Journal of the Washington Academy of Sciences,
Volume 77, Number 4, Pages 215–223, December 1987

The Economic Utilization of the Babassu Palm: A Conservation Strategy For Sustaining Tropical Forest Resources

Michael J. Balick

Institute of Economic Botany, New York Botanical Garden, Bronx, New York 10458

ABSTRACT

This paper discusses progress on research towards the improvement of the utilization of the babassu palm (*Orbignya phalerata*) since a Lindbergh Grant was provided in 1980. The palm is a wild species occurring on some 200,000 Km^2 in Brazil, where it is harvested for oil and charcoal production. The palm is especially prolific on degraded sites that have been cleared of forest and thus helps to stabilize the ecosystem. Improvement in its utilization and introduction elsewhere will provide short and long term benefits and help conserve and exploit tropical forest resources in a biologically sound way.

Introduction

The babassu palm covers a vast area of Brazil and Bolivia, but is most abundant in the Brazilian states of Maranhão, Piauí and Goiás. In Brazil alone, some 200,000 km^2 is covered by stands of Babassu palms. The palm is an important resource to the livelihood of ca. two million people who harvest its fruits for oil and charcoal production. In fact, the babassu palm oil industry is said to be the largest oilseed industry based solely on the harvest of a wild plant.

The babassu palm grows in areas that have been cleared of forest and often is found in high density stands on so-called degraded sites otherwise unsuited for conventional agriculture (Fig. 1). As a source of food and protein-rich meal (the press-cake remains after oil extraction) it is a valuable resource for human and animal nutrition, in a region of the world where these commodities are often in short supply. In addition, the endocarp ("shell") that remains after extracting the kernels is converted into charcoal for use in the home and in industry. Charcoal from babassu has a higher energy content and lower sulfur than many mineral coals.

The challenge was to begin a program to better understand utilization of the babassu palm, so that it could be used more effectively in the regions where it is native, and be useful in other areas of the tropics where food and energy are in short supply. With this objective, a project was supported in 1980 by The Charles A.

Fig. 1. Stand of babassu palm in Maranhão, Brazil.

Lindbergh Fund, to work towards a more rational utilization of the babassu palm. Clearly, domesticating and distributing a tree with many valuable products which could grow in less than ideal conditions would be an effective way of helping to meet people's expanding needs while preserving and improving the environment. In the years that followed, collaborative efforts beteween U.S. and Brazilian, Colombian, Mexican, Bolivian, and Honduran scientists have led to the development of a network of researchers investigating the babassu palm resource. These studies have focused on many different facets of the palm and its environment, primarily along two different lines: domesticating the palm for use in plantations either within or outside of the native range and developing techniques for managing native stands of palms to improve yields.

Subsequent support was received from a number of sources, including the U.S. Agency for International Development, U.S.D.A. Forest Service, Consortium for the Study of Man's Relationship with the Global Environment, National Science Foundation, Inter-American Foundation, Scott Paper Company, Joyce Mertz-Gilmore Foundation, Pittsburgh Foundation and Brazil's Conselho Nacional de Desenvolvimento Cientifico e Tecnológico (CNPq). In addition, responsibility for the cost of the germplasm bank and national research program on babassu in Brazil was borne by the Centro Nacional de Recursos Genéticos/Empresa Brasileira de Pesquisa Agropecuária (CENARGEN/EMBRAPA) in Brasilia. Working as a multinational consortium, a great deal of knowledge about the babassu resource has been obtained. Studies of this kind, by definition, take decades to complete and thanks to the support of many individuals and foundations, this effort will be continuing into the future.

It is the intent of this paper to summarize research on babassu that has occurred since 1980, when the new initiative

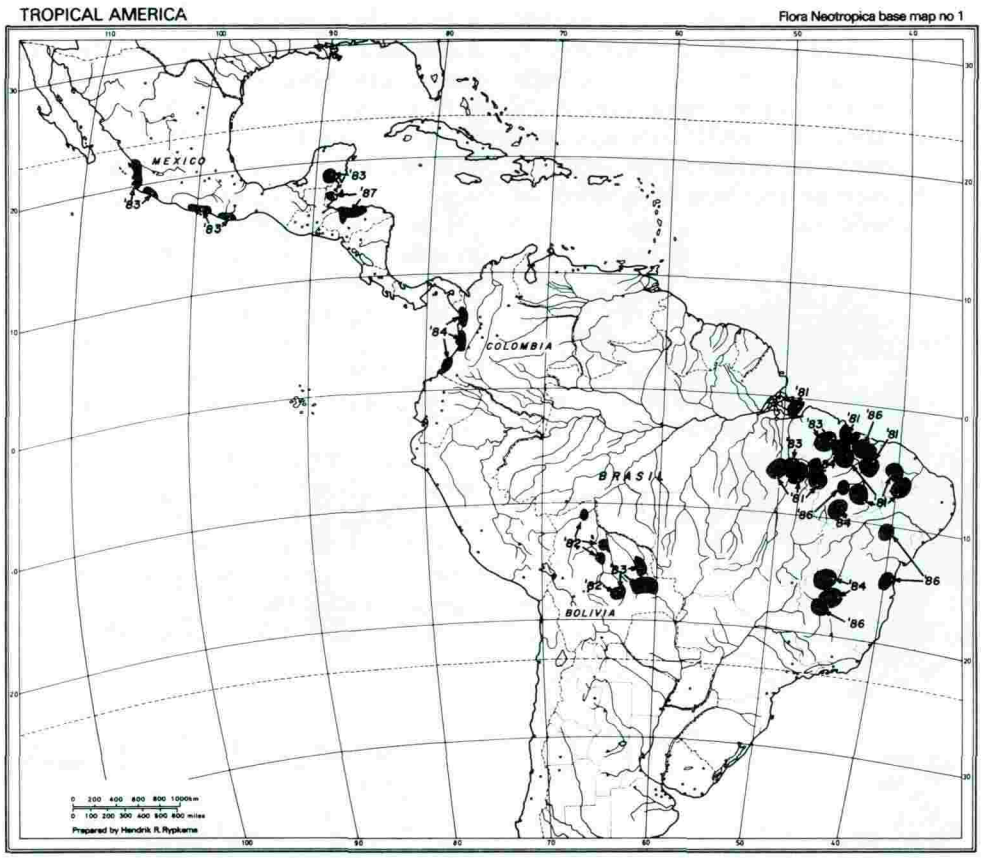

Fig. 2. Germplasm collecting sites from eight expeditions during 1981–1987.

began. Research lines are presented below as individual sections, with a brief explanation of the activities.

I. Fieldwork/Germplasm Collection

Expeditions to study the babassu and related palms in their native habitat and to collect germplasm were carried out in a number of locations, as indicated in Figure 2. Germplasm expeditions were as follows:

1981: Brazil (Pará, Goiás, Piauí, Maranhão) November–December.

1982: Bolivia (Beni, Santa Cruz) July–August.

1983: Mexico (Nayarit, Quintana Roo) March.

1983: Brazil (Maranhão, Goiás) August–September

1984: Colombia (Buenaventura, Tumaco Region) July.

1984: Brazil (Goiás, Minas Gerais) October.

1986: Brazil (Bahia, Piauí, Goiás, Minas Gerais) January–February.

1987: Honduras (Atlantida, Comayagua, Colón); Belize (Cayo) July.

Genetic material that was collected has been distributed to a number of locations.

Chief among these is the CENARGEN germplasm banks in Piauí and Maranhão, Brazil. Herbarium specimens have been sent to a number of institutions for study by specialists. CENARGEN has produced a computer inventory of all material collected or received as a result of these expeditions.

II. Nursery Trials

Because babassu is a wild species, little was known about its germination and requirements in the nursery. Time required for germination was up to one year, and this had to be reduced to shorten the amount of time the plants spent in the nursery. Research by Claudio U. B. Pinheiro and José Mário F. Frazão successfully resulted in obtaining germination of babassu in a matter of days. The technique involves removing kernels from the fruits, scratching the surface of the seed with a razor near the embryo (scarification), dipping the seed in fungicide and planting it in moist vermiculite. In this way, seeds are able to be transplanted to plastic bags filled with soil within a few months, and grow in the nursery for 6–12 months before being set out in the field. The overall strategy for germplasm banking and characterization is outlined in Fig. 3, kindly provided by Drs. Lidio Coradin and Eduardo Lleras of CENARGEN.

Tissue culture is another way to propagate plants, and a project at CENARGEN, led by Isabel Coría Cabral was undertaken with this objective. Results obtained from this work indicate that plantlets will form from excised babassu embryos cultures *in vitro*. Ongoing work

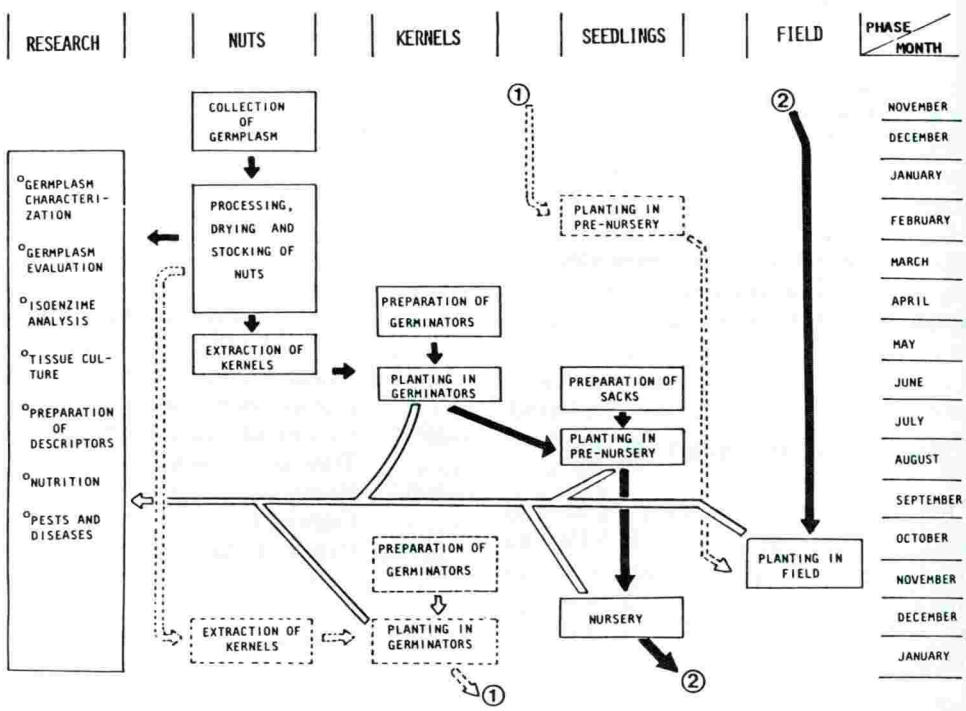

Fig. 3. Flow diagram of activities involved in the conservation of babassu germplasm. *Black:* flow of material; *open:* flow of research data; *dotted:* alternate flow of material.

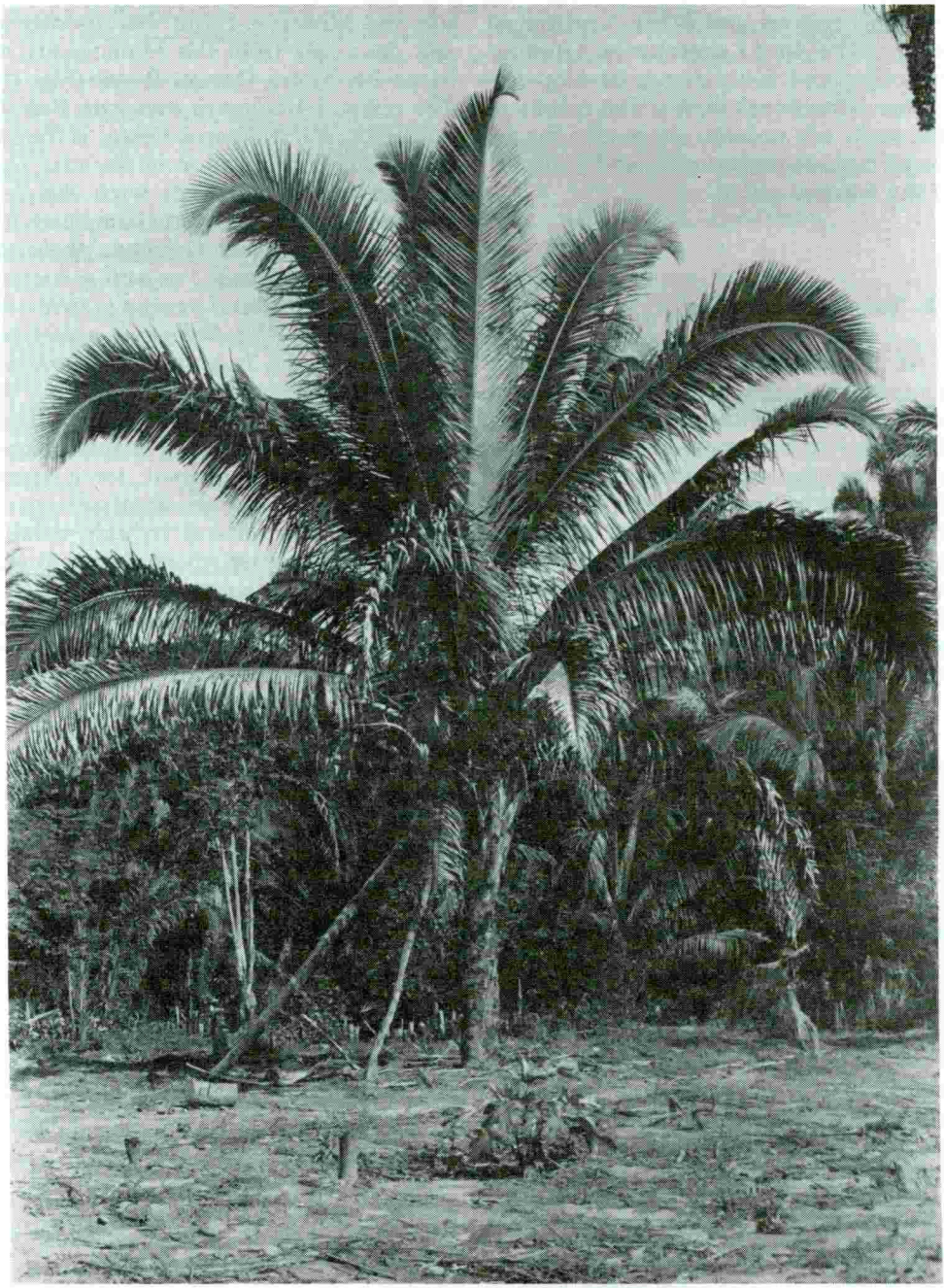

Fig. 4. The type tree of x*Attabignya minarum*. Reproduced from *Brittonia* 39(1)28. 1987.

with this species and other Neotropical palms at Twyford Laboratories, Glastonbury, England, is seeking to develop cryogenic storage techniques. The results of this work will provide alternative means for germplasm preservation and transport of the babassu palm.

III. Taxonomic Studies

At the initiation of this study, at least ten scientific names in the genus *Orbignya* were associated with babassu. An essential precursor to improvement of a plant is a knowledge of its identity and relationships with closely-linked species. The true identify for the babassu palm has been determined to be *Orbignya phalerata* Mart. Three hybrid complexes were discovered to exist, involving the closely related *Maximiliana* and *Attalea.* A new hybrid genus x*Attabignya* Balick, Anderson and Medeiros-Costa was discovered and described from the Municipality of Santa Fe, Minas Gerais, Brazil (Fig. 4). The palm, x*Attabignya minarum* Balick, Anderson and Medeiros-Costa, is the result of the hybridization of the rare *Orbignya oleifera* Burret with *Attalea compta* Mart. Other hybrid complexes involve a cross between *Orbignya phalerata* and *O. eichleri* Drude,[1] as well as a cross between *Maximiliana maripa* (Correa da Serra) Drude and *Orbignya phalerata.* This latter palm is known as *Markleya dahlgreniana* Bondar.

The discovery that natural hybridization occurs at a prolific rate in the babassu complex is most significant, for it opens up many avenues for the improvement of the palm. The natural hybrids exhibit many characteristics advantageous to utilization, such as increased fruit yield, lower stature, and hybrid vigor. Furthermore, studies of the populations of one of the hybrid complexes by Medeiros-

Table 1.—Subsistence uses of babassu fruits, leaves and stems*

Subsistence uses of babassu fruits.	
Kernels	
Snack nut	
Milk	stewing meat and fish
	beverage
Liquid endosperm	treatment of sties and bleeding
	beverage
Oil	cooking
	soapmaking
	burning in lamps
Residues	animal feed
	substitute or filler for coffee
	shrimp bait
Larvae	food for people
	fish bait
Husks	
Charcoal	primary source of fuel for cooking
Smoke	insect repellant
	smoking rubber
Anesthetic	condensed gases and tar from burning used to alleviate toothache
Handicrafts	pencil holders, keychains, figurines
Mesocarp	
Animal feed	
Flour	substitute for manioc flour and former staple among Indian tribes
	chocolate-like beverage
	medicine for gastrointestinal complaints
Hunting	attractant for rodents

Table 1.—(Cont'd.)

Subsistence uses of babassu leaves.	
Fibers	
Baskets	storage and transport
Mats	doors, windows, rugs, grain-drying
Fans	ventilating fires
Sieves	sifting manioc flour and rice
Others	twine, torches, whisks, bird cages, hunting blinds, animal traps
Construction materials	
Thatch	roofing and walls
Laths	support for clay-packed walls frames for windows
Rails	fencing to protect agricultural plots from animals and delimit hunting zones
Agricultural uses	
Leaves burned in shifting cultivation plots to promote nutrient recycling and pest control	
Rachis used for crop stakes and building raised planters	
Living leaves in pastures provide shade for livestock and feed during dry periods	
Medicine	
Liquid expressed from rachis used as antiseptic and styptic	

Subsistence uses of babassu stems.
Construction
Bridges
Foundations
Benches
Palm heart
Food for people
Feed for animals
Ripening agent for banana
Sap (collected from stump of felled palms)
Fermented drink
Attraction of beetle larvae that are eaten or used as fish bait
Mulch/planting medium (obtained from decayed stems)
Salt (made from ash of burned stems)

*From: May *et al.*, 1985

Costa *et al.*[2] have identified morphotypes within the hybrid swarm. The taxonomy of the babassu complex is summarized in a forthcoming paper by Anderson and Balick.[3]

IV. Ecology

A major study of the ecology of the babassu palm was carried out by Anthony B. Anderson, currently of the Museu Paraense Emilio Goeldi in Belém, Brazil as his doctoral dissertation research.[4] While it is impossible to describe all the results of his research in this section, the topics covered include taxonomy and phytogeography, reproductive biology, establishment growth and productivity, population structure and dynamics, implications for management, and five appendices on various relevant subjects.

V. Economics

To get a better idea of the economics of the babassu industry, the Institute of Economic Botany of The New York Botanical Garden commissioned a field

study by a group of business consultants. The objective was to identify possible ways in which wild babassu stands, and existing farming systems that incorporate babassu as an element can increase economic viability. Four sectors of the babassu industry were identified: peasants, merchants, landowners and oilseed pressers. Together, the estimated gross annual "value-added" by the industry in Brazil is US $150,000,000. Total industrial production in 1984 was estimated at 120,000 MT of oil and 90,000 MT of presscake. Production of charcoal for industrial use in 1983 was estimated at 15,000 MT; the bulk of the product is used for domestic fuel use.[5]

VI. Socioeconomics

The socioeconomic aspect of this resource has been addressed by Peter H. May, presently at the Ford Foundation in Brazil, who carried out fieldwork in Northeastern Brazil during 1983–1984. His doctoral thesis, entitled "A Modern Tragedy of the Non-Commons: Agro-Industrial Change and Equity in Brazil's Babassu Palm Zone," was recently published by Cornell University.[6] Chapter headings include: Babassu: subsidy from nature and problem resource; property rights and the tragedy of the non-commons; the babassu zone; history and character; structural change in babassu zone agriculture; babassu in peasant farming systems of Maranhão; landowners' decisions and the non-commons tragedy; the rise and decline of the babassu oil industry; technical innovation in babassu fruit processing; alternative development paths for the babassu industry; and conclusions and policy recommendations. There are many social factors that must be considered if progress is to be made on the utilization of babassu.

VII. Agroforestry

Because of the multiple uses of babassu (Table 1) this palm has great potential for expanded use in agroforestry systems. May *et al.*[7] discussed the current use of the palm in agroforestry systems in Northeastern Brazil, where the palm provides cash income, fuel, fiber, edible oil, and food to a large number of tenant farm households. Based on studies of rural families in four municipalities in Maranhão, he found that use of palms for thatch was practiced in 86% of all households, for basketry in 85% of all households, for charcoal in 83% of all households; for "milk" (a beverage from babassu) in 69% of all households, for oil in 71% of all households and palm heart (palmito) in 22% of all households. The two agroforestry systems documented in this study were palm-pasture and palm-shifting cultivation. The second system utilized crops such as rice, maize, cassava and a number of bean species. Other vegetable crops also were found to be grown. This agroforestry system was judged to be sustainable, especially in the less fertile areas where farmers have few alternatives for cultivation.

Prospects for the Future

Work on the improved utilization of babassu palms continues. Funding from a variety of agencies mentioned at the beginning of this paper has allowed a number of projects to be undertaken. Interest will continue to be relatively high in the search for alternative plant species for use in less fertile or degraded environments. Activities such as the workshop on babassu held in March, 1986 in Teresina, Brazil has helped to stimulate international interest in this palm. The weaknesses in this informal research "network" are a lack of long-term reliable funding and institutional instability insofar as priorities and programs are con-

cerned. Nevertheless, this long-term project to improve babassu has demonstrated that multinational scientific efforts to identify and utilize plant species to strike a better balance between technology and the environment can result in many benefits, both immediate and in the future. As tropical ecosystems are increasingly degraded, species such as the babassu palm can provide a stabilizing factor to help conserve and exploit tropical forest resources in a biologically sound way.

References Cited

1. **Balick, M. J., C. U. B. Pinheiro and A. B. Anderson.** 1987. Hybridization in the babassu palm complex I. *Orbignya phalerata* x *O. eichleri*. Am. Journ. Bot. 74:1013–1032.
2. **Medeiros-Costa, J. T., A. M. de Campos Mendes and J. L. de Castro Brito.** 1985. Morfodiagnose de *Orbignya teixeirana* Bondar (Palmae-Cocosoideae) nos estados do Piauí e Maranhão. Pesquisa em Andamento (EMBRAPA/UEPAE de Teresina) No 39:1–5. Offset.
3. **Anderson, A. B. and M. J. Balick.** 1988. Taxonomy of the babassu palm complex. Syst. Bot. In press.
4. **Anderson, A. B.** 1983. The biology of *Orbignya martiana* (Palmae), a tropical dry forest dominant in Brazil. Ph.D. Thesis, University of Florida.
5. **Pick, P. J., J. M. F. Frazão, W. P. Mason, P. H. May, and W. Milfont, Jr.** 1985. Babassu (*Orbignya* species): gradual disappearance vs. slow metamorphosis to integrated agribusiness. A report prepared for The New York Botanical Garden Institute of Economic Botany. January. Offset.
6. **May. P. H.** 1986. A modern tragedy of the noncommons: Agro-industrial change and equity in Brazil's babassu palm zone. Latin American Studies Program, Dissertation Series, No. 91. Cornell University, Ithaca.
7. **———, A. B. Anderson, J. M. F. Frazão and M. J. Balick.** 1985. Babassu palm in the agroforestry systems in Brazil's mid-north region. Agroforestry Systems 3:275–295.