Eco. Env. & Cons. 28 (October Suppl. Issue) : 2022; pp. (S210-S214)
Copyright@ EM International
ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2022.v28i06s.035

Studies on Correlation and Pathcoefficient Analysis for Fruit Yield and Quantitative Traits of Okra (*Abelmoschus esculentus* (L.) Moench)

R.K. Singh[1]*, Mritunjay Rai[2], Mukul Kumar[3] and S.V. Dwivedi[4]

Banda University of Agriculture and Technology, Banda 210 001, U.P., India

(Received 7 February, 2022; Accepted 24 March, 2022)

ABSTRACT

Nineteen genotypes of okra were evaluated for fifteen yield and its contributing traits. The experiment was conducted at Vegetable Research Farm of the Department of Vegetable Science, COH, BUAT, Banda during rainy season 2019 and 2020. The pooled data of correlation studies, revealed that the fruit yield per plant showed positive and significant genotypic and phenotypic correlation with plant height at 60 days after sowing, number of nodes at 60 days after sowing, number of primary branches, number of fruits per plant, fruit yield per plot and fruit yield (qha^{-1}). Path coefficient revealed that fruit yield (qha^{-1}) had maximum direct contribution towards fruit yield per plant followed by days to maturity and days to first flower. However, days to 50% flowering had maximum direct negative effect. These important traits may be viewed in selection programme for the further improvement of okra.

Key words: *Okra, Abelmoschus esculentus, Bhindi, Correlation, Path, Lady finger*

Introduction

Okra [*Abelmoschus esculentus* (L.) Moench] belongs to family Malvaceae and its chromosome number is 2n = 2 × = 130. The country's average yield is low due to poor quality of seeds, lack of suitable cultivar, poor agro-techniques and management. To improve the yield and other characters, information on genetic variability and inter-relationship among different traits is necessary. Information on the amount and direction of association between yield and yield related traits is important for rapid progress in selection and genetic improvement in crop (Ashish *et al.* 2008). This will indicate the interrelation between two or more plant characters and yield, providing suitable means for indirect selection for yield. If a number of independent characters is affecting a dependent character in an increasing way, there would be some amount of inter-dependence. In such a situation, correlation becomes inefficient. Then the path analysis helps in understanding relationship among characters. The present investigation aimed at assessing the association of different traits for yield improvement in okra.

Materials and Method

In pursuance of the envisaged objectives, the present study with nineteen genotypes of okra in randomized block design (RBD) was carried at vegetable research farm of the Department of Vegetable Science, College of Horticulture, Banda University of Agriculture and Technology, Banda during rainy season 2019 and 2020. Each variety was planted in

three rows replicated thrice with spacing 50 cm × 30 cm. Observations were recorded from five randomly selected plants from the middle row of each variety in each replication for fifteen plant characters *viz.*, days to 50% germination, days to first flower, days to 50% flowering, days to maturity, plant height (cm) at 60 days after sowing, number of nodes at 60 days after sowing, number of primary branches, node to first flower appear, fruit length (cm), fruit diameter (cm), number of seeds per fruit, average fruit weight, number of fruitsplant^{-1}, fruit yield plant^{-1}(kg), fruit yield plot^{-1}(kg) and fruit yield (qha^{-1}). The correlation coefficient was worked out by using formula suggested by Falconer (1981). The path analysis was done as given by Wright (1921) and elaborated by Dewey and Lu (1959) to calculate the direct and indirect contribution of various traits to yield.

Results and Discussion

Correlation coefficient analysis

For a breeding programme information on the genetic association between yield and its component is a pre-requisite. From this point of view the relationship between yield of okra and 15 other important traits were endeavoured to find out through correlation and path coefficient analysis. Knowledge of the association among plant characteristics is useful while selecting traits for yield improvement. It was evident from the Table 1. (Pooled data) that estimates of genotypic correlation coefficients were in most cases higher than their corresponding phenotypic correlation coefficients. These findings are in close harmony with Saryam *et al.* (2017), Singh *et al.* (2016), Balai *et al.* (2014); Senapati *et al.* (2011). More significant genotypic association between the different pairs of characters than the phenotypic correlation suggested that there is a strong association between those characters genetically, but the phenotypic value is lessened by the significant interaction of environment.

In the present study fruit yieldplant^{-1}showed positive and significant genotypic and phenotypic correlation with plant height at 60 days after sowing (0.549, 0.487), number of nodes at 60 days after sowing (0.711, 0.597), number of primary branches (0.582, 0.412), number of fruits plant^{-1}(0.371, 0.337), fruit yield plot^{-1} (0.968, 0.786) and fruit yield (qha^{-1}) (0.999, 0.985) respectively. Significant positive association of number of branches plant^{-1} with yield plant^{-1} is also reported by Patero*et al.* (2004). Pachiyappan and Saravannam (2016) reported that number of fruiting nodes is positively associated with fruit yield plant^{-1}. Similar result was correlated with Singh *et al.* (2016) that plant height is significantly positively correlated with fruit yield plant^{-1}.

Days to 50% germination is significantly and positively correlated with fruit length (0.259, 0.218) and number of fruits plant^{-1} (0.335, 0.253) and significantly negative correlated with number of nodes at 60 days after sowing (-0.326, -0.269) and number of primary branches (-0.566, -0.324). Days to first flower is significantly and positively correlated with days to maturity (0.951, 0.872) and number of primary branches (0.324, 0.193) and significantly negative correlated with fruit length (-0.628, -0.385). Days to 50% flowering is significantly and positively correlated with days to maturity (0.990, 0.965) and significantly negative correlated with fruit length (-0.571, -0.410). Days to maturity is significantly negatively correlated with fruit length (-0.510, -0.364). Plant height at 60 days after sowing is significantly and positively correlated with number of nodes at 60 days after sowing (0.829, 0.680), number of primary branches (0.425, 0.269), fruit length (0.302, 0.211), number of seeds per fruit (0.311, 0.248), number of fruits plant^{-1} (0.295, 0.231), fruit yield plot^{-1} (0.515, 0.367) and fruit yield (qha^{-1}) (0.547, 0.481). Similar finding of significant positive association of plant height with number of primary branches, fruit length and number of fruits plant^{-1} is also reported by Mehta *et al.* 2006 and Ahmad *et al.* 2015 respectively. Number of nodes at 60 days after sowing is significantly and positively correlated with primary branches plant^{-1} (0.546, 0.337), average fruit weight (0.190, 0.168), fruit yield plot^{-1} (0.675, 0.455), fruit yield (qha^{-1}) (0.711, 0.602). Number of primary branches is significantly and positively correlated with average fruit weight (0.434, 0.321), fruit yield plot^{-1} (0.618, 0.362) and fruit yield (qha^{-1}) (0.584, 0.415) and significantly negative correlated with node to first flower appear (-0.380, -0.255). Node to first flower is significantly negative correlated with fruit length (-0.458, -0.231). Fruit length is significantly negative correlated with average fruit weight (-0.269, -0.184). Fruit diameter is significantly and positively correlated with average fruit weight (0.403, 0.204). Number of seeds per fruit is significantly and positively correlated with number of fruits plant^{-1} (0.309, 0.218). Average fruit weight is

Table 1. Estimates of Genotypic (G) and Phenotypic (P) Correlation coefficient among fruit yield and its attributing traits in okra (Pooled data) (2019-20)

Traits		Days to 50% germi-nation	Days to first flower	Days to 50% flowe-ring	Days to maturity	Plant height [(cm) 60 DAS]	Number of nodes (60 DAS)	Number of primary branches	Node to first flower appear	Fruit length (cm)	Fruit diameter (cm)	No of seeds per fruit	Average Fruit Weight (g)	Number of fruits plant^{-1}	Fruit yield plot^{-1} (kg)	Fruit yield (qha^{-1})	Fruit yield plant^{-1} (kg)
Days to 50%	G	**1.000**	-0.164	0.011	0.000	-0.188	-0.326**	-0.566**	-0.084	0.259**	-0.329**	-0.100	-0.572**	0.335**	-0.126	-0.127	-0.138
germination	P	**1.000**	-0.146	-0.025	-0.023	-0.165	-0.269**	-0.324**	-0.086	0.218*	-0.141	-0.083	-0.495**	0.253**	-0.075	-0.118	-0.129
Days to	G		**1.000**	0.944**	0.951**	0.165	0.241*	0.324**	-0.050	-0.628**	-0.560**	-0.039	0.268**	-0.160	-0.014	-0.016	-0.039
first flower	P		**1.000**	0.894**	0.872**	0.099	0.166	0.193*	-0.054	-0.385**	-0.018	0.037	0.124	-0.105	0.005	-0.019	-0.029
Days to 50%	G			**1.000**	0.990**	0.070	0.102	0.054	0.100	-0.571**	-0.625**	0.062	-0.014	0.081	-0.050	-0.039	-0.055
flowering	P			**1.000**	0.965**	0.049	0.114	0.017	0.013	-0.410**	-0.129	0.082	-0.051	0.049	0.013	-0.032	-0.042
Days to	G				**1.000**	0.053	0.091	0.043	0.093	-0.510**	-0.562**	0.018	0.077	-0.050	-0.088	-0.071	-0.091
maturity	P				**1.000**	0.063	0.109	0.030	0.008	-0.364**	-0.128	0.038	0.022	-0.032	0.007	-0.058	-0.069
Plant height	G					**1.000**	0.829**	0.425**	-0.101	0.302**	0.304**	0.311**	-0.032	0.295**	0.515**	0.547**	0.549**
[(cm)60 DAS]	P					**1.000**	0.680**	0.269**	-0.079	0.211*	0.054	0.248*	-0.041	0.231*	0.367**	0.481**	0.487**
Number of	G						**1.000**	0.546**	-0.068	0.050	0.146	0.096	0.190*	0.127	0.675**	0.711**	0.711**
nodes (60 DAS)	P						**1.000**	0.337**	-0.075	0.055	0.009	0.083	0.168*	0.125	0.455**	0.602**	0.597**
Number of	G							**1.000**	-0.380**	-0.097	-0.063	-0.131	0.434**	-0.045	0.618**	0.584**	0.582**
primary branches	P							**1.000**	-0.255**	0.008	0.002	-0.106	0.321**	-0.066	0.362**	0.415**	0.412**
Node to first	G								**1.000**	-0.458**	0.191*	0.660**	0.049	0.035	-0.277**	-0.058	-0.041
flower appear	P								**1.000**	-0.231*	0.128	0.458**	0.013	0.046	-0.219*	-0.039	-0.023
Fruit length (cm)	G									**1.000**	0.235*	-0.144	-0.269**	0.134	0.205*	0.131	0.135
	P									**1.000**	0.002	-0.122	-0.184*	0.077	0.163	0.091	0.076
Fruit diameter	G										**1.000**	0.322**	0.403**	-0.362**	-0.031	0.021	0.035
(cm)	P										**1.000**	0.075	0.204*	-0.134	-0.035	-0.011	0.000
No of seeds per	G											**1.000**	-0.122	0.309**	-0.116	0.119	0.145
fruit	P											**1.000**	-0.108	0.218*	-0.080	0.111	0.121
Average Fruit	G												**1.000**	-0.852**	0.068	0.082	0.079
Weight (g)	P												**1.000**	-0.727**	0.028	0.075	0.065
Number of	G													**1.000**	0.376**	0.366**	0.371**
fruits Plant^{-1}	P													**1.000**	0.302**	0.326**	0.337**
Fruit yield	G														**1.000**	0.978**	0.968**
plot^{-1} (kg)	P														**1.000**	0.794**	0.786**
Fruit yield	G															**1.000**	0.999**
(qha^{-1})	P															**1.000**	0.985**

* &** indicates level of significance at 5% & 1% respectively

significantly negative correlated with number of fruits plant^{-1} (-0.852, -0.727). Number of fruits plant^{-1} is significantly and positively correlated with fruit yield plot^{-1} (0.376, 0.302) and fruit yield (qha^{-1}) (0.366, 0.326). Fruit yieldplot^{-1} is significantly and positively correlated with fruit yield (qha^{-1}) (0.978, 0.794).

Path coefficient analysis

The mutual relationship of component characters may vary both in magnitude and direction and the simple correlation coefficient may not provide the exact relationship between yield and yield attributes. Hence, path coefficient is an important method for estimating the association between traits with cause and effect, i.e. the direct and indirect basis of association. The estimates of direct and indirect effects of fifteen fruit yield related characters on fruit yield per plant are presented in Table 2 (Pooled data). In the present study fruit yield (qha^{-1}) (0.9477) had maximum direct contribution towards fruit yield plant^{-1} followed by days to maturity (0.1890) and days to first flower (0.1729). However, days to 50% flowering (-0.3937) had maximum direct negative effect. Similar result is reported by Patro *et al.* (2004) that days to 50% germination had negative effect on fruit yield plant^{-1}. These are the important traits which may be viewed in selection programme for the further improvement of okra. The genotypic direct effect of fruit yield (qha^{-1}) contributed directly and positively to fruit yieldplant^{-1} possess significant correlations suggesting that the association between these traits is perfect and direct selection through these traits will be effective.

Highly positive indirect effect on fruit yield plant^{-1} exerted by days to maturity (0.1645) and days to 50% flowering (0.1633) through days to first flower; fruit diameter (0.2461) and fruit length (0.2249) through days to 50% flowering; days to 50% flowering (0.1871) and days to first flower (0.1797) through days to maturity; fruit yield plot^{-1} (0.9271), num-

Table 2. Genotypic path coefficients showing direct (diagonal) and indirect effects of different characters on fruit yield plant^{-1} in okra (Pooled data) (2019-20)

Traits	Days to 50% germination	Days to first flower	Days to 50% flowering	Days to maturity	Plant height [(cm) 60 DAS]	Number of nodes (60 DAS)	Number of primary branches	Node to first flower appear	Fruit length (cm)	Fruit diameter (cm)	No of seeds per fruit	Average Fruit Weight (g)	Number of fruits plant^{-1}	Fruit yield plot^{-1} (kg)	Fruit yield (q ha^{-1})	Fruit yield plant^{-1} (kg)
Days to 50% germination	**-0.0403**	-0.0283	-0.0044	0.0000	0.0024	0.0010	0.0384	0.0001	-0.0022	0.0117	-0.0056	0.0037	0.0149	-0.0096	-0.1199	-0.138
Days to first flower	0.0066	**0.1729**	-0.3717	0.1797	-0.0021	-0.0008	-0.0220	0.0001	0.0054	0.0200	-0.0022	-0.0017	-0.0071	-0.0010	-0.0154	-0.039
Days to 50% flowering	-0.0004	0.1633	**-0.3937**	0.1871	-0.0009	-0.0003	-0.0037	-0.0001	0.0049	0.0223	0.0035	0.0001	0.0036	-0.0038	-0.0371	-0.055
Days to maturity	0.0000	0.1645	-0.3898	**0.1890**	-0.0007	-0.0003	-0.0029	-0.0001	0.0044	0.0201	0.0010	-0.0005	-0.0022	-0.0067	-0.0668	-0.091
Plant height [(cm) 60 DAS]	0.0076	0.0286	-0.0274	0.0100	**-0.0129**	-0.0026	-0.0288	0.0001	-0.0026	-0.0109	0.0175	0.0002	0.0131	0.0393	0.5180	0.549**
Number of nodes (60 DAS)	0.0131	0.0417	-0.0402	0.0173	-0.0107	**-0.0032**	-0.0370	0.0001	-0.0004	-0.0052	0.0054	-0.0012	0.0056	0.0515	0.6741	0.711**
Number of primary branches	0.0228	0.0561	-0.0214	0.0081	-0.0055	-0.0017	**-0.0678**	0.0005	0.0008	0.0023	-0.0073	-0.0028	-0.0020	0.0472	0.5531	0.582**
Node to first flower appear	0.0034	-0.0086	-0.0393	0.0176	0.0013	0.0002	0.0258	**-0.0012**	0.0040	-0.0068	0.0371	-0.0003	0.0016	-0.0211	-0.0549	-0.041
Fruit length (cm)	-0.0104	-0.1085	0.2249	-0.0964	-0.0039	-0.0002	0.0066	0.0005	**-0.0086**	-0.0084	-0.0081	0.0017	0.0060	0.0156	0.1240	0.135
Fruit diameter (cm)	0.0132	-0.0968	0.2461	-0.1063	-0.0039	-0.0005	0.0043	-0.0002	-0.0020	**-0.0357**	0.0181	-0.0026	-0.0161	-0.0024	0.0199	0.035
No of seeds per fruit	0.0040	-0.0067	-0.0246	0.0034	-0.0040	-0.0003	0.0089	-0.0008	0.0012	-0.0115	**0.0562**	0.0008	0.0138	-0.0088	0.1129	0.145
Average Fruit Weight (g)	0.0230	0.0463	0.0054	0.0145	0.0004	-0.0006	-0.0294	-0.0001	0.0023	-0.0144	-0.0069	**-0.0065**	-0.0380	0.0052	0.0776	0.079
Number of fruits Plant^{-1}	-0.0135	-0.0277	-0.0317	-0.0094	-0.0038	-0.0004	0.0031	0.0000	-0.0012	0.0129	0.0174	0.0055	**0.0446**	0.0287	0.3465	0.371**
Fruit yield plot^{-1} (kg)	0.0051	-0.0024	0.0195	-0.0166	-0.0066	-0.0021	-0.0419	0.0003	-0.0018	0.0011	-0.0065	-0.0004	0.0167	**0.0763**	0.9271	0.968**
Fruit yield (qha^{-1})	0.0051	-0.0028	0.0154	-0.0133	-0.0070	-0.0023	-0.0396	0.0001	-0.0011	-0.0007	0.0067	-0.0005	0.0163	0.0747	**0.9477**	0.999**

RESIDUAL EFFECT= 0.06

ber of nodes at 60 DAS (0.6741), number of primary branches (0.5331), plant height at 60 DAS (0.5180), number of fruits plant^{-1} (0.3465) through fruit yield (qha^{-1}).

When the interdependence of the component characters was considered, the residual values in a path coefficient analysis Table 2 (Pooled data) for 15 characters was only 0.06. This indicates that 15 yield contributing traits have adequately explained the variation.

Conclusion

It may be concluded from the study that fruit yield plant^{-1} showed positive and significant genotypic and phenotypic correlation with plant height at 60 days after sowing, number of nodes at 60 days after sowing, number of primary branches, number of fruits plant^{-1}, fruit yieldplot^{-1} and fruit yield (qha^{-1}) respectively. Path coefficient analysis further suggested that fruit yield (qha^{-1}) had maximum direct contribution towards fruit yield plant^{-1} followed by days to maturity and days to first flower. However, days to 50% flowering had maximum direct negative effect

References

Ahamed, K.U., Akter, B., Ara, N., Hossain, M.F. and Moniruzzaman, M. 2015. Heritability, correlation and path coefficient analysis in fiftyseven okra genotypes. *International Journal of Applied Sciences and Biotechnology*. 3(1) : 127-133.

Ashish, K., Manivannan, N. and Varman, P.V. 2008. Character association and path analysis in sunflower. *Madras Agric J.* 95 (7-12): 425-428.

Balai, T.C., Maurya, I.B., Verma, S. and Kumar, N. 2014. Correlation and path analysis in genotypes of okra [*Abelmoschus esculentus* (L.) Moench]. *The Bioscan*. 9(2): 799-802.

Dewey, D.R. and Lu, K.H. 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agronomy Journal*. 51: 515-518.

Falconer, D.S. 1981. *Introduction to Quantitative Genetics.* Longmann. 340 pp.

Syfullah, K., Sani, M.N.H., Nasif, S.O., Parvin, S., Rony, M.M.H., Islam, M.S. and Hossain, M.S. 2018. Genetic variability, heritability, character association and morphological diversity in okra (*Abelmoschus esculentus* L. Moench). *International Journal of Plant & Soil Science*. 25(6) : 1-11.

Mehta, D.R., Dhaduk, L.K. and Patel, K.D. 2006. Genetic variability correlation and path analysis studies in okra [*Abelmoschus esculentus*(L.) Moench]. *Agric. Sci. Digest*. 26(1) : 15-18.

Pachiyappan, R. and Saravannan, K. 2016. Studies on genetic variability and correlation for fruit yield and fruit quantity characters of okra. *The Asian Journal of Horticulture*. 11(1) : 101-104.

Patro, T.S.K.K.K. and Ravisankar, C. 2004. Genetic variability and multivariate analysis in okra [*Abelmoschus esculentus*(L.) Moench]. *Tropical Agriculture Research*. 16 : 99-113.

Saryam, D.K, Mittra, S.K, Mehta, A.K. and Prajapati, S. 2017. Variation in genetic diversity in okra (*Abelmoschus esculentus* (L.) Moench). *Journal of Functional and Environmental Botany*. 7(1) : 57-64.

Senapati, N., Mishra, H.N., Beura, S.K., Darla, S.K, Prasad, G. and Patnaik, A. 2011. Genetic analysis in okra hybrids. *Environment and Ecology*. 29(3A) : 1240-1244.

Singh, D., Dudi, B.S., Meena, O.P. and Dhankhar, S.K. 2016. Determination of genetic relationships among different agro-morphological traits in okra genotypes. *International Journal of Agricultural and Statistical Sciences*. 12(1): 245-253.

Wright, S. 1921. *Correlation and Causation. J. Agric. Res.* 20: 557-587.