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## Correlation coefficient and path analysis for yield and its component traits in Brinjal (*Solanum melongena* L.)

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### Abstract

The study conducted to know the association among different morpho-economical traits of brinjal. The experiment comprising forty diverse genotypes, grown in randomized block design with three replications. The experiment was conducted in Randomized Complete Block Design with three replications at the Main Experiment Station, Department of Vegetable Science, Narendra Deva University of Agriculture and Technology Narendra Nagar, (Kumarganj), Ayodhya (U.P.), during autumn-winter season 2016-17. The most important trait, total fruit yield per plant had exhibited highly significant and positive phenotypic correlation with marketable fruit yield per plant (0.9635), followed by unmarketable fruit yield per plant (0.6003), fruits per plant (0.5405), crop duration (0.4345), primary branches per plant (0.3156) and fruit length (0.2426). The higher magnitude of positive direct effect on fruit yield was exerted by marketable fruit yield per plant (0.8423) and unmarketable fruit yield per plant (0.2470) at phenotypic level. However, the positive direct effects of rest of the traits were very low. The negative direct effect on yield by either of the dependent traits were very low. However, plant height and average fruit weight contributed considerable negative direct effects on total fruit yield per plant.

**Keywords:** correlation, path, direct indirect, brinjal, *Solanum melongena*

### Introduction

Brinjal (*Solanum melongena* L.,  $2n=2x=24$ ) belongs to sub genus *Leptostemonum* section *Melongena* of the family *Solanaceae*, sub family *Solanoideae* and Tribe *Solaneae*. It is worldwide known as aubergine or guinea squash which is one of the most popular and major vegetable crop in India and other parts of the world.

Brinjal or egg plant is a perennial but grown commercially as annual crop. Inflorescence is often solitary but some time it constitutes a cluster of 2-5 flowers. Solitary or clustering nature of inflorescence is a varietal character. Flower is complete and hermaphrodite. Heterostyly is a common feature, and fruit setting flower consist of long (70-85%) and medium styled (12-55%) flower. The non-fruit setting flowers consist of short styled and pseudo styled.

Egg plant is usually self-pollinated but the extent of cross-pollination has been reported as high as 29% and hence it is classified as often cross-pollinated or facultative cross-pollinated. Flower generally emerges 40-45 days after transplanting. Anthesis occurs at about 6-8 a.m. in August-September and usually between 9.30-11.15 a.m. during winter (December-January). Stigma receptivity is highest during anthesis *i.e.* flower opening. Anthers usually dehisce 15-20 minutes after the anthesis.

It is easily cultivated in almost all parts of India except higher altitudes. It is a warm season crop and highly susceptible to frost. A long and warm growing season is desirable for successful brinjal production. The main crop of brinjal is raised during autumn- winter season however; some production is obtained during spring-summer season also. But during spring-summer season high temperature (above 35°C) causes drastic reduction in brinjal production due to poor fruit set. The optimum temperature for growth and fruit set is 15.5-21.1°C. Many of the round varieties usually set fruit at slightly lower temperature and are susceptible to frost and long-fruited varieties set fruits at higher temperature and show tolerance to frost.

### Materials and Methods

The study comprised 40 genotypes of Brinjal including four checks. The experiment was conducted in Randomized Complete Block Design with three replications at the Main Experiment Station, Department of Vegetable Science, Narendra Deva University of Agriculture and Technology Narendra Nagar, (Kumarganj), Ayodhya (U.P.), during autumn-winter season 2016-17.

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Each treatment consisted of 20 plants in two rows, having spacing of 75cm x 60cm with net plot size of 6.0x1.5 m<sup>2</sup>. The observations were recorded on twelve quantitative traits *viz.* days to 50% flowering, plant height (cm), primary branches per plant, days to first fruit harvest, crop duration, fruits per plant, fruit length (cm), fruit circumference (cm), average fruit weight (g), marketable fruit yield per plant (kg), unmarketable fruit yield per plant (kg) and total fruit yield per plant (kg) and qualitative traits *viz.* fruit colour, fruit shape and calyx colour.

The correlation coefficient among different traits is evaluated by the formula of Searle, 1961 [9]. The path analysis of important traits was done following Dewey and Lu, 1959 [3]. The residual effect was the variation in the dependent variable assumed to be due to variable(s) not included.

## Results and discussion

In the present study, correlations between twelve characters were worked out in all possible combinations at phenotypic level are presented in Table 1. In general, the magnitudes of genotypic correlation coefficients were similar in nature and higher in magnitude than the corresponding values of the phenotypic correlation coefficients. This indicated a strong genetic association between the traits and the phenotypic expression which was suppressed due to environmental influence.

The most important trait, total fruit yield per plant had exhibited highly significant and positive phenotypic correlation with marketable fruit yield per plant (0.9635), followed by unmarketable fruit yield per plant (0.6003), fruits per plant (0.5405), crop duration (0.4345), primary branches per plant (0.3156) and fruit length (0.2426). Similar results were also reported by Bansal and Mehta (2008) [2], Muniappan *et al.* (2010) [5] and Pandey *et al.* (2016) [6]. Unmarketable fruit yield per plant was significantly and positively correlated with fruits per plant (0.4378), marketable fruit yield per plant (0.3941), primary branches per plant (0.3468), fruit length (0.3087) and crop duration (0.3020). Marketable fruit yield per plant was significantly and positively correlated with fruits per plant (0.4800), crop

duration (0.4081), unmarketable fruit yield per plant (0.3941) and primary branches per plant (0.2462). Average fruit weight is significantly and positively correlated with fruit circumference (0.8677), days to first fruit harvest (0.5127), day to 50% flowering (0.3041), plant height (0.1786). While, negatively and significantly correlated with fruit length (-0.7605) and fruits per plant (-0.7462). Fruits per plant was positively and significantly correlated with fruit length (0.7182), marketable fruit yield per plant (0.4800), unmarketable fruit yield per plant (0.4378), crop duration (0.1859). While, negatively and significantly correlated with average fruit weight (-0.7462), fruit circumference (-0.7043), days to first fruit harvest (-0.3681) and days to 50% flowering (-0.2694). Crop duration was positively and significantly correlated with marketable fruit yield per plant (0.4081), unmarketable fruit yield per plant (0.3020) and fruits per plant (0.1859).

The direct and indirect effects of different characters on total fruit yield at phenotypic level has been presented in Table-2. The genotypic direct and indirect effects of most of the traits were similar in nature and higher in magnitude than the respective phenotypic direct and indirect effects. The higher magnitude of positive direct effect on fruit yield was exerted by marketable fruit yield per plant (0.8423) and unmarketable fruit yield per plant (0.2470) at phenotypic level. However, the positive direct effects of rest of the traits were very low. The negative direct effects on yield by either of the dependent traits were very low. Similar results had also been reported by Pandey *et al.* (2016) [6]. However, plant height (-0.0239) and average fruit weight (-0.0119) contributed negligible negative direct effects on total fruit yield per plant.

Regarding indirect contributions of the traits, characters like fruits per plant (0.4043) and (0.1081) exerted substantial indirect effects *via.* marketable fruit yield per plant and unmarketable fruit yield per plant respectively. However, crop duration (0.3438), unmarketable fruit yield per plant (0.3320), fruit length (0.1487) and primary branches per plant (0.2074) exerted substantial positive indirect effects *via.* marketable fruit yield per plant.

**Table 1.1:** Estimates of phenotypic correlation coefficients among twelve characters in brinjal germplasm

Characters	Plant height (cm)	Primary branches per plant	Days to first fruit harvest	Crop duration	Fruits per plant	Fruit length (cm)	Fruit circumference (cm)	Average fruit weight (g)	Marketable yield per plant (kg)	Unmarketable fruit yield per plant (kg)	Total fruit yield per plant (kg)
Days to 50% flowering	0.2193*	-0.1229	0.5650**	0.1064	-0.2694**	-0.3293**	0.4270**	0.3041**	-0.0783	0.0478	-0.0640
Plant height (cm)		0.1926*	0.3744**	0.0657	-0.0982	-0.0880	0.2420**	0.1786	0.0928	0.0767	0.0841
Primary branches per plant			-0.1204	0.0833	0.0891	0.2702**	-0.0305	0.0363	0.2462**	0.3468**	0.3156**
Days to first fruit harvest				0.0199	-0.3681**	-0.3894**	0.5881**	0.5127**	0.0388	-0.0754	-0.0533
Crop duration					0.1859*	-0.0661	0.1525	0.1477	0.4081**	0.3020**	0.4345**
Fruits per plant						0.7182**	-0.7043**	-0.7462**	0.4800**	0.4378**	0.5405**
Fruit length (cm)							-0.7684**	-0.7605**	0.1766	0.3087**	0.2426**
Fruit circumference (cm)								0.8677**	-0.0035	-0.0884	-0.0341
Average fruit weight (g)									-0.0196	-0.1612	-0.0700
Marketable fruit yield per plant (kg)										0.3941**	0.9635**
Unmarketable fruit yield per plant (kg)											0.6003**

\*- Significant at 5 per cent probability level, \*\*- Significant at 1 per cent probability level

**Table 1.2:** Estimates of genotypic correlation coefficients among twelve characters in brinjal germplasm

Characters	Plant height (cm)	Primary branches per plant	Days to first fruit harvest	Crop duration	Fruit per plant	Fruit length (cm)	Fruit circumference (cm)	Average fruit weight (g)	Marketable yield per plant (kg)	Unmarketable fruit yield per plant (kg)	Total fruit yield per plant (kg)
Days to 50% flowering	0.383	-0.1455	0.7434	0.1786	-0.3333	-0.4217	0.5309	0.3668	-0.1073	0.0232	-0.0874
Plant height (cm)		0.3139	0.6018	0.2728	-0.1376	-0.1453	0.3559	0.2635	0.1620	0.0604	0.1552
Primary branches per plant			-0.1266	0.0914	0.0926	0.2893	-0.0297	-0.0456	0.2761	0.4450	0.3461
Days to first fruit harvest				0.1086	-0.4200	-0.4503	0.6511	0.5843	-0.0515	-0.0370	-0.0610
Crop duration					0.2620	-0.0720	0.1984	0.1845	0.5936	0.5812	0.6356
Fruits per plant						0.7356	-0.7149	-0.7658	0.4793	0.5160	0.5357
Fruit length (cm)							-0.7889	-0.7884	0.1901	0.3662	0.2560
Fruit circumference (cm)								0.8918	-0.0103	-0.0997	-0.0393
Average fruit weight (g)									-0.0212	-0.1995	-0.0719
Marketable fruit yield per plant (kg)										0.5412	0.9768
Unmarketable fruit yield per plant (kg)											0.7235

**Table 2.1:** Direct and indirect effect of eleven characters on fruit yield per plant (kg) at phenotypic level in brinjal

Characters	Days to 50% flowering	Plant height (cm)	Primary branches per plant	Days to first fruit harvest	Crop duration	Fruits per plant	Fruit length (cm)	Fruit circumference (cm)	Average fruit weight (g)	Marketable yield per plant (kg)	Unmarketable fruit yield per plant (kg)	Correlation with total fruit yield per plant (kg)
Days to 50% flowering	-0.0117	-0.0052	-0.0033	0.0129	0.0009	-0.0097	0.0026	0.0074	-0.0036	-0.0659	0.0118	-0.0640
Plant height (cm)	-0.0026	-0.0239	0.0052	0.0085	0.0005	-0.0035	0.0007	0.0042	-0.0021	0.0781	0.0189	0.0841
Primary branches per plant	0.0014	-0.0046	0.0268	-0.0027	0.0007	0.0032	-0.0021	-0.0005	0.0004	0.2074	0.0856	0.3156
Days to first fruit harvest	-0.0066	-0.0089	-0.0032	0.0228	0.0002	-0.0132	0.0030	0.0102	-0.0061	-0.0327	-0.0186	-0.0533
Crop duration	-0.0012	-0.0016	0.0022	0.0005	0.0082	0.0067	0.0005	0.0026	-0.0018	0.3438	0.0746	0.4345
Fruits per plant	0.0032	0.0023	0.0024	-0.0084	0.0015	0.0360	-0.0056	-0.0122	0.0089	0.4043	0.1081	0.5405
Fruit length (cm)	0.0038	0.0021	0.0073	-0.0089	-0.0005	0.0258	-0.0078	-0.0133	0.0091	0.1487	0.0762	0.2426
Fruit circumference (cm)	-0.0050	-0.0058	-0.0008	0.0134	0.0013	-0.0253	0.0060	0.0173	-0.0103	-0.0029	-0.0218	-0.0341
Average fruit weight (g)	-0.0036	-0.0043	-0.0010	0.0117	0.0012	-0.0268	0.0059	0.0150	-0.0119	-0.0165	-0.0398	-0.0700
Marketable fruit yield per plant (kg)	0.0009	-0.0022	0.0066	-0.0009	0.0033	0.0173	-0.0014	-0.0001	0.0002	0.8423	0.0973	0.9635
Unmarketable fruit yield per plant (kg)	-0.0006	-0.0018	0.0093	-0.0017	0.0025	0.0158	-0.0024	-0.0015	0.0019	0.3320	0.2470	0.6003

**Table 2.2:** Direct and indirect effect of eleven characters on fruit yield per plant (kg) at genotypic level in brinjal

Characters	Days to 50% flowering	Plant height (cm)	Primary branches per plant	Days to first fruit harvest	Crop duration	Fruits per plant	Fruit length (cm)	Fruit circumference (cm)	Average fruit weight (g)	Marketable yield per plant (kg)	Unmarketable fruit yield per plant (kg)	Correlation with total fruit yield per plant (kg)
Days to 50% flowering	0.0449	0.0359	0.0109	-0.0912	-0.0181	0.0000	0.0004	-0.0292	0.0413	-0.0908	0.0084	-0.0874
Plant height (cm)	0.0172	0.0936	-0.0235	-0.0738	-0.0277	0.0000	0.0002	-0.0195	0.0297	0.1371	0.0220	0.1552
Primary branches per plant	-0.0065	0.0294	-0.0748	0.0155	-0.0093	0.0000	-0.0003	0.0016	-0.0051	0.2336	0.1620	0.3461
Days to first fruit harvest	0.0334	0.0563	0.0095	-0.1227	-0.0110	0.0000	0.0005	-0.0357	0.0658	-0.0436	-0.0135	0.0610
Crop duration	0.0080	0.0255	-0.0068	-0.0133	-0.1016	0.0000	0.0001	-0.0109	0.0208	0.5022	0.2116	0.6356
Fruits per plant	-0.0150	-0.0129	-0.0069	0.0515	-0.0266	0.0000	-0.0008	0.0393	-0.0863	0.4055	0.1879	0.5357
Fruit length (cm)	-0.0190	-0.0136	-0.0216	0.0553	0.0073	0.0000	-0.0010	0.0433	-0.0888	0.1609	0.1333	0.2560
Fruit circumference (cm)	0.0239	0.0333	0.0022	-0.0799	-0.0201	0.0000	0.0008	-0.0549	0.1005	-0.0087	-0.0363	-0.0393
Average fruit weight (g)	0.0165	0.0247	0.0034	-0.0717	-0.0187	0.0000	0.0008	-0.0490	0.1127	-0.0179	-0.0727	-0.0719
Marketable fruit yield per plant (kg)	-0.0048	0.0152	-0.0207	0.0063	-0.0603	0.0000	-0.0002	0.0006	-0.0024	0.8460	0.1971	0.9768
Unmarketable fruit yield per plant (kg)	0.0010	0.0057	-0.0333	0.0045	-0.0590	0.0000	-0.0004	0.0055	-0.0225	0.4579	0.3641	0.7235

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