Propagation and Tissue Culture

Effect of Presence of the Terminal Bud, and Size and Type of Sectioning of the Corm on Propagation of New Cocoyam

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ABSTRACT

Among factors which affect establishment of taro and cocoyam crops, the quality of planting material is of prime importance. During the period January and March, 1982, in Turrialba, Costa Rica, management of planting material was evaluated under greenhouse conditions. Weight of seed, corm, methods of corm sectioning, and presence or absence of terminal bud were studied. Number of buds, leaf area, and petiole length were determined at 60 days.

In both species, bud number was increased by increasing weight of the seed corm and by eliminating the terminal bud. Use of large corms with a terminal bud increased the leaf area and petiole length. When cocoyam corms were sectioned transversely, apical sections tended to produce larger leaf area than basal section. Longitudinal sectioning produced no differences. In taro, transverse sectioning produced no differences in leaf area while longitudinal sectioning affected this parameter. In neither species was petiole length significantly affected by type of corm sectioning.

Introduction

New cocoyam and taro are promising crops for the humid tropics, having high food production potential.

Establishment of these crops is affected by various factors, including nature of planting material. In Xanthosoma sagittifolium, larger seed corms result in higher yields and a larger leaf area index (Enyi, 1976b). This result has been related directly to the diameter of the bud which produces the plant (Spence, 1970). In taro, no differences have been observed in yield using small seed corms, weighing 41, 30, and 17 grams (Da Silva, 1971). Some yield factors such as leaf area index, number of tillers per plant, number of leaves per plant, mean weight per plant, leaf area, were significantly greater in plants from larger seed corms. This leads to the conclusion that two factors were responsible for the low production from smaller seed pieces: high mortality and low yield per plant (Bourke and Perry, 1976). In the case of transversely sectioned cocoyam corms, tip sections containing the terminal bud were superior to other sections in terms of rate of germination, rate of leaf area development, corm yield, and mean weight of lateral and principal corms (Vasquez and Torres, 1974). More rapid germination

of upper sections is perhaps due to lower dormancy levels in the younger sections (Enyi, 1976a).

The objective of this study is to determine the influence of handling propagation material of cocoyam and taro on growth and development.

Materials and Methods

Seed pieces of cocoyam and taro were evaluated under greenhouse conditions at Turrialba, Costa Rica, between January and March, 1983. Three different sizes (800, 200 and 100 g) were used in cocoyam and seven sizes (800, 200-300, 150-199, 75-100, 50-74, 25-49, and smaller than 25 g) were used in taro, each with and without terminal bud.

In the 800 and 200 g cocoyam corms and in the 800 g taro corms, different types of sectioning were: transverse in three sections (apical, medial, and basal) and two types of longitudinal sectioning (in halves or quarters). Seed corms were planted in black polyethylene bags containing three liters of soil in a completely randomized design. Sixty days after planting shoot number, leaf area and length of the longest petiole were measured.

Results and Discussion

Cocoyam (Xanthosoma sagittifolium)

Leaf area at 60 days was greater ($P = 0.01$) in plants produced from large (800 g) seed corms than from smaller (200 g) seed corms. Presence or absence of terminal bud did not affect leaf development significantly in any corm class (Figure 1) although leaf area tended to be somewhat greater in plants produced from corms from terminal buds. The greater leaf area in plants from larger seed corms without terminal buds is perhaps due to greater number of sub-terminal buds in the larger corms once apical dominance is removed as well as to larger bud size which Spence (1970) maintained regulates the development of leaf area.

Petiole length in plants from large corms was significantly superior ($P = 0.01$) to that in plants from corms of smaller weight. Petiole length in plants produced from corms with a terminal bud showed a tendency to be greater than in those from corms without a terminal bud although this difference did not attain statistical significance. This difference tended to decrease as corm size increased.

Shoot number was greater in seed corms without a terminal bud. Elimination of the terminal bud should remove the effect of apical dominance permitting development of sub-terminal buds. Increase in shoot number is greater in larger corms since they have a greater number of sub-terminal buds (Figure 2).

Trends noted in leaf development and petiole length as affected by presence or absence of a terminal bud possibly decrease with age as the corms without a terminal bud produce a greater number of shoots once apical dominance is eliminated. In corms without a terminal bud, shoot production from the sub-terminal buds is slower than in corms with terminal buds, but this difference may be compensated for by greater leaf area development proceeding from a greater number of shoots after 60 days.

In the two types of sectioning studied, transverse and longitudinal, no differences were observed for the parameters studied. In the case of transverse sectioning, the apical section showed significantly greater leaf area than the other sections ($P = 0.05$). There was no difference between medial and basal sections. No differences were observed between types of longitudinal sectioning (Figure 3).

Number of shoots per plant was smaller for the terminal transverse section and for the whole corm due to dominance exercised by the terminal bud (Table 1). The difference between number of buds in the terminal transverse section and the whole corm with respect to the other sections (medial, basal, half longitudinal and quarter longitudinal) is greater in corms of larger size, possibly due to the effect of a greater number of sub-terminal buds in the large corms, which are ready to sprout as soon as apical dominance is removed.

Table 1. Number of shoots per plant of cocoyam (Xanthosoma sagittifolium) and taro (Colocasia esculenta) at 60 days as affected by corm weight and type of corm sectioning.

Treatments Corm Weight (g)	Type of Section	Cocoyam $\bar{X}$	Cocoyam S	Taro $\bar{X}$	Taro S
	apical	1.20	0.44	1.00	0.00
	medial	5.25	0.43	3.22	0.67
	basal	4.00	3.16	2.56	1.42
	half longitudinal	3.80	1.92	1.92	0.90
	quarter longitudinal	2.33	0.82	1.83	0.58
	whole corm	1.66	0.58	1.00	0.00
200 g	apical	1.08	0.29		
	medial	1.27	0.46		
	basal	1.29	0.47		
	half longitudinal	1.53	0.64		
	quarter longitudinal	1.13	0.35		
	whole corm	1.00	0.00		

In the case of corms weighing 800 g, the medial transverse section produces a greater number of shoots, possibly by combined effect of the absence of apical dominance and the greater number of buds in this section, which are in a state of intermediate dormancy as compared with buds in the apical (terminal) and basal sections. The basal section has a greater number of buds than the apical section, yet fewer than the median section, due to elimination of apical dominance and a greater degree of bud dormancy. The half and quarter sections in the longitudinal cut have a greater number of shoots than the treatments having a terminal bud (terminal section of the transverse cut and the whole corm) but fewer than the medial and basal sections of the transverse cut. When the corm is sectioned longitudinally, functioning of the terminal bud is virtually eliminated although a partial apical dominance effect persists; furthermore, in the longitudinal sectioning, area of the cortex where buds are located is narrow, leaving a lesser number of subterminal buds which sprout first and acquire dominance over the remaining buds.

Taro (Colocasia esculenta)

Leaf area development and petiole length was greater (P = 0.01) in higher weight corms. Principal corms (weighing 800 g) produced a greater leaf area and petiole length than secondary (75-300 g) and tertiary (less than 50 g) corms; secondary corms were superior to tertiary corms (Figure 4).

There was no difference with regard to leaf area and petiole length for principal corms with or without terminal buds while for secondary and tertiary corms, those with terminal buds were significantly superior in terms of these parameters. It is possible that with age, these differences will diminish, since total leaf area from a larger number of shoots per plant may compensate for slower sprouting observed in corms without a terminal bud. In tertiary corms, leaf area and petiole length are directly related to corm size, attaining statistical significance at the 1% level.

Shoot number at 60 days was greater in corms without a terminal bud, due to the absence of apical dominance (Figure 5). In the case of transversely sectioned corms, the terminal section maintains the dominance of the terminal bud, the medial section triples the shoot number with respect to the terminal section, followed by the basal section with a smaller number of shoots than the medial sections but greater number than the terminal section.

The half quarter longitudinal sections produced a greater number of shoots than the terminal transverse section but fewer than the medial and basal transverse sections (Table 1). This result is similar to that observed with cocoyam.

Leaf area and petiole length were greater for whole corms than for sectioned corms (significant at p = 0.05). Among types of transverse sections, there was no difference in leaf area for the terminal section with respect to the medial and basal sections, but the medial and basal did differ significantly at the 1% level. In longitudinal sectioning, half sections produced significantly (P = 0.05) greater leaf area than the quarter sections. Different types of sectioning produced no significant differences in petiole length.

Conclusions

1. Taro and cocoyams showed similar effects of corm size and sectioning on leaf area, petiole length and shoot number.

2. Most vigorous plant development was obtained with propagating material of largest size.

3. Propagating material with terminal buds develops sprouts more rapidly. Delay in initial development of planting material without terminal buds is compensated for by a greater number of shoots.

4. It is possible to use corm sectioning to increase quantity of seed pieces and obtain a greater uniformity in the planting.

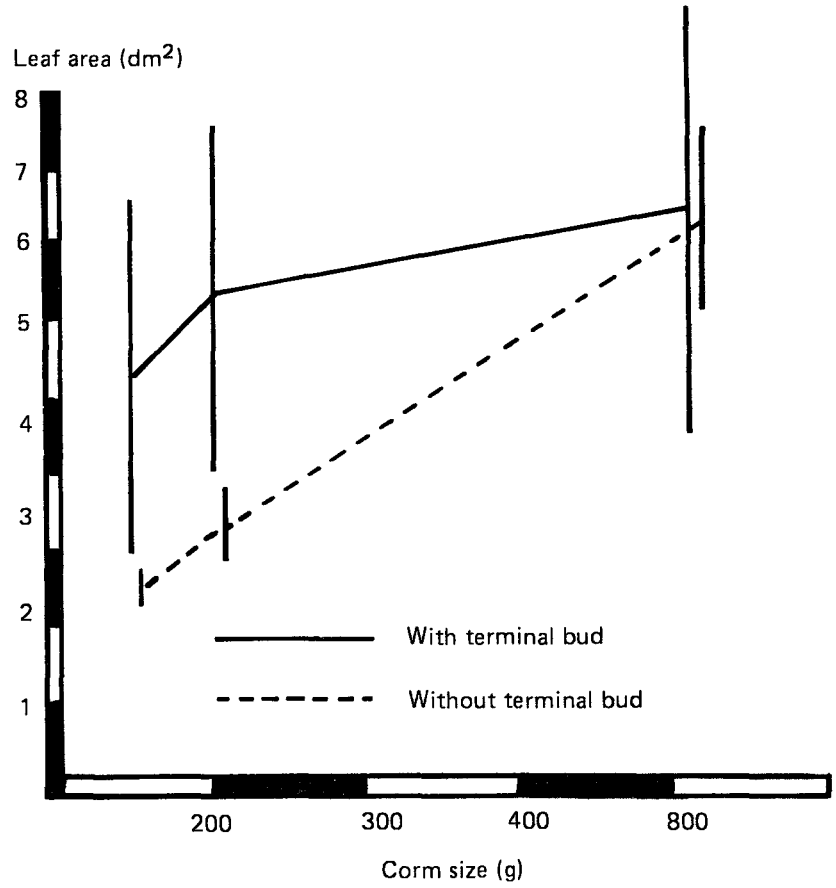

Figure 1. Variation of leaf area of cocoyam (Xanthosoma sagittifolium) at 60 days in relation to size and seed corm with and without terminal bud.

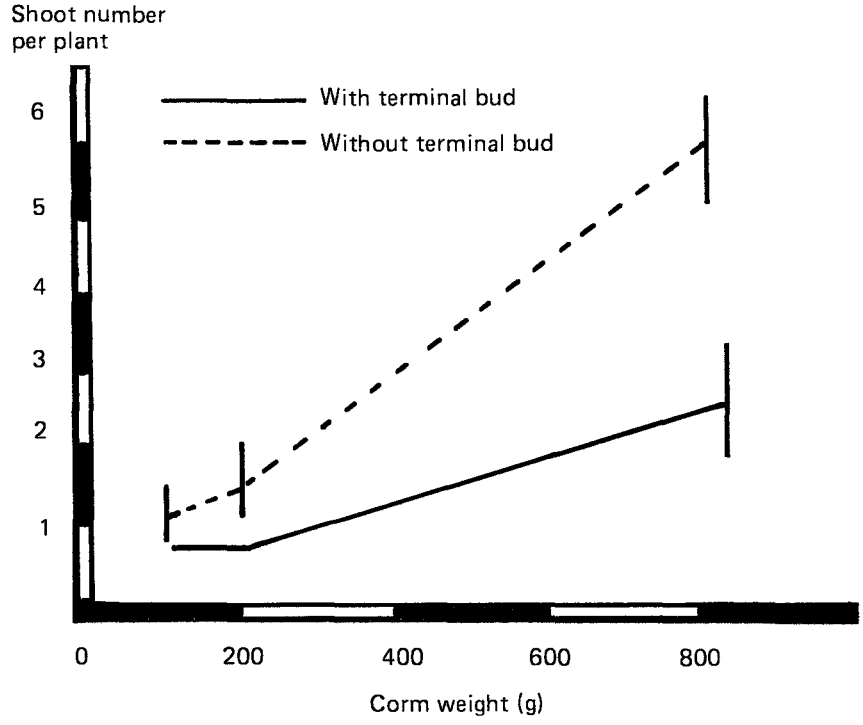

Figure 2. Number of shoots of cocoyam (Xanthosoma sagittifolium) at 60 days, as affected by weight of seed corm, with and without terminal bud.

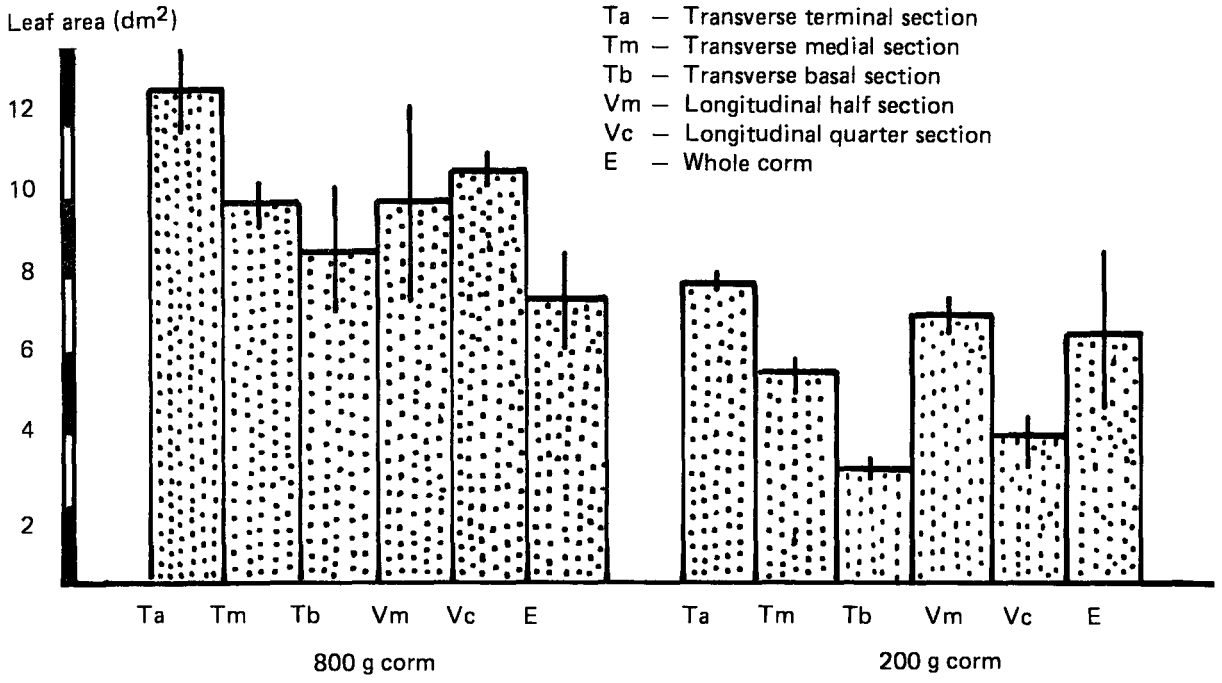

Figure 3. Leaf area (dm^2) in cocoyam plants (Xanthosoma sagittifolium) as affected by size and method of sectioning of seed corm.

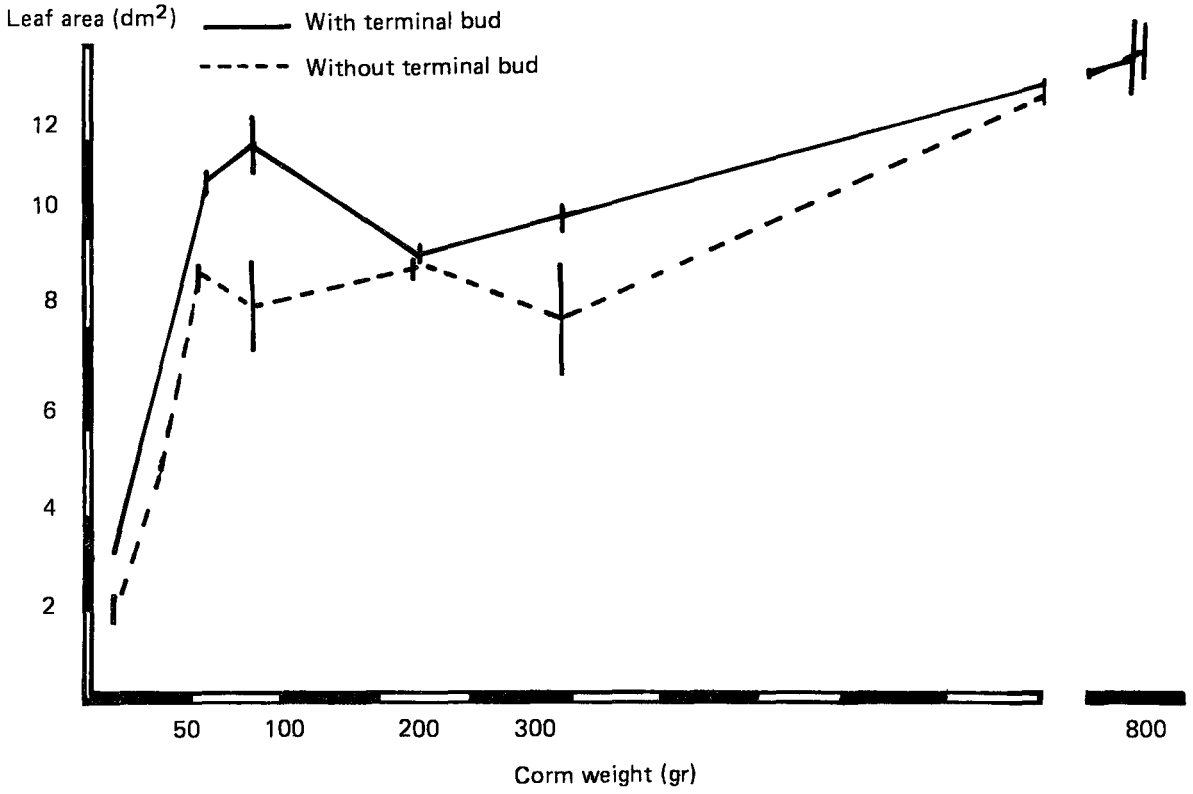

Figure 4. Variation in leaf area of Taro (Colocasia esculenta) as affected by weight of seed corm, with and without terminal bud.

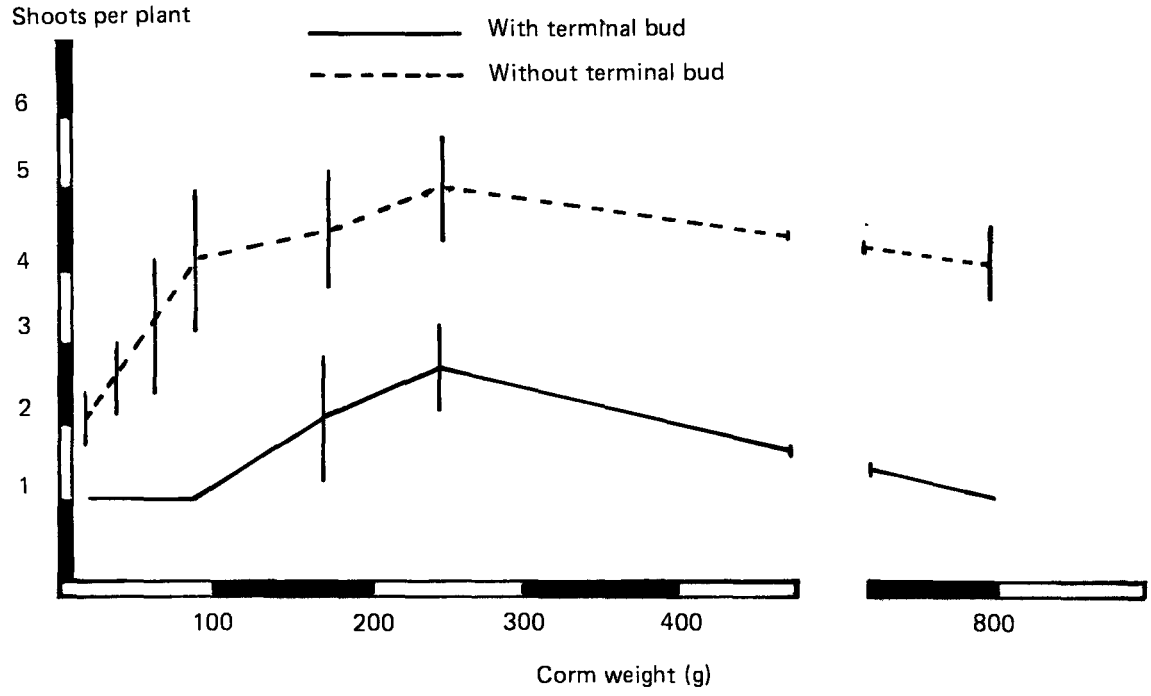

Figure 5. Number of shoots of Taro (Colocasia esculenta) as affected by weight of seed corm with or without terminal bud.

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