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# VARIATION IN SEEDLING CHARACTERS OF THREE DIFFERENT COCONUT CULTIVARS AND THEIR USE IN IDENTIFICATION IN THE NURSERY

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## ABSTRACT

There is no standard guide for the identification of seedlings of different cultivars at the nursery. Diagnostic traits are necessary to detect illegitimates amongst hybrid coconut seedlings and for sorting out the types, in the case of accidental mixing during transport. Requests for a guide to the identification of planting material have been made by overseas buyers. Several metric traits of seedlings of three different Coconut (*Cocos nucifera* L) cultivars were studied in order to identify those of value in distinguishing between these types in the nursery. Seedlings of *Dwarf*, *Tall* and the hybrid, *Dwarf* x *Tall* were used.

Although serveral traits studied were found to be useful discriminators, some were of greater value, the most useful being the time taken for sprouting. Rate of leaf production, length and width of leaves and time to first leaf splitting were important indicators when used in combination. The best stage of differentiation amongst the cultivar seedlings was at 6 months from laying.

The hybrids resembled the *Talls* more closely than the *Dwarf* so that chances of misclassifying the former two were greater than confusing them with the *Dwarf* types. A practical guide to aid identification was devised along with the recommendation that any seedling sprouting before the 6th week could safely be discarded as an illegitimate among the hybrids under standard nursery management practices.

## INTRODUCTION

Distinguishing illegitimate *Dwarf* seedlings from the hybrids (*Dwarf* x *Tall*) is important in the production of hybrid seedlings. Such an identification of *Dwarf* types in the nursery is easier when *Dwarf* yellow or *Dwarf* red has been used as the female parent due to the presence of a colour marker. For *Dwarf* green there is no such marker so that distinguishing between the two cultivars is difficult. Accidental mixing of seednuts may take place during transport, especially while exporting and requests for a guide to identification have been made by buyers. The hybrid seednuts of *Dwarf* green x *Tall* can be differentiated from tall seednuts because of the small nut size and its characteristic features of the *Dwarf* nut but the *Dwarf* yellow x *Tall* seednut cannot be identified likewise. Hence the need to evolve a practical guide for the identification of *Dwarf*, *Tall* and hybrid seedlings of coconut is essential. Considerable variation in germination time between different cultivars of coconut has been reported (Foale 1968; Wuidart 1979) and Whitehead (1965 b) indicated the rate of germination, as a character of taxonomic significance. Seedling characters were measured on *Tall*, *Dwarf* and hybrid seedlings and variation was studied in order to select which character or characters would be useful discriminators to distinguish among the cultivars.

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## MATERIAL AND METHODS

*Tall* x *Tall* and *Dwarf* green x *Tall* seednuts produced at the Isolated Seed Garden at Ambakelle by directed natural pollination were used. The *Dwarf* green seendnuts were produced by self pollination by bagging the inflorescences.

Two hundred seednuts of each of the cultivars *Tall* x *Tall*, *Dwarf green* x *Tall* and *Dwarf* green were used. The seednuts were laid in beds of 40 with five replicates in a fully randomized design (beds randomized) at the research nursery of the Isolated Seed Garden at Ambakelle. The nursery beds were maintained according to general CRI recommendations. The trial was repeated in June, September and November 1985 in order to study the seasonal variation in germination pattern. Time taken for the sprouts to emerge and seedling measurements such as height, girth at collar, number of leaves, number of split leaves, length and width of individual leaves were recorded at 6 months and 9 months from laying.

Multivariate discriminant analysis (Goulden 1952) was used to identify the seedling characters most useful in discriminating the three cultivars. The seedling measurements were standardized to zero mean and unit variance before the application of multivariate analysis in order to eliminate the differences in scale of measurements (Manly 1986). The characters which showed a significant difference between the three cultivars on a multivariate basis were then used to compute the discriminant functions. The percentage of misclassifications in each variety and the generalized squared distances were then computed using the above functions. The SAS (SAS 1985) procedures were used for the multivariate analyses.

## RESULTS AND DISCUSSION

### Time for sprouting

The percentage of sprouted nuts for each variety over the first five months from laying during the two seasons June (dry) and November (wet) are given in Figures 1 and 2 respectively. Under favourable weather conditions (higher rainfall) (Fig 2) *Dwarf* nuts began sprouting by the fourh week from laying and had reached 80% sprouting within 10 - 11 weeks; the small number (< 5%) which sprouted before the fourth week were probably fallen nuts. In *Talls* eighty percent sprouting was reached only at 16 to 17 weeks and sprouting continued up to 20 weeks from laying when 90% was reached. The hybrids were intermediate, with sprouting beginning at about 6 to 7 weeks, reaching 80% at 13 to 14 weeks and continuing up to about 16 weeks from laying.

The final germination percentage achieved by the seednuts laid during the dry season (June 85) was much lower for all cultivars, with *Dwarf* and hybrid seednuts being more sensitive to the relatively dry conditions. In dwarfs the time taken for the sprouts to emerge was much longer in the seednuts laid in June compared to seednuts laid in November and the percentage germination was even lower than the hybrids. However, the differences in the pattern of germination among the three cultivars remained similar in both seasons.

### Seedling characters at 6 months from laying

Multivariate discriminant analysis indicated highly significant differences between cultivars in height, girth, number of leaves, number of split leaves, length of petiole of first leaf and width of 2nd leaf (Table 1). However the two characters mentioned last, although statistically significant, were not very clearly different visually and hence were not considered to be of much practical

Figure 1 - *Germination pattern of three coconut cultivars laid in June 1985*

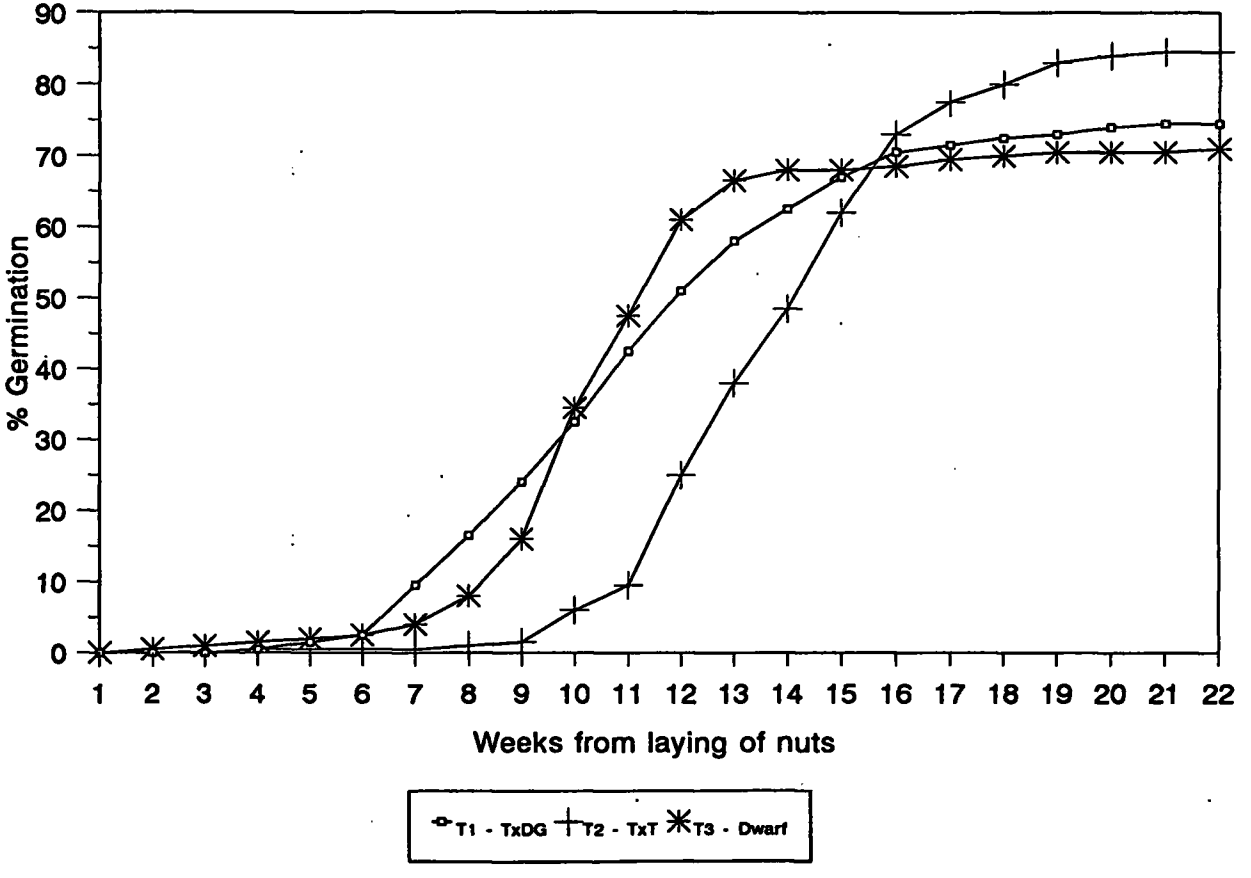
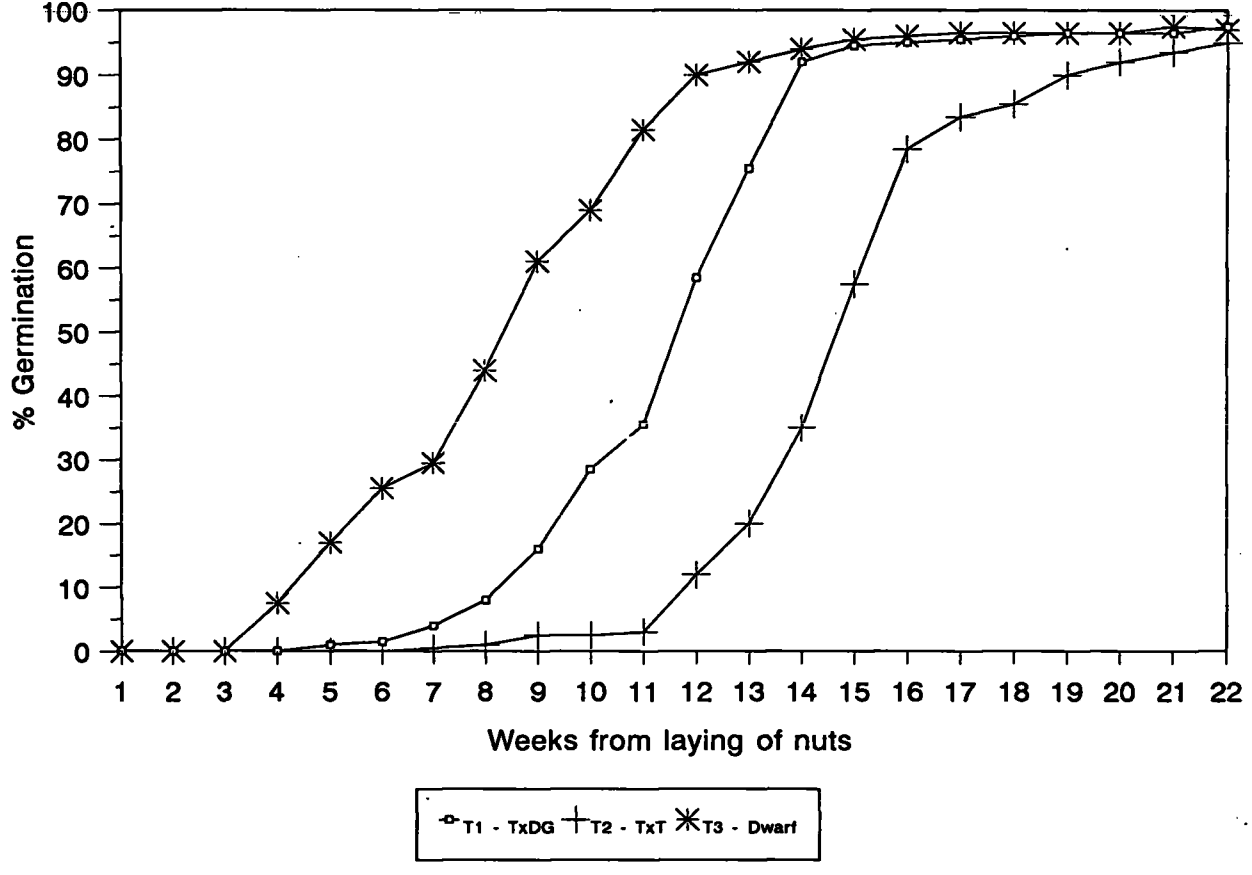


Figure 2 - *Germination pattern of three coconut cultivars laid in November 1985*



value. *Dwarf* seedlings appeared to be the most vigorous at the early stages with as many as four leaves at 6 months from laying by which time splitting of leaves had already begun. These seedlings were about 85 cm tall with a mean girth of 9 cm. At 6 months, the *Tall* seedlings were relatively small with only two unsplit leaves; the mean girth at collar was 7 cm and height 60 cm. The hybrids were intermediate in size with about 3 leaves as yet unsplit; a mean girth of 8 cm and a mean height of 80 cm.

Table 1 *Seedling characters measured and their significance levels in the multivariate discriminant analysis at 6 and 9 month stages ($p > 0.05$, ns ; $p$ 0.05 - 0.01* ; $p < 0.01$** ; $p < 0.0001$, ***)*

| Character | 6 months Pr > F | 9 months Pr > F |
|---|---|---|
| Height | *** | ** |
| Girth | *** | ** |
| No of leaves | *** | *** |
| Split leaves | *** | *** |
| length of petiole of 1st leaf | *** | * |
| length of petiole of 2nd leaf | ns | ns |
| length of 1st leaf | * | ** |
| length of 2nd leaf | ns | *** |
| width of 1st leaf | ** | *** |
| width of 2nd leaf | *** | *** |

**Seedling characters at 9 months from laying**

Significant differences were seen in the discriminant analysis in number of leaves, number of split leaves and length and width of individual leaves at this stage. Although the seedlings of tall variety start vegetative growth much later, they catch up with the other two cultivars at about 8 months and hence differences were visible only in leaf measurements. Out of the leaf measurements indicated, leaf length is not considered to be of much practical value although statistically significant. Leaf splitting occurs first in *Dwarfs* and at a later stage in *Tall* seedlings. At 9 months *Dwarfs* have a mean split leaf count of 2, *Talls* 0.01 and hyhrids 0.3. The mean leaf width of an average well developed leaf in *Dwarf* is 7 cm, *Tall*. 8 cm and hybrid 9 cm.

Visual observations were also found to be useful, For instance at about 2 to 3 months from laying, *Dwarfs* had about 2 to 3 leaves which were pale green in colour, curled and smooth in texture. At a later stage *Dwarf* leaf blades appeared narrower than *Tall* leaves and the length from the tip of the leaf up to the point of dischotomy was greater. Consequently *Dwarf* leaves appeared more elongated than *Tall* leaves. In *Dwarfs* the canopy width was lesser as the leaves were pointing upwards whilst the *Tall* had a good canopy spread.

## MISCLASSIFICATION

Table 2 indicates the percentages of seedlings correctly classified into each treatment and the percentage misclassified, using the most significant variables in the analysis at 6 month and 9 month stages. The percentages correctly classified under each treatment were more than 75% and

this confirms that the variables used are suitable enough to distinguish among the cultivars. It was seen that 20% of *Tall* seedlings had been misclassified as hybrids at 6 months but only 7% of hybrids were incorrectly classified as *talls*. The chance of *Dwarfs* being misclassified as *Tall* or hybrid was lesser. At 9 months the misclassification percentage of hybrids and *Tall* were more than at 6 month stage and therefore it would be much easier to distinguish the cultivars at 6 month stage. These observations were confirmed by the generalized squared distances ($D^2$) values obtained according to Mahalanobis (1936) (Table 3). The shortest distance is between hybrid and *Tall* and the longest is between *Tall* and *Dwarf*.

Table 2 *Percentages classified into treatments from the multivariate discrimi nant analysis using the significant characters (Table 1)*

| | 6 months | | | | 9 months | | | |
|---|---|---|---|---|---|---|---|---|
| Treatments | 1 | 2 | 3 | Total | 1 | 2 | 3 | Total |
| 1 | 77.33 | 6.67 | 16.00 | 100.0 | 65.33 | 29.33 | 5.33 | 100.0 |
| 2 | 20.00 | 77.33 | 2.67 | 100.0 | 26.32 | 70.18 | 3.51 | 100.0 |
| 3 | 16.00 | 9.33 | 74.67 | 100.0 | 37.68 | 31.88 | 30.43 | 100.0 |

1 - TxDG 2 - TxT 3 - Dwarf

Table 3 *Generalized Squared distance ($D^2$) to treatments from the multivariate discriminant analysis*

| | 6 months | | | 9 months | | |
|---|---|---|---|---|---|---|
| Treatment | 1 | 2 | 3 | 1 | 2 | 3 |
| 1 | - | 4.505 | 3.799 | - | 1.005 | 6.118 |
| 2 | | - | 10.252 | | - | 9.599 |
| 3 | | | - | | | - |

1 - TxDG 2 - TxT 3 - Dwarf

## CONCLUSION

Almost all characters measured showed continuous variation and therefore was difficult to categorize into discrete groups. One feature alone may not usually serve to distinguish between cultivars but several characters which show small but significant and detectable differences between cultivars may be used in combination to identify these cultivars. Certain detectable characters are visible at various stages and identification has to be carried out during this whole period for higher accuracy. Recommendations can be given to reject any seedling that sprouts before the 6th week in discarding the illegitimates from hybrid seedlings. *Talls* have a distinctly different period for sprouting from Dwarfs; so these can be identified at the sprouting stage itself. However, for distinguishing tall from hybrids other characters indicated may be used.

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