Performance of Tropical Production and Processing Systems Dept.

CIRAD

Mission to the Coconut Industry Board

(Jamaica)

~ May 2008 ~

Dr X. Bonneau
Persyst

Doc No.2184
June 2008

CONTENTS

SUMMARY....3
ABBREVIATIONS....3
ACKNOWLEDGEMENTS....4
MISSION SCHEDULE....4
INTRODUCTION....5
1. SITES VISITED....5
    1.1. Taino Hill plantation....5
    1.2. Spring Garden site....6
    1.3. Various sites in the Northeast....6
    1.4. Nuts River plantation....7
2. SEED GARDEN AT BARTON ISLES....8
    2.1. General considerations....8
    2.2. Current status....9
    2.3. Seed garden management....10
3. RECOMMENDATIONS....11
    3.1. Seed garden....11
    3.2. Plantations....13
4. CONCLUSION....14

SUMMARY

Jamaican coconut plantations occupy around 15,000 hectares divided into small plantations of around ten hectares (the largest, over 100 hectares, are rare). They were first affected by LY in the 1960s and 1970s and were devastated again in the 1990s with a second wave of LY which completely wiped out entire plantations and is continuing to inflict damage today. Apart from LY, which is the main threat, coconut plantings are exposed to cyclone risks, to *Phytophthora* and to mites, notably with the appearance of a new species, the red palm mite.

Under these conditions, it is not surprising to see the increasing disenchantment with the coconut sector in Jamaica. There are also some other causes: probably socio-economic causes (the way certain plots are farmed with a distant owner who does not encourage the search for productivity) and also, despite promotion efforts by the CIB, under-use of the many coconut-based products, resulting in a loss of local added-value earnings.

Fortunately there are some reasons for hope. In particular, one dynamic farmer was seen who has decided to systematically fell and replace coconut palms affected by LY, with success for the time being. The method should be tested at other points on the island.

At the same time as research on LY itself, the CIB proposes to carry out research to improve the productivity of coconut plantations, and thereby encourage farmers to regain confidence in the supply chain. It is felt that two points need to be emphasized: firstly, LY can be lived with and, secondly, profits can be gained by diversifying the use of coconut products locally.

At the moment, the CIB distributes to farmers the Maypan hybrid (Malayan Green Dwarf x Panama Tall) produced in the Barton Isles seed garden under good conditions. It is suggested that the mineral nutrition in the seed garden should be managed by leaf analysis every two years.

ABBREVIATIONS

CIB: Coconut Industry Board (Jamaica).
MOFA: Ministry of Foreign Affairs (France).
LY: Lethal Yellowing.
MAYPAN: Malayan Dwarf hybrid coconut (whatever the colour) crossed with the Panama Tall.
MYD: Malayan Yellow Dwarf.
MGD: Malayan Green Dwarf.
BGD: Brazilian Green Dwarf.
PNT: Panama Tall.

ACKNOWLEDGEMENTS

Thanks to Dr Basil Been, the Director of Research at CIB, and Miss Tracy Logan, a CIB agronomist, for the organization and smooth running of this mission on site, and to Mrs Aminata Eluther-Wesley, the cooperation and cultural action attaché at the French Embassy in Kingston, for preparing this mission and for the debriefing meeting.

MISSION SCHEDULE

Monday 19 May

- flight Montpellier-Paris on AF 7681
- flight Paris-Miami on AF 90
- flight Miami-Kingston on AA 331
- met in Kingston by Dr Been, checked into the Altamont Court hotel.

Tuesday 20 May

- visit to plantations in the East of the island.

Wednesday 21 May

- visit to the Barton Isles seed garden in the Southwest part of the island.

Thursday 22 May

- morning: visit to Mr Black's plantation at Nuts River (Southeast part of the island).
- afternoon: debriefing at the French Embassy with Dr Been, Miss Logan and Mrs Eluther-Wesley, then a meeting at the Coconut Industry Board.

Friday 23 May

- flight Kingston-Miami on AA 1376
- flight Miami-Paris on AF 95

Saturday 24 May

- arrival in Paris on flight AF 95
- flight Paris-Montpellier on AF 7680

INTRODUCTION

With MOFA funding and CIB collaboration, the mission consisted in carrying out an agronomic assessment of Jamaican coconut plantations, as they are severely affected by Lethal Yellowing disease (LY). This mission follows up from several missions in phytopathology, entomology and breeding since 2002, under a collaboration scheme between UPR 29 of CIRAD and CIB, supported by the French embassy in Jamaica. The aim was to improve the productivity of unaffected palms and propose alternative solutions in plots devastated by LY, focusing on three points:

- Draw up a nutritional balance of the coconut palms,
- Examine intercropping possibilities,
- Study the possibilities of adapting nitrogen enriching cover crops.

1. SITES VISITED

1.1. Taino Hill plantation

This plantation, which is located at Robin's Bay on the north coast, covers 800 ha, of which 200 ha of coconut palms. Mineral fertilization was halted 5 years ago. Most of the coconut palms are Maypan hybrids (Malayan Yellow Dwarf x Panama Tall) mixed with various types of Dwarf palms, a configuration found in most of the plantations visited.

Some of the coconut palms are interplanted with cocoa trees, which have a good pod load, but the harvest is neglected, as is that of the coconut palms.

The plantation is severely affected by LY, which has completely decimated the coconut plantings in the coastal plain and is now attacking the coconut palms on hillsides. In certain cases, some hillside coconut plots, though near to the plain and exposed to the wind, have been spared, whilst other plots, which are in theory better protected, are affected.

Coconut upkeep is neglected, like the harvest, with a fair quantity of germinating nuts at the foot of the palms. Many similar cases were seen travelling along the coastal road.

The plantation produces coconut oil from grated kernel, which is dried on site on plates heated by hot air rising from a pipe in which a mixture of wood and coconut husks are burnt. The oil is then extracted by cold pressing. It is sold locally as virgin coconut oil, the residue (presscake) is fed to the farm animals.

In this plantation, there is a plot of Panama Tall coconut palms used as a pollen source, some of which are showing LY symptoms. A team of CIB harvesters regularly takes male inflorescences from identified coconut palms and transports them the same day to the CIB premises in Kingston, where pollen is extracted, packaged then sent to the Barton Isles seed garden (see section 2.1.).

The CIB has selected a certain number of Panama Tall coconut palms in that way in different parts of the island. Those palms are used as male parents to produce Maypan hybrids, following the previously described procedure.

1.2. Spring Garden site

This site, which is located at Buff Bay in the northern coastal plain, is a former CIB test point, which was totally destroyed by LY: no mature coconut palms remain. It is interesting to see that a plantation located a few kilometres further east, under the same topographical conditions and without any natural barrier, is totally LY-free.

Some BGD (Brazilian Green Dwarf) palms have been replanted there recently to test how they fare in a zone with a strong disease incidence. These coconut palms have good potential as female parents: early bearing, well-loaded bunches, good fruit size and a good leaf emission rate (one inflorescence produced every two weeks in the best of cases). Unfortunately, they prove to be susceptible to LY, with already 10% losses accumulated over three years.

The site also has a nursery. The CIB does not transfer seedlings to polybags. Seednuts from the seed garden are placed in the seed bed, then delivered to growers at the 3-leaf stage, with bare roots. In fact, as many coconut plantations are located in sloping areas on hills, growers prefer to lighten the cost and laboriousness of transport.

1.3. Various sites in the Northeast

A few repeatable observations were made following the coast road in the northeastern part of the island. LY first of all devastates the coconut palms on the coast (though some plantations are virtually LY-free between two virulent foci) and then spreads inland to the hills. And there, the spread of the disease suddenly stops, for no clear reason.

The unaffected coconut palms generally display good mineral nutrition with a green and abundant foliage, and a good nut load (e.g., Rural Hill near Long Bay). Very often, as mentioned in section 1.1., upkeep and harvesting are neglected.

A particular case was seen at Airbase Darlingford near Mancioneal: some young coconut palms planted regularly on shallow limestone soil, on a cliff next to the sea. They are invaded with grasses and many display symptoms of a nitrogen deficiency.

The CIB's old field gene bank at Fair Prospect, which was planted in 1968 and devastated by LY, was also seen; it was affected for the first time in 1981, without too much damage, then a second time at the end of the 1990s, when the disease was much more virulent. A census was carried out in January 2008 (source: Mrs Milliford Wallace, CIB geneticist) over a period of 12 years (1996 to 2007), with a very variable initial number of coconut palms per ecotype: from 2 to 230. The overall

survival rate amounts to only 7%, with mortality mostly (95%) caused by LY. The least susceptible ecotype (MRD of local origin) exhibited a survival rate of 36%, only 7 out of 51 ecotypes have a survival rate exceeding 10% and 36 out of 51 ecotypes have totally disappeared.

The large plain at the southeastern tip of the island, around Duckenfield, was once covered with coconut palms. They were devastated by LY in the 1990s and sugarcane is now grown there.

1.4. Nuts River plantation

Mr Michael Black's plantation, which is located near Morant Bay in the southeastern part of the island, covers around 250 hectares in a monoculture: it is one of the largest single areas of coconut palms in Jamaica. It is located in an area of limestone hills.

The owner-farmer produces coconut oil by the same procedure as that described in section 1.1., and fresh coconut water. The virgin oil is sold locally, whilst the water is exported to the USA. The whole (plantation plus two processing units) employs 68 people.

As frequently seen, the plantation is made up of a mixture of hybrids (mostly Maypan) and of different types of Dwarf palms. There are no intercrops and, unlike the majority of the other plantations visited or seen, upkeep and harvesting are effectively carried out at Nuts River: regular chemical weeding and regular collection of ripe nuts. In fact, the owner achieves added-value by selling products processed on site; use is made of every nut harvested. He also buys nuts from some of his neighbours, as he is unable to satisfy demand.

The plantation is located in a zone affected by LY since 1997, but Mr Black has adopted a strategy consisting in systematically replanting all affected coconut palms. He has set in place a system of early LY symptom detection, by regular censuses (patrols two to three times per week) and promotes employee awareness (they are required to inform management immediately as soon as they suspect LY on a palm).

As soon as a coconut palm is suspected of having LY, it is immediately felled, burned and replaced (in fact, there is a small nursery with seedlings ready to be planted at all times). As a safety measure, in the event of doubt, the coconut palm is cut down, as it is better to be overzealous (eliminate a few palms that are not really affected) rather than negligent (allow a few palms affected by LY to become a contamination hotspot). The replanted coconut palms are regularly fertilized and particularly well kept.

The system has been in force for 12 years. Around a hundred coconut palms are replaced each year, i.e. a cumulative total of around 1,200 replanted palms, for an initial stand of around 60,000 palms.

For the moment, no cases of LY have been reported on the replacement palms (reminder: over a period of 12 years). This is a very encouraging result, which shows

that **LY is not a fatality.** Of course, this very promising result needs to be confirmed over time and, in particular, validated at other sites (indeed, it would be unwise to draw any general conclusion from a single example).

2. SEED GARDEN AT BARTON ISLES

2.1. General considerations

The seed garden has been set up in a zone free of LY, to protect seednut production from devastation by the disease, as has happened at the former seednut production sites at Spring Garden, Hart Hill and Doctor's Woods in Portland province. The Barton Isles seed garden was planted in 1975 and is located between the towns of Lacovia and Maggotty in the St. Elizabeth region.

A first generation of MYD mother-palms was planted in 1975, then a second in 1986. In the third generation, it is MGD mother-palms that were planted between 2002 and 2004. In fact, as the MYD palms proved susceptible to LY, and Yellow Dwarf hybrids were no longer accepted by local growers or the export market in Florida, the type of female parents was changed in favour of a Green Dwarf.

It is still pollen of the Panama Tall variety that is used as the male parent to produce Maypan hybrid seednuts. There are several plots of PNT scattered across the island, from which pollen is taken (see section 1.1.) PNT pollen is transported from Kingston to Barton Isles at a frequency of 1 rotation every 2 weeks. The Barton Isles seed garden therefore currently only produces the MGD x PNT hybrid.

However, it is worth mentioning that there is an extension in an isolated plot in the neighbouring forest further up, containing around 300 palms of the BGD (Brazilian Green Dwarf) variety, at the moment purely for experimental purposes: production of BGD x PNT hybrids for tests and observation of BGD performance, which is proving to be interesting: higher leaf emission rate than the MGD, better bunch load, and generally larger nuts (as at Spring Garden, see section 1.2.).

The seednuts produced at Barton Isles are sent to various CIB nurseries scattered throughout the plantation zones, placed in the seed bed, then the seedlings (with bare roots at the 3-leaf stage, see section 1.2.) are distributed free of charge to growers.

This seed garden at Barton Isles is duplicated by another one at Esher in St Mary province, which is not operational, as a safety measure in case the one at Barton Isles is affected by LY one day. It consists of 40 hectares of MGD coconuts planted from August 2004 onwards.

The Barton Isles seed garden is managed by a CIB employee, Mr Soloman, assisted by his deputy, Mr Genus. They supervise operations carried out by local contractors employing a work force which is adjusted in size according to requirements.

2.2. Current status

The seed garden is ideally located on a mountainside, protected above by the mountainous barrier covered with thick primary forest, and overlooking a swampy plain where no coconut palms can be seen in the vicinity. The isolation is therefore good, moreover in a region traditionally not geared towards coconut and very little affected by LY. The first suspected case was reported 6 km from Barton Isles (source: Dr Wayne Myrie, CIB plant pathologist).

The seed garden covers an area of around forty hectares, divided into 5 sections, one of which is irrigated (9 hectares: around 20% of the total area). The female parents in production are MGD, interplanted in the third generation (between 2002 and 2004) with old second generation MYD palms. The old MYD palms are currently being eliminated by poisoning (MSMA injection into the stem).

The planting design is in equilateral triangles of around 6.4 metres, at a planting density of 244 p/ha. The young MGD palms are planted in the middle of the interrow of the old MYD palms, in an identical design.

The topography is sloping, and the slope is steep but regular. The soil is reddish brown, with an apparently heavy texture, not very deep, developed over a limestone substrate with outcrops in places.

It is a soil that appears liable to water stress, with a low water reserve. Rainfall is very variable, 1,500 to 2,500 mm/year, distributed in four seasons (two peaks of heavy rainfall: April-May and September-October). In fact, the manager of this seed garden stated that the soil dries out very quickly at Barton Isles, very soon after the rain stops.

As already mentioned, one part of the seed garden is irrigated. A pump distributes water from a tube well down to a depth of 60 metres, with a flow rate of 300 l/min, in a network of buried pipes then sprinklers distributed throughout the zone to be irrigated, which are activated according to requirements. The irrigation system was installed in 1986.

Recent observations of nut loads in successive bunches revealed an average difference of 6 nuts per palm and per year between the irrigated part and the unirrigated part, on the young MGD parents. That may seem little given the investment made, but there is still not enough hindsight to assess the effectiveness of irrigation, and it should be remembered that the merits of irrigation lie as much in spreading yields over the year (to ensure more regular deliveries of hybrid seednuts, with fewer seasonal slumps caused by the effect of water stress) as in increasing production.

2.3. Seed garden management

2.3.1. Seednut production

The method used is assisted pollination (known in Jamaica as Mass Controlled Pollination or MASCOPOL): ablation of male flowers just before natural dehiscence of the spathe, and application of outside pollen during the period of female flower receptiveness. The castration and pollination operations seen showed that the workers have a good command of the procedure.

For castration, all male flowers, including the accompanying male flowers next to the female flowers, are effectively removed at the right time. Once cut, the sections of spikelet bearing the male flowers are spread on the ground at the foot of the palm and covered with dry fronds to prevent any pollen dispersal whilst they are still fertile.

For pollen application, the stigmas of receptive female flowers are dusted with an artist's brush containing PNT pollen transported by the operator. The operation is carried out each day so long as there remains at least one receptive female flower per inflorescence.

For the MYD mother-palms of the previous generation, those that have yet to be poisoned are totally castrated, to prevent their pollen from pollinating the female flowers of the MGD mother-palms in the lower storey.

2.3.2. Fertilization

The MGD mother-palms look good, indicating good nutrition, with young shiny dark green fronds. There are no generalized deficiency symptoms. However, it cannot be ruled out that there will be no one-off deficiencies, but only a leaf analysis will show that.

For the moment, the mother-palms are fertilized (rates in g of fertilizer per palm) in the first year after planting with 200 g of ammonium sulphate followed by 400 g of compound fertilizer, then, from the second year after planting onwards, with twice 800 g of compound fertilizer per year. The compound fertilizer used to be 12-4-28 and was recently changed to 8-21-32.

It should be noted that no magnesium fertilizer is applied and that the fixed fertilizer composition does not make it possible to adapt fertilization to the nutritional needs of the coconut palms nutrient by nutrient.

2.3.3. Irrigation

The sprinkler system was seen in operation, distributing water under apparently satisfactory pressure with regular rotation. If manpower is available, watering late afternoon would be more efficient than watering at midday, when direct evaporation is maximum.

3. RECOMMENDATIONS

3.1. Seed garden

3.1.1. Management

The seed garden appears to be well run on the whole. Two possible improvements are suggested:
- Firstly, eliminate the remaining old MYD mother-palms as soon as possible. The process is under way, and it was seen that the remaining MYD palms are properly castrated. Nevertheless, they are a source of possible contamination on the young interplanted MGD mother-palms. The sooner they disappear, the less there will be a risk for seednut legitimacy.
- Then, the technique of leaving male inflorescences on the ground after castration, and covering them with dry fronds, is not the surest, as pollen from the male flowers remains viable for a few hours after cutting. As the hard, shallow soil is not suitable for immediate burial at the foot of each palm, it is suggested that the castrators should take male inflorescences to a precise point where they are buried or destroyed.

To avoid confusion between the two types of Maypan hybrids produced in this seed garden, the old MYD x PNT and the current MGD x PNT, which both carry the same name, Maypan, it is suggested that a code be attributed to distinguish between them, e.g. Maypan 1 and Maypan 2, or any other distinctive code.

3.1.2. Nutrition

First point: the soil at Barton Isles. It is suggested that a description be drawn up of the profile, combined with a physical and chemical analysis of the characteristics of these soils. A description and analysis per division, i.e. 5 in all. A reminder is given here of a few important points, bearing in mind that CIRAD is available to assist the agronomist when the time comes, by providing detailed information on the standard procedures.

Profile description: number and types of distinct horizons, with for each: texture, structure, coarse element rate, biological activity (notably occupation by coconut roots: quantity and distribution).

Sample analysis: texture, organic matter with C, N and C:N ratio, pH, total P and available P, complete CEC with a list of exchangeable cations: K, Na, Ca, Mg, H, Al, Mn, and saturation: S, T, S/T.

Second point: the MGD mother-palms. It should be remembered that leaf analysis is a mineral nutrition management tool that is particularly suited to palms. It is suggested that a LA be carried out every two years in the seed garden, to guide mineral nutrition. As for soil, CIRAD is available to provide the agronomist with all the information needed for taking, preparing and dispatching leaf samples when the time comes.

It is proposed that the current arrangement be followed, i.e. one sample per division, which gives 5 samples to be analysed every two years. A selection of 24 LA palms should be made per division (2 adjacent rows of 12) which will be used throughout the life of these mother-palms. LAs will be carried out at the same period, in the dry season. There will be routine analysis of N, P, K, Ca, Mg and Cl. And, during the first check, S and the trace elements B, Fe, Cu, Zn and Mn will also be analysed. If it turns out there is no danger of deficiency, they will no longer be analysed, so as to focus on the basic six nutrients.

Leaf mineral analysis will be carried out locally or by the CIRAD laboratory in Montpellier, as the CIB chooses. If it is done locally, a cross-check will have to be made to validate the results.

Pending the introduction of this procedure, it is suggested that the nitrogen fertilizer rate applied to the young coconut palms be increased (see section 2.3.2.). Rather than applying a single rate of 200 g of ammonium sulphate in the first year after planting, a second application is recommended, i.e. 200 g of ammonium sulphate on planting and 400 g after around six months. The 8-21-32 compound fertilizer rates are maintained for the first three or four years (once again, until the LA provides a better solution).

3.1.3. Soil erosion control

As the seed garden is located on a steep slope, and some gullying was seen in certain places, the following practices should be adopted to limit erosion:

- Firstly, and this is self-evident, preserve the primary forest above the seed garden. Without this natural buffer, it would be a disaster.

- Windrow dry fronds every other interrow.

- In the zones most exposed to erosion, dig individual trenches up the slope from each coconut palm, perpendicular to the slope, and gradually filled in with organic coconut waste: dry fronds and coconut husks (though in theory there are few in the seed garden as whole nuts are taken out). This technique offers a double advantage: it limits the humus layer being dragged downwards, by intercepting some of it in the trenches, and increases the water-holding capacity of the soil in the zone explored by coconut roots. It was seen that a long trench has been dug between the edge of the forest and the beginning of the coconut rows in a very steep zone. It is a good idea, and it would be better still to have these individual trenches as well.

-Sow a legume cover crop in the interrow (*Pueraria javanica* is recommended, but any other fast-growing creeping legume that covers the soil well would be suitable).

3.2. Plantations

Before launching operations to improve productivity in Jamaican coconut plantations, the reasons why many owners have lost interest in their coconut plantations need to be understood. Indeed, it was seen during the visit that, apart from one exception (Nuts River), the plantations are largely neglected. There are certainly reasons for that, which go beyond the scope of this report: indeed they appear to be socio-economic (e.g. the type of farm with owners living in town and not wanting to invest in a coconut plantation that is considered barely profitable, if at all) rather than agronomic: apparently, neither nutrition nor cultural practices (e.g. with or without intercrops) are a limiting factor for the time being.

Moreover, it is not an easy problem to solve. Despite the CIB's circulation in the local media of good documentation on the diversification of coconut products and the added-value that can be achieved, and despite the apparent good connection between the CIB and the growers, it seems that most growers are still not very interested. To improve the dissemination of information, it is suggested that meetings be held in the field on a subject specific to each coconut growing zone, in addition to the statutory meetings of the Board in Kingston.

One of the least demanding coconut products in terms of investment, and one of the most lucrative, is coconut husks, either by extracting the fibre (coir) and also selling the residue (coir dust or cocopeat) as a culture medium (it is a product that is highly appreciated in horticultural nurseries) or by burning them and recovering the ash, which proves to be an excellent fertilizer, especially potassium.

Granted, LY incidence has a lot to do with the hesitation of growers to invest in coconut, and that is understandable. In addition to this terrible disease, other discouraging factors, such as recurrent cyclones, *Phytophthora* incidence, nut thefts and, to a lesser degree, mites: the species *Eriophyes guerreonis* is highly present and also, recently (first reported in April 2007), the species *Raoiella indica* (red palm mite) has appeared in Jamaica.

However, it was seen in the coconut plantation at Nuts River that this LY disease can be circumvented by adopting a practice of systematic replanting based on an early warning system for LY symptoms.

For reasons that are both scientific (demonstration of the validity of this cultural practice at several sites under varied environmental conditions) and educational (demonstration of the feasibility of managing a coconut plantation in the presence of LY by multiplying these pilot plantations at various points on the island), it is strongly recommended that CIB select some volunteer growers to set in place in their plantations the system adopted at Nuts River.

It is important to ensure that they take on board the system, and do not wait passively for a CIB sanitation team to come and eliminate coconut palms affected by LY.

As Dr Been said, let us demonstrate that we can "live with LY". Of course that does not rule out continuing research on this disease at the same time. The fact of

testing cultural practices that help to minimize its incidence, and make coconut growing profitable, even in infested zones, will certainly be an important argument in halting the decline of the coconut sector in Jamaica.

4. CONCLUSION

Regular and long-term collaboration with the CIB appears to be appropriate for the following reasons:

- The CIB is a well-structured research organization, with significant material and human resources. The CIB is seeking scientific partnerships, particularly for what concerns us, coconut agronomy. A young agronomist was recruited at the beginning of 2008 in a newly created agronomist post, thereby showing the CIB's determination to work in this discipline.

- The CIB, which was created and is funded by coconut growers themselves, is in direct contact with the needs being expressed in the field. Worth mentioning on this subject is the regularity with which the management committee, which has a majority of growers (5 out of 9 members), holds its meetings and the good quality of the advice documents distributed to growers.

- LY incidence is very serious in Jamaica: it is not new, but there do not seem to be any miracle solutions in the pipeline in the medium term, as the way the disease is transmitted and spreads is proving so complex. For instance, using planting material assumed to be perfectly resistant has proved disappointing, with the disease appearing to be one step ahead. Cultural techniques therefore need to be sought urgently as solutions (even partial, even not totally satisfactory) to this disease which is threatening the total disappearance of coconut plantations. It would seem advisable to set up on-farm agronomy trials and demonstration blocks.

- Beyond the urgent need to minimize LY incidence, thought needs to be given to improving the productivity of coconut plantations throughout the supply chain, by popularizing the idea of diversifying the uses made of coconut products, thereby showing that profits can be made by processing products locally, with a little investment in simple and profitable smallholder technologies. Coconut is an extremely ecological plant, demanding few inputs, with a long life span, multiple uses and suitable for intercrops. It is a plant to be recommended in a food self-sufficiency strategy in a region or country, especially today when the price of imports, notably food, is rising.

If the CIB and the Jamaican Department of Agriculture wish, CIRAD is ready to invest in long-term collaboration.

R

27/06/2008