



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(4): 2599-2603
Received: 15-05-2018
Accepted: 20-06-2018

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Estimation of direct selection parameter in okra [*Abelmoschus esculentus* (L.) Moench]

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Abstract

The experiment was conducted at Main Experimental Station, Department of Vegetable Science, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad during *Kharif*, 2016 in Randomized Block Design with three replications using thirty genotypes of okra collected from different sources to study the correlation and path coefficients analysis at phenotypic and genotypic levels for different quantitative characters. Characters like marketable fruit yield per plant (0.8522), unmarketable fruit yield per plant (0.7458), number of fruits per plant (0.7449), plant height (0.7204), days to 50% flowering (0.5720), days to first fruit harvest (0.5482), crop duration (0.5330) and fruit length (0.4370) have positive significant and desirable association with fruit yield. Thus there is an ample scope for improving characters through direct selection. Marketable fruit yield per plant (0.6192), unmarketable fruit yield per plant (0.4635), number of fruits per plant (0.0670) and days to first fruit harvest (0.0667) were identified as most important traits which had positive direct effect on total fruit yield per plant while, the negative direct effect on yield by rest of the dependent traits were very low.

Keywords: estimation, parameter, okra, *Abelmoschus esculentus*

Introduction

Okra is the most traditional and popular vegetable in India and it is extensively cultivated in summer and rainy season. It is one of the important vegetable crops which are grown throughout the tropical, subtropical and temperate parts of the world. It has been grown commercially in India, Turkey, Iran, Western Africa, Yugoslavia, Bangladesh, Afghanistan, Pakistan, Burma, Japan, Malaysia, Brazil, Ghana, Ethiopia, Cyprus and the Southern United States. Okra [*Abelmoschus esculentus* (L.) Moench $2n = 2x=130$] is one of the important member of the family Malvaceae. Okra is an African word and is native to northern Africa including the area of Ethiopia and Sudan. It is a summer and rainy season crop and is widely cultivated from tropics to sub tropics (Kochar, 1986) [6].

Okra (*Abelmoschus esculentus* L.) is probably an amphidiploids (allotetraploid) derived from *Abelmoschus tuberculatus* ($2n = 58$), a wild species from India, and a species (*Abelmoschus ficulneus* (L.) Wight and Arn. ex Wight) with $2n = 72$ chromosomes. Another edible okra species are *Abelmoschus caillei* (A. Chev.). Stevels occurs in the humid parts of West and Central Africa. There are strong indications that *Abelmoschus caillei* is amphidiploids with *Abelmoschus esculentus* being one of the parental species. The lowest chromosome number $2n=56$ reported in *Abelmoschus angulosus* (Ford, 1938) whereas, the highest chromosome number $2n=196$ reported in *Abelmoschus manihot* var. *Caillei* (Singh and Bhatnagar, 1975 Siemonsma, 1982a, 1982b) [11, 9, 10].

Largest area and production is in India followed by Nigeria in the world. India ranks first in the world with 72 per cent of the total world production of okra. In India the total area covered under okra is 0.51 million hectare with the production of 6.00 million tonnes green fruits in the year 2016-17. Leading okra producing state in India is West Bengal followed by Gujarat and Bihar (Anonymous, 2017) [2].

The information about correlation among different component of yield is necessary for designing efficient plant breeding programme through selection and for simultaneous improvement of yield components. Therefore, such information can be obtained by the studying genotypic and phenotypic correlation coefficient between yield and yield contributing characters.

Path coefficients analysis is helpful in portioning the observed correlation coefficient into direct and indirect effect and there effective use in selection programme.

Materials and Methods

The research work was undertaken at the Main Experimental Station, Department of Vegetable Science, Narendra Deva University of Agriculture and Technology Narendra Nagar (Kumarganj), Faizabad (U.P.) during the *Kharif*, 2016. Geographically the experimental site (Kumarganj, Faizabad) falls under humid sub-tropical climate and is located at 26.47° N latitude and 82.12° E longitude at an altitude of 113 meter above the mean sea level. The experiment was conducted using thirty genotypes in Randomized Block Design with three replications. Observations were recorded on thirteen quantitative characters *viz.* days to 50% flowering, node to first flower appearance, plant height (cm), crop duration, number of branches per plant, days to first fruit harvest, fruit length (cm), fruit circumference (cm), average fruit weight, number of fruits per plant, marketable fruit yield per plant (g), unmarketable fruit yield per plant (g). The correlation coefficient was carried out as per Searle (1961)^[8] and path coefficient analysis suggested by Dewey and Lu (1959)^[3].

Results and Discussion

In the present study, correlations between thirteen characters were worked out in all possible combinations at phenotypic and genotypic levels are presented in Table- 1 and 2. A perusal of data (Table-1 and 2) revealed that genotypic correlations were higher in magnitude than the corresponding values of phenotypic correlation coefficients suggesting therefore, a strong inherent relationship in different pair of characters. Umrao *et al.* (2015)^[13] had also reported higher

estimates of genotypic correlation than the corresponding phenotypic correlation between yield and yield component. The most important trait total fruit yield per plant had exhibited highly significant and positive phenotypic correlation with marketable fruits yield per plant (0.8522) followed by unmarketable fruits yield per plant (0.7458), number of fruit per plant (0.7449), plant height (0.7204), days to 50% flowering (0.5720), days to first fruit harvest (0.5482), crop duration (0.5330), fruit length (0.4370) while, significant positive correlation with average fruit weight (0.2511). Thus, these characters emerged as most important association of fruit yield in okra. Similar results have been reported by Nirosha *et al.* (2014)^[7], Umrao *et al.* (2015)^[13] Thulasiram *et al.* (2017)^[12] and Kerure *et al.* (2017)^[5].

The direct and indirect effects of different characters on fruit yield at phenotypic and genotypic level have been presented in Table-3 and 4. The higher magnitude of positive direct effect on fruit yield was exerted by marketable fruit yield per plant (0.6192) followed by unmarketable fruit yield per plant (0.4635). However, the positive direct effects of rest of the traits on fruit yield were very low. Dhall *et al.* (2000)^[4] had also reported high positive direct effect of marketable fruit yield per plant on total fruit yield per plant. The negative direct effect on yield by either of the dependent traits were very low. Adiger *et al.* (2011)^[1] had also reported negative direct effect of days to 50% flowering (-0.0529) on total fruit yield per plant. This indicated that direct selection based on marketable fruit yield per plant would result in an appreciable improvement of pod yield per plant in okra.

Table 1: Estimates of phenotypic correlation coefficients between thirteen characters in okra germplasm

Characters	Node to first flower appearance	Plant height	Crop duration	Number of branches per plant	Days to first fruit harvest	Fruit length	Fruit circumference	Average fruit weight	Number of fruits per plant	Marketable fruit yield per plant	Unmarketable fruit yield per plant	Total fruit yield per plant
Days to 50% flowering	0.0456	0.2486*	0.3247*	0.1514	0.9524**	0.5861**	0.2311*	0.1391	0.3209*	0.3716**	0.6146**	0.5720**
Node to first flower appearance		-0.0996	-0.0495	-0.0103	0.0999	0.0781	-0.0851	0.1362	-0.0059	0.1120	-0.0199	0.0672
Plant height (cm)			0.5170**	0.0418	0.2210*	0.1587	0.1118	0.1456	0.7096**	0.5943**	0.5572**	0.7204**
Crop duration				0.0739	0.3203*	0.2002	0.2615*	0.0235	0.5688**	0.4276**	0.4088**	0.5330**
Number of branches per plant					0.1947	0.1218	0.1539	0.0314	0.1687	-0.0619	0.3146*	0.1568
Days to first fruit harvest						0.5833**	0.2901*	0.1194	0.3396*	0.3468*	0.5792**	0.5482**
Fruit length (cm)							0.1931	0.0294	0.4134**	0.3184*	0.4141**	0.4370**
Fruit circumference (cm)								0.1302	0.1254	0.1504	0.1348	0.2109
Average fruit weight (g)									0.1168	0.1866	0.1581	0.2511*
Number of fruits per plant										0.6546**	0.4919**	0.7449**
Marketable fruit yield per plant (g)											0.3311*	0.8522**
Unmarketable fruit yield per plant (g)												0.7458**

* - Significant at 5 per cent probability level

**- Significant at 1 per cent probability level

Table 2: Estimates of genotypic correlation coefficients between thirteen characters in okra

Characters	Node to first flower Appearance	Plant height	Crop duration	Number of branches per plant	Days to first fruit harvest	Fruit length	Fruit circumference	Average fruit weight	Number of fruits per plant	Marketable fruit yield per plant	Unmarketable fruit yield per plant	Total fruit yield per plant
Days to 50% flowering	0.097	0.3026	0.8171	0.3761	1.0073	0.9315	0.4294	0.1013	0.4343	0.4279	0.7198	0.6302
Node to first flower appearance		-0.2086	-0.2954	0.1551	0.0902	0.2295	-0.0362	0.2311	0.0167	0.1503	-0.0347	0.0717
Plant height (cm)			1.1999	0.1650	0.2614	0.2276	0.2129	0.6571	0.9101	0.7699	0.6595	0.8522
Crop duration				0.1361	0.7676	0.7295	0.6383	0.4492	1.1060	0.9850	0.7897	1.0619
Number of branches per plant					0.4118	0.5823	0.4014	0.6964	0.2941	0.0237	0.4669	0.2747
Days to first fruit harvest						0.9651	0.4438	0.0464	0.4517	0.4194	0.7075	0.6191
Fruit length (cm)							0.1736	-0.0111	0.4519	0.5336	0.6881	0.6858
Fruit circumference (cm)								0.4351	0.2312	0.2687	0.2413	0.3326
Average fruit weight (g)									0.3451	0.6068	0.4241	0.6059
Number of fruits per plant										0.8405	0.6704	0.9000
Marketable fruit yield per plant (g)											0.4973	0.9230
Unmarketable fruit yield per plant (g)												0.8016

Table 3: Direct and indirect effects of twelve characters on fruit yield per plant at phenotypic level in okra

Characters	Days to 50% flowering	Node to first flower appearance	Plant height	Crop duration	Number of branches per plant	Days to first fruit harvest	Fruit length	Fruit circumference	Average fruit weight	Number of fruits per plant	Marketable fruit yield per plant	Unmarketable fruit yield per plant	Correlation with total fruit yield per plant
Days to 50% flowering	-0.0529	0.0002	0.0071	0.0043	0.0040	0.0635	-0.0026	0.0056	0.0063	0.0215	0.2301	0.2848	0.5720
Node to first flower appearance	-0.0024	0.0033	-0.0029	-0.0007	-0.0003	0.0067	-0.0003	-0.0021	0.0061	-0.0004	0.0693	-0.0092	0.0672
Plant height (cm)	-0.0131	-0.0003	0.0288	0.0069	0.0011	0.0147	-0.0007	0.0027	0.0065	0.0476	0.3680	0.2583	0.7204
Crop duration	-0.0172	-0.0002	0.049	0.0133	0.0019	0.0213	-0.0009	0.0064	0.0011	0.0381	0.2648	0.1895	0.5330
Number of branches per plant	-0.0080	0.0000	0.0012	0.0010	0.0263	0.0130	-0.0005	0.0038	0.0014	0.0113	-0.0383	0.1458	0.1568
Days to first fruit harvest	-0.0503	0.0003	0.0064	0.0042	0.0051	0.0666	-0.0026	0.0071	0.0054	0.0228	0.2147	0.2684	0.5482
Fruit length (cm)	-0.0310	0.0003	0.0046	0.0027	0.0032	0.0389	-0.0044	0.0047	0.0013	0.0277	0.1972	0.1919	0.4370
Fruit circumference (cm)	-0.0122	-0.0003	0.0032	0.0035	0.0040	0.0193	-0.0008	0.0244	0.0059	0.0084	0.0931	0.0625	0.2109
Average fruit weight (g)	-0.0074	0.0005	0.0042	0.0003	0.0008	0.0080	-0.0001	0.0032	0.0450	0.0078	0.1156	0.0733	0.2511
Number of fruits per plant	-0.0170	0.0000	0.0204	0.0075	0.0044	0.0226	-0.0018	0.0031	0.0053	0.0670	0.4053	0.2280	0.7449
Marketable fruit yield per plant (g)	-0.0196	0.0004	0.0171	0.0057	-0.0016	0.0231	-0.0014	0.0037	0.0084	0.0439	0.6192	0.1535	0.8522
Unmarketable fruit yield per plant (g)	-0.0325	-0.0001	0.0160	0.0054	0.0083	0.0386	-0.0018	0.0033	0.0071	0.0330	0.2050	0.4635	0.7458

R square = 0.9762 Residual effect = 0.1543

Table 4: Direct and indirect effects of twelve characters of fruit yield per plant at genotypic level in okra

Characters	Days to 50% flowering	Node to first flower appearance	Plant height	Crop duration	Number of branches per plant	Days to first fruit harvest	Fruit length	Fruit circumference	Average fruit weight	Number of fruits per plant	Marketable fruit yield per plant	Unmarketable fruit yield per plant	Correlation with total fruit yield per plant
Days to 50% flowering	0.0168	-0.0082	-0.0494	-0.0430	0.0096	0.2770	-0.1918	-0.0329	0.0118	0.1052	0.2895	0.2457	0.6302
Node to first flower appearance	0.0016	-0.0844	0.0340	0.0155	0.0039	0.0248	-0.0473	0.0028	0.0268	0.0041	0.1017	-0.0119	0.0717
Plant height (cm)	0.0051	0.0176	-0.1631	-0.0631	0.0042	0.0791	-0.0469	-0.0163	0.0763	0.2204	0.5210	0.2251	0.8522
Crop duration	0.0137	0.0249	-0.1957	-0.0526	0.0035	0.2111	-0.1502	-0.0489	0.0522	0.2678	0.6665	0.2695	1.0619
Number of branches per plant	0.0063	-0.0131	-0.0269	-0.0072	0.0254	0.1132	-0.1199	-0.0307	0.0809	0.0712	0.0160	0.1594	0.2747
Days to first fruit harvest	0.0169	-0.0076	-0.0426	-0.0404	0.0105	0.2749	-0.1987	-0.0340	0.0054	0.1094	0.2838	0.2415	0.6191
Fruit length (cm)	0.0156	-0.0194	-0.0371	-0.0384	0.0148	0.2653	-0.2059	-0.0133	-0.0013	0.1094	0.3611	0.2349	0.6858
Fruit circumference (cm)	0.0072	0.0031	-0.0347	-0.0336	0.0102	0.1220	-0.0358	-0.0765	0.0506	0.0560	0.1818	0.0824	0.3326
Average fruit weight (g)	0.0017	-0.0195	-0.1072	0.0236	0.0177	0.0128	0.0023	-0.0333	0.1162	0.0836	0.4106	0.1448	0.6059
Number of fruits per plant	0.0073	-0.0014	-0.1484	-0.0582	0.0075	0.1242	-0.0931	-0.0177	0.0401	0.2422	0.5687	0.2288	0.9000
Marketable fruit yield per plant (g)	0.0072	-0.0127	-0.1256	-0.0518	0.0006	0.1153	-0.1099	-0.0206	0.0705	0.20355	0.6766	0.1698	0.9230
Unmarketable fruit yield per plant (g)	0.0121	0.0029	-0.1076	-0.0415	0.0119	0.1945	-0.1417	-0.0185	0.0493	0.1623	0.3365	0.3413	0.8016

R square = 0.9762 Residual effect = - 0.0067

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