



## Correlation analysis for yield and yield contributing traits in tomato (*Solanum lycopersicon* L.)

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**Abstract:** Tomato (*Solanum lycopersicum* L.) is an important vegetable in the horticultural industry worldwide. The present research work was conducted to examine correlation of yield related traits of tomato (*Solanum lycopersicum* L.). The experiment was conducted at the experimental field of the department of Plant Breeding and Genetics, University of Agriculture, Faisalabad. Eight genotypes (PB-LO-2752, LO-2840, LO-2875, LO-3886, Stakeless, Pioneer 2761, Wheatleys Frost Resistant and Veepick) was grown in Randomized Complete Block Design (RCBD) with three replications. Standard agronomic and plant protection practices were applied. The data of various yield related traits, plant height, number of branches per plant, fruit clusters per plant, number of fruits per cluster, fruit yield per plant, fruit weight, fruit shape, fruit length, fruit width and number of lobes in a fruit were collected. Analysis of variance resulted highly significant differences between all traits. Analysis of variance revealed highly significant differences among all the traits. Plant height showed highly positive correlation with number of branches, clusters per plant, fruit weight and number of lobes in a fruit. A highly positive correlation was observed for number of branches per plant with fruit clusters per plant, fruits per cluster, fruit weight, fruit shape and number of lobes. Fruit clusters per plant had a positive correlation with fruits per cluster, fruit weight, fruit shape, fruit length and number of lobes. A highly significant correlation was observed for number of fruits per cluster with fruit yield per plant, fruit weight, fruit shape and number of lobes. Fruit yield per plant showed highly significant and positive correlation with fruit weight and number of lobes. Correlation of fruit weight with fruit length was positive and highly significant while fruit weight, fruit shape and number of lobes express significant association. There was negative and highly significant association was found among fruit shape and number of lobes. Fruit length and width had negative correlation with fruit width and number of lobes respectively.

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**Key words:** Tomato, correlation, fruit weight, yield

### Introduction

Tomato (*Lycopersicon esculentum* Mill.) belongs to family Solanaceae with chromosome number;  $2n=24$ . Tomato is a native plant of Peru-Ecuador area (Jenkins, 1948). Tomato is a valuable source of vitamins C, E and some other nutrient compounds i.e. lycopene, beta-carotene which act as antioxidants (Canane *et al.*, 2005). Tomato is widely used in salads and sandwiches as raw vegetable, in processed items like pickles, soup, ketchup, juices, jelly, drinks, whole peeled tomatoes, tomato chips and in many other dishes due to its high food ingredients which gives specific taste to food. Tomato crop is cultivated in Pakistan at 57,400 hectares area with production of 580 thousand tones

(Anonymous, 2012).

Through breeding, domestication and research activities of breeders worldwide have introduced modern varieties of tomato of all colors, sizes and shapes (Bai and Lindhot, 2007). Many Asian countries including Bangladesh is suffering from poverty and malnutrition which can be overcome by increasing tomato production. Farmers may increase vegetable production which can generate income to alleviate poverty. In terms of acreage tomato is one of the most important vegetable in commercial use, consumption, yield and production (Islam *et al.*, 2010).

The role of tomato in human healthy diet is important. Among the most commonly used fresh

vegetables in America tomato is on fourth number and it is mostly consumed as canned vegetable. The consumption of tomato is increasing day by day and reducing the risk of cardiovascular disease as well as prostate cancer. Recently it is investigated that tomato are affective in decreasing the risk of prostate cancer (Canene *et al.*, 2005).

In the past, no serious efforts had been made for tomato inbred lines development which may lead to exploitation in genetic variability. A massive variability in tomato is expected due to variation of fruit in size and shape (Bhardwaj and Sharma, 2005). Different genetic parameters are reported by researchers in tomato breeding (Kamruzzahan *et al.*, 2000). Correlation among different traits of tomato is important to know relationship which may be positive or negative. The present study found correlation among plant height, number of branches per plant, fruit clusters per plant, fruits per cluster, fruit weight, fruit shape, fruit length, fruit width, number of lobes in a fruit and fruit yield per plant. The information derived from this study will help the breeders to select tomato plants with good combination of traits.

#### Materials and methods

A research work was conducted at the experimental field of the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad during 2018. Eight genotypes (PB-LO-2752, LO-2840, LO-2875, LO-3886, Stakeless, Pioneer276, Wheatleys Frost Resistant and Veepick) were sown in Randomized Complete Block Design with three replications in the field. There were five plants for each genotype in a replication. All the standard agronomic practices were applied for healthy crop development. Following data was recorded at maturity; plant height (cm), number of branches per plant, fruit clusters per plant, number of fruits per cluster, fruit yield per plant (g), single fruit weight (g), fruit shape, fruit length (mm), fruit width (mm) and number of lobes in a fruit.

#### Statistical Analysis

The collected data was statistically analyzed by applying analysis of variance (Steel *et al.*, 1997). Among the traits, correlation was found by following Kwon and Torrie (1964).

#### Results and discussion

The current research work was conducted to find out correlation of yield related traits of tomato. Analysis of variance results for all parameters are shown in tables 1. The average values of genotype are shown in table number 2.

#### Plant Height

Plant height showed highly significant differences among the genotypes. Table of mean showed that genotype Wheatleys Frost Resistant showed maximum mean plant height 115.78cm whereas genotype LO-2875 showed minimum plant height with a mean value of 35.67cm.

#### Number of branches per plant

For number of branches per plant highly significant differences were found among the genotypes. Mean value for genotype WheatleysFrost Resistant is 11.44 which was maximum value of mean number of branches per plant and the genotype Pioneer 2761 showed minimum mean value of 1.56.

#### Fruit clusters per plant

The results showed that genotypes had highly significant differences for fruit clusters per plant. Table of mean showed maximum fruit clusters per plant with a value 51.56 of genotype WheatleysFrost Resistant and minimum value showed by genotype stakeless with a value of 11.33.

#### Number of fruits per cluster

The genotypes showed highly significant differences. Genotype WheatleysFrost Resistant showed maximum mean value. The genotype PB-LO-2752 showed minimum mean value of 2.78.

#### Fruit yield per plant

Highly significant differences were expressed among all genotypes for fruit yield per plant. Maximum mean value of genotype LO-3886 from the mean table was 1742(g) on the other hand minimum mean value for fruit yield per plant of genotype pioneer 2761 was 105.1(g) per plant.

#### Fruit weight

Differences among all genotypes for fruit weight were highly significant. Mean values from the table of mean showed the maximum mean value of 93(g) for genotype stakeless. Whereas minimum weight of a single fruit with mean value of 10.22(g) for genotype WheatleysFrost Resistant.

#### Fruit shape

Seven types of fruit shapes high rounded, circular, heart shaped, flattened, slightly flattened, pear shaped and cylindrical were observed. PB-LO-2752 and LO-2875 had high rounded shape, LO-2840 was circular, LO-3886 showed heart shape, Stakeless was flattened, Pioneer2761 was found slightly flattened, WheatleysFrost Resistant was observed as pear shaped and Veepick showed cylindrical shape.

Correlation study revealed that fruit shape had highly significant association with number of lobes.

### Fruit length

Results obtained revealed that genotypes showed highly significant variation for fruit weight. Among the mean values the most highest mean value of fruit length was 80.96(mm) for Veepick variety. And the most lowest value among the mean values was 20.34(mm) of Pioneer2761.

### Fruit width

Differences were non-significant among the genotypes for fruit length. Table of mean showed the

highest mean value of fruit width 132.91mm for genotype WheatleysFrost Resistant and lowest mean value of fruit width was 30.22 for genotype Pioneer2761.

### Number of lobes in a fruit

There were significant differences among the genotypes. Maximum mean value for number of lobes in a fruit was Four to six showed by genotype Stakeless and the minimum value only two was expressed by three genotypes PB-LO-2752, LO-3886 and WheatleysFrost Resistant. Correlation values expressed negative correlation among fruit width and number of lobes.

**Table 1: Analysis of variance for various traits in tomato**

Source	DF	P.H	NBP	FCP	FC	FYP	FW	FL	FW	NL
Genotypes	7	3974.19**	25.44**	589.70**	9.03**	1306792**	2226.84**	1081.79	3661.52NS	5.71**
Replications	2	1.26	0.4630	0.032	0.01852	0.28241	0.68	0.02	5632.45	0.018
Error	14	0.91	0.1878	0.223	0.10847	0.25066	0.93	0.03	5594.64	0.018
Total	23									

\*\*=< 0.01

\*=< 0.05

N.S.=>0.05

**Table 2: Mean values of traits and genotype effects in tomato**

Genotypes	Plant Height (cm)	Branches per plant	Clusters per plant	Fruits per cluster	Yield per plant (g)	Fruit weight (g)	Fruit Shape (in longitudinal section)	fruit Length (mm)	Fruit width (mm)	Number of lobes
PB-LO-2752	77.33	6.22	25.33	2.78	1740.1	48.33	High rounded	40.60	40.58	Only two
LO-2840	114.67	4.22	22.33	3.00	996.1	36.00	circular	39.50	40.30	Two to three
LO-2875	35.67	3.67	17.44	3.44	662.7	44.11	High rounded	40.53	30.84	Three to four
LO-3886	72.11	4.44	20.00	4.56	1742.0	51.44	Heart shaped	30.63	30.66	Only Two
Stakeless	138.33	3.67	11.33	2.56	975.8	93.00	Flattened	40.43	132.91	Four to six
Pioneer2761	42.00	1.56	4.89	3.33	105.1	16.78	Slightly flattened	20.34	50.39	Three to four
WheatleysFrost Resistant	115.78	11.44	51.56	7.89	291.7	10.22	Plum shaped	20.59	30.22	Only two
Veepick	74.78	5.22	13.56	4.56	125.0	72.78	cylindrical	80.96	30.59	Three to four

**Table 3: Correlation matrix of yield related traits in tomato**

	Plant Height	Number of Branches	Clusters per plant	Fruits per cluster	Yield per plant	Fruit weight	Fruit shape	Fruit length	Fruit width
Number of branches	0.39**								
Fruit clusters per plant	0.39**	0.91**							
Fruits per cluster	0.14	0.77**	0.73**						
Fruit Yield per plant	0.14	-0.03	0.045	-0.34**					
Fruit weight	0.30**	-0.29**	-0.45**	-0.45**	0.27*				
Fruit shape	-0.02	0.77**	0.76**	0.81**	-0.18	-0.37**			
Fruit length	-0.01	-0.11	-0.31**	-0.18	-0.14	0.64**	0.12		
Fruit width	0.14	0.15	0.21	0.07	-0.07	-0.11	0.16	-0.10	
Number of lobes	0.27*	-0.45**	-0.61**	-0.41**	-0.33**	0.60**	-0.64**	0.26	-0.07



**Fig.1: Collection of eight different types of tomato fruits.**

#### **Correlation between plant height and other traits**

Correlation is defined as the measurement of association between two independent variables. It may be positive or negative between two traits. Plant height was positively associated with number of branches, clusters per plant, fruit weight and number of lobes in a fruit (table 3). Singh *et al.* (2006) and Anjum *et al.* (2009) found positive correlation between plant height and fruit yield per plant. Akinfasoye *et al.* (2011) studied that plant height was positively associated with fruit yield. Nwosu *et al.* (2014) found a positive relationship among plant height as well as fruit yield per plant.

#### **Correlation between number of branches per plant and other traits**

A positive as well as high association was found for number of branches per plant with fruit clusters per plant, fruits per cluster, fruit weight, fruit shape and number of lobes (table 3). Singh *et al.* (2006) studied positive correlation in number of branches per plant and fruit yield per plant. Anjum *et al.* (2009) also found positive relationship between number of branches per plant and fruit yield. Denton and Nwangburuka (2011) studied

positive phenotypic as well as genotypic association for number of branches per plant and fruit weight with number of fruits per plant.

#### **Correlation between fruit clusters per plant and other traits**

Fruit clusters per plant expressed positive correlation with fruits per cluster, fruit weight, fruit shape, fruit length and number of lobes (table 3). Dhankar *et al.* (2001) found the number of clusters per plant positively correlated with fruit yield. Rajaguru *et al.* (2010) also observed character association among number of fruits per plant and fruit yield per plant.

#### **Correlation between fruits per cluster and other traits**

A highly significant correlation was observed for number of fruits per cluster with fruit yield per plant, fruit weight, fruit shape and number of lobes (table 3). Results found by Singh (1997) exhibited positive association of number of fruits per plant with fruit yield per plant. Dhankar *et al.* (2001) also observed correlation among number of fruit per cluster and fruit yield per plant. Comparatively Anjum *et al.* (2009) found positive

association among number of fruits per plant and fruit yield per plant.

#### **Correlation between fruit yield per plant and other traits**

Fruit yield per plant had highly significant as well as positive correlation with fruit weight and number of lobes (table 3). Experiment of Ece and Darakei (2007) found positive correlation between number of fruits per plant and fruit yield per plant. Hidayatullah *et al.* (2008) studied that fruit weight exhibited positive genotypic and phenotypic relationship with number of fruits per plant.

#### **Correlation between fruit weight and other traits**

Fruit weight had highly significant as well as positive association with fruit length and highly significant correlation with fruit shape and number of lobes as well as negative correlation was found with fruit width (table 3). Blay *et al.* (1999) observed a positive correlation among fruit weight, yield per plant and number of fruits per plant. Prasad and Mathura (1999) observed positive relationship of fruit weight with fruit yield. Das *et al.* (1998) found positive correlation of fruit weight with fruit yield. Dhankar *et al.* (2001) also observed positive association of fruit weight with fruit yield per plant. Arun (2004) studied that average fruit weight had positive correlation with fruit yield per plant and fruit length. Hidayatullah *et al.* (2008) observed that fruit weight expressed positive genotypic as well as phenotypic association with number of fruits per plant.

#### **Correlation between fruit shape and other traits**

A highly significant and negative correlation was found between fruit shape and number of lobes (table 3).

#### **Correlation between fruit length and other traits**

Fruit length showed negative correlation with fruit width. Das *et al.* (1998) found positive correlation of fruit length with fruit yield (table 3). Prasad and Mathura (1999) also observed highly positive relationship of fruit length with fruit yield per plant. Sucic *et al.* (2002) observed positive association of fruit length with fruit yield and fruit width. Arun (2004) studied that mean fruit length showed positive correlation with fruit width.

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