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Character Association Study on Fruit Yield of Tomato (*Solanum lycopersicum* L.)

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Abstract: ***Fruit yield is a quantitative character, which is influenced by a number of yield contributing characters in tomato. To increase the genetic yield potential, maximum utilization of the desirable characters for synthesizing of any ideal genotypes is essential. The present investigation was carried out to determine simple correlation of fruit yield and 29 yield contributing and quality characters. The experiment was conducted at the experimental farm of the department of Vegetable science of VCSG Uttarakhand University of Horticulture and Forestry with 22 different tomato (Lycopersicon esculentum L.) genotypes. Two yield parameters fruit yield per plant and fruit yield per ha. (0.745) are positive and significantly correlated. Fruit yield per plant is also positive significantly correlated with days to fifty per cent flowering (0.475), fruit density (0.427), tritratable acidity (0.522), fruit infected with insect (0.956) whereas, it is negative and significantly correlated with acidic acid (-0.450), fruit damage with insect (-0.466) and plant infected with disease (-0.945). However, fruit yield per ha is also positive and significantly correlated with number of node first flower (0.495). Therefore these characters can be explore directly to enhance fruit yield in tomato.***

Keywords: Simple Correlation, Yield and quality characters, tomato, and *Solanum lycopersicon* L.

1. Introduction

Tomato (*Solanum lycopersicum* L.) is a self-pollinated diploid species with twelve pairs of chromosomes (2n = 24). It belongs to the Solanaceae family. Tomato is a rich source of vitamins (A and C), minerals (Ca, P and Fe) and a strong antioxidant against cancer and heart diseases (Dhaliwal *et al.*, 2003). Knowledge of inter-character relationship is very important in plant breeding for indirect selection to the characters that are not easily measured and for those that exibit low heritability. Correlation studies between characters have also been of great value in the determination of the most effective breeding procedures. Yield is a complex trait that shows a chain of linear and non-linear associations among yield components with varying degree of effects. To increase the genetic yield potential, maximum utilization of the desirable characters for synthesizing of any ideal genotypes is essential. Fruit yield is a quantitative character, which is influenced by a number of yield contributing characters in tomato. Selection for higher yield, the complex interrelationship between the yield contributing characters usually shows a complex chain of interacting relationship. Understanding of relationships among these components lead to the choice of elite genotypes, authenticates the benefits of a selection pattern and highlights real-time increase in yield through inter related characters. Various studies on such aspect had already been conducted using genetic pool viz. cultivars, elite lines, accessions and land races of tomato. Regarding the genetic parameters such as degree of association between the various characters and direct and indirect effects of characters contributory to total fruit yield are of permanent significance in formulator appropriate breeding strategy. The objective of this present research work has been undertaken in order to study interrelationship among varies component traits of fruit yield so as to devise a suitable selection criteria for its improvement.

2. Material and Methods

The experiment was undertaken in the Ranichauri campus of VCSG, Uttarakhand University of Horticulture and Forestry Bharsar (Pauri Garhwal) in the month of march 2016 august 2017. The experiment was laid out with 22 genotypes in a randomized block design (RBD) having 3 replications. The thirty day old seedlings transplanted from nursery to the field keeping the plant-to-plant and row-to-row distances of 45 and 60cm, respectively. The observations were recorded on various growth, yield and quality parameters from 10 randomly selected plants in each replication as per standard procedure. Simple correlation coefficient has obtained using the slandered procedure.

Table 1: Simple correlation among fruit yield, yield contributing and quality traits in tomato

	FYPP	FY	FL	DFF	NFF	NFCP	NFPC	PHF	PHFP	PHLP	NPB	NSB	LA	DAP	IL	FD1	LPF	FD2	FV	PT	PH	AA	LC	TA	DWC	TSS	FI	FDI	PID	PD
FYPP	1	0.745**	-0.203	0.475*	0.357	-0.328	0.347	0.128	-0.025	0.076	0.073	0.201	-0.061	0.358	-0.117	-0.221	-0.14	0.427*	-0.149	-0.177	0.215	-0.450*	0.174	0.522**	0.036	-0.158	0.956**	-0.466*	0.065	-0.945**
FY		1	0.067	0.278	0.495*	-0.028	0.145	0.206	0.115	0.17	-0.178	-0.05	0.394	0.147	0.025	0.079	-0.271	0.360	0.016	-0.207	0.198	-0.371	0.066	-0.394	0.082	0.142	0.715**	-0.175	0.093	-0.734**
FL			1	-0.277	0.142	0.649**	-0.299	0.263	0.142	0.096	-0.128	0.502**	0.158	-0.078	0.359	0.641**	-0.01	-0.171	0.415*	-0.04	0.019	0.096	0.103	0.17	-0.027	0.131	0.226	0.434*	-0.009	0.188
DFF				1	0.516**	0.508**	0.520**	-0.054	0.107	0.298	0.09	0.493*	0.137	0.84	-0.363	-0.348	-0.141	0.425*	0.602**	-0.219	0.525**	0.071	0.219	0.011	0.398	-0.275	-0.369	-0.496*	0.230	-0.373
NFF					1	-0.249	0.181	0.222	0.480*	0.538**	-0.112	0.112	0.234	0.507**	-0.048	-0.041	-0.272	0.37	-0.231	-0.337	0.654**	0.238	0.176	0.215	0.6	0.046	-0.345	-0.135	0,110	-0.350
NFC						1	0.501	0.091	0.039	-0.036	-	-	0.109	-0.275	0.609	0.586	-	-0.286	0.433	0.138	-0.201	0.172	-	0.237	-0.229	0.332	0.28	0.62	-	0.229

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P							**				0.038	0.807**			**	**	0.091		*				0.447*						0.291	
NFPC							1	-0.042	-0.196	-0.129	0.072	0.305	0.03	0.422*	-0.433	-0.190	0.198	0.287	-0.373	0.061	0.088	0.108	0.017	0.026	-0.068	-0.06	-0.231	-0.34	0.100	-0.237
PHF								1	0.168	0.126	0.035	-0.112	-0.07	-0.088	0.213	0.103	-0.326	0.075	0.118	-0.059	-0.035	0.172	0.148	0.238	-0.085	0.104	-0.173	0.192	0.196	-0.173
PHFP									1	0.965**	-0.061	-0.087	-0.14	0.109	0.346	0.095	-0.305	0.513**	-0.423*	-0.399	0.608**	0.339	0.055	0.377	0.502**	0.313	-0.136	0.059	0.048	-0.160
PHLP										1	-0.034	-0.012	-0.142	0.288	0.249	0.055	-0.356	0.591**	-0.493*	-0.437	0.733**	0.315	0.065	0.324	0.616**	0.19	-0.203	-0.024	0.083	-0.231
NPB											1	0.055	-0.249	0.116	-0.369	-0.007	-0.133	-0.214	-0.083	0.217	0.052	0.247	-0.313	0.206	0.006	-0.458*	0.038	0.025	0.068	0.029
NSB												1	-0.026	0.427*	-0.380	0.545**	0.198	-0.006	-0.246	0.018	0.200	-0.151	0.464*	-0.18	0.225	-0.268	-0.186	0.605**	0.094	-0.130
LA													1	0.069	-0.070	0.167	-0.138	-0.008	0.111	0.009	-0.084	-0.302	0.218	-0.234	-0.006	0.148	0.176	0.304	0.101	0.135
DAP														1	-0.139	-0.076	0.015	0.212	-0.317	0.016	0.549**	0.216	0.209	0.152	0.421*	-0.321	-0.261	-0.255	0.032	-0.253
IL															1	0.376	-0.069	-0.186	0.422*	0.124	0.075	0.198	-0.102	0.28	0.030	0.53	0.019	0.421*	-0.136	0.033
FD1																1	0.112	-0.112	0.504**	0.244	-0.102	0.096	-0.279	0.135	-0.141	0.055	0.285	0.638**	0.113	0.282
LPF																	1	-0.116	0.089	0.165	-0.301	0.012	-0.006	0.01	-0.334	0.082	0.16	-0.168	0.166	0.195
FD2																		1	0.657**	0.685**	0.443*	-0.065	0.11-0	-0.114	0.292	0.092	-0.441*	-0.195	0.183	-0.487
FV																			1	0.422*	-0.311	-0.183	-0.098	-0.158	-0.161	-0.034	0.203	0.447*	-0.159	0.238
PT																				1	-0.358	0.064	0.066	0.092	-0.409*	-0.017	0.229	0.289	-0.054	0.284
PH																					1	0.324	0.019	0.246	0.915**	0.086	-0.240	-0.185	-0.036	-0.260
AA																						1	-0.397	0.981**	0.248	0.287	0.374	0.183	-0.123	0.382
LC																							1	-0.34	0.109	-0.218	-0.102	-0.127	0.319	-0.074
TA																								1	0.175	0.338	0.432*	0.264	-0.071	0.438*
DWC																									1	-0.055	-0.034	-0.179	-0.036	-0.050
TSS																										1	0.036	0.195	-0.185	0.023
FI																											1	0.457*	0.005	0.991
FDI																												1	0.028	0.436*
PID																													1	0.024
PD																														1

FYPP- Fruit yield per plant (g), FY- Fruit yield (q/ha.), FL- Fruit length (cm), DFF- Days taken to first flowering, NFF- Node number at first flowring, NFCP- Number of flower cluster per plant, NFPC-Number of flower per cluster, PHF- Plant height at 50% flowering(cm), , PHFP- Plant height at first picking(cm), PHLP-Plant height at last picking(cm), NPB- Number of primary branches, NSB- Number of secondary branches, LA- Leaf area(cm^2), DAP- Days taken to first picking, IL- Internodal length (cm), FD1- Fruit diameter(cm), LPF-Number of locules per fruit, FD2- Fruit Density (g/cm^3), FV- Fruit volume (cm^3), PT- Pericarp thickness, PH- pH, AA- Ascorbic acid(mg/100g), LC- Lycopene content, TA- Tritratable acidity(%), DWC- Dry weight content(%), TSS- Total soluble solid, FI- Fruit damaged with insect, FDI- % of fruit damaged with disease, PID- % of plant infected with disease, PD- Plant infected with disease.

3. Result and Discussion

The investigation was carried out to determine simple correlation of fruit yield and yield contributing characters. Yield is the resultant of combined effect of several component characters and environment. Simple correlation studies provide information on the nature and extent of association between two pairs of metric characters. From this it would be possible to bring about genetic up gradation in one character by selection of the other of a pair of character. A positive correlation occurs due to coupling phase of linkage between characters and negative correlation arises due to repulsion phase of linkage of genes controlling different traits. No correlation indicates that genes concerned are located far apart on the same chromosome or they are located on different chromosomes. Results of correlation studies for yield components are presented in Table1. In the present investigation, the correlation coefficient analysis for yield and yield components showed that the two fruit yield parameter fruit yield per plant and fruit yield quental per hectare (0.745) are positive and significantly correlated.

Fruit yield per plant is also positive significantly correlated with days to fifty per cent flowering (0.475), fruit density (0.427), tritratable acid (0.522), fruit infected with insect (0.956) whereas, it is negative significantly correlated with acidic acid (-0.450), fruit damage with insect (-0.466) and plant infected with disease (-0.945). However, fruit yield per ha is also positive significantly correlated with number of node first flower (0.495).The results are in correspondence with findings of Reddy *et, al.* (2013), Singh *et, al.* (2018), Laxmi *et, al.* (2017) in tomato. Therefore these characters can be explore directly to enhance fruit yield in tomato. Fruit length exhibited positive significant correlation with fruit diameter. The results are in agreement with findings of Reddy *et, al.* (2013)

Days taken to first flowering exhibited positive significant correlation with number of node at first flowering (0.516), number of flower cluster per plant (0.508), number of flower per cluster (0.520), number of secondary branches (0.493), fruit density (0.425), fruit volume (0.602) and pH (0.525). The same results were observed by Bernousi *et, al.* (2011). Node number at first flowering positively correlated with

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plant height at first picking (0.480), Plant height at last picking (0.538) daysv taken to first picking (0.507), pH (0.654), Number of flower cluster per plant is positively correlated with number of flower per cluster(0.501), Internodal length (0.609), fruit diameter (0.586), fruit volume (0.433) according to Reddy *et, al*. (2013), Hasan *et, al.* (2016), Meena *et, al.* (2014), number of flower per cluster is positively signifying with days taken to first flowering. Plant height at first picking is So, selection for these traits can increase the fruit yield significantly. Plant height at first picking is positively correlated with plant height at last picking (0.95), fruit density (0.513), pH (0.608), Dry weight content (0.502). According to Hasan *et, al.* (2016) reported that plant height at first picking is negative correlated with dry matter content, Rajoli *et, al.* (2017) and Laxmi *et, al*. (2017) reported that plant height at first flowering is significantly correlated with pH. Plant height at last picking is positively correlated with fruit density (0.591) and dry weight content (0.616). pH is positively correlated with dry weight content (0.915). Ascorbic acid is positively correlated with tritratable acidity (0.981). Rani *et, al*. (2008), also reported positive correlation between these characters, but Sharma *et, al.* (2015) and Singh *et, al*. (2018) reported significant correlation between these characters.

Some parameters are negatively correlated such as fruit yield per plant is negatively correlated with tritratable acidity (-0.522) and fruit damaged with insects (-0.956), fruit yield quental per hectare negatively correlated with fruit damaged with insect, days taken to first flowering negatively correlated with number of flower cluster per plant (-0.508) and fruit volume (-0.602), number of flower cluster per plant with number of flower per cluster (-0.501), Number of secondary branches with internodal length (-0.545), and percentage of fruit damaged with insect (-0.605), fruit density with fruit volume (-0.657) and pericarp thickness (-0.685).

In conclusion, the correlation coefficient analysis of twenty nine quantitative traits revealed strong association among growth, quality and yield parameters of tomato under study. So we can be considered these characters as yield components of tomato. Selection should be based on these components for yield and quality improvement in tomato.

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