Institut de Recherches pour les Huiles et Oléagineux

Département du Centre de Coopération Internationale
en Recherche Agronomique pour le Développement (CIRAD)

MISSION TO ASSESS OIL PALM PHYTOSANITARY PROBLEMS IN GHANA

CURRENT STATE OF RESEARCH AT THE OPRI PHYTOPATHOLOGY LABORATORY 12TH-17TH NOVEMBER 1990

J.L. RENARD

IRHO DOC. 2303 BIS
JANUARY 1991

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INTRODUCTION

This mission was carried out as part of the World Bank's activities to develop the Kusi Oil Palm Research Institute (OPRI). It had a dual purpose:

- An update on the phytosanitary condition of Ghanaian oil palm plantations;
- An assessment of oil palm phytopathology research activities.

During the mission, we visited the major oil palm plantations in Ghana: TWIFO, NOPL, BOPP, GOPDC and the Kusi Research Station, in the following order:

- Monday	12/11/90:	Arrival in Accra
- Tuesday	13/11/90:	TWIFO
- Wednesday	14/11/90:	NOPL in Pretsea and BOPP in Benso
- Thursday	15/11/90:	Returned to Kusi Talks at OPRI
- Friday	16/11/90:	Kusi: field visit, talks
- Saturday	17/11/90:	GOPDC, then returned to Accra and left for Paris.

We were accompanied by Mr. DERY on our visits to TWIFO, NOPL and BOPP and were shown around the Kusi centre by Miss S. TAGOE and Mr. AFRIM.

In the absence of Mr. WONKYI APPIAH, who was unable to be on site, we met with Mr. ASAMOAH, Deputy Director, and gave him our comments on our visits.

We should like to thank the OPRI researchers who welcomed us and accompanied us on our various visits, and the plantation Managers and their colleagues who welcomed us and organized our visits to each unit.

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Missions and courses carried out under the OPRI/WORLD BANK Project

Missions by Mr. Renard

- 19th February to 2nd March 1985: Phytopathology Mission to Ghana under the World Bank Project (IRHO Doc. 1906, June 1985).

- 21st February to 1st March 1987: Mission to assess Oil Palm Phytosanitary Problems in Ghana (IRHO Doc. 2057, July 1987).

- 13th to 18th November 1989: Phytopathology mission to OPRI, Kusi Station, Ghana (IRHO Doc. 2233 bis, March 1990).

- 12th to 17th November 1990: Mission to assess oil palm phytosanitary problems in Ghana. Current state of research at the OPRI Phytopathology Laboratory (IRHO Doc. 2303 bis, January 1991).

Courses for OPRI phytopathologists

- Mr. Owusu Appiah: course at IRHO La Mé and Dabou from 3rd November to 15th December 1987.

- Visits to GOPDC during missions by Mr. de Franqueville (training for technical staff), 5th and 6th April 1990 (Miss Sheila Tagoe).

- Training course at IRHO, Dabou, Ivory Coast, December 1990: Miss Sheila Tagoe and Mr. Afrim.

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I. ASSESSMENT OF PHYTOSANITARY PROBLEMS

During our various visits, we attempted to assess the phytosanitary situation at the different stages in oil palm cultivation: as our previous visits enabled us to draw up an inventory of the diseases seen in Ghana, we shall look at the various problems in succession.

1.1. NURSERY DISEASES

Three diseases have been observed in the nursery: Blast, Dry Bud Rot and *Cercospora* leaf spot.

I.1.1. Blast

This disease caused significant clone losses during the 1989/90 nursery campaign at Kusi, due to the lack of preventive control measures (Table I). Losses in the same clones at GOPDC were much lower due to monthly Temik applications (Table II).

Blast was seen in November 1990 in the nurseries at Kusi, GOPDC and NOPL. (There were only leftovers from the previous year's nurseries at BOPP and TWIFO).

It seems unlikely that the Azodrine treatments applied at Kusi will be enough to slow Blast development; Temik applications should prevent the disease spreading at GOPDC.

We strongly recommend shading the nurseries in the absence of Temik (or possibly Furadan or Vydate) applications. This well-established control method is now tried and tested, and is easy to implement for small nurseries such as the one at Kusi. In view of the significant damage this disease can cause, we think a research programme will be necessary.

I.1.2. Dry Bud Rot (DBR)

This disease has been observed in Ghana, but it only causes very minor damage. One case of DBR was seen at Kusi in November 1990.

I.1.3. *Cercospora* leaf spot

Cercospora elaeidis does not seem to harm leaf development in the nursery; in fact, older nurseries, where treatments are no longer possible, are only slightly affected by the parasite. To be on the safe side, preventive treatments should be applied, but the disease would not warrant a research programme. At the most, treatment trials could be set up.

TABLEAU I : Blast incidence and general performance on clonal material in OPRI, August 1990 (OPRI's report)

Clone N°	Identity	Total Transplanted	Dry Bud Rot (Aug. 90)		Dead mainly due to Blast		Other abnormalities (Aug. 90)		Total Healthy seedlings	
			N°	%	N°	%	N°	%	N°	%
72	D759D x L311P	237	4	1.7	170	71.7	1	0.4	62	26.1
44	L10T x D17D	219	0	0	91	41.6	6	2.7	122	55.7
51	L2T x D8D	208	3	1.4	174	83.7	7	3.4	24	11.5
103	L10T x D118D	238	7	2.9	30	12.6	6	2.5	195	81.9
111	L10T x D28D	203	1	0.5	49	24.1	3	1.5	150	73.9
78	D10D x L498P	160	10	6.3	90	56.3	7	4.4	53	33.1
74	L452T x UR 425/4D	240	8	3.3	93	38.8	9	3.8	130	54.2
22	D115D x L2T	224	1	0.4	190	84.8	1	0.4	32	14.3
52	D3D x L2T	224	1	0.4	18	8.0	9	4.0	196	87.5
37	L2T x D118D	228	1	0.4	185	81.1	22	9.6	20	8.8
TOTAL		2181	36	1.7	1090	50.0	71	3.2	984	45.1

TABLE II : Blast incidence in clonal material at GOPDC (May 1990)

Clone	Total planted	Blast	%	Losses DBR	%	Others	%	Total losses	%	Healthy seedlings
22	280	38	13.6	11	4	3		52		228
44	237	4	1.7	0	0	0		4		233
51	182	19	10.4	8	4.4	2		29		153
52	227	1	0.4	0	0	1		2		225
72	102	25	12.4	2	1	1		28		174
74	232	21	9.1	5	2.2	2		28		204
78	96	3	3.1	5	5.2	0		8		88
103	405	5	1.2	0	0	0		6		400
111	197	1	0.5	0	0	1		2		195
Total	2058	117	5.7	31	1.5	10	0.5	158	7.7	1900

I.2. FIELD DISEASES

I.2.1. Vascular wilt

Our March 1990 report (IRHO Doc. 2233 bis) on the November 1989 mission remarked upon the existence of vascular wilt foci in replantings at NOPL and at BOPP, Kusi and GOPDC. This situation was confirmed in 1990 and we now have more details.

1.2.1.1. Situation at BOPP (Benso)

In 1989, we suspected the existence of vascular wilt in older plantings (Block K5, 1977). Our latest visit confirmed our suspicions. A diseased tree was felled in December 1989. One tree showed chronic disease symptoms and another showed typical symptoms (dry lower leaves, hanging down the stem). In addition, 3 trees were missing (due to unknown causes). Unfortunately, we were unable to check the diagnosis of internal symptoms (no labourers or tools were available to fell the tree), but we strongly recommended that the Kusi phytopathologists visit this vascular wilt focus and dissect the tree showing the typical symptoms, taking samples for isolation. This small vascular wilt focus affects material produced by OPRI.

According to the plantation managers, no other vascular wilt focus has been detected. This should be checked by systematic observation rounds.

I.2.1.2. Situation at NOPL

No cases of vascular wilt were seen in first generation plantings at this plantation. However, there do not appear to be any accurate records for the period, but in the absence of more precise details, we consider that vascular wilt did not have any economic effect. Quite a large vascular wilt focus (around fifteen trees with varying stages of the disease) was seen in Block VI of the 1986 replantings. This focus, which had already been observed in 1989, confirms that vascular wilt is a potential risk at the site and can appear less than 3 years after replanting. Systematic observation rounds should be undertaken to record the extent of the disease in replantings set up between 1983 and 1990.

I.2.1.3. Situation at Twifo

According to the managers, no cases of vascular wilt have been seen at the plantation.

I.2.1.4. Situation at Kusi

During our November 1989 visit, we happened to detect a case of vascular wilt at the research station, despite the fact that the managers claimed that the station was not affected.

On our advice, Miss S. Tagoe carried out systematic observation rounds in the plantings, and an inventory is given in Table III. More details are needed of the type of symptoms, but the work already carried out has provided some interesting information. In fact, we made the following observations using the experimental designs in the breeding trials:

- in Block K1 (1957 planting), 7 of the 9 typical vascular wilt cases come from the same cross: the 537 Deli Self. Some of the chronic cases and abnormal trees were also from this cross.

- in Block K6, 5 consecutive trees out of the 7 from the same 5.1295D Self x (32.2612T x 32.3005T) cross are affected by Fusarium. Other cases of vascular wilt have also been observed in the following crosses near this focus:

  - 1 case on (851.215D x 851.255D) x (A.43.2.4T Self)
  - 1 case on a commercial DxP cross.

This preliminary study showed that:

- the spread of vascular wilt cases is closely linked to the type of planting material,

- there are sources of susceptibility in the material planted at OPRI.

This is an interesting first step in interpreting the observations. Such a study should be stepped up.

TABLE III : Vascular wilt incidence in OPRI field and in OKUMANING (OPRI's report, Sept. 1990)

Fields	Year of planting	No of trees	No of tree that are acute	No of tree that are chronic	No of tree with other abnormalities	Total No of trees infected
K1	1967	6000	9	5	12	26
K2	1968	3600	8	0	0	8
K3	1969	3438	1	0	0	1
K4	1970	3174	7	1	2	10
K5	1970	1950	3	3	5	11
K6	1971	1800	5	1	4	10
K7	1972	462	5	0	0	5
K8	1973	3300	4	0	3	7
K9	1974	2640	1	0	4	5
851	1961	840	2	0	8	10
852	1964	900	4	1	17	22
853	1966	1800	2	0	2	4
Total		29 904	51	11	57	119

I.2.1.5. Situation at GOPDC

Two vascular wilt foci had developed in the 1977 and 1978 plantings at GOPDC since 1987. Recent observations show that numerous diseased trees have developed into the chronic stage of the disease (Table IV).

Table IV: Vascular wilt observations at GOPDC
Second half of 1990

PLOT	TREES PLANTED	VASCULAR WILT			
		Typical	Chronic	Total	%
CS6	3,488	3	5	8	0.2
CS7	3,512	7	17	24	0.7
CS8	3,414	2	6	8	0.2
CN5	3,479	4	25	29	0.8
AN1	2,979	2	11	13	0.4
BN1	3,500	1	11	12	0.3
BN2	3,486	1	17	18	0.5
BN3	3,442	6	16	22	0.6
BN5	2,963	3	20	23	0.8

Isolated cases were also observed in other plots.

The disease is more frequent on Temang soils than on other soil types (Kokofu, Nzima or Oda).

I.2.2. Other problems - various abnormalities

During this mission, we were shown a tree which had been blown down by the wind at Benso. It showed signs of rot at the base of the stem (about 50 cm above the ground). We were unable to identify the cause, but *Rhynchophorus* damage, following wounds, may be the answer. This type of symptom is very rare and has no economic impact.

Bending, even breakage of the upper leaf crown, is quite common. There may be several reasons behind this, depending on the planting: drought, wind, insect damage (particularly *Oryctes*) or a combination of these factors. The symptoms do not usually lead to tree death, but disrupt leaf emission and flowering, which can halt production for several months.

Other abnormalities were noted during our visits (boron deficiency, orange spotting, genetic abnormalities: erect habit, chimeras, abnormal trees, etc.), resulting in somewhat heterogeneous plantings. This heterogeneity could probably be reduced by effective selection at the end of the nursery stage.

I.3. CONCLUSION

The surveys carried out in Ghanaian oil palm plantations over the past four years show that there are two major problems or potential problems:

- Blast in the nursery
- Vascular wilt in the field.

If no steps are taken to control Blast, up to 50% of plants can be lost, particularly clones. In view of this, we consider that effective nursery management, involving either Temik treatment or shading, is essential.

With no shading or Temik treatments, it is almost inevitable that a large proportion of plants will be lost due to Blast. Although both control methods are effective, further research could be undertaken to find a substitute for Temik or to obtain more detailed knowledge of the population dynamics of the insect vector (or vectors) and the type of pathogen involved (mycoplasmas are suspected).

Vascular wilt is still a relatively minor problem in Ghana in first generation oil palm plantings, and it seems unlikely that the damage caused by the disease by the end of the first cycle will have any economic effect. Parasite multiplication during the first generation will have an adverse effect on the second generation of trees (replantings). **This second phase, which began in 1983 at Pretsea, will be launched at the other agro-industrial complexes around 1997. It is essential to prepare for this now, so as to obtain tolerant planting material as soon as possible.**

The foci at Benso, Pretsea and Kusi show that the OPRI material contains sources of vascular wilt susceptibility. Crosses destined for replantings should not contain these susceptibility genes, and it is therefore essential that planting material be characterized by early inoculation tests at the nursery stage.

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II. STATE OF THE PHYTOPATHOLOGY RESEARCH STRUCTURE

II.1. LABORATORY INSTALLATION

The site intended as a phytopathology laboratory is still being used to store the Breeding Service's pollination bags. It should be refurbished urgently for use as initially intended.

II.2. LABORATORY EQUIPMENT

An autoclave and 2 microscopes were delivered to the station around 2 years ago. The autoclave still is not operational and the microscopes have been left in their original packing.

A very low temperature freezer is also being stored in the entomology room. According to Mr. Dery, it was not intended for use by the Entomology Division, and is of no use to phytopathologists. We did not manage to find out where it belonged.

Apart from the -85°C freezer, the autoclave and the microscopes should be installed in the Phytopathology laboratory once all the boxes being stored there have been removed.

II.3. CHEMICALS AND EQUIPMENT

The phytopathologists have made lists of chemicals and equipment with a view to placing orders. These lists are extensive, in terms of both the diversity of headings and the quantities for each product, for example:

- 20 kg of agar (used in quantities of 20 g/l)
- 2 kg of rose bengal
- 2 kg of yeast extract
- sorbitol
- mannose
- lactose
- beakers : 500 (five hundred) of each size!
- test tubes: 100 (one hundred) of each size!

It is entirely reasonable to have a few items in stock, but having almost enough to open a shop seems excessive and, in any event, unrealistic and illogical. We therefore suggested the lists be cut down drastically (entirely removing certain items, reducing the quantities for others).

We would stress that in order to launch a programme, only the following equipment is essential:

- an autoclave
- a microscope
- a binocular microscope
- a balance (accurate to 10^{-2} g)
- 1 or 2 kg of agar
- a few salts for culture media
- PDA (Potato Dextrose Agar).

A laminar flow hood is also useful, and is a more effective replacement for the old glove boxes often made locally. If it is not possible to obtain a hood, the glove boxes are still perfectly adequate.

II.4. CONCLUSION

Although we appreciate the efforts made on field surveys, we regret the fact that nothing has been done about fitting out the laboratory and hope that concerted efforts will be made to improve the situation in 1991.

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III. STATE OF PROGRESS AND RECOMMENDATIONS

III.1. STATE OF PROGRESS

During our first mission to OPRI at Kusi, and based on our field visits, we suggested conducting a two-stage phytopathology programme (see IRHO Doc. 2057, July 1987), along the following lines:

A. General survey: Inventory of phytosanitary problems in Ghana.

B. Blast and vascular wilt study (planting material assessment by early tests).

Operation A would require programme follow-up by agronomists (for the most part), whereas programme B would mean employing a phytopathologist.

Following the first visit in February 1987, the current situation is as follows:

- A young phytopathologist was recruited in 1989, and a second from the Breeding Service is due to join the Phytopathology Service. These two researchers took a short course in the Ivory Coast at the end of 1990.

- The surveys in Ghana are apparently limited (unless there are confidential reports to which our expert did not have access) to the visits by Mr. Renard, accompanied by an OPRI agent. Miss Sheila Tagoe produced an inventory of the Kusi Plantation in 1990.

- The major items of equipment were ordered. They were delivered and installed, but have never been used. This situation is regrettable.

- No prenursery inoculation tests have been implemented.

- No attempt was made to control Blast and hence protect the clones in the nursery in 1989/90.

In short, the Phytopathology Service appears to have been largely inactive. This situation stems from the fact that there was no phytopathologist until 1989, and that since then, the young phytopathologist, Miss Sheila Tagoe, who has no experience and no direct supervisor, has been unable to organize her work. In effect, a young, inexperienced researcher cannot be expected to take charge of a service. There should soon be two researchers in the service, which should be sufficient to satisfy present requirements. Full-time supervision by a phytopathologist would be expensive for the Station (and there is almost undoubtedly not enough work for three people), so we think it would be best to continue with the present situation, but ask for advice from outside on how to organize the Phytopathology

Service. Mr. Afrim was a good choice, and he will provide a close link between the Phytopathology and Breeding Services, which is essential if the reseach programme on tolerant material is to run smoothly.

III.2. RECOMMENDATIONS/PROGRAMME

There are clear indications of vascular wilt susceptibility sources in the planting material at Kusi, and it is also clear that the area around Kusi and GOPDC is particularly propitious to Blast development. An analysis of the situation therefore led us to select two major lines of research for the OPRI Phytopathology Division. However, we think it essential to carry out inspections and surveys in all the plantations to determine the extent of the various underlying problems or those which might develop.

III.2.1. Blast

The programme involves more entomology than phytopathology, and the basic outline is as follows:

- Setting up trials to define a control method other than Temik (all other insecticides are toxic, even if they are less dangerous than Temik) - Comparison of insecticides - Effect of shading - Cropping techniques.
- The search for the vector or vectors - is *Recilia mica* the only vector in Ghana? - Cage experiments.
- Population dynamics of the vector or vectors.
- Biology of vector(s).
- Intermediate host plants.
- The search for the causal agent: such a programme can only be undertaken with backup from a laboratory specializing in mycoplasmas.

III.2.2. Vascular wilt

The basic aim of the programme is to characterize the planting material at Kusi with respect to vascular wilt. This will involve two lines of work:

III.2.2.1. Field observations

The surveys begun at the station should be continued, at least 3 times per year (every 4 months). This is important if vascular wilt-affected trees are to be identified correctly.

The results of these observations will be interpreted in conjunction with the Breeding Service.

III.2.2.2. Prenursery tests

Such tests were also recommended in previous reports. Miss Tagoe and Mr. Afrim's course in the Ivory Coast should enable this idea to take shape.

We still believe it would be wise to start testing the material from Kusi (20 to 30 crosses) in the Ivory Coast if Miss Tagoe and Mr. Afrim are not entirely familiar with techniques after their first course. This test would lead on to a second course in Dabou with a Dabou *F. oxysporum* f.sp. *elaeidis* strain, as long as the germinated seeds are sent to Dabou in 1991 (250 seeds per cross).

This preliminary experiment should make it possible to develop a test at the research centre for the various types of basic planting material used at Kusi, so as to gradually identify the zones of resistance and define the categories of susceptible and tolerant crosses. Inoculation would obviously be carried out using one or several strains isolated in Ghana. One (or more) susceptible and tolerant cross(es) could be included in each batch.

Initially, "susceptible crosses" could cover those crosses at the station which are affected by the disease in the field, and "tolerant crosses" those which are next to a susceptible cross in a vascular wilt focus. These crosses will be reproduced from parent trees.

Successive tests should be set up as part of close cooperation between the Breeding and Phytopathology Divisions. Characterization of planting material should lead to the production of tolerant crosses for replanting.

III.2.2.3. Effect of environmental factors

It is known that tolerant crosses only fully express their tolerance under specific environmental conditions. This is why we think it is also important to determine under which environmental conditions vascular wilt foci develop in Ghana:

- soil type
- rainfall
- relief
- previous crop cover
- legume cover
- etc.

In the longer term, this study would make it possible to draw up a programme on soil receptivity to vascular wilt as part of a network covering the whole of the oil palm growing zone.

III.2.3. Other problems

The Phytopathology Division should cover all oil palm phytosanitary problems (diseases and various disorders or abnormalities).

Whilst avoiding any disruption to operations, surveys and/or inventories should be carried out in the plantations to assess damage. This would provide the basic knowledge to answer growers' questions and also make it possible to judge the development of a given problem, which is essential if steps are to be taken before it is too late.

III.3. ORGANIZATION

Apart from the equipment aspect, which we commented on in section II, we think that the above programme could be implemented without difficulty and without creating an excessive workload for Miss Tagoe and Mr. Afrim. Mr Afrim is an essential link with the Breeding Service.

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CC: DIR-DRO-DAF-DP-AGRO-ENTO-SEL
GOPDC-IBRD-CIRAD

Paris, 6th March 1991

Dr. Wonkyi Appiah
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KADE
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PHYTO 24

Dear Sir

We have pleasure in enclosing 7 copies of the report on Mr. Renard's mission to OPRI at Kusi in November 1990.

During this last visit our expert was able to confirm - in conjunction with your colleagues - the existence of Vascular Wilt at the Station. The observations undertaken by Miss S. Tagoe were a valuable help for our field visits. Based on the information supplied by Mr. Afrim, we were able to confirm that Vascular Wilt depends on the nature of the planting material. Vascular Wilt was confirmed on the NOPL plantations and is strongly suspected at BOPP; this latter point should be confirmed by your phytopathologists. The situation at GOPDC is stable, with a few foci in old plantings and development towards the chronic form of the disease.

Vascular Wilt will almost certainly not cause any significant damage in the first oil palm growing cycle, but there are risks of it spreading in the replantings which are due to increase from 1997 onwards. Steps should be taken now to prepare for this:

the search for sources of resistance and susceptibility in the material at Kusi (by accurate field observations),

tests on the planting material produced.

The current structure will allow this:

You have 2 phytopathologists who recently took courses at IRHO in the Ivory Coast (prenursery tests, isolation, culturing)

You (theoretically) have a laboratory and an area which could be used for prenursery tests

You have a breeding and seed production programme to supply material for the tests.

It is obviously essential that the laboratory be operational, and this is the weak link in the chain. The room should be fitted out and the autoclave and microscopes set up, ensuring that they are working correctly. In addition, the planned orders (and perhaps even orders already placed) are excessive, and Mr. Renard remarked upon this on site.

In conclusion, it is essential that the laboratory be fitted out if a Vascular Wilt programme is to be a viable operation.

As regards Blast, Mr. Renard stresses the importance of shading in controlling this nursery disease, if Temik is not available. He also suggest attempting to find substitutes for Temik and studying the vector and pathogen. Miss S. Tagoe and Mr. Afrim saw something of these aspects in the Ivory Coast.

We consider that the whole of the programme - Vascular Wilt and Blast - could be covered by two phytopathologists, involving the Breeding Service on Vascular Wilt and the Entomology Service on Blast.

We hope that it will be possible to begin effective work in 1991, and that collaboration with IRHO will continue, if you so wish.

Yours faithfully

M. de NUCE de LAMOTHE
Director