

The Carnauba Wax Palm (*Copernicia prunifera*).

III. Exploitation and Plantation Growth

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In Brazil a slow process of exploitation took place which led to the carnauba's present state of incipient domestication. This occurred by first harvesting leaves of wild stands without any regard for the care and maintenance of the tree population, followed by the management or protection of natural stands, and finally with the actual plantation growth of this palm.

Management of Natural Stands

The practice of managing natural carnauba stands began in the second half of the nineteenth century. It involved practices aimed at protecting and preserving, as well as extending, the native stands. Protecting mature trees so that they would provide a continuing source of wax led to the practice of protecting naturally occurring seedlings from being browsed by livestock. This was accomplished by fencing off sections of the grove where young plants were present in any number.

Burning of groves each year at the end of the dry season to control brush and stimulate the growth of herbaceous plants is another practice detrimental to young carnauba palms. It is of no danger to mature plants, as already mentioned, and the fact that livestock could graze on grasses and herbs growing beneath the trees is actually an efficient use of the land.

There have been several attempts to

discourage the practice of burning, as well as other measures to protect the carnauba. The State of Ceará (Dept. Econ. Agr., 1942) recommended that burning be abandoned, and also mentioned regulations in force which made it illegal to destroy a carnauba without permission. The same publication also stated penalties that could be imposed for the damaging practice of early harvest of leaves. This in reference to the official designation of the beginning of the harvest season based on the date of the end of the rainy season.

Harvesting of carnauba leaves is typically associated with three different land and labor systems: (1) harvest by the landowner himself; (2) harvest by a tenant under a special rental agreement; (3) harvest by a sharecropper.

The least common method is that involving harvest by the landowner. Under this arrangement the amount of land is quite small, perhaps no more than a few acres. The work of harvesting the leaves and extracting the wax is often done by the owner and his family, with help on some occasions from hired day labor. Or group labor parties may be organized among a number of small property owners. This involves the owners and some members of their families pooling their labor to harvest the leaves and extract and render the wax of each member's property in turn; the property owner providing food and drink for the duration of his harvest.

The most common method of harvesting carnauba wax is that of the rental agreement. The property owner contracts to rent his land for the sole purpose of harvesting carnauba leaves. A cash rental figure is agreed upon, taking into consideration the number and condition of the palms. Such an arrangement often results in overexploitation, as the renter is interested in deriving as large a profit as possible without much regard for the condition in which the trees are left. The practice is also facilitated by the absence of the landowner who commonly does not reside on the property.

The third system is the traditional sharecropper method common among peasants in northeast Brazil. It is generally associated with large land holdings with extensive areas of native carnauba. The sharecroppers are most often year-long residents on the property, taking part in the carnauba wax harvest as part of the annual cycle of work on a number of crops.

The share of the harvest which a sharecropper could expect for his labors was originally set at two-thirds. More recently this has been reduced to one-third with the advent of higher yields obtained by mechanized wax extraction with the Guarany-Ciclone leaf chopper.

Mechanization of the extracting phase of the wax harvest has led to modification of the systems under discussion. The practice of organizing group labor parties among small property owners has all but disappeared since the bulk of the work has been mechanized. It is now common for the small land owners to contract with the owner of a Guarany-Ciclone, having the harvested leaves processed in return for a portion of the wax obtained. The rental system continues as before, except that now the renter either owns or has access to a machine. On the large plantations, the sharecropper system also continues, although mod-

ified by the introduction of mechanized wax extraction.

Plantations

It is not possible to determine exactly when the planting of carnauba began, since the practice evolved out of the management of natural stands. A visitor to northeast Brazil near the end of the nineteenth century mentions visiting a carnauba "plantation," owned by a German immigrant, which had been in operation for about 40 years. This particular "plantation" was described as being near a river, and may have been only a managed grove (Gissern, 1901).

An account of planting carnauba in upland areas of western Rio Grande do Norte dates back to the 1890s, and by the second decade of the present century cultivation in these areas was said to have developed appreciably (Lins and Andrade, 1960). Since carnauba does not occur naturally in these upland areas, the accounts may represent the first clear-cut examples of cultivation.

These early activities of both managing and cultivating carnauba appear to have been at the initiative of the individual landowners. This is indicated by a Recife, Brazil, newspaper account translated and printed in the *Tropical Agriculturist* (25:814-815, 1905) which exclaims that it is impossible to understand why the state and local governments in the northeast had not undertaken programs to promote carnauba cultivation.

In Ceará, the first published account of planting carnauba dates from 1914, with several reports from the following decade (Souza Pinto, 1928). Additional plantings were also reported in Rio Grande do Norte in the late 1920s (Andrade and Salgado, 1945).

As early as 1924 government programs with regard to the carnauba palm were being discussed. Among the issues were measures to prohibit the cutting of trees,

and measures to encourage cultivation, especially in areas most seriously affected by drought (Bertino, 1936).

The tempo of carnauba planting picked up in the 1930s, mainly in Ceará. By 1939 it was reported that 5 counties combined had a total of 894,000 maturing trees (Chaves, 1939).

The S. C. Johnson & Son, Inc. bought Fazenda Raposa near Fortaleza in 1937, and a year later began a program of planting carnauba. Company records for the period 1938 through 1942 indicate that 196 acres were planted with nearly 83,000 palms. During the same period the Chaves Brothers began planting carnauba on Fazenda Campestre near Pacajus, Ceará. Data on these plantings show that 1,833 acres were planted with an estimated 1,650,000 trees between 1939 and 1950 (Kitzke, 1951, 1952).

Plantation cultivation has increased rapidly since the 1940s and has played an important role in the overall expansion of production which reached 17,000 metric tons in 1967. An idea of the number of planted trees is derived from Bayma (1958) who estimated that every county in Ceará had some carnauba production, and that Ceará and neighboring Piauí combined had over ten million planted trees. It should be mentioned that there is no indication that any selection process was used in gathering seed for the above plantings.

Plantation Practices

The planting of carnauba is traditionally accomplished by placing seeds in small mounds of earth at the onset of the rainy season. The germination rate and success of such plantings is dependent upon adequate rainfall. Research on the germination rate of seeds planted directly in the field indicates that a rate of 60 to 70 percent success can be expected (Prata, 1963). Where germination fails

or seedlings die, replanting is carried out the following year to maintain field capacity.

While a majority of planting is still done by seed directly in the field, experimentation at Fazenda Raposa indicates that planting seeds in nursery beds and subsequently transplanting the most robust seedlings into the field is very effective. The addition of compost into the hole into which the seedling is transplanted provides a good initial source of nutriment and also acts to help store moisture (Kitzke, 1953).

Considerable disagreement exists with regard to the optimal number of plants to the acre. Gomes (1945) mentions densities ranging from 250 to 500 per acre, but favors the lower figure. Bayma (1958) is in general agreement with a figure of 330 per acre. It is interesting to compare these recommended densities with those of Fazenda Raposa and Fazenda Campestre. For the former, the average is 423 per acre, for the latter about 900 per acre.

The use of fertilizer is not common in growing carnauba, nor is irrigation. Mature plants are well adapted to the rainfall regime, and the chief justification for irrigation would be in the event of a drought during the first year or two of a new planting. Of prime concern to the plantation owner is the protection of young plants from damage by browsing animals and fire, and from competition of weeds and brush.

The time interval between planting and first harvesting of carnauba leaves varies somewhat in response to soil and water conditions. The uninformed or impatient planter may begin to harvest leaves when the plants are between four and six years of age. If such measures are followed, they can result in the stunting of the growth of the plant to the degree that average yields may never be achieved.

By postponing the first harvest until the palms are eight to ten years old, they will provide higher yields.

In summary, it can be stated that as far as plantation cultivation is concerned the carnauba palm has considerable promise. Through further improvements in plantation practices and the development of higher yielding strains through seed selection and plant breeding, wax production could be significantly increased without the necessity of expanding present acreage.

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