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The Raposa Palm Plantation Revisited*

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The Raposa plantation near Fortaleza, Brazil, was a research facility of S. C. Johnson & Son, Inc., from 1937 to 1970. During that period research was conducted on the native carnauba wax palm (*Copernicia prunifera*) and 14 introduced congeners, in an attempt to identify high wax-yielding palms for plant breeding. In 1970 S. C. Johnson ended their research on waxy palms and donated Raposa to the Federal University of Ceará in Fortaleza. On the occasion of the gift, a terminal report of botanical research conducted and a detailed survey of the plantation were completed (Johnson 1970). Short papers about Raposa were published in *Principes* by Kitzke (1970) and Johnson (1971). The purpose of this paper is to report the findings of a follow-up survey of Raposa in August 1980, which focused on survival and growth rates of the introduced species of *Copernicia*.

At Raposa the introduced palms are planted in eight individual fields, which were established from 1947 to 1955. Currently they are in fair to good condition in terms of undergrowth. Almost all of the palms are tall enough so that they are not experiencing competition for light, but undoubtedly are experiencing some competition for soil moisture. Precipitation in Northeast Brazil was below normal for both the 1979 and 1980 rainy seasons, and the condition is being described as a mini-drought.

The survey included enumeration of the fields of introduced species to ascertain the losses which had occurred since the previous survey in July 1970. Some palms had died and their remains were destroyed completely by decay, while others were dead and still standing. Palms exhibiting a stunted growth form, judged by an absence of trunk development after a minimum of 25 years or by abnormal trunk form, were counted as losses. Stunted palms apparently never reach botanical maturity and do not live as long as normal specimens. Selected palms which had been photographed during the 1970 survey were rephotographed to obtain an approximate record of the rate of growth.

Losses among the introduced palms are listed in Table 1. Total losses for the ten-year period are overstated somewhat because certain specimens counted as viable in 1970 already were exhibiting abnormal characteristics; these same palms were considered as losses in 1980 even if still alive. The species names in Table 1 have not been changed from those used in 1970 (Johnson 1971). However, two species misidentifications now are evident from the character of mature trees. The palms designated as *Copernicia tectorum* appear to be *C. fallaense*; the palms identified as *C.* × *vespertilionum* do not resemble that species and possibly are *C. Burretiana*. More detailed botanical study is needed to resolve these problems. Accurate identification of several species is difficult because they are or may be natural hybrids.

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Table 1. Losses of introduced Copernica *palms by species, 1970–80*

Species	1970 Population	1980 Population	Losses	Percentage Lost
Copernicia alba	286	263	23	8.0
C. Baileyana	62	58	4	6.5
C. Burretiana	2	2	0	0.0
C. Cowellii	23	16	7	30.4
C. Curtissii	10	10	0	0.0
C. glabrescens	41	40	1	2.4
C. hospita	853	774	79	9.3
C. macroglossa	47	47	0	0.0
C. rigida	2	1	1	50.0
C. × *Shaferi*	28	24	4	14.3
C. tectorum	2	2	0	0.0
C. × *textilis*	14	14	0	0.0
C. × *vespertilionum*	2	2	0	0.0
C. Yarey	89	81	8	9.0
Total number of specimens	1,461	1,334	127	8.7

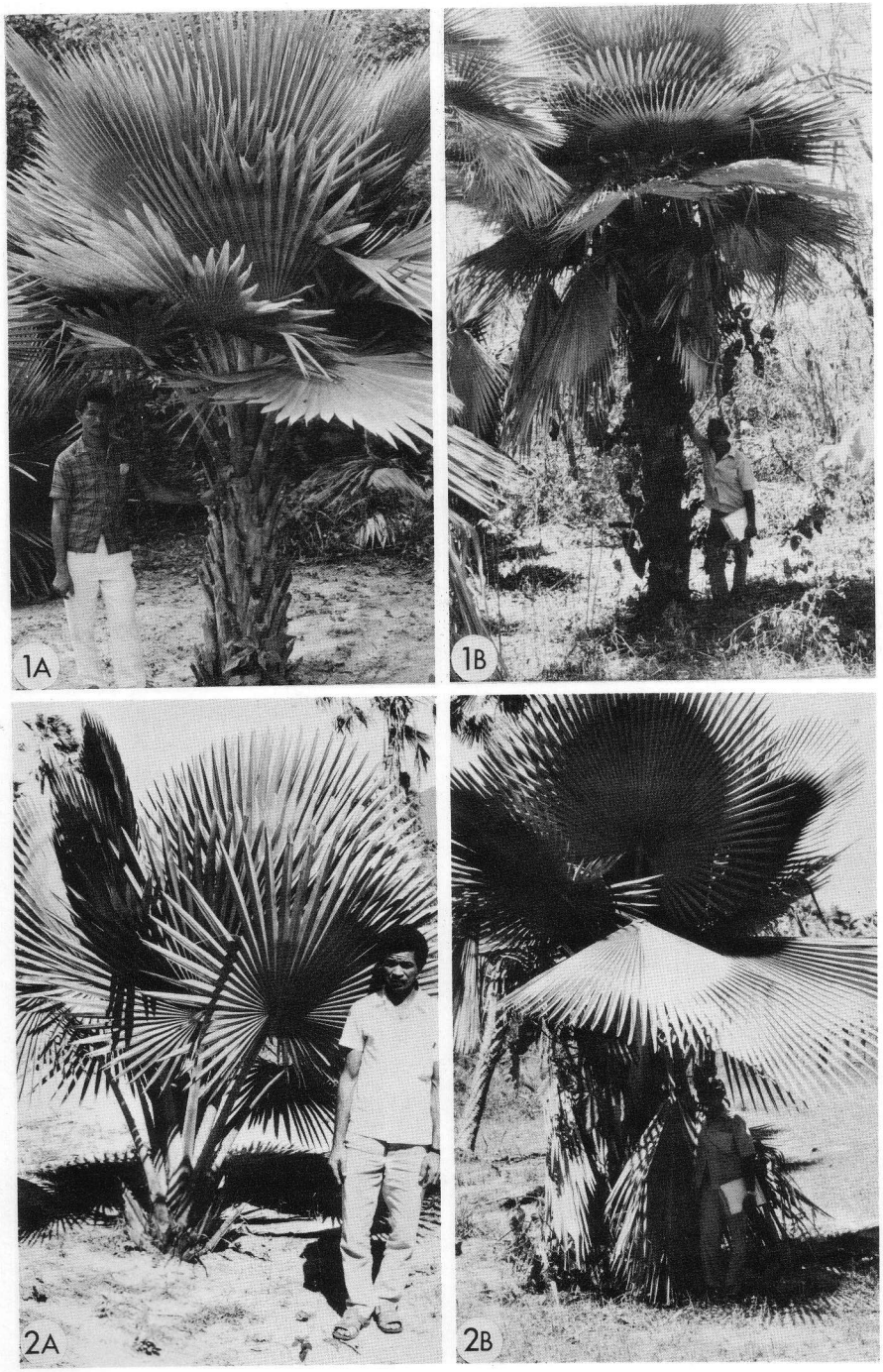
For discussion purposes, the introduced species can be divided into three groups: Group 1—no losses; Group 2—losses of 1–8 percent; Group 3—losses of 9 percent or greater.

Group 1 consists of *C. Burretiana*, *C. Curtissii*, *C. macroglossa*, *C. tectorum* (?), *C.* × *textilis* and *C.* × *vespertilionum* (?). These palms are healthy in appearance and perfectly adapted to the climate of coastal Northeast Brazil. Figure 1 shows a specimen of *C. Burretiana* which increased its trunk height from about 1.1 m in 1970 to 2.5 m in 1980. The palm in the photograph is 25 years old and ultimately may reach a height of 4–5 m (Dahlgren and Glassman 1963). All specimens of *C. Curtissii* are producing suckers vigorously, whereas in the native habitat in Cuba they are described as occasionally producing them (Dahlgren and Glassman 1963). The more vigorous suckering habit could be some type of environmental response.

C. macroglossa is the showcase palm at Raposa and seed reportedly has been collected for ornamental plantings in the Fortaleza area. A few of the palms now are large enough to show an exposed trunk beneath the dense skirt of adhering dead leaves. Figure 2 provides photographic evidence for the redesignation of *C. tectorum* as *C. fallaense*. Over the ten-year period, the palm has produced a trunk of about 1.4 m in height.

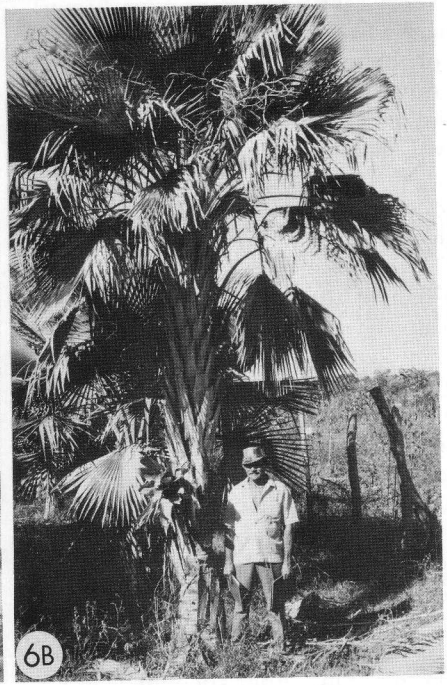
C. × *textilis*, one of the natural hybrids, is pictured in Figure 3. This specimen has increased its trunk height from about 1.5 m to 3.0 m. One specimen of *C.* × *vespertilionum* (?) was measured and showed an increase in trunk height from 1.0 m to 3.3 m in ten years.

Group 2 includes *C. alba*, *C. Baileyana* and *C. glabrescens*. The second largest number of specimens at Raposa belongs to *C. alba*. Wide variation in size is found among the trees, with no apparent pattern which can be related to environmental factors. The occurrence of stunted palms is random; no plant parasites were observed to account for the stunted growth. Figure 4 shows a mature *C. alba* with trunk height of about 8.0 m in 1970



1. *Copernicia Burretiana*. a. 1970. Man is 1.76 m tall; b. 1980. Man is 1.65 m tall; 2. *Copernicia tectorum* (*fallaense* ?). a. 1970; b. 1980.

3. *Copernicia* × *textilis*. a. 1970; b. 1980; 4. *Copernicia alba*. a. 1970; b. 1980.



5. *Copernicia Baileyana*. a. 1970; b. 1980; 6. *Copernicia hospita*. a. 1970; b. 1980.

and 10.7 m in 1980. In Paraguay the palm reaches up to 30 m in height (Dahlgren and Glassman 1961).

C. Baileyana also shows considerable variation in size at Raposa. The palm in Figure 5 increased its trunk height from 4.5 m to 5.7 m in ten years. Other specimens are even taller, with two reaching 10 m, as tall as those in Cuba (Dahlgren and Glassman 1963). *C. glabrescens* is described as occasionally producing suckers in Cuba (Dahlgren and Glassman 1963), but all specimens at Raposa are suckering vigorously. Once again, this could be some type of environmental response. Despite the loss rates within Group 2, the presence of numerous mature healthy specimens indicates that the species are adaptable to coastal Northeast Brazil.

Group 3 consists of *C. Cowellii*, *C. hospita*, *C.* × *Shaferi*, *C. rigida* and *C. Yarey*. With losses of over 30 percent, *C. Cowellii* is the least successful of the species introduced to Raposa. Several of the plants have reached botanical maturity, but the largest is only 1 m tall, although it is 30 years old. Normally this species in Cuba reaches a height of 1.2–2.5 m (Dahlgren and Glassman 1963).

C. hospita represents more than one-half of the introduced specimens at Raposa. A loss rate of over 9 percent indicates that some problems of adaptation exist. Losses due to death or stunted growth appear to be random except in Field C where a group of six large palms had recently died. Accounting for this concentration may be the recent drought conditions and very sandy soils of the field, but a plant parasite cannot be ruled out. Figure 6 shows a specimen in another field which increased its trunk height from 0.6 m to 1.9 m. Other specimens of *C. hospita* at Raposa are over 3 m in height. This species represents the most promising waxy palm in the collection. Despite the losses experienced, it does appear to be adaptable to the environment providing it is planted in more favorable sites.

C. × *Shaferi* also has suffered relatively high losses at Raposa. A few specimens are botanically mature, but all are rather small in stature. The largest plant has a trunk about 1 m tall, whereas in Cuba this natural hybrid reaches heights of 2.0–3.5 m (Dahlgren and Glassman 1963). This species does not appear to be well adapted. The loss of one of the two specimens of *C. rigida* occurred recently in the same field where the group of *C. hospita* also died, and probably for the same reason. The surviving palm appears to be healthy, but with only a single specimen no conclusions can be drawn.

C. Yarey had a loss rate of 9 percent, but one-half of the losses occurred in Field C where conditions are most severe. Measurement of a specimen in another field showed an increase in trunk height from 1.1 m to 2.8 m. Like *C. hospita*, this species appears to be adaptable to more favorable sites in coastal Northeast Brazil.

In conclusion, it should be mentioned that the Raposa plantation is the largest collection of cultivated *Copernicia* palms known, and its species list is exceeded only by the Fairchild Tropical Garden in Miami. At least three species are unique to Raposa. Much could be learned about the nature of spontaneous palm hybrids and other aspects of *Copernicia* species through careful study of the research records and living specimens in the collection.

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LETTERS

Dear Editor,

I am sure that many members of the Palm Society will be interested to hear the findings of the special Meeting on the Future of Lethal Yellowing Research held 1–2 September 1980 in Kingston, Jamaica, which was cosponsored by the International Council on Lethal Yellowing and the Coconut Industry Board, Jamaica. This meeting was convened because the financial and technical support for the U.K. Overseas Development Administration LY Research Team in Jamaica will come to an end in March 1981, after nine years of work. The Coconut Industry Board also indicated its desire to withdraw its support. The aim of the meeting was to review research on LY to date, decide what future research was needed, and attempt to identify sites and financial support for this research.

Participants in the meeting included representatives from ODA, FAO, Univ. Fla., Univ. W. Indies, Coconut Industry Board Jamaica, Caribbean Development Bank, European Communities Commission and Ministries of Finance and Agriculture Jamaica.

To update all the participants, the following Background Papers were circulated previously:

(1) Global Significance of LY (L. Chiarappa)
(2) Outstanding Scientific Problems—The Need for Continued Research on LY (S. J. Eden-Green)
(3) LY and Lethal Declines of Palms in the United States (W. B. Ennis)
(4) Brief Review of Research on LY (D. H. Romney)
(5) Variety Resistance to LY—Current Situation (B. O. Been)

In addition, Policy Statements on LY were received from Central Plantation Crops Research Institute, India; Coconut Research Institute, Indonesia; Institut pour Recherches en Huiles et Oléagineux (IRHO), France; Ministry of Agriculture, Jamaica; Philippine Coconut Authority; Royal Tropical Institute, The Netherlands; Council for Scientific and Industrial Research, Ghana; Coconut Industry Board, Jamaica; and the National Coconut Development Project (GTZ), Tanzania. All of these territories/organizations stressed the need for continuation of research into LY.

The meeting concluded that priority work should be pursued in two major fields of research:

A. International testing of coconut varieties to find practical resistance in each territory and to identify where diseases are co-identical. A project was drawn up that delineates the varieties to be tested and the criteria for running the experiment. Statistical advice is being obtained from E. Malling Research Station, U.K. It is hoped that trials can be established in Nigeria (Awka wilt), Philippines (Socorro disease and Cadang-cadang), Jamaica (LY), Malaysia and Sumatra (stem necrosis), New Hebrides (unnamed disease), India (root wilt), Solomon Islands (unnamed disease), Sri Lanka (leaf scorch), Guyana (cedros wilt) and Trinidad (red