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Estimation of Yield and Yield-related Traits among Seedling Colnes of Mango [*Mangifera indica* (L.) Cv. Langra] using Correlation and Path Coefficient

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ABSTRACT

Background: Mango is one of the most important fruits in the world. The superior position of mango is due to its very wide and variety utilization and because of that, the main goal of all mango breeding programs is to obtain new inbred and hybrids that will outperform the existing hybrids concerning many traits for efficient selection of fruit yield, like the most important economic traits, regarding its on the great influence the environmental factors, has a complex mode of inheritance and low heritable is necessary to know the relation between fruit yield and other traits which are influencing on fruit yield. The current study aimed to verify the variability and correlation between the traits in fruit yield, to practice indirect selection.

Methods: In this field investigation during 2018-19, Forty diverse clones (vegetative propagate) of mango cv. Langra were selected on Fruit Research Station (Farm), Imalia, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) to determine the genotypic correlation along with their direct and indirect effects through path coefficient analysis in mango as to estimate the contribution of most important characters towards yield.

Result: Yield was positively and significantly correlated with panicle length (0.38**), length of leaves (0.22*). The residual effect of path analysis was -0.06 revealed higher genetic variability and also proved a lower per cent of environmental influence on the selected characters of mango clones of Langra. Higher positive direct effects on yield were exhibited by the length of leaves, the width of leaves, flower shoot length, number of panicles, number of flowers, and fruit drop %. In combination with correlation coefficient and path analysis, it was found that the length of leaves gave a significant positive correlation coefficient with yield and also produce a high positive direct effect.

Key words: Clone, Fruit yield, Genotypic correlation, Langra, Path coefficient.

INTRODUCTION

Mango (*Mangifera indica* L.) belonging to the family Anacardiaceae is one of the commercially important fruit crops after banana and referred “King of Fruits” because having excellent flavour, attractive fragrance, beautiful shades of colour, delicious taste and hurtful value recognize mango as one of the best fruits in the world markets. It’s cultivated an area of 2.258 million hectares with an annual production of 21.822 million metric tons and productivity of 9.66 MT/ha (Anonymous, 2018).

Grafius (1959) suggested that there may not be only one gene for yield, rather for various components, the multiplicative interaction of many genes results in the yield. Hence, the knowledge of the correlation between yield and component characters and among the component characters themselves is essential for a rational and directed improvement of yield (Rao *et al*., 2004). Correlation and path coefficient analysis would provide a true picture of genetic association among different traits (Bhatt, 1973).

Correlation in combination with path coefficient analysis quantifies the direct and indirect contribution of one character upon another (Dewey and Lu, 1959). The concept of path analysis was originally developed by Wright in 1921, but the technique was first used for plant selection by Dewey and Lu (1959). Path analysis help in determining yield contributing characters and thus is useful in indirect selection. Knowledge of correlations, if accompanied by the understanding of the magnitude of contribution (direct and indirect) of each component character to the final makeup of the fruit yield, the criteria formulated would be effective in selecting the clones and using themselves in the crop improvement programme. Correlation along with path analysis would give a better appreciation of the cause and effect relationship between pairs of characters. The aim of correlation studies is primarily to know the suitability of various characters for indirect selection, because the

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selection of any particular trait may bring about undesirable changes in other associated characters. Genotypic correlation is the inherent or heritable association between two variables. This type of correlation may be either due to pleiotropic action of genes or due to linkage or more likely both. This type of correlation is more stable and is of paramount importance for a plant breeder to bring about genetic improvement in one character by selecting the other character of a pair that is genetically correlated.

MATERIALS AND METHODS

The research work was conducted from November 2018-June 2019 at Fruit Research Farm, Imalia, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) which is situated at 22°49′ and 20°80′ North latitude and 78°21′ and 80°58′ East longitude at an altitude of 411.78 meters above the mean sea level. The average rainfall ranges from 1350 mm, winter rains are also received usually. The soil of the experimental site was clayey in texture (58.4% clay, 22.5% silt and 20.1% sand) having pH 7.2 determined by International pipette method (Piper, 1967), medium available N (302 kg ha^{-1}) determined by alkaline permanganate method (Subbiah and Asija, 1956), high in P (22.6 kg ha^{-1}) determined by colorimeteric method (Jackson 1965) and K (430.7 kg ha^{-1}) determined by flame photometer method (Jackson, 1965) with medium organic carbon (0.70%) determined by Walkey and Black method (Black, 1965). Healthy and vigorous forty superior clones from 50-year-old plantation of Langra were selected for the collection of data and the data was analyzed in randomized block design (RBD) and opstat software. The distance from the plant to plant was 10 m and row to row was 10. Standard horticultural practices were followed including irrigation, weeding, protection from pests and diseases. All the morphological observations were taken as per the IPGRI descriptor for mango (IPGRI, 2006). Observations were recorded on growth parameters like length of leaves (cm), the width of leaves (cm), flower shoot length (cm), panicle length (cm), number of panicles, number of flowers, fruit drop % and fruit yield kg. The data were subjected to statistical analysis for assessing correlation and path analysis.

RESULTS AND DISCUSSION

Correlation among different agronomic and morphological characters is an important aspect for better planning of selection programs and is also helpful in determining the components of a complex trait like yield. But the correlation alone cannot prove the exact picture of the relative importance of direct and indirect influences of each of the component characters towards yield. So, the character association is further analyzed through the path coefficient. The relationship between yield and its components may be due to genetic linkage, pleiotrophy, or developmental causes. The correlation and path analysis studies are important assets to the breeder; especially in the case of fruit crops like mango, sapota and citrus, wherein quantity and quality both are important. The information on the nature and magnitude of variability and correlation in a population owing to genetic and non-genetic factors is one of the prerequisites in any hybridization programme for selecting parents with desirable characters. In the present investigation, the correlation between yield and yield contributing characters was measured and discussed.

Correlation between yield and yield contributing characters

The correlation studies between different characters would certainly provide an idea, which might be utilized for the selection of desirable parameters for future breeding programmes. The highly significant positive correlation between desirable characters is favorable because it might help in the simultaneous improvement of those characters. On the other hand, the negative correlation would hinder the synchronized expression of the characters. In such a situation, it would require making some compromises including economic ones. The genotypic correlation coefficient was analyzed and presented in Table 1. The results showed that yield was positively and significantly correlated with panicle length (0.38**), length of leaves (0.22*). This was in agreement with the findings of Karibasappa *et al*. (1999). Similarly, length of inflorescence also revealed positive and significant correlation with fruit yield per plant was in confirmatory with the finding of Mayavel *et al*. (2018) and Challapillai *et al*. (1995). These findings

Table 1: The correlation coefficient between different quantitative and qualitative characters of Langra clones of mango.

Traits	Length of leaves (cm)	Width of Leaves (cm)	Flower shoot length (cm)	Panicle length (cm)	No. of panicles /panicle	No. of flowers /panicle	Fruit drop %	Yield Kg/ tree
Length of leaves	1							
Width of leaves	0.51**	1						
Flower shoot length	0.19*	0.01	1					
Panicle length	-0.02	0.06	-0.06	1				
No. of panicles	0.22*	0.05	0.03	0.46**	1			
No. of flowers	-0.33**	-0.23**	-0.12	0.26**	0.00	1		
Fruit drop	-0.40**	-0.26**	-0.05	-0.08	0.21*	0.12	1	
Yield kg/tree	0.22*	0.12	-0.09	0.38**	0.12	-0.30**	0.15	1

Table 2: Direct (bold) and indirect effects of quantitative and qualitative traits on yield of Langra clones of mango.

Traits	Length of leaves (cm)	Width of leaves (cm)	Flower shoot length (cm)	Panicle length (cm)	Number of panicles/ panicle	Number of flower/ panicle	Fruit drop (%)
Length of leaves	0.74	0.22	0.04	0.00	0.12	-0.39	-1.29
Width of leaves	-0.37	0.43	0.00	0.00	0.02	-0.23	-0.84
Flower shoot length	-0.14	0.00	0.23	0.00	0.01	-0.12	-0.18
Panicle length	0.01	-0.02	-0.01	-0.14	0.25	0.26	0.27
Number of paniclets	-0.16	0.02	0.00	-0.06	0.55	0.06	0.66
Number of flower	0.29	-0.10	-0.03	-0.03	0.03	1.00	0.39
Fruit drop %	0.29	-0.11	-0.01	-0.01	0.11	0.12	3.21

Residual effect: -0.06.

were also reported earlier by Divakara *et al.* (2008). But it was a negative correlation with the number of flowers (-0.38**). Genotypic correlation coefficient revealed that length of leaves had positively and significantly correlated with the width of leaves (0.51**), flower shoot length (0.19*), number of panicles (0.22*) and negative correlation with the number of flowers (-0.39**), fruit drop % (-0.40**). In the case of the width of leaves negative correlation with the number of flowers (-0.23**), fruit drop % (-0.26**). Panicle length had a significant positive correlation with the number of panicles (0.46**), number of flowers (0.26**). The number of panicles had a significant positive correlation with fruit drop % (0.21*).

Path coefficient analysis for yield and yield contributing characters

Path analysis is a form of multiple regression statistical analysis used to evaluate causal models by examining the relationships between a dependent variable and two or more independent variables. To find out a clear picture of the relationship between fruit yield and its components. This allows the partitioning of the correlations between yield and its components into direct and indirect effects.

The residual effect of path analysis was -0.06 revealed higher genetic variability and also proved a lower percent of environmental influence on the selected characters of mango clones of Langra. Direct and indirect effects of different yield contributing characters toward the yield of Langra have been presented in Table 2.

A perusal of path coefficient analysis indicated that positive direct effects on yield were exhibited by the length of leaves, width of leaves, flower shoot length, number of panicles, number of flowers, and fruit drop %. This indicates the selection of these traits would give a better response in yield. Therefore, direct selection of these traits could be useful in mango clones improvement programme where negative direct effects were exhibited by panicle length. Hence, such character should never consider as a parameter in selection programmes.

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Conflict of interest

All authors declare that they have no conflict of interest.

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