.012	-0.002	-0.187	0.397	-0.270	0.057	-0.141	0.019	0.007	0.016
VF	-0.001	0.019	-0.031	0.048	0.001	-0.016	-0.002	-0.247	0.930	-0.288	0.044	-0.182	0.022	0.002	0.008
TSS	-0.001	0.008	-0.016	0.034	0.041	-0.017	-0.007	0.028	-0.027	0.175	-0.008	0.031	-0.127	-0.009	0.007
AD	0.001	-0.020	-0.055	0.020	0.206	0.003	-0.007	-0.010	0.200	0.022	0.088	0.008	-0.023	-0.051	0.015
AA	0.001	-0.013	-0.008	0.004	0.020	0.000	-0.001	-0.097	0.064	-0.043	0.007	-0.012	-0.007	0.006	0.120

DFF= Days to first flowering, 50% F= Days to 50% flowering, PH= Plant height, NB= # branches, F/C= Flowers/cluster, FFS= Days to first fruit set, FS = Fruits set, F/P= Fruits/plant, FW= Fruit weight, Y/P= Yield/plant, Y/PT= Yield/plot, DF= Diameter of fruit, VF= Volume of fruit, AD= Acidity, AA= Ascorbic acid

same observation was made by Mohanty (2003) and Singh (2009). Fruits per plant had significant and positive correlation with yield per plant as well as per plot whereas significant negative correlation was found with average fruit weight, diameter and volume as earlier reported by Singh (2009) for average fruit weight. Average fruit weight showed significant positive association with diameter and volume of fruit and similar observation was reported by Singh (2009). A significant positive correlation of yield per plant was found with yield per plot. Direct and indirect effect of various characters on fruit yield per plant indicated that there is an agreement between direction and magnitude of direct effect of various characters and correlation with fruit yield per plant. Thus a significant improvement in fruit yield per plant can be expected through selection in the component traits with high positive direct effects. In these investigations (Tables 3 & 4) average fruit weight had the highest direct positive effect on fruit yield per plant at genotypic level followed by plant height. Days to first fruit set, flowers per cluster and ascorbic acid and at phenotypic level among the various characters studied, yield per plant exhibited maximum positive direct effect on fruit yield per plot followed by average fruit weight, number of fruits per plant, number of flowers per cluster, ascorbic acid, fruit set percentage, days to first fruit set, plant height, diameter of fruit and days to first flowering. The present findings are in close

proximity to earlier work done by Nandpuri et al (1977).

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