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ASSOCIATION OF METRIC TRAITS AND PATH ANALYSIS IN COCOYAM, *XANTHOSOMA SAGITTIFOLIUM* (L.) SCHOTT.

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ABSTRACT

Correlation and path coefficients were studied for seven characters utilizing 16 genotypes of cocoyam. Genotypic correlation coefficients were generally higher than phenotypic ones except for number of cormels with other characteristics such as dry matter content of corm and cormels, corm + cormel fresh weight, leaf area, and number of leaves. Number of leaves, leaf area and total cocoyam yield (corm + cormel fresh weight) were positively correlated with each other. The path coefficient analysis showed that number of leaves had the highest genotypic correlation with cocoyam yield. Leaf area and number of cormels had high positive direct effect on cocoyam yield while dry matter content of corms exhibited high negative direct effect.

Key words: *Xanthosoma sagittifolium*, cocoyam, correlation, path analysis.

Selection of cocoyam genotypes with high yielding ability requires the manipulation of characters, many of which are correlated to one another. These correlations may be due to either genetic linkages or physiological and developmental relations. It is often assumed that association between two characters is evidence of pleiotrophy rather than linkage [1]. Under complex situations, path coefficient analysis is a powerful tool for studying character associations [2]. Although path coefficient has been used to analyse intercharacter associations in many crops, its use has not been reported in cocoyam.

This study was undertaken to 1) estimate the genotypic and phenotypic correlations among some agronomic characters and their relationships with cocoyam yield; and 2) estimate the direct and indirect effects of some agronomic characters on yield of cocoyam.

MATERIALS AND METHODS

Six hybrid cocoyam clones (80071, 80048, 80005, 81281, 81391 and 81034) and 10 cocoyam accessions (X 130, X 199, X 224, X 185, X 221, X 181, X 111, X 235, X 229 and X 196) from germplasm collection were evaluated at the Institute of Agronomic Research, Njombe

Centre (Cameroon) in randomized complete block design with three replications. Each genotype was grown in one ridge of 10 m length. The ridges and plants within the row were spaced at 1.0 m. Observations were recorded at harvest 10 months after sowing.

Two leaves were randomly taken from two plants in a plot per replication to measure leaf area with a leaf area meter LICOLOR, model LI 3000. Data on number of leaves, number of cormels, weight of cormels, weight of corm, mean volume of cormels, dry matter content of cormels and corm were collected from all the plants in a row leaving the two border plants. To determine dry matter content of corms and cormels, samples were sliced into smaller pieces and dried in force oven at 80°C for 24 h. They were then weighed and dry matter percentage calculated. The average volume of cormels was obtained by dipping them in a 10 liter bucket filled with water. The excess water was collected and its volume was determined by a measuring cylinder. The volume of water displaced was divided by the number of cormels to obtain mean cormel volume. Phenotypic (rp) and genotypic (rg) correlation coefficients and path-coefficient analysis was carried out following the procedure of Dewey and Lu [3].

RESULTS AND DISCUSSION

Phenotypic and genotypic correlations among cocoyam yield and its components are presented in Table 1. Significant and positive genotypic correlations were observed between number of leaves, leaf area, dry matter content of corms and cormels, and corm + cormel fresh weight. Leaf area exhibited significant and positive genotypic correlations with dry matter content of corms and cormels, and corm + cormel fresh weight. Number of cormels had significant negative genotypic correlation with dry matter content of corms, while cormel volume had significant positive genotypic correlation with dry matter content of

Table 1. Direct (in bold) and indirect (off diagonal) effect of yield components in cocoyam yield

Characters	No. of leaves	Leaf area	No. of cormels	Cormel volume	Cormel dry matter	Corm dry matter	Total effect
Number of leaves	**– 0.20**	1.27	– 0.03	– 0.05	0.01	– 0.15	0.85
Leaf area	– 0.20	**1.30**	– 0.01	– 0.04	0.01	– 0.15	0.90
Number of cormels	0.03	– 0.11	**0.19**	0.02	– 0.01	0.09	0.23
Cormel volume	– 0.05	0.31	– 0.02	**– 0.18**	0.01	0.01	0.06
Dry matter of cormels	– 0.11	0.72	– 0.05	– 0.05	**0.02**	– 0.12	0.40
Dry matter of corms	– 0.13	0.83	– 0.07	0.01	0.00	**– 0.23**	0.41

Residual factor = 0.06.

corms and corm + cormel fresh weight. Dry matter content of corms had significant positive genotypic correlation with corm + cormel fresh weight.

The result of path coefficient analysis showed that leaf area has maximum positive direct effect on corm + cormel fresh weight, followed by number of cormels and their dry matter content (Table 2). The high direct influence (1.29) of leaf area on corm + cormel fresh weight was intensified by the positive indirect effect through cormel dry matter content although

Table 2. Phenotypic (rp) and genotypic (rg) correlation coefficients between yield and yield components of cocoyam

Characters		No. of leaves	Leaf area	No. of cormels	Cormel volume	Cormel dry matter	Corm dry matter
Number of leaves	rp	0.87^{**}	– 0.01	0.12	0.28	0.23	0.72^{**}
	rg	0.98^{**}	– 0.14	0.27	0.55	0.66	0.85^{**}
Leaf area	rp		0.08	0.02	0.39^{**}	0.29^{*}	0.74^{**}
	rg		– 0.08	0.24	0.56^{**}	0.65^{**}	0.90^{**}
No. of cormels	rp			-0.49^{**}	0.18	0.09	0.40
	rg			– 0.13	– 0.26	-0.41^{**}	0.23
Volume of cormel	rp				– 0.24	– 0.28	– 0.09
	rg				0.30^{*}	– 0.03	0.06
Dry matter of cormels	rp					0.49	0.26
	rg					0.54^{**}	0.41^{**}
Dry matter of corms	rp						0.29^{**}
	rg						0.41^{**}

Note. Cocoyam yield is taken as corm + cormel fresh weight.

*,**Significant at 5% and 1% levels, respectively.

it was reduced to a some extent by the negative effects through corm dry content, cormel volume, number of cormels and leaves. The direct positive association between number of cormels and corm + cormel fresh weight was slightly reduced by the negative indirect effects through leaf area and dry matter content of cormels. The positive direct effect of dry matter content of cormels was further enhanced by the positive indirect effect through leaf area although it was reduced to some extent through the negative indirect effects of number of leaves and cormels, cormel volume and dry matter content of corms.

The dry matter content of corms had maximum negative direct effect on corm + cormel fresh weight, followed by number of leaves and cormel volume. The negative direct effect (–0.23) of dry matter content of corms on corm + cormel fresh weight was further intensified by the negative indirect effects through number of leaves and cormels in spite of the large positive indirect effects through leaf area, cormel volume and dry matter content of cormels. The negative direct effect of number of leaves on corm + cormel fresh weight was slightly increased by the negative indirect effect through number of cormels, cormel volume and dry matter content of corms even though it was reduced by the high positive indirect effects through leaf area and, to a lesser extent, by dry matter content of cormels. The total effect for each yield component is positive and higher than its direct effect for leaf area. Although a large number of character were used in the path coefficient analysis, the residual factor still had appreciable contribution. This indicates that there may be some important characters influencing cocoyam yield which were not taken into consideration in this study.

It is apparent that many of the characters considered in this study were correlated perhaps because of the positive and mutual associations among them. Dewey and Lu [3] proposed the use of path coefficient analysis to clearly separate direct and indirect causes of association and thus permit a critical examination, while measuring the relative importance of each causal factor.

The high genotypic correlations of corm + cormel fresh weight with some yield components such as number of leaves, leaf area, dry matter content of corms and cormels were in most cases due to their respective direct influence on yield. However, there were instances where genotypic correlations were mainly due to their indirect influence on yield through each other. From path coefficient analysis, it became obvious that while the direct contributions of number of leaves, cormel volume, and dry matter content of corms to corm + cormel fresh weight were negative, their genotypic correlations with the latter trait were positive and highly significant due to their indirect influence through other yield components apart from the genotypic correlation of cormel volume and corm + cormel fresh weight which was positive and nonsignificant.

Leaf area had maximum direct effect and highest positive significant genotypic correlation with corm + cormel fresh weight due to the small indirect and positive effect (0.01) via dry matter content of cormels. Number of cormels also had a positive direct association with corm + cormel fresh weight and its magnitude was mainly increased by the indirect effects through number of leaves, cormel volume, and dry matter content of corms. Also, dry matter content of cormels had positive direct effect on corm + cormel fresh weight. Therefore, greater emphasis should be put on dry matter content while breeding for high yielding cocoyam variety. According to Thamburaj and Muthukrishnan [4], number of tubers, the most important yield component in sweet potato, must be improved with reduction of number of leaves. The present study suggests that leaf area and number of cormels are two major components of corm + cormel fresh weight. The path coefficient analysis, therefore, supports the conclusion that while breeding cocoyam for higher yield, maximum attention should be paid to leaf area and cormel number. If selection is carried out to deliberately increase the number of cormels and leaf area in cocoyam, corm + cormel fresh weight will increase automatically.

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