

BROWN AND GREEN COLOUR FORMS IN THE SRI LANKA TALL PALM - SOME OBSERVATIONS ON THEIR DISTRIBUTION AND COMPARATIVE VIGOUR

V. ABEYWARDENA,* D. T. MATHES and G. KARUNASENA

Coconut Research Institute, Lunuwila, Sri Lanka.

• ABSTRACT

Abeywardena, V., Mathes, D. T. and Karunasena, G. (1979). Brown and Green colour forms in the Sri Lanka tall palm — some observations on their distribution and comparative vigour. *Ceylon Cocon. Q.*, 30, 101-106.

A survey of the colour forms, Brown and Green of the Sri Lanka Tall palm revealed that normal plantations showed the distribution of Greens and Browns in a 3 : 1 ratio. A block planted with seednuts from high yielding palms and also a block planted with seednuts selected from an estate heap also showed a 3 : 1 ratio of Greens and Browns, whereas palms arising from seednuts derived from low yielding palms and seednuts (unselected) from the heap showed the distribution of Greens and Browns in a ratio significantly higher than 3 : 1 This indicates that the larger coconut plantations in Sri Lanka derived their seednuts from either high-yielding palms or from nuts selected from a heap.

All artificially pollinated crosses — Tall x Tall or Inbred tall, or Tall x Dwarf or Dwarf x Tall — showed a significant departure from the 3 : 1 ratio of Greens and Browns observed in normal plantations, the ratio approximating to 7 : 1.

Brown seedlings were significantly more vigorous than Greens and in adult palms Browns yielded more than Greens.

INTRODUCTION

There appears to be no recorded information on the distribution and comparative vigour of the Brown colour form (commonly called *Rathi* in Sri Lanka) as against the common Green colour form although both these colour forms occur in every coconut plantation in Sri Lanka. However, there is undocumented evidence that both owners of large plantations as well as smallholders have evinced some interest in *Rathi* palms. Some appear to be even of the firm belief that *Rathi* palms yield more than the Greens.

This study was undertaken to ascertain the frequency distribution of Green and Brown palms and also their comparative yield performance.

* Present address: Agroskills, Colombo 4, Sri Lanka.

MATERIALS AND METHODS

A survey was carried out to record the relative frequency of Green and Brown palms in a number of experimental blocks at Bandirippuwa Estate, Ratmalagara Estate, the Isolated Seed Garden, and Poththukulama Estate. Therein experimental blocks derived from both open-pollinated seednuts as well as from artificially pollinated crosses were examined for this purpose.

In the adult palms we were able to identify four colour forms. These are (1) Green (2) Brownish green (3) Greenish brown and (4) Brown. However, for the purpose of this preliminary analysis we grouped them into two broad groups, namely, Green and Brownish green as one group (Green) and Brown and Greenish Brown as the other group (Brown).

RESULTS

1. Distribution of Green and Brown palms in plantations derived from open – pollinated seednuts

1.1 Distribution of colour forms derived from open – pollinated seednuts

Table 1.1 shows the distribution of the two colour forms in plantations derived from open – pollinated seednuts.

Table 1.1 *Distribution of Greens and Browns in normal plantations*

| Name of Block | Frequency of | | χ^2 value for testing the hypothesis of a 3:1 ratio | Significance |
|------------------------|--------------|-------|--|--------------|
| | Green | Brown | | |
| RE – Fertilizer trial | 743 | 229 | 1.111 | n.s. |
| ISG – Old stand | 201 | 66 | 0.011 | n.s. |
| BE – 300 palm Block | 141 | 58 | 1.820 | n.s. |
| RE – Calibration Block | 123 | 38 | 0.131 | n.s. |
| All Blocks | 1208 | 391 | 0.258 | n.s. |

The ratio of Green to Brown corresponds very closely to a 3 : 1 ratio as evidenced by the low and non-significant χ^2 (Chi-square) values for the tests of this hypothesis.

1.2 Distribution of colour forms in palms from selected and unselected open – pollinated seednuts

The data from the selection trial (Latin square) at Ratmalagara Estate were examined to verify whether selection affects the ratio of Greens and Browns.

Table 1.2 *Distribution of colour forms in palms from selected and unselected seednuts*

| Progenies from | Frequency of | | χ^2 value of test of hypothesis of a 3 : 1 ratio | Significance |
|----------------|--------------|-------|---|--------------|
| | Green | Brown | | |
| Selected | 216 | 57 | 2.47 | n.s. |
| Unselected | 222 | 52 | 5.02 | ** |

Palms derived from selected seednuts do not depart significantly from the 3 : 1 ratio of Greens and Browns observed in normal plantations. But palms derived from unselected seednuts show a significant departure from the 3 : 1 ratio of Greens and Browns—there being a higher proportion of Greens. Apparently the plantations reported in Table 1.1 have been derived from seednuts subjected to some sort of selection. If such selection has been on the basis of seedling vigour, comparatively higher proportion of Browns may have been unconsciously planted.

1.3. Distribution of colour forms in palms derived from high yielding and low yielding palms

Table 1.3 *Distribution of colour forms in progenies from high yielding and low yielding palms*

| Progenies form | Frequency of | | χ^2 value for test of hypothesis of a 3 : 1 ratio | Significance |
|---------------------|--------------|-------|--|--------------|
| | Green | Brown | | |
| High-yielding palms | 145 | 40 | 1.26 | n.s. |
| Low-yielding palms | 157 | 30 | 8.00 | *** |

The data from the selection experiment at Ratmalagara Estate (Table 1.3) show that in the case of progenies from high yielding palms the proportion of Greens and Browns does not depart significantly from the 3 : 1 ratio, whereas in progenies from low yielding mother palms the proportion departs significantly from this ratio, there being a relatively higher proportion of Greens.

2. Distribution of Green and Brown palms in artificially pollinated crosses.

Table 2. *Distribution of colour forms in artificially pollinated crosses*

| Type of cross Female x Male | Frequency of | | χ^2 value for hypothesis of a 3 : 1 ratio | χ^2 value for hypothesis of a 7 : 1 ratio |
|--------------------------------|--------------|-------|--|--|
| | Green | Brown | | |
| Tall x Tall | 298 | 56 | 15.9*** | 3.57 (n.s.) |
| Inbred Tall | 251 | 33 | 27.1*** | 0.20 (n.s.) |
| Tall x Dwarf | 441 | 64 | 41.2*** | 0.01 (n.s.) |
| Dwarf x Tall | 122 | 21 | 8.1*** | 0.62 (n.s.) |
| All crosses | 1113 | 174 | 90.7*** | 1.22 (n.s.) |

It is clear (Table-2) that the proportion of Greens and Browns in all crosses depart significantly from the 3:1 ratio which was seen consistently in plantations derived from open pollinated nuts. These crosses show a relatively higher predominance of Greens – corresponding closely to a 7 : 1 ratio as evidenced by the non significant χ^2 value for the test of this hypothesis. The cross Tall, although it does not show a significant departure from a 7 : 1 ratio, yet the nearly significant χ^2 value for same and a ratio of 5 : 1 has to be noted for future studies for whatever, it is worth. Perhaps in planting of this Tall x Tall block, no selection of progenies has been done and therefore the ratio corresponds to what one would get in a plantation derived from unselected seedlings from open – pollinated nuts (Table 1 : 3).

In the case of Tall x Dwarf and its reciprocal Dwarf x Tall, the observed high ratio of Greens to Browns is perhaps understandable because the Dwarf is 100% green.

As for the high ratio in inbred Tall, the Tall used may have been all Green palms.

3. A comparison of vigour and yield between Green and Brown colour forms

3:1 Nursery stage (Ratmalagara Nursery)

As only Green and Brown colour forms could be identified clearly in seedlings – with the Brownish green and greenish Brown hardly identifiable – the comparison of growth is made only for the clear green and clear brown (Table 3.1).

Table 3.1. *Comparative vigour in Green and Brown seedlings*

| Vigour character | Mean growth | | Significance |
|-------------------------------|-------------|-------|--------------|
| | Brown | Green | |
| Number of leaves per seedling | 3.67 | 3.46 | t – 2.06* |
| Height of seedlings (cm) | 72.93 | 65.30 | t – 4.25*** |

It is observed that at the Nursery stage, Brown seedlings compared to Green show a significantly higher vigour, both in respect of leaf production and height.

3.2 Adult palm yield (nuts/palm)

Comparison of the yield performance of Brown and Green colour forms is shown in Table 3.2.

Table 3.2. *Comparative nut yield in Brown and Green colour forms*

| Block | Mean nut yield per palm per annum | | Significance |
|---|-----------------------------------|-------|-----------------|
| | Brown | Green | |
| 300 palm Block (BE) (Av 1952 – 1955) | 72.0 | 65.9 | t – 5.84*** |
| Calibration Trial (RE) (Av 1967 – 1970) | 67.0 | 66.0 | not significant |

In the 300-palm block at Bandirippuwa Estate the brown colour form yields significantly more than the green. But the data from the calibration trial at Ratmalagara Estate do not show a significant superiority of Browns over Greens in respect of yield, although numerically the yield of Browns is slightly higher.

3.3 Adult palm yield (weight/nut)

Table 3.3. *Comparative nut size in Brown and Green colour forms*

| Block | Weight/ nut (gm) | | Significance |
|------------------------------------|------------------|-------|--------------|
| | Brown | Green | |
| 300-palm block (Av 1952 – 1955) | 758.2 | 726.4 | 1.61 n.s |
| Calibration Trial (Av 1967 – 1970) | 658.3 | 608.4 | 2.26* |

In the 300-palm block where the Browns yield significantly more nuts than Greens, the nut size too is slightly larger though not significant. But in the calibration block where no significant difference between Browns and Greens was observed in respect of nut production, the nut size is significantly larger in Browns.

DISCUSSION

In the case of open – pollinated seednuts, there is clear evidence that progenies derived from selected seednuts on the one hand and high yielding mother palms on the other consistently show the distribution of Greens and Browns in a 3 : 1 ratio, whereas progenies from unselected seednuts and those from low yielding mother palms show a relatively higher proportion of Greens. The consistent ratio of 3 : 1 in respect of Greens and Browns in normal plantations can therefore be explained by the strong possibility that those who planted them obtained their seed material, either from high yielding palms and/or selected good seedlings derived from heap nuts. In the process, relatively more of Greens would have got into the plantations.

On the contrary, hand-pollinated crosses whether inbred Tall or Tall x Dwarf or its reciprocal Dwarf x Tall – all show a relatively very high proportion of Greens. The ratio of Greens to Browns is around 7 : 1. In fact the proportion of Browns is almost half that obtained in plantations derived from open – pollinated progenies. The cross Tall x Tall corresponds closely to the ratio observed in unselected progenies from open – pollinated nuts.

Faced with these two ratios, namely, 3 : 1 for open pollinated and 7 : 1 for hand pollinated crosses, plant breeders may be tempted to think in terms of Mendel's laws of segregation. When two pure lines in respect of a single trait are crossed and the F_1 (or the first filial generation) is allowed to self, according to Mendel the F_2 generation obtained therefrom would segregate in a 3 : 1 ratio for the pair of contrasting traits. The homozygous dominant (AA) and the heterozygous (Aa) would constitute 3/4th and show the dominant character, while the homozygous recessive (aa) would constitute 1/4 th and show the recessive character.

However, we would hesitate to try explaining out the observed distributions of the two colour forms through any such process of mono-factorial segregation. In the first place, the observed 3 : 1 ratio applies strictly to progenies from selected seednuts or those from high yielding mother palms. Secondly, the near 7 : 1 ratio applies to crosses wherein, in the selection of parents for crossing, no distinction has been made between the colour forms of the Tall parents. Therefore any attempt to tie up these observations with Mendel's theories would be a frivolous exercise. More objective experimentation would be needed to clarify these observations.

Incidentally, Menon and Pandalai (1953) report the work of Patel in India, where some work on colour inheritance has been done. It appears that Patel did not go into these ratios seriously. His main finding had been that segregation of colour forms was independent of whether there was natural pollination or selfing.

Reverting to the economic importance of colour forms, are the browns superior to the Greens? This study shows that as far as seedling vigour is concerned, the Browns are decidedly superior to the Greens. However, from the point of view of yield performance, in one block the Browns yielded significantly more than the Greens whereas in another block the difference was not significant. As for nut size, in the block where Browns showed significantly more nuts, there was hardly a difference in nut size. But in the block where the difference in nut production between Browns and Greens was not significant, the nut size was significantly larger in the Browns. Here again, we would suggest controlled experiments for further confirmation of their relative yield performance.

If the superiority of the Browns is firmly established one could use Brown seedlings as much as possible for future planting.

ACKNOWLEDGEMENTS

We thank Dr. U. Pethiyagoda, Director of the Coconut Research Institute of Sri Lanka for suggesting this study, the other staff of the Biometry Division for help in the statistical analysis, and Miss Princy Fernando for the typescript. *UPT*

REFERENCES

- Menon, K. P. V. and Pandalai, K. M. (1953). The coconut palm - A Monograph, Indian Central Coconut Committee Ernakulam, South India.-357