REPORT ON THE MISSION TO GHANA

27 April to 3 May 2003

TRAN – VAN – CANH

CIRAD-CP
Rubber Programme
Acknowledgements

We should like to thank Management and staff at GREL and ROU, more particularly Mr Patrick Berny Tarente, Mr et Mrs de Rostolan, Messrs Owusu and Aikins for their hospitality and the very good organization of this mission. We also thank the communities and outgrowers met.
Mission schedule

**Sunday 27 April**
- Departure from Libreville at 10 am by Air Gabon,
- Arrival in Lomé, Togo at midday,
- Travel from Lomé to Takoradi by road in a GREL car around 1 pm,
- Arrival at Takoradi around 8 pm.

**Monday 28 April**
- **AM**
  - Work meeting at GREL Head Office in Takoradi with Messrs Berny Tarente and de Rostolan on the objectives of the mission programme.
- **PM**
  - Work meeting at ROU Head Office in Abura with Messrs Owusu, de Rostolan, Aikins and Larby on the visit programme.

**Tuesday 29 April**
- **AM**
  - Tour of outgrower replantings: farm Nos. 677 and 679 at Nsuaem, farm No. 1 being tapped, and the ROPP nursery and budwood garden.
  - Visit to the GREL factory and work meeting with Messrs Berny Tarente, de Rostolan, Awusi and Mrs Acolatse
- **PM**
  - Work meeting at ROAA Head Office with the outgrowers and Mr Christophe Nivoix.

**Wednesday 30 April**
- **AM**
  - Tour of outgrower plots, Morison Junction village: 5 farms
- **PM**
  - Tour of outgrower plots, Awukyire village: 3 farms

**Thursday 1 May**
- **AM**
  - Estate visit and discussion with Messrs Berny Tarente and de Rostolan.
  - Free
- **PM**

**Friday 2 May**
- **AM**
  - Talk on rubber tree diseases and control methods,
  - Debriefing meeting with ROU Management.
- **PM**
  - Travel Takoradi-Accra

**Saturday 3 May**
- Travel Accra-Lomé

**Sunday 4 May**
- Travel Lomé-Libreville
- Arrival in Libreville around 2 pm.
List of abbreviations used and persons met

GREL: Ghana Rubber Estates Limited

Patrick BERNY-TARENTE: Managing Director
Edouard de ROSTOLAN: Technical Manager
Isaac Sebastien AWUSI: Factory Manager
Felicity ACOLATSE: Marketing Manager
E. OWUSU ACQUAH: Agricultural Technical Officer (ATO)
Charles NTOW BOAHEN: Production Manager
Géraldine de ROSTOLAN: Internal Audit Officer
KAYANG: Tapping Inspector
LEFEBVRE: Head of the Coconut Smallholder Project

ROPP: Rubber Outgrower Plantation Project
ROU: Rubber Outgrower Unit

Emmanuel Akewesi OWUSU: Project Manager
Edouard de ROSTOLAN: Applied Research Manager
A.A. AIKINS: Agricultural Technical Officer (ATO)
Christian Ayisi LARBI: Field Manager
Robert Kojo DANQUAH: Field Supervisor
Daniel OFORI: Supervisor (Agricultural Extension Officer)

ROAA: Rubber Outgrower Agent Association

Nana Asaa KOFI III: Chairperson
Paul L. APPIAH: Secretary General
John Nchona: Treasurer

ROAA.SP: Rubber Outgrower Agent Association. Support Project

Christophe NIVOIX: Project Manager Senior Staff of I.D (Institutions and Development)
Benjamin ARTHUR: Assistant

ADB: Agriculture and Development Bank
AFD: Agence française de Développement
Contents

Acknowledgements ..................................................................................................................... i
Mission schedule ........................................................................................................................ ii
List of abbreviations used and persons met............................................................................ iii
1. Mission objectives .................................................................................................................. 1
2. Description of diseases encountered in outgrower plantations ........................................... 1
   2.1. Root diseases ................................................................................................................... 1
       2.1.1. Rigidoporus lignosus or Fomes lignosus (plate 1,2) .................................................. 1
       2.1.2. Fomes noxius (plate 3) ........................................................................................... 2
       2.1.3. Ganoderma pseudoferrum (plate 4) ....................................................................... 2
       2.1.4. Sphaeroistibe repens (planche 5) ............................................................................ 2
   2.2. Trunk and branch diseases ............................................................................................ 2
       2.2.1. Phytophthora palmivora (plate 6) .......................................................................... 2
       2.2.2. Dieback (plate 7) .................................................................................................. 2
   2.3. Leaf diseases (plate 8) .................................................................................................... 2
       2.3.1. Colletotrichum gloeosporioides ............................................................................. 2
       2.3.2. Helminthosporium hevea ...................................................................................... 3
       2.3.3. Phytophthora palmivora ....................................................................................... 3
       2.3.4. Oidium heveae ...................................................................................................... 3
       2.3.5. Corynespora cassicola ........................................................................................... 3
   2.4. Termites (plate 9) .......................................................................................................... 3
   2.5. Mistletoes (plate 10) ....................................................................................................... 3
3. Current Fomes control procedure ......................................................................................... 4
   3.1. Localization of foci ......................................................................................................... 4
   3.2. Classification of trees in the focus .................................................................................. 4
   3.3. Treatment procedure ..................................................................................................... 4
4. Control recommendations ....................................................................................................... 4
   4.1. Fomes control ................................................................................................................. 4
   4.2. Black stripe control (Phytophthora palmivora) ............................................................. 5
   4.3. Dieback control .............................................................................................................. 5
   4.4. Leaf disease control ....................................................................................................... 5
   4.5. Termite control .............................................................................................................. 5
   4.6. Mistletoe control .......................................................................................................... 6
5. Proposed trials ....................................................................................................................... 6
Annexes
Annex 1: Disease control – Immature period
Annex 2: Proposed trials
Annex 3: Photos:

Plate 1: White root disease symptoms caused by *Fomes lignosus*
Plate 2: Leaf symptoms on an immature rubber tree affected by *Fomes lignosus*
Plate 3: Brown root disease symptoms caused by *Fomes noxius*
Plate 4: Red root disease caused by *Ganoderma pseudoferrum*
Plate 5: Stinking root rott caused by *Sphaerostilbe repens*
Plate 6: Black stripe cankers caused by *Phytophthora palmivora*
Plate 7: Dieback
Plate 8: Leaf diseases
Plate 9: Termite attacks
Plate 10: Mistletoe attacks
1. Mission objectives

The objectives of this mission were as follows:

- draw up a list of diseases encountered in outgrower plantations,
- inform outgrower project managers on rubber tree diseases and control methods,
- study procedures currently used to control root diseases and make modifications where necessary,
- propose trials with a view to answering specific questions raised by outgrower rubber growing in Ghana.

2. Description of diseases encountered in outgrower plantations

2.1. Root diseases

2.1.1. *Rigidoporus lignosus* or *Fomes lignosus* (plate 1.2)

This parasite causes white root disease, so-called from the white colour of the mycelium filaments found around the collar of affected trees. A *Fomes* attack that reaches a certain degree of severity results in typical reactions in the foliage of affected trees: out of season flowering, yellowing and withering of leaves which turn reddish-brown and fall; sometimes the tree emits new leaves, which are smaller and paler in colour. At the same time as, or following this leaf withering process, the branches gradually die, carpophores are emitted at the collar and, lastly, the tree dies. When uncovered roots are examined, yellowish mycelium cords running lengthwise down the affected areas are found, which anastomose and form networks firmly anchored to the surface of these lateral roots.

Data for the 1 370 ha detected in 2002, indicate that *Fomes* damage is fairly stable for the moment (following table), meaning the the foci can be easily circumscribed.

Table: Number of dead trees (total isolation) and treated trees (partial isolation: infected trees, contaminated trees and healthy neighbours) depending on planting age, in 2002.

<table>
<thead>
<tr>
<th>Planting years</th>
<th>Area Ha</th>
<th>Number of tree positions</th>
<th>Dead trees</th>
<th>Treated trees</th>
<th>TOTAL Trees affected by <em>Fomes</em></th>
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</table>
2.1.2. *Fomes noxius* (plate 3)

This parasite causes brown root disease. Infected roots are covered with a blackish-brown crust of soil particles and grains of sand stuck to the mycelium with mucilaginous substances secreted by the latter.

2.1.3. *Ganoderma pseudoferrum* (plate 4)

This parasite, like *Fomes*, belongs to the family of the Polyporaceae; it causes red rot on the roots. Infected roots are covered with red rhizomorphs varying in thickness. The carpophore develops in the form of a bracket with a narrow base. The upper surface is brownish-red and the underside is white.

2.1.4. *Sphaerostilbe repens* (planche 5)

This disease is recognized by the appearance of a canker at soil level with latex flow. When the collar and lateral roots are uncovered, there are almost always latex sleeves around the tap-root that extend much deeper than the visible part of the canker above the soil suggests. If the latex is pulled away, there is necrosis of the wood often limited by well-formed raised scars, especially when the attacks are old. In attacked zones, the tissues become watery, turn violet and give off a smell of fermented latex.

2.2. Trunk and branch diseases

2.2.1. *Phytophthora palmivora* (plate 6)

This causes black stripe. The first symptoms are characterized by the appearance of dark vertical stripes on the recently tapped panel above the cut, which develop depthwise with or without latex flow. When bark is removed from the diseased area, vertical black stripes that are typical of the disease can be seen on the wood. Abundant infection points on the same tapping panel lead to the destruction of wide areas of regeneration bark and reduce latex production by altering the normal functions of the tree. But it is particularly if the disease is allowed to persist that the tapping panel is completely destroyed and tapping has to be halted.

2.2.2. Dieback (plate 7)

Branch decay symptoms due to many different causes are commonly referred to as dieback. There is gradual death of terminal stems and branches, beginning with the tips and spreading downwards, sometimes reaching the trunk and causing tree death. Dieback results from secondary infections caused by fungi of various species such as *Botryodiplodia* (in 90% of cases), *Colletotrichum*, *Phyllostica*, *Pestalozia*, etc., which attack tissues damaged by external causes (pruning, wind damage, lightning, sunburn, etc.) or physiologically weakened by poor growing conditions, notably drought, or lastly by leaf diseases (*Colletotrichum gloeosporioides*, *Phytophthora palmivora*, etc.).

2.3. Leaf diseases (plate 8)

2.3.1. *Colletotrichum gloeosporioides*

*Colletotrichum* leaf disease occurs in the nursery and sometimes causes substantial damage in mature plantations at refoliation time.
2.3.2. *Helminthosporium hevea*

This leaf disease is known as bird's eye spot.

2.3.3. *Phytophthora palmivora*

Leaf fall caused by this parasite is easily identified by the existence of whole, yellow or still green leaves on the ground, the leaf blades remaining attached to the petiole on which there are usually brown or black lesions in places with white spots of coagulated latex in the centre.

2.3.4. *Oidium heveae*

This disease begins with the appearance of a few round spots from a few millimetres to 1 cm in diameter covered with white powder that is easily removed by rubbing.

2.3.5. *Corynespora cassicola*

The most typical symptom of *Corynespora* is a brown, fish-bone shaped lesion on the veins that is visible on both sides of the leaf.

2.4. Termites (plate 9)

Termite attacks have been seen on the immature 2002 plantings. We examined several of these young plants in detail, removing soil from around the plants to seek out termite nests. In a radius of one metre around the attacked plants, we found several nests a few centimetres in diameter linked by tunnels, at a depth of around 10 to 30 cm. From these nests, we were able to identify the species of termite attacking *Hevea* stumps. They belong to the genus *Microtermes* (family Termitinae), which includes numerous species that are very harmful to crops in the tropics, due to their diet (large consumer of fresh wood to make fungus combs and cultivate a fungus *Termitomyces*, then they eat the rotted litter with the mycelium of the fungus).

2.5. Mistletoes (plate 10)

Mistletoes are parasitic phanerogam that develop on rubber tree branches to extract mineral sap via suckers emitted right inside the wood. Parasitized rubber tree branches stop growing and may be totally overcome. In some trees severely affected by the parasite, latex flow is disrupted and may even stop. Two species of mistletoe are found in the GREL plantations:

- *Phragmenthera capitata*, a very frequent species, very invasive with rapid dissemination, largely dominant on *Hevea*, with yellow flowers.
- *Globimetula sp.*, less frequent than the above species on *Hevea*, usually found on citrus. It has red flowers.

There is substantial mistletoe in mature plantings but it has not been seen in immature plantings.
3. Current *Fomes* control procedure

3.1. Localization of foci

*Fomes* control is launched two years after planting. Foci are located by project supervisors twice a year (from May to July and from September to November). *Fomes* foci are easily identified by the existence of:

- empty tree positions (more than 5 missing trees),
- one or more dead trees,
- one or more infected trees with leaf symptoms.

Outside these periods, dead or infected trees have been reported by farmers when the supervisors visited. It appears that the outgrower plantations are regularly and satisfactorily monitored. This enables rapid intervention as soon as a focus is identified.

3.2. Classification of trees in the focus

When infection foci are identified, the trees around dead trees undergo closer inspection, making it possible to class them in different categories, so as to define the treatment to be applied:

- **Dead tree**: all the leaves are dry or the tree is totally defoliated,
- **Infected tree**: existence of leaf symptoms, *Fomes* mycelium or carpophores on the collar, existence of rhizomorphs on lateral roots with tap-root necrosis,
- **Contaminated tree**: no leaf symptoms, existence of *Fomes* mycelium, but no tap-root necrosis,
- **Healthy neighbouring tree**: the neighbouring tree of a dead, infected or contaminated tree but displaying no leaf symptoms or *Fomes* mycelium filaments.

3.3. Treatment procedure

Treatment combines physical action (partial or total isolation) and chemical action with fungicide granules (*Atemi* S or *Bayfidan*) and depends on the classification category:

- **Dead tree**: grubbing up of the infected stump or total isolation,
- **Infected or contaminated tree and healthy neighbour**: parital isolation by a trench 25–30 cm deep 1 m from the trunk. Fungicide treatment with 25 g of *Atemis* S around the collar, and 25 g of *Atemis* S in the trench.

Treatments are carried out twice a year for three years.

4. Control recommendations

4.1. *Fomes* control

Focus localization, tree classification within the focus, and the frequency, duration and period of treatments comply with CIRAD recommendations and should not be modified.
Detection of only the immediate neighbours of a dead, infected or contaminated tree is insufficient for a row planting design:

- in the actual row: detection of the four neighbouring trees (2 either side),
- in the neighbouring row: detection of the two trees opposite a dead or infected tree.

The depth of the trenches (20-30 cm) for partial isolation is not enough for effective isolation of infected trees (60 to 80 cm is needed).

Partial isolation of contaminated trees and their healthy neighbours is not warranted.

Infected and contaminated trees, and healthy neighbours should be recorded separately on a map and they should be recorded after each detection, to monitor the appearance of foci and check treatment efficiency (see example 1 in annex 1).

A simple and well-illustrated technical information sheet on Fomes control should be drafted and distributed to farmers.

4.2. Black stripe control (*Phytophthora palmivora*)

At the moment, only preventive control is really effective. The recommended method consists in protecting bark tissues by applying a 1.25% Difolatan solution with a brush after each tapping. The application period is usually during the rainy season, or for longer if there is a threat of this parasite attacking. Several products that are just as effective as Difolatan can be used: Folpel at 0.5%, Alliette at 1%, Ridomil at 0.5% and Sandofan paste.

4.3. Dieback control

Treatments against dieback consist in:
- cutting off the affected portions of trunk or branches to at least 30 cm below the necrotized zone,
- protecting the wounds with petrolatum,
- removing dead stems and branches immediately from the plantation and incinerating them.

4.4. Leaf disease control

In the nursery, leaf diseases are well controlled by applying Dithane M 45 at a dose of 1-2 kg/ha in 300 l of water twice weekly.

Mature trees are protected by aerial treatment or hot-fogging, but the results are very limited and random. In Cameroon and Gabon, the artificial defoliation method has been used (aerial spraying with Ethrel 3 l/ha), which has given some very good results.

4.5. Termite control

To control termites, it is necessary to apply 20 g of Regent 5 Gr (Aventis product containing 5 g of Fipronil/kg) around the attacked plant. Another form of Fipronil may be more effective (tradename 'Régent 50 SC', concentrated suspension 50 g/l of Fipronil). The tap-roots of stumps are dipped in a 0.2% insecticide solution mixed with clay (dressing) before planting.
4.6. Mistletoe control

Monitoring is recommended during the various visits, especially on the edge of forests, to immediately eliminate any clumps of mistletoe by cutting off the affected branch at least 80 cm below the sucker.

5. Proposed trials

Protocols for the trials to be set up can be found in annex 2:

1) Study on what becomes of old rubber tree stumps in replanted plots (NS OP 01),
2) *Fomes* monitoring in replanted plots (NS-AP 01).
ANNEXES
Annex 1

Disease control
Immature period
### DISEASE CONTROL

#### IMMATURE PERIOD - (YR.2 - YR. 7)

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#### Treatment

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#### Legend
- **PARTIAL ISOLATION**: ARBRES Infecté contaminé X voisins directs
- **TOTAL ISOLATION**: ARBRES MORTS
## Example 1

### DISEASE CONTROL

**IMMATURE PERIOD - (YR.2 - YR. 7)**

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### Treatment

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### Treatment

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### Legend

- (X) - Partial Isolation
- (A) - Total Isolation
Annex 2

Proposed trials
Proposed trials

1. NS . OP. 01

Study on what becomes of old rubber tree stems in replanted plots

1/ Aim: The purpose of this trial is to:
   a) study what becomes of old rubber tree stumps and observe how they will be infected by Fomes,
   b) find a method for early detection of such infected stumps,
   c) find a control method to prevent contamination of such stumps by Fomes

2/ Material and method:

2.1/ Site : NSUAEM village, plantation D677/C/O2, 2002 planting, replanting.

2.2/ Experimental design: 2 treatments, 4 replicates of 10 stumps.

2.3/ Procedure:
   - Choose 80 rubber tree stumps with a diameter of between 35 and 45 cm
   - Plant 5 bamboo sticks and 5 groups of 2 cassava cuttings around these stumps.

2.4/ Treatments:
   - 40 untreated control stumps.
   - 40 stumps treated with Atemi S (100 g/stump)

2.5/ Observations of contamination:
   - On the bamboo sticks, every month for 6 months, then at 9, 12, 15 and 18 months.
   - On cassava at 18 months.

3/ Timetable:
   - start of trial: September 2003
   - duration of trial: 18 months
2. NS . AP. 01

**Fomes monitoring in replanted plots**

1/ **Aim:** The purpose of this trial is to:

   a) locate Fomes foci in the old plantation prior to felling,
   b) monitor the appearance of trees affected by Fomes depending on the presence of old foci,
   c) test different control methods, combining different types of land preparation with integrated control.

2/ **Material and method:**

2.1/ **Site:** NSUAEM village, plantation D../C/04, 2004 planting, replanting.

2.2/ **Experimental design:** 4 treatments, 4 replicates, 16 elementary plots (100 trees).

2.3/ **Procedure:**

   - Detection, location and recording on a map of Fomes foci in the old plot before felling: November 2003.
   - The rubber wood is sold and removed from the plot by the buyer.

2.4/ **Treatments**

   - A. control with 800 untreated stumps.
   - B. Isolation of the stumps of old rubber trees found to have been dead or diseased during the November 2003 detection process.

In May 2004, after land preparation, a Fomes census will be carried out just before planting, using sticks installed during lining, to assess the distribution of Fomes foci when the planting is set up.

End of May/ beginning of June 2004: planting

2.5/ **Observations:**

The plots will be regularly monitored every 6 months for 2 years, then every year from 3 to 6 years.

3/ **Timetable:**

   - start of trial: November 2003
   - duration of trial: 6 years
Annex 3
Photos
PLANCHE 1

SYMPTOMES DES POURRITURES BLANCHES CAUSEES PAR POMES LIGNOSUS

Mycéliums blancs de Pomes lignosus sur l'hévéa

Rhizomorphes de F. lignosus sur racines d'hévéa
PLANCHE 2

Symptômes foliaires d'un jeune hêvéa atteint du F. lignosus

Carpophores de F. lignosus (couleur orange) développés en consoles semi-circulaire au niveau du collet des arbres infectés
SYMPTOMES DES POURRITURES BRUNES CAUSEES PAR FOMES NOXIIUS

Croûte de mycélium noirs en bas du tronc de l’arbre infecté

Lignes noires de Fomes noxius dans les tissus du bois en décomposition

Carpohore de Fomes noxius couleur jaune rouille.
POURRITURES ROUGES CAUSEES PAR GANODERMA PSEUDOFERRUM

Rhizomorphes rouges de Ganoderma sur une racine latérale de l'hévéa

Carpophores de Ganoderma
PLANCHE 5

CHANCRE DU PIVOT CAUSE PAR SPHAEROSTILBE REPENS

Aspect externe du chancre du pivot causé par Sphaerostilbe repens

Aspect d'un pivot gravement atteint

Aspect d'un pivot après enlèvement des bourrelets de latex
sur les jeunes plantes

infections des tissus entre l'écorce et le bois

sur les arbres de 5 ans

recépage de la partie malade
Corynespora cassicola

Helminthosporium heveae

Colletotrichum gloeosporiodes

Phytophthora palmivora

Oidium heveae

Mycocyclus ulei

Corynespora cassicola
PLANCHE 9

ATTAQUES DES TERMITES

Plantules mortes et consommées par les termites

Meules à champignons de termites dans le sol (10 à 30 cm) près de plantules attaquées

Traitement par Friponil en granulé
Les touffes, les feuilles, les fleurs, les fruits de Phragmanthera capitata

Globimetula sp. espèce à fleurs rouges