Studies on correlation and path coefficient for direct selection between pair of traits using green fruit yield as dependent characters in Okra.

Abstract

The present experiment was carried out at the Horticulture Research Centre, Sardar Vallabhbhai Patel University of Agriculture & Technology; Modipuram, Meerut (U.P.) during *summer season*-2021. Thirty genotypes of okra were evaluated in Randomized Block Design (RBD) with three replications for fourteen quantitative characters. Fruit yield per plant showed highly significant and positive correlation with plant height, fruit diameter, number of branches per plant, fruit length, number of flowers per plant, test weight and number of fruits per plant at both genotypic and phenotypic level, indicating mutual association of these characters. Path coefficient analysis exhibits positive direct effect was observed towards fruit yield per plant for number of branches per plant followed by number of fruits per plant, days to first fruit harvesting, days to first flower initiation, fruit diameter, plant height, days to first fruit set and duration of crop at genotypic level. At the phenotypic level also the estimates of direct and indirect were generally less than genotypic level. The magnitudes of residual effects at both phenotypic and genotypic level were observed to be low. These characters may be used in selection programme for the further crop improvement of okra.

Keywords: *Abelmoschus esculentus, correlation, okra, path coefficient, yield.*

INTRODUCTION

Okra [*Abelmoschus esculentus* (L.) Moench] is also as Lady's finger or bhindi belongs to the family Malvaceae and somatic chromosome number of cultivated Okra 2n=130.

The geographical origin of okra is disputed, with supporters of South Asian, Ethiopian and African origins. Okra is originated in Ethiopian region **(de candolle, 1883 and**

N.I. Vavilov, 1951). Okra plants are grown commercially in many countries such as India, Japan, Turkey, Iran, Western Africa, Yugoslavia, Bangladesh, Afghanistan, Pakistan, Myanmar, Malaysia, Thailand, India, Brazil, Ethiopia, Cyprus and in the Southern United States **(Qhureshi, 2007).** This crop is suitable for cultivation as a garden crop as well as on large commercial farms.

Okra has a prominent position among fruit vegetables due to its multiple virtues like high nutritive and medicinal value, ease of cultivation, wide adaptability, year-round cultivation, good portability, export potential and bountiful returns **(Reddy, 2010).** It is an important cash crop for marginal, small and large farmers with a potential to boost food, nutritional and health security, foster rural development and support sustainable land care **(Reddy, 2010).** It is an important vegetable crop grown for its immature tender fruits which are canned, dehydrated and processed to a limited extent.

Okra is considered to be a prized vegetable due to its high nutrient value **(Dabire-Binso et al., 2009).** Normally, okra green fruits are rich sources of carbohydrate, protein, dietary fiber, calcium, magnesium, potassium, and vitamins A and C etc. The composition of okra pods per 100 g edible portion is water 88.6 g, energy 144.00 kJ (36 kcal), protein 2.10 g, carbohydrate 8.20 g, fat 0.20 g, fibre 1.70 g, Ca 84.00 mg, P 90.00 mg, Fe 1.20 mg, β-carotene 185.00 µg, riboflavin 0.08 mg, thiamin 0.04 mg, niacin 0.60 mg, ascorbic acid 47.00 mg and Vitamin B6 0.22 mg **(Gopalan *et al.*, 2007)**.

Correlation and path coefficient analyses are prerequisites for improvement of any crop including okra for selection of superior genotypes and improvement of 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 **(Kang *et al*., 1983).**

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 realistic basis for allocation of appropriate weightage to various yield components.

MATERIALS AND METHODS

The experiment was carried out during *summer season* 2021 at the Horticulture Research Centre, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, U.P. Thirty different germplasm (Table-1) was collected from different location in India. The collections were made from different source of supply comprising indigenous and exotic means of collections. The above genotypes were sown in the experimental plot as per sown in Randomized Block Design (RBD) with three replications. Seeds were planted in the soil at a depth of 2.5-3 cm. Each plot was sown row to row 45 cm and plant to plant 30 cm. Various cultural procedures were scheduled according to crop needs during the course of the inquiry. The specifications of the agricultural procedures and packaging used to raise an okra crop. The observation was recorded for five randomly selected plants for fourteen quantitative characters viz., days to first flower initiation, plant height, number of branches per plant, number of flowers per plant, days to first fruit set, fruit length, fruit diameter, number of fruits per plant, days to first fruits harvesting, days to second fruit harvesting, number of seeds per pod, test weight, duration of crop and fruit yield per plant. Mean values of five Randomly selected plants were used for statistical analysis. Characters association genotypic and phenotypic correlation coefficient levels and path coefficient analysis for fruit yield was taken as the dependent variable while rest of the traits were considered as independent variable simultaneous equations. which expressed the basic relationship between path

coefficient which were solved to estimate the direct and indirect effects with the formula of suggested by **Dewey and Lu (1959**). The data was analyzed for different parameters of correlation and path analysis using the OPSTAT software.

RESULT AND DISCUSSION

Correlation coefficient analysis measures the mutual relationship between plant characters and determines the component character on which selection can be made for genetic improvement of yield. Investigation regarding the presence of component and nature of association among themselves is essential and prerequisite for improvement in yield. Correlation coefficient provides a clear picture of the extent of association between a pair of traits and indicates whether simultaneous improvement of the correlated traits may be possible or not.

The genotypic and phenotypic correlations for fourteen characters analysed are presented in Table-2**.** In general, genotypic correlation coefficients were higher than their corresponding phenotypic correlation coefficients for most of the characters under studies. At both genotypic and phenotypic correlation level, Fruit yield per plant showed highly significant and positive correlation with plant height, fruit diameter, number of branches per plant, fruit length, number of flowers per plant, test weight and number of fruits per plant. The character number of seeds per pod showed positive but significant association with fruit yield per plant. Two characters showed positive and non-significant correlation with fruit yield per plant that is duration of crops and days to first fruit set. Characters showed negative and non-significant correlation with fruit yield per plant were days to first flower initiation, days to second fruit harvesting and days to first fruit harvesting. These characters that the phenotypic expression of correlation is reduced due to the influence of environment. These results were close in conformity with findings of **Shashi K. and Reddy M.T. (2016),**

Pithiya *et al.* (2017), **Singh *et al.* (2017)**, **Thulsiram *et al.* (2017), Yadav *et al.* (2017)**, **Raval *et al.* (2019), Chavan *et al.* (2019) and Janarthanan R. and Sundaram V. (2020).**

The path-coefficient analysis was used to partition the phenotypic and genotypic correlation coefficients of all the component characters studied with fruit yield into direct and indirect effects. The results of various causes influencing fruit yield (direct and indirect effects) at the genotypic level and phenotypic level. The results obtained with respect to direct and indirect effects of different components on fruit yield per plant. Path coefficient analysis revealed that direct and indirect effects at the genotypic level were slightly higher than direct and indirect effects at the phenotypic level.

Path coefficient highest positive direct effect on fruit yield per plant was observed by number of branches per plant followed by number of fruits per plant, days to first fruit harvesting, days to first flower initiation, fruit diameter, plant height, days to first fruit set and duration of crop while negative direct effect was exerted by number of flowers per plant followed by days to second fruit harvest, test weight and fruit length on fruit yield per plant at genotypic level. Highest positive direct effect on fruit yield per plant was recorded by plant height, days to first fruit harvesting, fruit diameter, number of branches per plant, days to first fruit set, number of seeds per pod number of flowers per plant, days to first flower initiation and duration of crop. Whereas, negative direct effect was showed via fruit length, days to second fruit harvesting, test weight and number of fruits per plant on fruit yield per plant at phenotypic level. Similar results were also earlier reported by **Pithiya *et al.* (2017), Chavan *et al.* (2019), Binepal *et al.* (2019), Kumar *et al.* (2019) and Alam *et al.* (2020).**

CONCLUSION

The result was concluded that fruit yield showed positive and significant correlation with plant height, number of branches per plant, number of flowers per plant, fruit length, fruit

diameter, number of fruits per plant, number of seeds per pod, test weight, duration of crop and days to first fruit set.

Path coefficient analysis exhibits high positive and direct effect on fruit yield per plant was recorded for number of branches per plant followed by number of fruits per plant, days to first fruit harvesting, days to first flower initiation, fruit diameter, plant height, days to first fruit set and duration of crop.

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Table-1: The details of Germplasm with their Source:

S. No.	Germplasm	Source	S. No.	Germplasm	Source
1.	Hisar Naveen	**HAU, Hisar**	**16.**	IIVR-II	**IIVR, Varanasi**
2.	Varsha Uphar	**HAU, Hisar**	**17.**	VRO-4	**IIVR, Varanasi**
3.	Punjab Kranti	**PAU, Ludhiana**	**18.**	VRO-5	**IIVR, Varanasi**
4.	Arka Anamika	**IIHR, Bengaluru**	**19.**	VRO-6	**IIVR, Varanasi**
5.	Arka Abhay	**IIHR, Bengaluru**	**20.**	368-A	**IARI, New Delhi**
6.	Pusa Sawani	**IARI, New Delhi**	**21.**	Hisar Unnat	**HAU, Hisar**
7.	Pusa A-4	**IARI, New Delhi**	**22.**	IC-18530	**Dr. PDKV, Akola**
8.	Parbhani Kranti	**MPKV, Rahuri**	**23.**	EC-305642	**Dr. PDKV, Akola**
9.	Kashi Pragati	**IIVR, Varanasi**	**24.**	EC-305643	**Dr. PDKV, Akola**
10.	Mona	**Lawad, Meerut**	**25.**	EC-305644	**Dr. PDKV, Akola**
11.	Kashi Kranti	**IIVR, Varanasi**	**26.**	EC-305645	**Dr. PDKV, Akola**
12.	U.S-8063	**IARI, New Delhi**	**27.**	EC-305639	**Dr. PDKV, Akola**
13.	IC-090491	**IARI, New Delhi**	**28.**	IC-014026	**Dr. PDKV, Akola**
14.	Y.V.S-9	**IARI, New Delhi**	**29.**	EC-305637	**Dr. PDKV, Akola**
15.	IC-316/2,4,5	**IARI, New Delhi**	**30.**	EC-305635	**Dr. PDKV, Akola**

Table-2. Estimates of correlation coefficient at genotypic and phenotypic levels in Okra

Characters		Days to first flower initiation	Plant height (cm)	Number of branches per plant	Number of flowers per plant	Days to first fruit set	Fruit length (cm)	Fruit diameter (cm)	Number of fruits per plant	Days to first fruits harvesting	Days to second fruit harvesting	Number of seeds per pod	Test weight	Duration of crop	Fruit yield per plant
Days to first flower initiation	G	**1.000**	-0.210*	-0.220*	-0.027	0.327**	0.042	-0.155	0.016	0.198	0.249*	0.000	-0.258*	0.437**	-0.185
	P	**1.000**	-0.180	-0.179	-0.020	0.271**	0.049	-0.119	0.040	0.134	0.174	0.038	-0.229*	0.356**	-0.146
Plant height (cm)	G		**1.000**	0.802**	0.629**	-0.109	0.755**	0.825**	0.581**	-0.071	0.036	0.175	0.555**	0.055	0.772**
	P		**1.000**	0.752**	0.587**	-0.090	0.726**	0.760**	0.562**	-0.066	0.020	0.122	0.470**	0.069	0.698**
Number of branches per plant	G			**1.000**	0.796**	-0.125	0.896**	0.830**	0.815**	0.200	0.326**	-0.006	0.651**	-0.058	0.495**
	P			**1.000**	0.750**	-0.095	0.836**	0.751**	0.771**	0.180	0.272**	0.015	0.584**	-0.033	0.466**
Number of flowers per plant	G				**1.000**	-0.108	0.744**	0.632**	0.873**	0.263*	0.305**	-0.254*	0.410**	-0.333**	0.396**
	P				**1.000**	-0.071	0.703**	0.578**	0.824**	0.224*	0.259*	-0.205	0.367**	-0.288**	0.356**
Days to first fruit set	G					**1.000**	-0.077	-0.141	0.136	0.022	0.055	0.178	0.033	0.102	0.028
	P					**1.000**	-0.074	-0.140	0.116	-0.009	0.008	0.176	0.023	0.080	0.016
Fruit length (cm)	G						**1.000**	0.852**	0.788**	0.157	0.283**	-0.007	0.512**	0.126	0.447**
	P						**1.000**	0.804**	0.749**	0.161	0.234*	-0.011	0.425**	0.109	0.401**
Fruit diameter (cm)	G							**1.000**	0.607**	0.056	0.176	0.189	0.451**	0.143	0.580**
	P							**1.000**	0.565**	0.047	0.167	0.160	0.378**	0.111	0.505**
Number of fruits per plant	G								**1.000**	0.284**	0.389**	-0.120	0.500**	-0.129	0.339**
	P								**1.000**	0.251*	0.315**	-0.093	0.447**	-0.090	0.316**
Days to first fruits harvesting	G									**1.000**	0.886**	-0.225*	0.101	-0.066	-0.099
	P									**1.000**	0.771**	-0.194	0.081	-0.040	-0.093
Days to second fruit harvesting	G										**1.000**	-0.289**	0.008	0.025	-0.135
	P										**1.000**	-0.195	0.027	0.031	-0.113
Number of seeds per pod	G											**1.000**	0.083	0.359**	0.243*
	P											**1.000**	0.099	0.310**	0.201
Test weight	G												**1.000**	0.062	0.359**
	P												**1.000**	0.072	0.294**
Duration of crop	G													**1.000**	0.045
	P													**1.000**	0.035
Fruit yield per plant	G														**1.000**
	P														**1.000**

*, ** significant at 5% and 1% level, respectively

Table-3. Path coefficient analysis at genotypic and phenotypic levels with fruit yield per plant in Okra

Characters		Days to first flower initiation	Plant height (cm)	Number of branches per plant	Number of flowers per plant	Days to first fruit set	Fruit length (cm)	Fruit diameter (cm)	Number of fruits per plant	Days to first fruits harvesting	Days to second fruit harvesting	Number of seeds per pod	Test weight	Duration of crop	Fruit yield per plant
Days to first flower initiation	**G**	**0.299**	-0.255	-0.309	0.026	0.052	-0.045	-0.042	0.010	0.306	-0.469	0.000	0.197	0.046	-0.185
	P	**0.0242**	-0.1412	-0.0219	-0.0012	0.0239	-0.0155	-0.0148	-0.0019	0.0242	-0.0414	0.0025	0.0165	0.0007	-0.146
Plant height (cm)	**G**	-0.063	**0.213**	0.475	-0.100	-0.017	-0.308	0.873	0.361	-0.109	-0.068	-0.068	-0.423	0.006	0.772**
	P	-0.0044	**0.7851**	0.0917	0.0355	-0.0079	-0.2284	0.0943	-0.0263	-0.0118	-0.0048	0.0082	-0.0339	0.0001	0.698**
Number of branches per plant	**G**	-0.066	0.973	**0.703**	-0.759	-0.020	-0.259	0.224	0.506	0.308	-0.615	0.002	-0.497	-0.006	0.495**
	P	-0.0043	0.5906	**0.1220**	0.0454	-0.0084	-0.2631	0.0931	-0.0360	0.0323	-0.0646	0.0010	-0.0422	-0.0001	0.466**
Number of flowers per plant	**G**	-0.008	0.763	1.116	**-0.954**	-0.017	-0.796	0.170	0.542	0.406	-0.576	0.099	-0.313	-0.035	0.396**
	P	-0.0005	0.4611	0.0915	**0.0605**	-0.0062	-0.2213	0.0717	-0.0385	0.0404	-0.0616	-0.0137	-0.0265	-0.0006	0.356**
Days to first fruit set	**G**	0.098	-0.132	-0.176	0.103	**0.159**	0.083	-0.038	0.084	0.035	-0.104	-0.069	-0.025	0.011	0.028
	P	0.0066	-0.0705	-0.0116	-0.0043	**0.0882**	0.0234	-0.0174	-0.0054	-0.0016	-0.0018	0.0118	-0.0017	0.0002	0.016
Fruit length (cm)	**G**	0.012	0.916	0.258	-0.710	-0.012	**-0.070**	0.230	0.489	0.242	-0.533	0.003	-0.391	0.013	0.447**
	P	0.0012	0.5701	0.1020	0.0425	-0.0065	**-0.3146**	0.0996	-0.0350	0.0290	-0.0558	-0.0007	-0.0306	0.0002	0.401**
Fruit diameter (cm)	**G**	-0.046	0.801	0.864	-0.603	-0.022	-0.111	**0.270**	0.377	0.086	-0.332	-0.373	-0.344	0.015	0.580**
	P	-0.0029	0.5970	0.0916	0.0350	-0.0124	-0.2529	**0.1240**	-0.0264	0.0084	-0.0397	0.0107	-0.0273	0.0002	0.505**
Number of fruits per plant	**G**	0.005	0.705	0.744	-0.433	0.022	-0.843	0.164	**0.621**	0.437	-0.734	0.047	-0.382	-0.014	0.339**
	P	0.0010	0.4412	0.0940	0.0498	0.0102	-0.2356	0.0701	**-0.0467**	0.0452	-0.0749	-0.0062	-0.0322	-0.0002	0.316**
Days to first fruits harvesting	**G**	0.059	-0.086	0.281	-0.251	0.004	-0.168	0.015	0.176	**0.541**	-0.673	0.088	-0.077	-0.007	-0.099
	P	0.0033	-0.0515	0.0219	0.0136	-0.0008	-0.0506	0.0058	-0.0117	**0.1800**	-0.1836	-0.0130	-0.0059	-0.0001	-0.093
Days to second fruit harvesting	**G**	0.074	0.043	0.457	-0.291	0.009	-0.302	0.047	0.241	0.365	**-0.887**	0.112	-0.006	0.003	-0.135
	P	0.0042	0.0157	0.0331	0.0157	0.0007	-0.0737	0.0207	-0.0147	0.1388	**-0.2380**	-0.0131	-0.0020	0.0001	-0.113
Number of seeds per pod	**G**	0.000	0.212	-0.009	0.242	0.028	0.007	0.051	-0.075	-0.347	0.545	**-0.388**	-0.064	0.038	0.243*
	P	0.0009	0.0955	0.0019	-0.0124	0.0155	0.0034	0.0198	0.0043	-0.0349	0.0464	**0.0670**	-0.0071	0.0007	0.201
Test weight	**G**	-0.077	0.673	0.913	-0.391	0.005	-0.548	0.122	0.310	0.156	-0.015	-0.032	**-0.763**	0.007	0.359**
	P	-0.0056	0.3688	0.0713	0.0222	0.0020	-0.1337	0.0468	-0.0209	0.0146	-0.0065	0.0066	**-0.0721**	0.0002	0.294**
Duration of crop	**G**	0.131	0.067	-0.081	0.318	0.016	-0.135	0.039	-0.080	-0.101	-0.048	-0.139	-0.047	**0.106**	0.045
	P	0.0086	0.0542	-0.0040	-0.0175	0.0071	-0.0343	0.0138	0.0042	-0.0073	-0.0075	0.0208	-0.0052	**0.0021**	0.035

Genotypic Resi = 0.172
Phenotypic Resi = 0.452
*, ** significant at 5% and 1% level, respectively