Effect of Foliar Application of Nitrogen and Boron on the Yield of Tomato (Lycopersicon esculentum Mill.)

Ayushi yadav, Aneeta Yadav* and Krishna Kumar Mishra

Faculty of Agricultural Sciences and Allied Industries

Rama University, Mandhana, Kanpur (U.P.)-209217

Corresponding author: draneeta@ramauniversity.ac.in

Abstract

The experiment was undertaken with thirty eight genotypes of okra [Abelmoschus esculentus (L.) Moench] to conduct the correlation and path coefficient analysis to work out the inter-relationships among the traits. From the analysis it was observed that at genotypic and phenotypic levels, days to 50 % flowering exhibited significant positive correlation with number of branches per plant. Plant height showed significant positive correlation with number of fruits per plant followed by fruit diameter. Number of fruits per plant showed significant positive correlation with fruit length. Fruit length exhibited significant positive correlation with number of seeds per fruit. Fruit diameter showed significant positive correlation with edible yield per plant. At both genotypic and phenotypic level, path coefficient analysis revealed that direct effect was maximum in case of fruit diameter. The negative direct effect was maximum, in case of number of branches per plant. However, fruit diameter showed significant positive highest indirect effect on yield and number of branches per plant showed significant negative indirect effect on yield. The traits which are correlated positively with yield can be used as selection criteria in crop improvement programmes. The characters having maximum direct and indirect effects can also be used in breeding programmes. The residual factors were 0.9716 and 0.5823 at phenotypic and genotypic levels, respectively indicating that there are some other factors which have not been considered here and need to be included in this analysis to account fully for variation in yield.

Keywords: Correlation, path coefficient, inter-relationship, okra and genotypes.

Introduction

Okra ***(Abelmoschus esculentus (L.) Moench***) is commonly known as bhindi or lady's finger belonging to family Malavaceae . Okra is extensively grown in tropical, sub-tropical and warm areas of the world. It is a powerhouse of variable nutrients and because of this okra has a prominent position among all the vegetables in India. The experiment was conducted to estimate correlation and path coefficient analysis, which is important in deciding the degree and direction of relationship and the effect of different traits on yield. An attempt was made to evaluate 38 genotypes for different characters like days to flowering, fruit length, plant height, fruit diameter, number of branches per plant, number of fruits per plant, number of seeds per fruit and edible yield per plant. The experiment was conducted with certain objectives to study correlation and path coefficient analysis to identify the character association as well as the direct and indirect effects on yield and its component characters under the study.

In okra, all growth, earliness and yield associated traits are quantitative in nature. Such characters are controlled by polygenes and are much influenced by environmental fluctuations. 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. 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. Indirect selection for other yield - related characters, which are closely associated with yield, will be more effective. The appropriate knowledge of such interrelationships between pod yield and its contributing components can significantly improve the efficiency of a breeding program through the use of appropriate selection indices.

Materials and methods

The experiment was conducted at Research Farm, Faculty of Agricultural Sciences and Allied Industries, Rama University, Kanpur in the year 2019-20. The genotypes used in the experiment shows geographical as well as morphological diversity, which is the pre-requisite for any breeding programme. The experiment material consists of total 38 genotypes. Randomized block design was used for experimentation. The observation were recorded for different traits *viz.,* days to 50% flowering, plant height (cm), number of branches/plant, length of fruit (cm), diameter of fruit (cm), number of seeds per fruit, number of fruits per plant and edible fruit yield per plant (g).

Correlation and path coefficient analysis 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 a realistic basis for allocation of appropriate weight age to various yield components.

Result and Discussion

Complex characteristics such as yield must be related to many individually distinguishable characteristics. It is obvious that fruit yield is a complex character that depends up on many independent yield contributing characters, which are regarded as yield components. All changes in the components need not however, be expressed by changes in yield. This is due to varying degree of positive and negative associations between yield and its components and among components themselves. Therefore, selection should be based on these component characters after assessing their association with fruit yield per plant. The correlation coefficients at genotypic level and phenotypic level have been presented in table 1 and 2 respectively.

The path coefficient analysis was used to partition the correlation coefficients of all the component characters studied with seed yield per plant, into direct and indirect effects. The results of various causes influencing seed yield (direct and indirect effects) are shown in Tables 3 and 4 at the genotypic and phenotypic levels, respectively.

At genotypic level, days to 50 % flowering exhibited significant positive correlation with number of branches per plant (0.638**) followed by plant height (0.247*). Plant height showed significant positive correlation with number of fruits per plant (0.597**) followed by fruit diameter (0.402**). Number of branches per plant showed significant positive correlation with fruit diameter (0.198*), while it showed significant negative correlation with yield per plant and number of seeds per fruit. Number of fruits per plant showed significant positive correlation with fruit length (0.250**) followed by number of seeds per fruit (0.231*). Fruit length exhibited significant positive correlation with number of seeds per fruit (0.664**), followed by fruit diameter (0.213*). Fruit diameter showed significant positive correlation with edible yield per plant (0.350**). Number of seeds per fruit also showed significant positive correlation with yield per plant (0.225*).

At phenotypic level, days to 50 % flowering exhibited significant positive correlation with number of branches per plant (0.312**). Plant height showed significant positive correlation with number of fruits per plant (0.253**). Number of branches per plant showed highest positive correlation with fruit diameter (0.162). Number of fruits per plant showed highest positive correlation with fruit length (0.122) followed by number of seeds per fruit (0.054). Fruit length exhibited significant positive correlation with number of seeds per fruit (0.303**). Fruit diameter showed highest positive correlation with edible yield per plant (0.141). Number of seeds per fruit also showed positive correlation with yield per plant (0.087).

At genotypic level, path coefficient analysis revealed that direct effect of fruit diameter was maximum (1.3514) followed by number of fruits per plant (1.2965), days to 50% flowering (1.0817) and fruit length (0.3884). The negative direct effect was maximum in case of number of branches per plant (-1.6949), followed by plant height (-1.6137) and number of seeds per fruit (-0.8236). However, fruit diameter showed significant positive highest indirect effect on yield (0.350**) and number of branches per plant showed significant negative indirect effect on yield (-0.303**).

At phenotypic level, path coefficient analysis revealed that direct effect of fruit diameter was maximum (0.156) followed by number of seeds per fruit (0.092), days to 50% flowering (0.039) and plant height (0.026). The negative direct effect was maximum in case of number of branches per plant (-0.177), followed by number of fruits per plant (-0.049) and fruit length (-0.035). However, fruit diameter showed highest positive indirect effect on yield (0.141).

The residual factor was 0.9716 and 0.5823 at phenotypic and genotypic levels, respectively indicating that there are some other factors which have not been considered here and need to be included in this analysis to account fully for variation in yield.

Traits	DFF	PH(cm)	NBPP	NFP	FL(cm)	DF(cm)	SPF	EYPP(g)
DFF	1.000	0.247**	0.638**	0.032	0.032	0.188*	-0.162	0.042
PH(cm)		1.000	0.003	0.597**	0.074	0.402**	-0.033	0.023
NBPP			1.000	0.150	0.120	0.198*	-0.238*	-0.303**
NFP				1.000	0.250**	-0.135	0.231*	-0.164
FL(cm)					1.000	0.213*	0.664**	0.166
DF(cm)						1.000	0.154	0.350**
SPF							1.000	0.225*
EYPP (g)								1.000

**** &** Signficant at 5% & 1% respectively***

Table 1: Genotypic correlation coefficients among the traits under study in okra

Traits	DFF	PH(cm)	NBPP	NFP	FL(cm)	DF(cm)	SPF	EYPP(g)
DFF	1.000	0.150	0.312**	-0.029	0.067	0.117	-0.074	-0.002
PH(cm)		1.000	0.076	0.253**	0.038	0.122	0.008	0.025
NBPP			1.000	0.008	-0.064	0.162	0.018	-0.134
NFP				1.000	0.122	-0.065	0.054	-0.055
FL(cm)					1.000	0.155	0.303**	0.026
DF(cm)						1.000	0.089	0.141
SPF							1.000	0.087
EYPP (g)								1.000

**** &** Signficant at 5% & 1% respectively***

Table 2: Phenotypic correlation coefficients among the traits under study in okra

Traits	DFF	PH(cm)	NBPP	NFP	FL(cm)	DF(cm)	SPF	EYPP(g)
DFF	**1.0817**	-0.3985	-1.082	0.0412	0.0125	0.2535	0.1335	0.042
PH(cm)	0.2672	**-1.6137**	-0.0042	0.7743	0.0287	0.5432	0.0276	0.023
NBPP	0.6906	-0.004	**-1.6949**	0.1948	0.0466	0.2679	0.1963	-0.303**
NFP	0.0344	-0.9637	-0.2547	**1.2965**	0.097	-0.1831	-0.1906	-0.164
FL(cm)	0.0348	-0.1192	-0.2032	0.3237	**0.3884**	0.2885	-0.5465	0.166
DF(cm)	0.2029	-0.6486	-0.336	-0.1757	0.0829	**1.3514**	-0.1268	0.350**
SPF	-0.1754	0.054	0.404	0.3001	0.2577	0.208	**-0.8236**	0.225*

**** &** Signficant at 5% & 1% respectively***

R SQUARE = 0.6609 RESIDUAL EFFECT = 0.5823

Table 3: Genotypic Path coefficients among the traits under study in okra

Traits	DFF	PH(cm)	NBPP	NFP	FL(cm)	DF(cm)	SPF	EYPP(g)
DFF	**0.039**	0.004	-0.055	0.002	-0.002	0.018	-0.007	-0.002
PH(cm)	0.006	**0.026**	-0.014	-0.013	-0.001	0.019	0.001	0.025
NBPP	0.012	0.002	**-0.177**	0.000	0.002	0.025	0.002	-0.134
NFP	-0.001	0.007	-0.001	**-0.049**	-0.004	-0.010	0.005	-0.055
FL(cm)	0.003	0.001	0.011	-0.006	**-0.035**	0.024	0.028	0.026
DF(cm)	0.005	0.003	-0.029	0.003	-0.005	**0.156**	0.008	0.141
SPF	-0.003	0.000	-0.003	-0.003	-0.011	0.014	**0.092**	0.087

***** &** Signficant at 5% & 1% respectively***

R SQUARE = 0.0561 RESIDUAL EFFECT = 0.9716

Table 4: Phenotypic Path coefficients among the traits under study in okra

Conclusion

The grain yield is a complex and highly variable character and a result of cumulative effect of its component characters and therefore, direct selection for yield may not be very effective. The yield components may not always be independent in their action but may be inter-linked. The selection practiced for one character may simultaneously bring change in the other related character. Thus, the information on the magnitude and direction of association between the component characters are essential for the improvement in the desirable direction. The traits like fruit length, fruit diameter showed positive correlation with yield, means selection for one trait will automatically select the positively correlated traits**.** For selection purpose, phenotypic correlation is of little practical value unless genetic and environmental correlations between pairs of characters are in the same direction when estimated separately. Genetic correlation provides a measure of genetic association between characters and is generally used in selection for one character as a mean of improving another one. Genetic correlation may be accounted by linkage or pleiotropy. Thus, the association between two traits that can be directly observed is the phenotypic correlation. The genotypic correlation in the true sense may be interpreted as the correlation of breeding value. The environmental correlation includes both environmental and non-additive genetic deviations.

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