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1. **Background Situation**

Natural rubber production, carried out by modern methods and using improved plant material, is the most profitable use for much of the evergreen rainforest belt of Southern Nigeria. It has been estimated that there are more than 350,000 acres of mature rubber planted in Nigeria plus 150,000 immature acres.

In 1966, 64,000 tons of rubber were exported valued at some £11,411,000. This is a labor intensive industry that it is estimated provides direct employment for more than 130,000 people. The industry is centered in the Midwest State where it is the most important source of income. Important quantities of rubber are also produced in areas around Port Harcourt and Calabar and in the southwestern part of the Western Region.

Climate and soil conditions are nearly ideal for rubber growing over a vast area of land in Southern Nigeria much of which is under-utilized at present. Proof of the potentialities of rubber growing in this area can be seen on the several company-owned estates which have been started in recent years with adequate trained staff and capital. The 350,000 acres of mature rubber estimated to exist in Nigeria, if it were of top grade plantings, should yield nearly 200,000 tons of rubber instead of 64,000 tons with very little more labor input than the present plantings.

World rubber prices have been falling for some time and are presently about $.20 per pound. It is felt to be unlikely that they will go much lower since at this level production of both natural and synthetic is probably being reduced. Cost of production on an efficient, modern plantation should be $.10-$.12 per pound which even at present price levels leaves an adequate profit margin.

At present, world consumption is made up of roughly 50 percent synthetic and 50 percent natural rubber with, for most purposes, price determining which type is used. The cost of production of natural rubber is lower than that of synthetic. Furthermore, increasing productivity in the planting industry has more than cancelled out rising labor cost for many years. It seems likely that the present situation will continue for the foreseeable future; whereby all the natural rubber which is produced finds a market, at a price slightly above the cost of producing synthetics, while the synthetic producers supply the balance of the demand.

The quality of rubber as it comes from the trees in Nigeria is equal to that from any other rubber growing region. However, due to peculiar sociological and economic conditions, the rubber is usually adulterated or poorly processed before it reaches the exporter. This situation must be remedied if Nigeria hopes to maintain a place in the world rubber market.

Through the use of presently recommended techniques and planting materials, local planters can be assured of yields three to four times the present national average of about 300 pounds per acre per year. Based on the results of research in other rubber growing regions, it can be confidently predicted that a program of applied research in Nigeria will be able to further increase yield potentials of local plantings to six or seven times the present national average. The time necessary to bring plantings to maturity can also be significantly reduced.

Encouragement of the rubber growing industry has been given a priority rating in the six year Nigerian Development Plan. Requests have been made to the World Bank, F.A.O., U.S. A.I.D., and private companies for help in developing Nigeria's rubber growing industry. Interest has been shown by all of these organizations. The World Bank has sent several study teams. F.A.O. has provided experts, several temporary and one permanent. USAID has now provided 2 experts plus commodities and several private companies have set up at least 10 plantations covering some 50,000-60,000 acres. Self development includes Regional Development Corporation Plantings; over 50,000 acres in all three of the old southern regions, Farm Settlement and School Leaver Farms, and numerous privately owned Nigerian plantings.

One of the chief difficulties being encountered in all of these efforts is the lack of research work done under local conditions. Recommendations can be made for planting materials, cultural treatments, disease control methods, etc., that are improvements over traditional methods but they cannot assure plantings of a quality to compete economically with Far Eastern or Liberian plantings.

In order to provide the Rubber Development Program with the best available means to accomplish its objectives, an applied research program working with plant materials, cultural practices, and improved extractive and processing methods that will yield the highest possible economic return under the environmental and social conditions prevailing in Nigeria, is essential.

Answers to the problems and uncertaintities already encountered in the extension program and on estates developments have not, and will not, come necessarily from direct application of practices found to be successful in other rubber growing countries. Certain accepted methods may be transferable in total; however, the majority of these are better used as guides which must be adapted to local conditions.

It might also be noted that in order to make a break from the locally prevailing subsistence farming pattern, raise standards of living, and allow local capital formation, a good cash crop is necessary. To date there is no other crop that can approach the potentialities of rubber for this purpose in this area.

The Rubber Research Project was originated by the old Western Region Ministry of Agriculture with USAID Technical advice, a small amount of material assistance in the form of commodities, and financial assistance in the form of payment for construction costs of three buildings. Legislation has been written, and is only awaiting final Executive Council approval, setting up a Federal Rubber Research Institute of Nigeria which would take over the present project. The Rubber Research Institute would then become one of the group of Federal Agricultural Research Institutes which carry on most long term Agricultural Research in Nigeria.

It is contemplated that until the Institute will be able to develop its own staff and physical plant USAID would be able to continue to supply some technical and commodity assistance. The approved work plan suggests the need for eight experts to be supplied by foreign technical aid for varying periods of time between the present and until 1972, it is hoped USAID will supply at least three of these. Commodities required through 1972 total about $100,000 of which it is hoped that USAID can supply about 50 percent.

2. Project Targets and Goal Plan Objectives:

A. Short Range Project Targets:

Tree crop research is essentially a long term project. The project was started with absolutely no physical plant and no staff. There were no short range project targets.

B. Long Range Objectives:

i. Development of the physical plant of a central Rubber Research Station on a 5,000 acre site twelve miles south of Benin City in the Mid-West Region. The Station will eventually supply facilities and administrative support for a rubber research organization capable of serving the rapidly growing rubber industry of all Nigeria and cooperate with other stations, especially regionally, such as those in Liberia, Ivory Coast, and Congo.

ii. Gathering and training of a staff and labor force capable of planning and carrying on a rubber research program which will meet the needs of Nigerian farmers.

iii. Carrying out an applied research program to develop information under local conditions for transmittal to farmers by the extension division. Work on testing improved plant materials, propagating methods, planting systems, disease control, plant nutrition, tapping, and processing will be done.

3. **Project Results**

A. **Development of the Physical Plant.**

i. 5197 acres were gazetted for acquisition by the Western Region Government. Crop compensation has been completed on 3840 acres. Crop enumeration has been completed on the remaining 1357 acres. Survey for land compensation has been done and permanent markers placed on all corners.

ii. 21 miles of secondary roads have been constructed.

iii. 560 acres of land have been cleared, of which about 540 have been put into permanent experimental rubber plantings.

iv. Various buildings have been completed or are under construction :-

a. A prefabricated aluminium building on a cement slab (11' x 20') was first set up as a temporary office. It is now serving as a storage shed.

b. A cement block building (18' x 54') was later constructed which is serving as a combination office and storage shed at present.

c. A cement block warehouse (20' x 40') for fertilizer storage has been built.

d. Construction has just been completed of an administrative-laboratory building which is being financed by USAID.

e. Drilling of a deep well for water supply is underway. A 10,000 gallon water tank and pipelines for distribution have been completed.

f. Construction of two houses for USAID technicians is about 60 percent complete.

g. Construction of four 3-family junior staff houses is about 75 percent complete.

D. Recruiting and Training of Staff and Labor Force.

i. The Midwest Regional Government currently has an Agricultural Development Officer and six Junior Grade Officers assigned to the project. Additional senior staff have been promised as soon as some of the men at present on Future Agricultural Leader Scholarships return.

ii. A basic labor force of about 100 men has been built up composed of men trained in budding, pruning, pollinating, disease control, tapping, operation of special equipment, and office staff. Varying numbers of unskilled labor are employed according to needs.

iii. USAID provided one technical advisor from 1961-1966 and two advisors since April 1966.

C. Research Programs

i. Three acres of budwood gardens containing 121 clones imported from seven different countries have been established.

ii. Rootstock nurseries are planted each year. From these, rootstock for 540 acres of field plantings and the budwood gardens have been supplied. In addition some 480,000 clonal seedling plants have been supplied to the Extension Division for distribution to local farmers.

iii. A 35 acre field test comparing five different clonal seedling families, from seven seed sources, at four different spacings was set out in 1962. Data on growth, wind damage susceptibility, root disease incidence, and tolerance to Gloeosporium and Helminthosporium leaf disease have been collected from the planting.

Data on growth and leaf disease incidence were used to convince the Extension Division that they should change their recommended spacing for new plantings from 7' x 30' to 10' x 20' for clonal seedlings and 11' x 22' for budded rubber.

This area will be brought into tapping in October 1967. Publicity at that time will emphasize that PROPER CARE of IMPROVED PLANTING MATERIAL allows Nigerian planted rubber to come into production in five years instead of the usual ten to twelve years.

iv. Two 38 acre field tests to compare 59 of the imported clones were field budded in 1963 and 1964 respectively. Data on growth, form, leaf disease tolerance, and wind damage susceptibility are being collected.

A paper has been published on performance of the 30 clones in the older test. A summary of the observations taken is given. Also the clones are grouped, on the basis of performance, to 3 years of age only, into 3 groups: above average, average, and below average. This has been distributed widely and it is hoped will help many planters to avoid the costly mistake of planting clones classified below average.

v. The Nigerian Institute for Oil Palm Research carried out for us a fertilizer pot test with Hevea rubber seedlings. There were no significant responses. This information, which applied only to the virgin soils of Iyanomo, was incorporated in a letter to the Extension Division when they were preparing a publication on fertilizer practices for various crops.

vi. 100 acres have been planted to monoclonal blocks to provide material for future trials.

vii. Approximately 12 acres have been planted with 16 tree plots of each of the clones established at the station. This clone museum will provide certified budwood and data on clones not included in the various clone trials.

viii. Two 40 acre, polyclonal seed gardens have been planted. By 1970 they should be producing ample high quality clonal seeds to meet all the needs of the Midwest.

A small hand pollination program was started in 1965 to secure, for testing, representative populations of some of the families to be produced by these seed gardens. To date 377 plants representing 7 families have been field planted. Seeds from the 1967 pollinations are still on the trees.

ix. A 64 acre trial has been planted to compare the effects of the following treatments on the growth of rubber plantings and the cost of establishing them:

a. Burning of natural cover versus non burning in site preparation.

b. Dibble stick planting versus conventional holing.

c. 8 different ground covers.

x. The most important cause of tree mortality is root disease. Control work is also a significant expense item in a planter's budget. Two trials covering 62 acres have been laid out in an attempt to find preplanting treatments that will reduce subsequent losses and disease expenses.

xi. Tapping system demonstrations have been started on some of the old farm, rubber stands within the station boundaries.

xii. A comparison of fungicides for control of Helminthosporium leaf disease on nursery plants was completed. The results are being analyzed.

xiii. A new method of budding known as green budding is being utilized in some rubber growing areas to reduce the period between planting of seeds and maturity by as much as 6 months. The problems of using this technique in Nigeria is that the time of seedfall in relation to the dry season is such that transplanting of the green buddings has to be done at the beginning of the dry season. Two trials were carried out in an attempt to find a dependable, practical means of successfully establishing field plantings of green buddings. No successful method was found and attempts to use the green budding technique under Nigerian conditions are not being recommended.

xiv. A new chemical product designed to be used as a collar protectant against root disease was tested and found not to be as satisfactory as the presently recommended chemical. The company was so notified and the Ministry recommendation was not changed.

xv. Numerous leguminous cover plants have been introduced and tested. Seven species that appear to do well in this area are being maintained and seed is kept on hand for distribution to farmers in small amounts.

xvi. A clonal seed collection was requested from Malaya to be used for verification of clones. To date 66 lots have been received. Stands on several commercial estates have been checked at the request of the owners. In general, clonal identifications in Nigeria seem to be quite accurate.

4. Resources Employed

a. U.S. Resources Employed

(1) U.S. Funds (net obligations)

	Dollar	Counterpart and for U.S. owned local currency (Dollar equivalent)
Total (From FY 1961 /April/ thru FY 1967	386,000	—
Programmed for FY 1968	70,000	—

(2) Resources by Type

(a) U.S. Technicians

A rubber research advisor has been supplied since 1961, that is for 6½ years. Duties have been to advise the regional government on the planning and execution of the necessary steps for setting up a rubber research station.

A rubber pathology advisor has also been supplied since April 1966 to advise on the setting up of a research program in this field.

(b) Participants

To date no participants have been sent by the project. It is hoped that some students sent under the Future Agricultural Leaders program will be assigned to the project.

(c) Commodities

Some $107,000 worth of U.S. commodities have been supplied to the project or are on order. Major items have been agricultural and laboratory equipment, agricultural chemicals, and books and periodicals.

Without these commodities very little progress would have been made on the project since nearly all money available from the Nigerian Government has had to be spent on wages, crop compensation, and building materials.

Maintenance of mechanical equipment is a continuing unsolved problem. Funds, replacement parts, qualified mechanics, and qualified field operators are all in short supply.

(d) Other Resources

Funds to a total of $82,000 have been made available for the construction of three buildings which are in various stages of construction.

1. Administration - Laboratory: Cost $52,000, now complete.

2. Two technicians houses: Cost $15,000 each now 60 percent complete

(e) U.S. owned Local Currency:

None

(f) Counterpart Local Currency

None

b. Cooperating Country Resources Employed

(1) Total Value 1961 - 1967 (March)

$488,000

(2)

	Staff Salaries and Allowances	Labor	Materials	Crop Compensation	Fuels
1961-63	$ 8,450*	$58,000*	$16,800*	$185,000	-
1963-64	8,176	26,185	2,000*	-	-
1964-65	13,608	39,338	2,080	24,360	-
1965-66	11,228	52,532	9,794	-	1,406
1966-67	9,576	36,741	11,264	-	818

*Estimates

c. Resources Employed by Other Contributors

Funds for station operation were supplied by the Western Region from 1961 until August 1963. From August 1963 until the present all funds have been from the Midwest Government except for $ 35,961.40 supplied by the Federal Government in 1966. All funds are included in the above table.

5. Major Factors Affecting Progress

a. Cooperating Country Performance

Work on the station was started by the Western Region Government. The Western Region Ministry of Agriculture and Natural Resources understood fully the importance of research work and of rubber growing to this section of the country. The Ministry was relatively well organized and staffed and the initiative was taken by them to found a rubber research station with the understanding that

the work would be taken over by the Federal Government eventually since the whole country would benefit from the results. However, Cocoa and Cola culture, amongst other crops, were always of more vital interest than rubber to the Western Region.

The establishment of the Midwest Government made rubber research of much more vital interest to the regional government as rubber was the chief source of income and employment in the new region and many of the members of the government are rubber growers who know something of the problems of the industry. However, the difficulties of organizing and staffing a completely new regional government have taken most of the human energy and funds available to the government with the result that the rubber research program has not been able to keep up with the work plan program. It should be noted, however, that the rubber research budget was quadrupled to $112,000 for 1967-68 and a second senior officer was assigned in July 1967.

All administrative, accounting, and mechanical services have been supplied by the regional Ministry of Agriculture. Due to communications difficulties, conflicting interests, and changing personnel, this has not been a particularly satisfactory arrangement. It is expected that when the station is taken over by the Federal Government it will become semi-autonomous as are the other Federal Agricultural Research Stations. This should be a more satisfactory arrangement.

Legislation establishing several Federal Agricultural Research Institutes, including a Federal Rubber Research Institute, was passed by the Government in 1966. It is understood that the legislation enabling the Federal Government to take over the Iyanomo Rubber Research Station as the Federal Rubber Research Station is now awaiting Executive Committee approval.

It appears that financing of the Federal Rubber Research Station may be difficult. The usual formula is that the Regional and Federal Governments contribute according to a pre-agreed rate assessed depending upon their interest in the crops. Their representation on the Governing Council is proportional to their contribution. In this case Eastern Nigeria would be expected to make a considerable contribution since it is the second largest area under rubber. At the present, funds from this source seem doubtful. Also, it is understood that Northern Nigeria is making their contribution contingent upon cooperation of the other Governments in some of their institutions.

Staffing has been the most serious technical problem. The region is very short of both senior and junior agricultural officers. Furthermore, there is a very apparent distaste for any job involving field work on an undeveloped area 18 miles from town.

b. U.S. Performance

A work plan was developed in 1963 and has been modified annually as circumstances dictated. Progress, while it has not met schedules set up in the work plan, has been made; and practical information has been gained and will be passed on to the Government Extension Services in constantly increasing amounts as the station expands and the first plantings mature.

U.S. financing and staffing has been according to the plan and, it is felt, has been supplied usually at about the rate that the local government has been able to make use of it.

On the two USAID financed building contracts, the choice of contractors has been limited by the local government and the quality of the work has not been adequately controlled. Subcontracting, shortage of materials, and delays in payments to contractors have delayed completion of all buildings far beyond scheduled dates.

It would seem that USAID should either take over full responsibility for letting and supervising contracts or, if the objective is to teach local governments proper procedures while constructing project buildings, then proper procedures should be insisted upon by USAID.

6. Appraisal of Results

Actual rate of progress.

i. Physical Plant

Due chiefly to the difficulties that have been encountered in organizing, staffing, and financing the completely new regional government in the Midwest Region, this phase of the project is considerably behind the work-plan schedule. However, very considerable progress has been made.

ii. Staff Development

This has proven to be the most difficult project objective on which to make overall satisfactory progress.

Local labor supply is plentiful and of excellent quality. The training of men in specialized work such as budding, tapping, disease control, etc., is relatively easy and rewarding. There has been good success in building a skilled labor force.

More difficulty has been encountered in developing a junior staff cadre for field supervision, record keeping, etc. A combination of difficulties for which no immediate solution seems available has been responsible for this; first, all of these men are under Civil Service and the system does not provide a satisfactory work incentive; second, to be qualified for these jobs a man must have had some secondary schooling which seems to give an unchangeable distaste for field work; finally, there is a very high rate of turnover via transfer throughout the Ministry.

iii. Applied Research Program
Due to the previously mentioned shortage of senior staff in the Ministry, there has been only one senior officer assigned permanently to the project to date.

iii. Applied Research Program

To date this phase of the program has been kept almost exactly on schedule. Many important field trials have been set out and data is being collected. Information and recommendations have been passed on to the Extension Services on spacings, fertilizers, clones, fungicides, and various cultural practices.

Significance of Findings

Rubber is a very important crop to both the Government of Nigeria and the people, especially in the Midwest State where it probably provides more than 130,000 jobs directly and, for the past several years, has earned over £10,000,000 annually.

The general problems afflicting the Nigerian rubber growing industry are obvious; low productivity and poor quality. Since large very successful research programs have been underway for many years in the far eastern countries, the technical problems and most promising lines of work are well understood. Ideally, a research program would have been started before large scale rubber planting was started and before poor practices had become widespread. In spite of its unsolved problems, rubber has been a profitable crop in Nigeria for 50 years but, now, with the entry into the market of synthetic rubbers and increased far eastern production, it is essential that productivity be increased and the quality of production improved if Nigeria is to continue to grow rubber profitably.

Judging by productivity in other rubber growing areas, and by growth and yields of well managed plantings in Nigeria, the scope for improvement of productivity of Nigerian plantings is probably on the order of 300 percent to 400 percent. Better planting material, cultural methods, tapping, and field processing are all needed. Considerable improved planting

material has been imported and many techniques for improving the other aspects of rubber growing have been developed in other countries; however, all have to be tested under Nigerian conditions and, frequently, modifications are necessary to suit local conditions. It is chiefly the testing and adapting of these materials and techniques that are being carried out by the Rubber Research Project. First results are now coming in. Some significant improvements have already been brought about, such as the screening out of unsuitable clones, the provision of several additional clones, the change in spacing recommendation, etc. However, the results of the research program are just beginning to come in.

In November 1966 the International Rubber Study Group held its annual meeting in Lagos. At this time the Liberian Delegation suggested the desirability of cooperative research between the various West African countries interested in rubber culture. It was generally realized that, because of the widely varying conditions, a central research station would not be satisfactory; however, close cooperation was felt to be highly desirable. A subsequent meeting to discuss cooperative research between the West African rubber producing countries was held in Monrovia in March 1967. It is felt that the Nigerian Rubber Research Institute will play a key role in any rubber research scheme for West Africa since Nigeria is the largest rubber producer and is centrally located. It is expected that at least the Cameroon Republic, Congo (Kinshasa), Dahomey, Ghana, Ivory Coast, Liberia, and Nigeria would be involved.

The Nigerian Federal Government policy has been to set up semi-autonomous commodities research institutes to carry out research, under the Federal Department of Agricultural Research, on the more important export crops. Some of these institutes, such as the Oil Palm and Cocoa Institutes, have been notably successful. It is expected that the rubber research project will eventually be integrated into this system. In fact, the necessary legislation is already awaiting executive committee approval.

Attachment

Ivancna Rubber Research Station
Working Balance Sheet

Components	1961 Status	1967 Status
Physical Plant		
Land	None	5197 acres gazetted 3840 acres crop compensation paid 1357 acres crop enumeration completed - no payment. All boundaries surveyed and marked.
Roads	None	21 miles of secondary roads constructed.
Plantings	None	560 acres
Buildings	None	One 18' x 54' cement block building being used as office-warehouse. One 20' x 40' cement block fertilizer warehouse. One administration-Laboratory building to serve as permanent headquarters. Two senior staff houses are 60% complete. Four 3-family junior staff houses are 75% complete. A 46.5 KV generator set and a power distribution system have been installed. A water system consisting of a deep well gravel packed, a submersible pump, a 10,000-gallon storage tank, and the necessary piping and sewage has been installed.
Staff	None	About 100 laborers trained in budding, pruning, pollinating, tapping, disease control, and operation of special equipment. Six Junior Staff Officers One Senior Staff Officers Two USAID Advisors

Components	1961 Status	1967 Status
Research Program		
Clone Collection	Various clones had been brought into the country but had not been gathered in one place, nor did anyone know which clones were here or where.	A collection of 121 clones has been brought together, including all those known to have been in the country, plus 80 clones not previously in Nigeria. Three acres of budwood gardens plus a clone museum have been planted to preserve and multiply these clones. About 540 acres of material for field trials has been planted; included are (1) Clonal Seedling Family Comparisons, (2) Clonal Comparison Trials, (3) Transplanting Trials, (4) Fungicide Trials, (5) Cover Crop Comparisons, (6) Cultural Methods Trials, (7) Fertilizer Trials, (8) Forest pre-treatment trials for root disease control.