The Pharma Innovation Journal 2019; 8(9): 544-546

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2019; 8(9): 544-546

www.thepharmajournal.com
Received: 25-07-2019
Accepted: 27-08-2019

**Vrinda Joshi**
Department of Genetics and Plant Breeding College of Agriculture, UAS, Dharwad, Karnataka, India

**O Sridevi**
Department of Genetics and Plant Breeding College of Agriculture, UAS, Dharwad, Karnataka, India

**Suma Biradar**
Department of Genetics and Plant Breeding College of Agriculture, UAS, Dharwad, Karnataka, India

**Correspondence**
**Vrinda Joshi**
Department of Genetics and Plant Breeding College of Agriculture, UAS, Dharwad, Karnataka, India

# Genetic association analysis for yield and yield contributing traits in single cross $F_2$ populations of tomato (*Solanum lycopersicum* L.)

**Vrinda Joshi, O Sridevi and Suma Biradar**

**Abstract**
In the present investigation the number of clusters and average fruit weight were positively associated with fruit yield per plant in all the three $F_2$ populations, while number of fruits per plant was also positively associated with fruit yield per plant in all the populations except $F_2$ population of TSH-8. Plant height recorded significant negative correlation and positive direct effect in all the populations. In all the $F_2$ populations number of clusters recorded negative direct effect on fruit yield per plant, whereas fruits per plant recorded positive direct effect. Average fruit weight exhibited positive direct effect on fruit yield per plant in all the $F_2$ populations except $F_2$ population of TSH-2 hybrid. The information obtained helps in revealing proper weightage to the various characters during selection or other breeding programme so that the improvement of desirable traits can be achieved effectively.

**Keywords:** Yield contributing traits, single cross F2 populations, tomato, *Solanum lycopersicum* L.

## Introduction
One of the most economically important vegetable in India as well as the world is Tomato (*Solanum lycopersicum* L.). The fruit can be consumed raw, cooked and can also be processed in to various products. It is a very good source of an antioxidant (lycopene), Vitamin C and Vitamin B; consumption of tomato and its products has been associated with lowerrisk of developing digestive tract and prostate cancers (Giovannucci *et al*., 2002) [3].
Selection based on multiple traits is always better than selection based on yield alone. Since yield is a quantitative character controlled by many genes, an adequate knowledge about the magnitude and degree of association of yield with its attributing characters is of great significance to the breeders, through which they can clearly understand the strength of correlated traits, when they have to exercise selection for simultaneous improvement of more than one character. However, correlation alone does not provide information on the contribution of related characters, which necessitates the study of cause and effect relationship of different characters among themselves. Therefore, the path analysis depicts the exact relationship of characters there by providing more information than correlation.

## Material and Methods
Phenotypic correlations were calculated in three single cross $F_2$ populations (TSH-2, TSH-6 and TSH-8) to determine the degree of association of a character with yield and also among the yield components using the formula given by Weber and Moorthy (1952) [6]. Correlation coefficients were estimated and compared against r values given in Fisher and Yates (1963) table at (n – 2) degrees of freedom at the probability levels of 0.05 to test their significance. To know the direct and indirect effects on yield path coefficient analysis was carried out for all the traits as suggested by Wright (1921) [7] and illustrated by Dewey and Lu (1959) [1].

## Results and Discussion
Yield is the sum total of the several component characters which directly or indirectly contributed to it. Correlation studies give an idea about the positive and negative associations of different characters with yield and also among themselves. However, the nature and extent of contribution of these characters towards yield is not obtained. Hence, path coefficient analysis was used to make partition of the correlation coefficient of the different characters studied to know direct and indirect effects on yield.

Correlation analysis (Table 1) revealed that number of clusters and average fruit weight and number of fruits per plant was positively associated with fruit yield per plant in all the three $F_2$ populations which are in accordance with, Khapte and Jhansirani (2014) [4]. Plant height exhibited negative correlation with yield per plant in all the three populations which is in accordance with Chandan and Prashad (2013). Correlation studies indicated that number of clusters, number of fruits per plant and average fruit weight deserve greater weightage during selection for fruit yield in tomato.

Plant height exhibited positive direct effect (Table 2) on fruit yield per plant in all $F_2$ populations except in $F_2$ populations of TSH-2 hybrid. It is mainly due to its indirect effect via major characters which affect the fruit yield per plant, like number of inflorescence per plant and number of fruits per plant were positive and of higher magnitude. Plant height appears to be most desirable trait to get more number of fruits per plant. Patil *et al*. (2013) [5] also reported positive direct effect for plant height. In all the $F_2$ populations number of clusters recorded negative direct effect on fruit yield per plant. Selection for maximum number of clusters results in increased number of flowers in early fruiting and higher number of fruits per plant ultimately leading to increased yield. It was found that in $F_2$ populations of single cross hybrids number of fruits per cluster had positive direct effect on fruit yield per plant which is in accordance with the reports made by Khapte and Jhansirani (2014) [4]. Fruit length recorded negative direct effect on fruit yield per plant while, fruit diameter recorded positive direct effect on fruit yield in all the five $F_2$ populations. In $F_2$ populations of TSH-8 hybrid number of locules recorded negative direct while, pericarp thickness and total soluble solids exhibited positive direct effect on fruit yield per palnt in all $F_2$ populations.

Average fruit weight exhibited positive direct effect on fruit yield per plant in all the $F_2$ populations except $F_2$ population of TSH-2 hybrid. These findings are in agreement with Khapte and Jhansirani (2014) [4].

Low residual effect indicated that the selection of traits for path coefficient analysis is appropriate and none character was neglected. In the present study weightage must be given to plant height, number of primary branches per plant number of inflorescence per plant, number of clusters, number of fruits per plant, and average fruit weight which formed important components characters for plant breeder when he practices selection.

**Table 1:** Phenotypic correlations among different quantitative traits in $F_2$ population of single cross hybrids of tomato

| | **$F_2$ population** | **Plant height (cm)** | **No. of clusters** | **Fruits per cluster** | **Fruits per plant** | **No. of branches** | **Fruit length (cm)** | **Fruit diameter (cm)** | **No. of locules** | **Pericarp thickness (mm)** | **TSS** | **Average fruit weight (g)** | **Fruit yield per plant (kg)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Plant height (cm) | TSH-2 | 1 | 0.119 | -0.036 | 0.063 | 0.075 | 0.035 | 0.153 | 0.156 | -0.074 | -0.067 | 0.008 | 0.012 |
| | TSH-6 | 1 | 0.062 | -0.002 | 0.125 | 0.010 | -0.017 | 0.116 | -0.008 | 0.237* | 0.037* | 0.061 | 0.166 |
| | TSH-8 | 1 | 0.205* | -0.055 | 0.179* | -0.033 | -0.123 | -0.119 | -0.003 | 0.064 | -0.049 | -0.094 | 0.127 |
| No. of clusters | TSH-2 | | 1 | -0.014 | 0.731** | 0.247* | 0.136 | 0.132 | 0.064 | -0.024 | 0.057 | -0.105 | 0.602** |
| | TSH-6 | | 1 | 0.211* | 0.753** | 0.028 | -0.099 | -0.190* | 0.080 | 0.007 | 0.012 | -0.151 | 0.577** |
| | TSH-8 | | 1 | 0.154 | 0.700 | 0.184* | 0.140 | 0.092 | -0.144 | -0.004 | -0.076 | -0.075 | 0.539** |
| Fruits per cluster | TSH-2 | | | 1 | -0.009 | -0.022 | -0.073 | -0.028 | 0.054 | -0.176 | 0.119 | 0.002 | 0.016 |
| | TSH-6 | | | 1 | 0.114 | 0.035 | 0.031 | 0.003 | 0.005 | -0.029 | -0.007 | 0.047 | 0.139 |
| | TSH-8 | | | 1 | 0.221 | 0.074 | -0.052 | 0.076 | 0.103 | 0.159 | -0.111 | -0.064 | 0.157 |
| Fruits per plant | TSH-2 | | | | 1 | 0.318* | 0.018 | 0.037 | 0.092 | -0.069 | -0.003 | 0.075 | 0.919** |
| | TSH-6 | | | | 1 | 0.020 | -0.203* | -0.196* | 0.098 | 0.003 | 0.046 | -0.095 | 0.849** |
| | TSH-8 | | | | 1 | 0.149 | 0.149 | 0.089 | -0.075 | 0.098 | -0.054 | -0.024 | 0.820 |
| No. of branches | TSH-2 | | | | | 1 | 0.142 | 0.051 | 0.057 | -0.144 | -0.151 | 0.068 | 0.321** |
| | TSH-6 | | | | | 1 | 0.077 | -0.118 | 0.035 | -0.037 | -0.090 | -0.004 | 0.026 |
| | TSH-8 | | | | | 1 | -0.084 | -0.049 | 0.024 | 0.011 | -0.071 | -0.028 | 0.078 |
| Fruit length (cm) | TSH-2 | | | | | | 1 | 0.684** | -0.005 | 0.007 | 0.070 | -0.035 | -0.027 |
| | TSH-6 | | | | | | 1 | 0.226 | 0.018 | -0.088 | -0.069 | -0.018 | -0.191* |
| | TSH-8 | | | | | | 1 | 0.368 | -0.140 | 0.115 | -0.119 | 0.058 | 0.167* |
| Fruit diameter (cm) | TSH-2 | | | | | | | 1 | 0.079 | -0.104 | 0.102 | -0.133 | -0.022 |
| | TSH-6 | | | | | | | 1 | -0.001 | -0.108 | 0.021 | 0.110 | -0.108 |
| | TSH-8 | | | | | | | 1 | 0.223** | 0.229** | 0.019 | 0.271** | 0.222** |
| No. of locules | TSH-2 | | | | | | | | 1 | 0.106 | -0.082 | -0.119 | 0.046 |
| | TSH-6 | | | | | | | | 1 | 0.055 | 0.006 | 0.035 | 0.127 |
| | TSH-8 | | | | | | | | 1 | 0.325** | 0.093 | 0.018 | -0.123 |
| Pericarp thickness (mm) | TSH-2 | | | | | | | | | 1 | 0.197 | -0.022 | -0.080 |
| | TSH-6 | | | | | | | | | 1 | -0.092 | -0.083 | -0.032 |
| | TSH-8 | | | | | | | | | 1 | 0.101 | 0.122 | 0.128 |
| TSS | TSH-2 | | | | | | | | | | 1 | 0.013 | -0.006 |
| | TSH-6 | | | | | | | | | | 1 | 0.092 | 0.041 |
| | TSH-8 | | | | | | | | | | 1 | 0.131 | -0.024 |
| Average fruit weight (g) | TSH-2 | | | | | | | | | | | 1 | 0.409** |
| | TSH-6 | | | | | | | | | | | 1 | 0.390** |
| | TSH-8 | | | | | | | | | | | 1 | 0.467** |
| Fruit yield per plant (kg) | TSH-2 | | | | | | | | | | | | 1 |
| | TSH-6 | | | | | | | | | | | | 1 |
| | TSH-8 | | | | | | | | | | | | 1 |

*, ** indicates significant at 5 per cent and 1 per cent level of probability, respectively

**Table 2:** Direct and indirect effects of different quantitative traits on fruit yield in $F_2$ population of single cross hybrids of tomato

| | $F_2$ population | Plant height (cm) | No. of clusters | Fruits per cluster | Fruits per plant | No. of branches | Fruit length (cm) | Fruit diameter (cm) | No. of locules | Pericarp thickness (mm) | TSS | Average fruit weight (g) | Fruit yield per plant (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Plant height (cm) | TSH-2 | -0.05226 | -0.00218 | -0.00068 | 0.05702 | 0.00177 | -0.00184 | 0.00552 | 0.00121 | 0.00022 | 0.00053 | 0.00260 | 0.01200 |
| | TSH-6 | 0.02568 | -0.00403 | -0.00004 | 0.11742 | 0.00007 | 0.00011 | 0.00135 | -0.00019 | -0.00119 | -0.00167 | 0.02853 | 0.16600 |
| | TSH-8 | 0.02928 | -0.00673 | -0.00052 | 0.15016 | 0.00088 | 0.00161 | -0.00525 | 0.00022 | 0.00042 | 0.00190 | -0.04538 | 0.12700 |
| No. of clusters | TSH-2 | -0.00624 | -0.01828 | -0.00025 | 0.65915 | 0.00582 | -0.00719 | 0.00477 | 0.00050 | 0.00007 | -0.00045 | -0.03594 | 0.60200** |
| | TSH-6 | 0.00160 | -0.06462 | 0.00492 | 0.70582 | 0.00019 | 0.00064 | -0.00220 | 0.00195 | -0.00003 | -0.00056 | -0.07086 | 0.57700** |
| | TSH-8 | 0.00600 | -0.03288 | 0.00144 | 0.58807 | -0.00491 | -0.00183 | 0.00404 | 0.01211 | -0.00003 | 0.00294 | -0.03627 | 0.53900** |
| Nmuber of fruits per cluster | TSH-2 | 0.00188 | 0.00025 | 0.01882 | -0.00779 | -0.00053 | 0.00386 | -0.00101 | 0.00042 | 0.00052 | -0.00094 | 0.00060 | 0.01600 |
| | TSH-6 | -0.00005 | -0.01366 | 0.02328 | 0.10711 | 0.00024 | -0.00020 | 0.00004 | 0.00012 | 0.00015 | 0.00032 | 0.02204 | 0.13900 |
| | TSH-8 | -0.00161 | -0.00507 | 0.00936 | 0.18598 | -0.00197 | 0.00068 | 0.00336 | -0.00868 | 0.00105 | 0.00428 | -0.03086 | 0.15700 |
| Nmuber of fruits per plant | TSH-2 | -0.00331 | -0.01337 | -0.00016 | 0.90123 | 0.00750 | -0.00097 | 0.00133 | 0.00071 | 0.00020 | 0.00002 | 0.02566 | 0.91900** |
| | TSH-6 | 0.00322 | -0.04868 | 0.00266 | 0.93701 | 0.00013 | 0.00133 | -0.00227 | 0.00237 | -0.00001 | -0.00207 | -0.04444 | 0.84900** |
| | TSH-8 | 0.00524 | -0.02303 | 0.00207 | 0.83978 | -0.00397 | -0.00196 | 0.00391 | 0.00626 | 0.00065 | 0.00208 | -0.01147 | 0.82000 |
| No. of branches | TSH-2 | -0.00392 | -0.00451 | -0.00042 | 0.28660 | 0.02358 | -0.00751 | 0.00185 | 0.00044 | 0.00043 | 0.00120 | 0.02338 | 0.32100** |
| | TSH-6 | 0.00026 | -0.00178 | 0.00082 | 0.01847 | 0.00682 | -0.00050 | -0.00137 | 0.00085 | 0.00019 | 0.00409 | -0.00184 | 0.02600 |
| | TSH-8 | -0.00097 | -0.00605 | 0.00069 | 0.12495 | -0.02670 | 0.00110 | -0.00215 | -0.00202 | 0.00007 | 0.00273 | -0.01335 | 0.07800 |
| Fruit length (cm) | TSH-2 | -0.00182 | -0.00248 | -0.00137 | 0.01642 | 0.00334 | -0.05298 | 0.02465 | -0.00004 | -0.00002 | -0.00056 | -0.01194 | -0.02700** |
| | TSH-6 | -0.00044 | 0.00638 | 0.00072 | -0.19033 | 0.00053 | -0.00652 | 0.00262 | 0.00044 | 0.00044 | 0.00314 | -0.00845 | -0.19100** |
| | TSH-8 | -0.00359 | -0.00460 | -0.00049 | 0.12515 | 0.00224 | -0.01312 | 0.01620 | 0.01176 | 0.00076 | 0.00458 | 0.02803 | 0.16700 |
| Fruit diameter (cm) | TSH-2 | -0.00801 | -0.00242 | -0.00053 | 0.03325 | 0.00121 | -0.03625 | 0.03602 | 0.00062 | 0.00031 | -0.00081 | -0.04549 | -0.02200 |
| | TSH-6 | 0.00298 | 0.01227 | 0.00007 | -0.18324 | -0.00081 | -0.00147 | 0.01160 | -0.00002 | 0.00054 | -0.00097 | 0.05128 | -0.10800** |
| | TSH-8 | -0.00349 | -0.00302 | 0.00071 | 0.07449 | 0.00130 | -0.00482 | 0.04409 | -0.01868 | 0.00151 | -0.00072 | 0.13082 | 0.22200 |
| No. of locules | TSH-2 | -0.00814 | -0.00118 | 0.00101 | 0.08257 | 0.00135 | 0.00028 | 0.00285 | 0.00779 | -0.00031 | 0.00065 | -0.04071 | 0.04600 |
| | TSH-6 | -0.00020 | -0.00518 | 0.00012 | 0.09146 | 0.00024 | -0.00012 | -0.00001 | 0.02431 | -0.00027 | -0.00027 | 0.01655 | 0.12700 |
| | TSH-8 | -0.00008 | 0.00475 | 0.00097 | -0.06266 | -0.00064 | 0.00184 | 0.00981 | -0.08392 | 0.00215 | -0.00357 | 0.00875 | -0.12300 |
| Pericarp thickness (mm) | TSH-2 | 0.00388 | 0.00044 | -0.00331 | -0.06242 | -0.00340 | -0.00034 | -0.00374 | 0.00083 | -0.00295 | -0.00157 | -0.00741 | -0.08000 |
| | TSH-6 | 0.00608 | -0.00044 | -0.00069 | 0.00240 | -0.00025 | 0.00057 | -0.00126 | 0.00133 | -0.00502 | 0.00416 | -0.03885 | -0.03200 |
| | TSH-8 | 0.00188 | 0.00014 | 0.00149 | 0.08190 | -0.00028 | -0.00151 | 0.01008 | -0.02724 | 0.00662 | -0.00389 | 0.05883 | 0.12800 |
| TSS | TSH-2 | 0.00349 | -0.00104 | 0.00223 | -0.00270 | -0.00357 | -0.00372 | 0.00367 | -0.00063 | -0.00058 | -0.00795 | 0.00435 | -0.00600** |
| | TSH-6 | 0.00095 | -0.00080 | -0.00017 | 0.04279 | -0.00062 | 0.00045 | 0.00025 | 0.00014 | 0.00046 | -0.04528 | 0.04283 | 0.04100 |
| | TSH-8 | -0.00145 | 0.00251 | -0.00104 | -0.04550 | 0.00190 | 0.00156 | 0.00083 | -0.00780 | 0.00067 | -0.03847 | 0.06302 | -0.02400 |
| Average fruit weight(g) | TSH-2 | -0.00040 | 0.00192 | 0.00003 | 0.06754 | 0.00161 | 0.00185 | -0.00479 | -0.00093 | 0.00006 | -0.00010 | 0.34241 | 0.40900** |
| | TSH-6 | 0.00157 | 0.00979 | 0.00110 | -0.08900 | -0.00003 | 0.00012 | 0.00127 | 0.00086 | 0.00042 | -0.00414 | 0.46784 | 0.39000** |
| | TSH-8 | -0.00276 | 0.00247 | -0.00060 | -0.01998 | 0.00074 | -0.00076 | 0.01196 | -0.00152 | 0.00081 | -0.00503 | 0.48210 | 0.46700** |

**Residual effect:** TSH-2 = 0.18, TSH-6 = 0.22, TSH-8 = 0.28

## References


1. Dewey DR, Lu KN. A correlation and path coefficient analysis of components of crested wheat grass seed production. Agron. J. 1959; 51:515-518.
2. Fisher RA, Yates F. Statistical Tables for Biological, Agric. and Medical Research. (6th Ed.) Longman Group Ltd, Harlow, 1963, 63–64.
3. Giovannucci E, Rimm EB, Liu Y, Stamper MJ, Willett WC. A prospective study of tomato products, lycopene, and prostate cancer risk. J National Cancer Institute. 2002; 94(5):391-398.
4. Khapte PS, Jansirani P. Correlation and path coefficient analysis in tomato (*Solanum lycopersicum* L.). Electronic J Pl. Breeding. 2014; 5(2):300-304.
5. Patil S, Bhalekar MN, Kute NS, Shinde GC, Shinde S. Genetic variability and interrelationship among different traits in $F_3$ progenies of tomato (*Solanum lycopersicon* L.). Biofolet. 2013; 10(2):728-732.
6. Weber and Moorthy BR. Heritable and non-heritable relationship and variability of oil content and agronomic characteristics in the $F_2$ generation of soybean crosses. Agron J. 1952; 44:202-209.
7. Wright S. Correlation and causation. J. Agril. Res. 1921; 20:557-585.