Int.J.Curr.Microbiol.App.Sci (2023) *12*(10): 208-213

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 12 Number 10 (2023)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2023.1210.023

Study of Correlation and Path Analysis on Yield and Yield Attributing Parameters in Brinjal (*Solanum melongena* (L).)

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Keywords

Correlation, direct and indirect effects, Brinjal, Solanaceae family

Article Info

Received:
18 August 2023
Accepted:
22 September 2023
Available Online:
10 October 2023

A B S T R A C T

At Dr. YSR Horticultural University in Venkataramannagudem, thirty-two brinjal genotypes were examined during the Rabi 2022–23 growing season in terms of character association and path analysis. The reciprocal relationship between two plant characteristics is evaluated by correlation coefficient analysis, which also identifies the yield components for selection in order to increase yield. According to the results of the current study, fruit yield per plant significantly and favorably correlated with the number of fruits per plant, the percentage of fruits set in long styled flowers, the percentage of fruits set in medium styled flowers, the weight of the fruits, and the duration of the harvest time. Direct selection based on these characteristics could improve fruit yield. In addition, it was found that genotypic correlations were significantly higher than phenotypic correlations, pointing to a strong inborn association between these features. Through path coefficient analysis, the direct and indirect effects of various component attributes on yield were found. The number of fruits per plant, the proportion of fruits set in long-styled flowers, the proportion of fruits set in medium-styled flowers, the length, diameter, and weight of the fruits, as well as the duration of the harvest time, all exhibited positive correlations and direct effects on the number of fruits per plant.

Introduction

Brinjal, a herbaceous perennial in the Solanaceae family that is grown all over the country, is one of the most significant and popular vegetable crops. It goes by the names aubergine and eggplant as well. Unripe, immature fruits are consumed as pickled meals, dried products, or fresh vegetables. Despite being a perennial plant, egg-plant is raised every year for commercial use. Due to its tremendous production potential and consumer accessibility, brinjal is also known as the poor man's vegetable. It has also been proposed as a remedy for liver conditions (Shukla and Naik, 1993). In unani medicine, roots are used to treat pain. India is considered as centre of origin of Brinjal (Vavilov, 1931). Based on the agro-climatic factors and growing conditions, genotype performance varies.

Additionally, consumer preferences vary by location. Regional tastes vary substantially when it comes to fruit color, shape, and prickle presence on the calyx. Studies of correlation reveal the connections between various yield-related characteristics and the influence they have on yield, which is useful for modifying certain features that have a big impact on yield. Path analysis is another important technique for separating the direct and indirect effects of an independent variable on the dependent variable from the correlation coefficient. The causal relationships between various character pairs can be better understood when correlation studies and path analysis are combined. As a result, it is thought that choosing the right genotype is essential for achieving genetic improvement. The relationship between the traits and the direct and indirect effects of associated features on yield would significantly aid in the establishment of the selection criteria and their efficient usage in crop improvement programs.

Materials and Methods

The research work was done at HRS, Venkataramannagudem, Dr. YSRHU to study genetic diversity in 32brinjal genotypes in two replications with RBD design during Rabi 2022-23. Thirty two genotypes were studied in the experiment, all of which were obtained from NBPGR Hyderabad. Planting was done with 75 cm x 40 cm inter and intra row spacing. Twelve traits were observed on five randomly chosen plants in each genotype which includes number of fruits per plant, percent fruit set in long styled flowers, percent fruit set in medium styled flowers, fruit length (cm), fruit diameter (cm), fruit weight (g), days to first harvest, duration of harvest period, fruit yield per plant (kg), ascorbic acid content (mg/100g), total phenol content (mg/100g), shoot and fruit borer infestation(%). The correlation and path co-efficients were computed by using the formula of Dewey and Lu (1959).

Results and Discussion

Number of fruits per plant exhibited significant positive correlation with percent fruit set in medium styled flowers (0.2314) and fruit yield per plant (0.3059). Higher the number of fruits produced per plant, higher will be the fruit yield per plant. However, significant negative correlation was noticed with fruit diameter (-0.5094), fruit weight (-0.3652), days to first harvest (-0.2526) and percent plants infested with shoot and fruit borer (-0.2915).

Similar results were reported by Thangamani and Jansirani (2012) and Divya *et al.,* (2019). Percent fruit set in long styled flowers had significant positive correlation with per cent fruit set in medium styled flowers (0.5231) and fruit yield per plant (0.3504). These results are in line with the findings of Nair and Mehta (2007). Percent fruit set in medium styled flowers showed significant positive correlation with duration of harvest period (0.2927) and fruit yield per plant (0.2079).

Fruit length is significantly and positively correlated with fruit weight (0.2522). Similar findings were reported by Muniappan *et al.,* (2010); Praneetha *et al.,* (2011). Fruit diameter exhibited significant positive correlation with fruit weight (0.7463), days to first harvest (0.4886) and per cent plants infested with shoot and fruit borer (0.5564). Similar results were recorded by Senapathi and Senapathi (2006) and Naqvi *et al.,* (2009). Fruit weight had shown significant positive correlation with days to first harvest (0.4837), fruit yield per plant (0.6790) where as it was negatively and significantly correlated with ascorbic acid content (-0.3554). Increased fruit weight results in increased fruit yield per plant. Similar results were reported by Islam and Uddin (2009) and Muniappan *et al.,* (2010).

Days to first harvest had significant positive correlation with per cent plants infested with shoot and fruit borer (0.5058) on the other hand it was negatively and significantly correlated with ascorbic acid content (-0.3536) and exhibited negative association with duration of harvest period and fruit yield per plant. Early fruit picking leads to an early closure to the fruit-bearing season. Similar results were reported by Nair and Mehta (2007) and Sharma and Singh (2012).

Table.1 Estimates of phenotypic (P) and genotypic (G) correlation coefficients for yield and different characters in brinjal.

		No. of fruits per plant	Per cent fruit set in long style flowers	Per cent fruit set in medium style flowers	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Days to first harvest	Duration of harvest period	Ascorbic acid content (mg/ 100 gm)	Total phenol content (mg/100g)	Shoot and fruit borer infestation (%)
No. of fruits per plant	P	**1.0000**										
	G	**1.0000**										
Per cent fruit set in long style flowers	P	0.1909	**1.0000**									
	G	0.1954	**1.0000**									
Per cent fruit set in medium style flowers	P	*0.2309	**0.5046	**1.0000**								
	G	*0.2314	**0.5231	**1.0000**								
Fruit length(cm)	P	0.1127	-0.0065	0.1635	**1.0000**							
	G	0.1137	-0.0075	0.1647	**1.0000**							
Fruit diameter(cm)	P	**-0.5082	-0.0954	-0.017	-0.0994	**1.0000**						
	G	**-0.5094	-0.0973	-0.0184	-0.0982	**1.0000**						
Fruit weight (g)	P	**-0.364	-0.0863	0.0881	0.052	**0.7429	**1.0000**					
	G	**-0.3652	-0.0893	0.0899	0.0522	**0.7463	**1.0000**					
Days to first harvest	P	*-0.2471	0.0830	-0.083	-0.0502	**0.4802	**0.4751	**1.0000**				
	G	*-0.2526	0.0912	-0.0879	-0.0523	**0.4886	**0.4837	**1.0000**				
Duration of harvest period	P	-0.1558	0.0908	*0.2855	0.0798	0.1066	0.1488	-0.1565	**1.0000**			
	G	-0.1572	0.1192	*0.2927	0.0810	0.1079	0.1599	-0.1751	**1.0000**			
Ascorbic acid content (mg/100g)	P	0.0364	-0.1315	0.0137	-0.1924	-0.1416	**-0.3504	**-0.3516	*-0.2637	**1.0000**		
	G	0.0377	-0.1345	0.0146	-0.1932	-0.1474	**-0.3554	**-0.3536	*-0.2709	**1.0000**		
Total phenol content (mg/100g)	P	-0.1572	0.2299	-0.0002	0.1522	-0.1279	-0.0697	0.2408	**0.3449	**-0.4582	**1.0000**	
	G	-0.1612	0.2468	0.0011	0.1556	-0.1305	-0.0740	0.2480	**0.3608	**-0.4863	**1.0000**	
Shoot and fruit borer infestation (%)	P	*-0.2847	-0.0553	-0.1944	-0.0504	**0.5462	*0.3134	**0.4884	*-0.2517	0.0161	-0.0978	**1.0000**
	G	*-0.2915	-0.0460	-0.2015	-0.0503	**0.5564	*0.3169	**0.5058	*-0.2637	0.0155	-0.1074	**1.0000**
Fruit yield per plant (kg)	P	**0.3046	**0.3104	**0.2057	0.1829	0.3652	**0.6753	0.3027	0.1253	0.3533	0.1014	-0.0275
	G	**0.3059	**0.3504	**0.2079	0.1831	0.3695	**0.6790	0.3045	0.1266	-0.3557	-0.1049	-0.0290

*Significant at 5 percent level;** Significant at 1 percent level

Table.2 Phenotypic (P) and genotypic (G) path coefficient analysis with respect to yield and different characters in brinjal.

		No. of fruits per plant	Per cent fruit set in long style flowers	Per cent fruit set in medium style flowers	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Days to first harvest	Duration of harvest period	Ascorbic acid content (mg/ 100 gm)	Total phenol content (mg/100g)	Shoot and fruit borer infestation (%)
No. of fruits per plant	P	**0.9312**	0.1778	0.2150	0.1050	-0.4733	-0.3389	-0.2301	-0.1451	0.0339	-0.1464	-0.2651
	G	**1.0318**	0.2016	0.2387	0.1173	-0.52550	-0.37680	-0.26060	-0.16220	0.03890	-0.16630	-0.30080
Per cent fruit set in long style flowers	P	-0.0320	**-0.1678**	-0.0847	0.0011	0.0160	0.0145	-0.0139	-0.0152	0.0221	-0.0386	0.0093
	G	-0.0463	**-0.2371**	-0.124	0.0018	0.02310	0.02120	-0.02160	-0.02830	0.03190	-0.05850	0.01090
Per cent fruit set in medium style flowers	P	0.0012	0.0026	**0.0051**	0.0008	-0.0001	0.0005	-0.0004	0.0015	0.0001	0.0000	-0.0010
	G	0.0237	0.0535	**0.1022**	0.0168	-0.00190	0.00920	-0.00900	0.02990	0.00150	0.00010	-0.02060
Fruit length(cm)	P	0.0051	-0.0003	0.0075	**0.0456**	-0.0045	0.0024	-0.0023	0.0036	-0.0088	0.0069	-0.0023
	G	0.001	-0.0001	0.0014	**0.0086**	-0.00080	0.00040	-0.00050	0.00070	-0.00170	0.00130	-0.00040
Fruit diameter(cm)	P	-0.1188	-0.0223	-0.0040	-0.0232	**0.2338**	0.1737	0.1122	0.0249	-0.0331	-0.0299	0.1277
	G	-0.1886	-0.036	-0.0068	-0.0364	**0.37030**	0.27640	0.18090	0.04000	-0.05460	-0.04830	0.20600
Fruit weight(g)	P	-0.2270	-0.0538	0.0550	0.0324	0.4634	**0.6238**	0.2963	0.0929	-0.2186	-0.0435	0.1955
	G	-0.2094	-0.0512	0.0516	0.0299	0.42790	**0.57340**	0.27740	0.09170	-0.20380	-0.04240	0.18170
Days to first harvest	P	-0.0480	0.0161	-0.0161	-0.0097	0.0932	0.0922	**0.1941**	-0.0304	-0.0682	0.0467	0.0948
	G	0.0068	-0.0024	0.0024	0.0014	-0.01310	-0.01300	**-0.02680**	0.00470	0.00950	-0.00670	-0.01360
Duration of harvest period	P	-0.0276	0.0161	0.0506	0.0142	0.0189	0.0264	-0.0278	**0.1774**	-0.0468	0.0612	-0.0447
	G	-0.0153	0.0116	0.0286	0.0079	0.01050	0.01560	-0.01710	**0.09760**	-0.02640	0.03520	-0.02570
Ascorbic acid content (mg/100g)	P	0.0023	-0.0084	0.0009	-0.0123	-0.0091	-0.0224	-0.0225	-0.0169	**0.0640**	-0.0293	0.0010
	G	0.0041	-0.0147	0.0016	-0.0211	-0.01610	-0.03880	-0.03860	-0.02960	**0.10920**	-0.05310	0.00170
Total phenol content (mg/100g)	P	-0.0104	0.0153	0.0000	0.0101	-0.0085	-0.0046	0.0160	0.0229	-0.0304	**0.0664**	-0.0065
	G	-0.03	0.0459	0.0002	0.0289	-0.02430	-0.01380	0.04610	0.06710	-0.09040	**0.18590**	-0.02000
Shoot and fruit borer infestation (%)	P	0.0539	0.0105	0.0368	0.0095	-0.1034	-0.0593	-0.0924	0.0476	-0.0030	0.0185	**-0.1892**
	G	0.0305	0.0048	0.0211	0.0053	-0.05820	-0.03320	-0.05290	0.02760	-0.00160	0.01120	**-0.10470**
Fruit yield per plant (kg)	P	0.3046	0.0104	0.2057	0.1829	0.3355	0.68900	0.30150	0.10660	-0.34570	0.10290	-0.02800
	G	0.3059	0.0104	0.2079	0.1831	0.36950	0.67900	0.30450	0.12660	-0.35570	0.10490	-0.02900

Duration of harvest period had significant positive correlation with fruit yield per plant (0.2266) and significant negative association with ascorbic acid content (-0.2709), per cent plants infested with shoot and fruit borer (-0.2637). Similar results were reported by Bansal and Mehta (2008).

Ascorbic acid content registered significant negative correlation with total phenol content (-0.4863). Similar results were reported by Praneetha *et al.,* (2011) and Thangamani and Jhansirani (2012). Total phenol content exhibited positive correlation with fruit yield per plant and negative correlation with per cent plants infested with shoot and fruit borer. Shoot and fruit borer infestation recorded negative correlation with fruit yield per plant. These results are inconformity with the findings of Kranthi and Celine (2013).

The genotypic correlation coefficients were higher than the phenotypic correlation coefficients for nearly all features. This might be explained by the hypothesis that, despite the evaluated features (Tables 1 and 2) high inherent genotypic connection, environmental influences prevented their development as phenotypes.

The path analysis was used to determine the direct and indirect effects of nine features on fruit yield per plant based on phenotypic and genotypic correlation coefficients. The direct and indirect effects of different characters on fruit yield were presented in Table 3. The higher magnitude of a positive direct effect on fruit yield was exerted by the number of fruits per plant (1.0318) followed by fruit weight (0.57340), Percent fruit set in long styled flowers (0.2371), total phenols (0.18590), ascorbic acid content (0.10920), percent fruit set in medium styled flowers (0.1022), duration of harvest period (0.09760) and fruit length (0.0086). Similar results were reported by Koundinya *et al.,* (2017); Muniappan *et al.,* (2010); Bansal and Mehta (2008); Nikitha *et al.,* (2020); Divya *et al.,* (2019) respectively. The negative direct effect on yield was shown by fruit diameter (-0.37030), percent plants infested with shoot and fruit borer (-0.10470) and days to first harvest (-0.02680). These results are in line with the findings of Senapathi and Senapathi (2006); Jadhao *et al.,* (2009); Thangamani and Jansirani (2012) respectively. The estimate of the residual factor was very low (0.316).

The proportion of fruits set in long-styled flowers, the weight of the fruits, and the quantity of fruits per plant all showed a strong positive association and direct effect on fruit yield. Therefore, it appears that these traits are mostly responsible for the plant's fruit production. Since they are highly connected and have a favorable direct effect on fruit yield, choosing a genotype with a higher number of fruits, fruit weight, and percentage of fruits set in long styled flowers will significantly improve yield.

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How to cite this article:

Kolli Naga Durga Sai Prasanna, C. Sarada and Naram Naidu, L. 2023. Study of Correlation and Path Analysis on Yield and Yield Attributing Parameters in Brinjal (*Solanum melongena* (L).). *Int.J.Curr.Microbiol.App.Sci.* 12(10): 208-213. **doi:** https://doi.org/10.20546/ijcmas.2023.1210.023