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Correlation and Path coefficient Analysis for Yield and Yield Attributing Traits in Cashew (*Anacardium occidentale* L.) Genotypes

Chaithra K.[1], Bhoomika H.R.[2*], Veena G.L.[3], Dushyantha Kumar B.M.[4], Shivaprasad M.[5] and Ravi C.S.[6]

[1]PG Scholar, Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture, Mudigere (Karnataka), India.
[2]Assistant Professor, Department of Plantation, Spices, Medicinal and Aromatic Crops, College ofHorticulture, Mudigere (Karnataka), India.
[3]Scientist (Fruit Science), ICAR- Directorate of Cashew Research, Puttur (Karnataka), India.
[4]Professor of Genetics and Plant Breeding & Dean, College of Agriculture, Shivamogga (Karnataka), India.
[5]Assistant Professor, Associate Director of Research, ZAHRS, Mudigere (Karnataka), India.
[6]Assistant Professor, Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture, Mudigere (Karnataka), India.

(Corresponding author: Bhoomika H.R.)*
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ABSTRACT: An experiment was conducted to study the correlation and path analysis of fifteen cashew genotypes in DCR, Puttur. Results indicated that in correlation studies nut yield per tree has shown highly significant positive correlation with apple yield per tree and the traits *viz.*, sex ratio and number of nuts per panicle had significant positive correlation with nut yield per tree. Path coefficient analysis revealed that the traits, canopy spread, sex ratio, nut weight and apple yield per tree showed direct positive effect on nut yield per tree indicating the utilization of these parameters in crop improvement programme to evolve high yielding cashew varieties.

Keywords: Correlation, Path analysis, Cashew, Genotype.

INTRODUCTION

The cashew tree, *Anacardium occidentale* L., is a member of the Anacardiaceae family and is native of Brazil that was brought to India in the sixteenth century. The Portuguese word "Caju" is the origin of the English name "Cashew." Cashew is a crop that may be produced on marginal terrain and is best suited for rain-fed conditions. Initially, it was introduced as a crop for afforestation and soil binding to stop soil erosion. Early in the 20th century, India was the first nation to take advantage of the cashew kernel trade on a global scale. Today cashew occupies the status of an important export-oriented commercial crop Jha (2019).

About 10 lakh farmers are engaged in the cultivation of cashew, whereas 5 lakh persons (95 % being women) are engaged in processing units (Bhat *et al*. 2010). Besides, cashew adds substantial foreign exchange to the exchequer. Presently in India cashew is grown in about 11,66,000 hectare area with a production of 7,74,000 metric tonnes having a productivity of about 749 kg/ha in different states (Anon., 2021). Cashew therefore, plays a prominent role in Indian farming, commerce, industry and vitally provides employment opportunities to needy people. Successful cashew cultivation depends on the selection of the high yielding best varieties.

Nut yield is a complex attribute that is influenced by the interaction of morpho-economic characteristics.

Correlation study indicates the direction and strength of association between any given pair of traits. The study of path analysis (a standardised partial regression analysis) is more significant over correlation, in that, it subdivides the total correlation coefficients with nut yield into various direct and indirect effects. Individual components of yield can offer significant information in breeding for the yield since variations in the environment largely affect yield through the components of yield. The factors that contribute to yield are connected to one another in a long chain of interactions. A good tool for determining the level of relationship between variables is correlation analysis.

Correlations offer useful insights to breeders for developing selection schemes, on the other hand, path analysis is extremely helpful in separating links between components into direct (independent

contribution) and indirect impacts. The correlation analysis is employed to understand the complex connections between features whereas, path coefficient analysis defines the causes, quantifies the relative importance of each cause, and considers sensing mechanisms that exist between variables. In order to create a successful selection strategy for cashew, an effort has been made to quantify the correlation and path coefficients of different morpho-economic features. Thus, the objective of this study was to quantify the phenotypic relationship between nut yield and ten other agronomic traits in cashew.

MATERIAL AND METHODS

The experiment has been laid in Directorate of Cashew Research Station, Puttur during the year 2013 following Randomized Complete Block Design (RCBD) with fifteen cashew test genotypes comprising fourteen accessions and one check variety Vengurla-8, were planted in square system planting at a spacing of 7.5 m × 7.5 m. First harvesting of cashew nuts of the plantation had commenced from the year 2016. For the present study cashew nut and apples of one year *i.e.*, 2022 crop were selected. To estimate the degree of association between the traits studied, phenotypic correlation was computed by using the formula given by Al Jibouri (1958) and the path co-efficients (direct and indirect effects) were calculated as per Dewey and Lu (1959).

RESULTS AND DISCUSSION

A phenotypic correlation study of eleven component characters of cashew is represented in Table 1. The nut yield per tree has shown highly significant positive correlation with apple yield per tree (0.965). Significant positive correlation was observed with sex ratio (0.349) and number of nuts per panicle (0.360). This is due to sex ratio is directly proportional with higher number of hermaphrodite flowers per panicle which in turn resulted in more number of nuts per panicle. Whereas, the tree height (0.169), trunk girth (0.102) and shelling percentage (0.123) showed non-significant positive correlation.

Non-significant negative correlation of nut yield was observed with canopy spread (-0.115), apple weight (-0.157), nut weight (-0.225) and kernel weight (-0.265). The genetic cause of this negative correlation might be due to pleiotropy or linkage, where one gene influences two or more unrelated phenotypic traits. In a varietal development program, it is challenging to strengthen both characters at once when two qualities are adversely associated. Therefore, careful selection is required to increase these component features simultaneously. Both Azevedo *et al.* (1998); Abraham *et al.* (2007) noted a similar outcome while working with cashew genotypes.

Table 2 is the combined summary of direct and indirect effects, effect coefficients and residuals of ten agronomic traits on cashew nut yield at phenotypic level. Out of eleven characters studied, four characters showed positive and direct effect on nut yield per tree at phenotypic level *viz*., canopy spread (0.0937), sex ratio (0.0672), nut weight (0.1472) and apple yield per tree (0.9985). Thus, it is evident from both direct and indirect effects of the characters at phenotypic level selecting these characters would be of more value for nut yield. Whereas tree height (-0.1148), trunk girth (-0.0041), apple weight (-0.1409), number of nuts per panicle (-0.0066), kernel weight (-0.0781) and shelling percentage (-0.0509) had negative direct effect on nut yield per tree.

According to Aliyu (2006), the direct effect of nut weight on nut yield is extremely positive (0.317) whereas, the direct and indirect effects of whole fruit weight on nut yield were both unfavourable and appeared to be negative. According to Reddy *et al.* (1996), the majority of the yield component qualities have a strong negative indirect effect on yield through apple weight. This suggests that the genetic enhancement of nut yield will be negatively impacted by selection for cashew genotypes with larger kernel and apple size.

Table 1: Phenotypic correlation coefficients among growth and yield parameters of cashew genotypes.

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}
X_1	**1.000**	0.660**	0.630**	0.663**	0.286^{NS}	0.130^{NS}	0.416**	0.339*	-0.283^{NS}	0.175^{NS}	0.169^{NS}
X_2		**1.000**	0.490**	0.341*	0.117^{NS}	-0.230^{NS}	0.256^{NS}	0.186^{NS}	-0.553**	0.077^{NS}	0.102^{NS}
X_3			**1.000**	0.155^{NS}	0.170^{NS}	-0.061^{NS}	0.532**	0.315*	-0.178^{NS}	-0.185^{NS}	-0.115^{NS}
X_4				**1.000**	0.288^{NS}	0.408**	0.285^{NS}	0.385**	-0.060^{NS}	0.374*	0.349*
X_5					**1.000**	0.101^{NS}	0.510**	0.476**	-0.184^{NS}	-0.065^{NS}	-0.157^{NS}
X_6						**1.000**	-0.059^{NS}	0.018^{NS}	0.063^{NS}	0.382**	0.360*
X_7							**1.000**	0.814**	-0.292^{NS}	-0.272^{NS}	-0.225^{NS}
X_8								**1.000**	-0.219^{NS}	-0.267^{NS}	-0.265^{NS}
X_9									**1.000**	0.161^{NS}	0.123^{NS}
X_{10}										**1.000**	0.965**
X_{11}											**1.000**

* Significant at 5% level, ** Significant at 1% level

Where,

X_1– Tree height (m); X_4 – Sex ratio; X_7 – Nut weight (g); X_{10} – Apple yield (kg/tree)

X_2 – Trunk girth (cm); X_5 – Apple weight (g); X_8 – Kernel weight (g); X_{11} –Nut yield (kg/tree)

X_3 –Canopy spread (m^2); X_6 – Number of nuts per panicle; X_9 – Shelling per cent

Table 2: Phenotypic path coefficient analysis for growth and yield parameters of cashew genotypes.

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	r Value
X_1	**-0.1148**	-0.0027	0.0591	0.0445	-0.0402	-0.0008	0.0612	-0.0265	0.0144	0.1748	0.169
X_2	-0.0758	**-0.0041**	0.0459	0.0229	-0.0165	0.0015	0.0377	-0.0145	0.0281	0.0766	0.102
X_3	-0.0724	-0.0020	**0.0937**	0.0104	-0.0239	0.0004	0.0783	-0.0245	0.0090	-0.1842	-0.115
X_4	-0.0761	-0.0014	0.0145	**0.0672**	-0.0405	-0.0027	0.0419	-0.0300	0.0030	0.3729	0.349
X_5	-0.0328	-0.0004	0.0159	0.0193	**-0.1409**	-0.0004	0.0750	-0.0372	0.0093	-0.0650	-0.157
X_6	-0.0149	0.0009	-0.0057	0.0274	-0.0098	**-0.0066**	-0.0086	-0.0013	-0.0032	0.3818	0.360
X_7	-0.0478	-0.0010	0.0498	0.0191	-0.0719	0.0003	**0.1472**	-0.0636	0.0148	-0.2717	-0.225
X_8	-0.0389	-0.0007	0.0295	0.0258	-0.0671	-0.0001	0.1198	**-0.0781**	0.0111	-0.2663	-0.265
X_9	0.0325	0.0022	-0.0166	-0.0040	0.0259	-0.0004	-0.0429	0.0171	**-0.0509**	0.1605	0.123
X_{10}	-0.0201	-0.0003	-0.0173	0.0251	0.0091	-0.0025	-0.0400	0.0208	-0.0081	**0.9985**	0.965

Residual effect = 0.0424; r = correlation coefficient of component traits with nut yield per tree

X_1 – Tree height (m); X_2 – Trunk girth (cm); X_3 –Canopy spread (m^2); X_4 – Sex ratio;
X_5 – Apple weight (g); X_6–Number of nuts per panicle; X_7 – Nut weight (g); X_8 – Kernel weight (g);
X_{11} –Nut yield (kg/tree); X_9 – Shelling per cent; X_{10} – Apple yield (kg/tree)

CONCLUSION

Based on the above results it can be concluded that nut yield can be improved by selecting accessions having more sex ratio, number of nuts per panicle and apple yield per tree. Because these characters had shown significant positive correlation with the nut yield per tree.

Results of the phenotypic path analysis revealed that, out of eleven characters studied, four characters showed positive and direct effect on nut yield per tree at phenotypic level *viz.,* canopy spread, sex ratio, nut weight and apple yield per tree.

FUTURE SCOPE

Consideration should be made to keep these promising accessions available in the germplasm collections for the future use. Future correlation and path analysis studies needed to be carried out on different combination of characters.

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Conflict of Interest. None.

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