PROPOSALS FOR THE DEVELOPMENT

OF THE RUBBER RESEARCH INSTITUTE OF NIGERIA

(R.R.I.N.)

FINAL REPORT

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Contract RRI/1
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SUMMARY

I. INTRODUCTION

AIM OF THE MISSION AND JUSTIFICATION

The aim of the mission is defined in the terms of reference given in annex 1. It was to define and assess a plan of action to develop the activities of RRIN (Rubber Research Institute of Nigeria) as part of an overall hevea growing development operation in Nigeria.

It was possible to confirm that the "revival of hevea growing and rubber production in Nigeria was both highly desirable and feasible":

- desirable due to the current poor state of the Nigerian hevea sector, in terms of both estates and the quantity and quality of rubber produced,

- feasible since environmental conditions are propitious to hevea growing.

If the relevant technical resources to re-launch development are to be implemented successfully, it is essential that the social and economic prerequisites be satisfied.

After a brief look at the current state of the hevea sector, the available technical resources are considered, to enable definition of the role RRIN could play in development and of the necessary resources, based on an analysis of its current situation.

II. SUMMARY AND CONCLUSION

Various historical, political and economic circumstances have limited the effectiveness of the Rubber Research Institute of Nigeria. Few research results are available, and it would be worth checking their reliability; in particular their impact, both on hevea growing and on rubber production, is very low.

This is both the cause and the effect of the lack of links between RRIN and the profession. However, RRIN's potential is far from negligible:

- in terms of equipment and materials

  ♦ its infrastructure, buildings and equipment are in need of renovation,
  ♦ planting material (nurseries and budwood gardens) and plantings will have to be rehabilitated,
  ♦ land for replanting or planting.

- in human terms, a sizable but largely unmotivated staff.

Reviving RRIN's activities means bringing its material potential back into full use, which will provide the staff with adequate working facilities and conditions.

In addition, re-centring research activities on practical aspects of hevea growing and rubber production should:

- give renewed impetus to research work, by providing a practical justification

- re-establish the link between research and development, in the form of cooperation between RRIN and professional organizations, without which research cannot be effective.

If this operation is to stand a chance of lasting, it is important to use all the possibilities open to RRIN of acquiring its own financial resources: research or service contracts with the private sector and rubber production.

To reach these targets, the project described in the report would involve:

1. renovating the infrastructure and supplying equipment and materials to re-start the Institute's basic activity and implement the proposed research operations;

2. research programmes, essentially reinforcing existing projects. The aim of the programmes, which are simple and practical, concentrating on the most urgent development needs, is to revive research activities immediately and obtain results which can be used by the profession as soon as possible. The programmes will have to be adapted and extended as part of the overall restructuring of RRIN programmes, as and when the Research-Development link becomes stronger;

3. increasing staff efficiency based on the motivation provided by programmes, in turn involving

   ♦ operational technical assistance, concentrating on practical activities in the field,
   ♦ restructuring the activities of the existing staff, in accordance with the Institute's new operations;

4. lastly, the necessary financial resources to extend the estate with a view to eventually obtaining the resources needed for the Institute to operate effectively.

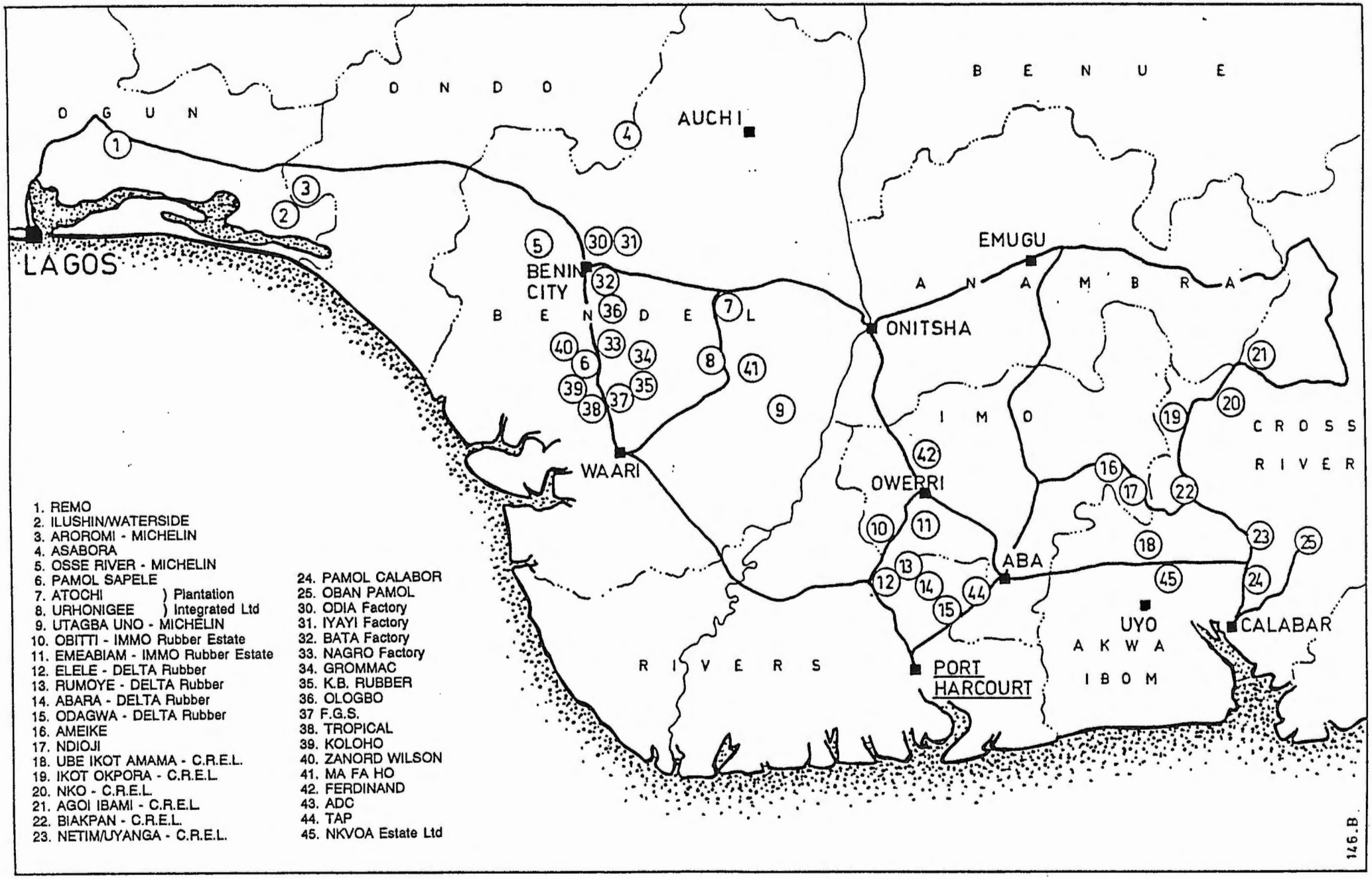
If RRIN is to be revived, it is essential to implement this project, which will enable the Institute to provide assistance to the development operations under way. It will also enable it to cope with the technical demands of a programme to rehabilitate hevea growing and rubber production, at least during the first phase.

The dynamics of development and the restructuring of the profession should subsequently enable RRIN to acquire the intrinsic organizational structures, technical experience and scientific capabilities of a modern research institute, capable of keeping pace with and stimulating the move towards overall development of the hevea growing and rubber production sector in Nigeria.

SUMMARY OF PROJECT COSTS

	Naira	ECU
Personnel	17 678 000	1 767 800
Equipment		
. infrastructure	1 619 000	161 900
. transport - option A	8 011 000	801 100
- option B	10 036 000	1 003 600
. plantation	20 650 000	2 065 000
. laboratories	1 579 000	157 900
. processing workshop	650 000	65 000
. computer	430 000	43 000
Chemical products	400 000	40 000
Documentation	250 000	25 000
Training	560 000	56 000
Work programme and costs estimate - option A	2 591 350	259 135
- option B	2 692 600	269 260
TOTAL - option A	54 418 350	5 441 835
- option B	56 544 600	5 654 460

HEVEACULTURE IN NIGERIA



1. REMO
2. ILUSHIN/WATERSIDE
3. ARUROMI - MICHELIN
4. ASABORA
5. OSSE RIVER - MICHELIN
6. PAMOL SAPELE
7. ATOCHI) Plantation
8. URHONIGEE) Integrated Ltd
9. UTAGBA UNO - MICHELIN
10. OBITTI - IMMO Rubber Estate
11. EMEABIAM - IMMO Rubber Estate
12. ELELE - DELTA Rubber
13. RUMOYE - DELTA Rubber
14. ABARA - DELTA Rubber
15. ODAGWA - DELTA Rubber
16. AMEIKE
17. NDIOJI
18. UBE IKOT AMAMA - C.R.E.L.
19. IKOT OKPORA - C.R.E.L.
20. NKO - C.R.E.L.
21. AGOI IBAMI - C.R.E.L.
22. BIAKPAN - C.R.E.L.
23. NETIM/UYANGA - C.R.E.L.
24. PAMOL CALABOR
25. OBAN PAMOL
30. ODIA Factory
31. IYAYI Factory
32. BATA Factory
33. NAGRO Factory
34. GROMMAC
35. K.B. RUBBER
36. OLOGBO
37 F.G.S.
38. TROPICAL
39. KOLOHO
40. ZANORD WILSON
41. MA FA HO
42. FERDINAND
43. ADC
44. TAP
45. NKVOA Estate Ltd

III. THE STATE OF HEVEA GROWING IN NIGERIA

III.1. BACKGROUND

The first rubber trees were introduced into Nigeria in around 1895, at the same time as in the Far East. Production spread in the smallholder sector, in extensive cropping systems with a very low level of technology. Industrial estates were set up at the same time (Pamol, 1904).

During the war, the increased demand for rubber prompted increased production by intensive tapping of all the existing latex crops (Funtumia).

It was not until after the war that relatively intensive industrial estates were set up, using Malaysian and Indonesian clones, but smallholder estates hardly developed.

Since the 1960s, technical progress, and subsequent production improvements, seem to have been held up by various factors: civil war, rubber price fluctuations, monetary problems, etc., but since the devaluation of the naira, rubber prices have become profitable for Nigerian planters, leading - amongst other things - to intensive tapping on smallholdings.

III.2. RUBBER PRODUCTION IN NIGERIA

III.2.1. General

Nigeria, with 120million inhabitants, is the most densely populated country in Africa, and one of the few countries to have its own rubber processing and automobile industries, along with considerable oil reserves.

- A vast domestic market
- The favourable development of South-South exchanges
- Soils and climate propitious to hevea growing
- Very low cost price factors (salaries - fertilizers - fuel), which could enable Nigeria to become a significant natural rubber producer.

III.2.2. State and development of the hevea forest

The hevea forest, comprising seedlings allowed to seed naturally, is unique to Nigeria, and the area covered - almost certainly around 200,000ha - is impressive. However, its run-down condition, due to over-tapping, is irreversible in the medium and long term. Over-equipment in the industry, discussed below, has led processors to raise prices out of all proportion with production, which has more than quadrupled in two years:

NA 0.4 per kg of roadside wet cup lump in 1988
NA 1.7 per kg of roadside wet cup lump in 1990 which does not reflect rubber prices on the world market.

This price increase is leading and will lead to further over-tapping, giving rise to excess bark consumption, which in turn results in reduced production, if not a total halt (see photo in annex 9)...

III.2.3. Production of natural rubber

It is made of :

- large plantations . state
  . mixed
  . private

- smallholders or local farmers

- anarchical gathering in the hevea forest.

After the first half-year 1990 where more and more estates were private, the new structure seems to be the following :

- private sector large plantations	46 000 ha([1])
- public sector large plantations	19 000 ha
- smallholders and hevea forests	195 000 ha
- Total	260 000 ha

The rubber production seems better than 80 000 t in 1990 (average yield : 300 kg/ha) divided as follows :

- plantation mills
- private manufacturers (the term "remillers" is not used here)
- manufacture of artisanal sheets by "local farmers" ([2])
- exportations more or less official towards Malaysia or Singapore ([3])

Year / Quality	1985	1986	1987	1988	%
Sheet rubber	4 262	5 154	7 356	12 068	20
Crumb	29 109	24 012	28 531	38 299	63
Crepe Rubber	10 664	7 270	8 905	9 529	16
Latex concentrate	536	375	494	624	1
Total	44 571	36 811	45 286	60 520	100

(from RPPTA and Natural Rubber Association, metric tons)

[1] It would be the surface of grantings and not the present plantations (from CIACO-INDURFINA)

[2] Wet and too thick smoked sheets

[3] Hybrid product made of cup lumps coagulated into latex

III.2.4. Consumption and exportation of natural rubber

Nigeria is one of the only countries to own a manufacture industry composed of pneumatic makers (Michelin, Dunlop, etc.) and many manufacturers (which textile : Bata).

As one can see on the following table, the consummed quantity in Nigeria is not negligible.

Consumption of natural rubber in Nigeria

Year / Dest.	1985	1986	1987
Exportation (T)	32 643	26 036	33 658
Domestic consumption (T) (source RPPTA and Natural Rubber Association)	11 928	10 775	11 628
Total (T)	44 571	36 811	45 286

The rest is exported to the international market following more or less standardized criteria (cf.2.2.). One must notice here more or less legal exportations towards Far-East of an hybrid product called All-Go ([4]).

III.2.5. Situation and evolution of plantations

Except the Michelin-Pamol plantations and perhaps CREL, there is no extension project and little replanting projects.

At present time, all the plantations -included the best- seem to have some financial problems and, if the private sector balances with difficulty its budget, the public sector seems to be in the red.

The age of plantations, the bad quality of tapping, the almost absolute lack of stimulation ([5]) are fixing the ridiculous yields.

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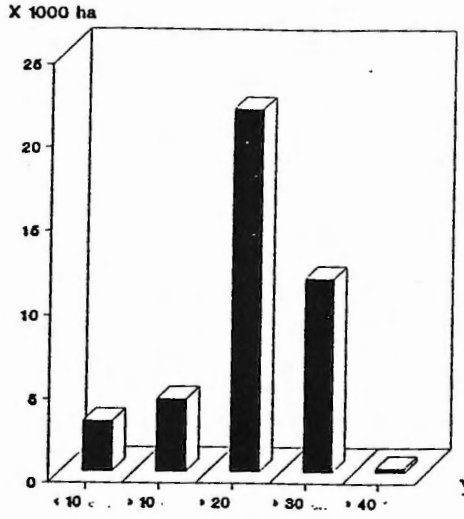
[4] All-Go : all comers. Mixing of bad dried and too thick smoked sheets with crumb

[5] Less than 50 % of large "Estates" are stimulating



DISTRIBUTION OF THE AGE OF PLANTATIONS

III.2.6. Market developments

Domestic prices are higher than those on the world market and less variable, since they are fixed by manufacturers to ensure supplies. This means that when world prices are low, domestic consumption provides an adequate market, as long as quality is satisfactory.

However, prices being what they are, and since Nigeria

- is outside the franc zone
- has a weak currency
- has exceptionally low production factors (labour, fuel, fertilizers),

it is in a remarkable position.

The drawback is the same as for Africa as a whole, with very high freight rates, due to domestic agreements.

However, the real handicap for Nigeria is the bad reputation of its production due to a long tradition of poor quality. This situation is easily reversible.

On an economic level, fluctuations in world price levels and in the naira have led to a situation rendered even more unstable by the fact that government action, which sometimes favours, sometimes hinders exports, is not coherent over time.

III.2.7 Rubber grades produced

The estate processing plants generally produce grades RSS1-2, SNR10 and CL7 ([6]) , which are bought by manufacturers. Lower grades are exported. In this respect, it is essential that Nigeria adopt norm ISO2000 urgently.

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[6] Sort of improved SNR 10 - C.L. = Cup Lump intended for Dunlop

Remillers are rarely professionals. However, their industrial significance - their capacity is almost certainly 150,000t or over - is considerable. This capacity is almost bound to increase even further, since processing plants are currently being set up and others are still being shipped. This industrialization was no doubt prompted by ADB funding, but bore no relation to the product to be processed.

Technical assistance is necessary for both processors and remillers, from product analysis right up to process improvement. It should be organized by the profession (RPPTA and Natural Rubber Association) with backup from experienced experts.

III.3. ENVIRONMENTAL CONDITIONS

Environmental conditions are generally propitious to hevea growing. The hevea growing zone covers too large an area for average climatic data to have any meaning, but overall, rainfall is good (1800mm), with a single, relatively long rainy season. Only 3 to 5 months have less than 100mm of rainfall, which allows certain planting techniques, such as non-irrigated nurseries and planting seed directly in the field. However, rubber losses due to rain are common, and tapping panel diseases have a definite economic impact.

Sunshine, relative humidity and mean temperatures are all suitable for hevea. The length of the period when the harmattan blows has a contradictory effect: the relative coolness in the morning facilitates latex flow, but prolonged drought reduces yields.

The hevea growing region almost exactly coincides with the tertiary sand area, with deep, light and well-drained soils, which are easily penetrated by the tap root.

Environmental conditions are therefore generally propitious to intensive rubber production. Were it possible to satisfy both the economic and social prerequisites, there would be no major obstacle to implementing the steps which would enable the development of the hevea sector, which will be looked at below.

III.4. SOCIAL CONDITIONS

The land problem and human behaviour:

Nigeria, with an area of 923,768km2, has a population density of 122 inhabitants/km2. The humid tropical green belt in the South has a population density of 400 to 600 inhabitants/km2, more than the Netherlands.

Food requirements are enormous, and states such as Imo are already having to import. There is therefore competition between land destined for:

- industrial crops
- food crops and housing.

The poverty of the ferralitic soils leads to extensive slash and burn food cropping, which shifts constantly and consumes large areas.

The almost wild hevea forest is under constant threat and is in fact shrinking steadily.

Furthermore, there is a well-established rural tradition of all land - regardless of what it is used for - belonging to the nearest village. A plantation over a hundred years old is still being claimed by villagers.

If they cannot recover land attributed to farmers by the State as concessions, villagers generally agree to allow the legal occupant to farm the land, as long as he pays a kind of rent to the village, which - although generally modest - maintains this ambiguous situation. The (entirely justified) fear of arson attacks shared by all the planters is no doubt explained by the failure to pay this rent, either because the planter is unable to pay or because it goes against the idea of legal concessions.

The villagers' behaviour is very typical of the way in which they see rubber production. Their trees, which are under constant threat due to the demand for land for food crops, particularly cassava, only provide extra income if, as is currently the case, they can find a rubber trader prepared to rent their trees. The trader pays tappers by the weight of rubber produced, which largely explains the lack of attention paid to tapping panel condition and tree preservation.

In fact, the situation is as if hevea were considered a "pick your own" tree in the smallholder sector.

The few large, dynamic estates are planning to replant and cover the whole of the area of the their concession, since they are unable to expand.

Two essential factors should be remembered:

- population pressure
- the increasing scarcity of agro-industrial land.

III.5. CONDITION OF ESTATES

The physical condition of the estates is far from satisfactory. Mean yields are estimated at 300kg per hectare.

This low production is essentially explained by:

- the age of the trees
- their genetic origin (naturally seeded seedlings)
- the lack of upkeep and disease control
- tapping panel condition
- poor harvesting conditions.

In terms of quality, the collection method used by small-scale and a large number of medium-scale planters, in the form of insufficiently drained, unprotected coagulum (often heaped directly on the ground), produces dirty rubber. Quite apart from the cost of cleaning, the necessary treatment processes are not likely to improve the technical characteristics of the rubber produced.

Although they are planted with more productive clones and upkeep is better, industrial estates are hardly any better off in terms of tree age and disease control, wind breakage and fire (tree density often drops to 90trees/ha).

The physical condition of the estates is expanded on in annex 2.

III.6. PROSPECTS

Despite the weaknesses and constraints of the current situation, three factors make hevea sector development a viable proposition in Nigeria:

- propitious environmental conditions,
- favourable economic factors
- potential for planting: 40,000ha of industrial estates to be or currently being rehabilitated and 200,000ha of wild hevea, which could - theoretically - be replanted without encroaching on land used for food crops.

Development could be achieved in the following ways:

- renovating and beginning to tap still feasible industrial estates,

- replanting those which are too run down,

- planting available land:
  - ♦ concessions on estates which have not yet been planted,
  - ♦ forest reserves belonging to the state or federal government,
  - ♦ large state plantations other than hevea (for example teak).

- setting up groups of young smallholder planters trained to an adequate technical standard, around the most dynamic of the industrial estates.

These different development possibilities should be accompanied by restructuring of the processing industry:

- closure or modernization of obsolete processing plants,
- improvement of modern processing plants to ensure better product quality,
- introduction of a general quality control system.

Development could then take 2 forms:

1. Current situation: there is no Government policy to develop hevea growing. There will therefore be no smallholder development, and industrial development will be limited to those private companies with viable estates and land for planting or replanting, either self-funding or able to draw from the capital market.

This is the case with the Michelin-Pamol estates, and possibly CREL, if the proposed projects become a reality.

At the same time, it is not totally out of the question for the industry to draw on its own resources and set up quality control. However, in this case, the hevea forest and the medium-sized and large estates other than those mentioned above will continue their steady and inevitable decline.

2. The other possibility, which is perhaps less likely, would be based on a Government decision enabling the launch of a development programme. This would involve all the possibilities described above, particularly setting up and developing a true hevea growing sector, made up of smallholders and medium-scale growers, which is essential if the capacity of current processing plants is to be used to the full.

Such a programme would mean using a whole series of technical, material and human resources, which could only be funded by major international financial institutions. This hypothesis was the subject of a study conducted by SOCFINCO for the World Bank in 1987, "Feasibility study for accredit lane for oil palm and rubber project in Nigeria".

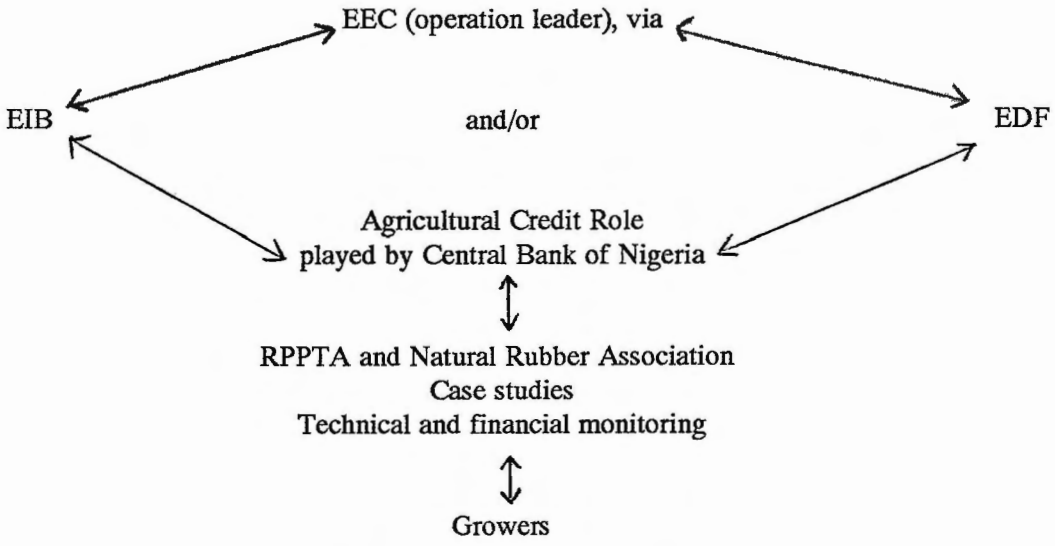
At a time when the EEC is about to study, and perhaps provide, funding to rehabilitate RRIN, it would be useful to also look at reviving the profession, a revival which would entirely warrant reviving RRIN.

Within a European or African framework, the following may be possible:

- deferred-payment, subsidized loans (deferred for 10years),
- support from local banks acting as agricultural credit organizations (CBN),
- RPPTA and Natural Rubber Association ([7]) which represent the profession, could play a pilot role.

If this revival is not undertaken, the rubber sector in Nigeria is bound to die out in the near future, except for the three companies mentioned above.

The operation could take the following form:



Loan Committee, comprising

EEC - CBN - RPPTA and Natural Rubber Association - Federal Government, Local Government

Chaired by RPPTA and Natural Rubber Association

EEC right of veto

N.B. This skeleton structure does not consider the fundamental question of financial guarantees for loans.

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[7] Rubber Producers and Processors Trade Associated : Rubber Producers and Processors Trade Associated

NRAN : Natural Rubber Association of Nigeria

IV. TECHNICAL OBSTACLES TO HEVEA DEVELOPMENT

These are linked to rubber production on the estates - agronomic problems - and raw material, latex or coagulum processing to produce marketable dry rubber - technological problems.

IV.1. AGRONOMY

It is unquestionably essential to replant ([8]). As far as industrial estates are concerned, the need is acknowledged by the growers themselves, who are conscious of the fact that even in those estates planted with productive clones and where upkeep has been good, the trees are now so old that Fomes attacks, wind and fire have reduced tree density below the tapping viability threshold. Replanting is even more essential for smallholdings, since the planting material is of poor quality. Once these areas have been replanted, **upkeep** and **protection** of the young plantings against destructive agents will be necessary, followed by **appropriate tapping techniques** to ensure productivity.

IV.1.1. Replanting

The population density in Nigeria is such that in most cases, soils have been exhausted by successive food crops, particularly cassava. Using this type of land to plant hevea - if land-use factors enable it to be used - will mean paying particular attention to fertilization problems. Replanting old hevea forest or old estates would almost certainly pose fewer fertility problems, but would involve a significant amount of land-clearing work to prevent Fomes outbreaks. However, even soils used to grow food crops are not necessarily Fomes-free, since some of the plants grown - particularly cassava - are Fomes hosts. Nevertheless, the Fomes density is likely to be lower.

The planting material will have to be renewed. Initially, recent clones will be used, whose productivity and disease and wind breakage resistance characteristics are already known. Subsequently, for future plantings, the results of clone comparative trials under the specific conditions in various parts of Nigeria will be used.

Land preparation will have to take account of the degree of Fomes infestation. Although it will very rarely be necessary to clear mature forest areas, complete soil clearing will be called for, particularly on former hevea plantings, removing roots and burning all plant waste.

Planting methods will have to be adapted to suit local soil conditions (their sandy texture makes it difficult to use polybags) and climate (staggering the planting period).

Weeding of young crops is almost certainly a hindrance to the development of the rubber sector at the moment. Despite low labour costs, chemical weeding will have to be practised in industrial estates, for reasons of speed. On smallholdings, food intercrops, besides providing additional income for smallholders, make upkeep easier in young plantings, provided they are effectively monitored.

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[8] See Table of estate ages, page 6

IV.1.2. Upkeep on mature crops and protection against destructive agents

Young plantings are a valuable capital that should not be allowed to decline; steps should be taken on:

- leaf disease control. Leaf diseases do not cause tree death, but can significantly reduce production;

- Fomes control;

- fertilization: latex production has rarely been seen to react directly to fertilization, but such a reaction may not be impossible on exhausted soils in Nigeria;

- fire protection. The length and intensity of the harmattan create a dry atmosphere, most propitious to fires, exacerbated by the arson factor (see "The land problem..."). Besides steps to be taken when planting (fire-breaks), estate upkeep is another way of limiting the spread of fires. A surveillance and intervention system should be set up in the dry season.

IV.1.3. Tapping

This is the final aim and justification of all the grower's activities. It is important to tap under the best possible conditions, not only in terms of productivity, but also of product quality. Activities should concentrate on:

- **tapping systems.** The most widespread system in Nigeria (S/2 D/2 without stimulation) would seem to be justified a priori by he fact that there is not the same need to make labour cost-effective as in Côte d'Ivoire, but as far as we know, no economic studies have been carried out on this in Nigeria. This does not mean that other systems might not be more effective, particularly with the new clones due to be introduced.

At the same time, stimulation should be extended to all the plantings being tapped. The techniques used on estates under similar conditions (Côte d'Ivoire/Cameroon) will be used. More detailed studies to determine the stimulation schedule and stimulants to be used under specific Nigerian conditions could be undertaken later.

- **Tapping practices** will involve long-term work to train tappers and inform smallholders. An incentive system should be introduced to reward tappers for tapping quality, depending on local conditions in Nigeria, and monitoring should be organized.

- Similarly, collection systems should be looked at and the emphasis in tapper training and smallholder information programmes shifted towards making tappers and smallholders aware of and responsible for rubber cleanness.

- Lastly, tapping panel disease prevention (cleanness of tapping tools) and treatment of diseased or wounded trees are an integral part of the tapper's work and should be covered by training and information programmes.

IV.2. TECHNOLOGICAL PROBLEMS

Nigerian rubber is currently fetching very low prices on the international market. This phenomenon is so marked that it is dragging down the price of African rubber as a whole.

This under-evaluation of African rubber prices can be put down to several factors:

- the poor quality of Nigerian rubber,
- significant heterogeneity between production batches,
- high freight rates to Europe and the United States.

IV.2.1. Quality of Nigerian rubber

By analysing the values given in the table on page 14a on production distribution per grade, 3 categories of product can be identified: high, medium and low quality.

- High quality includes RSS1-2-3 grades as well as NSRWF5L and W5 crumb. This rubber is produced exclusively from field latex and represents around 23% of total Nigerian production.

- Medium quality comprises CL10 crumb produced either from industrial estate cup lump or from coagulum from smallholdings. It represents 25% of total production.

- Low quality includes RSS/cutting, RSSIV, CL20 and CL50 crumb and crepe, and generally comes from smallholdings. It represents 52% of total Nigerian production.

The poor brand image is even further exacerbated by the fact that almost all the high quality rubber produced is consumed on site. In fact, Nigeria is one of the few African countries with a significant manufacturing industry. The major tyre manufacturers - Michelin, Dunlop, etc. - are all involved in Nigeria, as well as the shoe specialist, Bata, amongst others.

Domestic consumption in 1988 was estimated at around 15,000tonnes, i.e. around 25% of total production. In other words, only low and medium quality is exported at present. The domestic market is very profitable and high quality rubber is over-priced (10 to 20%), since the demand from tyre manufacturers exceeds the supply, and poor quality rubber is exported, which provides foreign currency.

IV.2.2. Heterogeneity of Nigerian rubber

There are different degrees of variation between batches of low and medium quality rubber, depending on where the raw material comes from. In fact, industrial estates produced around 24,000tonnes in 1988, i.e. 40% of total Nigerian production, which breaks down into 18,000tonnes of high quality and 6,000tonnes of medium and low quality.

As a result, the lowest quality rubber produced in Nigeria comes from small and medium-scale growers. There is a vast degree of heterogeneity between those growers (generally very small-scale) who leave their coagulum and cup lump on the roadside for collection by trucks from the nearest processing plant, and those who produce partially-dried sheet which is sent direct to Asia for re-processing.

This wide variety of grades has an adverse effect on product quality, hence on product image. There is no comparison in terms of quality between rubber made from fresh latex and a batch made from coagulum stored for 6 months in the sun and rain.

Impurity rates and Wallace plasticity (Po and PRI) values are sometimes outside the norms (with specified rubber).

The lack of quality control and specifications severely affects quantity and quality. In fact, we were unable to obtain details of the Nigerian norms (Nigerian Standard Rubber - NSR), although they do at least exist. The few laboratories currently operating have their own specification procedure. Production monitoring is nonexistent.

IV.2.3. High freight rates

Freight rates in relation to the distance covered are much higher for Europe and the United States than for Asia. In addition, there are few sailings from African ports, particularly Lagos, which makes exchanges with Europe even more difficult.

PRODUCTION ANALYSIS (TONS)

GRADE	1984	1985	1986	1987	1988	%
SHEET						
RSS I	3,256	3,509	3,096	3,325	3,281	5.42
RSS II	746	818	1,167	1,616	1,316	2.17
RSS III	1,490	1,246	699	283	575	0.95
RSS / CUTTING	487	189	192	132	193	0.32
RSS IV / B2	1,757	500	–	2,000	6,703	11.08
Total	7,736	6,262	5,154	7,356	12,068	19.94
CRUMB						
WF 5L	1,859	1,631	1,484	4,111	4,643	7.67
WF 5	3,491	3,553	3,613	3,845	3,447	5.70
CL 10	6,319	8,902	9,409	12,514	14,850	24.54
CL 20	8,907	11,858	9,182	7,576	14,397	23.79
CL 50	873	165	324	485	962	1.59
Total	21,449	26,109	24,012	28,531	38,299	63.28
CREPE						
MX I	–	100	25	105	202	0.33
MX II	1,731	936	25	256	43	0.07
MX III	7,965	9,628	7,220	8,544	9,284	15.34
Total	9,696	10,664	7,270	8,905	9,529	15.75
LATEX CONCENTRATED						
Total	325	536	375	494	624	0.01
TOTAL	39,206	43,571	36,811	45,286	60,520	100.0

Source RPPTA

V. THE RUBBER RESEARCH INSTITUTE OF NIGERIA - RRIN

Nigeria is one of the few African countries with a hevea research structure. It will have an important role to play in developing and implementing the necessary technical resources to ensure the development of rubber production.

It is worth stressing that RRIN's mandate from the Nigerian Government consists in studying not only hevea, but also other latex plants. This is for historical reasons, since rubber was produced from plants other than hevea at certain stages in the past.

Experience has shown that although some of these plants may be of interest, none of them has been studied in as much detail as hevea. Rubber production from other plants is therefore at a disadvantage right from the outset. Such a possibility could be looked at in regions with climates unsuitable for hevea, but hevea is undoubtedly the most profitable rubber-producing crop in the humid regions in Nigeria.

After a description of RRIN's current situation in organizational terms, the resources used and research programmes carried out, proposals will be made for a programme of action to be implemented with a view to overall revival of the hevea sector in Nigeria.

V.1. BACKGROUND

Since it was founded, RRIN has undergone several changes of status. It was successively under the aegis of the Western Region Government, then the Midwestern Region Government, and it was not until 1973 that the Iyanomo centre and the Akwete station were amalgamated to form the Rubber Research Institute, a federal organization, originally under the aegis of the National Research Council, then the Ministry of Science and Technology, which was at one stage merged with the Ministry of Education.

All these changes were marked by sometimes abrupt changes in the amount of funding available and the way it was used, although the current Director has held the post since 1979.

V.2. ORGANIZATION

RRIN has a dual organizational structure: an administrative structure, broken down into departments, governed by a research structure broken down into programmes.

The 8 departments or "divisions" are split between research:

- 7 actual research divisions:
  . Agronomy
  . Plant breeding
  . Pathology/Microbioly
  . Soils/Plant nutrition
  . Farming systems
  . End use
  . Physiology and latex exploitation

- 1 Administration and services division
  . Director's office
  . Assistant Director's office
  . Administrative division
  . Accounts division

. Audit division
. Instrumentation division
. Nursery division
. Clinic unit
. Central stores unit
. Estate management division
. Mechanisation/Building division
. Security unit
. Transport unit
. and RRIN sub-station Akwete.

- 1 intermediate division linking research and development:
  . extension and research liaison

These 14 administrative units are all directly answerable to the Director or, in his absence, the Assistant Director.

In parallel to these administrative divisions, scientific activities are broken down into research programmes. Each programme, which is generally under the authority of the Head of the Research Department under which it falls, involves researchers from several different departments. This multi-disciplinary structure should - at least theoretically- prove fruitful.

V.3. STATE OF PLANTINGS AT RRIN

On a 2,000ha concession, 372ha are currently planted with hevea, set up between 1962 and 1973.

The remaining 1,600ha or so are mostly farmed by smallholders growing food crops. RRIN management will have its work cut out to recover this land when it wants to replant it with hevea. Even if it succeeds, soil fertility is likely to be extremely poor.

The clones planted on the 372ha are:

RRIN501, 519, 600, 605, 607, 623, 628, 700
HARBEL1
PB2959-5/51
GT1
NIG800
TJIR.

There are also at least 2 clone trials. The planting density in the oldest plots has been reduced by 30to40%.

Apparently, only 100 trees per hectare are suitable for tapping in Nigeria. The reasons usually put forward for this low density are wind breakage, Fomes and fire. Dry cuts should probably be added to this.

The overall condition of the estate leaves a lot to be desired:

- in terms of upkeep, both of crops and tracks. It is all the more essential to slash regrowth in that the low density (planting density = 450trees/ha), poor tree development and numerous clearings are extremely propitious to weed growth. Although a lack of upkeep in mature crops does not have catastrophic consequences, it is a direct threat to nurseries and budwood gardens;

- in terms of the tapping panel (many have been severely damaged by canker and deformities due to wounds and various diseases, particularly mouldy rot);

- lastly, rubber collection techniques are far from satisfactory. The coagulum produced in tanks is generally left on the ground, and cup lump is mixed with latex.

To be quite honest, the overall appearance is not that of a research station. The reason given by RRIN staff to explain these weaknesses is the lack of resources, but this fails to explain the lack of upkeep in particular, since the estate has an excessively large staff. However, the fact that there is no system linking tappers' wages with tapping quality largely explains the extremely poor panel quality.

V.4. RESOURCES

V.4.1. Equipment and materials

The existing resources bear witness to RRIN's importance around 20 years ago, at a time when there was a will to develop hevea growing and when RRIN benefitted from the support of a permanent USAID mission.

The basic equipment has become so run-down that normal operations at the Institute are under threat:

- telecommunications between the Institute and the outside world are nonexistent. Telephone calls can only be made from Benin City to Lagos during the night, and the telex, telegram and postal services are all extremely unreliable;

- road travel is difficult. Between RRIN and Benin City, there are 9km of unmetalled roads and 25km of narrow metalled roads which are dangerous at night. The trip from Benin City to Lagos takes threehours, along a good quality road, but which is not at all advisable at night;

- the electricity supply is extremely unreliable. RRIN is connected to the National Grid and also has two generators of its own. Despite this, there are often power cuts;

- the water supply is sporadic and not suitable for drinking;

- school, supply, cultural, sport and leisure facilities are nonexistent;

- however, there is a dispensary, which was recently renovated;

- the transport system is drastically inadequate. There are hardly any cars for the researchers to travel around the estate. The staff are transferred to and from Benin City in an old, small bus which has to make 4 round trips a day. It is almost impossible to expect staff to be punctual and conscientious under these conditions.

Other resources are also largely inadequate, in terms of both quality and quantity:

- the work buildings are large enough and relatively functional, but maintenance is highly unsatisfactory. The water and electricity networks should be repaired. The air conditioning equipment is antiquated. Working conditions are physically very difficult;

- the housing is in the same state. Much of it is empty, since researchers and senior staff prefer to live in Benin City (or elsewhere), the most common reason given for this being the problem of schooling for children;

- almost all of the maintenance and repair equipment has disappeared;

- the laboratory equipment is inadequate. A spectro-photometer and a continuous analysis unit in the soils laboratory are still in working order, but all the other equipment is out of order. However, there is quite an extensive amount of equipment in the quality control laboratory:

- 1 set of infra-red lamps for dirt content determination without hood
- 2 muffle furnaces (Ogawaseiki and Griffon & George) for ash content,
- 4 Wallace MK II plastimeters fitted with steam generators
- 2 Wallace drying ovens, réf. 0.12
- 1 ultrasonic device for strainer cleaning
- 2 old NRPRA PRI ovens
- 1 Ogawaseiki type drying oven for volatile matter determination
- 4 analytical scales (Sartorius and Mettler H31)
- 1 slide projector for checking strainer cleanness
- 1 precision balance
- 1 Apex press for colour determination
- 1 Kjedahl system for nitrogen determination
- 1 viscosity meter for latex

and the following for vulcanized rubber :

- 1 Wallace Dunlop tripsometer for resilience measurement
- 4 Wallace compression set apparata
- 1 Wallace stress relaxometer
- 3 Wallace hardness meters
- 1 Wallace specific density meter
- 1 Wallace abrasion tester
- 1 Wallace relax modulus tester.

The other laboratories are almost empty, except for the laboratory studying by-products such as rubber seed oil.

List of rolling material at the RRIN in October 1990

S/N°	Description N°	Existing N°	Year of Purchase	Condition	Additionnal Need
1	Peugeot 504 Saloon Car	4	1981	Serviceable	8 N°
2	Peugot 504 Saloon Car	5	1983	Serviceable	8 N°
3	Peugot 504 Saloon Car	2	1984	Good	8 N°
4	Peugeot 504 Station Wagon	2 2	1980	Serviceable	
5	Peugeot 505	1	1988	Good	1 N°
6	V/W Satana Car	1	1988	Good	1 N°
7	V/W Beetle	4	1984	Serviceable	4 N°
8	V/W Transport	1	1981	Poor	-
9	Peugeot 504	1	1981	Serviceable	1
10	10 tonnes Fiat lorry	2	1979 1981	Poor	-
11	10 tonnes Bedford lorry	1	1978	Poor	2
12	10 tonnes Sedwater tanker	2	1980 1984	Serviceable	1
13	10 tonnes Bedford : refuse collector	1	1980	Serviceable	-
14	56-Seater Mercedes Benz Bus	1	1980	Serviceable	-
15	26-Seater Mercedes Benz Bus	3	1979 1981 1982	Serviceable	2
16	Peugeot 504 Pick-up	-	-	-	2

17	Honda Motor cycle	1	1984	Poor	3
18	80-100 HP Fiat Tractor	1	1989	Good	3
20	Tractor Mounted mower	3	1987	Serviceable	3
21	Harrow	1	1980	Serviceable	1
22	Plough	1	1980	Serviceable	1
23	D7 Caterpillar Bulldozer	1	1972	Poor	1
24	D8 Caterpillar	-	-	-	-
25	Caterpillar road	-	-	-	-

V.4.2. Water at RRIN

RRIN has a large pumping station and Bailey type reservoirs. However, the water supply to all of RRIN's buildings is inadequate, and even when there is running water, it is unsuitable for use by the laboratories or for human consumption, due to its iron oxide content.

Furthermore, it is not currently possible to water the nurseries, seed gardens or budwood gardens. It is worth noting that:

- the offices are 7.9km from the pumping station,
- the nurseries are 12.7km from the pumping station.

Supposing that the tanks are at a height of 12m, the down pressure at ground level will be 1.2kg. It is not surprising, therefore, that there is no pressure 8, and even 12km away.

A more detailed study should be carried out:

- if there is no force pump, one should be installed at the foot of the tanks,
- the budwood gardens or seed gardens and nurseries should be moved nearer to the tanks,
- the water should be analysed.

If the oxides only form when the water comes into contact with the air, a new well should be dug. If the oxide deposits are due to the lack of pressure, the pipes should be rinsed and a force pump installed. In all events, an in-depth study is necessary. According to certain researchers, information is available on this.

V.4.3. The staff

RRIN Staff statistics as at June, 1990

	Designation	N°
1.	Director	1
2.	Assistant Director	1
3.	Mechanical Engineer	1
4.	Research Officer	20
5.	Instrument technologists	2
6.	Technical officers	7
7.	Librarian	1
8.	Agric. Superintendents	30
9.	Administrative/Executive officers	8
10.	Account/Audit officers	8
11.	Statistician	1
12.	Secretariat assistants	23
13.	Medical nurses	3
14.	Dispensary assistant	1
15.	Medical record receptionists	4
16.	Store officers	2
17.	Agric. Field overseers	224
18.	Foremen	31
19.	Craftsmen	19
20.	Agric. Field attendants	45
21.	Laboratory technician	4
22.	Printer	1
23.	Livestock Overseer	6
24.	Storekeeper	5
25.	Library assistant	1
26.	Library attendant	1
27.	Assistant executive officers	4
28.	Senior Agric. officer	1
29.	Works Superintendent	1
30.	Laboratory assistants	3
31.	Clerical officers	20
32.	Motor mechanic/driver	20
33.	Tractor driver/mechanic	9
34.	Clerical assistants	8
35.	Agric. Field overseer (security)	3
36.	Security guard	34
37.	Watchmen	8
38.	Messenger	2
39.	Store assistant	1

	Total	**564**

Detail of the staff distribution in 1990

Divisions	Directors	Research officers	Agric. Field overseers	Technical officers	Administra.	Secretaries	Miscellan.	Total
Director's office	1					3	1	5
Assist. Director's office	1					1		2
Agronomy		1	13				1	15
Plant Breeding		4	9	1		1		15
Pathology/ Microbiology		3	22	3		1		29
Soils/Plant nutrition		1	2			1	1	5
Farming Systems Res.		1	8				4	13
Extension and Research Liaison Service		3	2			1	1	7
Library						1	3	4
End-use		5	1	6				12
Instrumentation				2	1			3
Physiology and latex Exploitation		1	146			1		148
Nursery			8					8
Administrative			3		18	7	1	29
Clinic unit							9	9
Accounts			1		13	2		15
Central stores unit							7	8
Audit							6	6
Estate Management			32				7	39
Mechanization/Building			3	7		3	37	50
Security unit			4				36	40
Transport unit							16	16
RRIN sub-station Akwete		1	53		5	7	28	94
Total	2	20	307	19	37	29	158	572

Qualifications

Year	Scientists	Technicians	All other categories	Total
1988	17	305	221	543
1989	21	348	195	564
1990 (1)	21	348	195	564
1991 (2) Forecast	38	413	255	708
(2-1)	+ 17	+ 65	+ 60	+ 142
en %	+ 81 %	+ 18 %	+ 30 %	+ 25 %

Staff distribution per sector of activity in 1990 was as follows, according to the "Staff Nominal Roll as of June 1990":

Administration 117
Research 101
Estate 260 + 94 at Akwete sub-station
(see annex 3)

The estate, which only covers 380ha with around 100 trees per hectare suitable for tapping, is extremely run-down, as are the budwood gardens, nurseries and tracks.

- Under normal management conditions on a modern estate, staff numbers at RRIN would be enough to cover more than 1,000ha.

- The administrative staff could cover a 10,000ha estate working on analyses.

These examples only serve to show that not only the budget should be looked at, but also organization and competence, and undoubtedly administrative management.

The following table shows budget trends (SOURCE RRIN - N = 1Naira).

Year	1988	1989	1990	1991 (Projections)
Capital	N 703,414.00	N 912,648.00	N 1,659,000.00	N 1,659,000.00
Recurrent (Staff)	N 3,298,964.33	N 3,398,960.00	N 3,970,220.00	N 3,970,220.00
Overheads	N 499,567.00	N 449,570.00	N 480,920.00	N 490,000.00
Total	N 4,501,945.33	N 4,661,178.00	N 6,110,140.00	N 6,119,220.00
RRIN income	N 1,255,675.42	N 1,121,336.35	N 772,888.45	N 892,990.00

There is no lack of staff. RRIN has 572 employees. Distribution per department and per category is given in the tables above. Technical reasons do not always account for the differences in numbers from one department to another, both in quantitative terms and in terms of the level of qualifications.

The researchers themselves admit that staff efficiency is limited by the lack of equipment. Communication difficulties, low wages and the rudimentary working conditions do not help to motivate the staff who, due to the Institute's status, benefit from good job security.

On the whole, the researchers are well qualified in scientific terms, but they have few opportunities for field experience. The improvement researchers are not familiar with the clone gardens, which are supervised by the Agricultural Superintendant". They are not involved in either trial management or in checking data. Although this is a somewhat subjective view, there appears to be a gap between intellectual scientific deliberations and agronomic or technological reality. This is reflected in the researchers' interest in advanced techniques, such as electrophoresis, without any consideration of how they might practically be used. This observation is greeted with genuine astonishment, as if the person voicing it was not sufficiently intelligent to appreciate the scientific value of the technique in question. The question of how to implement the technique in practical terms is apparently entirely irrelevant.

Another consequence of the gap between theory and practice is the publication, in all good faith, of results that are difficult to extrapolate (for example, yields of clones bred by RRIN). The researchers fail to appreciate that the experimental conditions or the failure to check findings may have falsified the results.

In practice, the researchers are perfectly capable of:

- designing and putting down on paper coherent scientific drafts and experimental protocols,

- analysing their results,

but anything in between appears to be beyond them.

V.5. PROGRAMMES AND RESULTS

Research projects are initially drawn up and discussed by researchers and researcher groups, then grouped together in structured programmes for each department. The Institute produces an overview of the programmes as a whole, for submission to the Governing Board, which has seven members, including the Director of RRIN, representatives from the Ministry of Agriculture and the Ministry of Science and Technology, and people from the private sector, designated by the Government on personal merit. Draft programmes include a financial assessment of the investment needed, but not of operating costs. The research programmes of the RRIN are classified on the basis of priority into "A", "B" and "C". Scarce resources are preferentially allocated to programmes classified as "A" whilst programmes classified as "C" receive least attention.

Annex 4 gives summaries of the programmes proposed for 1991.

V.5.1. Agronomic research programmes

♦ Genetic improvement of *Hevea brasiliensis*

a) Establishing a gene pool

Collection and multiplication of the various introductions.

b) Evaluation of new hevea genetic resources

Yields for the best clones vary from 4.7 to 5.6t/ha/year: there are the same methodological problems as for the previous section (over-hasty extrapolation).

c) Clone breeding for high latex yield and wind resistance

Of the 780 genotypes obtained by artificial crossing, split into 3 groups, 6 clones were chosen from the first group and 10 from the second. Yields for the 10 clones from the second group vary from 4.947 to 5.590kg of dry rubber per hectare. These unbelievable yields can be explained either by the failure to check results, or by the fact that yields per tree were extrapolated from values obtained on a very limited number of trees.

The experimental plots comprise only 9trees, and the report mentions that the number of surviving seedlings is very low. 3,616 trees were pollinated artificially between January and April 1989 on 6 different types of crosses. It is not known how many seedlings were obtained, since the percentage of aborted fruits was very high.

d) Physiological studies on the problem of flower and fruit abortion

Study limited to clone inventories.

e) Diseases associated with flowering and their control

Several pathogens were identified on different floral organs.

f) Screening of Nigeria 800 series and IAN clones for disease resistance and latex yield

Artificial inoculation tests.

g) Evaluation of the RRIN-developed clones for latex yield potential and stability

Yield, bark thickness and diameter at a height of 150cm were measured on 11 clones from the various stations. RRIM600 was used as a control. There were no significant results.

♦ Improvement of natural rubber production techniques

a) Evaluation of the effects of certain environmental conditions and surface sterilants on the viability of stored hevea seeds

The germination percentage obtained on sand is much higher than on topsoil. The sand moisture content also has a marked effect. Studies are being carried out on the effect of storage time and methods on the germination percentage.

b) Effects of seed size variation on the subsequent growth vigour of the emerging seedlings

No known results.

c) Evaluation of the effects of tapping methods on rubber latex and seed production

Trees are currently being selected.

d) Evaluation of the effects of applied chemicals on latex and seed production

No results as yet.

e) Reducing immaturity period

No results as yet.

f) Studies on endotrophic mycorrhizae

No clone effect but soil and season play a role.

g) Studies on the damage caused by Helminthosporium in the nursery

No results as yet.

h) Artificial inoculation of hevea seedlings

No results as yet.

i) Determination of the severity and distribution of fruit rot disease

Fruit rot disease: In 1986, out of 642 clones, 25 were disease-free and 4 proved highly susceptible: PR107, RRIM707, RRIM607 and TSIR16.

In 1987, infection by 3 fungal pathogens - Dreschlera, Aspergillus and Colletotrichum, was seen to be the cause of 83.6% of seed losses.

In 1988, the infection rate was higher in May and June; 80% of the fruits examined were affected.

j) Early detection and control of white root disease

No results as yet.

♦ Development of stump and budwood materials

a) Production of planting materials for sale

Numerous material problems connected with staff training.

b) Intercropping with biennial food crops

Plantain banana, pineapple and cocoyam are planned.

♦ Development of integrated farming systems

a) Intercropping of young rubber with common annual food crops

No results as yet. Lack of labour.

b) Identification and determination of nutrient contents of herbage species growing under mature rubber plantings

Trial to be set up.

c) Estimation of herbage availability and goats' preference for herbage species growing under mature rubber plantings

d) Studies on the stocking rate of goats per hectare of mature rubber planting

- inventory of weeds in plantings
- study on goat consumption and feeding preferences
- 53 to 54 goats are needed to graze six 1-hectare paddocks.

e) Studies on snail farming under mature rubber

No results as yet.

♦ Agricultural extension services

a) Dissemination of the Institute's Agricultural research findings

- distribution of 10,000copies of various publications by the Institute,
- 1986, 1987 and 1988 annual reports,
- coordination of the University of Benin's industrial role,
- planning the 1989 training programme,
- trials on cooperation with the Ministries of Agriculture in different states.

b) Development of an inventory of the problems of the agricultural and commercial sub-sectors of the Nigerian rubber industry

This programme, in fact drawn up by researchers, was undoubtedly designed in response to their own needs and hopes and their idea of development. It could only express true field requirements if users were adequately represented on the Governing Board and if the latter were not only consulted after the event. In addition, there is no order of priority, which means that when resources are scarce - as is generally the case - they cannot be allocated to the most urgent projects. The Director currently has sole control over resource allocation.

V.5.2. Technology research programmes

- Latex processing and utilization of natural rubber latex and dry rubber lumps

The official aim of this project is to explore the possibility of using Natural Rubber Latex and dry lumps in the production of consumer goods and industrial products.

In reality, this project is not a research programme but an analysis of production costs at the RRIN plantation. The following records are analysed (table n°3) :

. Monthly field coagula and latex production and sales - DRC
. Cost of production
. Cost/Revenue Differential
. Tapper performance e.g. average tapper production in litres and kg dry rubber.

- Characterization of Natural Rubber Latex from NIG 800 series clones

The aim of this project is to determine the technological characteristics of the rubber produced by a new series of clones : NIG 800.

The following latex properties namely :

- Dry Rubber Content (DRC)
- Total Solid Content (TSC)
- Specific gravity
- Potassium Hydroxide Number (KOH)
- pH
- Odour
- Colour
- Volatile Fatty Acid Number (VFA)
- Mechanical Stability Time (MST)

have been determined using the British Standard and ASTM procedures. A summary of the results is given in Table n°4. These different analyses have been carried out at the University of BENIN, for KOH and VFA number. Because of factors such as seasonal rhythm, very small numbers of trees (2 for NIG 805), at least one year study cycle and batch of trees (it seems that is not available at this moment) are necessary before reliable conclusions and recommendations can be made.

- Natural Rubber Blends in product manufacturing using thermoplastic Natural Rubber (TPNR)

The aim of this project is to duplicate/repeat in NIGERIA the recent development of producing thermoplastic materials from Natural Rubber.

This analysis of the Progress Report on research programmes and associated activities, published by RRIN in 1989, shows that:

- there are few concrete results considering the number of projects and programmes implemented,
- the few results obtained are sometimes unrealistic (improvement),
- many projects are only making slow progress or have been halted due to a lack of material resources,
- projects are often geared towards topics which are of little interest for the development of the hevea sector and rubber production,
- preparation of alkyd resines using rubber seed oil. The alkyd resins (medium oil) have been prepared and should be tested in paint company,
- toxicological evaluation of rubber seed meal. No results because rubber seed meal was not available in 1989.

The RRIN has neither the equipment nor the chemical products and raw material (Polypropylene). A collaboration with NIPOL Ibadan and Bata Shoe Company seems a little bit difficult.

The main activities is to provide raw materials. No results.

CHARACTERIZATION OF LATEX FROM SERIES NIG 800 CLONES

(FIRST QUARTER OF 1988)

CLONES	PARENTAGE	DRC AVERAGE (%)	SPECIFIC GRAVITY	pH	KOH	VFA	MST (s)
NIG 800	RRIM 500 X HAR 1	31.30	0.980	6.50	0.60	0.041	560
NIG 801	RRIM 600 X PR 107	33.20	0.980	6.50	0.60	0.028	571
NIG 802	RRIM 501 X RRIM 628	34.00	0.977	6.40	0.67	0.050	550
NIG 803	RRIM 600 X PR 107	31.70	0.976	6.50	0.60	0.051	552
NIG 804	RRIM 600 X TJIR 1	33.40	0.978	6.40	0.60	0.050	556
NIG 805	RRIM 628 X RRIM 501	36.20	0.978	6.40	0.63	0.049	556

Source : Progress Report RRIN - June 1989

- *Determination of standard technics for the production of Nigerian Standard Crumb*

The aim is to evaluate the influence of production parameters on physical and chemical properties of Nigerian Standard Crumb. Three parameters have been studied :

a) influence of processing water
b) influence of drying temperature
c) influence of soaking time

Results :

a) the quality of processing water would affect the colour of crumb (from bright to brown)
b) drying temperature influences the colour of the crumb (between 90°C and 110°C)
c) soaking time (7 days) before processing influences the colour of field coagula (brighter than if it is not soaked)

- *Rubber Seed Oil*

. Determination of optimum drying temperature prior to storage of rubber seed, cake and oil. No results in 1989 but only in 1986 and 1987.

. Large scale drying of rubber seed prior to storage. No results because the fire destroyed the dryer and the batch of seeds.

. Design and fabrication of rubber seed oil extraction equipment. A prototype of rubber seed oil empeller was successfully developped at the end of 1988 but there is a major problem of oil backflow due to inadequate spacing in the barrel. Some technical modifications are developped.

. Processing the seeds of natural rubber (*Hevea brasiliensis*). Improvement of the batch extractor which is based on the percolation principle.

. Refining of crude rubber seed oil. Some techniques for removing free fatty acids, gums and colour pigments have been developped in 1988. The main activity is to find and to test a technique for deodorisation rubber seed oil.

. Physio-chemical analysis of crude and refined rubber seed oil. Some properties decrease during storage of rubber seed oil. Control of peroxyde value and free fatty acid should allow to keep quality of rubber seed oil.

. Formulation of liquid soap, hair shampoo and skin cream from rubber seed oil. Some formulations using rubber seed oil as a raw material have been developped like hair shampoo, liquid soap, potash soap.

. Preparation of alkyd resines using rubber seed oil. The alkyd resins (medium oil) have been prepared and should be tested in any paint company.

. Toxicological evaluation of rubber seed meal. No results because rubber seed meal was not available in 1989.

♦ Comments

The Technology Division's research programmes are mainly geared towards using rubber seed oil.

We were not able to see the economic calculations which must have been undertaken before embarking on this research programme, but apparently:

- seed collection is an important factor in economic terms, considering that one person can collect 20kg of seeds per day in a plantation where upkeep is satisfactory;

- technical oil, which can be used to manufacture shampoos, soaps and paints, is starting to compete with other vegetable oils (palm oil, soybean oil, cottonseed oil, etc.);

- lastly, similar studies have been undertaken by numerous Asian countries (Vietnam, Malaysia, Sri Lanka), which have shown the limitations of using rubber seed oil ([9]).

N.B. It should be noted that 1ha of hevea can yield:

- 125kg of technical oil, unsuitable for human consumption, since it costs too much to refine,

- 250kg of shells which can be used to fuel boilers,

- 125kg of cake, which can be used as cattle feed, providing that it is processed beforehand to remove the hydrocyanic acid.

V.6. CONCLUSIONS ON RRIN

RRIN is isolated from the profession and lives in a closed world, indifferent to both the end result of its research and the reliability of its conclusions.

However, RRIN's infrastructure and human resources are considerable.

On the one hand:

- the lack of operating resources considerably hinders the Institute's day to day activities and is a threat to the maintenance of its production potential in material terms (infrastructure) and on a psychological level (researcher motivation and involvement).

On the other hand:

- staffing levels are too high, hence under-used, which means wastage of some of the State grant in the form of wages.

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[9] Rubber seed processing for the production of vegetable oil and animal feed - UNIDO project US/GLO/81/103, Dec. 1989, Ceylon Institute of Scientific and Industrial Research.

VI. PROPOSALS FOR THE REVIVAL OF RRIN

The above analysis shows that in order to revive RRIN, it is essential to:

- renovate the infrastructure,
- reorientate research to meet the production requirements expressed by the profession,
- bring the maximum possible amount of operating equipment back into use,
- reorganize staff resources.

VI.1. PROGRAMMES

The following proposals are based on the programmes put forward by RRIN for 1991, which are summarized in Annex IV, whilst attempting to adjust them to technical development demands, as described in section II.

They were discussed with the professionals met during the mission, who gave them their overall approval.

However, to ensure general agreement on the project, the proposals should be discussed once again and voted on during a meeting between RRIN and official representatives of the profession (RPPTA and Natural Rubber Association).

This meeting could be the starting point for ongoing dialogue between research and its users.

Programme 01 - Genetic improvement

Project 01/01. Improving the state of the existing clone collection, importing those clones missing from the collection.

Project 01/02. Large-scale trials to compare those clones likely - in theory - to be suitable for local conditions, with a view to making practical recommendations as soon as possible.

Project 01/03. Resumption - on a rational basis - of the hybridization programme, compilation and assessment of results obtained, restructuring of comparative trials.

Programme 02 - Agronomy

Project 02/01. Cropping techniques

Future replantings will use clonal material. It is therefore important that the clones, which have a high production potential, be planted under good conditions. Planting techniques will have to be adapted to local conditions, taking account of ecological and socio-economic factors.

The trials should provide answers to the following problems:

- choice of seeds and stump families,
- nursery techniques, with or without irrigation (polybags, field, others) - is budding possible in the field?
- budding technique, budwood quality,
- land preparation techniques,
- planting techniques, stage of development reached when seedlings are planted out,
- upkeep techniques for young seedlings,
- temporary or perennial intercropping with hevea,
- fertilization of young plantings. Changes in soil fertility under hevea replantings.

For the preservation, protection and maintenance of the capital represented by the estates:

Project 02/02. Root disease (Fomes) control

The major root disease in Nigeria is caused by Rigidoporus lignosus (Fomes).

It is important to carry out the following work, under Nigerian conditions:

- develop a detection method suitable for use in young plantings,
- adapt the control methods already used in other African countries (particularly Côte d'Ivoire and Cameroon) to Nigerian conditions,
- test new molecules which may be effective.

Project 02/03. Leaf disease control

A large number of leaf diseases have been observed in Nigeria by RRIN phytopathologists. It is important to set up a system to assess the economic impact of attacks and a plan of action using control methods to be implemented once the degree of attack is likely to affect tree growth and yield.

To this end, studies will have to be conducted on:

- leaf disease epidemiology,
- treatment methods,
- active ingredients and application.

Project 02/04. Fire protection

Due to the disappearance of the forest and the land preparation techniques used by small-scale planters, involving burning vegetation, there is a major risk of fire in hevea plantings.

Preventive anti-fire techniques will have to be developed.

Programme 03 - Tapping

It is important to master the appropriate tapping systems for each clone, to ensure optimum productivity.

The aims of the trials to be set up are to:

- adapt systems to each clone,
- reduce tapping work by reducing the tapping frequency and the length of the cut, offset by stimulation,
- reduce bark consumption,
- improve tapping quality so as to ensure that the tree is in optimum physiological condition for production.

To ensure production quantity and quality.

Programme 04 - Technology

Project 04/01 - latex and/or coagulum collection methods, transport, storage. This project will consist in identifying the collection procedure most suitable for small-scale growers, depending on the amount produced and the geographical location, whilst maintaining the quality of the rubber produced.

Project 04/02 - quality control:

- drawing up a Nigerian standard based on the existing norm (sampling plan, analyses, etc.) and its extension to all the natural rubber producers in Nigeria,

- setting up a central quality control laboratory based around the existing laboratory, which could be used for research operations, but also as a reference laboratory for other laboratories run by producers and processors,

- setting up and operation of a multi-laboratory test network to guarantee the validity of processing plant results.

Project 04/03 - technological properties of new clones planted in Nigeria.

Project 04/04 - impact of processing conditions on the properties of the rubber produced; after determining the effect of mechanical, chemical and heat treatments on the properties of the rubber produced, a technical assistance service could be set up to help the major processors improve processing techniques.

Project 04/05 - technical assistance to small-scale natural rubber processors in Nigeria; this service will almost certainly call for formulation and rubber processing trials, which will be carried out at the Auchi Polytechnic centre, in close collaboration with the team on site.

Project 04/06 - training: it is essential that RRIN play a prime role in training:

- laboratory heads and technicians from private companies in analysis techniques and sampling schemes,

- rubber engineers and technicians, in conjunction with the Auchi Polytechnic centre.

VI.2. RENOVATING INFRASTRUCTURES

It would be unreasonable to try to revive RRIN without renovating its infrastructures.

♦ Certain work is urgent:

1. Resurfacing the track from the highway to the offices (9km)
   Resurface the track from the offices to the budwood gardens and nurseries (4km)
   (contracted out to specialist company)
2. Renovate the generators
3. Renovate the water supply network (contracted out to an outside company)
4. Renovate the electrical installation (contracted out to an outside company)
5. Group the workshops under a single service, with certain essential items of equipment
6. Install radio-telephone-telex apparatus connected to the RRIN-Benin City national network

Modify Benin City-Lagos telephone line, which is totally inadequate although fitted out with modern equipment (micro-wave links).

♦ Certain work is necessary, but less urgent:

- Resurface all the tracks (sub-contracted to a specialist company)
- Fit out a building for use as a guest house for visitors and to provide a midday meal for senior staff and employees.

VI.3. ADDITIONAL RESOURCES NEEDED

1. Equipment

♦ Transport
- One 20-seater air-conditioned minibus for researchers
- One 50-seater air-conditioned bus for employees
- Eight 4-wheel drive vehicles:
  . 2 for on-site researchers
  . 1 for the Head of the Maintenance Service
  . 1 for the Head of liaison with the profession
  . 4 for the various divisions which need to travel
- One 8/10t truck fitted with latex tanks

♦ Fields
- Two 80 hp tractors with horizontal rotary slashers and rotavators

♦ Offices
- 5 microcomputers with protection
  . statistics software - scientific-analytical accounts word processor - data base - spread sheet
  . for Deputy Directors, except for Deputy Director of External relations

- 10 air-conditioning units

♦ Mechanics workshop, comprising (amongst others):
- 2 welding sets
- 1 fixed drill
- 1 bow drill
- 1 2-t workshop hoist
- 1 Facom tool-chest

♦ Field
- 1 complete sprinkler system for 10ha of nurseries and budwood gardens

♦ Genetics
- 1 set of scaffolding for artificial pollination

♦ Laboratory
- 1 laminar flow hood
- 1 autoclave
- 1 microscope
- 1 binocular microscope

- glassware, small items of equipment, products
- drying ovens
- water deioniser
- various chemicals

♦ Technology
a) short term
- 1 Mooney viscosimeter
- 1 Monsanto rheometer
- 1 hotplate for impurities
- 1 Lhomargy dynamometer
- small items of equipment and glassware
- 1 microcomputer and peri-pherals
- 1 laboratory blender
- various chemicals
- documentation

b) Medium term
- 1 100 kg/hr crumber
- 1 100 kg/hr BM
- 1 mini-creper
- 1 experimental drier
- 1 transport truck fitted with a jib

plus 2 years' spare parts.

♦ Training
- furnishings - audiovisual equipment - redecorate rooms

♦ Meteorology
- 1 automatic weather station to record:
  . rainfall, wind, sunshine, temperature, evapotranspiration

2. Staff

2.1. Strengthening of research by technical support:

♦ 1 senior agronomist with the rank of Assistant Director and Deputy Director, in charge of:
  . coordinating research
  . researcher training
  . supervising the replanting project
  . managing EEC funding granted to RRIN

♦ 1 agronomist in charge of planting techniques, crop protection and technical support to the Plantation Manager

♦ 1 field geneticist in charge of improvement, nursery and budwood garden upkeep and of setting up and monitoring clone trials

♦ 1 technologist to head the Technology Division

2.2. Reorganization of maintenance services by technical support:

♦ 1 Deputy Director for Maintenance, in charge of transport and vehicle workshop sections - vehicle electrics - LV electrics - water - cold circuits - carpentry - general mechanics - buildings - mechanical stores

2.3. Strengthening of Estate Management Division:

♦ 1 Plantation Manager from an industrial estate, Pamol or Michelin, or from RRIN capable of training budders and tappers, implement intensive tapping with stimulation in old plantings and manage a modern planting, to replace the current manager.

2.4. Staff reorganization:

The general reorganization of services should be geared towards better use of the current, excessively large workforce by transferring staff to the priority sector: estate and maintenance service.

VI.4. TRAINING

Senior staff and technicians will be trained by the four experts during their four years and two experts during two years at RRIN in their respective divisions. In fact, the different experts will train their Nigerian counterpart, mostly in the field with a high proportion of practical work. The Nigerian scientists will therefore be able to take over from the expatriate experts when they leave. In addition, further training could be given in Nigerian technical centres or universities, if necessary.

RRIN is planning to organize training courses for senior staff and technicians from the hevea sector, particularly on:

- clone characteristics
- nurseries and planting methods
- phytopathology
- physiology and tapping
- production monitoring
- specification
- milling
- natural rubber processing.

On this last point, practical training courses will be organized in cooperation with the Auchi Polytechnic centre, during which practical trials will be conducted for the processing industry.

VI.5. REPLANTING

Work schedule

Areas (ha) per year:

Year	0	1	2	3	4	5	6	7	8	9	10
Tapped until completely dry	380	380	380	380	380	380					
Nursery (ha)	2	2	10	10							
Cleared	100	100	500	500							
Exp. plantings		100	100	100	100						
Ind. plantings			400	400							
Tapped							100	200	700	1200	1200

Starting in Year 0, the 380 hectares of old seedlings will be tapped until completely dry, using the 1/2S+1/4Sd/4 6d/7ET5%12/y for 3 years before being felled.

The 400ha of experimental plantings will be planted in 100 ha lots from Years 1 to 4, whilst the 800 ha of industrial plantings will be split into two 400-ha lots in Years 3 and 4.

Clearing will be carried out one year before planting, at the same time as the nurseries needed for the extensions are set up. 1 ha of nurseries should be allowed for every 50ha of plantings. With a one-year nursery stage in polybags, planting will take place in Year 1, from March to October.

The first experimental lots will be tapped in Year 6.

COSTS (1,000 Na)

	Costs/ha	0	1	2	3	4
Experimental planting (ha)			100	100	100	100
Nursery	1.5	150	150	150	150	
Land preparation	4.4	435	435	435	435	
Planting	0.8		75	75	75	75
Upkeep	13.5		1350	1350	1350	1350
Sub-Total	20.1	585	2010	2010	2010	1425
Industrial planting					400	400
Nursery				400	400	
Land preparation	2.9			1160	1160	
Planting	0.5				200	200
Upkeep	9.0				3600	3600
Sub-Total	13.4	0	0	1560	5360	3800
TOTAL		585	2010	3570	7370	5225

Costs for the experimental plantings are 50% higher than for the industrial planting.

Upkeep costs (Na13,500/ha) should be spread over the whole of the immature period, whereas in the above table, they are given as a lump sum for the planting year.

INCOME

Year	0	1	2	3	4	5	6
Plant. prod (t/ha)	1.1	1.1	1.0	0.9	0.8	0.6	
Extension prod (t/ha)							0.4
Income (1,000 NA/ha)	6.1	6.1	5.5	4.9	4.4	3.3	2.2
380-ha planting	2299	2299	2090	1881	1672	1254	220

Tapping old seedlings until they are completely dry has been estimated to produce 1.1t/ha, and rubber prices at Na 5,500/t, i.e. an income of 11,495 million Nairas for the first 6 years.

The first experimental extensions will be tapped to produce 0.54 t/ha in Year 6. Production then rises to 1.8 t/ha in Year 12.

With 1,200 ha producing 1.8 t/ha, estimated income will be around 12 million Nairas.

VI.6. PROPOSED FLOW CHART (SEE NEXT PAGE)

Organization chart proposal

Board of Directors

with federal Governement - RPPTA and Natural Rubber Association - money-lenders

DIRECTOR (NAT)

Administrative Subdivision	Extension and Research liaison Subdivision	Plantation Subdivision	Research and Development Subdivision	Technology Subdivision	Maintenance Subdivision
National	National	National	Expatriate with rank of assistant Director (1)	Expatriate	National
Financial Department	Estates Department	Nursery Department	Agronomy Department (Expatriate)	Technology Department (Expatriate)	
Personnel Department	S.H. Department	Farming System Department	Plant Breeding Department (Expatriate)	Industrial Department	
Welfare Department	Processor Department	Track Department	Physiology Department	End users Department	
	Documentation Department				

(1) and in charge of the management of the research budget

VI.7. ESTIMATE OF COSTS OVER A FOUR-YEAR PERIOD

TOTAL COSTS FOR 4 YEARS

	TOTAL		%	%
	NAIRA	ECU	option A	option B
I. Personnel (4/5 international experts)			32.49	31.26
. fees + air fares (126 000 $/y/m)	16,128,000	1,612,800	29.64	28.52
. housing = 25 000 Na/y/m	400,000	40,000	0.74	0.71
. cars (504) = 140 000 Na x 5	750,000	75,000	1.38	1.33
. operating costs = 2 500 Na/month/car	400,000	40,000	0.74	0.71
II. Equipment				
- Infrastructure			2.98	2.86
. electricity supply	200,000	20,000	0.37	0.35
. water network	400,000	40,000	0.74	0.71
. mechanical workshop	180,000	18,000	0.33	0.32
. guest house	200,000	20,000	0.37	0.35
. room airconditioner	90,000	9,000	0.17	0.16
. radio-telephone RRIN BENIN	229,000	22,900	0.42	0.40
. telex RRIN BENIN	220,000	22,000	0.40	0.39
. rehabilitation radio beam BENIN LAGOS	100,000	10,000	0.18	0.18
- Transport			14.72	17.75
. repairing of tracks - option A	4,090,000	409,000	7.52	
- option B	6,115,000	611,500		10.81
. creation of tracks	200,000	20,000	0.37	0.35
. 1 bus 20 places	971,000	97,100	1.78	1.72
. 1 bus 50 places	1,150,000	115,000	2.11	2.03
. 8 cars 4x4	1,600,000	160,000	2.94	2.83
- Plantation			37.95	36.52
. 86 HP tractor (2)	290,000	29,000	0.53	0.51
. 1 gyrobroyeur	80,000	8,000	0.15	0.14
. 280 HP truck (1)	1,020,000	102,000	1.87	1.80
. meteorological station	50,000	5,000	0.09	0.09
. irrigation system	450,000	45,000	0.83	0.80
. experimental plantation : 400 ha	8,040,000	804,000	14.77	14.22
. industrial plantation : 800 ha	10,720,000	1,072,000	19.70	18.96
- Phytopathology laboratory	429,000	42,900	0.79	0.76
- Technology laboratory	1,150,000	115,000	2.11	2.03
- Processing worshop	650,000	65,000	1.19	1.15
- Computer	430,000	43,000	0.79	0.76
III. Chemicals products	400,000	40,000	0.74	0.71
IV. Documentation	250,000	25,000	0.46	0.44
V. Training	560,000	56,000	1.03	0.99
VI. Work programme and costs estimate				
- option A	2,591,350	259,135	4.76	
- option B	2,692,600	269,260		4.76
TOTAL - option A	54,418,350	5,441,835	100	
TOTAL - option B	56,544,600	5,654,460		100

FINANCIAL PLANNING

	YEAR 1		YEAR 2		YEAR 3		YEAR 4		TOTAL		%	%
	NAIRA	ECU	NAIRA	ECU	NAIRA	ECU	NAIRA	ECU	NAIRA	ECU	option A	option B
I. Personnel												
. fees + air fares	5,040,000	504,000	5,040,000	504,000	3,024,000	302,400	3,024,000	302,400	16,128,000	1,612,800	29.64	28.52
. housing	125,000	12,500	125,000	12,500	75,000	7,500	75,000	7,500	400,000	40,000	0.74	0.71
. cars	750,000	75,000							750,000	75,000	1.38	1.33
. operating costs	125,000	12,500	125,000	12,500	75,000	7,500	75,000	7,500	400,000	40,000	0.74	0.71
II. Equipment												
- Infrastructure												
. electricity supply	200,000	20,000							200,000	20,000	0.37	0.35
. water network	400,000	40,000							400,000	40,000	0.74	0.71
. mechanical workshop	180,000	18,000							180,000	18,000	0.33	0.32
. guest house					200,000	20,000			200,000	20,000	0.37	0.35
. room airconditioner	90,000	9,000							90,000	9,000	0.17	0.16
. radio-telephone RRIN BENIN	229,000	22,900							229,000	22,900	0.42	0.40
. telex RRIN BENIN	220,000	22,000							220,000	22,000	0.40	0.39
. rehabilit. radio beam BENIN LAGOS	100,000	10,000							100,000	10,000	0.18	0.18
- Transport												
. repairing of tracks - option A	4,090,000	409,000							4,090,000	409,000	7.52	
- option B	6,115,000	611,500							6,115,000	611,500		10.81
. creation of tracks	60,000	6,000	70,000	7,000	70,000	7,000			200,000	20,000	0.37	0.35
. 1 bus 20 places	971,000	97,100							971,000	97,100	1.78	1.72
. 1 bus 50 places			1,150,000	115,000					1,150,000	115,000	2.11	2.03
. 8 cars 4x4	800,000	80,000	800,000	80,000					1,600,000	160,000	2.94	2.83
- Plantation												
. 86 HP tractor (2)	290,000	29,000							290,000	29,000	0.53	0.51
. 1 gyrobroyeur	80,000	8,000							80,000	8,000	0.15	0.14
. 280 HP truck (1)			1,020,000	102,000					1,020,000	102,000	1.87	1.80
. meteorological station	50,000	5,000							50,000	5,000	0.09	0.09
. irrigation system			450,000	45,000					450,000	45,000	0.83	0.80
. experimental plantation : 400 ha	585,000	58,500	2,010,000	201,000	2,010,000	201,000	3,435,000	343,500	8,040,000	804,000	14.77	14.22
. industrial plantation : 800 ha	0	0	0	0	1,560,000	156,000	9,160,000	916,000	10,720,000	1,072,000	19.70	18.96
- Phytopathology laboratory			429,000	42,900					429,000	42,900	0.79	0.76
- Technology laboratory	550,000	55,000	500,000	50,000	100,000	10,000			1,150,000	115,000	2.11	2.03
- Processing worshop			650,000	65,000					650,000	65,000	1.19	1.15
- Computer	215,000	21,500	215,000	21,500					430,000	43,000	0.79	0.76
III. Chemicals products	100,000	10,000	100,000	10,000	100,000	10,000	100,000	10,000	400,000	40,000	0.74	0.71
IV. Documentation	100,000	10,000	50,000	5,000	50,000	5,000	50,000	5,000	250,000	25,000	0.46	0.44
V. Training	140,000	14,000	140,000	14,000	140,000	14,000	140,000	14,000	560,000	56,000	1.03	0.99
VI. Work programme and costs estimate												
- option A	774,500	77,450	643,700	64,370	370,200	37,020	802,950	80,295	2,591,350	259,135	4.76	
- option B	875,750	87,575	643,700	64,370	370,200	37,020	802,950	80,295	2,692,600	269,260		4.76
TOTAL - option A	16,264,500	1,626,450	13,517,700	1,351,770	7,774,200	777,420	16,861,950	1,686,195	54,418,350	5,441,835	100	
TOTAL - option B	18,390,750	1,839,075	13,517,700	1,351,770	7,774,200	777,420	16,861,950	1,686,195	56,544,600	5,654,460		100

List of annexes

ANNEX A

Study of Rubber Research Institute
Acc. No. 6605.31.41.043

Contract RRI/1

TERMS OF REFERENCE

ESTABLISHMENT OF A PLAN OF ACTION TO DEVELOP THE ACTIVITIES OF THE RUBBER RESEARCH INSTITUTE OF NIGERIA

1 Background

Reactivation of heveaculture and rubber production in Nigeria is highly desirable and feasible. The Rubber Research Institute of Nigeria should play a major leading role in any future development of rubber industry. However, accumulated underfunding over recent years has rendered the Institute unable to fulfil adequately its numerous tasks, as embodied in its mandate.

A plan of action to develop the activities of the Institute is necessary.

2 Objective

The plan of action should be established on the basis of the existing conditions in the RRIN in correlation with present and foreseeable future needs of the industry. It should recommend orientation of research to be undertaken by the Institute in complement to existing ones. It should be gradual and multi-staged. It should be designed so as to allow a quick reactivation of the Institute in congruence with immediate, short term and medium term needs of heveaculture and rubber industry. It should include proposed timetables and working plans. It should cover the various existing and recommended activities of the RRIN. It should design organisational and technical developments of the Institute and specially recommend the provision of scientific and technical equipment, genetic materials and training of staff of the Institute. It should be costed.

3 Methods, coverage and content

3.1 An evaluation of the existing means of operation of RRIN, both in terms of material and human resources will serve as a basis to draw the plan of action. The plan of action itself will be established in close cooperation with the Director and staff of the Institute. It will address the following:

3.2 Description of proposed research programmes, in the following fields of activity:

a) in the field of plantation management
   - improvement of heveaculture
   - introduction of clones
   - development and selection of clones
   - studies on genetic characteristics of clones

- phytotechnology:
  - preparation of vegetal materials
  - studies of material development under soil and climatic conditions
  - nutrition and fertilisation
  - associated plantations
  - management of the interspacing

- phytopathology of roots, trunk and leaves:
  - physiology and exploitation
  - study of systems of exploitation of clones
  - use of latex diagnosis
  - study of dry tapping.

b) in the field of products technology
   - smallholder plantation : technical and socio-economical diagnosis, and trials of technology transfer and extension
   - estate plantations
     - monitoring of plantation techniques
     - specific experiments
   - establishment of a rubber quality control network
   - design of pilot projects.

3.3 On the basis of the existing means of operation of RRIN (see para. 1) and of the recommended research activities (as listed under para. 2), the following will be drawn:

a) list of equipment to be supplied to the RRIN to permit it to undertake the proposed research and R and D programmes
b) training schemes for the staff of RRIN

For the items a) and b) above, time schedules and cost estimates should be provided.

3.4 Outline proposals in view of further developments of the Institute:
a) proposals for a management system of contractual research to be conducted by RRIN for the benefits of estates and industrial plants;
b) extension of the plantation to the total acreage of the estate (2000 hectares): study of the opportunity of such a development, in view of the costs involved and of the possible direct financial returns, which would allow auto-financing of future research activities;
c) evaluation of the opportunity to develop smallholder plantation at the periphery of the RRIN.

TECHNICAL NOTES

1. Overall estate condition

The average age of Delta Rubber Company estates is 26 years. The total number of trees is 111,203 for 1,800hectares originally planted, i.e. a current average density of 61.8trees per hectare. It is worth noting that some of the areas planted have been taken over by local villagers to grow food crops. This phenomenon is a result of the war, which enabled villagers to reaffirm their land rights.

The main causes of these low densities are (in order of importance):

- destruction by man, either direct - by fire - or more or less spontaneous;
- Fomes;
- Wind breakage.

Estate condition at Imo Rubber Ltd. (Mr.Détrieux) is excellent, despite the poor upkeep or total lack of upkeep in the past. There is no black stripe, leaf disease or Fomes. Mean yields, since reorganizing tapping, are 20kg of dry rubber/tapper/day, which is perfectly normal.

The fact that natural conditions in Nigeria are propitious to rubber is proved by observations. At Uronegle (Plantation Integrated Ltd.), there is an unshaded seed garden and a non-irrigated nursery, without any phytosanitary treatments or fertilizer applications, whose appearance is far from disastrous.

2. Improvement

RRIN has a collection of 127 clones of foreign origin.

There is a 13-hectare clone comparative trial containing 30 clones of foreign origin in 4 replications, with 49 trees per plot, i.e. 588 trees. the trial was set up in 1963. 7 years of production results are available, but production has not been monitored since 1976.

RRIN has a clone collection, which it would be worth completely reorganizing.

The improvement work carried out at RRIN is based on crossing by artificial pollination. Parents were chosen based on the following criteria, according to the literature:

- yields,
- wind breakage resistance,
- root disease resistance.

The clones chosen as parents were GT1 and PB260.

The nursery assessment criteria for the crosses obtained are:

- height,
- girth at a height of 10cm,
- number of leaf stages,
- height of second internode,
- number of leaves in stage 3,
- microtapping.

Measurement of these criteria begins at 2 years of age, every 3 months.

720 new clones have been obtained by crossing. They have been split into 3 groups (arbitrarily)

- Group 1 contains clones 1 to 130. 6 clones were chosen after 5 years of observations.
- Group 2 contains 250 clones, numbered 131 to 380. 10 clones were chosen.
- Group 3 contains clones 381 to 780. No clones were chosen.

The comparative trials to test these clones comprise 11 different clones, with RRIM600 as a control, 5 replications and 10 trees per treatment.

RRIN (Dr.Olapade) would like to develop improvement activities in the following fields:

- electrophoresis, to identify and analyse the new clones chosen,
- tissue culturing, to study the stump-scion interaction (?),
- reproduction by micro-cutting for industrial production of new plants.

According to Michelin (Mr.Wierre), the best clones in Nigeria are GT1 and PB2859.

The clones planted most recently at Pamol are RRIM600, GT1 and PB217.

Artificial pollination

According to RRIN, the low success rate for pollination is due to fungal diseases, which cause fruit abortion. A research operation has been undertaken on this problem.

3. Agronomy

Planting methods

Planting methods on medium-sized estates are often anarchic and haphazard. At Plantation Integrated Ltd., stumps are theoretically planted after 20months, but may in fact have spent several months longer in the nursery, with or without being cut back, producing highstumps (Advanced Planting Material), which are supposed to be kept as replacements. There is no coherent budding programme. Some of the plantings are set up with stump seedlings, which are then budded in the field, supposedly because there is not enough labour to bud in the nursery.

At Garick Rubber Plantation, the Managing Director described their rational replanting programme to us. In the field, it transpired that the person in charge of replanting was merely replacing dead trees in the centre of plots with seedlings.

The final aim of the research being carried out at RRIN on planting methods is to shorten the immature period (Mr.Sagay). Several methods are being looked at:

- 9-month old budded stumps,
- 18-month old budded stumps,
- budded stumps, cut back in the nursery and planted out after 9 to 12 months' scion regrowth (Advanced Planting Material = High stump?), used mostly for replacement,
- to facilitate and speed up striking, soil is removed from one side of the plants in the nursery, 2 weeks before the plants are lifted and transferred to the field. the hole next to the plants is then either:

- left open,
- or stopped up with sand.

At Michelin, seeds are planted directly in the field. There are apparently no rodents, and the rainfall distribution enables good young plant growth. However, technicians themselves admit that this method does not have any economic advantage over using nurseries. On a technical level, stump selection is better, since only 3 out of every 10 plants are budded. However, budding is more difficult to monitor.

At Araromi (Michelin), subsoiling is practised, before planting seeds in the field, on moist, clay soils. Polybags are only used in the nursery for replacements.

Also at Michelin, this time at Osse River, some areas were planted in double rows, as an experiment.

According to Mr. Détrieux, planting seeds in the field costs the same as polybags, but it would be difficult to use bags due to the soil type (at IREL).

Intercropping

This is totally nonexistent in Nigeria, and trials only began this year at RRIN. Yields of 165kg/ha of soybean and cowpea were obtained.

Nursery intercropping trials were turned down by the RRIN Board.

Soil problems (Mr. Assawalam)

The aim of the studies conducted by the RRIN soils department is to establish a link between the various soil types and agronomy trial results.

There is a very good response to fertilization, not in terms of production but in terms of growth.

The problem lies in extending the existing knowledge of fertilization to cover new clones and intercrops.

The fertilizer recommendations made by RRIN are based on soil analyses. For the Benin City region, recommendations are 420kg/ha of 15-15-15 in mature, tapped estates.

The recommended rates for young plantings are:

- 115g of P2O5 in the planting hole,
- 115g of 15-15-15 2 months later,
- 230g of the same formula, twice a year, in Year 2,
- 345g of the same formula, twice a year, in Year 3,
- 520g of the same formula, twice a year, in Year 4.

This gradual increase in fertilizer rates is based on the idea that tree requirements increase with size.

Thereafter, fertilization is based on leaf analysis results.

Fire control

At Pamol (Sapele), fire-breaks 3m wide have been extended to all the plantings. Surveillance using motorized guards is proving effective.

Other problems

RRIN agronomists are extremely concerned about the stump-scion interaction problem.

Leaf area is used as a criterion of plant vigour in trials. Mr.Sagay wonders whether there is apparatus to measure leaf area.

4. Physiology - tapping methods (Mr. Igene)

Seedlings and budded trees are tapped at different diameters at RRIN.

Yields per hectare decrease systematically after 16 years' tapping. This stems not only from a drop in tree density but also from reduced individual yields. However, the drop in yields also seems to be linked to bark availability.

Tapping is always S/2,D2,D2. No experiments have yet been carried out on tapping systems.

Stimulation is only practised on old trees.

The problem with tapping is not the same as in Côte d'Ivoire - i.e. making labour cost-effective - given the low cost of labour in Nigeria.

Tapping problems affect old plantings in particular. Panels really are difficult to tap (and for good reason).

Comments - the economic and social aspects of tapping

To say that the low cost of labour in Nigeria is a positive factor for hevea growing leads to an error of judgement as far as tapping is concerned. In fact, despite the low cost, tapping probably does not provide such good value for money as in Côte d'Ivoire. The tapper is almost always paid for the amount produced, with total disregard for tapping quality. He is even free, as part of his job, to manage his trees as he likes, even to stop tapping certain trees which he considers unproductive and tap the best trees every day. this explains the disastrous state of the tapping panels and deplorable physiological condition of the plantings being tapped. Tapping in Nigeria is in fact expensive because it is shoddy, and above all, the system leads to the rapid decline of the capital constituted by the trees.

This situation can be changed relatively easily. When quality bonus systems are introduced, tapping immediately resembles that on the best plantations (IREL).

RRIN's position, which consists in saying that there are no tapping problems due to low labour costs is ill-founded and dangerous.

5. Phytopathology (Mrs.Igeleke)

Nurseries

Leaf diseases: Helminthosporium
Gleosporium and Coletotrichium

These diseases are very common in budwood gardens and nurseries, and reduce growth and the number of buds and lead to branch death.

Chemical control using Difolatan and Dithane.

A study is planned in 1991 on the relationship between nutrient levels in the soil and the degree of infection. It has in fact been observed that disease attacks are more virulent during the dry season, which can perhaps be put down to plant weakness. Hence the idea to conduct experiments on:

- the effect of irrigation,
- " " of fertilization,
- " " of other agronomic practices,
- " " of using chemicals

on diseases, making the comparison in terms of the cost:profit ratio;

2 trials will be set up, one for each fungus.

Last year, tests were carried out on the effectiveness of different clones as stumps in relation to disease resistance. Of GT1, RRIM600 and TJIR16, GT1 gave the best results as a stump.

Leaf diseases in mature plantings

Phytophthora (Secondary Leaf Fall) leads to leaf fall between June and August, whereas normal leaf fall takes place in January or February. It also affects fruits, which in turn influences seed production. The disease appeared in Nigeria three years ago, and is spreading from West to East, in relation to dominant winds.

The most susceptible clones are:

- PR 107
- RRIM 600
- GT 1
- PB 86
- PB 5/51.

According to a trial conducted in India, production can fall by 30 to 40%, and seed production by 30 to 50%. The disease also affects plant vigour, and is linked to black stripe. During the rainy season, panels can be infected by rain running off the leaves.

Control methods are mainly agricultural: cleaning plantings.

The infection can be transmitted by dead leaves which fall to the ground and by affected fruits, remaining on the tree.

Chemical treatments are based on Bordeaux mixture, Cuprosan, Aliette and Ridonil, but powerful sprayers are needed.

The disease is spreading, and clones which appeared to be resistant are now affected. Young plantings are less severely affected, but the disease is becoming more serious.

The major lines of research are:

- breeding resistant clones,
- biological control,
- using systemic fungicide by bark injection,
- preventive treatments applied by air (planes or helicopters).

Not everyone shares RRIN's view on the Phytophthora threat, particularly the agronomist at Pamol - Sapele, which is only around 40kilometres from RRIN.

Root diseases

Fomes is a very significant problem for replantings. Calixine trial in young plantings. A new inoculation method was used.

There are Armillaria in Calabar State.

Generally speaking, phytosanitary problems differ widely from one region to another.

This has been proved: 40km from RRIN, where Fomes and Phytophthora seem to be causing serious damage, the Pamol estate at Sapele does not appear to be affected by any cryptogamic diseases, but it is not clear whether these differences stem from upkeep in the plantings or... the personal opinions of the people we spoke to.

According to Mr.Comyn, Fomes incidence is extremely variable. He confirms that the incidence seems to be extremely high at RRIN and high at Osse River, but that Sapele and IREL are not affected. A Fomes map should be drawn up. Replanting is carried out without stump removal at Pamol (in fact, there are very few trees), and Fomes is nonexistent.

Calixine is only used on young plantings that are to be preserved.

Tapping panel diseases

Black stripe is common at Pamol - Calabar and Osse River (Michelin) in Bendel State. This disease is closely linked to climatic conditions. Growers stop tapping once attacks are too severe.

Ceratocystis (Mouldy Rot) is a disease affecting bark regeneration. It leads to the destruction of the cambium. It can be transmitted by the undergrowth if it is left to grow too high, and by tappers. The remedy is effective upkeep.

At Pamol (Sapele), Mouldy Rot control is implemented during the rainy season: Agrisol or Benlate (14 applications using a brush), but control is facilitated by effective upkeep at the estate.

6. Quality control - milling

According to Mr.Comyn (Michelin), quality control should be implemented jointly by the profession (producers and consumers) and RRIN, without RRIN playing an authoritative role. Mr.Ogowewo thinks that RRIN could, however, play a leading role, supervising the laboratories at each processing centre.

Mr.Comyn stressed the problem of rubber uniformity. In fact, he has seen in several processing plants that mixing cup coagulum from various sites, or even mixing large coagula obtained in tanks with cup lump led to visible colour variations between bales in the same batch and even within the same bale.

We observed that in a modern, well organized processing plant (Iyayi Rubber Factory), production costs and quality could be improved very easily:

- by setting the machines better: drying temperature and time,
- by sorting rubber on arrival: the different types of coagulum are mixed,
- by laboratory checks: the rubber characteristics given by the analyses do not seem to correspond to reality,
- by reducing "extravagant" expenditure: high-quality wooden crates.

7. Economic and social data

According to Mr. Comyn, the current factors in favour of rubber production are:

- easy communications,
- labour costs,
- fuel costs.

However, Mr. Iyayi does not share this opinion, and maintains that the Nigerian infrastructure, particularly roads, is inadequate.

There are a certain number of unfavourable factors:

- the lack of a political will to develop hevea growing, reflected in:

♦ a certain incoherence in rules and regulations and in export operations,
♦ the lack of a clear policy on land problems, on three levels:
  . federal government,
  . state government,
  . local communities and individuals.

Not all of these groups necessarily agree with one another. In Cross River, regional leaders can impose their wishes over and above the decisions taken by the State Government.

The Nigerians themselves are not motivated in terms of long-term production, and prefer short-term speculation.

On a technical level, estate age, Fomes damage and poor planting material quality have an adverse effect on production. Only Michelin and Pamol are replanting, but they are encountering difficulties with new extensions, due to land availability problems.

In social terms, there are difficulties in obtaining labour, particularly when the estates are near towns. Smallholder promotion poses the problem of funding the necessary administrative structure. It is not possible to make the grower pay for this himself, as marketing structures are too numerous and diverse for it to be possible to recover administration costs by virtue of increased rubber sales.

The labour problem is critical at Delta Rubber Company: there are not enough tappers, hence rubber production is falling (not all the trees are tapped), and there is not enough money to pay tappers, etc., but the managers also blame the lack of social infrastructures, particularly housing, for the difficulty in obtaining labour.

A tapper is paid 8Nairas for 50kg of wet rubber, 10Nairas on Saturday and 12 on Sunday.

The salary at RRIN is 10 Nairas per day, but very good tappers can earn 15 Nairas.

Each tapper is given 450 trees to tap.

The price paid to small-scale growers (delivered to the factory) is 2 to 2.1 Nairas per kilogramme of wet rubber.

According to Mr.Détrieux, the difficulty in obtaining labour is less due to living conditions and salaries than to a certain reluctance on the part of the population to work as tappers.

Land preparation costs:
(Source: RRIN)
In Nairas:

-	Manual:	
	. Under brushing (25 days)	500
	. Tree felling	1000
	. Logging	500
	. Burning	50
	. Contingency	200
	Total	2250
-	Mechanical:	5500

According to Mr.Ogowewo, small-scale growers need to be encouraged. There are very few medium-scale growers (less than 10), and they do not produce very much. However, if the small-scale growers were provided with backup, they could produce enough to enable the processing plants to operate at full capacity. They should be organized in "farm settlements" of around 200hectares, on a mixed cropping basis.

From a land availability point of view, forest reserves and major state-owned estates (teak), which are no longer profitable, could be used to develop hevea growing.

The World Bank is mainly interested in oil palm. In terms of rubber, it has only funded factory modernization or construction (US$25 million), which has led to the current over-capacity in the milling sector.

STATE	ESTATE	OWNERS OR LESEES	MATURE AREAS PLANTING PERIOD	MATURE AREAS HA	IMMATURE AREAS HA	TOTAL PLANTED HA	PLANTABLE RESERVE HA	1987 RUBBER PRODUCTION TONS		%
OGUN	Remo	Ogun state	1961–66	1,127		1,127	400	295		
	Ilushin	Ogun State	1958–81	1,937	226	2,163	1,700	1,835		
	Waterside	Ogun State	1965–78	1,128	263	1,391	1,400	990		
				4,192	489	4,681	3,500	3,120		13
ONDO	Araromi	Michelin/Ondo state	1955–71	3,427		3,427	500	1,645		
	* Asaboro Estate (Ifon)	Private	1950's	1,320		1,320		500	(e)	
				4,747		4,747	500	2,145		9
BENDEL	Urhonigbe	Plantations	1953–67	2,372	/1	2,372		900		
	Atochi	Integrated Ltd (Grommac)	1968–76	1,189		1,189	500	713		
				3,561		3,561	500	1,613		
	Sapele			321	261	582	200			
	Sapoba	Pamol		622	61	683	87			
				943	322	1,265	287	1,000	(e)	
	* Osse River	Michelin/	1961–	1,300	200	1,500		1,000	(e)	
	* Utagbauno	Bendel State		1,550	150	1,700		1,250	(e)	
	* Jathomas rubber Estate (Sapele)	Private	1950–60's	500		500		400	(e)	
	* Chief Ogbene Rubber Estate (Sapele)	Private	1950's	1,036		1,036		300	(e)	
				8,890	672	9,562	787	5,563		23
IMO	Emeabiam	IREL	1962–76	852		852	700	476		
	Obitti	IREL	1963–77	1,040		1,040	1,000	601		
	Ndioji Abam	IREL	1964–77	290		290	400	148		
	Amaeke Abam	IREL	1963–66	264		264	1,600	187		
				2,446		2,446	3,700	1,412		6
RIVERS	Elele	Delta Rubber Co/RS	1961–67	1,817		1,817				
	Odagwa	Delta Rubber Co/RS	1963–66	882		882	800			
	Abara	Delta Rubber Co/RS	1963–67	998		998	800			
	Umuoye	Delta Rubber Co/RS	1960's	128		128	800			
				3,825	/2	3,825	2,400	1,903		
AKWA IBOM	Use Ikot Amama	Akwa Estates Ltd/A	1976–88	194	134	328	1,172	70	(e)	
CROSS RIVER	Calabar	Pamol	1948–81	3,353	234	3,787		3,500	(e)	
	Oban	Onrel/CRS	1955–71	1,065		1,065		720		
	Akamkpa	CREL/CRS	1957–72	1,943		1,943	100	1,300	(e)	
	Uyanga	CREL/CRS	1957–72	1,767		1,767	150	1,300	(e)	
	Uwet	CREL/CRS	1959–64	1,899		1,899	200	1,250	(e)	
	Netim	CREL/CRS	1982–88		1110	1,110	300			
	Ikot Okporo	CREL/CRS	1965–72	518		518	3,000	450	(e)	
	Biakpan	CRADC/CRS	1963–78	1,605		1,605		704		
	Nko	CRADC/CRS	1963–66	1,193		1,193		757		
	Agoi Abami	CRADC/CRS	1966–72	303		303		179		
				13,846	1344	15,190	3750	10160		41
	TOTAL			38,140	2639	40,779	15809	24373		100

/1 Includes 1,183 ha abandoned
/2 Includes 1,141 ha abandoned
* Limited information and estimates made wherever necessary
(e) estimated
Source : Rubber sub sector review – SOCFINCO – January 1

INDUSTRIAL PLANTATIONS IN NIGERIA

- Analysis of the RRIN's staff

Research, Production, Farm Management and supporting Services Personnel 1990

RESEARCH, PRODUCTION, FARM MANAGEMENT AND SUPPORTING SERVICES PERSONNEL, 1990

DIRECTOR'S OFFICE

Director	:	Dr. E.K. Okaisabor, B.Sc (Agric) London Ph.D (Plant Path), Exeter.
Assistant Director	:	Dr. Ayoola B. Fasina B.Sc (Chem) Ibadan Ph.D (Polym. Sc. Tech.) Manchester.
Principal Research Officer (Planning)	:	Vacant
Principal Technical Officer (Planning)	:	Vacant

RESEARCH DIVISIONS:

Agronomt/Plant Physiology	:	B.A. Wankwo, B.Sc (Bot) UNN
Chief Research Officer	:	M.Phil (Reading); Ph.D (U.N.N.)
Assistant Chief Research Officer	:	Vacant
Principal Research Officer	:	G.A. Sagay, B.Sc. (Agric); M.Sc. (Agric) Ife.
Senior Research Officer	:	Vacant
Research Officer I	:	Vacant
Principal Agricultural Superintendent II	:	S.E. Edokpa, O.D. (Agric); H.D (Agric) Umudike.
Senior Agricultural Superintendent	:	Vacant
Higher Agricultural Superintendents	:	H.C. Njoku, O.D. (Agric) Umudike; H.N.D. (Crop Prod^{n}) Umuagwo
		F.E. Izekor, O.D. (Agric); H.D. (Agric) Asaba
Agricultural Superintendents	:	A.I. Okoeki, O.D. (Agric) Asaba.
		One Vacancy.

LAND-USE DIVISION:

Principal Research Officers	:	2 Vacancies
Senior Research Officers	:	F.E. Imeokparia (Mrs), B.Sc (Chem) M.Sc. (Anal. Chem.) Ibadan
		A.F. Iyayi, B.Sc (Chem) UNN; Dip Chem.Eng; M.Eng (Chem Eng), Benin.
		A.I. Aigbodion, B.Sc. (Chem) Ife, M.Sc. (Ind. Chem.), Benin
Research Officers I	:	K.I. Idehen, B.Sc (Ind. Chem.); M.Sc (Ind. Chem.) Benin
		I.O. Momodu, B.Sc (Chem) Nagpur; M.Sc (Anal. Chem) Gujarat.
Principal Technical Officer I	:	S.O. Imoebe, Sc. Tech. Part I; Sc. Tech. Part II Cert.
Principal Technical Officer II	:	S.K. Imoukhuede, CGLT (Part I) Sc. Lab. Tech.
Senior Technical Officer	:	J.C. Otuonye, LPRI, LNCRT
Higher Technical Officer	:	Vacant
Higher Agricultural Superintendent:		Vacant

EXTENSION AND RESEARCH LIAISON SERVICES:

Principal Research Officers	:	Dr. Oseloka B.C. Uraih, B.Sc (Soil Sci) Dip Agric Ext. (Reading); M.Sc Ph.D (Ibadan).
		E.O. Aigbekaen, B.Sc (Soc) Lagos M.Sc (Agric. Ext & Rular Soc), Ife.
Senior Ressarch Officers:	:	** P.A. Elabor-Idemudia (Mrs) B.Sc (Biol.) Buffalo; M.Sc Agric Ext Edu) Guelph.
		One Vacancy.
Research Officers I	:	Two Vacancies

** Study Leave without pay.

Senior Agricultural Superintendent	:	A. Ade-Okoror (Mrs), O.D. (Agric.) H.D. (Agric.) Umudike.
Higher Agricultural Superintendent	:	E. Edoseghe, O.D. (Agric.) H.D. (Agric.) Asaba.
Higher Superintendent of Press	:	Vacant
Superintendent of Press	:	C.I. Ayeke.

FARMING SYSTEMS:

Principal Research Officer	:	Dr. A.A. Awah, B.Sc (Agric.) UNN Ph.D (Animal Sci) Ibadan.
Senior Research Officer	:	Vacant
Higher Agricultural Superintendents	:	C.N. Isibor, O.D. (Agric.); H.D. (Hort. Landscape) Ife.
		One Vacancy
Agricultural Superintendent	:	J.O Agbonifo, O.D. (Agric) Asaba

PLANT BREEDING

Chief Research Officer	:	Vacant
Principal Research Officer	:	Dr. E.O. Olapade, B.Sc (Bot); M.Sc (Agric Biol); Ph.D (Ibadan)
Senior Research Officer	:	Vacant
Research Officer I	:	Edith E. Aniamaka, B.Sc (Boichem) M.Sc (Bioche) Benin.
		K.O. Omokhafe, B.Sc (Agric) Ife; M.Phil (Plant Sci) O.A.U.
		O. Aghughu, B.Sc (Botany) Ife; M.Phil (Plant Breeding) O.A.U.
Principal Agrultural Superintendents II	:	A.O. Igene, O.D. (Agric): H.D. (Agric.) Umudike.
		W.E. Momoh, O.D. (Agric); H.D (Agric), Umudike, P.G.D. (Farm Mgt & Ext) UNN; AMNIM.

Senior Agricultural Superintendents	:	S.E. Arasomwan, O.D. (Agric). H.D. (Agric), Umudike
		B.O. Ewards, O.D. (Agric) Asaba H.D. (Agric) Ife.
Higher Agricultural Superintendents	:	R. Imagbenikaro, O.D. (Agric.) Umudike; H.D. (Agric.), Asaba
		One Vacancy

PLANT PATHOLOGY/MICROBIOLOGY

Chief Research Officer	:	V.O. Otoide, B.Sc (Agric.) Ibadan M.Sc (Wisc.)
Assistant Chief Research Officer	:	Vacant
Principal Research Officers	:	C.L. Igeleke (Mrs), B.Sc (Microbiol) Benin; M.Sc (Ibadan)
		One Vacancy
Senior Research Officer	:	Edith R. Begho; B.Sc (Micro-biol.) Benin; (M.Phil (Ibadan)
Research Officers I	:	2 Vacancies.
Senior Laboratory Technologist	:	Vacant
Principal Technical Officer II	:	S.M.C. Ekpebor, CGLT (Sc. Lab. Tech) Parts I & II.
Principal Agricultural Superintendent II	:	C.O. Anetor, O.D. (Agric.), H.D (Agric.), Umudike
Officer Agricultural Superintendent	:	Vacant
Assistant Agricultural Superintendent	:	C.O. Akharia

SOILS & PLANT NUTRITION

Chief Research Officer	:	Vacant
Principal Research Officer		Vacant
Senior Research Officer	:	Vacant
Research Officer I	:	D.O.K. Asawalam, B.Agric (Soil Sci); M.Sc (Soil Sci) UNN
Senior Statistical Officer	:	R.O. Aifuwa, I.O.S. Preliminary
Senior Agricultural Superintendents	:	E.E. Ehigiator, O.D. (Agric) H.D. (Agric.) Umudike
Higher Agricultural Superintendents	:	F.O. Ugavah, O.D. (Agric), Asaba H.D. (Agric) Umudike S. Omo-Ikerodah, O.D. (Agric) H.D. (Agric), Asaba

AGRICULTURAL AND INDUSTRIAL PRODUCTION AND FARM MANAGEMENT DIVISION

Estate Management	:	(Plantation Establishment, Roads Maintenance, Horticulture and Landscapping). (In collaboration with Agronomy, Soils & Pathology)
Senior Agricultural Superintendents	:	N.A. Obazelu, O.D. (Agric), H.D. (Agric) Umudike
	:	J.N. Eguakun, O.D. (Agric) Asaba H.D. (Agric) Umudike
Agricultural Superintendent	:	N. Aghimien, O.D. (Agric.) Asaba.

MECHANISATION/BUILDING

Chief Engineer	:	A.A. Ikhoroloa, B.Sc (Mech. Eng.) Lagos MNSE.
Principal Technical Officer I (Electrical)	:	M.C. Ibhadode, T.T.C. ASEE (London)
Principal Technical Officer (Civil)	:	P.J. Otoibhi, City & Guilds Cert.
Principal Technical Officer II (Mechanical)	:	W.A. Ayeke H.N.D. (Mech) Port Harcourt.

NURSERY (In collaboration with Agronomy)

Senior Agricultural Superintendent	:	S.U. Obamedo, O.D. (Agric.) Asaba H.D. (Agric) Umudike
Higher Agricultural Superintendents	:	N.R.O. Ihamah, O.D. (Agric), H.D. (Agric.) Umudike
		J.G. Okwuokenye, O.D. (Agric) Umudike; H.D. (Agric) Asaba

TAPPING

(In collaboration with Agronomy, Applied Chemistry, Pathology, Soil Science & Estate Management).

Principal Agricultural Superintendent I	:	R.G.B. Smart, Cert. (Gen Agric) Dip Agric. (Ife); Dip Nat. Rubb. Proc. Tech. (RRIM)
Principal Agricultural Superintendents II	:	Vacant
Senior Agricultural Superintendents	:	S.M. Ehika, O.D. (Agric) Umudike H.D. (Agric.) Ife
		B.E. Onyenakwe, O.D. (Agric) Umudike H.D. (Agric) Ife.
Higher Agricultutal Superintendent	:	S.O. Ebhohon, O.D. (Agric.) H.D. (Agric) Asaba

AKWETE SUB-STATION:

Principal Reseach Officer Officer-in-charge	:	Ikechi Ugwa, B.Dc (Plant & Soil Sc.) M.Sc (UNN)
Senior Agricultural Officer	:	A.M.O. Igbakwe, B.Sc (Agric) UNN
Principal Agricultural Superintendent II	:	O.O. Okoronkwo, O.D. (Agric) H.D. (Agric.) Umudike
Senior Agricultural Superintendent	:	A. Nworgu, O.D. (Agric) Asaba H.D. (Agric) Ife.
Agricultural Superintendent	:	L.N.O. Eze, O.D. (Agric) Onne Port Harcourt.
Higher Executive Officer (Accounts)	:	A.S. Adams, HND (Accounts) Kwara Poly.

UNTING DIVISIONS

ccounts (including Stores)

rincipal Accountant	:	I.I.Y. Ohiokpahai, H.N.D. (Bus. Admin) Yaba; ACIS Part III; Cert in Financial Management (ASCON)
rincipal Executive Officer	:	A.I. Sadoh
igher Executive Officer	:	S. Ajzoba
xecutive Officer	:	A.O. Ogbebor
gher Stores Officer	:	J.S. Olaye, Dip . Purchasing Dip. Purchasing & Supply. (London); M.I.P.M.: M.I.P.C.: C.M.I.P.S.

MINISTRATION

ief Administrative ficer/Secretary	:	J. Reader Alhfohai, B.A. (Hist/ Pol.Sci) Ibadan; M.P.A. (Ife.)
nior Admin Officer	:	P. Obazee (Mrs) B.Sc (Social work) Florida
ncipal Executive Officers	:	J.E. Aikhuomogbe, C.P.A. (ASCON)
		B.E. Bello
		P.O. Ofuase, C.P.A.; D.P.A.(Benin)
ior Executive Officer	:	E.I.O. Akpaka;
her Executive Officer	:	A. Chimekwene
onal Secretary II	:	M.O. Monye;
idential Secretary II	:	B.I. Ohiokpehai (Miss) NCE (Warri)

RUMENTATION

or Instrument Technologist:	:	G.O. Sowande, HND (Electronics) Ibadan Poly.
		S.T.Y. Akpotaire, N.I.S.T.: Cert. in Phy/Electronics Tech. (Unical)

RNAL AUDIT

tant Chief Internal or	:	G.S.O. Adaka, HND (Accounts) Salford; Member Inst. of Book-keepers (London).
nal Auditor I	:	S.O. Osayomwanbor, HND (Accounts) Auchi; ICAN Part I.
r Executive Officer	:	I.B. Nwankwo, B.Sc Bus. Admin Part II RSA Acct. Part III, GCE Adv. Lev. AIAB London.

LIBRARY AND LEARNING RESOURCES CENTRE

Librarian I	:	L.M. Coo, Dip Library Science, B.L.S. (ABU)
Librarian II	:	S.I. Odudu (Mrs) M.L.S. (Kuban) USSR.

POULTRY

Senior Agricultural Superintendent	:	O.E. Douglas, O.D. (Agric) H.D. (Agric) Umudike; P.G. Dip (Farm Management & Ext) UNN; AMNIM
Livestock Superintendent	:	H. Sadoh (Mrs).

SECURITY DIVISION

Higher Agricultural Superintendent	:	G.I. Omoregbee, O.D. (Agric) H.D. (Agric) Asaba.

PROGRAMME FORMS

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°:91/01
Title: Genetic improvement of Hevea Brasiliensis.
Project N°:91/01/01
Title: Evaluation of new Hevea genetic ressources from within and outside Nigeria.
Contents:
Genotypes of the local provenances and the Amazonian genotypes will be multiplied for establishment in the gene bank (for conservation) and fiel planting (for evaluation). The non-brasiliensis Hevea shall be explored within the Nigerian ecosystem.

Twenty stumps of each genotype will be established in the budwood nursery for germplasm maintenance. Genotypes of the Nigerian Hevea provenances shall be cloned and planted at field spacing 6,7 m X 3,4 m.

Department responsible: Plant breeding
Investment cost (en Naira): 500.000
Results already obtained :
Exploration of the Hevea provenances in Nigeria in 1978 revealed a lot of variability among the unselected Hevea genotypes in the country. Following the IRRDB sponsored Hevea collecting mission in 1981, 2.822 genotypes were introduced into the gene bank. They are referred to as the Amazonian genotypes of wich 490 were surviving as at october 1989. Replacements for some of the genotypes that were lost were received in 1990. Data taken on secondary characters in 1990, revealed high genetic variability among the Amazonian genotypes.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/01
Title: Genetic improvement of Hevea Brasiliensis
Project N°: 91/01/02
Title: Breeding and evaluation of RRIN developed clones for high latex yielding and other desirable characteristics.

Contents:
- Breeding of Hevea clones for multiple traits, latex yield, wind resistance, good bark regeneration, disease resistance and early maturity,
- Preliminary of latex yiel potential of RRIN developed clones in RRIN main station,
- Stability test of selected RRIN C genotypes,
- Studies of soils requirements of RRIN C clones,
- Correlation studies using the C clones from the three locations,
- Viability of rubber seeds: post harvest changes in food reserves of rubber seeds,
- Physiological and biochemical test in Hevea research,
- Carbohydrate status of Hevea Brasiliensis in RRIN,
- Activity and electrophoretic patterns of some enzymes of Hevea cultivars,
- Screening of NIG 800 series for diseases resistance.

Department responsible: Plant breeding
Investment cost (en Naira): 500.000
Results already obtained:
Initial work on Hevea breeding started in 1965 in RRIN. Controlled hybridisation in which parents with proved desirable characteristics are matred, is being carried out on annual basis since 1965 except for a three year break (1972 - 1975). As new genetic informations are gathered on the basis of biometrical analysis of available data, parental clones are varied accordingly in the breeding programme for year to year. The progenies derived from previous breeding programmes are at various stages of establishment and evaluation. Correlation of secondary characters with yield has been carried out at Okhuo station while data from other locations are been collected. This will aid the release of promising clones to rubber farmers for plantation.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°:91/01
Title: Genetic improvement of Hevea Brasiliensis
Project N°:91/01/03
Title: Studies on problems of low fruit set in Hevea brasiliensis.

Contents:
- further identification and characterisation of insect pest associated with flowering, pollination and fruit set,
- pathogenity pests of associated pathogens,
- assessment of resultant disease incidence caused by the pathogens,
- study of the effect of selected hormones on fruit set,
- further research on the most effective hormone selected from 1990 work on fruit abortion.

Department responsible: Plant pathology/Microbiology
Investment cost (en Naira): 20.000
Results already obtained :
A preliminary investigation of floral microflora of Hevea brasiliensis has been carried out. Fungal species associated with the flowers of seven clones used for hand pollination exercise were isolated and characterised. Four genera were identified. There are Deschlera, Colletotrichum, Aspergillus and Penicillium species.
In 1990, isolation, identification and characterisation of insects pests associated with flowering, pollination and fruit set was carried out. Over fifty species belonging to about six orders were isolated. The orders are Heteroptera, Isoptera, Lepidoptera, Diptera, Hymenoptera and Coleoptera. Amongst the insects species were some that feed in the rubber inflorescence, puncturing unopened flowers which bring about premature flowers fall. Two of such species were identified - Eurystilus and Lygus spp. There were other Heteroptera species (true bugs) with proboscis that were isolated. These could act as disease carriers inoculating flowers and young developing embryo with infective fungi/virus and/or bacteria. The identification and characterisation of the insects pests are continuing. Preliminary research on the activity of the exogenous growth regulators in modifying fruit abortion were carried out using clone PB 5/51. Data collection and preparation of results are on going.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/01
Title: Genetic improvement of Hevea Brasiliensis
Project N°:91/01/04
Title: Studies on mineral nutrition of RRIN developed Hevea Brasiliensis clones.

Contents:
- Experiment I.
Comparison of different fertilizers formulations.
- randomised complete bloc design,
- four blocks,
- five fertilizers treatments,
- clones: NIG 800 and NIG 802.

- Experiment II
Yield response of mature rubber to different fertilizer regimes.
- seed garden trees,
- randomized complete block design,
- five treatments,
- four replications.

Department responsible: Soils and plant nutrition
Investment cost (en Naira): 10.000
Results already obtained :
New project.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/02
Title: Improvement of natural rubber agricultural production techniques
Project N°: 91/02/01
Title: Rubber seed viability and growth vigour of hevea seedlings

Objective:
Obtain optimum conditions for rubber seed storage to:
- obtain production of nursery seedling when necessary,
- adjust nursery planting dates to rainfall pattern,
- examine a possible correlation of seed size and growth vigour.

Contents:
Experiment 1a
- three storage media,
- three storage temperatures,
- three seed moisture content.

Experiment 1b
Effect of various concentrations of mercuric chloride, sodium chloride and sodium hypochloride as surface sterilisants.
Experiment 2a.
Correlation between seed diameter and seed weight.
Experiment 2b.
Randomised block
- three main plots (clones)
- four split plots (sizes)
- four replications.

Experiment 2c.
Growth of buds on rootstocks of different seed sizes.
- randomized block of 4 sizes replicated 6 times.

Experiment 2d.
Examination of the growth rates of buds of different seed sizes.
randomized block of 4 seed sizes replicated 6 times.

Department responsible: Physiology and latex exploitation
Investment cost (en Naira): 79.000
Results already obtained :
On going project which started in july 1986.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/02
Title: Improvement of natural rubber agricultural production.
Project N°: 91/02/02
Title: Factors affecting rubber latex and seed production

Objective:

To enable us predict the health of the plant through a study of its latex composition.
Determination of the stimulation level that each clone can tolerate without showing signs of overtapping.

Contents:

- Acquisition of the testing equipments,
- Acquisition of analytical manuals,
- Routine analysis of parameters with requisite equipment available.
    - Latex analysis,
    - Latex micro analysis,
        - dry extract,
        - sucrose,
        - inorganic phosphorus,
        - thiols.

Department responsible: Physiology and latex exploitation
Investment cost (en Naira): 27.000
Results already obtained: New project.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/02
Title: Improvement of natural rubber agricultural production techniques.
Project N°: 91/02/03
Title: Tissue culture of Hevea Brasiliensis.

Objectives:
- To be able to raise Hevea plants which are genetically equivalent in large quantities from bred and selected plants with desirable qualities predictable from their parents sources.
- To raise genetically equivalent plants for use as rootstocks in bud grafting elite materials.
- To use embryo culture technique for
    - raising embryos developed from hand pollinated flowers before fruit abortion,
    - encouraging pods to develop to maturity in "in vitro" culture,
    - developping callus from fertilized egges in Hevea flowers.

Contents:
- hand pollination of flowers to be accomplished,
- some hand pollinated flowers and newly formed fruits will be transfered to agar culture medium for nourishment,
- excised embryo will be grown in agar culture.

Department responsible: Physiology and latex exploitation.
Investment cost (en Naira): 300.000
Results already obtained : New project.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/02
Title: Improvement of natural rubber agricultural production techniques.
Project N°: 91/02/04
Title: Characterisation of soils supporting Hevea brasiliensis in Nigeria.

Objectives:
- To study and document the special features of soils supporting rubber in Nigeria.
- To provide important soil information on which clonal trials and agronomic investigations can be based.
- To characterise the soils for the purpose of enhacing international communications and extension of research results.

Contents:
The field study will be extended to other locations outside the Institute while the analysis continue on the samples already collected.
Selected rubber estates in Bendel, Ondo, Ogun, Imo, Rivers and Cross Rivers state will be chosen for the study. 12 estates.

Department responsible: Soils and plant nutrition
Investment cost (en Naira): 50.000
Results already obtained :
On going. Work began in april 1990. So far about eight pedons have been examinated within the Institute farm in Iyanomo. Soils samples have been collected and prepared for analysis. There were marked pedological differences in the pedons examinated.

"The vital information are almost non - existent as reveled at the RRIN progress report review session (13 - 15 june 1989)"

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/02
Title: Improvement of natural rubber agricultural production techniques.
Project N°: 91/02/05
Title: Mycoflora and fauna of Hevea brasiliensis plantations in Nigeria.

Objectives:
- To identify the various macrofungi found within the rubber plantation and determine their frequency of occurrence.
- To determine the effect of soil and management factors on mycorrhizal fungi spore populations and types of soils under mature rubber.
- To study the influence of season on mycorrhyzal fungi spore numbers in soil and on vesicular - arbuscular mycorrhyza infection of roots of Hevea clonal seedlings.
- To identify the various animals normally found within the rubber plantation.

Contents:
Experiment 1 - Collect of fruit - Characteristics - Frequency of occurence of the fungus - Identification and classification of the various fungi.
Experiment 2 -Effect of some chemicals on mycorrhiza spore numbers in soil and on percentage of VA mycorrhyzal infected Hevea roots.
Experiment 3 - Plantation of seedlings of known clones in a randomised complete block design - Percentage infection - Spore population in the soils.
Experiment 4 - Animal population in the rubber plantation in RRIN -

Department responsible: Plant pathology/Microbiology
Investment cost (en Naira): Unknown
Results already obtained :
The study of endomycorrhyza of Hevea was started in february 1988, and results so far obtained show that there were no significant differences in the mean percentage infection of roots of 5 hevea clonal seedlings (RRIM 623, GT1, RRIM 6OO, Tjir 1 and PR 107) examined during either the dry season or rainy season of 1988. However, rainy season endomycorrhizae infection levels of aproximately 10 months old were higher (24,46% - 34,63%) than of 5 months old plants examined during the dry season (12,47% - 25,02%). The number of mycorrhyzal fungi spore in soils under mature trees of the listed 5 hevea clones was determined during the dry season of 1989 and some properties of these soils were analysed. First year information concerning the influence of season on the ecology of Hevea of endomycorrhyzae is being collected. Studies of the macrofungi of the rubber plantation started in july 1989 and a total of 60 diferent specimens of fungi have so far been collected at RRIN. They are yet to properly identified.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/02
Title:Improvement of natural rubber agricultural production techniques.
Project N°: 91/02/06
Title: Control of the white root disease.

Objectives:

To minimise the prevalence of the white root rot disease of rubber by the use of cultural and chemical methods of disease control.

Contents:
- Artificial inoculation of rubber seedlings
Two methods will be tried:
  - The Tran Van Canh method.
  - The field method.
- Screening three fungicides: SAN 619 - ANVIL 5% SC - Calixine.
- Application of sulphur in mature plantation
- Early identification of disease pockets in new planting.

Department responsible: Plant pathology/Microbiology.
Investment cost (en Naira): 12.000
Results already obtained :
- Continuous effort to control the disease.
- Nursery to supply the seedlings for artificially inoculation experiments was raised in 1989 and 1990.
- Earlier experiments on intercropping rubber with cassawa indicated the possible use of cassawa in locating pockets of infection. Principle used in the early detection of disease pockets.
- The artificial inoculation of rubber seedlings commenced in july 1990.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/02
Title: Improvement of natural rubber agricultural production techniques.
Project N°: 91/02/07
Title: Epidemiology of phytophtora leaf fall and fruit rot diseases of rubber in Nigeria.

Objectives:

- Determination of the severity and distribution of phytophtora leaf fall disease.
- Evaluation of rubber seed deterioration as a result of fruit rot desease.
- Epidemiology of phytophtora leaf fall disease in rubber plantation.
- Effective control measure of the desease.

Contents:

- Etiology of the disease.
- Control mesure in vitro and in vivo.

Department responsible: Plant pathology/Microbiology.
Investment cost (en Naira): 10.000
Results already obtained :
- Experiment initiated in 1986.
- Isolation and identification of the causa organism.
- Survey of the severity and distribution of the disease at Iyanomo
- From 142 clones sampled, 117 were observed to be diseased while 25 were disease free.
- In 1987, floral pathology were carried out.
- Epidemiological study was initiated in 1988.
- Isolates of the pathogen was obtained from 10 different clones.
- In 1990, a survey of the incidence and severity of the disease in 10 rubber estates located in six rubber growth states was carried out.
- Characterisation of the isolates is still going to establish the most prevalent Phytophtora isolate in Nigeria.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/02
Title: Improvement of natural rubber agricultural production techniques.
Project N°: 91/02/08
Title: Studies on tapping panel dryness syndrome in Hevea brasiliensis in Nigeria.

Objectives:
- To determine the incidence and development of the disease in Nigeria.
- To assess variation in clonal susceptibility to the disease among Hevea clones.
- To determine the pattern of the distribution of the syndrome in Heva plantations.
- To determine the relationship between agroclimatic conditions, soil type and soils nutrient status to the development of the disease.

Contents:
- Determination of the incidence and development of the syndrome in RRIN.
- Determination of the distribution pattern within plantations.
- Assessment of variation in clonal susceptibility.

Department responsible: Plant pathology/Microbiology.
Investment cost (en Naira): 20.000
Results already obtained :
New project.
Preliminary investigation in Iyanomo between february and april 1989.
Survey of the incidence in 8 rubber estates.
4 clones highly susceptible: PB28/59, RRIM 707, RRIM 6OO and Tjir16;
5 other clones were prone to partial dryness: RRIM 605, Tjir 1X16, RRIM 707, RRIM 513 and Harbel 1

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°:91/02
Title:Improvement of natural rubber agricultural production techniques
Project N°: 91/02/09
Title: Establishment of a 100 hectare rubber plantation.

Objectives:

- To provide rubber plantation for the siting of various research project.
- To improve the revenue generating sources of the Institute.

Contents:
Plantation of 40 hectares of rubber in 1991.

Department responsible: Farm management;
Investment cost(en Naira): 172.000
Results already obtained :
This project started in 1988 with the planting of 20 hectares.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/02
Title: Improvement of natural rubber production techniques.
Project N°: 91/02/10
Title: Protection of rubber plantations from fire hazard.

Objectives:
- To reduce the high incidence of fire hazard in rubber plantations resulting in huge financial losses to rubbers farmers.
- To prevent the spread of fire from one plantation to another in rubber estate.

Contents :
- Identification of hedge plants that are capable of growing under a suppressed light condition as obtained in rubber plantation. (Forestry Research Institute of Nigeria - Ibadan)
- Experiment using different treatments:
    - Construction of fire trace,
    - Planting of hedge of 0,66 M height.
    - Planting of hedge of 1,3 M height.

Department responsible: Agronomy Division.
Investment cost (en Naira): 23.000
Results précédemment obtenus:

New project.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/02
Title: Improvement of natural rubber production techniques
Project N°: 91/02/11
Title: Examination of various factors for increasing latex yields in Hevea Brasiliensis.

Objectives:
- To increase latex production,
- To expand knowledge of latex production mechanism.

Contents:
Experiments:
- effects of fertilizers,
- ethrel and Ca++,
- tapping system,
- weather conditions,
- mulching,
- effects of varying tapping methods (frequency and cut length).

Department responsible: Physiology and latex exploitation.
Investment cost (en Naira): 32.000
Results already obtained :
New experiment.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/02
Title: Improvement of natural rubber agricultural production techniques.
Project N°:91/02/12
Title: Exploitation of unselected rubber grove for production of rubber coagula.

Objectives:

- To earn revenue from unselected trees in the institute,
- To explore profit margins available in grove rubber in this part of the country,
- To obtain information for feasibility reports from local unselected trees.

Contents:
The unselected grove trees are in two zones : Uhie and Obayantor.
Records taken both for estimation of dry rubber produced and tapper efficiency assessment are as listed for plantation.

Department responsible: Physiology and latex exploitation.
Investment cost (en Naira): Unknown
Results already obtained :
On going experiment.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°:91/02
Title: Improvement of natural rubber agricultural production techniques.
Project N°: 91/02/13
Title: Development of "Rain guards" for use in Nigerian rubber plantations.

Objectives:

- To prevent rain water dilution and washing away of rubber latex during tapping,
- To prevent labour wastage during rain.

Contents:
Experiment on comparison of two methods of achieving rain guard:

- developed in Malaysia,
- originating from RRIN.

Department responsible: Physiology and latex exploitation.
Investment cost (en Naira): 22.500
Results already obtained :
New experiment.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°:91/03
Title: Development of rootstock and budwood material.
Project N°:91/03/01
Title: Studies on the techniques for reducing immaturity of natural rubber.

Objectives:

- To study the effects of lifting method and the age of budded stumps at transplanting on transplant shock and field establishment success of Hevea brasiliensis.
- To study the time taken for stumped budding (advanced planting materials) to attain maturity after transplanting into the field,
- To reduce the immaturity period of rubber.

Contents:
Experiment 1
Treatments:

- lift and plant same day - control,
- dig and cut part of the roots and cover roots for two weeks before lifting and planting,
- dig and cut parts of the roots and expose them for two weeks before lifting and planting,

Three replications.

Experiment 2
Locational trials of the use of stumped buddings in different parts of the growing rubber belt of Nigeria. These will include Akwete sub - station, Calabar and Igbotako sub - station. Visits will be made to Adeola Odutola Farms, where a substantial quantity of stumped buddings were purchased for planting from the Institute.

Department responsible: Agronomy Division.
Investment cost (en Naira): 13.000
Results already obtained :

The project is being undertaken as a continuation of project 90/03/01 (Techniques for reducing immaturity period of rubber) which was commenced in 1988. The earlier field planting of budded stumps had to be discarded owing to failure resulting from hard pans created by the bulldozer in the field.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/03
Title: Development of rootstock and budwood material.
Project N°: 91/03/02
Title: Studies on nursery diseases of Hevea brasiliensis.

Objectives:

- Evaluation of damage caused by helminthosporium to rubber seedlings in nursery,
- Evaluation and control of Gleosporium leaf spot in the budwood nursery,
- Studies on the phylloplane fungi of seedling and budwood nurseries of hevea Brasiliensis.

Contents:
Experiment 1.
Treatments

- shading,
- irrigation,
- fertilization,
- mulching.

Data collected: plant heigh, plant girth, plant vigour, leaf area index and budding success;

Experiment 2.
Assessment of the incidence of Gleosporium leaf spot and effective control measures on seedlings budgrafted with selected clones of the NIG 800 series.

Experiment 3.
Monthly and diurnal sampling of phylloplane fungi of both seedling and budwood nursery plants. Two culturing methods: serial dilution technique and ballitospore method. Pathogenity tests. Control measures.

Department responsible:Plant pathology/ Microbiology.
Investment cost (en Naira): 15.000
Results already obtained :
The experiment on the evaluation of dammage caused by Helminthosporium to rubber seedlings in the nursery were initiated in 1989. The pathogen Helminthosporium were isolated from infected rubber seedling. Leaves from the nursery and pure culture maintened on agar slant in Mo - Cathney bottles in the laboratory. A one hectare of land was bulldozed at the nursery site for the establishment of seedling nursery. 800 seedling comprising of three clones viz. RRIM 600, GT1, and Tjir 16 were planted in Sept. 1989. In november 1989, shades were constructed over three beds of each of the clones. Starting from november, heights and girth measurements of the seedlings were taken on weekly basis. Data collection continued till september 1990 when the seedlings were 12 months old. The data will be analysed statistically to confirm if there is any significant difference in the effect of shading.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMMES

Programme N°: 91/03
Title: Development of rootstock and budwood material.
Project N°: 91/03/03
Title: Root stockscion compatibility and its effect on Hevea growth and development

Objectives:
To investigate rootstock - scion compatibility in rubber clones as it affects budding success, plant growth, nutrient uptake and rubber productivity.

Contents:

Factorial experiment on RCBD with three replications. Five hevea clones. Each of these clones will be budded on itself and the other four.

Department responsible: Soils and plant nutrition.
Investment cost (en Naira): 5000
Results already obtained :

New experiment.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/03
Title: Development of rootstock and budwood material.
Project N°: 91/03/04
Title: Commercial production of planting material.

Objectives:

Mass production of rubber planting materials for commercial purpose.

Contents:

8 hectares of rootstocks nursery with plant holding capacity of 700.000 seedlings on conventional seed bed nursery.

Department responsible: Nursery division.
Investment cost (en Naira): 259.795
Results already obtained :

New.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/04
Title: Utilisation of natural rubber and by - product of rubber tree..
Project N°: 91/04/01
Title: Studies on the characterisation and utilisation of natural rubber.

Objectives:

- To demonstrate the commercial viability of latex and coagula production,
- To investigate processing behaviour and the properties of crumb rubber produced from the RRIN 800 serie clones,
- To determine the physical, chemical and technological properties to be identified with various grades of Nigeria standard crumb rubber,
- To produce, test and use thermoplastic natural rubber,
- To produce and test poly(metthyacrylamide) PMAA and poly(methylmethacrylate) PMMA, modified natural rubber.

Contents:
Experiment 1.
Latex production and marketing.
Data collection:
- daily field coagula production and sales,
- tree population tapped per day, hydrometer based measurement of bulk dry rubber content, weight of latex drippings etc...

Experiment 2.
Characterization of natural rubber latex of NIG 800 serie clones and their derivatives.
Experiment 3.
Determination of standard techniques for the production of Nigerian standard crumb rubber,
Experiment 4.
Production and utilisation of thermoplastic natural rubber.
Experiment 5.
Graft copolymerisation of MAA and MMA monomers into natural rubber

Department responsible:Physiology and latex exploitation
Investment cost (en Naira): 2.000.000
Results already obtained :

On going experiment.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/04
Title: Utilisation of natural rubber and by - product of the rubber tree.
Project N°: 91/04/02
Title: Quality assurance on Nigeria natural rubber.

Objectives:

- To help carry out analysis with a view to determine the various grades of rubber produced by estates and processing factories before export,
- To assist an offering suggestion based on our fiding on how to improve various grades of rubber produced in Nigeria.

Contents:

- written reminders will be sent to all the 23 estates that had earlier been written,
- personnal visits will be carried out if the response is still not encouraging,
- analysis of the questionnaires to enable the determination of interested estates and the modalities for carrying out the test be worked out,
- visits to laboratory where similar tests are conducted to know their terms.

Department responsible: Extension and research liaison service.
Investment cost (en Naira): 25.000
Results already obtained:

On going experiment.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°:91/04
Title: Utilisation of natural rubber and by - products of the rubber tree.
Project N°: 91/04/03
Title: Studies on the storage of the rubber seeds.

Objectives:
To determine the optimum conditions for the storage of rubber seeds and guarantee good quality seed always for the oil manufactures.

Contents:

- to effectively control the presence of insects and moulds on the seeds and seed cake,
- to determine the optimum moisture level to which rubber seeds should be dried prior to storage.
- to determine the optimum drying temperature for rubber seed cake,
- to determine the optimum storage conditions of rubber seed oil.

Department responsible: Plant pathology/ microbiology.
Investment cost (en Naira): 13.000
Results already obtained :

Studies commenced in 1986.
Rubber seed must be dried before storage.
Aspergillus and penicilium association, Tribolium and unidentified moth also associated were found to be the cause of seed deterioration.
Optimum temperature of drying was 70° C.
Insect infestations were controlled by photoxin .

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°:91/04
Title: Utilization of natural rubber and by - products of the rubber tree.
Project N°: 91/04/04
Title: Design and fabrication of rubber seed processing equipment

Objectives:
- To develop, design and fabricate an efficient extraction equipment for rubber seed oil on semi - commercial scale.
- To develop an efficient purification equipment for rubber seed oil.

Contents:
- The imperfections in the already developed screw press will be corrected.
- The impurities in the rubber seed oil and the extend they are present will be determined.

Department responsible: End use.
Investment cost (en Naira): 250.000
Results already obtained :
- A flowchart for the rubber seed processing has been establish.
- Equipment for the following operations have been fabricated/purchased: Dehuling, milling and hydraulic pressing.
- A mechanical screw press has been designed and fabricated at RRIN's workshop. Work is going to improve this design.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/04
Title: Utilization of natural rubber and by - products of the rubber tree.
Project N°: 91/04/05
Title: Purification and storage of rubber seed oil.

Objectives:
- To evaluate some Nigerian clays for their natural and activated bleaching power.
- To determine the keeping quality of rubber seed oil and factors affecting it.

Contents:
- by the end of the project a suitable local clay would have been obtained for the bleaching of rubber seed oil.
- Factors that cause rancidity of rubber seed oil would have been highlighted.
- The best method of keeping rubber seed oil without it turning rancing for at least a year would have been found.

Department responsible: End use
Investment cost (en Naira): Unknown
Results already obtained :
Peroxyde values of the rubber seed oil was determinated every two weeks for five months. There was gradual rise in the peroxyde value for four months, followed by sudden fall of peroxyde value. The interpretation of this finding is that hydroperoxyde is an intermediate or precursor of what is actually responsible for rancidity. When this hydro-peroxyde is eventualy broken to aldehydes, ketones, etc..., there will be no peroxyde to measure in the oil and this accounts for the low peroxyde value of the oil after four months.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/04
Title: Utilization of the natural rubber and by - products of the rubber tree.
Project N°: 91/04/06
Title: Utilization/Applications of the rubber seed oil.

Objectives:
- To develop the potential of the rubber seed oil as raw material for a number of manufacturing industries.
- To prepare rubber seed oil modified alkyn resins.
- To prepare printing ink from rubber seed oil and its alkyn resins.
- To enhance the quality of rubber seed oil alkyds as surface coating materials.
- To enhance the quality of rubber seed oil as a paint vehicle and stabilizer from PVC through epoxydation.

Contents:
- Generation of public awareness of rubber seed oil for the production of liquid soap, hair shampoo and skin cream.
- preparation of rubber seed oil modified alkyn resin
    - Establishment and evaluation of pilot plant.
    - Preparation of pigmented and clear coatings.
    - Modification of the oil by blowing, boiling and addition of metalic dryers.
- Preparation of printing inks.
    - Effects and evaluation of blending rubber seed oil with oil modified alkyn resins.
    - Determination of the best type of oil modified alkyn resin for printing inks.
- Production of corrosion resistant and marine paints.
    - Suitable methods of preparing chlorinated rubber.
    - Production of various blends of chlorinated rubber and oil modified alkyn resins.
    - Determination of the best blend for the purpose.
- Production and utilization of epoxided natural rubber.
    - Use epoxyded rubber seed oil and blends of epoxided rubber seed oil and rubber seed oil modified alkyn resins as paint vehicle.

Department responsible: End use

Investment cost (en Naira): Unknown

Results already obtained :

Liquid soap and hair shampoo have been formulated and produced. They have Ph between 7 and 9, pleasant smell and rich lather . They are stayed for up to a year without changing color or having two phases or sediments. Different formulations of alkyn resins modified with crude rubber seed oil have been prepared on a laboratory scale. Pigmented as clear coatings have also been made. The results compare favourably with industrial standards. Aquisition of a pilot plant scale alkyd reactor is being pursued vigourously. Alkyd resin derived from rubber seed oil served successfully as a pigment binder to produce uniformed dispersed printing inks.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/04
Title: Utilization of the natural rubber and by - products of the rubber tree
Project N°: 91/04/07
Title: Utilization/Application of the rubber seed meal.

Objectives:
- To study the effect of intrinsic toxin.
- To investigate pathologic effect on specific organs.
- To study effect of inclusion of RSM in the diet of blood chemistry - Safety merits for human consumption.
- To determine measurement of tissues and tissue composition.
- To determine the optimum level of RSM in the diet
- To determine the protein quality of RSM.
- To study the effects on reproductive organs.
- The use of RSM as a nutrient medium for the cultivation of the fungi.
- To cultivate pure isolate of various fungi.

Contents:
To establish whether or not RSM could be used as sole source of crude protein in the diet for rabbits and broiled birds.
Optimum level of inclusion.
Versatility of the use of RSM in the diets of animals that are producing young ones.
Suitability of deflatted RSM as a nutrient base for various fungi.

Department responsible: Farming systems
Investment cost (en Naira): 400.000
Results already obtained :
Studies on the toxological evaluation of RSM in the nutrition of farm animals is an on going one.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/05
Title: Development of integrated farming system for rubber.
Project N°: 91/05/01
Title: Intercropping of young rubber with food crops.

Objectives:
- To study the growth of rubber as a sole crop and when intercropped.
- To ascertain the changes in the soil properties arising from intercropping rubber with food crops.
- To provide authentic data for the determination of economic returns arising from intercropping of young rubber with food crops.

Contents:
Second year rotation of two food crops and a fallow plot.
Experime nt 1.
Three course rotation of yam, maize and fallow (cow pea)
Experiment 2.
Continuous intercropping with maize and cow pea until closure of rubber canopy.
Soil sampling before and after each cropping season.

Department responsible: Agronomy 15.000
Investment cost (en Naira):
Results already obtained :
On going experiment.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/05
Title: Development of integrated farming systems.
Project N°: 91/05/02
Title: Intercropping with food crops in budwood nursery.

Objectives:
To investigate the profitability of intercropping practices in budwood nurseries.
- improvement of the soil properties when intercropped with legumes.
- Yield some revenues from the sale of the products.

Contents:
Treatments:
- Rubber
- Rubber + Melon.
- Rubber + Melon + Soybean.
- Rubber + Soybean.

Department responsible: Soils and plant nutrition.

Investment cost (en Naira):

Results already obtained :
New experiment.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/05
Title: Development of integrated farming system.
Project N°: 91/05/03
Title: Rearing of animals in mature rubber plantations.

Objectives:
- To rear the West African Dwarf (Fouta Djallon) goat under mature rubber plantations.
- To develop the farming of the West African Geant Snail under mature rubber plantations.
- To incorporate broiler birds and table eggs production under mature rubber plantation.
- To introduce the rearing of rabbits under mature rubber plantation.
Reduction of the cost of clearing plantation by introducing goats.

Contents :
- Herbage species prefered by goats.
- Unpalatable species.
- The most economically feasible material for the construction of open snail paddock.
- Parents stocks of breading snails.
- Production of table birds/ table eggs and the rearing of rabbits

Department responsible:Farming systems
Investment cost (en Naira): 368.000
Results already obtained :
- Studies on the rearing of West African Dwarf goat.
- Estimation of quantity of herbages growing under rubber
- Stocking rate of goats under mature rubber is 53 to 54 goats in a six paddock unit each paddock measuring one hectare and rotationaly greased for one month.
- Identification, taxonomy and chemical analysis of herbages growing under mature rubber.
- Preliminary studies on open snail paddock system as recommanded by ELSMLIE (1987) will soon follow.
- Integration of poultry production and rabbits rearing is new.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/05
Title: Development of integrated farming system for rubber.
Project N°: 91/05/04
Title: Economics of rubber production in Nigeria.

Objectives:

- To determine a structure of cost and return for rubber plantations.
- To determine the right compensation in case of compulsory acquisition or otherwise at any point in the life of the plantation.

Contents:
Use of questionnaire to collect data and information from all segments of rubber estates as well as analysis of the data.

Department responsible: Extension and research liaison office.

Investment cost (en Naira): 45.000

Results already obtained :
On going study.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°:91/06
Title: Extension and research Liaison Service.
Project N°: 91/06/01
Title: Dissemination of Institute's research findings and obtaining response to RRIN recommendations.

Objectives:
- To disseminate the research findings in both natural rubber farmers and agro-allied industries all over the country.
- To monitor the problems of the various rubber clientele thus enabling RRIN research personel gain access to the pratical problems experienced by the rubber industry.
- To evaluate the response of the users of the RRIN recommendations vis a vis the expectation of the Institute's research personnel and those of the rubber farmers and rubber products manufacturers and remillers.
- To establish a reliable data bank on rubber which can be used for planning, in research, production and marketing programs.

Contents :
- Materials for the publication of the annual report.
- Collection of data on annual production, export and local consumption of natural rubber in Nigeria.
- Planned programme for research, production and marketing of natural rubber for the decade 1990 - 2000.
- In road into some other areas not yet growing rubber but whose soil type and microclimate may support rubber cultivation.

Department responsible : Extension and Research Liaison Service
Investment cost (en Naira): 304.500
Results already obtained :
On going studies.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/06
Title: Extension and Research Liaison Service.
Project N°: 91/06/02
Title: Survey of production, consumption and utilization profile of natural rubber in Nigeria.

Objectives:
- To establish and maintain a reliable Nigeria data bank on the rubber industry.
- To use the data for planning programmes in the area of research, production and projection.
- To enable policy formulation and evaluation.

Since the demise of Nigerian Rubber Board in 1985, the RRIN is the only Federal Government Agency specifically mandated to work on rubber in Nigeria.

Contents:
- To update the data on annual production export and local consumption of natural rubber in Nigeria for the years 1988 - 1990.

Department responsible: Extension and Research Liaison Service.
Investment cost (en Naira): 35.000
Results already obtained :
On going studies.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/07
Title: Research on improved production techniques of Funtumia and other latex producing plants.
Project N°: 91/07/01
Title: Nursery studies on Funtumia and acacias species.

Objectives:
- To acquire a standard technique for propagating the crop.
- To establish a method for raising the seedlings and maintaining them in the nursery prior to field planting.

Contents :
Commencement of nursery studies on growth media, watering, shading, weeding and mulching requirements of Funtumia seedlings in polybags and ground nurseries.

Department responsible: Physiology and Latex Exploitation.
Investment cost (en Naira): 56.500
Results already obtained :
Plants of these categories are completely new in the Institute.
They have been studied under conditions that are allien to their Nigerian habitat.
On going Studies.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/07
Title: Research into improved technique of Funtumia and other latex producing plants.
Project N°: 91/07/02
Title: Field plantation establishment and maintenance of Funtumia and acacia species.

Objectives:
- To find out the effects of spacing and fertilizers application on the field growth and hence determine the optimum planting distance.
- To plant out a 7 hectares field of funtumia for further experimental work.
- To carry out a survey of the diseases and pests of Funtumia species, identify them, assess their importance and devise means of controlling them.

Contents:
Commencement of work. Transplanting of Funtumia seedlings in the 7 hectare land for establishment of the Funtumia plantation.

Experiment 1.
Four spacing treatments.
Three fertilizers treatments.
Randomized complete block.

Experiment 2.
Various spacing and planting patterns in the 7 hectare piece.

Department responsible: Agronomy
Investment cost (en Naira): 40.000
Results already obtained :
On going studies. Work began on this project with the planting of Funtumia seeds in the pre - nursery in january 1988.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/07
Title: Research into improved production techniques of Funtumia and other latex - producing plants.
Project N°: 91/07/03
Title: Morphological studies and exploitation techniques (tapping systems) for Funtumia and Acacia Species.

Objectives:
- To distinguish between the two species of Funtumia (Funtumia Elastica and Funtumia Africana).
- To investigate into the form and function of latex vessels.
- To acquire effective method of tapping Funtumia latex.

Contents :
Examination of leaf, stem and pod morphology. Stem bark anatomy in liaison with the University

Department responsible: Physiology and Latex Exploitation
Investment cost (en Naira): 101.000
Results already obtained :
It is obvious from our preliminary studies that the tapping method presently in use for exploiting Hevea rubber is most inadequate for Funtumia.
On going studies.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°: 91/07
Title: Research into improved production techniques of Funtumia and other latex producing plants.
Project N°: 91/07/04
Title: Characterisation and processing of Funtumia Elastica and Funtumia Africana latex.

Objectives:
- To acquire knowledge on scientific methods of effecting Funtumia latex coagulation.
- Processability of Funtumia latex.
- The properties and behaviour of products manufacturable from Funtumia latex in actual service life.

Contents :
- Acquisition of requisite chemicals and materials for work.
- location of Institution where test facilities are available.

Department responsible: End use
Investment cost (en Naira): 35.050 excluding optical and electron microscope.
Results already obtained :
New studies.

RUBBER RESEARCH INSTITUTE of NIGERIA

1991 RESEARCH PROGRAMMES

Programme N°:91/07
Title: Research into improved techniques of Funtumia and other latex producing plants.
Project N°: 91/07/05
Title: Establishment of an arboretum of economic latex producing trees in RRIN.

Objectives:
- To indentify all localy available latex producing trees species of economic importance and plant them in one location towards their conservation and exploitation.
- To identify other latex producing plant species alien to Nigeria, import them and plant them within the Institute.

Contents :
- To embark on visits to all the relevant institutions to identify all the economic latex producing trees, collect seeds and/or other propagules.
- Establishment of a nursery from the collected planting materials preparatory to their use for plantation establishment.

Department responsible:Physiology and latex exploitation
Investment cost (en Naira): 165.000
Results already obtained :
New study.

NATURE OF SOILS AT RRIN

PHYSICAL AND CHEMICAL ANALYSIS

LOCATION	DEPTH (CM)	% SAN	% SELT	% CLAY	TEXTURAL CLASS	PH H20	PH IN KCL	% OC	AVAIL P (PPM)
RSS1	0-7.5	92	5	3	S	5.35	4.45	2.56	6.9
	7.5-15	87	5	8	LS	5.45	4.35	1.28	1.5
	15-30	75	5	8	SL	5.50	4.35	1.16	1.2
	30-105	73	5	20	SCL	5.60	4.35	0.93	1.0
	105-120	75	7	18	SL	5.60	4.35	0.64	-
	120-180	71	3	26	SCL	5.45	4.35	0.50	-
	K	NA	CA	Mg (Me/100 g soil)					
ST 15 + 16	0.15	0.09	0.02	1.10	0.24	5.00		0.75	11.40
Q3 + 4	0.15	0.05	0.02	0.25	0.66	4.10		0.79	6.20
OP6 + 7	0.15	0.06	0.02	1.15	0.06	4.35		0.84	8.00
N9	0.15	0.05	0.02	0.55	0.06	5.45		1.07	11.70

PAMOL - SAPELE

CROP: RUBBER — ANALYSIS OF HECTARES - PRODUCTION (TONNES) - YIELD PER HECTARE

YEAR OF PLANTING	CLONE	HECTARES		PRODUCTION (M/T)			CROP PER HECTARE (KILO)															
		1990	1991	AE 1990	LE 1990	AE 1991	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	AE 1990	LE 1990	AE 1991	PE 1992
1963	RRI 513	12	12	8	11	15	1460	1220	1324	2056	1658	1301	1660	1250	1083	766	1125	791	667	667	917	1250	1083
	RRI 605	11	11	6	7	6	1849	1616	1794	2276	1985	1596	1163	909	727	871	808	489	499	545	636	545	545
1965	RRI 623	48	48	30	29	26	2361	1808	1978	2015	1820	1706	1130	750	1041	861	864	552	577	625	604	542	500
	PB 5/51	27	27	23	19	20	2397	2002	1842	2024	1847	1577	1042	686	963	1107	796	488	786	852	704	741	852
1966	RRI 623	8	8	8	11	15	1600	1873	3131	2896	2141	1930	2191	1250	1500	1432	1357	115	1240	1000	1375	1875	1750
	PB 5/51	19	19	11	12	13	1671	2052	2320	2135	1751	1679	1567	736	1000	1025	961	624	548	579	631	684	632
1967	RRI 623	24	24	16	13	19	1144	1389	1971	1665	1426	1143	1482	1041	1333	1037	1162	974	618	667	542	792	708
	PB 5/51	24	24	14	12	18	1327	1558	2331	2140	1629	1389	2874	916	958	964	912	604	391	583	500	750	708
1975	RRI 600	39	39	71	50	73						685	1241	974	1487	2001	2168	1705	1609	1820	1282	1741	1615
	PB 5/51	21	21	26	29	27							262	1290	613	1059	1172	1063	1238	1238	1286	1782	1718
1977	RRI 600	7	7	1	9	10									900	916	1172	1485	548	1143	1786	1429	1571
1983	RRIM 600	8.6	8.6	-	-	1																116	814
		240	248.6	214	202	243																	
HECTARES							667	640	595	593	533	530	559	554	503	410	240	210	210	210	210	218.6	218.6
KILOS / HECTARE							1398	1038	1210	1285	1698	1282	999	606	698	898	1056	1076	860	892	812	977	965
PRODUCTION (METRIC TONS)							892	695	720	761	905	680	566	336	357	368	254	1258	206	211	202	243	240

Annex 6

Annex 7

ASPECT OF TAPPING PANEL

Initials and abbreviations

CBN	Central Bank of Nigeria
CDC	Commonwealth Development Corporation
EDF	European Development Fund
EEC	European Economic Community
EIB	European Investment Bank
Ha	Hectare
IRCA	Institut de Recherches sur le Caoutchouc
MAE	Ministère des Affaires Etrangères
RPPTA	Rubber Producers and Processors Trade Associates Limited
RRIN	Rubber Research Institute of Nigeria
RSS1 - 2	Ribbed Smoked Sheet 1 or 2
SMR	Standard Malaysian Rubber
SNR	Standard Nigerian Rubber
WB	World Bank

Chronology of the mission

. J. Viratelle, from September 16th to October 13th
. P. Drouet, from August 15th to 29th and from October 1st to 14th
. J. Sainte-Beuve, from September 17th to 22nd

August 15th Arrival of Mr Drouet in Lagos

August 16th Meeting with Mrs Barret, French Embassy
Meeting with EEC representatives : Mr Humphrey and Mr Zuik
Transfer to Benin City
Meeting with Mr Egbase

August 17th Tour of the RRIN and meeting with Dr Okaisabor, Director and Dr Fasina, Assistant Director
Plant Breeding Department : Mr Omokheage and Mr Aghughi

August 18th Meeting with Mr Comyn (Michelin) at Benin City

August 20th Tour of the RRIN with the Plant Breeding Department searchers

August 21st Tour of the clone fields of the Garick Rubber Plantation with the Plant Breeding Department searcher and Mr Sagay, Agronomy Department, Dr Olapado, Plant Breeding Department, Mr Igene, Physiology and Latex coagulation

August 22nd Tour of the Osse River plantation (Michelin) with Mr Wierre

August 23rd Tour of the Farming System Department with Mr Awah and Mr Assawalam, Soil and Plant Nutrition Department.

August 24th Benin City. Tree Crops Agricultural Project Mountering and Evaluation Unit (EEC project) : Dr Ologide, Mr Garland, Mr Renter
Tour of the phytopathology Department (RRIN) with Mrs Igeleke.

August 25th Benin City. Meeting with EEC representative, Mr Renter.

August 26th Transfer to Lagos
Meeting with Mr Bizalion

August 27th Meeting with Mrs Barret, French Embassy
Meeting with EEC representative in Lagos, Mr Gigugliaris

August 28th Meeting with a World Bank representative, Mr Turtnainen
Preparation of the draft report.

August 29th Departure of Mr Drouet

September 17th	Arrival of MM. Viratelle and Sainte-Beuve in Lagos Meeting with Mr Bizalion - Mrs Suard, French Embassy - Mr Deltheil, Michelin representative in Nigeria
September 18th	Transfer to Benin City Meeting with Mr Wierre (Michelin)
September 19th	Tour of the RRIN Meeting with Dr Okaisabor, Dr Oseloka BC Uraih, RRIN and the Agro extension research liaison, Dr Halufohai Adm. Secretary
September 20th	Tour of the RRIN, meeting with : Dr Okaisabor, Director Dr Fasina, Assistant Director Dr Utoide, phytopathologist Edith Begho, phytopathologist Dr B. Anwanko, chief Dept Physiology
September 21st	Tour of the Osse River Estate Plantation (Michelin) Meeting with Dr Okaisabor (RRIN)
September 22nd	Transfer to Lagos Meeting with Mr Bizalion in Lagos Departure of Mr Sainte-Beuve
September 23rd	Study of the documents from the World Bank and RRIN
September 24th	Meeting with Mrs Suard, French Embassy, Mr Pablo Pardo Ortiz, EEC Counsellor, Mr Guy de Paep, Project coordinator for Indufina, for Ciaco (ex Socfines). Meeting with Mr Bizalion
September 25th	Transfer to Benin City Tour of smallholdings near of RRIN
September 26th	Tour of the RRIN, meeting with : . S.G. Halufohsi . Dr Oseloka, Ag. Extension Services . Dr Okaisabor . Mr Ohiokpehai, Financial Dept . Dr Olapade, chief of Breeding of improved division . Mr A.A. Ikheloa . Dr V.O. Otoide, chief of Pathol. Division . Mr Arasowan, Estate Management Division
September 27th	Tour of the RRIN, meeting with Mr Arasowan (Plant.), Mr Alufohai (Adm.), Mr Asawalam (Sols)
September 28th	Tour of smallholdings near the road Benin-Warri (90 km)
September 29th	Meeting with Mr Comyn (Michelin). Transfer to Lagos.

September 30th	Preparation of the draft report
October 1st	Independance day in Nigeria. Arrival of Mr Drouet
October 2nd	Meeting with the secretary of RPPTA and Natural Rubber Association and Mr Egbase Transfer to Delta Rubber
October 3rd	Tour of Delta Rubber Plantation, Mr Nwala Transfer to Calabar
October 4th	Tour of Pamol plantation with Mr S.V. Akpan Transfer to Oweri, tour of Obiti plantation, Rubber Estate with Mr Linus and Mr Okeke
October 5th	Meeting with Mr Detrieux (IREL) Transfer to Benin City
October 6th	Tour of Pamol plantation at Sapele with Mr Kolowale Meeting with 4 Michelin expatriates in Benin MM. Wierre, Merceron (Clermont), Le Trionnaire, Heems, Pericart
October 7th	Preparation of the draft report
October 8th	Meeting with Mr Ogowewo, Director of RPPTA and Natural Rubber Association Meeting with Dr Okaisabor, RRIN
October 9th	Tour of the Plantation Integrated Limited (Mr Esegobor)
October 10th	Tour of a factory and plantation of Garrick Company Tour of a factory of Iyayi Company
October 11th	Tour of the Araromi Plantation (Michelin) Transfer to Lagos
October 12th	Meeting with EEC representative, Mr Gigugliaris Meeting with the Indufina manager, Mr Vandamme Departure of Mr Viratelle
October 13th	Preparation of the draft report
October 14th	Departure of Mr Drouet.

List of persons met during the mission

MM.	Agkughi	RRIN Plant Breeding Department
	Asamawai	Plantation Manager Rubber Estate
	Akpau S.V	Plantation Manager Pamol
	Alufohai	Administrative Secretary RRIN
	Arasomwan	Estate Manager RRIN
Dr	Asawalam	Chief of soils department RRIN
Mme	Barret	Attaché Culturel, Ambassade de France
M.	Bizalion	Correspondant de l'IRCA au Nigeria
Miss	Begho Edith	Phytopathology officier RRIN
MM.	Comyn	Managing Director Michelin à Benin City
	Detrieux	General Manager IREL
	Deltheil	Group Chief executive Michelin Lagos
	Egbase	Correspondant de M. Bizalion à Benin City
	Emeka	Secrétaire du RPPTA
	Esegobor	Managing Director, Plantation Integrated Limited
Dr	Fasina	Chief of Technology Division, Directeur adjoint RRIN
MM.	Garland	CEE, Benin City
	Garrick	General Manager Garrick Group (planteur et usinier)
	Gigugliaris	CEE, responsable du projet réhabilitation du RRIN
	Humphrey	Chef de mission CEE Lagos
	Heems	Plantation Manager Michelin
	Igeleke	RRIN, Principal Research Officer, phytopathology
	Igene	RRIN, Physiology and Latex exploitation Department
	Ikhzloa A.A.	Financial Department RRIN
	Iyayi Efranayi	Group chairman
Dr	Iyayi Osaheni	Corporate Strategist
MM.	Kolewale	Plantation Manager Pamol Sapele
	Le Trionnaire	Plantation Manager Michelin
	Linus E. Okekee	Plantation Manager IREL Obiti Estate
	Merceron	Technology Process Michelin France
	N'desi	Delta Rubber Company, Plantation Manager
Dr	Nwanko B.A.A.	Chief department physiology
M.	Nwala	Secrétaire Général Delta Rubber
Dr	Okaisabor	Director of RRIN
MM.	Ologide	Project Manager Tree Crops Agricultural Projects - Monitoring and evalutation unit
	Omokheage	RRIN, Plant Breeding Department
	Oseloka B.C. Uraih	Agro-extension and research liaison
Dr	Otoide	Chief of Pathology Division
MM.	Ortiz Pablo Pardo	CEE Counsellor
	Ohiokpehai	Financial Department RRIN
Dr	Olapade	Chief of breeding of improved division
MM.	Ogowewo	Executive Director RPPTA
	Guy de Paep	Indufina - Ciaco

MM.	Pericard	Managing Division Michelin
	Renter	CEE, Benin City, Tree Crops Project
	Sagay	RRIN, Agronomy Department
Mme	Suard	Attaché culturel à l'Ambassade de France
MM.	Suard	Attaché économique à l'Ambassade de France
	Turtuainen	Banque Mondiale, Lagos
	Van Damme	Directeur Général du Ciaco (formation finances)
	Wierre	Agronome Inspecteur de plantation Michelin
	Zuik	CEE, Lagos.

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5. Rubber Research Institute of Nigeria. Priority research programmes as at June 1989.
6. Rubber Research Institute of Nigeria. Research programmes and allied activities. Progress Report Review Session, 13-15 June 1989
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12. IRCA. Mission report at SOCFINCO. D. Nicolas, May 1988.
13. Encyclopedia Universalis. Atlas statistique 1989.

Documents collected during the mission

RRIN Coût d'établissement de 1000 ha de plantations
RRIN 1990 - Research and production proposal
RRIN 1989 - Approved research programme
RRIN 1981 - Annual report
RRIN 1987 - Annual progress report
RRIN 1988 - Annual progress report
RRIN RRIN in brief
RRIN 1990 - Audit externe (Spiro poulos Audit)
RRIN Plan de concession
RRIN Staff Nominal Roll 15th 06.90
Co-operation schema 12th 07.88
PAMOL 1977 - 1989 analyse des rendements par clone et par an
Delta Rubber Brief on September 1990
Spectrum Road Map of Nigeria (90)