Cocoa Research Institute of Ghana (CRIG), Tafo (Ghana Cocoa Board)
CRIG HANDBOOK
REVISED EDITION

Cocoa Research Institute of Ghana (CRIG), Tafo
(Ghana Cocoa Board)

Revised by Mrs. Victress Johnson, Scientific Secretary
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(Ghana Cocoa Board)

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- Production of pectin, alcohol and alcoholic beverages, animal
  feed, jelly, soap and cosmetics as byproducts from cocoa wastes

- Overcoming the problem of cross-and self-incompatibility in
  kola (Cola nitida); selection and multiplication of types which
  are cross-and or self-compatible, thus guaranteeing high yielding
  planting material.

- Development and release of elite Robusta coffee planting
  materials for establishment of national Coffee Wood Gardens.

- The Institute has won several awards for research achievements both
  at local level and at International Fairs.

CRIG handbook
Some notable achievements of CRIG

Among the most notable achievements of the Institute may be mentioned:

- Control of capsids by mass spraying with insecticides
  Date: Mid 1950s

- Characterization of cocoa swollen shoot disease as caused by a virus, discovery of mealy bugs as vectors of the virus and control of the disease by eradication
  Date: Early to mid 1940s / current

- Isolation and characterization of CSSV and development of diagnostic methods
  Date: Current

- Introduction and testing of Amazon cocoa
  Date: 1954

- Development of early bearing and high yielding WACRI series II hybrids by crosses between Amelonado and Amazon cocoa
  Date: 1964

- Development of inter Amazon hybrids
  Date: 1985 / current

- Understanding of the relationship between cocoa shade, nutrition and yield
  Date: 1959–1963 / current

- Development of agronomic packages guaranteeing yields of over 3 tones/ha.
  Date: 1959–1975 / current

- Mass hand pollination of clonal seed gardens for large scale production of seed pods
  Date: Early 1970s

- Understanding of cocoa fermentation and flavour chemistry
  Date: Late 1950s / current

- Short term control of a severe type of Black pod disease (*Phytophthora megakarya*)
  Date: Current
COCOA RESEARCH INSTITUTE OF GHANA
(Ghana Cocoa Board)

History
In June 1938 the Gold Coast Department of Agriculture established a Central Cocoa Research Station at Tafo to investigate problems of diseases and pests, which had considerably reduced cocoa production in the Eastern Region. In 1944 it became the West African Cocoa Research Institute (WACRI) with a sub-station in Ibadan, Nigeria, and some research activities in Sierra Leone. After the attainment of independence by Ghana and Nigeria, WACRI was dissolved, and Cocoa Research Institute of Ghana (CRIG) and Cocoa Research Institute of Nigeria (CRIN) were formed in its place. CRIG was administered by the National Research Council, which was later superseded by the Ghana Academy of Sciences and the Council for Scientific and Industrial Research (CSIR). CRIG was transferred to the Ministry of Cocoa Affairs in 1976 and taken over by the Ghana Cocoa Marketing Board (now Ghana Cocoa Board) in 1979 after the abolition of the Ministry.

Mandate
At its inception in June 1938, the Tafo Central Cocoa Research Station was assigned clear goals within the Gold Coast Department of Agriculture to investigate the pest and disease problems of cocoa in order to maintain production in the Eastern Region. In 1944 when the Research Station was up-graded to WACRI, the objectives were widened to include the disease and pest problems of cocoa in West Africa and also to investigate soil fertility and agricultural practices with a view to increasing yield. Since 1966 CRIG research mandate has been further widened to include coffee, kola, sheanut and more recently cashew.

CRIG also conducts research into the development of by-products of cocoa and the other mandated crops with the aim of diversifying utilization and to generate additional income for farmers.

CRIG Mission Statement
Over the years, CRIG mission has been to:
Undertake research into all problems relating to production, processing and utilization of cocoa, kola, coffee, sheanut, cashew, other indigenous and introduced tree species, which produce fats similar to cocoa butter or are of value in developing a suitable mixture with the mandated crops.
Provide information and advice on all matters relating to the production of the mandated crops.
Current Mission
In 2003, the mission was revised to reflect the changes in emphasis that are expected to take place at the Institute. The following is the revised mission statement: “CRIG will be a centre of excellence for developing sustainable, demand driven, commercially oriented, cost-effective, socially and environmentally acceptable technologies which will enable stakeholders to realize the overall vision of the cocoa industry and the other mandated crops (Cashew, Shea, Kola and Coffee).”

CRIG Vision Statement
“By the year 2010, the Ghana Cocoa Industry and other mandated crops will be research driven and commercially viable, making a sustainable contribution to the development of Ghana in a socially responsible and environmentally friendly manner.

Other mandated crops (cashew, shea, kola and coffee) will have significant shares of their respective markets.”

Objectives
To accomplish its mission, the Institute conducts research, trains, provides information and undertakes technology transfer activities. These activities are undertaken to assist farmers to improve cocoa, coffee, sheanut, cashew and kola productions (cultivation and processing) in a sustainable and environmentally friendly manner. To this end, CRIG’s principal objectives are:
- To provide the farmer with a package of husbandry practices/technologies for realizing optimal yield and high economic returns under sustainable environmentally clement conditions.
- To conduct research into, and develop techniques for the processing of cocoa, coffee, sheanut and kola for the market.
- To conduct research into and develop new products (other than traditional ones) from cocoa, coffee kola and sheanut with the aim of diversifying utilization and improving market prices. Also to develop by-products from residues or waste parts of crops to give farmers more income from their crops.
- Establish strong linkage for effective transfer of research findings, new technologies and agronomic practices to farmers.

FOR COFFEE THE THRUSTS ARE:
Coffee Agronomy, Coffee Improvement, Coffee Pest and Diseases

Coffee Agronomy
The mission is to conduct research into all aspects of coffee cultivation with a view to developing appropriate technological packages that offer solutions to farmers’ problems with regard to establishment, management and harvesting.

Coffee Improvement
The mission is to provide easy to establish and manage, high yielding, yield stable and good cup-quality coffee material which is also acceptable to the Ghanaian farmer.
Activities being carried out include:
- Germplasm introduction, conservation, evaluation and characterization.
- Improvement of yield and maintenance of quality.
- Development and multiplication of improved planting materials for the Extension Service for the establishment of Wood Gardens.
- Experimental and farm level testing of selected coffee materials. Selection and breeding for drought resistance/tolerance.

Coffee Pest and Diseases
The mission is to evaluate the impact of coffee insect pests and diseases on establishment and yield and determine the effects of biological and ecological factors on the pests and diseases so as to develop appropriate and cost effective pests and diseases management practices. Activities are focused on identification of pests and diseases of coffee, effects of biological and ecological factors on the pests and diseases impact of the pests and diseases, and the development of integrated pest management.

KOLA
Kola Development
The mission is to develop improved material through selection and multiplication of compatible parents with a view to establishing clonal seed gardens to supply nuts as planting material to farmers. The focus of research is on:
- Germplasm collection, selection and multiplication of compatible and high yielding parents and their progenies.
- Effect of spacing and pruning on the performance of selected improved kola trees
- Effect of kola pests on fruit/seed production, storage and quality of kola nut.
Resources
To achieve these objectives CRIG has 48 well-trained professionals in various scientific disciplines and 112 technical staff. Accommodation for professional and technical staff is provided on the Institute’s estates, served with own water supply and a health clinic.

Other resources are:
- Laboratories, a library, records and a research tradition of over 70 years.
- Three sub-stations located at:
  - Bumso – for cocoa, kola and coffee (total area: 92ha; area developed: 51ha)
  - Afosu – for coffee and kola (total area: 263 ha; area developed 80ha)
  - Bole – for sheanut (total area: 6,277ha; area developed: 59ha)
- Three COCOBOD plantation farms with farm managers, technical staff and labourers transferred to CRIG to form part of the New Products Development Unit. The farms provide raw materials viz. beans and fresh cocoa pods, for by-products research and development.

Management
Management Committee
CRIG has a Management Committee which is appointed by the Government and which supports CRIG Management with policy formulation and development. It has appointed a number of sub-committees such as Research Policy Sub-committee to assist in research policy development and a Research Grade staff Promotion Committee to review assessors’ reports for the promotion of Research Officers who apply for promotion.

Administration
An Executive Director who is assisted by three Deputy Executive Directors in charge of Cocoa, Coffee and administration heads the Institute. There are six Scientific Divisions and two Units. The Divisions are Agronomy, Soil Science, Entomology, Physiology/Biochemistry, Plant Breeding, Plant Pathology; the units are Social Science and Statistics and New Products Development.

Staff Strength:
As at now, total number of workers stands at 1172

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<tr>
<th>Senior Staff</th>
<th>155</th>
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<tbody>
<tr>
<td>Junior Staff</td>
<td>1017</td>
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Organizational Structure

An Executive Director, who is assisted by three Deputy Executive Directors and a Scientific Secretary, heads the Institute. There are six Scientific Divisions and two Units. The Divisions are Agronomy, Soil Science, Entomology, Physiology/Biochemistry, Plant Breeding and Plant Pathology; the Units are Social Science and Statistics and also the New Products Development. The Accounts, General Administration, Plantation/Station Management, General Services, Scientific Information Division and Commercial Unit provide supporting services. Research Scientists/Scientific Officers who report to the Executive Director head the three sub-stations at Bunso and Afosu in the Eastern Region and Bole in the Northern Region.

The Management Committee has the following membership:
1. Chairman
2. Deputy Chief Executive (A&QC), COCOBOD - Member
3. Executive Director, CRIG - Member
4. Representative, Crop Research Institute - Member
5. Representative, Public Universities - Member
6. Representative, Ministry of Trade & Industry - Member
7. Director of Research, COCOBOD - Member
8. Executive Director, CSSVD Control Unit - Member
9. Three Farmers’ Representatives - Member
10. CRIG Staff Representative - Member

The management Committee of CRIG is currently constituted as follows:
1. Prof. A.A. Oteng-Yeboah, C/o Botany Dept. UG, Legon - Chairman
2. Dr. Yaw Adu-Ampomah, Ag. Deputy Chief Executive (A&QC), Ghana Cocoa Board, Accra - Member
3. Dr. F. M. Amoah, Ag. Executive Director, CRIG, Tafo - Member
4. Dr. Hans Adu-Dapaah, Director, Crops Research Institute, CSIR, Fumesua, Kumasi - Member
5. Prof. L. Enu-Kwesi, C/o Botany Dept, UG, Legon, Accra - Member
6. Rev. K. Abaka-Ewusi, Ag. Executive Director, CSSVD-CU, Accra - Member
7. Mr. Abraham Adusei, Gen. Supt., Saviour Church of Ghana, Osiem - Member
8. Mr. Emmanuel Awuri, Director (Policy Planning), Min. of

Cocoa Swollen Shoot Virus

The mission of the thrust is to achieve effective and economic control of the swollen shoot disease of cocoa. This objective is being pursued in the following ways:

I. Study of disease epidemiology to provide data to support the field eradication programme and to reduce the rate of virus spread.

ii. The development of cocoa types with enhanced resistance/tolerance to CSSV in the absence of immunity.

iii. The control of mealybug vector of CSSV and assessment of existing cultivars for mealybug resistance in order to reduce virus spread.

iv. The use of mild CSSV strains to cross-protect cocoa trees against severe strains of the virus, especially in the endemic area.

v. The determination of serological relationships and variation in attempts at classification of the virus.

vi. Genome characterization to provide for quicker and more reliable diagnosis and possibly for the development of non-conventional disease resistance.

vii. Development of management practices to reduce virus spread, such as barrier cropping, to complement other control measures.

New Products Development

The overall goal of the Unit to identify alternative uses for cocoa, coffee, kola and shea nuts and their by-products, and to conduct research into the possible utilization of waste products. The ultimate goal is to expand the income generating capacities of these products in terms of increased producer prices and added sources of income for the benefit of farmers in particular, and the country as a whole. To achieve the above goals, the thrust is conducting research into the following areas:

- assessment of the economic and commercial viability of large scale production of these products as a cottage industry.
- promotion of the uses of the above products.
Cocoa Improvement
The mission of the thrust is to develop genetically improved varieties with the ability to establish easily in the field, bear early, have high and stable yield potential and good bean quality and suitable to the Ghanaian cocoa farmer in different environments. To achieve these objectives the thrust is working on the following programmes:

i. Germlasm introduction, conservation, evaluation and characterization
ii. Improvement of yield and maintenance of quality, with emphasis on development of alternatives to the Series II and Inter-Amazon hybrids
iii. Experimental and farm level testing of promising varieties
iv. Breeding for easy establishment under degraded environments
v. Selection and testing for drought resistance/tolerance.

Cocoa Insects Management
The mission of the thrust is to develop effective and economic capsid control measures for cocoa. To achieve this goal the thrust conducts research into:

i. Population dynamics of capsids in relation to the planting materials now in use.
ii. Biological, cultural and integrated pest management
iii. Chemical control and techniques of application

Cocoa Fungal Diseases Management
The mission of the thrust is to provide cocoa farmers with effective control strategies compatible with their resources for the control of Phytophthora pod rot, in particular the form caused by the species P. megakarya in order to maintain cocoa production in affected areas.

A short term objectives are to:
- examine the technical and economic feasibility of using chemical and cultural techniques for control of Phytophthora pod rot and
- improve information on the life-cycle and development of the pathogens responsible so that new control strategies can be developed

Long term objective is to:

i. find cocoa material resistant to Phytophthora pod rot.

The activities of the thrust include:

i. Survey of Phytophthora isolates in Ghana
ii. Evaluation of fungicides at standard and extended intervals of application
To identify constraints (social and economic) to the adoption of technologies and to find solutions.

**RESEARCH DIVISIONS/UNITS**

There are six scientific divisions namely Agronomy, Soil Science, Entomology, Plant Breeding, Plant Pathology and Physiology/Biochemistry; and two research units: Social Science and Statistics and New Products Development.

**Agronomy/Soil Science Division**

The Division studies techniques of establishment and management of cocoa, coffee, kola (Coffea nitida) and shea nut (Vitellaria paradoxa) and cashew with a view to developing appropriate technologies, which address farmers problems on establishment and management. Experiments of the division include bare root transplanting of cocoa seedlings, use of mulches to enhance establishment of cocoa and coffee. Others are the development of efficient and cost effective weed management strategies, use of fertilizers in cocoa establishment and to increase yield, benefit-cost of various combinations of cocoa/food crop and cocoa/cash crop inter-cropping. Optimum shade levels, planting distances of cocoa, coffee etc., the use of leguminous cover crops and the economics of management practices are also studied.

**Entomology Division**

The Division investigates pest problems of cocoa, coffee, kola and sheanut and their control. Studies are undertaken on the biology, ecology and population dynamics of mirids which attack cocoa, and pests of coffee, kola and sheanut as well as the mealybug vectors of cocoa swollen shoot virus; screening of insecticides for mirid control and their effect on non-target organisms. Other studies include integrated pest management (IPM) involving the use of sex pheromones, parasites and natural enemies for the control of mirids and mealybugs. The study of termites has become important in recent years.

**Plant Breeding Division**

The Division is responsible for the introduction and study of new germplasm, selection and breeding of new varieties of cocoa, coffee, kola, improvement of yield and maintenance of quality, testing of promising varieties, breeding for disease resistance and for establishment in degraded environments. Also responsible for the provision of improved coffee planting materials for the establishment of Coffee Wood Gardens.

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**THE MULTI DISCIPLINARY THRUST SYSTEM**

The conduct of research at CRIG has been re-organised since 1990 along the lines of a multi disciplinary thrust system. The thrusts for cocoa are:

**Cocoa**

Cocoa Establishment, Cocoa Management, Cocoa Improvement, Cocoa Insects Management, Cocoa Fungal Disease Management, Cocoa swollen shoot virus (CSSV), New Products Development.

**Cocoa Establishment**

The mission of the thrust is to develop appropriate technological packages that address farmers’ problems with respect to the early establishment of cocoa farms and the efficient management of young cocoa farms until they come into full bearing. To achieve this objective, the thrust carries out the following research activities:

1. Bare root transplanting of seedlings using different methods of packaging to alleviate logistic difficulties and huge transportation costs.
2. The use of various types of mulches to enhance the establishment of cocoa in degraded areas.
3. Development of efficient and cost effective weed management strategies for young cocoa farms.
4. Studies on the benefits of various combinations of cocoa/food crop and cocoa/cash crop inter-cropping and the attendant pests and other problems associated with such combinations.
5. Studies of optimum shade levels and planting distances to ensure rapid establishment and maximum use of the land.
6. The uses of leguminous covers crops and fertilizer during the establishment of cocoa.

**Cocoa Management**

The mission of the thrust is to address all aspects of mature cocoa farm management, develop appropriate technologies which can contribute to the realization of the full potential of the farm and to appraise the risk and cost-effectiveness of technologies in order to make recommendations of farmers. To this end areas of investigation by the thrust are:

2. Inter-cropping cocoa with other plantation crops
Pathology Division
This Division is made up of the Virology and Mycology Sections. The Mycology section works on fungal diseases of cocoa, coffee, kola, cashew and sheanut. In cocoa the most important fungal disease is black pod caused by Phytophthora palmivora and P. megakarya. In this and other diseases, fungicides are screened on-station, on-farm and in on-farm farmer-managed trials to select the most effective ones for disease control in the short term. In the medium and long term, cultural and biological measures including resistance breeding are being developed. The Virology section deals mainly with cocoa swollen shoot virus (CSSV) disease. Cocoa types are continuously assessed to identify possible sources of resistance/tolerance that will prolong the economic life of the trees. Studies of disease epidemiology are carried out to provide data to support the field eradication programme and reduce the rate of virus spread. Other studies include the use of mild CSSV strains to cross-protect cocoa against severe strains of the virus; determination of Dr. I. Y. Opoku, Head of Division serological relationships, and variations among isolates; genome characterisation and early detection of infection. The Division also works on mistletoes parasitic on cocoa.

Physiology/Biochemistry Division
The Physiology section of the Division studies the physiological basis for yield, drought resistance and establishment of cocoa and coffee in degraded areas. The biochemistry section works closely with the Pathology Division on molecular aspects of CSSV and Phytophthora. It also works on cocoa, coffee and kola quality.

Social Science and Statistics Unit (SSSU)
This Unit was established in 1990 as Farming Systems Research Unit (FSRU). In 1993 the name was changed to Social Science and Statistics Unit (SSSU) to reflect its role in providing social science perspectives to research and development. It liaises with all the research divisions by improving the relevance of research to the small scale cocoa producer, co-ordinating off-station trials of component and packaged technologies and identifying constraints (social and economic) to the adoption of technologies and in the analysis of data.

New Products Development Unit
The Unit was established in 1993 and its role is to give additional income to the farmer by processing his farm wastes. The Unit conducts research and development into production of animal feed from cocoa pod husks, toilet soap and cosmetics from cocoa butter extracted from discarded beans; alcoholic beverages and industrial alcohol, soft drinks, marmalade/jelly, pectin, theobromine and acetic acid from cocoa sweetings. It also assesses the economic and commercial viability of large scale production of the products.
Scientific Information Division
This was established in June 1996. The Division is responsible for the dissemination of information and extension and comprises the Library, Public Relations, Bindery and Photography. In addition, all matters relating to the general administration of computers, and computer use come under this Division.

HEADS OF DIVISIONS

Dr. Opoku Ameyaw
Head of Agronomy Division

Dr. I. Y. Opoku
Head of Pathology Division

Dr. J. F. Takrama
Head of Physio/Biochem. Division

Dr. A. R. Cudjoe
Ag. Head of Entomology Division

Mr. E. A. Asamoah
Head of Scin. Info. Division

Dr. Boamah Adomako
Head of Plant Breeding Div.