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# Correlation studies and path analysis in bottle gourd

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**Abstract**
Correlation studied revealed that number of fruits per vine highly significant and positively correlated with the number of primary branches per vine whereas negatively correlated with days to 1st harvest. The highest direct positive effect was exhibited by number of fruits per vine followed by average fruit weight and fruit length while negligible positive direct effect was expressed by vine length, total number of nodes per vine and number of primary branches per vine.

**Keywords:** Correlation, path analysis and bottle gourd

## Introduction
Cucurbits acquired in an important place in the kingdom of Indian agriculture, which are included in our daily diet. The family cucurbitaceous have about 90 genera and 750 species (Whitaker and Davis, 1962) [22] and contribute to major production of vegetable in India. This includes bottle gourd, bitter gourd, pointed gourd, ash gourd watermelon, snap melon, cucumber and squashes. All these vegetable require similar climatic and adaphic condition hence cultural practices followed in their cultivation are almost same. The genus *Lagenaria* has been under cultivation since time in commemorative like many other cucurbits and is believed native to India. The single species of the genus *Lagenaria* viz., *Lagenaria siceraria* is extensively grown in India as summer and rainy season crop. The bottle like shape of the fruit and it's used as pot of wines, sprits, etc. in the past most likely gave this vegetable the common name bottle gourd. It can be grown in different agro-climatic conditions and thrives well in hot weather. Bottle gourd (*Lagenaria siceraria* (monlina) standl.) is a photo-insensitive crop but sensitive to thermoperiodism. Thus, most of the existing bottle gourd varieties are season specific or season bond. It is rich in vitamin B‟ and Ca‟ and a fair source of minerals viz., phosphorus, calcium and iron. Bottle gourd production has been increased considerably to meet the increasing internal demands as well as to open the export market abroad. Many types of preserves are prepared and exported to foreign countries, which earns foreign swap over to a substantial amount. In general, correlation assesses the strength and direction (positive or negative) of a link that exists between two or more variables (Gomez and Gomez 1984, Rohman *et al*., 2003) [7, 16]. Estimates of genetic and phenotypic correlations reflect the degree of genetic and phenotypic variables in forming a link between two plant features, whereas simple correlation describes the total relationship between two or more characteristics. Genetic correlation (rg) is the relationship between two plant features owing to the plant's genetic makeup, whereas phenotypic correlation (rp) is the association between two plant characters due to their physical appearance at a morphological, anatomical, or biochemical level (Affifi, 1984, Kang 1998, Zhang *et al*., 2005) [1, 8, 23]. Dewey and Lu (1959) [5] utilized path analysis in plant breeding trials, and it has since been widely used in agronomic and environmental research (Garcia del Moral *et al*., 2003; Zhang *et al*., 2005) [6, 23]. It is a standardized partial regression analysis that measures the direct impact of one variable on another and allows for the separation of direct and indirect effects of correlation. The contribution of component variables to a character may be determined via path analysis (Rafi and Nath, 2004; Zhang *et al*., 2005; Carlos *et al*., 2005) [14, 23, 3]. Character association and path coefficient analysis were used to establish the nature of the connection, the direct and indirect link between yields and yield contributing characters, and the relative contribution of each character to fruit yield in bottle gourd.

## Methods and Materials
The present research was carried out at Vegetable research farm of Bihar Agricultural University Sabour, Bhagalpur, Bihar, India during *kharif* season 2018 which is geographically

situated between 25°C'15'40''N latitude to 87°2'42''E longitude at 46 m above mean sea level. All essential conveniences for development of winning crop including inputs, field preparation, irrigation facilities and labours were provided by department of Horticulture (Vegetable and Floriculture), BAU, Sabour. Plot size 3.0 m x 2.5 m with a row to row spacing of 3.0 m and plant to plant spacing of 0.50 m. Observations 5 randomly selected plants from each genotype in each replication were made for vine length, number of primary branches per vine, number of node per vine, days to first harvesting, fruit length, fruit girth, average fruit weight, number of fruit per vine, yield/ plot. Genotypic and phenotypic correlations were calculated per Al-Jibouri *et al*., (1958) [2] using an ANOVA and covariance matrix in which total variability was split into replications, genotypes, and errors. Genotypic and phenotypic correlation coefficients were used to determine direct and indirect contribution toward yield per plot. The direct and indirect paths were obtained according to the method of Dewey and Lu (1959) [5].

**Results and Discussion**

The phenotypic and genotypic correlation coefficients between characteristics were calculated. The magnitude of genotypic correlation coefficients was greater than that of phenotypic correlation coefficients. This suggests that there is a strong underlying genotypic connection between the characteristics investigated, despite the fact that phenotypic manifestation was hampered by environmental factors. Correlation coefficient of all the phenotypic characters has been offered in Table-1. Correlation studies opined that the vine length of plant showed highly significant and positive correlation with days of first harvesting (rp=0.968) but negative and highly significant correlation with number of primary branches per vine (rp = -0.799) and yield per plot (rp = -0.816). The positive and significant correlation with number of node per vine (rp = 0.759) but negative and significant correlation with fruit length (rp = -0.671), fruit girth (rp = -0.734), average fruit weight (rp = -0.714) and number of fruit per vine (rp = -0.742). Number of primary branches per vine showed highly significant and positive correlation with number of fruit per vine (rp = 0.930) and yield per plot (rp = 0.822) but negative and highly significant correlation with days to first harvesting (rp = -0.853). Number of node per vine showed highly significant and negative correlation with fruit length (rp = -0.929), Fruit girth (rp = -0.897) and average fruit weight (rp = -0.461). The negative and significant correlation with yield per plot (rp = -0.701) but positive and significant correlation with days of first harvesting (rp = 0.697). Days to first harvesting showed highly significant and negative correlation with of fruit per vine (rp = -0.784) and yield per plot (rp = -0.804).The negative and significant correlation with fruit girth (rp = 0.633). Fruit length showed highly significant and positive correlation with fruit girth (rp = 0.992), average fruit weight (rp = 0.987) and yield per plot (rp = 0.699). Fruit girth showed highly significant and positive correlation with average fruit weight (rp = 0.947) and positive and significant correlation with yield per plot (rp = 0.711). Average fruit weight showed significant and positive correlation with yield per plot (rp = 0.775).

Number of fruit per vine showed highly significant and positive correlation with yield per plot (rp =0.952).

**Table 1:** Correlation studies opined that the vine length of plant showed highly significant

| | VLe | NoPB/V | NNo/V | DFH | FrLe | FrDi | AFrW | NFr/V | Y/P |
|---|---|---|---|---|---|---|---|---|---|
| VLe | 1.000 | -0.799** | 0.759* | 0.968** | -0.671* | -0.734* | -0.714* | -0.742* | -0.816** |
| NoPB/V | | 1.000 | -0.359 | -0.853** | 0.264 | 0.328 | 0.357 | 0.930** | 0.822** |
| NNo/V | | | 1.000 | 0.697* | -0.929** | -0.897** | -0.931** | -0.461 | -0.701* |
| DFH | | | | 1.000 | -0.556 | -0.633* | -0.602 | -0.784** | -0.804** |
| FrLe | | | | | 1.000 | 0.952** | 0.987** | 0.427 | 0.699* |
| FrDi | | | | | | 1.000 | 0.947** | 0.469 | 0.711* |
| AFrW | | | | | | | 1.000 | 0.519 | 0.775* |
| NFr/V | | | | | | | | 1.000 | 0.942** |
| Y/P | | | | | | | | | 1.000 |

**Path coefficient analysis**

Path coefficient analysis is representing direct and indirect contribution toward yield per plot represented in Table 2 along with residual effect. Data indicates that the no. of fruit per vine articulated maximum direct positive effect (0.726) in the direction of yield per plot followed by fruit weight (0.567), number of node per vine (0.012), vine length (0.078) and number of primary branches per vine (0.004. Maximum indirect positive effect was contributed *via* number of fruit per vine (0.675) followed by fruit length (0.560) and Fruit girth (0.537) towards yield per plot. Vine length had showed highly significant negative correlation (-0.816) with yield per plot. It had positive direct effect on yield/plot (0.078). Number of primary branches per vine had showed highly significant positive correlation (0.885) with yield/plot. It had positive direct effect on yield/plot (0.004) but indirect effect on yield/plot *via* vine length (-0.003). Number of node per vine had showed significant negative correlation (-0.759) with yield/plot. It had positive direct effect on yield/plot (0.012) but indirect effect on yield/plot *via* vine length (0.009) and number of primary branches per vine (-0.004). Days to first harvesting had showed highly significant negative correlation (-0.885) with yield/plot. It had negative direct effect on yield/plot (-0.052) but indirect effect on yield/plot *via* vine length (-0.050), number of primary branches per vine (0.044) and number of node per vine (-0.036). Fruit length had showed significant positive correlation (0.733) with yield/plot. It had negative direct effect on yield/plot (-0.111) but indirect effect on yield/plot *via* vine length (0.074), number of primary branches per vine (-0.029), number of node per vine (0.103) and days to first harvesting (0.062). Fruit girth had showed significant positive correlation (0.851) with yield/plot. It had negative direct effect on yield/plot (-0.028) but indirect effect on yield/plot *via* vine length (0.020), number of primary branches per vine (-0.009), number of node per vine (0.025), days to first harvesting (0.018) and fruit length (-0.26). Average fruit weight shows significant positive correlation (0.945) with yield/plot. It had positive direct effect on yield/plot (0.567) but indirect effect on yield/plot *via* vine length (-0.404), number of primary

branches per vine (0.203), number of node per vine (-0.528), days to first harvesting (-0.342), fruit length (0.560) and Fruit girth (0.537). Number of fruit per vine had showed highly significant positive correlation (0.727) with yield/plot. Positive direct effect on yield/plot (0.727) indirect effect on yield/plot *via* vine length (-0.539), number of primary branches per vine (0.676), number of node per vine (-0.335), days to first harvesting (-0.570), fruit length (0.310), Fruit girth (0.341) and average fruit weight (0.377).

**Table 2:** Direct (diagonal) and indirect effects of component traits attributing to yield per plot in bottle gourd at phenotypic level

| | VLe | NoPB/V | NNo/V | DFH | FrLe | FrDi | AFrW | NFr/V |
|---|---|---|---|---|---|---|---|---|
| VLe | 0.078 | -0.003 | 0.009 | -0.050 | 0.074 | 0.020 | -0.405 | -0.539 |
| NoPB/V | -0.062 | 0.004 | -0.004 | 0.044 | -0.029 | -0.009 | 0.203 | 0.676 |
| NNo/V | 0.059 | -0.001 | 0.012 | -0.036 | 0.103 | 0.025 | -0.528 | -0.335 |
| DFH | 0.075 | -0.003 | 0.008 | -0.052 | 0.062 | 0.018 | -0.342 | -0.570 |
| FrLe | -0.052 | 0.001 | -0.011 | 0.029 | -0.111 | -0.026 | 0.560 | 0.310 |
| FrDi | -0.057 | 0.001 | -0.011 | 0.033 | -0.105 | -0.028 | 0.537 | 0.341 |
| AFrW | -0.055 | 0.001 | -0.011 | 0.031 | -0.109 | -0.026 | 0.567 | 0.377 |
| NFr/V | 0.058 | 0.003 | -0.005 | 0.040 | -0.047 | -0.013 | 0.294 | 0.727 |
| Y/P | -0.816** | 0.885** | -0.759* | -0.885** | 0.733* | 0.851* | 0.945* | 0.727** |

**Characters and their abbreviation in parenthesis**

Vine length in meter (VLe), No of primary branches per vine (NoPB/V), Number of node per vine (NNo/V), Days to first harvesting (DFH), Fruit Length cm (FrLe), Fruit girth in cm (FrDi), Average fruit weight in kg (AFrW), No of fruit per vine (NFr/V), Yield/ Plot (Y/P)

## Conclusion

The phenotypic correlation coefficients were in general higher than their corresponding genotypic correlation coefficient. At phenotypic level, yield per plot, had significant positive correlation with number of primary branches per vine, number of fruit per vine. In bottle gourd, there was remarkable negative correlation vine length and days of first harvesting. Thus we can say that almost growth train and fruit characters parameter have direct influence on yield. The phenotypic path analysis of the different characters revealed that number of fruit per vine expressed maximum direct positive effect towards yield per plot followed by fruit weight, number of node per vine, vine length and number of primary branches per vine. These negative direct effects on yield per plot should be avoided for direct selection. Instead, indirect selection would be more promising method to be used. Maximum indirect positive effect was contributed *via* number of fruit per vine followed by fruit length and fruit diameter towards yield per plot.

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