*Original Research Article*

# Correlation and path coefficient studies in Brinjal (*Solanum melongena* L.) for yield and yield contributing traits.


## Abstract

~~Genetic studies in terms of c~~Correlation and path coefficient analysis ~~were studied for~~of 43 germplasms ~~lines and $F_1$s of~~ brinjal, ~~(~~*Solanum melongena* L.~~)~~ for seventeen qualitative and quantitative characters. ~~The studies~~ revealed ~~that~~ a highly significant and positive correlation of ~~most important traits~~ total fruit yield per plant$^{-1}$ ~~had highly significant and positive association~~ with fruit weight (…), ~~number of~~ fruits per plant$^{-1}$ (Nos.), fruit length (….), fruit diameter (….) and ~~number of~~ pickings per plant$^{-1}$ (Nos.) at both phenotypic and genotypic level. A significant negative correlation of fruit yield was recorded with days to first flowering, ~~days to~~ first fruit set and ~~days to~~ first fruit picking. ~~The present study on path coefficient analysis revealed that t~~The highest magnitude of positive direct effect on yield was exerted by number of fruits per plant$^{-1}$ (1.865) followed by fruit weight (0.848), fruit length (0.259), plant spread (0.188), plant height (0.142), and number of pickings (0.109) ~~whereas,~~as against the lowest ~~positive direct effect on fruit yield was observed~~ for fruit diameter (0.088). Among the negative direct effects, days to first flowering ~~(-0.868)~~ showed highest negative direct effect on total fruit yield per plant$^{-1}$ (-0.868) followed by number of branches per plant$^{-1}$ (-0.099), days to first fruit picking (-0.078), and days to first fruit set (-0.044). ~~Therefore, during selection, these characters should also be taken into consideration.D~~A direct selection ~~may be carried out considering these traits as the main~~based on ~~selection~~ criteria showing significant correlation will help in ~~to~~ cutting down the indirect effect of other characters for developing high yielding brinjal varieties in the future.



**Key words** Correlation, path coefficient-, brinjal, variability, yield


**Comment [SK1]:** Please remove the superscript and replace the word Plant$^{-1}$ with " per plant" in all the cases

**Comment [SK2]:** Unit??

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**Comment [SK5]:** What about the chemical constituents present on the brinjal fruit???

## Introduction

Brinjal or eggplant (*Solanum melongena* L.) is one of the important Solanaceous vegetable crops having diploid chromosome no 2n=2x=24. Vavilo (1928) regarded the crop as being of Indian origin. Keeping in view the medicinal and nutritional importance of brinjal and keeping the land constraint in mind it is important to improve the yield of brinjal by developing high yielding varieties.For developing high yielding varieties it is essential to know the genetics of yield of brinjal and its component correlation and path coefficient analysis to furnish information regarding the nature and magnitude of various associations and help to find direct and indirect effects of the components studied on the yield.

## Materials and Methods:

The study was conducted ~~using~~ with 43 collections of eggplant germplasms (10 lines, 3 testers and 30 $F_1$s) for evaluation ~~in Randomized Block Design, with three replications~~ at three different elevations by following ~~. During *Kharif*2017 the set of thirty crosses along with their parents were evaluated in~~ Randomized Completely Block Design with three replications ~~at a spacing of 60 × 45 cm~~ at three locations. The crop was grown following recommended package of practices ~~was adopted to raise a healthy crop~~and a spacing of 60 cm × 45 cm. From each ~~Five random plants per~~ replication, observations on different yield and quality characters ,*viz*., days to first flowering, days to first fruit set, days to first fruit picking, plant height (cm), plant spread (cm), number of branches plant$^{-1}$,fruit length (cm), fruit diameter (cm), number of fruits plant$^{-1}$, No of pickings plant$^{-1}$, average fruit weight (g), fruit yield plant$^{-1}$ (kg), fruit yield ha$^{-1}$ (q),dry matter (%), Total soluble solids ($^{o}$Brix), Vitamin C (mg 100$^{-1}$g) and total Phenols (mg100$^{-1}$g) was recorded on five randomly selected plants ~~were selected to record observation on each genotype for 17different yield and quality characters. Observations were recorded on days to first flowering, days to first fruit set, days to first fruit picking, plant height (cm), plant spread (cm), number of branches plant$^{-1}$,fruit length (cm), fruit diameter (cm), number of fruits plant$^{-1}$, No of pickings plant$^{-1}$, average fruit weight (g), fruit yield plant$^{-1}$ (kg), fruit yield ha$^{-1}$ (q),dry matter (%),~~

**Comment [SK6]:** Is this the only reason for variability study and development of HYV.... The problem was not elaborately discussed ... I think a few more line could be added to justify the problem and intervention thereon.....Recast the paragraph with proper citation of objective of the study

**Comment [SK7]:** For evaluation of what??

**Comment [SK8]:** Where from the plant materials were collected.... F1 hybrids were developed by the author or not ?? Details of the planting materials required

**Comment [SK9]:** Was it done in different locations? ... If so, effect of location on yield parameters could have been evaluated

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~~Total soluble solids~~ ~~°Brix, Vitamin C (mg 100$^{-1}$g) and total Phenols (mg100$^{-1}$g).~~ Phenotypic and genotypic correlation was computed by formulae suggested by Aljibouri *et al* (1958). Path coefficient analysis was carried out to partition the total correlation into direct and indirect effects as suggested by Dewey and Lu (1959).

**Results and Discussion**

~~**Correlation**~~

~~The~~ eEstimation of the nature and magnitude of the ~~the association~~interaction between yield and ~~its~~ the component traits ~~are~~ is an essential requisite~~necessary~~ for adequate selection in advanced generations. Correlations between character pairs are due to the linkage of genes or pleiotropy of genes~~.~~ and hence, ~~Therefore,~~ selection of one trait influences the other linked or pleiotropically affected traits. ~~Considerable importance has been attached to correlation studies in the plant improvement because they are helpful in making an effective selection.~~ In the present study, correlations between seventeen yield attributing characters of brinjal were worked out in all possible combinations at phenotypic and genotypic level and presented in ~~(~~Table 1~~)~~. ~~In general, the~~A higher magnitude of genotypic correlation coefficient was ~~higher~~ experienced as compared to the ~~than the~~ corresponding ~~values of the~~ phenotypic correlation coefficient, which ~~. This~~ indicated a strong genetic association between the traits and the phenotypic expression which was suppressed due to environmental influence. The current study also suggested that both genotypic and phenotypic correlation were similar in direction. A ~~H~~highly significant and positive correlation of days to first flowering was observed with days to first fruit set and days to first fruit picking at genotypic and phenotypic levels. All the three

**Comment [SK11]:** Correlation coefficient values were not enlisted..... results should included along with conclusive statement for effective interpretation

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maturity traits i.e., days to first flowering, days to first fruit set and days to first fruit picking revealed a significant positive correlation with plant spread, number of fruits per plant and total soluble solids at genotypic and phenotypic levels, however it had a significant but negative correlation with dry matter at both levels. ~~H~~A highly significant and positive correlation was shown by plant height with fruit length and total soluble solids while it had a negative significant correlation with fruit weight, fruit diameter and total phenols at both the levels. Plant spread expressed a significant positive correlation with maturity traits, fruit diameter, fruit weight and total phenols at genotypic as well as phenotypic levels. Number of branches per plant exhibited a highly significant and positive correlation with fruit diameter and number of pickings at both levels while it expressed a negative but significant correlation with fruit length (Table 1). Fruit length showed a positive significant correlation with fruit yield and negative significant correlation with total phenols. Fruit diameter had a highly significant positive correlation with fruit weight and total phenols at genotypic as well as phenotypic levels. At genotypic and phenotypic levels number of fruits per plant had a positive correlation with number of pickings and vitamin C and a negative significant association with fruit weight.

**Comment [SK13]:** Data on the subject matter could be included

**Comment [SK14]:** Reason for obtaining such data could have been explained

Dry matter and number of pickings had significant negative correlation with each other at both the genotypic and phenotypic levels while total soluble solids expressed a positive significant correlation with number of pickings per plant at both levels. At both levels, vitamin C recorded a negative significant correlation with fruit weight while total phenols had a positive significant correlation with fruit weight. A ~~N~~negative significant correlation was recorded by total phenols with number of pickings per plant.

**Comment [SK15]:** Statement could be supported with sufficient data

A study of data (Tables 1) revealed that most important traits total fruit yield per plant had highly significant and positive association with fruit weight, number of fruits per plant, fruit length, fruit diameter and number of pickings plant$^{-1}$ at both phenotypic and genotypic level. Thus, these characters emerged as most important associates of fruit yield in brinjal. The available literature has also

indicated correlation between total fruit yield per plant and character mentioned above in brinjal which confirms the findings of Ansari *et al.* 2011, Nesgea *et al.* 2002, Chung *et al.* (2003) Nainar *et al.* (1990), Sharma and Swaroop (2000), Singh *et al.* (2003), Pratibha *et al.* (2004) and Patel and Sarnaik (2004).

**Comment [SK16]:** Important findings could sufficiently be discussed with previously done works on the subject matter along with the possible reason for such interactions

**Comment [SK17]:** Year of publishing is not matched with the reference cited

**Path coefficient analysis**

Path coefficient is simply standardized partial regression coefficient, which splits the correlation coefficient into the measures of the direct and indirect effects of a set of independent variables on the dependent variable. This analysis provides a method for separating out the direct and indirect effect of causal factors, which affect the yield**.** The genotypic correlation coefficient of fruit yield and its components along with morphological and quality traits were partitioned into direct and indirect effect taking total fruit yield per plant as dependent variable. Direct and indirect ~~effect of different characters on total fruit yield per plant are~~effects of different characters on total fruit yield per plant are presented in Table 2. The present study on path coefficient analysis revealed that the highest magnitude of positive direct effect on yield per plant was exerted by number of fruits per plant (1.865) followed by fruit weight (0.848), fruit length (0.259), plant spread (0.188), plant height (0.142), number of pickings (0.109) whereas, lowest positive direct effect on total fruit yield per plant was observed for fruit diameter (0.088). Among the negative direct effects, days to first flowering (-0.868) showed highest negative direct effect on total fruit yield per plant followed by the number of branches per plant (-0.099), days to first fruit picking (-0.078), and days to first fruit set (-0.044). Therefore, during selection, these characters should also be taken into consideration. Similar results had also been reported by (Naliyadhara *et al.*, 2007; Mishra *et al.*, 2007; Bansal and Mehta, 2008; Muniappan *et al.*, 2010; Thangamani and Jansirani, 2012.

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**Table 1:Genotypic (above diagonal) and phenotypic (below diagonal) correlation coefficient among different traits in Brinjal.**

| S. No. | Character | Days to first flowering | Days to first fruit set | Days to first fruit picking | Plant height (cm) | Plant spread (cm) | No. of branches plant$^{-1}$ | Fruit length (cm) | Fruit diameter (cm) | No of fruits plant$^{-1}$ | No. of pickings plant$^{-1}$ | Fruit weight (g) | Fruit yield plant$^{-1}$ (kg) | Fruit yield ha$^{-1}$ (q) | Dry matter (%) | Total soluble solids (°brix) | Vitamin C (mg 100$^{-1}$ g) | Total phenols (mg 100$^{-1}$ g) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Days to first flowering | | 0.903** | 0.966** | 0.265 | 0.508* | -0.018 | -0.214 | 0.139 | 0.424** | 0.156 | -0.114 | -0.417** | -0.417** | -0.387** | 0.612** | 0.228 | -0.236 |
| 2 | Days to first fruit set | 0.900 | | 0.883** | 0.260 | 0.395* | -0.231 | 0.043 | 0.046 | 0.317* | 0.300* | -0.109 | -0.303* | -0.303* | -0.290 | 0.417** | 0.109 | -0.186 |
| 3 | Days to first fruit picking | 0.906 | 0.805 | | 0.242 | 0.516* | 0.009 | -0.172 | 0.098 | 0.397* | 0.074 | -0.147 | -0.376* | -0.376* | -0.200 | 0.507* | 0.256 | -0.266 |
| 4 | Plant height (cm) | 0.235 | 0.202 | 0.203 | | -0.273 | -0.087 | 0.399* | -0.639** | -0.074 | 0.186 | -0.37* | -0.24 | -0.24 | -0.146 | 0.397* | -0.014 | -0.498** |
| 5 | Plant spread (cm) | 0.501 | 0.375 | 0.499 | -0.270 | | 0.262 | -0.64** | 0.60** | -0.24 | -0.22 | 0.465** | -0.006 | -0.006 | -0.165 | 0.210 | 0.176 | 0.462** |
| 6 | No. of branches plant$^{-1}$ | -0.01 | -0.178 | 0.004 | -0.080 | 0.260 | | -0.84** | 0.33* | 0.120 | -0.326* | -0.218 | -0.007 | -0.007 | 0.284 | -0.112 | -0.08 | 0.335* |
| 7 | Fruit length (cm) | -0.198 | 0.038 | -0.160 | 0.387 | -0.610 | -0.78 | | -0.48** | 0.01 | 0.228 | -0.063 | 0.384** | 0.384** | 0.06 | -0.163 | -0.189 | -0.426** |
| 8 | Fruit diameter (cm) | 0.100 | 0.039 | 0.091 | -0.630 | 0.600 | 0.30 | -0.39 | | -0.170 | -0.147 | 0.716** | 0.376** | 0.376** | -0.259 | 0.072 | -0.299 | 0.539* |
| 9 | No of fruits plant$^{-1}$ | 0.394 | 0.304 | 0.368 | -0.060 | -0.220 | 0.11 | 0.008 | -0.15 | | 0.302* | -0.414** | 0.878** | 0.878** | -0.127 | 0.293 | 0.423** | -0.549* |
| 10 | Number of pickings plant$^{-1}$ | 0.115 | 0.298 | 0.070 | 0.180 | -0.200 | -0.32 | 0.201 | -0.140 | 0.27 | | -0.007 | 0.331* | 0.331* | -0.482** | 0.353* | -0.091 | -0.521** |
| 11 | Fruit weight (g) | -0.112 | -0.100 | -0.144 | -0.36 | 0.445 | -0.20 | -0.060 | 0.700 | -0.40 | -0.005 | | 0.382** | 0.382** | -0.234 | -0.100 | -0.391** | 0.307* |
| 12 | Fruit yield plant$^{-1}$ (kg) | -0.402 | 0.292 | 0.360 | -0.23 | -0.004 | -0.004 | 0.344 | 0.360 | 0.86 | 0.310 | 0.37 | | | -0.264 | 0.261 | 0.249 | -0.46** |
| 13 | Fruit yield ha$^{-1}$ (q) | -0.402 | 0.301 | 0.361 | -0.21 | -0.004 | -0.004 | 0.344 | 0.370 | 0.86 | 0.320 | 0.37 | 0.98** | 0.98** | -0.271 | 0.269 | 0.24 | -0.46** |
| 14 | Dry matter % | -0.33 | 0.185 | -0.200 | -0.140 | 0.145 | 0.234 | -0.04 | -0.249 | -0.117 | -0.448 | -0.231 | -0.224 | -0.240 | | 0.02 | -0.04 | 0.01 |
| 15 | Total soluble solids (°Brix) | 0.608 | 0.404 | 0.501 | 0.376 | 0.200 | -0.110 | -0.160 | 0.061 | 0.277 | 0.341 | -0.100 | 0.216 | 0.261 | 0.01 | | -0.06 | -0.311** |
| 16 | Vitamin C (mg 100$^{-1}$ g) | 0.201 | 0.108 | 0.244 | -0.011 | 0.134 | -0.06 | -0.178 | -0.267 | 0.412 | -0.087 | -0.354 | 0.240 | 0.213 | -0.03 | -0.023 | | 0.633** |
| 17 | Total phenols (mg 100$^{-1}$ g) | -0.214 | 0.172 | -0.254 | -0.394 | 0.400 | 0.331 | -0.415 | 0.519 | -0.528 | -0.413 | 0.296 | -0.42 | -0.40 | 0.01 | -0.266 | 0.54 | |

*,** significant at 5% and 1% levels respectively.



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## Table 2: Path coefficient analysis in Brinjal (Data Pooled over locations)

| S. No. | Character | Days to first flowering | Days to first fruit set | Days to first fruit picking | Plant height (cm) | Plant spread (cm) | No. of branches plant$^{-1}$ | Fruit length (cm) | Fruit diameter (cm) | No of fruits plant$^{-1}$ | No. of pickings plant$^{-1}$ | Fruit weight (g) | Fruit yield plant$^{-1}$ (kg) | Fruit yield ha$^{-1}$ (q) | Dry matter (%) | Total soluble solids ($^{o}$brix) | Vitamin C (mg 100$^{-1}$ g) | Total phenols (mg 100$^{-1}$ g) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Days to first flowering | -0.868 | -0.019 | -0.029 | -0.019 | -0.067 | 0.981 | 0.195 | -0.004 | -1.020 | 0.910 | 0.732 | -0.004 | -0.179 | -0.986 | 0.018 | 0.001 | -0.003 |
| 2 | Days to first fruit set | 0.369 | -0.044 | 0.016 | 0.03 | 0.093 | -0.569 | 0.017 | 0.042 | 0.718 | -0.502 | 0.373 | -0.001 | 0.095 | 0.250 | 0.008 | -.002 | -0.001 |
| 3 | Days to first fruit picking | 0.318 | 0.009 | -0.078 | 0.04 | 0.034 | 0.502 | 0.119 | 0.018 | 0.434 | 0.555 | 0.475 | 0.044 | 0.144 | -0.144 | 0.674 | -0.146 | -0.003 |
| 4 | Plant height (cm) | 0.116 | 0.009 | 0.022 | 0.142 | 0.047 | 0.883 | 0.104 | -0.012 | -0.914 | 0.818 | 0.219 | 0.110 | 0.021 | 0.434 | 0.574 | -0.002 | -0.001 |
| 5 | Plant spread (cm) | 0.307 | 0.022 | 0.014 | 0.035 | 0.188 | 0.300 | 0.007 | 0.026 | 0.381 | -0.507 | -0.313 | -0.025 | 0.852 | 0.025 | 0.039 | 0.030 | 0.056 |
| 6 | No. of branches plant$^{-1}$ | -0.718 | -0.02 | 0.04 | 0.05 | -0.87 | -0.999 | 0.133 | 0.023 | 1.128 | -0.911 | -0.750 | 0.022 | -0.173 |  | 0.828 | 0.035 | -0.014 |
| 7 | Fruit length (cm) | 0.655 | 0.003 | 0.036 | 0.017 | 0.005 | -0.513 | 0.259 | 0.010 | -0.207 | -0.240 | -0.339 | 0.026 | -0.056 | 0.882 | -0.033 | -0.017 | -0.321 |
| 8 | Fruit diameter (cm) | 0.044 | 0.021 | 0.016 | 0.034 | 0.056 | -0.264 | -0.031 | 0.088 | 0.569 | -0.200 | -0.112 | 0.028 | 0.001 | -0.086 | 0.126 | 0.062 | -0.12 |
| 9 | No of fruits plant$^{-1}$ | 0.475 | 0.017 | 0.018 | 0.041 | 0.038 | -0.604 | 0.029 | 0.027 | 1.865 | -0.902 | -0.416 | 0.042 | -0.152 | -0.139 | 0.339 | 0.021 | -0.012 |
| 10 | Number of pickings plant$^{-1}$ | -0.481 | -0.013 | -0.035 | -0.009 | 0.054 | 0.828 | 0.057 | -0.016 | 1.53 | 1.099 | 0.632 | -0.085 | 0.169 | -0.358 | -0.119 | 0.023 | -0.011 |
| 11 | Fruit weight (g) | -0.749 | -0.019 | -0.044 | -0.037 | 0.069 | 0.033 | 0.234 | 0.896 | 0.185 | 0.056 | 0.848 | -0.024 | 0.217 | 1.116 | 0.113 | 0.112 | -0.220 |
| 12 | Fruit yield plant$^{-1}$ (kg) | 0.016 | 0.001 | 0.015 | 0.068 | 0.02 | -0.094 | 0.029 | 0.011 | 0.341 | -0.407 | -0.087 | 0.230 | 0.036 | -0.013 | -0.189 | 0.010 | 0.023 |
| 13 | Fruit yield ha$^{-1}$ (q) | -0.093 | -0.041 | 0.262 | 0.003 | -0.143 | 0.537 | 0.045 | -0.001 | 0.881 | 0.577 | 0.571 | 0.026 | 0.323 | -0.806 | -0.202 | 0.043 | -0.034 |
| 14 | Dry matter % | 0.555 | 0.007 | 0.034 | 0.04 | 0.005 | -0.536 | -0.148 | 0.005 | -0.168 | -0.255 | -0.615 | -0.028 | -0.169 | -1.54 | 0.017 | 0.011 | -0.013 |
| 15 | Total soluble solids ($^{o}$Brix) | 0.128 | -1.53 | 0.019 | 0.03 | 0.004 | 0.012 | 0.217 | 0.167 | 0.0233 | 0.033 | 0.87 | 0.023 | 0.019 | 0.043 | -0.044 | 0.123 | 0.34 |
| 16 | Vitamin C (mg 100$^{-1}$ g) | 0.78 | 0.78 | 0.47 | 0.066 | 0.076 | 0.650 | 0.225 | 0.228 | -0.009 | 0.005 | 0.012 | 0.112 | 0.056 | 0.441 | 0.036 | -0.541 | 0.060 |
| 17 | Total phenols (mg 100$^{-1}$ g) | 0.076 | 0.023 | 0.45 | 0.133 | 0.056 | 0.054 | 0.188 | 0.564 | 0.156 | 0.044 | 0.04 | 0.502 | 0.119 | 0.018 | 0.116 | 0.009 | 0.099 |

Residual effect: 0.024