OPEN ACCESS

# International Journal of Applied Sciences and Biotechnology

A Rapid Publishing Journal

**ISSN 2091-2609**

## Indexing and Abstracting

**CrossRef, Google Scholar, Global Impact Factor, Genamics, Index Copernicus, Directory of Open Access Journals, WorldCat, Electronic Journals Library (EZB), Universitätsbibliothek Leipzig, Hamburg University, UTS (University of Technology, Sydney): Library, International Society of Universal Research in Sciences (EyeSource), Journal Seeker, WZB, Socolar, BioRes, Indian Science, Jadoun Science, Jour-Informatics, Journal Directory, JournalTOCs, Academic Journals Database, Journal Quality Evaluation Report, PDOAJ, Science Central, Journal Impact Factor, NewJour, Open Science Directory, Directory of Research Journals Indexing, Open Access Library, International Impact Factor Services, SciSeek, Cabell's Directories, Scientific Indexing Services, CiteFactor, UniSA Library, InfoBase Index, Infomine, Getinfo, Open Academic Journals Index, HINARI, etc.**

**CODEN (Chemical Abstract Services, USA): IJASKD**

Vol-3(2) June, 2015

**Available online at:**

http://www.ijasbt.org

&

http://www.nepjol.info/index.php/IJASBT/index

SEM-Biotech Publishing

Impact factor*: **1.422**
Scientific Journal Impact factor#: **3.419**
Index Copernicus Value: **6.02**

*Impact factor is issued by Universal Impact Factor. Kindly note that this is not the IF of Journal Citation Report (JCR).
#Impact factor is issued by SJIF INNO SPACE.

For any type of query and/or feedback don't hesitate to email us at: editor.ijasbt@gmail.com

M.S. Rahman et al. (2015) Int J Appl Sci Biotechnol, Vol 3(2): 223-226
DOI: 10.3126/ijasbt.v3i2.12421

ISSN (Online): 2091-2609
DOI Prefix: 10.3126/ijasbt

International Journal of Applied Sciences and Biotechnology (IJASBT)

Research Article

# CORRELATION AND PATH COEFFICIENT ANALYSIS OF TOMATO GERMPLASMS

**Md. Salehur Rahman[1], Shahanaz Parveen[2], Md.Harun-Ur-Rashid[2*], Runa Akter[1], Abu Yousuf Hossin[1], Md. Golam Robbani[2]**

[1]IUBAT-International University of Business Agriculture and Technology, Dhaka, Bangladesh
[2]Department of Genetics and Plant Breeding, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh

*Corresponding author email: sumonsau@gmail.com

## Abstract

Forty eight genotypes of tomato were evaluated for yield contributing characters to observe their associations and direct and indirect effect on yield. Character association analysis among yield and yield contributing characters revealed that in most of cases the genotypic correlation coefficient was higher than the respective phenotypic correlation coefficients. This indicated that the suppressive effect of the environment modified the phenotypic expression of these characters by reducing phenotypic correlation values. Also, narrow difference between phenotypic and genotypic correlation coefficient was noticed for almost all the pairs of characters studied showing that masking or modifying effects of the environment was little indicating the presence of an inherent association among these characters. Fruit/cluster showed non-significant positive association with yield/plant at genotypic and phenotypic level but individual weight of fruit had significant negative association at phenotypic level with yield/plant. Path coefficient analysis revealed that no. of fruit/cluster had the highest positive direct effects on fruit yield/plant suggesting their importance while imposing selection for correlation of yield in tomato.

**Key words:** Correlation analysis; Path coefficient analysis; Tomato; Germplasms

## Introduction

Tomato (*Solanum lycopersicum* L.) is a self-pollinated diploid species with twelve pairs of chromosomes (2n = 24). It belongs to the *Solanaceae* family with other frugally important crops such as pepper, eggplant and potato. 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). Yield is a complex trait that shows a chain of linear and non-linear associations among yield components with varying degree of effects. 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 determine the nature of association, direct and indirect relationship between yield and yield contributing characters and relative contribution of each character towards seed yield in tomato through the correlation coefficient and the path coefficient analysis.

## Materials and Methods

The experiment was undertaken in the experimental farm, Sher-e-Bangla Agricultural University (SAU), Dhaka during September 2013-May 2014. The experiment was set up in a RCBD design with three replications, following 60 cm × 50 cm spacing. The unit plot size was 37.71m×15m and block to block distance was 1 m. The plot was fertilized with 550, 450, 250 kg/ha Urea, TSP, MP and 10 tan/ha cow dung respectively. All recommended agronomic package of practices were followed to grow a healthy crop. The observations were recorded on various growth and yield parameters from 10 randomly selected plants in each replication as per standard procedure. The data were analyzed by GENSTAT program. Simple correlation coefficient has obtained using the formula suggested by Singh and Chaudhary (1985) and path coefficient analysis was done following the method outlined by Dewey and Lu (1959).

## Result and Discussion

### *Correlation analysis*

Character association analysis among yield and yield contributing characters (Table 1) revealed that in most of

cases the genotypic correlation coefficient were higher than the respective phenotypic correlation coefficients. This indicated that the suppressive effect of the environment modified the phenotypic expression of these characters by reducing phenotypic correlation values. Also, narrow difference between phenotypic and genotypic correlation coefficient was noticed for almost all the pairs of characters studied showing that masking or modifying effects of the environment was little indicating the presence of an inherent association among these characters. % of ash showed significant positive association with % of protein both genotypic (0.52) and phenotypic (0.516) level, but it possessed negative and non-significant correlation with % of chlorophyll content, flower/cluster, fruit/cluster, length of fruit, shelf life of tomato, individual wt. of fruit and yield/plant. % of protein disclosed non-significant positive association with yield/plant. Flower/cluster showed significant positive association both genotypic (0.997) and phenotypic (0.938) level with fruit/cluster. It also showed non-significant positive association with pH of tomato juice, plant height, shelf life of tomato and yield/plant but non-significant negative association with length of fruit and individual fruit weight. Fruit/cluster disclosed non-significant negative association with length of fruit, no. of seeds/fruit, pH of tomato juice and individual weight of fruit but non-significant positive association with plant height, shelf life of tomato and yield/plant. Length of fruit showed highly significant positive association with individual fruit weight but it also showed non-significant positive association with pH of tomato juice and yield/plant. No. of seed per fruit showed non-significant negative association with shelf life of tomato and yield/plant but non-significant positive association with plant height and individual fruit weight. Plant height showed non-significant negative association with individual weight of fruit both genotypic and phenotypic level and non-significant positive association with yield/plant both genotypic (00.44) and phenotypic (0.148) level. Shelf life of tomato (ambient temperature) registered non-significant negative association with yield/plant. Individual weight of fruit had highly significant negative association with yield/plant. Prasad and Rai (1999), Mohanty (2002a and 2002b) and Harer *et al.* (2003) and Islam *et al.* (2010) reported very high and significant correlation coefficient between yield and fruit weight.

***Path coefficient analysis***

Correlation between yield and yield components were, partitioned into direct and indirect effects to know the particular factor responsible for that correlation. Path analysis revealed that yield/plant had positive direct effect on % of protein, % of chlorophyll content, fruit/cluster, flower /cluster, length of fruit, no. of seed/fruit, plant height and individual fruit weight. On the other hand % of ash, % of vit-C, % of brix, $p^H$ of tomato juice and shelf life of tomato had negative direct effect on yield. % of ash employed direct negative effect (1.153) on yield/plant as well as indirect positive effects via % of protein, % of vit-C , % of brix ,% of chlorophyll content , length of fruit, no. of seed/fruit, pH of tomato juice, plant height and individual weight of fruit. % of protein showed positive direct effect (0.523) on yield/plant. It also showed negative indirect effects via % of ash, % of vit-C and shelf life of tomato. % of vit-C applied positive direct effect (0.523) on yield/plant and also showed positive indirect effects via flower/cluster, fruit/cluster and length of fruit. On the other hand, % of chlorophyll content showed negative direct effect on (-0.763) on yield/plant. Flower/cluster (0.763) and fruit/cluster (1.779) had positive direct effect on yield/plant. Supporting evidence of direct positive influence of no. of fruit/plant on yield/ plant had been reported earlier (Rani *et al.*, 2008, Islam *et al*., 2010).

Length of fruit (-1.756) and individual weight of fruit (-0.34) had negative direct effect on yield/plant. The result was in line with finding of (Saleem *et al.*, 2013). On the other hand no. of seeds/fruit (0.688), pH of tomato juice (0.752), plant height (0.231) and shelf life (0.931) had positive direct effect on yield/plant. Singh *et al.*, 2006 and Hayadar *et al.*, 2007 got positive direct effect plant height on yield/plant but contrast to (Ghosh *et al.*, 2010) who reported negative direct effect of plant height on yield/ plant in tomato. Significant genotypic associations and direct positive effects of % of protein, % of vit-C, % of brix, flower/cluster, fruit/cluster, no. of seed/fruit, pH of tomato juice, plant height and shelf life of fruit on fruit yield/plant. Direct selection of these traits would be effective to enhance yield.

There were similarities and dissimilarities in findings of earlier workers and ours which could be attributed to different breeding material and environmental conditions. Consequently, such anomalous situation suggested that a restricted simultaneous selection model could be followed to nullify the undesirable indirect effects to make proper use of the direct effect. On perusal to significant correlation and desirable direct effect % of protein, flower/ cluster, fruit/ cluster and plant height on yield/ plant, it could be concluded that these parameters could be considered for the development of elite hybrids via heterosis breeding or for the development of inbred lines followings pure line selection in succeeding generations. It could be noticed that most of the direct effects were less than one at the phenotypic level indicating that inflation due to multicolinearity was minimal phenotypically. The unexplained variation in phenotype was 0.331 which might be due to many reasons such as other characters not considered here, environmental factors and sampling errors.

**Table 1:** Genotypic (rg) and phenotypic (rp) correlation coefficient for different yield contributing characters in tomato

| Characters | Correlation | PA | PP | PVC | PB | PCC | FlPC | FPC | LF | NS | PTJ | PH | SL | IWF | YP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | rg | - | 0.520* | 0.284 | 0.094 | -0.260 | -0.011 | -0.045 | -0.100 | 0.244 | 0.256 | 0.344 | -0.298 | -0.086 | -0.180 |
| **PA** | rp | - | 0.516* | 0.219 | 0.088 | -0.250 | -0.008 | -0.042 | -0.099 | 0.243 | 0.233 | 0.342 | -0.295 | -0.086 | -0.174 |
| | rg | | | -0.008 | 0.292 | -0.228 | 0.069 | 0.009 | -0.269 | 0.079 | 0.027 | 0.348 | -0.124 | -0.163 | 0.005 |
| **PP** | rp | | | -0.004 | 0.288 | -0.216 | 0.062 | 0.008 | -0.269 | 0.079 | 0.025 | 0.347 | -0.124 | -0.163 | 0.004 |
| | rg | | | | -0.129 | 0.015 | 0.110 | 0.087 | -0.046 | -0.072 | -0.138 | -0.073 | -0.084 | 0.944 | -0.189 |
| **PVC** | rp | | | | -0.108 | 0.018 | 0.089 | 0.083 | -0.038 | -0.058 | 0.175 | -0.059 | -0.066 | 0.763 | -0.141 |
| | rg | | | | | 0.012 | -0.123 | -0.167 | -0.285 | 0.103 | 0.068 | 0.400 | -0.040 | -0.137 | -0.332 |
| **PB** | rp | | | | | 0.001 | -0.114 | -0.163 | -0.281 | 0.101 | 0.063 | 0.395 | -0.039 | -0.135 | -0.313 |
| | rg | | | | | | -0.048 | -0.048 | 0.147 | -0.385 | -0.053 | -0.482* | 0.043 | 0.143 | 0.172 |
| **PCC** | rp | | | | | | -0.054 | -0.049 | 0.141 | -0.367 | -0.043 | -0.460 | 0.038 | 0.136 | 0.154 |
| | rg | | | | | | | 0.997** | -0.314 | -0.245 | 0.012 | 0.044 | 0.223 | -0.315 | 0.029 |
| **FlPC** | rp | | | | | | | 0.938** | -0.285 | -0.222 | 0.008 | 0.040 | 0.200 | -0.287 | 0.005 |
| | rg | | | | | | | | -0.260 | -0.222 | -0.012 | 0.005 | 0.245 | -0.301 | 0.040 |
| **FPC** | rp | | | | | | | | -0.250 | -0.213 | 0.002 | 0.005 | 0.235 | -0.290 | 0.008 |
| | rg | | | | | | | | | -0.012 | 0.036 | -0.306 | 0.039 | 0.712** | 0.006 |
| **LF** | rp | | | | | | | | | 0.022 | 0.033 | -0.306 | 0.039 | 0.712** | 0.005 |
| | rg | | | | | | | | | | 0.017 | 0.465 | -0.182 | -0.001 | 0.526 |
| **NS** | rp | | | | | | | | | | -0.008 | 0.464 | -0.182 | -0.001 | 0.500 |
| | rg | | | | | | | | | | | 0.039 | -.0140 | 0.021 | -0.193 |
| **PTJ** | rp | | | | | | | | | | | 0..035 | -0.016 | 0.019 | -0.161 |
| | rg | | | | | | | | | | | | 0.007 | -0.343 | 0.440 |
| **PH** | rp | | | | | | | | | | | | -0.154 | -0.343 | 0.148 |
| | rg | | | | | | | | | | | | | -0.025 | -0.133 |
| **SL** | rp | | | | | | | | | | | | | 0.040 | -0.126 |
| | rg | | | | | | | | | | | | | | 0.435 |
| **IWF** | rp | | | | | | | | | | | | | | -0.859** |

**, *= Significant 1% and 5% level respectively; Here, PA=% of Ash, PP=%of protein, PVC=%of Vit C, PB=% of Brix, PCC= % of Chlorophyll content, FlPC= Flower per cluster, FPC= Fruit per cluster, LF= Length of fruit, NS= Number of seed per fruit, PTJ= pH of tomato juice, PH= Plant height, SL= Shelf life, IWF= Individual weight of fruit, YP= Yield per plant

Table 2: Direct (Bold) and indirect effects at phenotypic levels of various component characters on yield of tomato

| Characters | PA | PP | PVC | PB | PCC | FlPC | FPC | LF | NS | PTJ | PH | SL | IWF | YP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PA** | **-1.153** | 0.272 | 0.148 | 0.081 | 0.191 | -0.008 | -0.080 | 0.175 | 0.168 | 0.193 | 0.079 | -0.277 | 0.030 | -0.180 |
| **PP** | -0.599 | **0.523** | -0.004 | 0.251 | 0.168 | 0.052 | 0.017 | 0.473 | 0.054 | 0.020 | 0.080 | -0.115 | 0.056 | 0.005 |
| **PVC** | -0.327 | -0.001 | **0.523** | -0.111 | -0.011 | 0.085 | 0.156 | 0.082 | -0.049 | -0.104 | -0.016 | -0.078 | -0.328 | -0.189 |
| **PB** | -0.109 | 0.153 | -0.067 | **0.860** | -0.009 | -0.094 | -0.298 | 0.500 | 0.070 | 0.051 | 0.092 | -0.038 | 0.047 | -0.332 |
| **PCC** | 0.300 | -0.119 | 0.007 | 0.010 | **-0.736** | -0.037 | -0.086 | -0.259 | -0.265 | -0.039 | -0.111 | 0.040 | -0.049 | 0.172 |
| **FlPC** | 0.012 | 0.036 | 0.058 | -0.106 | 0.035 | **0.763** | 1.775 | 0.551 | -0.168 | 0.009 | 0.010 | 0.208 | 0.109 | 0.029 |
| **FPC** | 0.051 | 0.005 | 0.045 | -0.144 | 0.035 | 0.761 | **1.779** | 0.457 | -0.152 | 0.009 | 0.001 | 0.228 | 0.104 | 0.040 |
| **LF** | 0.115 | -0.141 | -0.024 | -0.245 | -0.108 | -0.239 | -0.463 | **-1.756** | -0.008 | 0.027 | -0.070 | 0.036 | -0.247 | 0.006 |
| **NS** | -0.282 | 0.041 | -0.038 | 0.088 | 0.283 | -0.187 | -0.395 | 0.022 | **0.688** | 0.012 | 0.107 | -0.170 | 0.043 | 0.526 |
| **PTJ** | -0.296 | 0.014 | -0.072 | 0.059 | 0.039 | 0.009 | 0.023 | -0.063 | 0.011 | **0.752** | 0.009 | -0.013 | -0.007 | -0.193 |
| **PH** | -0.397 | 0.182 | -0.038 | 0.344 | 0.355 | 0.033 | 0.008 | 0.539 | 0.320 | 0.026 | **0.231** | 0.071 | 0.119 | 0.440 |
| **SL** | 0.343 | -0.065 | -0.044 | -0.035 | -0.032 | 0.170 | 0.437 | -0.068 | -0.125 | 0.029 | 0.017 | **0.931** | 0.008 | -0.133 |
| **IWF** | 0.099 | -0.085 | 0.494 | -0.118 | -0.105 | -0.240 | -0.536 | -1.251 | -0.085 | -0.010 | -0.079 | -0.024 | **-0.347** | 0.435 |
| **Residual** | **0.331** | | | | | | | | | | | | | |

## Reference


Dewey DR and Lu KH (1959) A correlation and path coefficient analysis of components of crested wheatgrass seed production. *Agron. J.* **51**: 515- 518.

Dhaliwal MS, Singh S and Cheema DS (2003) Line x tester analysis for yield and processing attributes in tomato. *J. Res.* **40**: 49-53.

Ghosh, KP, Islam AKMA, Mian MAK and Hossain MM (2010) Variability and characters association in $F_2$ segregation population of different commercial hybrids of tomato (*Solanum lycopercicum* L.). *J. App.Sci. Manage.* **14**: 91-95.

Harer PN, Lad DB and Bhor TJ (2003) Correlation and path analysis studies in tomato. *Journal of Maharashtra Agricultural Universities* **27**(3):302-303.

Haydar A, Mandal MA, Ahmed MB, Hannan MM, Karim R, Razvy MA,. Roy UK and Salahin M (2007) Studies on genetic variability and interrelationship among the different traits in tomato. *Middle East Journal of Scientific Research* **2**(3-4): 139-142.

Islam BMR, Ivy NA, Rasul MG and Zakaria M (2010) Characters association and path analysis of exotic tomato (*Solanum lycopercicum* L.) genotypes . *Bangladesh J. Pl. Breed. Genet.* **23**:13-18.

Mohanty BK (2002a) Genetic variability, correlation and path coefficient studies in tomato. *J. Indian Agril. Res.* **37**(1): 68-71.

Mohanty BK (2002b) Variability, heritability, correlation and path coefficient studies in tomato. *Haryana J. Hort. Sci.*, **31**(3/4): 230-233

Prasad VSR and M Rai 1999. Genetic variability, components association and direct and indirect selection in some exotic tomato germplasm. *Indian J. Hort.*, **56**(3): 262-266.

Rani I, Veeraragavathatham D and Sanjutha D (2008) Studies on correlation and path coefficient analysis on yield attributes in root knot nematodes resistant $F_1$ hybrids of tomato. *Journal of Applied Sciences Research*. **4**:287-*295*.

Saleem MY, Iqbal Q and Asghar M (2003) Genetic variability, heritability, character association and path analysis in $F_1$ hybrid of tomato. *Pak. J. Agri. Sci.* **50**(4): 649-653.

Singh KP, Mandal G and Saha BC (2006) Genetic variability of yield components and bio-chemical characters in spring season tomato (*Lycopersicon esculentum Mill*). *J. Interacade*. **10**(3): 314-318

Singh RK and Chaudhury. BD (1985) Biometrical methods of quantitative genetic analysis. *Haryana J. Hort. Sci.*, **12**(2): 151-156.