COSCA

Working Paper No. 1

Collaborative Study of Cassava in Africa (COSCA)

Project Description

by

Felix I. Nweke

International Institute of Tropical Agriculture
Ibadan, Nigeria

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Felix I. Nweke

International Institute of Tropical Agriculture (IITA)
PMB 5320
Oyo Road
IBADAN
Nigeria.

1988

COSCA: PROJECT AGENCIES AND COLLABORATORS

Executive Agency:
International Institute of Tropical Agriculture (IITA)

Collaborating Agencies:
Centro Internacional Agricultura Tropicale (CIAT)
Overseas Development Natural Resources Institute (ODNRI)
International Child Health Unit (ICHU)
National Agricultural Research Systems of Côte d'Ivoire, Ghana, Nigeria, Tanzania, Uganda and Zaire.

Primary Funding Agency:
The Rockefeller Foundation

Steering Committee:
D. Spencer, IITA (Chairman)
S. Hahn, IITA
J. Cock, CIAT
H. Ezumah, IITA
R. Barker, IITA Board
T. Tshibaka, IFPRI
J. Lynam, The Rockefeller Foundation
T. Philips, University of Guelph
J. Strauss, Yale University
M. Dahniya, University of Sierra Leone
F. Nweke, IITA (Secretary)

Project Leader:
F. Nweke

Regional Research Coordinators
C. Prudencio, West Africa
G. Mullins, East/Central Africa

National Research Coordinators:
K. Tano, Côte d'Ivoire
C. N'dri, Côte d'Ivoire (Assistant)
R. Al-Hassan, Ghana
A. Kissiedu, Ghana (Assistant)
B. Ugwu, Nigeria
O. Ajobo, Nigeria (Assistant)
G. Okwor, Nigeria (Assistant)
B. Rwenyagira, Tanzania
M. Msabaha, Tanzania (Assistant)
G. Otim-Nape, Uganda
S. Zziwa, Uganda (Assistant)
V. Kuezi-Nke, Zaire
D. Lutete, Zaire (Assistant)

IITA Scientists:

D. Spencer	Agricultural Economist (RCMP)
F. Nweke	Agricultural Economist (RCMP)
C. Prudencio	Agricultural Economist (RCMP)
G. Mullins	Agricultural Economist (RCMP)
H. Ezumah	Agronomist (RCMP)
S. Hahn	Breeder (TRIPP)
D. Osiru	Crop Physiologist (TRIPP)
J. Otoo	Breeder (TRIPP)
W. Jeon	Postharvest Technologist (TRIPP)
A. Almazan	Biochemist (TRIPP)

Subject Matter Specialists:

S. Carter	Agroclimatologist (CIAT)
R. Baulch	Agricultural Economist (ODNRI)
N. Poulter	Food Scientist (ODNRI)
H. Rosling	Physician (ICHU)
J. Lynam	Agricultural Economist (The Rockefeller Foundation)
S. Romanoff	Anthropologist (The Rockefeller Foundation)

Consultants:

W. Jone	Stanford University, USA
L. Frescoe	University of Wageningen, Holland
A. Dyer	University of Guelph, Canada

Administrative Manager:
E. Deganus ICTP/IITA

ABBREVIATIONS

CBSC: Cassava Based Systems Working Group

CIAT: Centro Internacional Agricultura Tropicale

COSCA: Collaborative Study of Cassava in Africa

IARCS: International Agricultural Research Centres

ICHU: International Child Health Unit

IFPRI: International Food Policy Research Institute

IITA: International Institute of Tropical Agriculture

NARS: National Agricultural Research Systems

ODNRI: Overseas Development Natural Resources Institute, U. K.

RCMP: Resource and Crop Management Program, IITA.

TRIPP: Root Tuber and Plantain Improvement Program, IITA.

UNDP: United Nations Development Program.

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PREFACE

This document is prepared from delibrations of three planning and two steering committee meetings, together with contributions from experts who did not attend the meetings. Three planning meetings were held; the first in New York in September 1987; the second in London in June 1988, and the third was in Ibadan in September 1988 which was attended by most members of the COSCA Steering Committee and all the project collaborators. The structure and methodologies of COSCA were discussed on the basis of papers presented by project members (see list of Agencies and Collaborators.). A Draft Project Description was later put together by the Project Leader based on the conclusions and recommendations of the Third Planning Meeting.

The Steering Committee first met in Ibadan in September 1988 and then in London in January 1989, to review the Draft Project Description. The present document presents a revised Draft Project Description based on discussions during the second Steering Committee meeting and on comments by project members. The Project Leader then undertook the compilation of this document.

Individuals and institutions may receive single copies free of charge by writing to :

The Project Leader
Collaborative Study of Cassava in Africa (COSCA)
Resource and Crop Management Program
International Institute of Tropical Agriculture
P. M. B. 5320, Oyo Road
Ibadan
Nigeria.

EXECUTIVE SUMMARY

COSCA was initiated through the realization that the potentials of cassava depends on availability of more detailed and reliable information on the cassava crop. The general objective of COSCA is therefore to improve the relevance and impact of agricultural research on cassava by International Agricultural Research Centres and National Agricultural Research Systems in Africa in order to take full advantage of the potentials of cassava in increasing food production and incomes of poor people.

COSCA will be conducted in Côte d'Ivoire, Ghana, Nigeria, Zaire, Uganda and Tanzania. The major consideration in the choice of these countries is that they provide a wide range of conditions of climate, altitude, population density, and market access infrastructure in the important cassava zones of the continent in order to collect relevant information over a wide range of ecologies in the cassava belt of Africa.

A systems approach, with a multi-disciplinary team, is adopted in COSCA to study cassava within the context of mixed farming and food systems. Not only will information be collected on production, processing, marketing and consumption of cassava, but also similar information will be collected on other crops which are grown or consumed in the same farming and food systems.

COSCA study will be conducted in three phases, Phase I will involve broad characterization of the cassava producing zones. Information will be collected by group interviews at the village level

and by key informant interviews at institutional level. Phase II will involve characterization of individual production, processing, marketing and consumption units. The information will be collected on single visits and collection methods will include direct observations, field measurements, and individualised interviews. Phase III is an extension of Phase II but involves more intensive surveys with repeated interview visits for collection of information on seasonal variables.

The components of COSCA are integrated into one study for data collection and analyses. Integration is assured at data collection stage through the sampling process. Phase II survey will be conducted on a subsample of Phase I sites and Phase III survey will be conducted on subsamples of Phase II. During the analyses, COSCA study is further integrated since each hypothesis will be tested with information collected at different phases and on different components.

The time frame is 4 years between 1988 and 1992, with intermediate outputs issued at the end of each phase. These outputs will be disseminated through a working paper series, research reports, journal articles, books and conference proceedings, especially the triennial symposia of the African Branch of the International Society of Tropical Root Crops.

INTRODUCTION

Background

Since its introduction into Africa in the 16th century, cassava had spread throughout sub-saharan Africa to become one of the dominant starchy staples in the diet of the people. Although the crop is grown in every country of the sub-continent, cultivation is concentrated in the humid, tropical regions. Africa produces 48 million tons of cassava annually from 7.4 million hectares, and provides more than 200 calories per day for 200 million people. It is the dominant staple particularly in Central Africa, where it constitutes over 50 percent of average staple food consumption in Zaire, People's Republic of the Congo and in the Central African Republic. In the coastal West African countries stretching from Côte d'Ivoire to Nigeria, cassava is as important as yams, and further west in coastal West Africa, cassava is the second most important staple after rice. In East Africa, although maize is the dominant staple in most countries, cassava is crucially important in Mozambique, Tanzania, Uganda, Rwanda and Burundi.

The central role played by cassava in the African diet is specially important because per capita food production in Africa is declining. During the succeeding two decades after most African countries became independent, the continent has steadily deteriorated into food import dependence, where cereal imports are filling the gap created by unsatisfactory growth in production of

domestic staples. Financing these imports has become increasingly difficult as the balance of trade in African countries become negative and the repayments of external debt rise. Falling per capita food production and declining international financial liquidity are particularly problematic in the light of estimates that approximately 150 million out of 450 million Africans suffer from some form of malnutrition.

The African food problem is commonly traced to difficulties with food supplies. Because of stagnant or even falling food production, area expansion, which is usually into more marginal agricultural zones, is not sufficient for production to keep pace with rapidly expanding human population demands for foods. Moreover, rising population densities in these more marginal rainfall areas have reduced the buffering capacity of subsistence production units against major variations in rainfall, often resulting in substantial shortfall in food needs in years when rainfall is especially inadequate. This situation results in periodic famines which have made the African food problem a matter for deep and urgent concern.

Nevertheless, demand-side factors are also operative in defining food needs. The most salient feature in this regard is the very marked rate of growth in the urban population. Although only approximately 25 percent of the African population is estimated to reside in urban areas, the growth rate of the urban population has been high, in most countries exceeding 5 percent per annum. Rapid urbanization usually results in a shift to foods that are relatively convenient to store and prepare in the home. If transport and

marketing systems are not limiting and farmers are responsive to changes in food demands in the urban diets, urbanization can generate demand-led growth and increased incomes in the agricultural sector. On the other hand, when the domestic agricultural sector is unable to respond to increased urban demand, rising urban food prices have often led governments to intervene by regulating prices and to meet shortfalls through imports of cereals. Prices of imported cereals to urban consumers are often kept relatively low through overvalued exchange rates, food aid, concessional sales, and sometimes direct subsidies. Such interventions, further retard the development of domestic marketable surpluses, not only of cereals but also of cassava and other substitutes for grain. This is a clear example of the tendency to sacrifice long-term growth and structural adjustment in favor of short-term political needs.

Development Strategies for Cassava

What role can cassava therefore serve in bridging the food gap? Food production in Africa is fundamentally based on rainfed farming systems. This makes African farming inherently risky, with marked variations in seasonal and annual food supplies. This highly variable production situation is made even more unstable in areas where land is scarce through rapid growth in rural populations which either reduces farm sizes or induces migration to more marginal agricultural areas.

The adaptation of cassava to relatively marginal soils and rainfall conditions, its high productivity per unit of land or labor, the certainty of obtaining some yield even under adverse conditions, and the possibility of maintaining continuity of supply throughout the year make this root crop a basic component of the farming system in many areas of Africa. Famines rarely occur in areas where cassava is widely grown, since it provides a stable base to the food production system. This indicates that cassava has potentials for bridging the food gap. However, the full realization of this potential depends on availability of more detailed information about cassava growing conditions, production systems, processing methods, marketing, and urban consumption patterns. Authoritative information on these issues is lacking and even the production statistics that are available are at best educated guesses. The COSCA Project was therefore initiated to correct these information deficiencies.

Objectives

The broad objective of this COSCA study is to improve the relevance and impact of agricultural research on cassava by International Agricultural Research Centres (IARCS) and National Agricultural Research Systems (NARS) in Africa in order to optimize the potentials of cassava in raising food production and the incomes

of poor people. The specific objectives are to:

1. Describe the structure of cassava based cropping systems in principal producing areas.

2. Quantitatively and qualitatively characterize the nature and distribution of cassava processing systems.

3. Describe the marketing system for cassava and their implications for incomes.

4. Understand present and future problems of demand for cassava in rural and urban areas for human consumption and other uses.

5. Provide general information on the nutritional effects of cassava consumption.

6. Evaluate the impact of price and import policies on the production and consumption of cassava.

Hypotheses

In this section, a number of working hypotheses which will guide COSCA study are listed. The results of tests of these hypotheses will provide directions for research that will reveal the full potentials of cassava in raising food production and the incomes of poor people. The hypotheses are classified into two groups as follows:

Group (a) those related to the changes in production systems. As population pressures and market access increase, cassava farming systems are expected to evolve towards either more land use intensification or extensification depending on the resource situation and location of the farming systems.

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Hypotheses

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Group (a) those related to the changes in production systems. As population pressures and market access increase, cassava farming systems are expected to evolve towards either more land use intensification or extensification depending on the resource situation and location of the farming systems.

Group (b) those related to the processes of urbanization which alter the nature and quantity of demand for cassava products.

(a) Intensive - Extensive Production Systems Driven Hypotheses:

1. As population density increases, fallow periods decrease, and the importance of cassava increases, but cassava yields decline.

2. In areas of intensive production, high use of purchased inputs and high population pressure, cassava is being replaced by other crops while cassava yields are increasing.

3. The nature of the cropping systems changes with progression from extensive to intensive production.

4. Production of cassava is increasing disproportionately in non-traditional cassava growing areas e.g. low rainfall areas, high altitude and higher latitudes.

5. Cassava is grown using purely traditional technology because marginal returns to purchased inputs such as fertilizer are low.

6. Producers seek greater flexibility in timing of harvest through early maturing varieties or varieties that store better in the soil.

7. The major pests and diseases such as cassava mealybug, green spider mite, mozaic virus, and leaf blight seriously reduce cassava yields in many regions.

8. Land tenure systems do not have a significant impact on production practices.

9. There are no economies or diseconomies of scale in cassava production, processing and marketing.

10. National agricultural policies usually accord low priority to cassava production, consequantly limiting awareness of improved cassava varieties and cultivation practices.

11. High labour requirements for harvesting and processing of cassava is a major constraint to expanded production.

12. The macro political and economic environment determines relative resource allocation to cassava production which increases during periods of political conflict or economic down turn.

13. The occurrence of drought,general food shortages, inadequate processing, and/or lack of suitable low cyanide cassava varieties lead to high cassava consumption hence high cyanide in the food.

14. High cyanide in the food coupled with generally inadequate nutrition is associated with serious health problems.

(b) Urbanization Driven Hypotheses

1. Market sales of cassava are significant and increasing.

2. Market demand and not supply are constraining factors in the expansion of cassava production.

3. Demand for and production of bitter cassava is expanding more rapidly than sweet cassava.

4. Demands for unfermented cassava flour and starch are increasing.

5. The relative value of cassava leaves is important and increasing.

6. As individual incomes rise people tend to consume less of whole cassava and more of different forms of processed cassava.

7. Growth in urbanization is increasing the demand for processed cassava products.

8. The high cost of marketing fresh cassava limits its demand in urban centers.

9. The farmers who grow cassava commercially utilise better agronomic practices and are more able to adopt improved cassava varieties.

10. Gender role in cassava production and processing changes as we move to more commercial production.

11. Governments' pricing and subsidies policies for other crops tend to constrain urban demand for cassava.

12. Lack of market infrastructure is an important constraint to increased demand for cassava.

Data generated in this study will permit full testing of some of these hypotheses. However, for some of them, e.g. hypotheses 12-14 in Group (a) only partial examination will be possible. Additional studies outside COSCA would need to be undertaken to fully test all of these hypotheses.

Study Countries

COSCA will be conducted in Côte d'Ivoire, Ghana, Nigeria, Zaire, Uganda, and Tanzania (Figure 1). The major consideration in the choice of these countries is existence of the wide range of the conditions of climate, altitude, population density and market access infrastructure in the cassava important zones of the continent.

Other considerations include: ability to provide national scientists to coordinate the study, ease of movement into and within the country.

Cote d'Ivoire, Ghana, Nigeria, Cameroun, Zaire, Congo, Angola, Central African Republic (CAR), Mozambique, Uganda, Tanzania, and Rwanda are identified as cassava "important" countries, (Carter 1988). Mozambique and Angola are not included in the COSCA study because of political uncertainty, and CAR on the basis of inability to provide national scientists; Cameroun because of close proximity to Nigeria and similarities with conditions there,while the Congo situation is very well represented by Zaire. Rwanda is sandwitched between Uganda, Tanzania and Zaire and presents similar conditions with these countries.

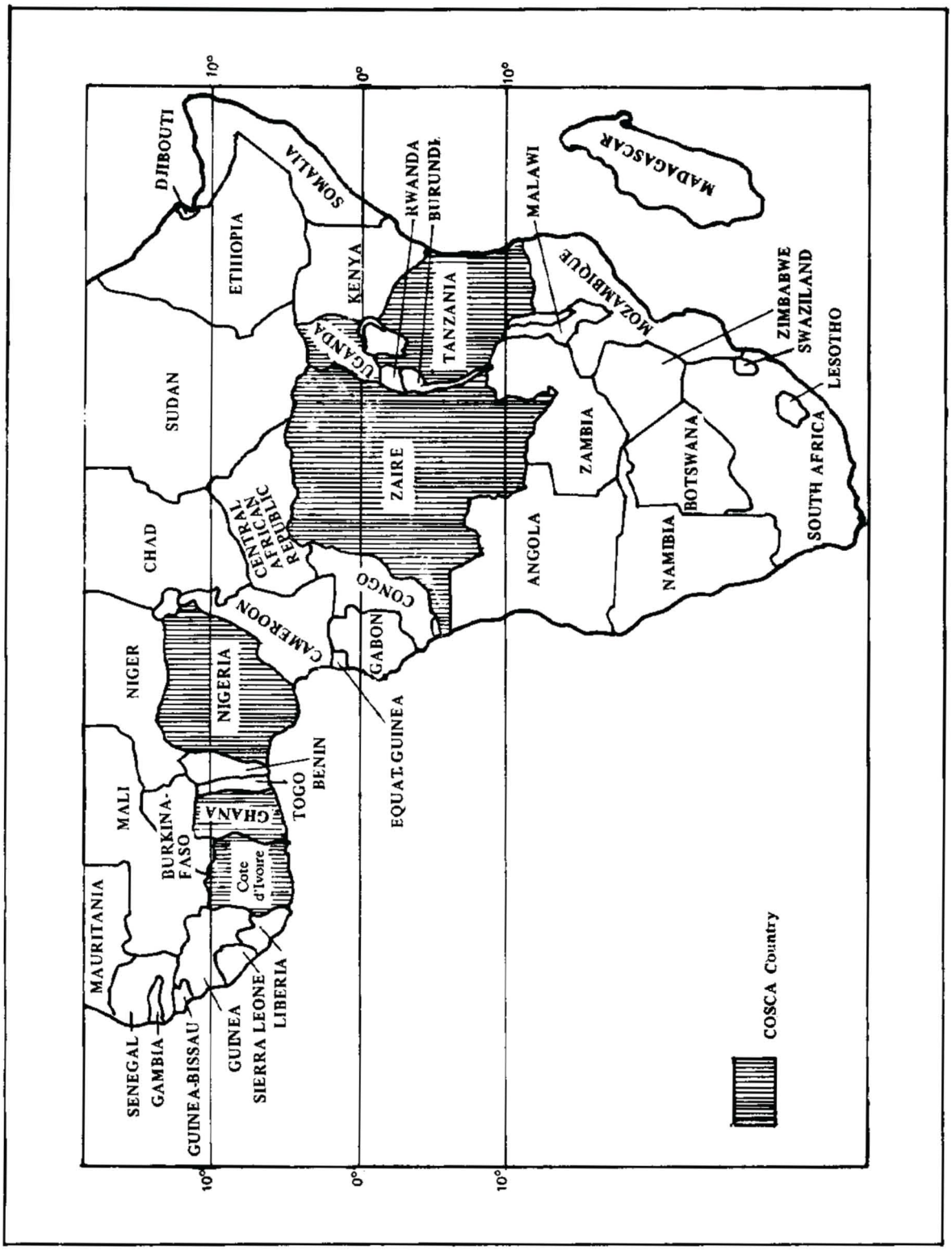

Figure 1: COSCA Countries

ORGANIZATION OF COSCA

Composition of the Study Team

The COSCA study has a Steering Committee consisting of the Director of IITA's RCMP as (Chairman), Director of IITA's TRIPP, Director of CIAT's Cassava Program, the Rockefeller Foundation Project Officer, IITA's Cassava Agronomist, two representatives of the Rockefeller Foundation, one representative each of IITA Board of Trustees, National Research Systems Agronomists, International Food Policy Research Institute (IFPRI), and the Project Leader who serves as the Secretary.

The project will be coordinated by the Project Leader, two regional coordinators, one national and one assistant national coordinators in each country, consisting of a social scientist and a biological scientist in agriculture, and 6 subject matter specialists in the the areas of Agricultural marketing, Agro-geography, Food sciences, Processing economics, Human nuitrition, and in Anthropology. In addition to these, IITA's RCMP and TRIPP scientists will participate as much as possible (see Figure 2).

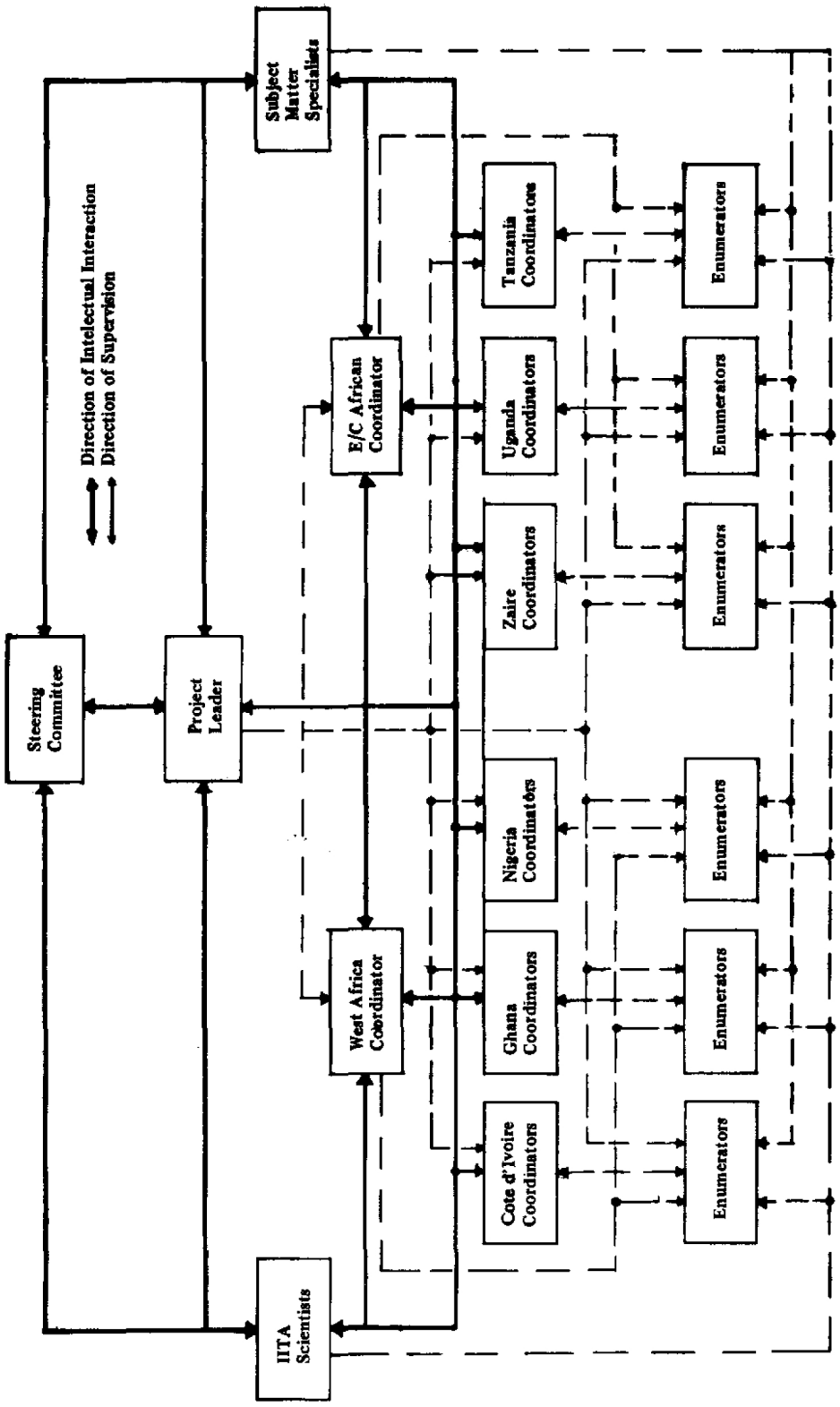

Figure 2: Orgonogrom of Collaborative Study Team of Cassava in Africa (COSCA)

Roles of Team Members

(a) Steering Committee

Defines the broad guidelines for the study and guides the study team on specifications for researchable problems, survey design and methodologies for data collection and analyses.

(b) Project Leader

(i) Participates in the identification of researchable problems and methodologies by developing the methodology framework in his area of expertise, by participating in the discussions of methodologies at the planning meetings and in the design and finalization of the questionnaires.

(ii) Participates and assists in training for village surveys and in the training for intensive surveys.

(iii) Supervises the village surveys and assists in the supervision of enumerators in the intensive surveys.

(iv) Analyzes data and writes reports for the surveys in his area of expertise for all regions and countries.

(v) Assists in the compilation of reports for both the village and intensive surveys at country and regional levels and compiles continental reports.

(vi) Proposes the study to national governments and assists national ministries of agriculture or agricultural research to nominate national coordinators, recruits regional coordinators, recruits office support staff at the headquarter, and recruits consultants as needed.

(vii) Convenes and organizes planning meetings, training programs and Steering Committee meetings.

(c) Regional Coordinators:

(i) Participate in the identification of researchable problems and in the development of methodology frameworks in their areas of expertise, by participating in the discussions of the methodologies at the planning meeting, and in the design of the questionnaires.

(ii) Participate in the samples design and selection processes by assisting in the grids definition for sites selection, in selecting zones within countries for village surveys, and by assisting in selecting village sites and individual farm, processing, marketing and household units for intensive surveys.

(iii) Participate and assist in training for village surveys and in the central training for intensive surveys and assist in the in-country training of enumeratiors for intensive surveys.

(iv) Assist in conducting village surveys and supervising the enumerators in the intensive surveys.

(v) Analyse the survey data and write reports for the intensive surveys in their areas of expertise for all study countries.

(vi) Assist in the compilation of final reports for both the village level and intensive surveys at the country and continental levels and carry out the compilation of the final reports at the regions .

(vii) Advise the national ministries of agriculture or of agricultural research on the nomination of national coordinators, and assist national coordinators in the recruitment of enumerators and office support staff at the regions.

(d) National Coordinators:

(i) Participate in the identification of researchable problems and methodologies by providing information on data within their countries, identifying information needs for national agricultural research and agricultural policy plannings respectively, carrying out literature review within their countries, participating in the discussions of the researchable problems and methodologies in the planning meetings and assisting in the determination of methodologies.

(ii) Participate in the samples selection processes by assisting in grids definition for sites selection, selecting zones within countries, selecting village sites within the zones for village level surveys, and by s selecting village sites and individual farm, processing, marketing and household units for intensive surveys.

(iii) Participate in training for the village surveys and in the central training for intensive surveys, conducting in-country training of enumerators for intensive surveys.

(iv) Conduct village surveys and supervise enumerators in the intensive surveys.

(v) Analyse the data and write the country reports for the village surveys, compile the final country reports and assist in the compilation of the regional reports.

(vi) Recruit enumerators for intensive surveys and office support staff for the country level.

(vii) Assist in budget planning, and procure field and office equipment for the country.

(e) IITA Scientists:

(i) Participate in the identification of researchable problems and in developing methodologies by identifying information needs for their breeding, production systems,

and processing research within their respective programs and activities; developing methodology framework in their areas of expertise, participating in the discussions of the methodologies at the planning meetings.

(ii) Assist in the training for the village surveys, in the central and in-country training of enumerators.

(iii) Participate in field supervision for both the village and intensive surveys.

(iv) Where applicable analyse data and write reports for the intensive surveys in their areas of expertise for all study countries.

(v) Participate in the compilation of final reports for the village and intensive surveys.

(f) Subject Matter Specialists:

(i) Participate in identification of researchable problems and in developing methodology frameworks in their areas of expertise by participating in the discussions of the methodologies at the planning meetings and in the finalization of questionnaires.

(ii) Where applicable, participate in the samples design and selection processes by defining grids for sites selection and by participating in selecting zones within countries for village surveys.

(iii) Where applicable, assist in the training for village and the intensive survey data collection.

(iv) Participate in the field supervision for the village and intensive surveys.

(v) Analyse data and write reports for the surveys in their respective areas of expertise for all study countries.

STRUCTURE OF COSCA PROGRAMS

Phases of COSCA

COSCA will be conducted in three phases; Phase I is regional characterization with the objective of providing broad based village and institutional information for generating hypotheses and sampling frame for subsequent phases. Phase II provides basic information about individual production, processing, marketing and consumption units. Phase III will extend some of the Phase II information over a one calender year for seasonal effects.

Researchable Problems

(a) Phase I

The key issues will be characterization of the following:

1. Cassava production environment including geographical (altitude, latitude) climate/weather, edaphic, cultural, economic, and related factors.

2. Cassava production techniques including land use patterns, cropping patterns, calender of operations, crop disorders including especially, pests and diseases, crop varieties and labour utilization.

3. Cassava consumption by ecology, rural-urban location, ethnicity and type of processed form.

4. Market organizations namely rural-rural, rural-urban and urban-urban flows and market infrastructures.

5. The nature and distribution of cassava processing technologies.

6. Uses of cassava e.g. for human consumption and non-human consumption by form and by variety and relative importance of cassava in the staple diets of Africans.

7. Nutritional and health effects of cassava consumption.

(b) Phases II and III

1. Cassava production objectives at the farm level, resource use and value (private and social) in cassava production versus other farm and non-farm enterprises.

2. Effect of cassava growing on soil fertility in different environments.

3. Technical processing parameters including measurement of HCN levels in different varieties and various processed forms of cassava.

4. Economic evaluation of choice of available on-farm processing techniques.

5. Measurement of relative volumes in the channels and estimation of marketing margins in relation to transportation and market infrastructures.

6. Impact of output markets on development of input markets and on adoption of new production technologies.

7. Market demand (household consumption and other uses) versus supply and marketing infrastructure as constraining factors in the expansion of cassava system and implications for market diversification into alternative uses.

8. The role of price in directing cassava flows through space and time.

Information To Be Collected (Table 1)

Sources of information in Phase I will be group and key informants namely extension workers, research centres, policy makers, and health workers, interviews, direct observations by investigators, and various secondary sources. Information sources for Phase II include individual (production, processing, marketing and

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Table 1: Information to be collected by sources and by phases.

Source	Phase I	Phase II	Phase III
Group interviews in phase I and individual interview in phases II and III.	Calender of farm activities. Farm land tenure systems (ownership, acquisition systems, etc. Sources of basic farm inputs (labour, planting materials, fertilizers, other). Production objectives and strategic roles of cassava. Relative importance of various processed cassava forms. Ownership of processing facilities by gender. Relative importance for home consumption and market of processed cassava form. Source of roots for processing by variety. Market infrastructure availability. Cassava products marketed.	Cropping history of land by field. Source of planting materials (friends, own, market, extension staff, etc) by farm household. Fertilization and soil improvement practices including fallow practices. Farmer production objectives. Farm resources endowments (land, labour, capital equipment, and other inputs). Farm ownership by gender. Storage/arbitrage/speculative functions. Vertical integration (production/processing/marketing etc). Horizontal integration in processing, in marketing, in production. Market information sources.	Calender of farm operations. Farm resources allocation to cassava and other farm and non-farm enterprises. Amount of inputs purchased and output marketed. Market volumes. Marketing input costs (labour, transportation,etc). Prices of cassava products and other major food items. Household consumer expenditure. Household consumption levels for cassava and other major food items. Sources and quantities of roots and other inputs for on-farm processing.

Table 1: Continued

Source	Phase I	Phase II	Phase III
	Major forms and varieties of cassava consumption. Major staples consumed. Non-staples consumed along with cassava. Infant feeding practices. Occurance of toxicity symptoms.		
Direct Observations/ Measurements	Cassava varieties grown. Crop disorders. Cropping patterns for cassava. Available processing and marketing infrastructures.	Field size. Yields of cassava by age and by variety. Soil samples. Varieties grown by field. Cropping patterns by fields. Processing techniques. Storage techniques.	Intensity of Cassava disorders. Chemical, physical and microbiological attributes of cassava processed products. Occurence of toxicity symptoms.

Continued

Table 1: Continued

Source	Phase I	Phase II	Phase III
Extension Agencies	Input delivery system. Extension advisory system. Extension constraints. use of improved technologies.		
Research Agencies	Level of committment to cassava research.		
Policy Making Agencies	Role of cassava in development plans. Production targets. Policy objectives with respect to cassava. Where it exists, government marketing board activities with respect to cassava. Strategic roles of cassava.		

Continued

Table 1: Continued

Source	Phase I	Phase II	Phase III
Secondary Sources	Geographical location (latitude, longtitude) Soil classification. Weather (rainfall, insolation, temperature, etc) Market prices for cassava by forms and related food items. Production trends (production, area, yield) for cassava and other staples. Official exchange rates. Real (black market) exchange rate. Population census. Land area by village/zone, etc. Import/export trade in cassava and in substitutes. National income trend. Trends in industrial uses of starch and glues. Trends in production and consumption of sweetners and confectioneries. Research institutes reports.		

consumption) units interviews, direct observations, and measurements by enumerators. In Phase III, information will be based on repeated interviews of individual production, marketing and consumption units and direct observations by the enumerators to reflect seasonal effects. These details are presented in Table 1.

Integration of COSCA

Within phases integration of the various components of the COSCA study will commence at the sampling stage. In certain cases, same households in a village cluster, will serve as production units and market agents, or production and consumption units, or as production units, market agents and consumption units at the same time (Figure 3). Similarly in the urban centre, the same households may serve as market agents and consumption units. In some cases, the same units could also possibly serve as both urban and rural market agents. These will be accomplished wherever desireable and possible in the sample frame stratification processes.

As will be shown later, the study is also integrated across phases by the sampling procedure. Phases II and III samples are the same and are subsamples of Phase I locations.

The study is further integrated over phases since virtually every one of the hypotheses of the study will be tested with information collected throughout the three phases (Table 2).

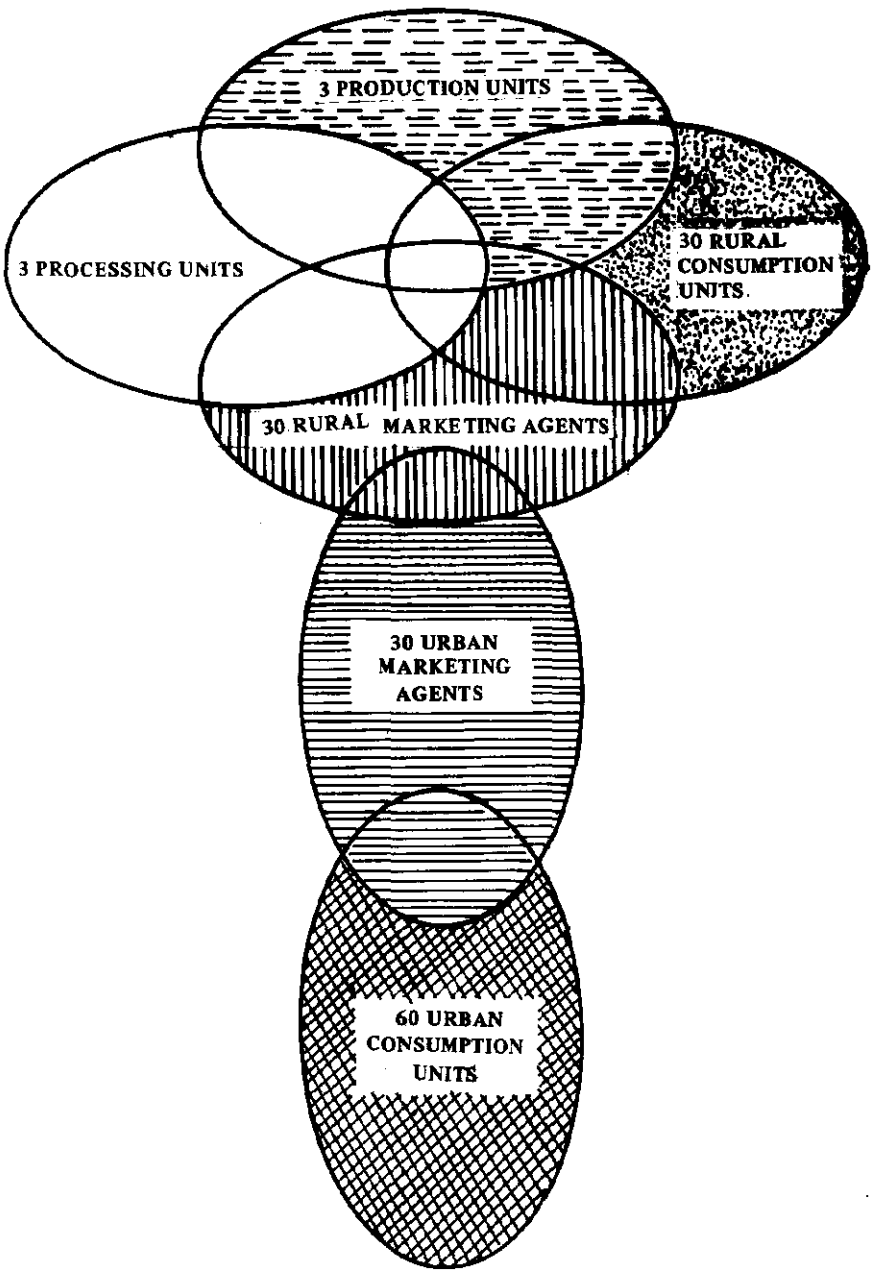

Figure 3: Integration through Sampling Procedures

Table 2: Source of Information (by phase) that will be used to test various hypothesis.

HYPOTHESIS	PHASE I	PHASE II	PHASE III
1. As population density increases fallow periods decrease and the importance of cassava increases but cassava yields decline.	Human population. Land area.	Field History Cassava yield	Household consumption. Resource allocation
2. In areas of intensive production, high use of purchased inputs and high population pressure, cassava is being replaced by other crops and cassava yields are declining.	Human population Land area	Field History Cassava yield	Use of purchased inputs Resource allocation
3. The nature of cropping systems changes as you move from extensive to intensive production.	Human population Land area.	Field History	Use of purchased inputs
4. Production of cassava is increasing disproportionately in non-traditional cassava growing areas, e.g.	Crop production history Weather Location		Resource allocation
5. Cassava is grown using purely traditional technology because marginal returns to purchased inputs such as fertilizer are low compared to other crops.		Crops yields Crops varieties	Resource allocation among Use of purchased inputs Market prices
6. Producers seek greater flexibility in timing of harves through early matruring varieties or varieties that store better in field.	Advantages of varieties grown Disadvantages of varieties grown	Varieties grown Age at harvest	Calender of farm operations

Continued

Table 2: Continued

HYPOTHESIS	PHASE I	PHASE II	PHASE III
7. Cassava mealybug, green spider mite, mozaic virus and leaf blight seriously reduce cassava yields in many regions.		Cassava yields	Crop disorders
8. Land tenure systems do not have a significant impact on production practices.	Control of farm land Farm land acquisition	Soil management practices Vertical/Horizontal integrations Crop varieties grown Cropping patterns Field sizes Market volumes Marketing inputs	
9. There are no economies or diseconomies of scale in cassava production, processing and marketing.		Resource endowments Vertical/Horizontal integrations Processing techniques Field sizes Market volumes Marketing inputs	
10. National agricultural policies usually attach low priority to cassava production, consequently awareness of improved cassava varieties and cultivation practices are limited.	Roles of cassava in development plans National production objectives Input delivery systems Ext. advisory systems National production targets Varieties grown Cropping patterns Market prices Production trends	Farm production obj. Soil improvement practices Sources of planting materials	Calender of farm operations Resource allocations Use of purchased inputs

Continued

Table 2: Continued

HYPOTHESIS	PHASE I	PHASE II	PHASE III
11. High labour requirement for harvesting and processing of cassava is a major constraint to expand production.	Source of Labour Source of other farm inputs wage rates	Farm labour availability Availability of other farm inputs Marketing Inputs Level of integration Processing techniques Field sizes	
12. The macro political and economic environment determines relative resource allocation to cassava with cassava production increasing during periods of political conflict or economic down turn.	Role in development plan National production targets National strategic role Market price trends Weather trends Production trends Exchange rates National income trends Import/Export trends in food		
13. General food shortage, drought, inadequate processing and or lack of suitable low cynaide cassava varieties lead to high cassava consumption hence high cyanide in food.	Strategic role of cassava Varieties grown Occurance of toxicity National food production trends Human population trends Food import/export trends National income trends Weather trends	Sources of planting materials Processing techniques	Prices of cassava processed by form Household consumption levels Varieties processed Occurence of malnutrition problems
14. High cyanide in the food coupled with generally inadequate nutrition is associated with serious health problems.	Occurence of malnutrition problems Infant feeding practices	Processing techniques Storage techniques Processed forms consumed Varieties grown	Household consumption levels Occurence of malnutrition

Continued

Table 2: Continued

HYPOTHESIS	PHASE I	PHASE II	PHASE III
15. Market sales of cassava are significant and increasing.	Relative importance of home consumption Cassava products marketed Marketing board activities Market price trends National products trends Role in development plans Policy objectives Human population trends Food import/export trends	Farmer production objectives	Market volumes
16. Market demand not supply is the constraining factior in the growth of cassava production.	Market surplus Cassava products marketed Marketing board activities Market price trends Production trends popualtion trends Food import/export trends National income trends	Farmer production objectives	Prices of major food items by season Household consumtion levels Household consumer expenditure
17. Demand for and production of bitter cassava is growing more rapidly than sweet cassava.	Varieties grown Processing techniques Leaf consumption Forms consumed	Farmer production objectives Varieties grown Forms consumed Processing techniques Yield by variety	Prices by variety Household consumption levels Sources of tuber processed
18. Demand for cassava in unfermented flour and starch is growing.	Cassava products marketed Trends in industrial uses	Processing techniques Processed forms consumed	Household consumption levels Prices of processed products
19. The relative value of cassava leaves is important and increasing.	Cassava leaves consumtion		Non-staple consumption Cassava leaves consumption

Continued

Table 2: Continued

HYPOTHESIS	PHASE I	PHASE II	PHASE III
20. As individual incomes rise, people tend to consume less cassava and cassava in different forms.	Wage rates	Household characteristics Household composition	Prices of major food items Prices of cassava products Household consumption levels Household consumer expenditure
21. Growth in urbanization is increasing the demand of r processed cassava.	Human population trends Wage rates	Household characteristics Household composition	Prices of major food items Prices of cassava products Household consumption levels Household consumer expenditure
22. The high cost of marketing fresh cassava limits its demand in urban centres.	Market infrastructure Location of markets Means of transportation Market price trends	Cassava products marketed Cassava product consumed Cassava varieties produced Location of processing facilities Prices of cassava products Household characteristics Household composition	Market volumes Marketing costs Market prices Household consumption levels Prices of major food items Household consumer expenditure
23. Farmers who grow cassava commercially are using better agronomic practices and are more apt to adopt modern varieties.		Source of Planting material Use of fertilizer Farm resource endowments Vertical/Horizontal integration Varieties grown Cropping patterns Field sizes Yields attained Soil samples analysis	

Continued

Table 2: Continued

HYPOTHESIS	PHASE I	PHASE II	PHASE III
24. Gender role in cassava production and processing changes as commercialization of products increases.	Household decision making	Farm ownership Processing techniques Production for market Farm resource endowments Vertical/Horizontal integration	Use of purchased inputs
25. Government tends to constrain urban demand for cassava through pricing and subsidies policies for other crops.	Food import/export trends Exchange rates Production trends Marketing board activities Input supply and distribution		
26. Lack of market infrastructure is an important constraint to increased demand for cassava.	Market infrastructure Market price trends	Cassava products marketed Cassava products consumed Cassava varieties produced Location of processing facilities	Market volumes Marketing costs Market prices Household consumption Prices of major food items Prices of cassava products Household consumption levels Household consumer expenditure

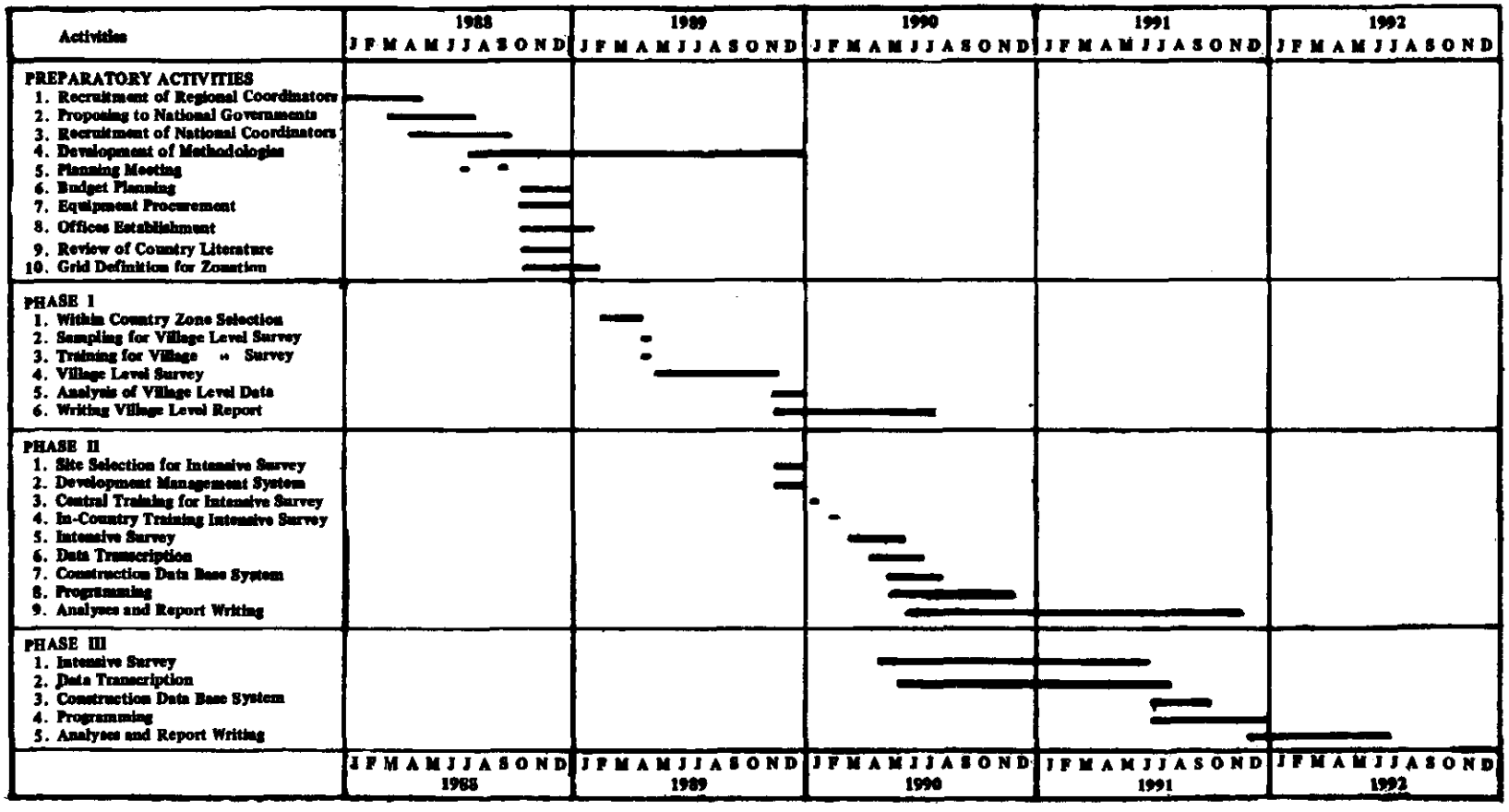

Figure 4: Calendar of Research Activities

Outputs of COSCA.

(a) Phase I

1. Determination of ecological distribution of cassava production practices, varieties grown, pests and diseases, preferred age at harvest and implications for cassava breeding, agronomy and utilization research, processing techniques, preferred consumption forms, and storage practices.

2. Assessment of input delivery systems and implications for adoption of new production and processing technologies.

3. Assessment of national cassava production and consumption objectives, food import policies and implications for producer incentives for adoption of new technologies.

4. Historical description of cassava movement and prediction of the potentials of cassava as a strategic crop in times of crises.

5. Assessments of potentials of cassava as a source of industrial raw materials and implications for future demand and supply patterns.

(b) Phase II

1. Determination of yield gaps between research and farm levels by variety, production systems and ecology and implications for breeding and agronomy research.

2. Assessment of on-farm resource constraints, processing, storage and marketing costs and implications for breeding, agronomy and utilization research.

3. Determination of scales of production and economy of scale in production and implications for ultimate clientelle of research focus and for adoption of new technologies.

4. Explanation of the effects of consumption patterns on varieties grown and forms processed, prediction of their effects on adoption of new technologies.

5. Understanding of the market structure and processes of price formation and implications for growth in the cassava subsector.

(c) Phase III

1. Assessment of resource allocation to cassava relative to other farm and non-farm activities, prediction of the effects of resource allocation on production potentials for cassava.

2. Estimation of the effects of seasonality, substitutability, relative prices, income and urbanization on cassava consumption by variety and form, prediction of market potentials for cassava as human food, and recommendations of new directions for cassava breeding and processing research.

3. Estimation of the level of efficiency of the cassava marketing system, assessment of the implications for consumer and producer prices and the consequences for product and input markets.

4. Determination of the effects of cassava cultivation on soil fertility and implications for agronomy research.

5. Determination of technical processing parameters especially the relationships and influences that may exist between the use of different varieties, processing techniques and qualities of the processed products and implications for breeding, processing and utilization research.

Training

There will be three group training field oriented activities for data collection and analyses for Phase I of the study, i.e the village and institutions surveys. Training will be for two weeks.

The second and third group training activities will be for Phases II and III, i.e. the intensive surveys. One will be conducted at the IITA, Ibadan for the team members some of whom will also serve as resource persons. This training will also be for two weeks . The other will be in-country training of enumerators, with the same content as the central IITA training but will be conducted by the national coordinators, also for two weeks.

Higher degree training will be arranged for only those candidates who are also national coordinators or other nationals collaborating in COSCA. For such nationals, COSCA will cover only research costs. The study program will be arranged in such a manner that it does not interfere with COSCA activities.

Calender of Activities (Figure 4)

Preparatory Activities: Three Regional Coordinators were interviewed at IITA and two appointed for Eastern and Western Africa between January and April, 1988. The COSCA study was proposed to 8 countries namely: Cameroun, Côte d'Ivoire, Congo, Ghana, Nigeria, Tanzania, Uganda and Zaire between March and June 1988. National Coordinators were nominated between April and August, 1988.

A Second Planning Meeting was held in June, 1988 in London, the first having been held in 1987. In the Second Planning Meeting responsibilities for developing the methodologies for the study were assigned and the Third Planning Meeting scheduled. The development of methodologies started in July, 1988.

The Third Planning Meeting was held at IITA, Ibadan early in September. 1988. Drafts of methodology papers, organizational structure and calender of activities for the study were discussed. Following agreements reached in the Third Planning Meeting, the methodologies will continue to be improved until December, 1989.

Country literature reviews will commence in October, 1988. Between October and December 1989, budget will be planned, office and field equipment procured and support staff recruited at country, regional and central levels.

Grid maps for country zonation will be prepared between October, 1988 and January 1989.

Phase I: Within country zone selection will be made between February and March, 1989, sampling and training for village surveys in April, 1989.

The village surveys will be conducted from May to October, 1989. Analyses of the data and writing of the report for the survey will be done from November 1989 to June, 1990.

Phase II: When the village survey report is being written, preparation for intensive surveys will be made with selection of sites and development of data management systems in November and

December, 1989. These will be followed by central training in January and in-country training in February, 1990.

The intensive surveys commence during March and April, 1990. Data transcription starts soon after and runs concurrently with the surveys. Towards the end of the surveys and data transcription when enough feeling for the data has been acquired, the data base system will be constructed and programming commenced. Analyses and report writing will be extended from June 1990 to October 1991 because those activities will run concurrently with supervision of Phase III intensive survey.

Phase III: Intensive survey will be continuous from Phase II and will be completed by May 1991. Data transcription will be concurrent with the survey. Data base construction which will start in May 1990 with Phase II will be completed by August 1991. Programming will also continue until December 1991. Analyses and report writing will be completed by June 1992.

SAMPLING PROCEDURE, DATA COLLECTION, TRANSCRIPTION AND ANALYSES, AND REPORTING

Sampling Procedure (Figure 5)

Sampling procedure involves identification and selection of zones within countries, sites within zones and individual units of production, processing, marketing and consumption. Working Paper No. 2 entitled "A Sampling Frame for the COSCA Village Level Survey" by S. E. Carter and P. G. Jones will provide details for the selection of the zones and the sites. The process is briefly summarized as follows:

Selection of Zones: Variable factors such as climate, human population densities, and infrastructures which significantly influence cassava production and consumption (Carter 1988) form the bases for zoning each study country for the selection of within country study locations. According to Carter (1988), the climatic environments favourable for cassava production in Africa include lowland humid, tropical lowland semi-hot, lowland hot, highland humid tropical, and highland Brazilian isothermic (Table 3).

Each study country is stratified into these climatic zones, each zone is further stratified into high and low population densities while each population density zone is substratified into good or poor infrastructure (Figure 6).

According to Carter (1988) in Uganda, Ghana, and Cote d'Ivoire, cassava is important only in the lowland humid tropical zone and in

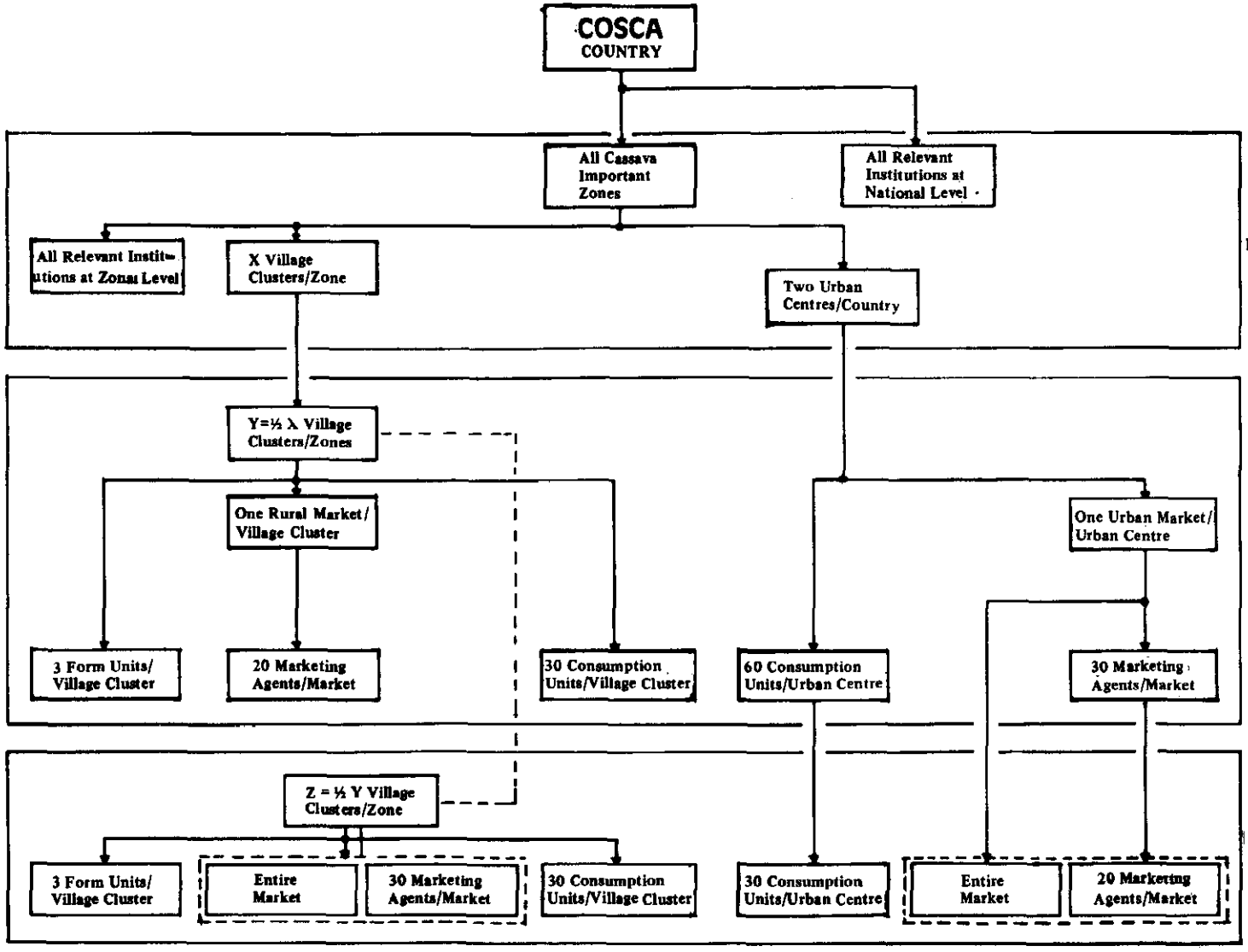

Figure 5: Sampling Procedure

TABLE 3. Percentage distribution of African (major zones) cassava crop area by climate mass.

Climate class	Percentage crop area	Countries
A Lowland humid tropical	33.26	Zaire, Uganda, Cameroun, Ghana, Côte d'Ivoire.
C Lowland semi-hot isothermic	16.62	Tanzania, Nigeria.
E Lowland hot isothermic	9.45	Zaire, Angola.
J Highland humid tropical	7.17	Rwanda, Zaire.
M Highland Brazilian isothermic	7.15	Burundi, Tanzania, Angola.
G Lowland semi-arid isothermic	4.84	Tanzania.
F Lowland hot non-isothermic	4.39	Mozambique

Source: Carter (1988).

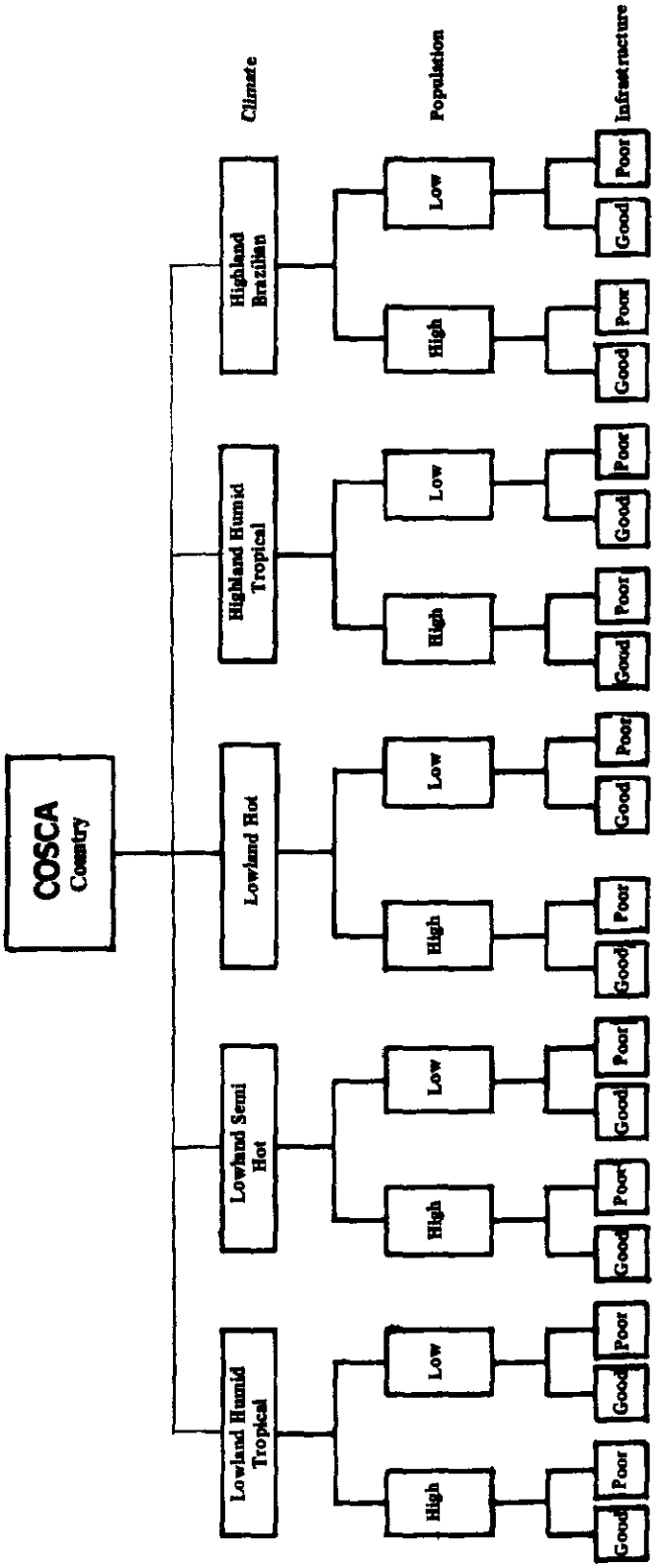

Figure 6: Bases for Country Zonation

Nigeria only in the lowland semi-hot isothermic climatic zones (Table 3). In these countries therefore, only population density and infrastructure form the bases for zonation; thus reducing the maximum sample frame for zone selection to only four in each of these countries.

In Tanzania, cassava is important in two climatic zones namely lowland semi-hot and highland Brazilian isothermic reducing the sample frame to eight. In Zaire, cassava is important in three of the climatic zones
namely lowland and highland humid tropical and lowland hot isothermic yielding a sample frame of twelve.

Selection of Sites: Phase I consists of institutions, urban as well as village components. Institutions and urban components will cover entire countries. For the village component, each zone will be divided into 20 sq km grid cells (Carter 1988). A maximum of 60 such cells will be selected in each country depending on the size of the country and resource availability. The X number will be distributed among the relevant zones in proportion to zone size. Within each zone, the cells will be selected randomly. The survey will be conducted in the village cluster nearest the centre of each cell.

Phases II and III consist of village and urban components. For the village component, Phase II will have a (50%) subsample of Phase I, and Phase III a (50%) subsample of phase II sites. An urban centre in the most important, and another in the least important cassava zones will also be selected randomly.

Table 4: Sample sizes at various sampling stages for Phase II by country.

Country	Sites		Units							
			Production		Processing		Marketing		Consumption	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Côte d'Ivoire	20	2	60	-	60	-	400	60	600	120
Ghana	15	2	45	-	45	-	300	60	450	120
Nigeria	30	2	90	-	90	-	600	60	900	120
Tanzania	21	2	63	-	63	-	420	60	630	120
Uganda	19	2	57	-	57	-	380	60	570	120
Zaire	24	2	72	-	72	-	480	60	720	120
Total	**129**	**12**	**387**	-	**387**	-	**2580**	**360**	**3870**	**720**

Table 5: Sample sizes at various sampling stages for Phase III by country.

Country	Rural	Urban	Units							
			Production		Processing		Marketing		Consumption	
			Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Côte d'Ivoire	**10**	**2**	**30**	-	**30**	-	**200**	**60**	**300**	**60**
Ghana	**8**	**2**	**24**	-	**24**	-	**160**	**60**	**240**	**60**
Nigeria	**15**	**2**	**45**	-	**45**	-	**300**	**60**	**450**	**60**
Tanzania	11	2	33	-	33	-	220	60	330	60
Uganda	10	2	30	-	30	-	200	60	300	60
Zaire	12	2	32	-	32	-	240	60	360	60
Total	**66**	**12**	**198**	-	**198**	-	**1320**	**360**	**1980**	**360**

Selection of Individual Units: Village clusters are the units of analyses in Phase I survey. Discussion of selection of individual units is therefore in relation to Phases II and III.

Three production units/three processing units, 20 market agents and 30 consumption units will be selected in each rural site which make up the village cluster, 30 market agents and 60 consumption units will be selected in each urban site (Tables 4 and 5). Selection will be random for the production, processing and consumption units. Market agents will be first stratified by function and a random selection method will be adopted within each stratum.

Collection of Data

Phase I: The National Coordinators will be the primary enumerators for the Phase I survey. They will be assisted by local guides/interpreters in each village cluster. The Project Leader, Regional Coordinators, relevant IITA scientists and Subject Matter Specialists will participate as much as possible.

Phase II: One enmerator will be used for data collection per village cluster and one per urban centre. The enumerators will be supervised primarily by the National Coordinators periodically by the Regional Coordinators and the Project Leader and as frequently as possible by IITA scientists and Subject Matter Specialists.

As much as possible, enumerators will be appointed from the community where they will work in order to create confidence of the respondents and facilitate the enumeration process. This

arrangement will also be cost effective as it will eliminate housing and significantly reduce transportation costs of the enumerators.

Phase II survey will involve interviews and direct observations, soil sampling, yield data (Ezumah and Lawson, 1988) and field area measurements. These measurements are subject to bias and errors from many sources, therefore to maintain consistency, the same assistant with experience in such measurements will guide local enumerators at every site. This means that the production survey component of Phase II will not run concurrently in all countries but sequentially, one country at a time, starting with the country to first complete Phase I surveys.

Phase III: Phase II enumerators will continue to Phase III and the supervision process will be the same.

The production survey will run for 13 calender months. Interviews will be conducted fortnightly; the recall period will also be fortnightly. A minimum of 26 interviews per farm unit will be conducted during the 13 calender months.

The marketing survey and market price data collection in the rural and the urban areas will also run for 13 calender months. Marketing interviews will be quarterly but recall periods will not exceed one month. There will be a minimum of 5 interviews per marketing agent during the 13 calender months. The market price data will be collected at a minimum frequency of 7 days.

The rural and urban consumption surveys will also run for 13 calender months, with fortnightly interview visits in the urban and monthly in rural sites. Recall periods are 24 hours for food

consumption, 1 month for non-durable and quarterly for durable expenditures. There will be minimum of 26 interviews per consumption unit in urban and 13 in the rural sites during the 13 calender months.

Data Transcription

Data will be transcribed centrally at Ibadan using a suitable data base management computer program, in order to reduce errors and maintain consistency. Diskett copy of the data and the questionnaire for each country will be returned to the national coordinators for their own use.

Data Analyses and Report Writing

Each team member is required to analyse and write up the data collected for publication provided credit is given COSCA and relevant team members. The data will also be simultaneously analysed centrally at Ibadan. Comprehensive reports will also be written centrally incorporating individual reports which will give full professional credit to the authors.

To accomplish the above, suitable computer hard and software facilities are provided at Ibadan. Depending on need and budget allocations, lap-top computers may be provided in some countries. Data management consultants may be used at the initial stages to develop the data base and team's expertise in the management of the data.

Dissemination of Reports

Technical reports that may be required by the funding agency will be prepared. In addition, technical reports will be disseminated through regular professional media such as working/discussion papers, research reports, annual reports, journal articles, monographs, books and conference proceedings especially the triennial symposia of the African Branch International Society of Tropical Root Crops .

BUDGET

Available Fund

Total available fund is US $ 2,212,500 (Table 6), provided mainly by the Rockefeller Foundation. IITA's cash contribution is the 18% overhead recovery and the costs of the administrative manager which will not be charged. UNDP contribution covers Training for Diagnostic Skills in Root Crops in Africa and is to be administered by IITA, specifically for training for field work.

Budget Summary

The major component of the budget (42%) covers international position costs (Table 7). However, another 41% is budgeted for data collection and analyses. International travel allocation is 3%; while contingencies amount to 4% of total budget costs.

About 30% of the budget will be spent in the second and in the third years respectively (Table 8). Most of the equipment will be purchased in the second year and field work activities will be concentrated in the third year. Some field work will also be done in the fourth year. While the first year has been the project's preparatory phase, the fifth year will be mainly for report preparation and minimal field work which will be mainly field re-visits to verify information.

TABLE 6. Distribution of cash budget by contributing agencies.

Contributing Agencies	US $
The Rockefeller Foundation	1,975,000
Less 18% Overhead Recovery Charge	(355,500)
IITA: 18% Overhead Recovery not Charged	355,500
Administrative Manager's Position Cost	127,500
UNDP (Training for Diagnostic Skills in Africa)	25,000
Total cash Available	2,212,500

TABLE 7. Distribution of budget by major items

Major Items	US $	%
International Positions	933,300	42
Data Collection and Analysis (incentive allowances, enumerators, data transcribers, drivers, vehicle maintenance, survey travels)	600,200	28
Equipment and Supplies (field vehicle, field equipment, office equipment, office supplies, computer)	281,500	13
Miscellaneous (processing, nuitrition, history studies, meetings,training and consultants)	197,000	9
International Travel	89,600	3
Office Support	45,800	2
Contingency	85,400	4
Total	2,212,500	100

Table 8: Distribution of budget by year.

Year	US $	%
1988	132,300	6
1989	694,100	31
1990	641,400	29
1991	528,500	24
1992	130,800	6
Contingency	85,400	4
Total	2,212,500	100

Budget Details

Central Budget (Appendix Table1): Although the project life is 4.5 years beginning from January 1988 and ending June 1992, most team members were not on board and major activities did not start before the Third Planning Meeting in early September, 1988. The Project Leader was on part time as he also covered the work of the Cassava Based Systems Working Group (CBSG) economist within IITA's RCMP until the Third Planning Meeting. The Project Leader is budgeted for 3.83 (see Appendix Table 1) years because his costs were paid by CBSG up to August, 1988. The Regional Coordinators are each budgeted for 3 years from July, 1988 for the West African Regional Coordinator and February, 1989 for the East African Regional Coordinator. Administrative Manager provided by IITA is budgeted at 40% of time for 3.75 years.

Seven field vehicles are budgeted for, one for each of the six countries and West African Regional Coordinator. East African Regional Coordinator will use an old IITA land rover in Tanzania. The Project Leader has a four-wheel drive official/family car which will double for field vehicle when necessary.

Two individuals experienced in soil sampling and in cassava yield and field area measurements at IITA will lead local teams to perform these tasks in all the six countries. A total of $40,000 is budgeted to cover the travel cost of such individuals. The sum of $84,900 is budgeted for soil analyses which will be done at IITA.

Travel budget in Appendix Table 1 covers work supervision in all study countries and other international travels related to the

study by the Project Leader, the Administrative Manager, and IITA scientists who are expected to participate actively in the study.

Budget for the nutrition component of the study is for travel by the principal investigator of that component. It is expected that field work will cost additional $10,000. This is budgeted as part of enumerator wages and other field work budgets of various national teams.

National Teams: (Appendix Tables 2-7): Although the National Coordinators started making contributions in preparation for the September 1988 Planning Meeting, incentive allowance payment will start with Phase I field work. The incentive allowances are therefore provided for in each country for 42 months with effect from the date of commencement of the Phase I survey.

One field team consists of one full time and one half time (two half times in Nigeria) national coordinators for 42 months, 13 enumerators for 15 months for the intensive surveys plus equivalent of one for local guide and interpretation during Phase I survey, and one driver for 23 months.

In addition to a car (4 wheel drive) each team will have 4 mobylettes, one 25-kilogram scale, one 10-kilogram scale, 4 3-kilogram scales, 1 altimeter, 2 chain tapes, 4 ranging poles, 16 setts of protective clothing, 2 cutlasses, 2 hoes and some baskets, bags and ropes. Each team also needs small data collection budgets to compensate farmers for taking yield samples from their farms. The car and the altimeter will be purchased from Central Budget.

Compasses will be needed but they will be carried by the field measurement leader who will travel to all the countries from IITA.

Each country is provided with minimal office support staff consisting of a clerk/typist for 30 months and office equipment consisting of either a pc computer or a typewriter, 4 desks, 4 chairs, and some convenient shelf where the coordinators do not already have or will lose access to these equipment. It is hoped that they will continue to use their present office spaces. In the regional headquarters namely Ghana and Tanzania, office facilities are provided for in the Regional Coordinators budget.

For survey travel, during Phase I, 26 working days per month for the 6 months of field work is assumed. It is also assumed that in each working day 2 scientists per country (the National Coordinator, and Assistant National Coordinator or any of their national colleagues who may participate) will be on field travel to conduct village level, urban or institution level interviews or collect secondary data. During Phases II and III, 26 working days per month for 15 months of field work is also assumed. Each working day, one scientist per country (the National Coordinator, or Assistant National Coordinator, or any of their national colleagues who may participate) will be on field travel to supervise enumerators.

Zaire, Uganda, Tanzania, Nigeria and Ghana estimates are based on the same unit cost for each item; Côte d'Ivoire estimates are based on twice the estimates of those countries. Nigerian budgets for National Coordinators, enumerators, and field equipment are larger than other countries because of larger samples to be taken in Nigeria.

Regional Headquarters (Appendix Tables 8 and 9): The regional coordinators will share offices with national teams in regional headquarters namely Ghana and Tanzania. In those countries, office support, equipment and supplies are provided for in the regional headquarters budgets. An extra $5,000 is provided in the travel budget of East/Central African regional headquarters for limited data collection in Eastern Zaire, Rwanda and Burundi. Vehicle maintenance budget is also higher in the East/Central than in West African regional headquarters budgets. The East/Central African Regional Coordinator has an old field vehicle.

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Appendix Table 1: Central budget; estimate for project life; January 1986 to June 1992 (US $ 000)

Item	Total	1988	1989	1990	1991	1992
International Position Costs:						
1. Project Leader (3 yrs x $85,000)	325.8	28.4	85.0	85.0	85.0	42.5
2. West Afr. Coordinator (3 yrs x $85,000)	255.0	42.5	85.0	85.0	42.5	0.0
3. E/C Afr. Coordinator (3 yrs x $75,000)	225.0	0.0	68.8	75.0	75.0	6.2
4. Admin. Manager (3.75 yrs x $85,000 x 4)	127.5	8.5	34.0	34.0	34.0	17.0
5. Secretary (3.5 yrs xz $3,600)	12.6	0.0	2.7	3.6	3.6	2.7
6. Clerk Typist (4.5 yrs x $1,000)	4.5	0.7	1.0	1.0	1.0	0.8
7. Research Associate (3 yrs x $3,600)	10.8	0.0	1.8	3.6	3.6	1.8
8. Data Transcriber (2 yrs x $1,200)	2.4	0.0	0.3	1.2	0.9	0.0
9. Field Vehicles (7 vehicles x $25,000)	175.0	0.0	175.0	0.0	0.0	0.0
10. Soil Sampling/Yield and Field Area Measurements	40.0	0.0	10.0	20.0	0.0	0.0
11. Soil Analysis	84.9	0.0	0.0	0.0	94.6	0.0
12. Travels	89.6	5.2	29.2	28.4	18.8	8.0
13. Computer	20.0	0.0	20.0	0.0	0.0	0.0
14. Office Equipment	8.0	8.0	0.0	0.0	0.0	0.0
15. Office Supplies (4.5 yrs x $3,000)	13.5	3.0	3.0	3.0	3.0	1.5
16. Nutrition Studies	20.0	0.0	15.0	5.0	0.0	0.0
17. Consultants	55.0	3.7	12.5	15.0	16.3	7.5
18. Planning Workshops	55.0	25.0	10.0	10.0	5.0	5.0
19. Training (3)	40.0	0.0	10.0	30.0	0.0	0.0
20. Contingency	85.4	-	-	-	-	-
Total	1,649.7	124.9	563.3	399.8	383.3	93.0

APPENDIX 2: Côte d'Ivoire national coordination; budget estimate for project life; January 1988 to June 1992 (US $ 000).

Item	Total	1988	1989	1990	1991	1992
1. National Coordinators (42 months x 1.5 men x $200)	25.2	0	3.6	7.2	7.2	7.2
2. Guides/Interpreters	3.0	0.0	3.0	0.0	0.0	0.0
3. Enumerators (15 months x 11 men x $200)	33.0	0.0	0.0	22.0	11.0	0.0
4. Driver (23 months x $400)	9.2	0.0	2.4	4.8	2.0	0
5. Yield and other samples compens.	0.6	0	0.0	0.4	0.2	0
6a. Phase I Survey travel (6 months x 26 days x 2 men x $40.00)	12.6	0.0	12.6	0.0	0.0	0.0
6b. Phases II and III surveys travel (15 mth x 26 days x 1 man x $20)	15.6	0.0	0.0	10.6	5.0	0.0
7. Vehicle maintenance	13.6	0.0	2.8	5.4	5.4	0.0
8. Field Equipment	8.0	0.0	0.0	6.0	2.0	0
9. Secretary (30 months x $200)	6.0	0.0	0.0	2.4	2.4	1.2
10. Office/data processing Equipment	7.0	0.0	7.0	0.0	0.0	0.0
11. Office supplies	5.0	0.0	0.0	2.0	1.0	2.0
Total	138 .8	0.0	31.4	60.8	36.2	10.4

APPENDIX 3: Ghana national coordination; budget estimate for project life; January 1988 to June 1992 (US $ 000).

	Item	Total	1988	1989	1990	1991	1992
1.	National Coordinators (42 months x 1.5 men x $200)	12.6	0.0	1.8	3.6	3.6	3.6
2.	Guides/Interpreters	1.5	0.0	1.5	0.0	0.0	0.0
3.	Enumerators (15 months x 14 men x $100)	21.0	0.0	0.0	11.0	5.5	0.0
4.	Driver (23 months x $200)	4.6	0.0	1.2	2.4	1.0	0.0
5.	Yield and other samples compens.	0.3	0.0	0.0	0.2	0.1	0.0
6a.	Phase I Survey travel (6 months x 26 days x 2 men x $20.00)	6.3	0.0	6.3	0.0	0.0	0.0
6b.	Phases II and III survey travel (15 mth x 26 days x 1 man x $20)	7.8	0.0	0.0	5.3	2.5	0.0
7.	Vehicle maintenance	6.8	0.0	1.4	2.7	2.7	0.0
8.	Field Equipment	4.0	0.0	0.0	3.0	1.0	0.0
9.	Secretary	0.0	0.0	0.0	0.0	0.0	0.0
10.	Office data processing Equipment	0.0	0.0	0.0	0.0	0.0	0.0
11.	Office supplies	0.0	0.0	0.0	0.0	0.0	0.0
	Total	64 .9	0.0	12.2	28.2	16.4	3.6

APPENDIX 4: Nigeria national coordination; budget estimate for project life; January 1988 to June 1992 (US $ 000).

	Item	Total	1988	1989	1990	1991	1992
1.	National Coordinators (42 months x 2 men x $200)	16.8	0.0	2.4	4.8	4.8	4.8
2.	Guides/Interpreters	3.0	0.0	3.0	0.0	0.0	0.0
3.	Enumerators (15 months x 11 men x $100)	22.5	0.0	0.0	15.0	7.5	0.0
4.	Driver (23 months x 1 man x $200)	4.6	0.0	1.2	2.4	1.0	0.0
5.	Yield and other samples compens.	0.6	0.0	0.0	0.4	0.2	0.0
6a.	Phase I Survey travel (6 months x 26 days x 2 men x $20.00)	6.3	0.0	6.3	0.0	0.0	0.0
6b.	Phases II and III surveys travel (15 mth x 26 days x 1 man x $20)	7.8	0.0	0.0	5.3	2.5	0.0
7.	Vehicle maintenance	6.8	0.0	1.4	2.7	2.7	0.0
8.	Field Equipment	8.0	0.0	0.0	6.0	2.0	0.0
9.	Secretary (30 months x $ 100)	3.0	0.0	0.0	1.2	1.2	0.6
10.	Office/ data processing Equipment	3.5	0.0	3.5	0.0	0.0	0.0
11.	Office supplies	2.5	0.0	0.0	1.0	0.5	0.0
	Total	60 .4	0.0	12.2	28.2	16.4	3.6

APPENDIX 5: Tanzania national coordination; budget estimate for project life; January 1988 to June 1992 (US $000)

	Item	Total	1988	1989	1990	1991	1992
1.	National Coordinators (42 months x 1.5 men x $200)	12.6	0.0	1.8	3.6	3.6	3.6
2.	Guides/Interpreters	1.5	0.0	1.5	0.0	0.0	0.0
3.	Enumerators (15 months x 11 men x $100)	16.5	0.0	0.0	11.0	5.5	0.0
4.	Driver (23 months x $200)**	4.6	0.0	1.2	2.4	1.0	0.0
5.	Yield and other samples compens.	0.3	0.0	0.0	0.2	0.1	0.0
6a.	Phase I Survey travel (6 months x 26 days x 2 men x $20.00)	6.3	0.0	6.3	0.0	0.0	0.0
6b.	Phases II and III surveys travel (15 mth x 26 days x 1 man x $20)	7.8	0.0	0.0	5.3	2.5	0.0
7.	Vehicle maintenance	6.8	0.0	1.4	2.7	2.7	0.0
8.	Field Equipment	4.0	0.0	0.0	3.0	1.0	0.0
9.	Secretary*	0.0	0.0	0.0	0.0	0.0	0.0
10.	Office/ data processing Equipment	0.0	0.0	0.0	0.0	0.0	0.0
11.	Office supplies*	0.0	0.0	0.0	0 0	0 0	0.0
	Total	60.4	0.0	12.2	28.2	16.4	3.6

* Provided in Regional Coordinate's budget

** Both wage and allowances.

APPENDIX 6: Uganda national coordination; budget estimate for project life; January 1988 to June 1992 (US $ 000).

	Item	Total	1988	1989	1990	1991	1992
1.	National Coordinators (42 months x 1.5 men x $200)	12.6	0.0	1.8	3.6	3.6	3.6
2.	Guides/Interpreters	1.5	0.0	1.5	0.0	0.0	0.0
3.	Enumerators (15 months x 11 men x $100)	16.5	0.0	0.0	11.0	5.5	0.0
4.	Driver (23 months x $200)	4.6	0.0	1.2	2.4	1.0	0.0
5.	Yield and other samples compens.	0.3	0.0	0.0	0.2	0.1	0.0
6a.	Phase I Survey travel (6 months x 26 days x 2 men x $20.00)	6.3	0.0	6.3	0.0	0.0	0.0
6b.	Phases II and III surveys travel (15 mth x 26 days x 1 man x $20)	7.8	0.0	0.0	5.3	2.5	0.0
7.	Vehicle maintenance	6.8	0.0	1.4	2.7	2.7	0.0
8.	Field Equipment	4.0	0.0	0.0	3.0	1.0	0.0
9.	Secretary (30 months x $100)	3.0	0.0	0.0	1.2	1.2	0.6
10.	Office /data processing Equipment	3.5	0.0	3.5	0.0	0.0	0.0
11.	Office supplies	2.5	0.0	0.0	1.0	0.5	1.0
	Total	69 .4	0.0	15.7	30.4	18.1	5.2

APPENDIX 7: Zaire national coordination; budget estimate for project life; January 1988 to June 1992 (US $ 000).

	Item	Total	1988	1989	1990	1991	1992
1.	National Coordinators (42 months x 1.5 men x $200)	12.6	0.0	1.8	3.6	3.6	3.6
2.	Guides/Interpreters	1.5	0.0	1.5	0.0	0.0	0.0
3.	Enumerators (15 months x 11 men x $100)	16.5	0.0	0.0	11.0	5.5	0.0
4.	Driver (23 months x $200)	4.6	0.0	1.2	2.4	1.0	0.0
5.	Yield and other samples compens.	0.3	0.0	0.0	0.2	0.1	0.0
6a.	Phase I Survey travel (6 months x 26 days x 2 men x $20.00)	6.3	0.0	6.3	0.0	0.0	0.0
6b.	Phases II and III surveys travel (15 mth x 26 days x 1 man x $20)	7.8	0.0	0.0	5.3	2.5	0.0
7.	Vehicle maintenance	6.8	0.0	1.4	2.7	2.7	0.0
8.	Field Equipment	4.0	0.0	0.0	3.0	1.0	0.0
9.	Secretary (30 months x $100)	3.0	0.0	0.0	1.2	1.2	0.6
10.	Office /data processing Equipment	3.5	0.0	3.5	0.0	0.0	0.0
11.	Office supplies	2.5	0.0	0.0	1.0	0.5	1.0
	Total	69 .4	0.0	15.7	30.4	18.1	5.2

APPENDIX 8: West African regional headquarter; budget estimate for project life; January 1988 to June 1992 (US $ 000).

	Item	Total	1988	1989	1990	1991	1992
1.	Secretary (30 months x $ 100)	3.0	0.0	0.0	1.2	1.2	0.6
2.	Driver (25 months x $200)	5.0	0.0	1.6	2.4	1.0	0.0
3.	Travels (Survey and International)	15.0	3.7	2.5	5.0	3.8	0.0
4.	Office /data processing Equipment	3.5	0.0	3.5	0.0	0.0	0.0
5.	Office supplies	3.5	0.0	0.3	1.3	0.8	1.1
6.	Vehicle maintenance	5.0	0.0	2.0	2.0	1.0	0.0
	Total	35.0	3.7	9.9	11.9	7.8	1.7

APPENDIX 9: East/Central African regional headquarter; budget estimate for project life; January 1988 to June 1992 (US $ 000).

	Item	Total	1988	1989	1990	1991	1992
1.	Secretary (30 months x $ 100)	3.0	0.0	0.0	1.2	1.2	0.6
2.	Driver (25 months x $200)	5.0	0.0	1.6	2.4	1.0	0.0
3.	Travels (Survey and International)	20.0	3.7	7.5	5.0	3.8	0.0
4.	Office/ data processing Equipment	3.5	0.0	3.5	0.0	0.0	0.0
5.	Office supplies	3.5	0.0	0.3	1.3	0.8	1.1
6.	Vehicle maintenance	9.0	0.0	3.0	3.0	3.0	0
	Total	44 .0	3.7	15.9	12.9	9.8	1.7

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Felix I. Nweke is an Agricultural Economist and Project Leader, Collaborative Study of Cassava in Africa (COSCA), Resource and Crop Management Program, International Institute of Tropical Agriculture, Ibadan, Nigeria.

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