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Correlation Analysis of Quantitative Characters in Okra (*Abelmoschus esculentus* L. Moench)

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ABSTRACT: The present investigation was carried out at New Orchard, Main Agricultural Research Station, University of Agricultural Sciences, Raichur, during late *Kharif* 2021-22 using thirty-one okra genotypes and laid out in Randomized Block Design (RBD) with three replications. In okra fruit yield is dependent character and it controlled by many other characters. Fruit yield per plant had a positive and significant association with the number of fruits per plant, plant height, number of nodes per plant, internodal length, chlorophyll content, harvesting period, stem girth, fruit length, first flowering node, number of leaves per plant and leaf area index. Hence, these traits can be used as selection criteria in okra breeding for high yield.

Keywords: Okra genotypes, Variability and Correlation.

INTRODUCTION

Okra (*Abelmoschus esculentus* L. Moench) also known as lady's finger and bhendi, is an important spring-summer and rainy season vegetable crop cultivated in tropical and sub-tropical parts of the world. It can also be cultivated throughout the year where winter is mild. India is the largest producer of okra in the world with an annual production of 6.35milliontonnes from an area of 521 thousand hectares with a productivity of 12.19 tonnes per hectare (Anon., 2020a). Uttar Pradesh, Bihar, Orissa, West Bengal, Andhra Pradesh, Karnataka and Assam are the major okra growing states. Agricultural and Processed Food Products Export Development Authority (APEDA) has sanctioned Agriculture-Export Zones in Punjab, Uttar Pradesh, Gujarat, Andhra Pradesh, Bihar and West Bengal for enhancing the export of vegetables including okra. It has vast potential as one of the foreign exchange earning fresh vegetable crop from India. At present, it is being exported to United Arab Emirates, United Kingdom, Nepal, Bahrain, Saudi Arabia, Singapore, Kuwait, Qatar and Sri Lanka (Anon., 2020b).

It is an annual herbaceous plant and belongs to the family Malvaceae under the order Malvales, having a chromosome number of 2n=130 and is considered to be an amphidiploid. Okra being an often cross-pollinated crop, out crossing to an extent of 20 percent by insects, which renders a considerable amount of variability. Emasculation and pollination processes are easier in okra due to large flower and monadelphous stamens.

Okra is being cultivated for its fruits and has multiple uses. Tender fruits are used as a vegetable and eaten boiled or in culinary preparations as sliced and fried pieces. It is also used in thickening of soups and gravies because of its high mucilage content. Okra fruits are sliced and sun-dried or canned and dehydrated for off-season use. The ripe seeds are roasted, grinded and used as a substitute for coffee. Fruits contains protein (2.10 %), fat (0.2 %), carbohydrate (8.2 %), fibre (1.70 %), ash (0.8 %),vitamin C (30 mg/100g), calcium(84.00 mg/100g) and iron(1.20 mg/100g). Seeds contains 13 to 22 per cent edible oil and 20 to 24 per cent protein and used for refined edible oil (Saifullah and Rabbani 2009). It is also an excellent source of iodine (2.33-6.33 µg/100g).

Fruit yield is an economic end product of okra which is controlled by many other characters. Estimating the yield contributing variables correlation coefficient is useful during selection and maximizes the yield in the shortest period. The correlation coefficient between a pair of characters is either positive or negative and high or low. This value indicates the relative importance of character (s) on which greater emphasis has to be made during selection for yield. Therefore, the present investigation was conducted to estimate correlation among the fruit yield and its components in okra.

MATERIAL AND METHODS

The present investigation was carried out at New Orchard, Department of Horticulture, Main Agricultural Research Station, University of Agricultural Sciences, Raichur during late *Kharif* (2021-22) and the laboratory studies were carried out in the laboratory of Department of Agriculture Biochemistry, College of Agriculture, Raichur. The experimental material comprised of 31 okra genotypes (including check variety Arka Anamika) collected from ICAR- National Bureau of Plant Genetic Resources (NBPGR), New Delhi and ICAR- Indian Institute of Horticultural Research (IIHR), Bengaluru. These genotypes were evaluated by raising each entry in a plot of 3.6 m length and 2.4 m width, at a spacing of 60 cm × 45 cm in a Randomized Block Design (RBD) with three replications.

Recommended agronomic practices and need based plant protection measures were adopted as per the package of practices, UHS, Bagalkot (Anon., 2013). The observations were recorded on five randomly selected plants per plot in each replication for sixteen different growth (at 105 DAS), reproductive and yield characters *viz.*, plant height, stem girth, number of leaves per plant, leaf area index, internodal length, number of nodes per plant, chlorophyll content (SPAD readings), days to first flowering, days to 50 per cent flowering, first flowering node, fruit length, fruit girth, ten fruits weight, number of fruits per plant, harvesting period, fruit yield per plant. The data recorded was subjected to statistical analysis as per description of Panse and Sukhatme (1985). The correlation co-efficient among all possible character combinations at phenotypic and genotypic level were estimated employing formula suggested by Al-Jibouri *et al*. (1958). The test of significance for association between characters was done by comparing table 'r' values at n-2 error degrees of freedom for phenotypic and genotypic correlations with estimated values.

RESULTS AND DISCUSSION

Knowledge of correlation is mainly to judge the relationship between traits. Yield is not an independent trait; it is the resultant of number of traits interacting among themselves as well as with the environment in which the plant grows. So, knowledge of the degree of association of yield with its components is of great importance. Further, each trait is modified greatly not only by the action of genes present in the genotypes of plants but also by the environment and it becomes difficult to assess these complex traits directly. Therefore, correlation studies of yield along with its component traits have been conducted to find out which are all the traits contributing towards yield. Both phenotypic and genotypic correlation coefficients were measured for various traits. Generally, for most of the traits, higher values of genotypic correlation coefficients were obtained than phenotypic correlation coefficients. A simple correlation coefficient was worked out for sixteen important yield contributing traits of okra genotypes.

Genotypic correlation coefficients among the different traits (Table 1) indicated that, fruit yield per plant had a positive and significant association with the number of fruits per plant (0.970), plant height (0.956), harvesting period (0.946), number of nodes per plant (0.893), internodal length (0.879), stem girth (0.841), fruit length (0.812), first flowering node (0.510), number of leaves per plant (0.467), chlorophyll content (0.425) and leaf area index (0.378) and it had positive non-significant association with ten fruits weight (0.174). While, fruit girth (-0.308), days to first flowering (-0.042) and days to 50 per cent flowering (-0.012) had negative genotypic correlation coefficient fruit yield per plant.

Table 1: Genotypic correlation co-efficient for different parameters in okra genotypes.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	**1.000**	0.850**	0.388*	0.419*	0.968**	0.790**	0.450*	0.004	0.033	0.532**	0.627**	-0.036	0.143	0.896**	0.914**	**0.956****
2		**1.000**	0.681**	0.619**	0.862**	0.609**	0.380*	0.054	0.130	0.490**	0.681**	-0.084	0.344	0.798**	0.818**	**0.841****
3			**1.000**	0.411*	0.272	0.655**	-0.014	0.248	0.111	0.519**	0.514**	-0.305	0.279	0.403*	0.404*	**0.467****
4				**1.000**	0.460**	0.202	0.348	-0.012	-0.051	0.299	0.295	0.005	0.060	0.376*	0.365*	**0.378***
5					**1.000**	0.607**	0.403*	-0.050	-0.017	0.414*	0.576**	0.001	0.168	0.902**	0.868**	**0.893****
6						**1.000**	0.436*	0.129	0.160	0.627**	0.644**	-0.121	-0.025	0.825**	0.820**	**0.879****
7							**1.000**	-0.593**	-0.647**	0.091	0.143	0.029	-0.551**	0.647**	0.495**	**0.425***
8								**1.000**	0.908*	0.603**	0.017	-0.039	0.803**	-0.170	-0.092	**-0.042**
9									**1.000**	0.105	-0.054	-0.013	0.755**	-0.174	-0.120	**-0.012**
10										**1.000**	0.515**	-0.178	0.325	0.498**	0.490**	**0.510****
11											**1.000**	-0.658**	0.237	0.855**	0.741**	**0.812****
12												**1.000**	-0.059	-0.234	-0.269	**-0.308**
13													**1.000**	-0.049	-0.090	**0.174**
14														**1.000**	0.974**	**0.946****
15															**1.000**	**0.970****

** Significance at 1% probability
* Significance at 5% probability

1. Plant height (cm)
2. Stem girth (mm)
3. Number of leaves per plant
4. Leaf area index
5. Number of nodes per plant
6. Internodal length (cm)
7. Chlorophyll content (SPAD readings)
8. Days to first flowering
9. Days to 50 per cent flowering
10. First flowering node
11. Fruit length (cm)
12. Fruit girth (mm)
13. 10 fruits weight (g)
14. Harvesting period (days)
15. Number of fruits per plant
16. Fruit yield per plant (g)

Phenotypic correlation coefficients among the different traits (Table 2) indicated that, fruit yield per plant had a positive and significant association with the number of fruits per plant (0.950), plant height (0.911), number of nodes per plant (0.856), harvesting period (0.845), stem girth (0.775), fruit length (0.733), first flowering node (0.489), internodal length (0.464), number of leaves per plant (0.373), leaf area index (0.352) and chlorophyll content (0.293) and it had positive non-significant association with ten fruits weight (0.138). While, fruit girth (-0.306), days to 50 per cent flowering (-0.015) and days to first flowering (-0.007) had negative phenotypic correlation coefficient fruit yield per plant.

The correlation studies results indicated that, plants with higher plant height, more number of leaves per plant, higher stem girth, more number of nodes per plant, higher internodal length, greater leaf area index, higher node to first flowering, higher chlorophyll content in leaves, more number of fruits per plant and long harvesting period would results in significantly higher fruit yield per plant.

The positive and significant genotypic and phenotypic correlation coefficient results obtained with respect to

fruit yield per plant in the present investigation corroborate with the findings of Das *et al.* (2012) for number of nodes per plant and number of leaves per plant, Thulasiram *et al.* (2017) for chlorophyll content, Samim *et al.* (2018) for harvesting period, Shuirkar *et al.* (2018) for internodal length and first flowering node, Raval *et al.* (2019); Chaudhary *et al.* (2020); for plant height, fruit length and number of fruits per plant in okra.

Table 2: Phenotypic correlation co-efficient for different parameters in okra genotypes.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	**1.000**	0.753**	0.326**	0.393**	0.867**	0.601**	0.319*	0.006	-0.030	0.458**	0.568**	-0.020	0.099	0.791**	0.881**	**0.911****
2		**1.000**	0.503**	0.542**	0.765**	0.337**	0.211	0.071	-0.005	0.435**	0.533**	-0.060	0.244	0.652**	0.730**	**0.775****
3			**1.000**	0.451**	0.231	0.315*	0.036	0.265*	0.112	0.434**	0.396**	-0.221	0.215	0.267*	0.340**	**0.373****
4				**1.000**	0.427**	0.115	0.287*	0.032	-0.024	0.256*	0.262*	0.013	0.077	0.286*	0.353**	**0.352****
5					**1.000**	0.155	0.308*	-0.032	0.021	0.390**	0.480**	0.001	0.081	0.731**	0.822**	**0.856****
6						**1.000**	0.142	0.047	-0.150	0.276*	0.355**	-0.029	0.116	0.483**	0.466**	**0.464****
7							**1.000**	-0.338**	-0.315*	0.009	0.124	0.053	-0.274*	0.407**	0.370**	**0.293***
8								**1.000**	0.642**	0.433**	0.025	0.004	0.450**	-0.139	-0.081	**-0.007**
9									**1.000**	0.115	-0.079	0.003	0.422**	-0.275*	-0.088	**-0.015**
10										**1.000**	0.395**	-0.166	0.216	0.358**	0.433**	**0.489****
11											**1.000**	-0.596**	0.152	0.622**	0.695**	**0.733****
12												**1.000**	-0.036	-0.169	-0.262*	**-0.306**
13													**1.000**	0.059	-0.070	**0.138**
14														**1.000**	0.835**	**0.845****
15															**1.000**	**0.950****

** Significance at 1% probability
* Significance at 5% probability

1. Plant height (cm)
2. Stem girth (mm)
3. Number of leaves per plant
4. Leaf area index
5. Number of nodes per plant
6. Internodal length (cm)
7. Chlorophyll content (SPAD readings)
8. Days to first flowering
9. Days to 50 per cent flowering
10. First flowering node
11. Fruit length (cm)
12. Fruit girth (mm)
13. 10 fruits weight (g)
14. Harvesting period (days)
15. Number of fruits per plant
16. Fruit yield per plant (g)

CONCLUSIONS

Fruit yield per plant had a positive and significant association with the number of fruits per plant, plant height, number of nodes per plant, internodal length, chlorophyll content, harvesting period, stem girth, fruit length, first flowering node, number of leaves per plant and leaf area index. Hence, these traits can be used as selection criteria in okra breeding for high yield.

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