Deutscher Tropentag, October 11-13, 2005, Hohenheim
"The Global Food & Product Chain—Dynamics, Innovations, Conflicts, Strategies"

INSTITUTO LUTERANO DE ENSINO SUPERIOR DE SANTARÉM
SANTARÉM LUTHERAN INSTITUTE FOR HIGHER EDUCATION

Identification of botanical species of oil crops in the region of West Pará, Brazil as sources for Biodiesel production (Preliminary Results)

Nils Berger[1], Dr. sc. agr., Professor, Course of Agricultural Engineering

[1]: *Santarém Lutheran Institute for Higher Education/Lutheran University of Brazil (ILES/ULBRA), Av. Sergio Hénn, 1787, 68025-000 Santarém, PA, Brazil, E-mail: nberger@gmx.net*

Introduction.

The western region of the Brazilian federal state of Pará shelters a large number of neglected oil crops. Some of them with known industrial uses like the babassu Palm (*Attalea speciosa* Mart. ex Spreng.=*Orbignya martiana* Barb. Rodr), whose lauric-rich kernel oil is used for cooking or in soap industry (FAO, 1995; Marinho, 2004). Other oils like those of andiroba (*Carapa guianensis* Aubl.), copaiba (*Copaifera guyanensis* Desf.) or cumaru (*Dypterix odorata*) are used mainly for medical or cosmetic purposes (Maimom, 2000; FAO, 1992; Ferraz et al., 2002), whose exploration, until a few years ago, was restricted only to regional markets. Their economic importance at small scale farming level, thus, is increasing due to large federal programs for improvement of small-scale (farming) industries.

In 2004 the Brazilian government started a new program for Biodiesel production, in which regional oil crops, like castor bean (*Ricinus communis* L.) in the dryer northeastern region, sunflower (*Heliantus annuus* L.) or soybean (*Glycine max* Merr.) in the south and central regions and oil palm (*Elaies guinensis* Jacq.) or other *Arecaceae* species in the northern regions should provide the raw material for this alternative fuel. The program aims to reduce the petroleum based diesel consumption in 2% until 2007 and 5% until 2010 by mixing biodiesel with petroleum diesel (MME, 2005).

As part of the national Biodiesel program the CNPq launched a public research announcement (Edital CNPq 28/2004 CT-Amazonia Theme 4: *Survey of the legal Amazonian biodiversity with potential to Biodiesel production*) regarding basic research to identify regional oleaginousous crops which could deliver oil in enough quantities and even quality for the Biodiesel aims of the federal government. The ILES/ULBRA was considered with the project "*Identification of botanical species with potential to use as Biodiesel source in the Western Region of Pará, Lower Amazon*" and presents in this paper preliminary results of the biodiversity survey in the eastern Amazon Region, at the hydrographic Tapajos River basin.

↑ Fig. 1 Babassu (*Attalea speciosa*)

↑ Fig. 3 Patauá palm (*Oenocarpus pataua*) with fruiting bunch

↑ Fig. 2 Côco curuá (*Attalea microcarpa)*

← Fig. 4 Fruit capsule with germinated seed of Andiroba (*Carapa guianensis*)

Material & Methods

Field survey was done at three locations of the lower Tapajos hydrographic basin (Fig. 5):

(1) Community of Diamantino following a transect between S02°29'59.8990'' W054°39'44.6616'' and S02°29'59.2810'' W054°39'31.8386''. Survey perio d: April and August 2005.

(2) UNEPAGRO (Agricultural Experimental Station of the ILES/ULBRA) at following transects: between S02°35'34.0552'' W054°54'22.50458'' and S02°3 4'42.79953 W054°53'51.23245'' as well as S02°34'39.86416'' W054°54'48.29973'' and S02°34'16. 39668'' W054°54'34.11643''. Survey period: June and August 2005.

(3) Lago Grande de Curuai between the coordinates: S02°18'0 3.5091'' W055°38'44.5927'', S02°18'20.0398'' W055°28'19.430'' and S02°25'53.8675 '' W055°32'04.9154''. Survey period: April 2005.

Field appraisal is done indirectly by application of questionnaires to small scale farmers and populations to identify the survey sites. After site definition, in situ species identification is done were possible. If a proper on site identification is not possible, plant material (leaves, flowers and fruits) is collected for species identification in the laboratories of the Santarém Lutheran Institute of Higher Education (ILES/ULBRA). The geographic location of the survey sites was done with the aid of GPS equipment (*Garmin GPS 76S* and *Garmin Rhino 130*).

Soil samples are collected at each surveyed area at 30 cm depth and analyzed at the laboratories of the ILES/ULBRA, following the EMBRAPA (1997) methodology.

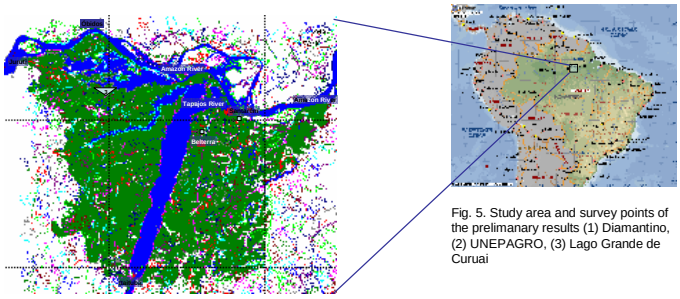

Fig. 5. Study area and survey points of the prelimanary results (1) Diamantino, (2) UNEPAGRO, (3) Lago Grande de Curuai

Table 1. Species identified during field surveys in Lago Grande de Curuai, UNEPAGRO (Agroexperimental Unit of the ILES/ULBRA Santarém) and Diamantino. i= Indivual plants; g= plant comunities with >5 individuals.

	Lago Grande do Curuai	UNEPAGRO'	Diamantino	Expected Oil yield	Oil Yield results
Identified Species	**Number**	**Number**	**Number**		
Mucaja (*Acromia aculeata* (Lacq.) Lood. Ex. Mart.)	11i				
Piririma (*Syagrus cocoides* Mart.)	10i	11i			
Mumbaca (*Astrocaryum mumbaca* Mart.)	1i	7i			
Piquia (*Caryocar villosum* (Aubl.) Pers.)	8i	6i		72%(a)	9%
Patauá (*Oenocarpus bataua* Mart.)	2g		4g	78%(a)	45%
Bacaba (*Oenocarpus bacaba* Mart.)	13g		3g		22%
Coco Curuá (*Attalea microcarpa*)	10g	22i			37%
Tucumã (*Astrocaryum vulgare*)	19i	1i	3i		
Inaja (*Attalea maripa* (Aubl.) Mart.)	24i		9i		
Brazil Nut (*Bertolletia excelsa* Humb. &. Bonpl.)	4i, 1g		1i	65%(b)	
Sapucaia (*Lecythis pisonis*)	2i	1i	1i		
Buriti (*Mauritia flexuosa* L.)	13g				8%
Babassu (*Attalea speciosa* Mart. ex Spreng.)	7g	2i		60-70%(a,b)	40%
Andiroba (*Carapa guianensis* Aubl.)	1i		8i	56%(a)	20%
Curuanema or Curuá-y (*Attalea agrestis* (Barb. Rodr.) Burret.	4i				
Cumaru (*Dipterix odorata* Aubl.)	1i	1i		39-43%(a)	
Uxi (*Endopleura uchi* (Huber.) Cuatr.)	4i				
Assai (*Euterpe oleracea* Mart.)	7g		4g	7-11%(a)	
Ucuuba (*Virola surinamensis*)	1i			65-76%(b)	
Paxiuba (*Aphanes caryoaefolia* Wendl.)			2i		

(a) Clay & Clement (1993);(b) FAO (1992)

Results and Discussion

Table 1 shows the species, in plant communities or as individuals, identified during three field surveys between January and August 2005. The surveys showed a high variety of oil crops, specially in the "terra firme" region of Lago Grande de Curuai. Two species of the *Attalea* family *(A. microcarpa* and *A. speciosa*) showed promising results, thus, their oil yields, obtained in the ILES laboratories, were lower than those found in other studies, probably due to different extraction methods (Clay & Clement, 1993; FAO, 1992). *A. speciosa* oil is already known in the cosmetic and soap industry. *A. microcarpa* is considered a weed with high population rates on highly degraded pasture areas. Its oil of shows similar properties with that of babassu, but it is not exploited commercially. Its high kernel oil concentration in could turn it an interesting source for Biodiesel production. *Oenocarpus bataua*, *Attalea maripa* and *Astrocaryum* spp. are palm species found in other Amazonian regions (Vormisto et al., 2004) and, depending on their oil concentration, could turn promising Biodiesel source candidates. One example is *O. bataua,* which presented mesosperm oil yields of 45%, which is of a high quality, almost identical with olive oil (Clay & Clement, 1993), being a interesting substitute for this oil in Latin America. The pulp of *C. villosum* delivers oil in high quality and quantity (Cley & Clement, 1993), even if our own extraction showed only low oil yields. A problem for commercial oil exploration of *C. villosum* is the consumption preference of local populations for the fresh pulp. *C. guianensis* showed lower than expected oil yields, due to extraction methodology: A use as Biodiesel source wouldn't be feasible economically, because its medical value is higher than its return as Biodiesel raw material.

References

Clay, J. W. & Clement, C. R. (1993). *Selected Species and Strategies to Enhance income generation from Amazonian Forests*. FAO Working Paper Misc/93/6, Rome

Maimom, D. (2000) *Estudo de mercado de matéria prima: corantes naturais (cosméticos, indústria de alimentos), conservantes e aromatizantes, bio-inseticidas e óleos vegetais e essenciais (cosméticos e oleoquímica).* Relatoriio Final Projeto BRA/96/025 SUDAM/PNUD, Belém

EMBRAPA (1997). *Manual de Métodos de Análise de Solo*. 2ª Ed.EMBRAP-CNPS, Documentos 1, Rio de Janeiro.

FAO (1992) *Minor Oil Crops*. FAO Agricultural Services Bulletin No. 94, Rome

FAO (1995) *Edible Nuts*. Non-Wood Forest Products 5. Rome, 112p.

Ferraz, I.D.K.; Camargo, J. L. C; Sampaio, P. de T. B. (2002) *Sementes e plântulas de andiroba (Carapa guianensis Aubl. E Carapaprocera D.C.): Aspectos Botânicos, Ecológicos e Tecnologicos*. Acta Amazonica 32 (4):647-661.

Marinho, V. M. C. (2004) *Como as empresas brasileiras de cosméticos estão utilizando o conhecimento tradicional e as plantas medicinais.* XXVI Reunião Anual sobre Evolução, Sistemática e Ecologia Micromoleculares Instituto de Química, Universidade Federal Fluminense, 1 a 3 de dezembro de 2004, Rio de Janeiro.

MME (2005). *Presidente Lula inaugura usina de biodiesel no Pará*. Acessoria de Comunicação Social do Ministerio de Minas e Energia, Brasilia.

Vormist, J.; Svenning, J.C.; Hall, P.; Balslev, H. (2004). Diversity and Dominance in palm (Arecaceae) communities in *terra firme* forests in the western Amazon basin. Journal of Ecology 92: 577-588

Acknowledgements

This study is a joint effort with the following researchers of the Santarém Lutheran Institute for Higher Education: Rubens Nobuo Yuki, Arlete Moraes and Eloi Gasparim. Its execution would not be possible without the financiation through the Conselho Nacional de Pesquisa (CNPq) and the students which are awarded with partial scholarships by the head of the ILES/ULBRA Santarém.