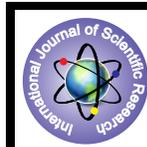


Character Association and Path Analysis for Yield and Yield Components in Okra [*Abelmoschus Esculentus* (L.) Moench]



Agriculture

KEYWORDS : Correlation, path analysis, fruit yield, okra

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ABSTRACT

Correlation and path analysis were carried out in ten different okra hybrids for fruit yield and its component traits. The correlation analysis indicated that fruit yield was significantly associated with fruit length, fruit girth, fruit weight, number of fruits per plant, plant height and duration at both genotypic and phenotypic level, indicating mutual association of these traits. Path coefficient analysis revealed that number of fruits per plant had maximum direct contribution (0.698) towards total yield followed by fruit weight (0.467), fruit girth (0.075) duration (0.042) and plant height (0.014). However, days to first flowering and fruit length exhibited negative direct effect. Hence, selection should be practiced for these characters in order to isolate superior plant types for improvement of fruit yield.

Introduction:

Vegetables play an important role in nutritional security and economic viability. It also fit well into the predominant intensive cropping systems prevailing in different parts of our country. More than 60 kinds of vegetables are grown in India in tropical, subtropical and temperate agro-climates. India is the largest producer of okra and ranks second in production of potato, onion, cauliflower and cabbage. Okra (*Abelmoschus esculentus* (L.) Moench) or ladies finger is an important vegetable of the tropical countries and most popular in India, Nigeria, Pakistan, Cameroon, Iraq and Ghana and grown for its tender green fruits in all seasons. For improving this crop through conventional breeding and selection, adequate knowledge of association that exists between yield and yield related characters is essential. Fruit yield of okra is a complex quantitative trait, which is conditioned by the interaction of various growth and physiological processes throughout the life cycle (Adeniji and Peter, 2005). In general, plant breeders commonly select for yield components which indirectly increase yield since direct selection for yield *per se* may not be the most efficient method for its improvement. The appropriate knowledge of such interrelationships between fruit yield and its contributing components can significantly improve the efficiency of a breeding program through the use of appropriate selection indices. Correlation and path coefficient analyses are the prerequisites for improvement of any crop in selecting superior genotypes and improving any trait. In plant breeding, correlation analysis provides information about yield components and thus helps in selection of superior genotypes from diverse genetic populations. The correlation studies simply measure the associations between yield and other traits. Usefulness of the information obtained from the correlation coefficients can be enhanced by partitioning into direct and indirect effects for a set of a pair-wise cause-effect inter relationships. Path coefficient analysis permits the separation of correlation coefficient into direct and indirect effects. It is basically a standardized partial regression analysis and deals with a closed system of variables that are linearly related. Such information provides a realistic basis for allocation of appropriate weightage to various yield components. Therefore the present investigation was undertaken to gather some useful information on character association and path coefficient analysis in okra.

Materials and Methods

The experimental material comprised of ten hybrids namely, Holavanalli local x Mallapalli local, Thirumala local x Punjab Phalguni, Thirumala local x Kattakada local, Kunnapuzha local x Punjab Phalguni, Kunnapuzha local x Kattakada local, Halu Bhenidi x Kattakada local, Thirumala local x Mallapalli local, Halu Bhenidi x Punjab Phalguni, IC1012-1 x Mallapalli local and IC1012-1 x Kattakada local developed by crossing during summer 2013. All the hybrids along with check (F₁ hybrid, Manjima and popular variety, Varsha Uphar) were evaluated in *kharif* 2013 at College of Agriculture, Vellayani. The crop received timely management practices as per package of practices recommendations of Kerala Agricultural University and five randomly selected plants were tagged in each entry to record the observations. Mean values were subjected to analysis of variance to test the significance for each character as per methodology advocated by Panse & Sukhatme (1967). The phenotypic and genotypic correlation coefficients were calculated using the method given by Johnson *et al.* (1955) and path coefficient analysis were worked as suggested by Dewey and Lu (1959).

Results and Discussion

The analysis of variance revealed significant differences among the genotypes for all the character studied. In majority of the characters, genotypic correlation coefficient was found to be higher in magnitude than phenotypic correlation coefficient, indicating a strong inherent association among various characters but their phenotypic expression was impeded by the influence of environmental factors (Table.1). Same as also reported by Kamal *et al.*, 2004, Niranjana and Mishra 2004.

The correlation analysis indicated that fruit yield was significantly associated with fruit length, fruit girth, fruit weight, number of fruits per plant, plant height and duration. Similar kind of association was reported by Kumar *et al.* (2012), Sogalad *et al.* (2012) and Nirosha *et al.* (2014) for fruit length, fruit weight, number of fruits per plant and plant height, Somashekhar *et al.* (2011) and Das *et al.* (2012) for fruit girth.

Days to first flowering is an indicator of earliness in okra. Early flowering not only gives early pickings and better returns but also widens the fruiting period of the plant. In the present study, days to first flowering had significant negative correlation with number of fruits per plant and non-significant association with

total yield per plant (Table.1). This is in line with the findings of Das *et al.* (2012), Kumar *et al.* (2012) and Reddy *et al.* (2013).

Fruit length, width, weight and number are considered to be the important fruit traits related to yield in okra. In the present study, fruit length had significant positive correlation with fruit girth, fruit weight, number of fruits per plant and duration. Fruit girth had significant positive correlation with fruit length, fruit weight and number of fruits per plant. Fruit weight had significant positive correlation with fruit length, fruit girth, number of fruits per plant and duration. Number of fruits per plant had significant positive correlation with all characters. All the fruit traits like length, width, weight and total number of fruits per plant showed significant positive association with fruit yield per plant and also among themselves. The present findings are in consonance with the earlier findings of Kumar *et al.* (2009) Das *et al.* (2012) and Reddy *et al.* (2013) (Table.1).

Plant height registered positive and significant association with number of fruits per plant indicating that increase in these characters can be possible with an increase in plant height. Duration was positively and significantly correlated with fruit length, fruit girth and number of fruits per plant.

Path coefficient analysis was developed to study the relationship between two characters through their direct influence and by way of indirect influence through other characters. The characters fruit girth, fruit weight, number of fruits per plant, plant height and duration exhibited positive direct effects on yield revealing that these were the major yield contributing characters in okra (Table.2). These results are supported by Sateesh *et al.* (2011), Sogalad *et al.* (2012), Das *et al.* (2012) and Nirosha *et al.* (2014).

On the contrary negative direct effects were existed by days to first flowering and fruit length. These results are in line with the findings of Singh *et al.* (2007), Sogalad *et al.* (2012), Das *et al.* (2012) and Reddy *et al.* (2013).

Days to first flowering had indirect positive effect through fruit length, fruit weight and duration. On contrary, it exhibited negative indirect effect through

Table1. Genotypic (G) and phenotypic (P) correlation coefficients among yield and yield components in okra

Character	DF	FL	FG	FW	NFPP	PH	DR	FY	
DF	G	1.000	0.275	-0.197	0.242	-0.299*	-0.230	0.259	-0.119
	P	1.000	0.276	-0.192	0.236	-0.295*	-0.225	0.259	-0.117
FL	G		1.000	0.761**	0.642**	0.640**	0.205	0.453**	0.735**
	P		1.000	0.714**	0.623**	0.600**	0.200	0.426**	0.705**
FG	G			1.000	0.379**	0.525**	0.013	0.197	0.554**
	P			1.000	0.375**	0.513**	0.013	0.197	0.547**
FW	G				1.000	0.447**	-0.016	0.420**	0.767**
	P				1.000	0.420**	-0.015	0.403**	0.754**
NFPP	G					1.000	0.631**	0.419**	0.910**
	P					1.000	0.624**	0.418**	0.905**
PH	G						1.000	0.238	0.437**
	P						1.000	0.237	0.435**
DR	G							1.000	0.509**
	P							1.000	0.505**

Table2. Estimates of Genotypic (G) and phenotypic (P) direct and indirect effects towards fruit yield in okra

Character	DF	FL	FG	FW	NFPP	PH	DR	FY	
DF	G	0.009	0.002	-0.001	0.002	-0.002	-0.002	0.002	-0.119
	P	-0.017	-0.004	0.003	-0.004	0.005	0.003	-0.004	-0.117
FL	G	-0.02	-0.094	-0.071	-0.060	-0.060	-0.019	-0.042	0.735
	P	-0.008	-0.032	-0.023	-0.020	-0.019	-0.006	-0.013	0.705

FG	G	-0.014	0.057	0.075	0.028	0.039	0.001	0.014	0.554
	P	-0.006	0.023	0.033	0.012	0.017	0.0004	0.006	0.547
FW	G	0.113	0.300	0.177	0.467	0.209	-0.007	0.196	0.767
	P	0.108	0.286	0.172	0.459	0.193	-0.007	0.185	0.754
NFPP	G	-0.209	0.447	0.367	0.312	0.698	0.441	0.292	0.910
	P	-0.203	0.413	0.353	0.289	0.688	0.429	0.287	0.905
PH	G	-0.003	0.002	0.0002	-0.0002	0.008	0.014	0.003	0.437
	P	-0.001	0.001	0.0001	-0.0001	0.003	0.005	0.001	0.435
DR	G	0.011	0.019	0.008	0.017	0.017	0.010	0.042	0.509
	P	0.011	0.018	0.008	0.017	0.017	0.010	0.042	0.505

Bold = direct effects Residual effect (Genotypic) = **0.080**
Residual effect (Phenotypic) = **0.093**

DF- Days to first flowering, **FL**- Fruit length, **FG**- Fruit girth, **FW**- Fruit weight,

NFPP- Number of fruits per plant, **PH**- Plant height, **DR**-Duration, **FY**-Fruit yield

* Significant at 5% level ** Significant at 1% level

fruit girth, number of fruits per plant and plant height at genotypic level. At phenotypic level fruit girth, number of fruits per plant and plant height had indirect positive effect, while fruit length, fruit weight and duration showed negative indirect effects (Table.2).

The character fruit length showed negative indirect effect through all characters on fruit yield. Fruit length, fruit girth, number of fruits per plant and duration showed positive indirect effect on fruit yield through fruit weight. The characters fruit length, fruit weight, number of fruits per plant, plant height and duration showed positive indirect effect through fruit girth on fruit yield (Table.2). The number of fruit per plant exhibited positive indirect effect through fruit length, fruit girth, fruit weight, plant height and duration which is in conformity with the results reported by Sateesh *et al.* (2011) and Sogalad *et al.* (2012).

Plant height exhibited positive indirect effects via fruit length, fruit girth, number of fruits per plant and duration. However, it exhibited negative indirect effects via days to first flowering and fruit weight. Plant duration exhibited indirect positive effects through all characters.

The residual factor determines how best the casual factors account for the variability of the dependent factor, the fruit yield per plant in this case. The residual effects were 0.093 and 0.080, which were of low and negligible magnitude at phenotypic and genotypic levels, respectively (Table.2).

Fruit yield in okra is the result of the interaction of number of inter – related characters. Therefore, selection should be based on these components characters after assessing their relation with fruit yield. In the present experiment, the values of correlation at genotypic level were higher than the phenotypic correlation, indicating that there is a strong inherent association between the various characters studied. The correlation studies revealed that fruit length, fruit girth, fruit weight, number of fruits per plant showed significant positive association with fruit yield and also among themselves. Critical analysis of the results by path analysis revealed the importance of the characters, fruit girth, fruit weight, number of fruits per plant, plant height and duration in influencing the fruit yield. Hence, selection should be practiced for these characters in order to isolate superior plant types for improvement of fruit yield.

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