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Correlation and path analysis in segregating population of brinjal (*Solanum melongena* L.)

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Abstract

The experiment was undertaken to study the correlation and path analysis in 300 F₂ segregating population of the bi-parental cross Surya × Harita for 12 different quantitative characters. The correlation study indicated that the total yield per plant had a positive and significant association with plant height, number of primary branches, number of flowers per cluster, number of fruits per cluster, fruit diameter, fruit length, average fruit weight and number of fruits per plant. The genetic improvement of fruit yield can be obtained by selection of these yield components. Path analysis revealed that the characters number of fruits per plant, average fruit weight, plant height, fruit length, fruit set percentage, fruit diameter, number of flowers per cluster, days to first picking had high positive direct effect on fruit yield per plant. Thus, the fruit yield per plant can be improved by making direct selection of these characters.

Keywords: Brinjal, F₂ population, correlation, path analysis

Introduction

Brinjal (*Solanum melongena* L.) commonly known as eggplant or aubergine is an important solanaceous vegetable crop of tropics and sub-tropics. Recent production data has revealed that India ranks second in brinjal production next to China with an area of 7.3 lakh hectares with the production of 128.01 lakh tonnes and the productivity is 17.54 tonnes per hectare (Anon, 2018) [3]. In Karnataka, brinjal covers an area of 0.16 lakh hectares with the production of 4.09 lakh tonnes and productivity is 25.31 tonnes per hectare (Anon, 17) [2]. It is grown for its immature, unripe fruits which are used as cooked vegetable in variety of ways and dried shoots are used as fuel in rural areas. It is popular among people of all social strata and hence, it is rightly called as vegetable of masses (Patel and Sarnaik, 2003) [12].

However, yield is a complex character, its direct improvement is difficult. Knowledge is respect of the nature and magnitude of associations of yield with various component characters is a pre-requisite to bring improvement in the desired direction. A crop breeding programme, aimed at increasing the plant productivity requires consideration not only of yield but also of its components that have a direct or indirect bearing on yield. The correlation study describe the degree of association between independent and dependent variables. Path coefficient analysis measures the direct influence of one variable upon another and permits the separation of correlation coefficient into components of direct and indirect effects. Hence, the present investigation was undertaken to study the association of characters and their direct and indirect effects with respect to yield and its related traits.

Material and Methods

The present research was carried out at the experimental block of Department of Vegetable Science, College of Horticulture, Mudigere during the *rabi* season of 2018-19. The experiment consists of 300 F₂ plants derived from the bi-parental cross Surya × Harita along with their parents, F₁ hybrids and four checks *viz.*, Arka Harshitha, Arka Keshav, Arka Kusumakar and Devanur Local were evaluated for yield and yield components. The experiment was laid out in a Augmented Block Design. The seeds were sown with a spacing of 60 × 45 cm and all the cultural practices followed as per the package of practices. Data was recorded on all the F₂ plants, ten randomly selected plants in each of the checks, parents and F₁ hybrids.

The observations were recorded on plant height (cm), number of primary branches, days to first flowering, number of flowers per cluster, number of fruits per cluster, fruit set percentage, days to first picking, fruit length (cm), fruit diameter (mm), average fruit weight (g), number of fruits per plant and fruit yield per plant (kg). Data was analyzed to estimate correlation as well as direct and indirect effects as per the methods of Al-Jiboure *et al.* (1958) [1] and Dewey and Lu (1959) [7] respectively.

Result and Discussion**Correlation coefficient analysis**

Estimates of correlation coefficient analysis for 12 different characters in F₂ segregating population of the bi-parental cross Surya × Harita are presented in the Table 1. From the results of F₂ segregating population of the cross Surya × Harita, total yield per plant had a positive and significant association with plant height (0.40), number of primary branches (0.45), number of flowers per cluster (0.25), number of fruits per cluster (0.28), fruit length (0.14), fruit diameter (0.45), average fruit weight (0.51), number of fruits per plant (0.80). These could be used as traits of interest for indirect selection to improve total yield per plant in the further breeding programme. These results are in close proximity with the results of Thangamani and Jhansirani (2012) [15], Mamatha *et al.* (2016) [9], Raval *et al.* (2017) [13], Sujin *et al.* (2017) [14] and Devaraju *et al.* (2020) [5]. However, total yield per plant has shown negative and significant correlation with days to first flowering (-0.12) and days to first picking (-0.13). Similar results were reported by Lohakare *et al.* (2008) [8]. It also showed non-significant correlation with fruit set percentage (0.03) which is in accordance with the findings of Sujin *et al.* (2017) [14].

Path coefficient analysis

The path coefficient analysis for 12 different characters in F₂ segregating population of the bi-parental cross Surya × Harita are presented in Table 2. The result of path analysis revealed that the characters number of fruits per plant (0.8006), average fruit weight (0.4950), plant height (0.0563), fruit length (0.0431), fruit set percentage (0.0392), fruit diameter (0.0288), number of flowers per cluster (0.0124), days to first picking (0.0100) had maximum positive direct effect on fruit yield per plant. Thus the higher magnitude of the positive direct effect of these traits explains the higher value of association between these traits and fruit yield per plant. Therefore, direct selection for these traits would reward for improvement of yield while the number of primary branches per plant (-0.0449), days to first flowering (-0.0073) and number of fruits per cluster (-0.0343) were negatively contributed towards yield per plant. The results are in accordance with the reports of Muniappan *et al.* (2010) [10], Nayak and Nagre (2013) [11], Banerjee *et al.* (2018) [4] and Devaraju *et al.* (2020) [6].

Table 1: Estimates of phenotypic and genotypic correlation coefficients for 12 different characters in F₂ segregating population of the cross Surya × Harita

	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀	X ₁₁	X ₁₂
X ₁	1.00	0.50**	-0.20**	0.37**	0.19**	-0.12*	-0.21**	-0.001	0.22**	0.17**	0.35**	0.40**
X ₂		1.00	-0.25**	0.23**	0.15**	-0.07	-0.25**	0.001	0.33**	0.26**	0.41**	0.45**
X ₃			1.00	-0.05	-0.02	0.03	0.97**	-0.04	-0.20**	-0.01	-0.08	-0.12*
X ₄				1.00	0.34**	-0.51**	-0.05	-0.05	0.14*	-0.05	0.35**	0.25**
X ₅					1.00	0.60**	-0.04	-0.05	0.11	0.18**	0.24**	0.28**
X ₆						1.00	0.01	0.01	-0.01	0.18**	-0.09	0.03
X ₇							1.00	-0.04	-0.22**	-0.10	-0.10	-0.13*
X ₈								1.00	0.12*	0.29**	-0.07	0.14*
X ₉									1.00	0.36**	0.31**	0.45**
X ₁₀										1.00	-0.01	0.51**
X ₁₁											1.00	0.80**
X ₁₂												1.00

Critical r_p value at 5% = 0.1133* Significant at p=0.05 Critical r_p value at 1% = 0.1485 ** Significant at p=0.01

X₁= Plant height (cm)

X₂= Number of primary branches

X₃= Days to first flowering

X₄= Number of flowers per cluster

X₅= Number of fruits per cluster

X₆= Fruit set percentage

X₇= Days to first picking

X₈= Fruit length (cm)

X₉= Fruit diameter (mm)

X₁₀= Average fruit weight (g)

X₁₁= Number of fruits per plant

X₁₂= Fruit yield per plant (kg)

Table 2: Direct and indirect effects of various characters on total yield per plant in F₂ segregating population of the cross Surya × Harita at phenotypic level

	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀	X ₁₁
X ₁	0.0563	0.0281	-0.0112	0.0206	0.0104	-0.0070	-0.0116	-0.0001	0.0126	0.0097	0.0195
X ₂	-0.0224	-0.0449	0.0113	-0.0104	-0.0068	0.0030	0.0114	-0.0004	-0.0148	-0.0118	-0.0185
X ₃	0.0014	0.0018	-0.0073	0.0004	0.0001	-0.0002	-0.0070	0.0003	0.0014	0.0007	0.0006
X ₄	0.0045	0.0029	-0.0006	0.0124	0.0042	-0.0064	-0.0006	-0.0006	0.0017	-0.0006	0.0043
X ₅	-0.0064	-0.0052	0.0005	-0.0117	-0.0343	-0.0206	0.0012	0.0016	-0.0037	-0.0062	-0.0082
X ₆	-0.0048	-0.0026	0.0010	-0.0201	0.0235	0.0392	0.0004	0.0004	-0.0005	0.0072	-0.0035
X ₇	-0.0021	-0.0025	0.0097	-0.0005	-0.0004	0.0001	0.0100	-0.0004	-0.0022	-0.0010	-0.0010
X ₈	-0.0001	0.0004	-0.0019	-0.0021	-0.0020	0.0004	-0.0019	0.0431	0.0053	0.0126	-0.0030
X ₉	0.0065	0.0094	-0.0057	0.0039	0.0031	-0.0004	-0.0064	0.0035	0.0288	0.0104	0.0088
X ₁₀	0.0856	0.1301	-0.0457	-0.0240	0.0899	0.0905	-0.0512	0.1444	0.1790	0.4950	-0.0026
X ₁₁	0.2781	0.3300	-0.0654	0.2781	0.1916	-0.0713	-0.0787	-0.0555	0.2459	-0.0042	0.8006
X ₁₂	0.3966	0.4474	-0.1153	0.2466	0.2795	0.0273	-0.1344	0.1362	0.4535	0.5117	0.7971

Diagonal values indicates direct effect

Residual effect = 0.3056

R square = 0.9066

X₁= Plant height (cm)

X₂= Number of primary branches

X₃= Days to first flowering

X₄= Number of flowers per cluster

X₅= Number of fruits per cluster

X₆= Fruit set percentage

X₇= Days to first picking

X₈= Fruit length (cm)

X₉= Fruit diameter (mm)

X₁₀= Average fruit weight (g)

X₁₁= Number of fruits per plant

X₁₂= Fruit yield per plant (kg)

Conclusion

The present investigation revealed that traits like plant height, number of primary branches, number of flowers per cluster, number of fruits per cluster, fruit length, fruit diameter, average fruit weight and number of fruits per plant showed significant and positive correlation with the total yield per plant. The characters number of fruits per plant, average fruit weight, plant height, fruit length, fruit set percentage, fruit diameter, number of flowers per cluster, days to first picking had maximum positive direct effect on fruit yield per plant. Hence, the direct selection may be executed considering these traits as the main selection criteria to reduce indirect effects of the other characters during the development of high-yielding brinjal varieties/hybrids.

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