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Path Coefficient Analysis for Yield and Yield Attributing Characters in Advanced Breeding Lines of Brinjal (*Solanum melongena* L.)

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ABSTRACT

A field experiment was conducted to evaluate thirty advanced breeding lines of brinjal at College of Horticulture, Mudigere, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka during *rabi* season 2021-2022.The experiment was laid out in Randomized Block Design with three replications. The observations were recorded on twelve quantitative traits. The analysis of data revealed the presence of considerable amount of variability for all the characters studied. High magnitude of positive direct effect on total fruit yield per plant was exhibited by the character number of fruits per plant (1.0178) followed by average fruit weight (0.4592), plant height at 60 days after transplanting (DAT) (0.2138), plant height at 90 DAT (0.0231), number of fruits per cluster (0.1532) and fruit diameter (0.0488). The negative direct effect on total fruit yield per plant was showed by number of primary branches at 60 DAT (-0.0770), number of flowers per cluster (-0.2251), fruit setting percentage (-0.0467) and fruit length (-0.0069). Thus, these could be used as a traits of interest for indirect selection to improve total yield per plant in the further breeding program.

Keywords Path analysis, Brinjal, Genotypic levels, Positive direct effects, Negative direct effects

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INTRODUCTION

Eggplant (*Solanum melongena* L.) is an important nutritive vegetable belonging to the Solanaceae family having a diploid chromosome number of 2n=2x=24. It is also known as brinjal, aubergine or guinea squash are widely cultivated in the tropics, subtropics and temperate regions. The fruit of some varieties with an egg-like shape given rise to the name “eggplant”. It has high nutritive value, high market demand and is the most cost-effective and profitable among other vegetables and usually finds its place as the poor man’s crop. It is also known as the “King of vegeta-

bles" for its versatile uses in Indian cuisine. Brinjal is grown on commercial scale in India, China, Turkey, Japan, Egypt, Italy, Indonesia, Iraq, Syria, Spain, Philippines, Bulgaria and USA. In India, Brinjal is grown with an area of 7.36 million hectares with the production of 1.28 million MT (Anon 2020). In Karnataka, brinjal covers an area of 11,294 hectares with the production of 3,00,521 metric tonnes and productivity is 26.61 metric tonnes per hectare (Anon 2020). Haveri, Belagavi, Kolar, Chikkamagaluru and Mandya districts are the major brinjal growing belts in Karnataka.

Brinjal fruits are a fairly good source of Calcium, Phosphorus, Iron, and Vitamins, particularly the `B' group. Brinjal is reported to stimulate the intra-peptic metabolism of blood cholesterol. Aqueous extracts of fruit inhibit choline esterase activity of human plasma. Dry fruit is reported to contain goitrogenic principles and fruits are an excellent remedy for those suffering from liver troubles. Brinjal fruits fried in sesame oil is an excellent remedy for toothache and white brinjal is said to be a remedy for diabetic patients. Brinjal is usually a self-pollinated, but the extent of cross-pollination has been reported as high as 48% due to heterostyly and hence it is classified as an often-cross pollinated crop.

Path co-efficient analysis are the important biometrical technique to determine the yield components. The characters that are positively correlated with yield are of considerably important to plant breeder for selection purpose. Path analysis is an important tool for partitioning the correlation coefficients into direct and indirect effects of an independent variable on a dependent variable or it simply measures the direct and indirect contribution of various independent characters on a dependent character. The degree of influence of one variable on the other can be expressed in quantitative terms with the help of path analysis. The concept of path analysis was originally developed by Wright (1921) but the technique was first used for plant selection by Dewey and Lu (1959).

Keeping in view the importance of these, the present research work has been formulated to find out the direct and indirect effect through path analysis using thirty advanced breeding lines of brinjal.

MATERIALS AND METHODS

The current research was done at the College of Horticulture, Mudigere, Karnataka during *rabi* season 2021-22. Thirty advanced breeding lines of brinjal along with five checks (Arka Neelanchal Shyama, Mattigulla, Devanur Local, Arka Keshav, Arka Harshitha) were evaluated in Randomized Complete Block Design with three replications. Thirty days old seedlings from the nursery beds were transplanted in the main field adopting a spacing of 75 cm × 60 cm. All the recommended cultural practices and plant protection measures were followed. Observations were recorded from five randomly selected tagged plants of each line in each replication for twelve quantitative

Table 1. Analysis of variance for yield and yield attributes in advanced breeding lines of brinjal.

Sl. No.	Source of variation / Characters	Replication	Treatments (Breeding lines)	Error	SEm ±	CD @ (5%)
	Degrees of freedom	2	34	68		
1	Plant height at 60 DAT (cm)	13.49	106.78**	4.58	1.24	3.49
2	Plant height at 90 DAT (cm)	2.63	111.16**	5.33	1.33	3.76
3	Number of primary branches (60 DAT)	1.92	11.94**	0.54	0.42	1.19
4	Number of primary branches (90 DAT)	0.07	15.13**	0.32	0.33	0.92
5	Number of flowers per cluster	0.17	2.91**	0.06	0.15	0.41
6	Number of fruits per cluster	0.01	1.18**	0.03	0.10	0.29
7	Fruit setting percentage	26.20	248.21**	7.55	1.59	4.48
8	Fruit length (cm)	1.33	16.73**	0.36	0.35	0.98
9	Fruit diameter (mm)	0.59	228.76**	6.21	1.44	4.06
10	Number of fruits per plant	1.01	127.94**	1.40	0.68	1.93
11	Average fruit weight (g)	4.32	429.26**	9.07	1.74	4.91
12	Fruit yield per plant (kg)	0.00	0.13**	0.00	0.03	0.08

**Significance @ 1%, AT – Days after transplanting.

Table 2. Estimates of genotypic path matrix of total fruit yield per plant in advanced breeding lines of brinjal.

Traits	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}
X_1	0.2138	0.0197	-0.0478	0.0047	-0.0694	0.0895	-0.0308	-0.0020	0.0056	0.7825	-0.1962
X_2	0.1819	0.0231	-0.0596	0.0049	-0.0268	0.0593	-0.0247	-0.0004	0.0048	0.8272	-0.2319
X_3	0.1328	0.0179	-0.0770	0.0056	-0.0386	0.0702	-0.0237	-0.0012	0.0053	0.7540	-0.1928
X_4	0.1254	0.0142	-0.0536	0.0081	-0.1129	0.0984	-0.0232	-0.0002	-0.0015	0.7531	-0.2623
X_5	0.0660	0.0027	-0.0132	0.0040	-0.2251	0.1151	-0.0047	-0.0011	-0.0057	0.3595	-0.1174
X_6	0.1249	0.0089	-0.0352	0.0052	-0.1691	0.1532	-0.0326	-0.0018	0.0035	0.6633	-0.1465
X_7	0.1409	0.0122	-0.0391	0.0040	-0.0228	0.1069	-0.0467	-0.0016	0.0132	0.7185	-0.1223
X_8	0.0628	0.0015	-0.0139	0.0003	-0.0370	0.0407	-0.0110	-0.0069	-0.0013	0.0807	0.1281
X_9	0.0248	0.0023	-0.008	-0.0002	0.0265	0.0109	-0.0127	0.0002	0.0488	0.1143	0.1647
X_{10}	0.1644	0.0188	-0.0570	0.0059	-0.0795	0.0998	-0.0330	-0.0005	0.0054	1.0178	-0.3031
X_{11}	-0.0913	-0.0117	0.0323	-0.0046	0.0575	-0.0488	0.0124	-0.0019	0.0175	-0.6718	0.4592
X_{12}	0.770**	0.758**	0.653**	0.545**	0.180^{NS}	0.574**	0.763**	0.244*	0.371**	0.839**	-0.251**

Diagonal values indicate direct effect, Residual effect – 0.09673.

X_1 = Plant height - 60 DAT
X_2= Plant height - 90 DAT
X_3= Number of primary branches – 60 DAT
X_4= Number of primary branches – 90 DAT
X_5 = Number of flowers per cluster
X_6 = Number of fruits per cluster
X_7 = Fruit setting percentage
X_8 = Fruit length
X_9 = Fruit diameter
X_{10} = Number of fruits per plant
X_{11}= Average fruit weight
X_{12} = Fruit yield per plant

characters and subjected to statistical analysis. Analysis of variance of the data for the component traits was analyzed as per the model given by Panse and Sukhatme (1967). The path coefficient analysis was carried out as per the method suggested by Dewey and Lu (1959).

RESULTS AND DISCUSSION

In the present investigation, significant differences were observed among all the characters providing scope of improvement in brinjal for yield traits (Table 1). The path coefficient analysis was carried out by taking fruit yield per plant as dependent variable and other components as independent variables from phenotypic and genotypic correlation coefficients to resolve direct and indirect effects of eleven characters on total fruit yield per plant. The direct and indirect effects of different characters on total fruit yield at phenotypic and genotypic level has been presented in Tables 2–3.

The result of path coefficient analysis indicated that at the genotypic levels, the maximum direct positive effect on fruit yield per plant was exerted by the character number of fruits per plant followed by average fruit weight, plant height at 60 DAT, plant height at 90 DAT, number of fruits per cluster and fruit diameter. Therefore, direct selection for these traits would reward for improvement of yield. While, number of primary branches at 60 DAT, number of flowers per cluster, fruit setting percentage and fruit length contributed negatively towards fruit yield per plant. Therefore during selection these characters should also be taken into consideration. These results are in agreement with the work of Sajjan *et al.* (2021), and Sakriya *et al.* (2022).

At phenotypic level among the various characters studied, number of fruits per plant had the highest positive direct effects on the yield per plant followed by average fruit weight, fruit setting percentage, plant height at 60 DAT, plant height at 90 DAT, number of flowers per cluster and fruit diameter. The negative direct effect on total fruit yield per plant was showed by number of primary branches at 60 DAT, number of primary branches at 90 DAT, number of fruits per cluster and fruit length. Therefore, direct selection for these traits would reward for improvement of yield. These results are in agreement with the work of Chithra *et al*. (2020) and Upadhyay *et al*. (2021).

It can be concluded that number of fruits per plant, followed by average fruit weight, plant height at 60 DAT, plant height at 90 DAT, number of flowers per cluster, number of fruits per cluster and fruit

Table 3. Estimates of phenotypic path matrix of total fruit yield per plant in advanced breeding lines of brinjal.

Traits	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}
X_1	0.1509	0.0815	-0.0017	-0.0013	0.0228	-0.0998	0.1406	-0.0009	0.0065	0.5725	-0.1729
X_2	0.1160	0.1059	-0.0021	-0.0013	0.0102	-0.0709	0.1174	-0.0001	0.006	0.5900	-0.1929
X_3	0.0830	0.0705	-0.0031	-0.0016	0.0108	-0.0715	0.1031	-0.0005	0.0061	0.5568	-0.1669
X_4	0.0783	0.0576	-0.0020	-0.0025	0.0366	-0.1142	0.1138	-0.0001	-0.0029	0.5796	-0.2399
X_5	0.0430	0.0135	-0.0004	-0.0011	0.0803	-0.1373	0.0187	-0.0005	-0.0055	0.2615	-0.0990
X_6	0.0793	0.0395	-0.0012	-0.0015	0.0580	-0.1900	0.1697	-0.0009	0.0047	0.4974	-0.1322
X_7	0.0879	0.0516	-0.0013	-0.0011	0.0062	-0.1336	0.2412	-0.0008	0.0152	0.5401	-0.1156
X_8	0.0407	0.0054	-0.0005	-0.0001	0.0116	-0.0494	0.0582	-0.0036	-0.0020	0.0618	0.1104
X_9	0.0158	0.0101	-0.0003	0.0001	-0.0070	-0.0143	0.0587	0.0001	0.0625	0.0764	0.1518
X_{10}	0.1062	0.0769	-0.0021	-0.001	0.0258	-0.1162	0.1603	-0.0002	0.0058	0.8129	-0.2829
X_{11}	-0.0598	-0.0468	0.0012	0.0013	-0.0182	0.0575	-0.0639	-0.0009	0.0217	-0.5270	0.4364
X_{12}	0.698**	0.678**	0.587**	0.504**	0.173^{NS}	0.523**	0.690**	0.233*	0.354**	0.785**	-0.198*

Diagonal values indicate direct effect, Residual effect – 0.17231.

X_1 = Plant height - 60 DAT
X_2= Plant height - 90 DAT
X_3= Number of primary branches – 60 DAT
X_4= Number of primary branches – 90 DAT
X_5 = Number of flowers per cluster
X_6 = Number of fruits per cluster
X_7 = Fruit setting percentage
X_8 = Fruit length
X_9 = Fruit diameter
X_{10} = Number of fruits per plant
X_{11}= Average fruit weight
X_{12} = Fruit yield per plant

diameter were the major contributing characters towards fruit yield per plant and selection based on these characters can be effective for developing high yielding brinjal varieties.

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