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YIELD AND YIELD ATTRIBUTES IN CASHEW — AN ANALYSIS THROUGH MULTIVARIATE APPROACH

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ABSTRACT

The stepwise regression analysis of ten seed/seedling characters on the nut yield of cashew has highlighted the prominence of six characters namely seed length, days taken for germination - seedling height, length and breadth of first leaf and number of opened leaves. Further study on direct and indirect effects of these characters suggested that the selection of long sized nuts (3cms and above) for raising better seedlings resulted in higher yield. The seedling which germinates early (not more than 20 days) had better yield potential and selection of 45 day old seedlings which has more number of opened leaves (12 leaves or more) preferably with long and narrow first leaf are indicative of high yields.

INTRODUCTION

The importance of seed and seedling selection in crop husbandry has been well recognised for long time. Plant yield in general, a complex entity determined by the interplay of a number of attributes and it is more complex in a perennial crop such as cashew. Adequate knowledge of inter-relation of factors influencing such complex character especially the influence of seed/ seedling characters through a multivariate approach is very much essential. Similar such studies are done in various crops (Ramachander and Bavappa, 1972; Bhagavan, 1982; Liyanage and Abeywardhane, 1957; Sukumaran, Narasimhayya and Vijayakumar, 1981). In cashew, Gopikumar, Aravindakshan and Nampoothiri (1984) have attempted to study correlation between nut and seedling characters. In the present study multivariate approach such as stepwise regression analysis (Draper and Smith, 1966) and path co-efficient analysis (Dewy and Lu, 1959) have been attempted to identify factors which contribute directly or indirectly towards high yield potential.

MATERIALS AND METHODS

At NRCC Experimental Farm, Shantigodu 37 germplasm accessions were planted in 1973 for which detailed seed and seedling measurements have been recorded. Data on three seed characters namely seed length, seed breadth, seed weight and 7 seedling characters (45 day old seedlings) namely days taken for germination, seedling height, seedling girth, length from cotyledon to 1st leaf, length and breadth of 1st leaf, number of opened leaves along with yield data in terms of nut weight averaged for 4 years 1977-78 to 1981-82 (excluding 1978-79 years data) were utilized for the present study.

As the data belonged to different accessions refinement of data was carried out by, eliminating the effect due to various accessions. Similar such attempts have been made in arecanut (Bhagavan and Nair, 1986) for selection of vigour variables. Stepwise regression analysis which culls out the characters that may have insignificant contribution towards the yield and suggests the best combination of the characters that are of prime importance was

attempted for the transformed data. After the identification of prime characters through stepwise regression analysis, these characters were subjected to path coefficient analysis to measure the contribution of each component to the observed correlation and to partition the correlation coefficient into components of direct and indirect effects.

RESULTS AND DISCUSSION

Large variation was found to exist in the yield character even after elimination of effects due to various accessions. This is in confirmity with the fact that crop yield is a complex entity and it is more so in case of a perennial crop such as cashew. Therefore any attempt made to quantify the contribution of characters that influence yield are to be considered only as indicative contributions. The mean values and the standard deviations of the characters studied are given in Table I.

Table 1. *Mean values at standard deviations*

Characters	Mean	Standard deviation
Seed length (cm)	2.99	0.20
Seed breadth (cm)	1.62	0.15
Seed weight (gms)	5.42	1.00
Days taken for germination	20.09	2.40
Seedling* height (cm)	16.55	2.47
Seedling girth (cm)	6.16	0.48
Length from cotyledon to 1st leaf (cm)	3.95	0.92
Length of first leaf (cm)	7.14	0.85
Breadth of first leaf (cm)	3.81	0.45
No. of opened leaves	11.40	1.88
Weight of nuts averaged for four years (kg)	1.91	0.93

* seedlings are of 45 days age

The stepwise regression analysis of the ten of seed/seedling characters regressed on yield indicated that six characters namely seed length (x_1), days taken for germination (x_2), seedling height (x_3), length of 1st leaf (x_4), breadth of 1st leaf (x_5) and number of opened leaves (x_6) combine together to give a multiple correlation coefficient of 0.58. The regression equation being:

$$Y = 2.89 + 1.01\ x_1 - 0.21\ x_2 - 0.05\ x_3 + 0.55\ x_4 - 1.18\ x_5 + 0.13\ x_6$$

The path coefficients of the 6 selected characters and residual factors are given in Fig. 1 and the direct and indirect effects of individual characters on the yield are presented in Table II.

Seed length *vs* yield

The results showed that the correlation coefficient between seed length and yield was very low whereas its direct effect was

Table II. *Correlations, direct and indirect effects*

Characters	Particulars	values on yield
Seed length	Correlation	0.10*
	Direct effect	0.19
	Indirect effect through days for germination	-.17
	seedling height	-.01
	length of first leaf	0.04
	breadth of first leaf	-.03
	no. of opened leaves	0.08
Days for germination	Correlation	-.33**
	Direct effect	-.52
	Indirect effect through seed length	0.06
	seedling height	0.02
	length of first leaf	-.16
	breadth of first leaf	0.21
	no. of opened leaves	0.05
Seedling height	Correlation	-.04
	Direct effect	-.07
	Indirect effect through seed length	0.03
	days for germination	0.12
	length of first leaf	0.28
	breadth of first leaf	-.42
	no. of opened leaves	0.03
Length of 1st leaf	Correlation	0.07
	Direct effect	0.60
	Indirect effect through	
	seed length	0.01
	days for germination	0.14
	seedling height	-.03
	breadth of first leaf	-.55
	no. of opened leaves	-.10
Breadth of 1st leaf	Correlation	-.04
	Direct effect	-.65
	Indirect effect through	
	seed length	0.01
	days for germination	0.17
	seedling height	-0.5
	length of first leaf	0.51
	no. of opened leaves	-.04
Number of opened leaves	Correlation	0.19**
	Direct effect	0.34
	Indirect effect through	
	seed length	0.05
	days for germination	-.08
	seedling height	-.01
	length of first leaf	-.18
	breadth of 1st leaf	0.08

* significant at P = 0.05 ** significant at P = 0.01

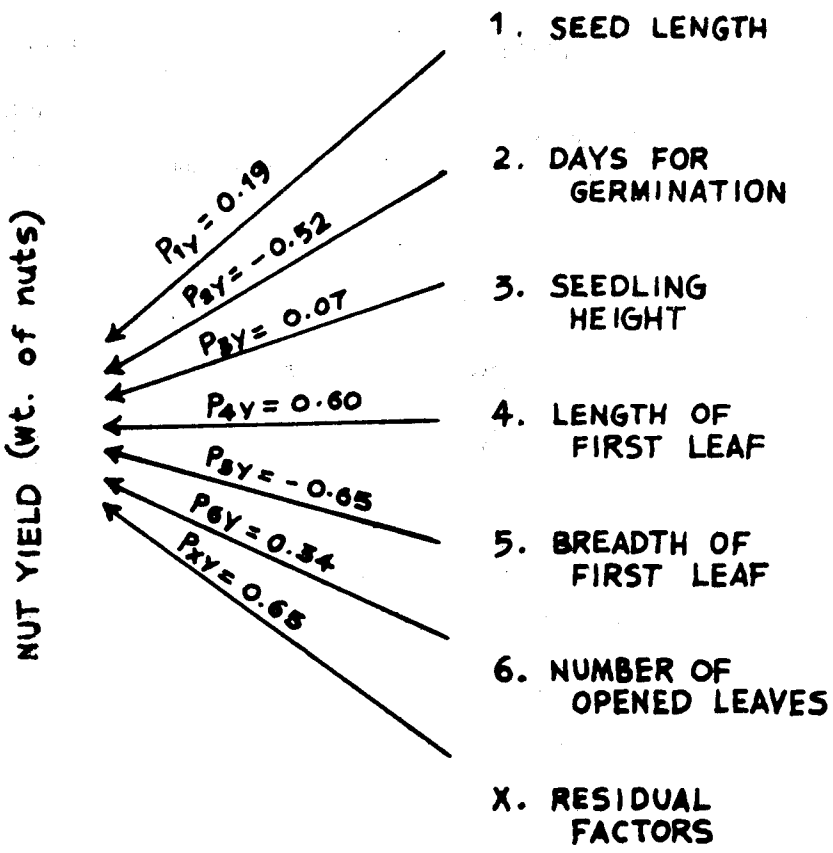

Fig. 1. Path diagram

considerably high in magnitude thereby explaining the true relationship that a direct selection through this trait would be effective in raising better seedlings of high yield potential.

Days taken for germination *vs* yield

It was observed that both the correlation and direct effect were significantly high in magnitude but negative. This clearly suggested the selection of seedlings which germinated early to have better yield potential.

Number of opened leaves *vs* yield

This character correlates significantly and also possessed high direct effect thereby indicating the importance of selecting seedlings that contain more number of leaves.

Other seedling characters *vs* yield

Seedling height neither had significant correlation nor any evidence of direct effect. However, linear measurements of first leaf although did not indicate any significant correlation, their contribution of direct and indirect effects suggested that the seedlings which had lengthy and narrow first leaf were preferred.

As evident from the magnitude of variation observed for the yield character, it becomes

an herculian task to pin point all the factors that explained the variation. Attempts made here have atleast explained 58 per cent of this variation highlighting few characters.It is inferred that selection of long sized nuts (3 cms and above) may be preferred for the purposes of rasing seedlings that had high yield potential. As a second step, selection of seedlings are preferred by selecting seedlings that germinated early (less than 20 days) and which possessed more number of leaves with its first leaf being lengthy and narrow for realising higher returns.

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