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Study about correlation and direct and indirect effect of various traits on Fruit yield of Brinjal (*Solanum melongena* L.)

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ABSTRACT

The experiment was conducted to estimate the correlation and direct and indirect effect of various yield attributing traits on fruit yield in brinjal, during the Rabi season of 2022-23 at the Department of Vegetable Science C.S. Azad University of Agriculture and Technology, Kanpur, Utter Pradesh, India. The results showed that the highest significant, positive and direct effect on yield per plant was exerted by average fruit weight (0.7705) followed by number of fruit per plant (0.6879, fruit length (0.2776) and fruit circumference (0.1880). Negative direct effect on fruit yield per plant was exerted by plant height (-0.1462) and day of first fruit harvest after transplanting (-0.1216) while number of primary branches per plant and number of secondary branches per plant showed low, negative and direct effect. The study concluded that selection for fruit circumference, average fruit weight, number of fruit per plant and fruit length will be more effective than other traits for fruit yield per plant.

Key words: *Brinjal, Correlation, Path analysis, Fruit yield.*

Introduction

Brinjal is most important solanacious vegetable crops after potato, tomato and chili in India and world. It is also known as Aubergine and eggplant. It has diploid chromosome number 2n=2x=24. Primary center of origin of Brinjal is India and Secondary center of origin is China. It is grown in different climatic condition from tropical region to subtropical region of Asia and Sub-Saharan Africa. Mostly cultivated species of brinjal are esculentum (round and egg-shaped), serpentinum (long and slender type), and depressum (all other early dwarf brinjal cultivars).

In plant breeding the development of high yielding, biotic and abiotic stress resistant variety is prime objective. The mostly economical traits are quantitative in nature and controlled by more than one genes. The high yield is dependent on several other characters or variable, for example the yield is associated with fruit weight, number of fruit, the number of branch on which fruit develop etc. This relationship between different characters may be direct or indirect ex. The high/fruit yield per plant is directly related with weight and number of fruit per plant but number of secondary branches is not directly related with yield. It affects yield indirectly via producing more number of leaves which pro-

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vide more photosynthates and place for producing more number of fruitd. For knowing association between such characters correlation coefficient is an important tool while path coefficient split the correlation coefficient into direct and indirect contribution of various independent characters on dependent characters, this tools provide précises knowledge of effect of various characters on yield.

Materials and Methods

The present study was conducted at the Department of Vegetable Science C. S. Azad University of Agriculture and Technology, Kanpur, Utter Pradesh, India, during the Rabi season of 2022-23. Ten brinjal varieties, viz., Kalyanpur T-3, Azad B-2, Azad B-3, Azad B-4, Azad Kranti, KS-449, KS-421, KS-451, KS-448 and Azad B-1 were crossed to obtain F1 hybrids. The F1 was evaluated in a randomized block design with three replications. Each plot consisted of five rows of five plants each. The spacing between rows and plants was 60 cm and 45 cm, respectively and performed all agronomical practices as usual. Five randomly selected plants was used for taking observation on the yield and yield attributing characters viz, days to 50 % flowering after transplanting, days of first fruit harvest after transplanting, number of primary branches per plant, number of secondry branches per plant, plant height, number of fruit per plant, average fruit weight, fruit weight/yield per plant, fruit length, fruit circumference and fruit TSS. The mean over of three replications for each character was subjected to statistical analysis. The phenotypic and genotypic correlation was estimated by Al-jibouri *et al.* (1958) and path phenotypic and genotypic coefficient by Dewey and Lu (1959)

Correlation equation

Genotypic correlation $[r_{xys}(g)]$ =

$$\frac{\text{Cov. xy (g)}}{\sqrt{[\text{Vx (g) Vy (g)}]}}$$

Phenotypic correlation $[r_{xy}(p)]$ =

$$\frac{\text{Cov. xy (p)}}{\sqrt{[\text{Vx (p) Vy (p)}]}}$$

where,

Cov.xy (g) and Cov. xy (p) = genotypic and phenotypic covariances, respectively.

Path coefficient equation

The equations used are as follows:

$$r_{ij} = P_{iy} + \sum_{j=1}^{10} r_{ij} P_{iy} \text{ for i = 1,2,…….10}$$

$$r_{ij} = \sum_{j=1}^{10} r_{ij} P_{iy} \text{ for} r_{ij} = 1$$

Residual factor was calculated as follows:

$$P_{xyss} = \sqrt{1 - R^2}$$

$$R^2 = \sum_{j} P_{iy}\, r_{ij}$$

Where,

- The r_{ij} i.e. $r_{1.1}$ to $r_{9,10}$ denote correlations between all possible combinations of independent characters P_{1y} to P_{10y} denote direct effects of various characters on character y.
- r_{iy} = Correlation coefficient between i^{th} and y characters.
- P_{iy} = Direct effect of i^{th}character on y.

Results and Discussion

The association observed in F_1 for the trait is presented in Table 1 fruit yield per plant exhibited correlation from 0.659 (average fruit weight) to -0.232 (days of first fruit harvest). It is highly significant and positive correlation with average fruit weight (0.659), fruit length (0.624), fruit circumference (0.250) and number of fruit per plant (0.207); number of secondary branches per plant (0.096) exhibited positive non-significant association; days of first fruit harvest showed negative and significant association (-0.232), plant height (-0.133), days of 50% flowering after transplanting(-0.122), exhibited negative and non-significant association with fruit yield per plant Jadhao and Thaware (2009), Singh *et al.* (2010), Chaudhary *et al.* (2013), Banerjee *et al.* (2018).

Fruit yield per plant association vary from 0.643 (average fruit weight) to -0.120 (plant height). It is presented in Table 2. It showed positive and significant association with average fruit weight (0.643), fruit length (0.595), fruit circumference (0.238), number of fruit per plant (0.219); Same finding also observed by Singh *et al.* (2010), Banerjee *et al*. (2018) for days of first fruit harvest after transplanting (-0.216) showed negative and significant association. Same result was also reported by Sajjan *et al.* (2021), Khan

Table 1. Estimation of Genotypic correlation for 11 characters in Brinjal

Parent/ Hybrids	Days of 50% flowering after TP	Days of First Fruit Harvest after TP	Plant height (cm)	Number of Primary Branches per plant	Number of Secondry Branches per plant	Fruit Length (cm)	Average Fruit weight (g)	Number of fruit per plant	Fruit Circum-ference (cm)	Fruit T.S.S.	Fruit weight per plant (Kg)
Days of 50% flowering after TP	1.000	0.182*	0.029	0.053	0.179*	-0.216**	-0.041	-0.026	-0.103	-0.100	-0.122
Days of First Fruit Harvest after TP			-0.152	-0.189*	-0.027	-0.056	-0.045	-0.174*	0.097	-0.131	-0.232**
Plant Height (cm)				0.353**	0.080	0.379**	-0.514**	0.612**	-0.606**	0.129	-0.133
No of Primary Branches /plant					0.237**	0.063	-0.305**	0.394**	-0.277**	0.356**	-0.091
No of Secondry Branches /plant						0.102	0.065	0.096	-0.028	0.407**	0.096
Fruit Length (cm)							0.140	0.489**	-0.169*	-0.048	0.624**
Average Fruit weight (g)								-0.519**	0.592**	-0.075	0.659**
Number of fruit per plant									-0.639**	0.110	0.207**
Fruit Circumference (cm)										0.087	0.250**
Fruit T.S.S.											-0.010
Fruit weight per plant (Kg)											1.000

*, ** significant at 5% and 1% level, respectively

Table 2. Estimation of phenotypic correlation for 11 characters in Brinjal.

Parent/Hybrids	Days of 50% flowering after TP	Days of First Fruit harvest after TP	Plant height (cm)	Number of Primary Branches per plant	Number of Secondary Branches per plant	Fruit Length (cm)	Average Fruit weight (g)	Number of fruit per plant	Fruit Circum-ference (cm)	Fruit T.S.S.	Fruit weight per plant Kg)
Days of 50% flowering after TP	1.000	0.174*	0.024	0.035	0.157*	-0.174*	-0.043	-0.020	-0.098	-0.073	-0.116
Days of First Fruit Harvest after TP			-0.144	-0.148	-0.026	-0.066	-0.045	-0.165*	0.088	-0.076	-0.216**
Plant Height (cm)				0.256**	0.080	0.362**	-0.502**	0.593**	-0.591**	0.112	-0.120
No of Primary Branches /plant					0.179*	0.032	-0.213**	0.248**	-0.179*	0.221**	-0.072
No of Secondry Branches /plant						0.095	0.062	0.081	-0.026	0.347**	0.087
Fruit Length (cm)							0.126	0.471**	-0.163*	-0.016	0.595**
Average Fruit weight (g)								-0.506**	0.576**	-0.063	0.643**
Number of fruit per plant									-0.611**	0.111	0.219**
Fruit Circumference (cm)										0.065	0.238**
Fruit T.S.S.											0.002
Fruit weight per plant (Kg)											1.000

*, ** significant at 5% and 1% level, respectively

Table 3. Estimation of direct and indirect effect of 11 characters on fruit yield/ plant in brinjal.

Parent/Hybrids	Days of 50% flowering after TP	Days of first fruit harvest after TP	Plant height (cm)	Number of primary branches per plant	Number of secondry branches per plant	Fruit length (cm)	Average fruit weight (g)	Number of fruit per plant	Fruit Circum-ference (cm)	Fruit T.S.S.	Fruit weight per plant (Kg)
Days of 50% flowering after TP	**0.0433**	-0.0221	-0.0042	-0.0034	-0.0058	-0.0601	-0.0313	-0.0176	-0.0194	-0.0012	-0.122
Days of First Fruit Harvest after TP	0.0079	**-0.1216**	0.0222	0.0120	0.0009	-0.0156	-0.0346	-0.1196	0.0182	-0.0016	-0.232**
Plant Height (cm)	0.0013	0.0185	**-0.1462**	-0.0224	-0.0026	0.1051	-0.3957	0.4213	-0.1139	0.0016	-0.133
No of Primary Branches /plant	0.0023	0.0230	-0.0516	**-0.0634**	-0.0077	0.0175	-0.2351	0.2713	-0.0521	0.0044	-0.091
No of Secondry Branches /plant	0.0077	0.0032	-0.0117	-0.0150	**-0.0323**	0.0283	0.0503	0.0662	-0.0053	0.0051	0.096
Fruit Length (cm)	-0.0094	0.0068	-0.0554	-0.0040	-0.0033	**0.2776**	0.1078	0.3363	-0.0317	-0.0006	0.624**
Average Fruit weight (g)	-0.0018	0.0055	0.0751	0.0194	-0.0021	0.0388	**0.7705**	-0.3571	0.1114	-0.0009	0.659**
Number of fruit per plant	-0.0011	0.0211	-0.0896	-0.0250	-0.0031	0.1357	-0.4000	**0.6879**	-0.1201	0.0014	0.207**
Fruit Circumference (cm)	-0.0045	-0.0118	0.0886	0.0176	0.0009	-0.0468	0.4564	-0.4393	**0.1880**	0.0011	0.250**
Fruit T.S.S.	-0.0043	0.0159	-0.0188	-0.0226	-0.0131	-0.0134	-0.0579	0.0756	0.0163	**0.0124**	-0.010

*, ** significant at 5% and 1% level, respectively

et al. (2023).

Path coefficient analysis was done to resolve the direct and indirect effects of different characters on fruit yield per plant and is presented in Table 3. The highest significant, positive and direct effect on yield per plant was exerted by average fruit weight (0.7705) followed by number of fruit per plant (0.6879, fruit length (0.2776) and fruit circumference (0.1880) similar observation also recorded by Chitra *et al.* (2020) Bansal and Mehata (2008), Jadhao and Thaware (2009). However, negative direct effect on fruit yield per plant was exerted by plant height (-0.1462) Madhavi *et al.* (2016), Tiwari *et al.*(2019) day of first fruit harvest after transplanting (-0.1216) while number of primary branches per plant and number of secondary branches per plant showed low, negative and direct effect. High, positive and indirect effect on fruit yield per plant was exerted by number of fruit per plant via plant height (0.4213), fruit length (0.3363) and number of primary branches per plant (0.2713); plant height via number of secondary branches (0.1051); average fruit weight via fruit length (0.1078). Bansal and Mehata, (2008); Chithra *et al.* (2020). The remaining estimates of the indirect effects in the analysis were too low to be considered and the estimate of residual effect (0.0847). similar finding was recorded by Banerjee *et al.* (2018). The low estimates of residual effect indicate role of other possible independent characters on fruit yield was low.

Conclusion

The correlation at genotypic level was significant and high than genotypic level for fruit circumference, average fruit weight, number of fruit per plant and fruit length and significant, direct and positive effect of fruit circumference, average fruit weight, number of fruit per plant on fruit yield per plant indicated the selection for such traits will be more e effective than other traits for fruit yield per plant.

Conflict of interest

None

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