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ACCELERATED MULTIPLICATION AND DISTRIBUTION OF CASSAVA AND SWEETPOTATO PLANTING MATERIALS AS A DROUGHT RECOVERY MEASURE IN MALAWI

ADOPTION RATE AND IMPACT ASSESSMENT STUDY

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A

TABLE OF CONTENTS

PAGE

LIST OF TABLES iv
LIST OF FIGURES vii
ACRONYMS AND ABBREVIATIONS viii
DEDICATION x
ACKNOWLEDGEMENTS xii
EXECUTIVE SUMMARY xiii

SECTION I: INTRODUCTION 1

1.1 Background 1
1.1.1 Macro-economic overview 1
1.1.2 Cassava and sweetpotato in Malawi 1
1.1.3 IITA and SARRNET 3
1.1.4 Government, IITA and donor response to the drought:The accelerated multiplication and distribution of cassava and sweetpotato planting materials as a drought recovery measure project . . . 3
1.1.4.1 Project Statement 4
1.1.4.2 Objectives 4
1.1.5 Structure of multiplication and distribution activities 5
1.2 Purpose of the Study 7
1.3 Team Composition and Study Methodology 8
1.4 Conceptual Framework 10

SECTION II: FARM LEVEL IMPACT 12

2.1 Introduction 12
2.2 Broad National and Household Impact 12
2.3 Socio-Economic Characteristics of Participating Households 13
2.4 Importance Attached to Various Crops by Farmers 16
2.5 Trends of Major Crops as Perceived by Farmers 17
2.6 Adoption of Cassava and Sweetpotato Materials 18
2.7 Sources of Cassava and Sweetpotato Planting Materials 21
2.8 Impact of the Improved Cassava and Sweetpotato Materials on Household Food Security 24
2.9 Gender Issues 29
2.10 Knowledge on Cassava and Sweetpotato Husbandry by Farmers 30
Cassava and Sweetpotato Production Constraints 31
2.12 Distribution of Benefits of Cassava and Sweetpotato among Producers, Traders Transporters and Consumers 33
2.13 Competitiveness of Cassava and Sweetpotato in the Farming Systems 34

B

SECTION III: INSTITUTIONAL LEVEL IMPACT 37

3.1 Introduction 38
3.1.1 Donor endorsement 38
3.1.2 Agricultural policy changes 39
3.1.3 Project management 39
3.1.4 Manpower allocations 41
3.1.5 Budgetary contribution of research, extension and NGOs 41
3.1.6 Project planning and monitoring 43
3.2 Institutional Stakeholder Linkages 44
3.3 Training 50
3.4 Environmental Issues 51
3.5 Outputs and Means of Verification 51
3.6 Sustainability 54

SECTION IV: CONCEPTUAL FRAMEWORK APPLIED 56

4.1 Introduction 56
4.2 Adoption/Diffusion 56

SECTION V: UNEXPECTED OR UNPLANNED IMPACTS 59

SECTION VI: LESSONS LEARNED FROM THE PROJECT AND RECOMMENDATIONS 61

ANNEX A: SCOPE OF WORK 67

ANNEX B: CASE STUDIES 69

1. Marketing of Sweetpotato in the Nkhata Bay Market
2. Marketing of Cassava in the Nanjiri Market
3. The Role of the Livingstonia CCAP Mission in the Multiplication and Distribution of Cassava and Sweet-potato Planting Materials
4. The Bunda Farmer
5. The Lilongwe East RDP and the Nathenje RTC
6. CSC Agricultural Development Worker: Building Capacity and Sustainability
7. Local Leadership: Mrs. Malias Chavukula Leader of the Nkhoma-Chabuka Women's Club

ANNEX C: REPORTS AND DOCUMENTS REVIEWED BY THE STUDY TEAM . . . . . .

C

ANNEX D: PERSONS CONTACTED BY THE STUDY TEAM 88

ANNEX E: REPORTS PRODUCED UNDER THE PROJECT 94

ANNEX F: DATA USED IN THE ANALYSES OF CASSAVA AND SWEETPOTATO COMPETITIVENESS IN THE SYSTEMS 95

ANNEX G: RANKING OF CASSAVA AND SWEETPOTATO VARIETIES BY FARMERS 100

ANNEX H: DESCRIPTION OF RECOMMENDED VARIETIES MULTIPLIED AND DISTRIBUTED UNDER THE PROJECT 101

LIST OF TABLES

Table		Page
1.	Performance of cassava and sweetpotato in 1993/94 and 1994/95	14
2.	Average number of household members for participating and nonparticipating households	14
3.	Age of heads of households in relation to cultivated area	14
4.	Total number of adult persons in the household by area of cassava and sweetpotato	15
5.	Area under cassava and sweetpotato by gender of household head	15
6.	Area under cassava for farmers and involvement in nonfarm activities	16
7.	Number of villages mentioning various crops as the first, second and third most important food crops	16
8.	Number of villages mentioning various crops as the first, second and third most important cash crops	17
9.	Production trends of various crops in the villages surveyed	18
10.	Number of farmers growing the new cassava and sweetpotato materials in the surveyed villages	19
11.	Number of villages with varying proportions of farmers growing cassava and sweetpotato	20
12.	Number/percent of farmers classifying the yield of new materials compared to traditional varieties	20
13(a)	Number of villages obtaining cassava planting materials from various sources, 1992/93-1994/95	

E

13 b Number of villages obtaining sweetpotato planting materials from various sources, 1992 93-1994 95 22

14. Number of farmers receiving planting materials from different sources 23

15. Number of farmers preserving planting materials for the next season 23

16. Farmers expressing requirement of planting materials outside their fields for the next season 24

17. Adequacy of planting material obtained against the actual requirement 24

18. Comments by farmers on some cassava attributes after harvest of the improved materials 25

19. Comments by farmers on some sweetpotato attributes after harvest of the improved materials 25

20. Perception of comparative food security between participating and nonparticipating households 26

21. Number of farmers growing cassava and sweetpotato in relation to the number of hunger months 27

22. Farmers selling the new cassava materials in the 1993/94 and 1994/95 seasons 28

23. Farmers selling the new sweetpotato materials in the 1993/94 and 1994/95 seasons 28

24. Average proportion sold and consumed for cassava and sweetpotato, 1993/94 and 1994/95 . . 28

25. Performance of various activities in cassava by gender 29

26. Performance of various sweetpotato activities by gender 29

27. Farmers' knowledge of various recommendations regarding cassava 30

28. Farmers' knowledge of various recommendations regarding sweetpotato 31

29. Most important constraints to increased cassava and sweetpotato production 31

30. Average proportion of area and extent of damage by crop, 1994/95 32

31. Precautions taken against livestock damage by farmers 33

32. Distribution of the sale price among participants 34

33. CSC cost sharing to various activities in cassava and sweetpotato multiplication and distribution 34

34. BAM cost sharing to various activities in cassava and sweetpotato multiplication and distribution 42

35. Role of institutions and agencies in the accelerated multiplication and distribution project of cassava and sweetpotato planting materials 47

G

LIST OF FIGURES

No.			Page
1.	Malawi:	Location of cassava and sweetpotato multiplication sites	6
2.	Malawi:	Location of villages visited by the Study Team	10
3.	Malawi:	Interactions among cooperators involved in the multiplication and distribution of cassava and sweetpotato planting materials	45

H

ACRONYMS AND ABBREVIATIONS

AA	Actionaid
ADD	Agricultural Development Division
ADMARC	Agricultural Development and Marketing Corporation
ADO	Assistant Development Officer
ADRA	Adventist Development and Relief Agency
AMDCSPM	Accelerated Multiplication and Distribution of Cassava and Sweetpotato Planting Materials
BAM	Baptist Agricultural Mission
BCA	Bunda College of Agriculture
CARO	Chief Agricultural Research Officer
CAS	Controller of Agricultural Services
CCAP	Church for Central Africa Presbyterian
CCM	Christian Council of Malawi
COSCA	Collaborative Study of Cassava in Africa
CPAR	Canadian Physicians Aid and Relief
CSC	Christian Service Committee of Malawi
CTL	Commodity Team Leader
DAR	Department of Agricultural Research
DO	Development Officer
EARRNET	Eastern Africa Root Crops Research Network
EMV	Extension Multiplier Volunteer
EPA	Extension Planning Area
ESARRN	Eastern and Southern Root Crops Research Network
EU	European Union
FA	Field Assistant
FAO	Food and Agriculture Organization (of the United Nations)
FHA	Farm Home Assistant
FMA	Famine Mitigation Activity
GDP	Gross Domestic Product
GOM	Government of Malawi
Ha	Hectare
HH	Household
HCN	Hydrogen Cyanide
IITA	International Institute of Tropical Agriculture
ISTRC	International Society for Tropical Root Crops
LOP	Life of Project
MASL	Meters Above Sea Level
MK	Malawi Kwacha (Malawi currency)
MOALD	Ministry of Agriculture and Livestock Development
NARS	National Agricultural Research System
NGO	Non-Government Organization
NRC	Natural Resources College
NRCP	National Root and Tuber Crops Program
OFDA	Office of Foreign Disaster Assistance
PM	Program Manager
PO	Project Officer
POW	Plan of Work
RDP	Rural Development Project
RTC	Residential Training Center
SACCAR	Southern Africa Center for Coordination Agricultural Research and Training

SADC	Southern Africa Development Community
SARRNET	Southern Africa Root Crops Research Network
SOW	Scope of Work
TA	Technical Assistant
TEAM	Study Team for This Assignment
TOR	Terms of Reference
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USDA	United States Department of Agriculture

5

DEDICATION

This report is dedicated to the late Raphael Felix Nembozanga Sauti, Leader of the Root Crops Commodity Team from 1978 to December 5, 1994, when he passed away. He courageously contended with the maize and tobacco era of the Department of Agricultural Research until he formed the Root Crops Commodity Program.

In collaboration with USAID, IITA, UNICEF, FAO and a number of NGOs, he championed the accelerated multiplication and distribution of cassava and sweetpotato planting materials. Today we are attempting to assess three years of impacts made by this momentous activity he pioneered. The purpose is to determine the achievements realized to date and pave the way for further progress so that his dream of cassava and sweetpotato eliminating hunger in Malawi can come true.

The following photographs illustrate, in part, the results of his work.

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Photo 1. Beneficiaries collecting sweetpotato planting material.

Photo 2. Plentiful supply of cassava roots at Nanjiri market near Lilongwe.

ACKNOWLEDGEMENTS

The Study Team is grateful to all of the persons listed in Annex D who took the time to meet with the Team and share their insights, knowledge, concerns, and suggestions. They all contributed to the success of the Team's efforts.

We especially wish to thank the 90 farmers and the 15 farmer groups who participated in the field level survey. The direct contact and interviews with the primary beneficiaries of the Project enabled us to directly see the positive impact of the program in increasing incomes and improving quality of life in rural Malawi.

The Acting Chief Agricultural Research Officer, Dr. A.S. Kumwenda, and the Chief Agricultural Extension and Training Officer Mr. E.S. Kabuye deserve special thanks for coordinating our movements through the help of the Agricultural Research Stations and ADDs' Program Managers.

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EXECUTIVE SUMMARY

The Accelerated Multiplication and Distribution of Cassava and Sweetpotato Planting Materials (AMDCSPM) Project was initiated in Malawi in 1992 as a drought recovery measure. Supported by USAID and the US Department of Agriculture, the Project has helped the Government of Malawi increase the production of cassava and sweetpotato, which not only aided in short-term drought relief but has established the means for the permanent increases in income and food security.

The overall objective was to expand Malawi's cassava and sweetpotato production through (1) accelerating multiplication, distribution and adoption of improved cassava and sweetpotato varieties which have already been tested in Malawi; and (2) providing technical and training support to organizations cooperating with IITA in the multiplication and distribution scheme.

Specific objectives were to:

(i) assist in the establishment of long-term sustainable multiplication sites in each of the major root crops production areas;

(ii) provide training, technical support and advice (primarily to extension agents and NGOs) managing multiplication sites;

(iii) multiply improved cassava and sweetpotato varieties at 20 primary and 50 secondary sites throughout the country;

(iv) provide financial and technical support in the distribution of planting materials to an estimated 300,000 smallholder farmers;

(v) produce sufficient cassava and sweetpotato planting materials to plant an estimated 4,500 hectares of sweetpotato and 2,000 ha of cassava during two subsequent crop years.

Authorized life of project funding consisted of a US Department of Agriculture/Office of Foreign Disaster Assistance grant to IITA/ESARRN of US$ 450,000 in 1992. USAID/Malawi provided an additional US$ 250,000 for the 1993/94 multiplication activities. A no-cost extension was approved through March 1996. IITA/SARRNET was the prime contractor, and the National Root Crops Commodity Team in the Department of Agricultural Research provided Project leadership.

This study is an overall impact assessment to determine what the Project has accomplished since its inception. The Team was to ascertain 1) the efficiency of the technology generation, 2) the effectiveness of the technology transfer, 3) the impact of investing in this Project at both farm and institutional levels, 4) the sustainability of the Project and 5) the "lessons learned" and recommendations, which can improve similar programs in other countries.

The Team found that the AMDCSPM has been successful in achieving and even surpassing its objectives. Coordination, training, technical backstopping and the collaborative efforts of stakeholders all helped establish the foundation for a strong and effective multiplication and distribution system countrywide. A major contribution of AMDCSPM was to influence change in Government of Malawi agricultural policy to support crop diversification with emphasis on cassava and sweetpotato as drought tolerant crops. An initiative was adopted in 1994, reversing the previous administration's heavy promotion of maize and thirty-year neglect of cassava and sweetpotato.

The 1995 estimate for cassava hectarage (95,000 ha) represented a 31 percent increase from the previous year, and sweetpotato hectarage more than doubled to 61,000 ha, a 63 percent increase. Farmers interviewed estimated that the new cassava varieties yielded 100-200 percent more than traditional varieties and new sweetpotato varieties increased yields by 200-300 percent. Economic case studies comparing cassava and sweetpotato with maize, tobacco, cotton and rice over the past three-year period indicate that farmers can realize four to five times greater net profit per ha compared to that from the alternative crops.

Farmers also reported reduction of the length of the yearly hunger period when the food supply is severely reduced and expensive, and they attribute this to the greater supply of cassava and sweetpotato. The consumption of the leaves of the crops adds needed nutrients to the rural diet, especially when food is scarce. One of the unexpected results of the Project has been the rapid increase in the commercial sales of cassava and sweetpotato from rural to urban areas. Over 20% of the amount produced is now marketed and the proportion is rising. This extra income is utilized to purchase other food, medicine, fertilizer for maize, and pay school fees.

Linkages were established among several groups of stakeholders: research stations and staff, eight Agricultural Development Divisions, 12 NGOs, many church groups, IITA/SARRNET, donors, and farmers. Several innovative multiplier volunteer contact farmer programs were developed by NGOs, and an NGO produced the first fact sheets on cassava in the local language. Additional funding and training will help the NGOs continue to establish secondary nurseries, distribute planting materials, and monitor and advise farmers.

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The assessment Team sets forth several practical recommendations such as further research into the requirements of different agro-ecologies with regard to cassava and sweetpotato, and the implementation of a quality control program to ensure that pathogen-free planting materials are distributed. Its overall recommendations for sustainability of the Project's impressive progress are for continued external support directed at enhancing the NGOs' role at local levels, building future research capacity, upgrading training for all stakeholders, and helping to strengthen extension and local farmers' organizations.

SECTION I: INTRODUCTION

1.1 Background

1.1.1 Macro-economic overview

Malawi is a small, agricultural, land-locked country of 11 million people. It became democratic in mid-1994, and with the new political climate there is now a great hope of achieving economic growth and improving the quality of life. As one of the poorest countries in the world, Malawi's biggest challenge is to overcome its endemic poverty. The per capita GDP is about $100; the average land holding is 1.0 hectare; the population growth rate is 3.2%; and access to clean water is attained by only 50% of the population. In addition, life expectancy is less than 50 years. The infant mortality rate is 134 per 1,000, and the majority of the population is illiterate (World Bank 1994; 1995).

These bleak conditions were exacerbated by severe droughts in two recent years--1991/92 and 1993/94--and low rainfall in 1994-95. Crop production for the last five years has been below normal. Severe hardships have been caused among the rural poor partly because maize, which is the staple food for the majority of Malawians and occupies 70% of the arable land, has produced yields well below normal during the droughts. The crop statistics indicate that for the drought years of 1991/92 and 1993/94, maize production decreased by about 50% (MOALD 1994).

1.1.2 Cassava and sweetpotato in Malawi

In Malawi the main root crop is cassava, followed by sweetpotato. Cassava alone supports about one quarter of the population in calorie requirements. The leaves of cassava are also rich in Vitamin A, calcium, iron and protein. Raw cassava leaves are surpassed as a source of Vitamin A only by carrots, eggplant and peppers (West et. al 1987).

The advantages of both cassava and sweetpotato are well documented (Jones 1959; Carter et al. 1992):

1. Cassava is drought tolerant and capable of providing yields in agro-ecologies where other crops cannot, and it provides good yields where crops like maize fare poorly.

2. Cassava survives and produces better than alternative crops in marginal soils.

3. Both cassava and sweetpotato have flexible growing characteristics which permit staggered planting and harvesting.

4. They require much lower inputs than other crops.

5. They have longer storage life under the soil.

6. They reduce soil and wind erosion in certain agro-ecologies.

7. Sweetpotato takes about four months to mature and requires less moisture compared to maize. Two crops per year of sweetpotato can be grown if sufficient moisture is available.

Interest in drought tolerant crops, particularly cassava and sweetpotato, has been increasing following the last three years of drought. Traditionally cassava has been grown mainly along the lakeshore of Lake Malawi and the southeastern part of the country. Sweetpotato, although occupying less area, is more widely scattered throughout the country. Area under both cassava and sweetpotato has increased dramatically in recent years. In addition, there is strong evidence from the crop estimates that cassava, sweetpotato and soyabeans are the only food crops that are expanding in both area planted and in total production.

The 1994/95 area under cassava is estimated to have been 95,000 hectares while that of sweetpotato was estimated at 65,000 ha. Given the dry weight estimates of cassava yields of 3.5 tons per ha and sweetpotato yields of 4.5 tons per ha, these translate into 332.5 thousand and 292.5 thousand tons for cassava and sweetpotato, respectively (MOALD 1995).

In the Agricultural Research Master Plan (MOALD 1995), the Agricultural Development Divisions (ADDs) ranked priority crops on a scale of 1 to 4. Cassava was ranked in category one by six out of eight ADDs (Blantyre, Karonga, Kasungu, Machinga, Mzuzu and Salima) and in priority three by two (Shire Valley and Lilongwe). Sweetpotato was ranked in priority one by two ADDs (Kasungu and Lilongwe), priority two by two ADDs (Blantyre and Shire Valley), in priority three by one ADD (Machinga), and in priority four by three ADDs (Salima, Mzuzu and Karonga) (MOALD 1995). The high priority ranking of these crops by these farmers' representatives who are in charge of all crops illustrates their growing importance as well as a change in attitude.

In national policy there is now a deliberate attempt to diversify out of maize into drought tolerant crops. Cassava and sweetpotato are at the top of the list because of their adaptation to marginal soils and drought and their very low external input requirements. Prior to 1992 public documents and fora on crop promotion campaigns by-passed cassava and sweetpotato. The agricultural extension reward mechanism then was pro-tobacco and maize. Now the Government of Malawi (GOM) is actively promoting cassava and sweetpotato on the radio, in newspapers, and at meetings and conferences. In November 1994, the Ministry of Agriculture and Livestock Development (MOALD) hosted a well-attended conference to present the "Agricultural and Livestock Development Strategy and Action Plan" in which the concept of crop diversification was elaborated and discussed.

The following policy statement, which will guide future projects, programs and plan formulation in the MOALD, emerged from the meeting:

> **"Production of maize in areas that are not suited to its production, largely as a result of low rainfall, will be discontinued to give room for more drought resistant crops such as cassava and sweetpotato to improve household food security".**

This policy statement has served as an important impetus in supporting the Accelerated Multiplication and Distribution of Cassava and Sweetpotato Planting Materials (AMDCSPM) Project.

1.1.3 International Institute of Tropical Agriculture (IITA) and Southern Africa Root Crops Research Network (SARRNET)

IITA is one of the International Agricultural Research Centres of the Consultative Group of International Agricultural Research. Headquartered at Ibadan, Nigeria, IITA conducts research and training, and germplasm and information exchange activities in partnership with regional and national programs in parts of sub-Saharan Africa. The research agenda addresses crop improvement, plant health and resource and crop management with a farming system's framework. Research focuses on smallholder cropping systems in the humid and subhumid tropics of Africa and on the following major food crops: cassava, maize, plantain and banana, yam, cowpea and soyabean. The goal of IITA's research and training mission is to improve the nutritional status and well-being of low-income people of the humid and subhumid tropics of sub-Saharan Africa.

SARRNET is a network for the Southern Africa Development Community (SADC). Its main purpose is to increase the production of cassava and sweetpotato by smallholders in the resource poor areas of Southern Africa through the adoption of improved varieties, production practices, and processing technologies. It also works to strengthen capabilities of national root crops research programs. The network is funded by USAID and executed by IITA and the International Potato Centre (CIP). IITA implements the Accelerated Multiplication and Distribution of Cassava and Sweetpotato Planting Materials in Malawi through SARRNET and in collaboration with the National Agricultural Research System NARS (Malawi), Agricultural Extension, and NGOs. (SARRNET is a successor to ESARRN which split into two networks in 1993 to form EARRNET and SARRNET.)

1.1.4 Government, IITA and donor response to the drought: Project on accelerated multiplication and distribution of cassava and sweetpotato planting materials as a drought recovery measure

In response to the droughts, the GOM started, among other programs, the multiplication and distribution of cassava and

sweetpotato planting materials in the 1991/92 season on a small scale. In 1992/93 and 1993/94 the Government received US$450,000 from the United States Department of Agriculture/Overseas Federal Disaster Assistance (USDA/OFDA) through IITA/ESSARN and later IITA/SARRNET. USAID Malawi provided an additional US$250,000 for the 1993/94 multiplication activities. The Project "Accelerated Multiplication and Distribution of Cassava and Sweetpotato Planting Materials as a Drought Recovery Measure in Malawi" was launched. A twelve-month no-cost extension of the Project was granted in November 1994 and another was granted in October 1995. These enabled the Project to run to March 1996.

1.1.4.1 Project statement

The Project was to expand the multiplication and distribution scheme for root and tuber crops, strengthen the linkage with NGOs and broaden the capacity of the system to produce planting materials. This would permit greater areas of root crops to be planted, which would contribute to household food security as rural Malawi sought to recover from the effects of drought.

1.1.4.2 Objectives

The overall objective of the Project was to expand Malawi's cassava and sweetpotato production through (1) accelerating multiplication, distribution and adoption of improved cassava and sweetpotato varieties which have already been tested in Malawi; and (2) providing technical and training support to organizations cooperating with IITA in the multiplication and distribution scheme.

Specific objectives were to:

(i) Assist in the establishment of long-term sustainable multiplication sites in each of the major root crops production areas;

(ii) Provide training, technical support and advice (primarily to extension agents and NGOs) managing multiplication sites;

(iii) Multiply improved cassava and sweetpotato varieties at 20 primary and 50 secondary multiplication sites throughout the country;

(iv) Provide financial and technical support in the distribution of planting materials to an estimated 300,000 smallholder farmers;

(v) Produce sufficient cassava and sweetpotato planting materials to plant an estimated 4,500 ha of sweetpotato and 2,000 ha of cassava during two subsequent crop years.

An internal evaluation of the Project was conducted in October 1994. The purpose of the evaluation was to determine the strengths and weaknesses in the planning, organization and management of the Project. A national workshop to review the evaluation report was held April 3-4, 1995. It was attended by all stakeholders, who discussed future development plans for the Project. The current study on adoption rate and impact assessment builds from the October 1994 evaluation findings to examine in greater detail the Project's impact at the farm, household and institutional levels.

1.1.5 Structure of multiplication and distribution activities

The multiplication and distribution of cassava and sweetpotato planting materials are organized and managed at three levels:

1. Primary multiplication nurseries--These are established by and at Agricultural Research Stations. Day-to-day management is provided by staff of the research stations. Financial support is provided by IITA/SARRNET.

2. Secondary multiplication sites--The establishment of these sites is mainly in the ADDs' jurisdiction areas. The responsibility for supervision and monitoring comes from the extension staff although the research staff also offers its support, particularly on pest and disease monitoring. Extension is made up of eight ADDS, 30 RDPs and 135 EPAs.

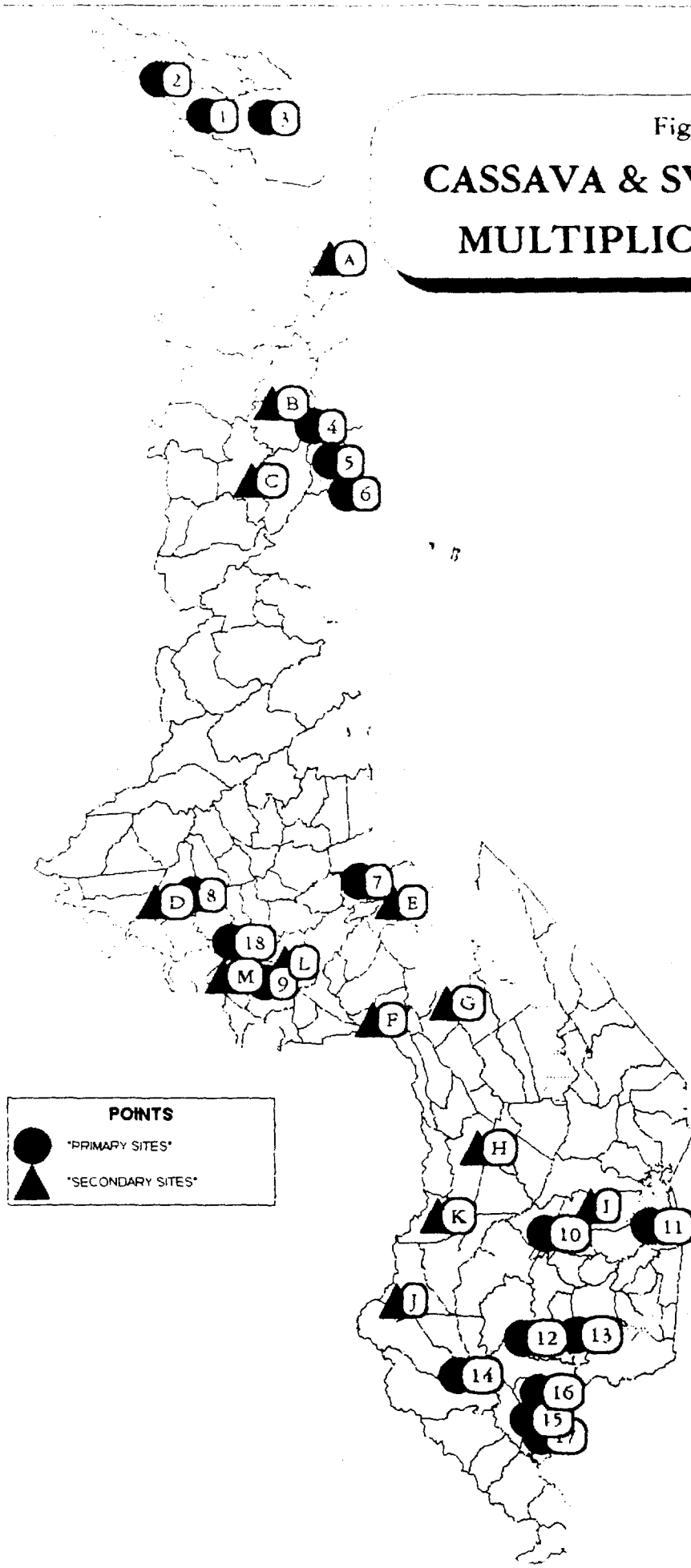
   Secondary sites can be established in a farmer's field if the farmer makes some form of contract concerning his or her responsibility after getting the financial and technical support. In principle, NGOs, churches, schools, prisons and other groups can also be involved in the establishment of secondary sites.

3. Tertiary multiplication nurseries--This category is composed mainly of farmers' clubs, farmers' groups and individual farmers. The total amount of planting materials distributed from these nurseries is very significant, but almost impossible to document.

The multiplication program involved eight research stations and their staff, eight ADDs with extension staff, 12 NGOs and various church groups, donors, and an estimated 200,000 farmers (Figure 1).

Figure 1:

CASSAVA & SWEET POTATO MULTIPLICATION SITES



ID	PRIMARY SITES
1	MERU
2	LUFLYA
3	BAKA
4	LUNYANGWA
5	MKONDEZI
6	LIMPHASA
7	CHITALA
8	KANDIANI
9	BUNDA
10	MAKOKA
11	LIKANGALA
12	BVUMBWE
13	TUCHILA
14	KASUNTHULA
15	MASENGERE
16	AMALIKA
17	MUONA
18	CHITEDZA

ID	SECONDARY SITES
A	LIVINGSTONIA
B	ZOMBWE
C	LUNJIKA
D	BUA
E	SALIMA
F	DEDZA
G	BWANJE
H	BAPTIST MISSION
I	DOMASI
J	CHISOMO
K	MATANDANI
L	NATHENJE
M	NRCOLLEGE

1.2 Purpose of the Study

The primary purpose of this study was to determine what the Project has accomplished since 1992, especially the impact at both primary beneficiary and institutional levels. A major part of the evaluation focused on the adoption rate of new planting materials and the contributing factors and the constraints to:

a. the efficiency of the technology generation
b. the effectiveness of the technology transfer
c. the impact of investing in this Project at the farm and institutional levels
d. sustainability of the Project
e. the "lessons learned" which can improve similar programs in other countries.

The specific terms of reference for the study were:

1. Assess the proportion of farmers in selected villages who are growing materials distributed by the Project, including the proportion of the total farm area covered by these crop materials.

2. Establish who is distributing the materials at different levels and the magnitude. It is hypothesized that farmer-to-farmer distribution is quite significant, but this is not well documented.

3. Establish the characteristics of farmers who are adopting these materials (e.g., by age, family composition, gender of household head).

4. Establish yield differences between the new and old varieties and also ascertain how the differences translate to increased household consumption, improved nutrition, sales and income as opposed to nonparticipating households.

5. Establish net benefits, if any, and how these are distributed spatially, within and between households, producers and consumers, and between men and women.

6. Determine the institutional level impact with specific reference to training in various aspects of cassava and sweetpotato, improvement in research infrastructure, technology development, management capability as well as cooperation and linkages among stakeholders.

7. Establish the impact on the environment emanating from the Project in terms of land use, environmental degradation, soil fertility, erosion, and pest and disease management.

8. Determine the factors in the Project which tend to accelerate or decelerate sustainability aspects.

1.3 Team Composition and Study Methodology

Adoption rate and impact assessment were listed as activities in the Project documents. The study was conceived and planned in July and the Team was constituted in September, 1995. It was composed of an agricultural economist (Team Leader) with 10 years of experience in project planning, appraisal and evaluation; a rural sociologist with 30 years of experience in institutional capacity building, project design and evaluation; an agricultural economist with extensive experience in Malawi agriculture in both research and extension; and an agronomist/breeder with long-term experience in the Malawi cassava and sweetpotato production with specific reference to multiplication and distribution of planting materials.

The Team reviewed the reports and documents of the AMDCSPM Project listed in Annex C. Field data and information from various stakeholders were collected using the following instruments:

1. Unstructured questionnaires

   (i) for collaborators, administered to FAO (Malawi), UNICEF (Malawi) and a sample of NGOs: ADRA, CSC, BAM, CCM and Actionaid.

   (ii) administered to research and extension administrators; Program Managers of Blantyre, Lilongwe and Mzuzu ADDs, and the Commodity Team Leader of root crops in Malawi.

   (iii) administered to 10 research technicians and extension agents who are closely associated with the Project and who received training from its resources.

2. Different sets of structured questionnaires were administered to the following:

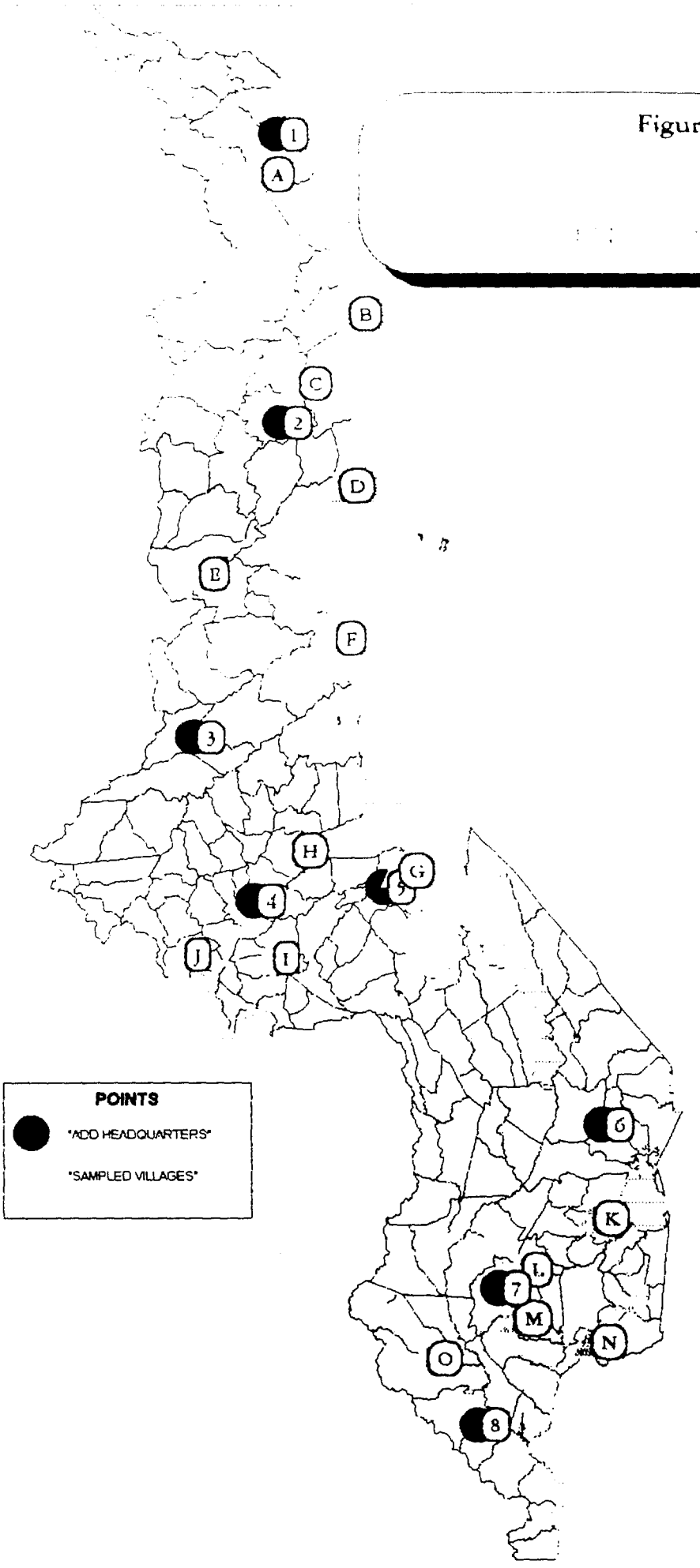
   (i) 15 farmers' groups
   (ii) 60 farmers participating in the Project
   iii) 30 nonparticipating farmers.

Direct field observations by Team members were recorded throughout the period. In determining the sampling frame for the villages for the participating and nonparticipating households, the Team recognized that the three administrative regions have participated more or less equally in the multiplication and distribution of cassava and sweetpotato planting materials.
A list of households per selected village that had benefited from the Project for the last two seasons was obtained with the help of the agricultural research and extension personnel. It was difficult to find many villages where new materials of both cassava and sweetpotato have been grown for two seasons. Hence, "cassava only" and "sweetpotato only" villages were included in the sampling frame (Figure 2).

Five villages were selected at random from each administrative region based on the sampling frame. From each one a list of participating farmers was obtained through the assistance of the extension agent in the village. Nonparticipating farmers were also listed. From each village, four participating and two nonparticipating farmers were randomly selected and interviewed. In total, for the three regions, 60 participating and 30 nonparticipating farmers were interviewed.

When the team arrived at a selected village, a group (village level) interview was first conducted, followed by the participating and nonparticipating farmers' interviews. On the average each village took the Team a day to survey. In addition, targeted informal interviews were conducted with farmers, NGO workers, agricultural extension officers, and retailers of cassava and sweetpotato in three markets. Some case studies are presented for these individuals in Annex B.

Figure 2:



ID	ADD HEADQUARTERS
1	KARONGA
2	MZUZU
3	KASUNGU
4	LILONGWE
5	SALIMA
6	MACHINGA
7	BLANTYRE
8	SHIRE VALLEY

ID	SAMPLED VILLAGES
A	MPANDE
B	CHIPOKA
C	KAITHAZI
D	LIMPHASA
E	MUBEKA SHABA
F	CHIYA
G	CHINGULUWE
H	MPAMBANO
I	MALIMBWE
J	CHIPWANYA
K	CHILUNGULO
L	MPHATA
M	BVUMBWE
N	WATULWA
O	KAMPOMO

1.4 Conceptual Framework

In his classic work on Diffusion of Innovations (1983 rev.), Rogers provides a model and number of principles appropriate to the IITA/SARRNET program. Classic adoption studies with hybrid maize, for example, indicate that adoption moves over time and that the rate can be plotted on a bell-shaped curve. He classifies five types of adopters: 1) innovator, 2) early adopter, 3) early majority, 4) late majority, and 5) laggard.

The Team felt that an overview of Rogers' work relating to the diffusion/adoption theory would be useful in looking at the adoption rates achieved in the cassava and sweetpotato multiplication and distribution Project. Many of the project impacts, recommendations and lessons learned can be specifically related to this conceptual field.

In the case of Malawi, the new cassava and sweetpotato varieties are a simple form of technology, or an innovation. An innovation is an idea, practice, or object perceived as new by an individual or a group. The Team decided to make observations in the cassava/sweetpotato multiplication and distribution Project regarding five attributes of the new planting materials, which are:

1. Relative advantage - the degree to which an idea is perceived as better than the one it supersedes.

2. Compatibility - the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of potential adopters.

3. Complexity - the degree to which an innovation is perceived as difficult to understand and use.

4. Trialability - the degree to which an innovation may be experimented with on a limited basis.

5. Observability - the degree to which an innovation is visible to others.

The results of the Team's observations utilizing the adoption/diffusion theory is reported in Section 4: Conceptual Framework Applied.

SECTION II : FARM LEVEL IMPACTS

2.1 Introduction

In assessing a project such as this, several types of impacts are expected both at the farm and at the institutional levels. The most common are production (covering both area and yield), economic, social-cultural (such as improvement in the status of women and their economic empowerment, or a more healthy environment created for children), environmental, and institutional level.

This evaluation broadly covers effectiveness and efficiency analysis. Effectiveness analysis determines whether the targets set in the original Project statement were met. Efficiency analysis compares the costs and benefits.

2.2 Broad National and Household Impact

During the three-year period of the Project, cassava was multiplied at ten primary sites and five secondary sites while sweetpotato was planted at eight primary and six secondary sites. The recorded area under multiplication on both primary and secondary sites (December 1994) reached 91 ha for cassava and 37 ha for sweetpotato. About 90% of the cassava materials were distributed between December 1994 and February 1995 whereas all the materials for sweetpotato were distributed.

Assuming multiplication ratios of 1:20 for cassava and 1:100 for sweetpotato, the materials from the nurseries were potentially sufficient for 2,000 ha of cassava and 3,500 ha of sweetpotato. These materials could potentially benefit 9,000 families for cassava and 350,000 families for sweetpotato. These calculations assume that each household allocated a conservatively small area of 0.2 ha and 0.01 ha for cassava and sweetpotato, respectively. Some losses of about 10% were estimated when the materials moved from primary to secondary and tertiary sites and from primary direct to tertiary sites. Losses in tertiary sites also occur due to such factors as lack of water and goat damage.

By definition, tertiary level multiplication is carried out by individual farmers or farmer groups on their own fields. These plots increased rapidly in the second and third year of the Project. As a result of the increased area under tertiary sites, there was a phenomenal increase in the area under production of cassava and sweetpotato during the 1993-94 and 1994-95 seasons. During this period cassava increased from 72,000 to 95,000 ha --a 31% increase--while sweetpotato increased from 37,000 to 61,000--a 63% increase--with corresponding increase in production of 31% and 92% for cassava and sweetpotato, respectively (IITA/SARRNET Multiplication Report No. 7). These significant increases are unmatched by any other commodity during the same period (MOALD 1995).

One of the specific objectives of the Project was to expand cassava area under new varieties by 2,000 ha and sweetpotato area under new varieties by 4,500 ha. In fact, the national area for both cassava and sweetpotato increased by some 47,000 ha between 1993/94 and 1994/95. (The increase in 1993/94 over 1992/93 cannot be precisely ascertained because of lack of proper records.) The Team concluded that both GOM/IITA/SARRNET and other participants contributed to more than 50% of this tremendous expansion in area. The additional production could be attributed to the farmers' response to pressure caused by the droughts.

Cassava and sweetpotato have moved from being marginalized to being important both as food and as cash crops. In the Agricultural Research Master Plan (1994), the ADDs ranked crop priorities on a scale of 1-4 (1 = top priority). Five out of eight ADDs ranked cassava in priority one, while sweetpotato was listed in priority one by three ADDs. The high ranking of these crops illustrates their increasing importance and helps to explain the sharp escalation in production.

2.3 Socio-Economic Characteristics of Participating Households

The socio-economic attributes investigated in the village and farm level interviews were age of household heads, gender of household heads, family sizes, farmland sizes, area under cassava and sweetpotato, social roles, and involvement in nonfarm employment. The average family size for the participating household was 7.8 persons (Table 2), with an average land holding of 1.95 ha and average land cultivated of 1.75 ha.

Table 1: Performance of cassava and sweetpotato in 1993/94 and 1994/95 by: Area (ha) and production (metric tons)

	Cassava			Sweetpotato		
	Area	Prodn	Yield (T/ha)	Area	Prodn	Yield (T/ha)
1994	72,149	250,066	3.46	37,151	165,322	4.45
1995	94,731	328,424	3.47	60,701	317,714	5.23
% Increase	31.3	31.3	0.3	63.4	92.2	17.5

Table 2: Average number of household members for participating and nonparticipating households

Family size per hh	No. of hh partici-pating	Total number of family members	No. of hh (Nonparti-cipating)	Total number of family members
1-3	5	14	11	5
4-6	13	61	11	55
7-9	27	216	9	71
10 and above	15	179	3	32
Average family size	7.83		6.04	

The average total area cultivated increased with the age of the household, suggesting the need to expand area as family size increases and also a tendency to acquire more land as the farmer gains experience over time (Table 3).

Table 3: Age of heads of households in relation to cultivated area

Age	No. of farmers	Average total area cultivated (ha)
20-29	3	1.73
30-39	6	1.17
40-49	15	1.68
50-59	7	1.95
60 and above	5	2.24

The cassava and sweetpotato area showed an increasing trend with increase in family size (Table 4). This trend is expected given the fact that most fields would draw labor from the household for the various farm activities (Table 4).

Table 4: Total number of adult persons in the household by area of cassava and sweetpotato

	Cassava		Sweetpotato	
No. of persons	No. of hh	Average area (ha)	No. of hh	Average area (ha)
1	2	0.34	4	0.16
2-5	32	0.42	34	0.13
6-9	14	0.66	14	0.26
	n = 48		n = 52	

Among the 60 participating farmers interviewed, 36 were heads of households. Among these, 26 were men and 10 were women. The results indicated that male-headed households had a larger area for both cassava and sweetpotato than their female-headed household counterparts (Table 5). The possible explanation is that male-headed households are associated with larger family sizes.

Table 5: Area under cassava and sweetpotato by gender of household heads.

Gender of hh head	No. of hh	Average area under cassava (ha)	Average area under sweetpotato (ha)
Male	26	0.38	0.21
Female	10	0.29	0.13

Although the sample of participating farmers interviewed was random, about half of the farmers interviewed were community leaders in the villages. The majority of leadership roles revolved around club-related responsibilities and functions such as club chairpersons, vice chairpersons, club treasurers and religious leaders. More women than men held positions of responsibility in the community. The Team believed that there was a significant association between a farmer's community involvement and his or her involvement in multiplication of cassava and sweetpotato planting materials. Farmer groups are very significant institutions in Malawi and they play a major role in technology transfer. In the group interviews six villages out of 15 used women's clubs or other forms of club organizations as a means of distributing planting materials.

About a third of the participating farmers were involved in a range of nonfarm activities: firewood collection and selling, fishing, brick making, weaving, beer brewing and baking. Farmers with nonfarm activities tended to have lower total area but

higher area for cassava than those with no nonfarm activities. The reason for this relationship is not obvious (Table 6).

Table 6: Area under cassava for farmers and involvement in nonfarm activities

Category	No. of hh	% of hh	Avg. total area (ha)	Average area
Non-farm activities	22	37	1.75	0.53
No non-farm activities	38	63	1.83	0.35
Total	60	100	1.79	0.44

2.4 Importance Attached to Various Crops by Farmers

The importance of a crop to a farmer is shown by size of the area he or she allocates to it. Of food crops, 13 out of 15 villages indicated maize to be the most important food crop, followed by cassava. Sweetpotato was mentioned by four villages as the second most important crop while sorghum was mentioned by two villages (Table 7).

Table 7. Number of villages mentioning the following crops as the first, second and third most important food crops

Rank	Measure -ment	Maize	Cassava	Sweet-potato	Rice	Sorghum
1st	No.	13	2	0	0	0
	%	87	13	0	0	0
2nd	No.	1	5	4	0	2
	%	13	33	27	0	13
3rd	No.	0	4	3	4	1
	%	0	27	20	27	7

Every crop grown by the farmer today has a potential of undergoing some sort of exchange either in barter or cash. The boundary between cash and food crops is thus very indistinct.

There was a less clear ranking of particular crops as cash crops. The main cash crops were tobacco, soyabeans, cotton and rice. Maize was mentioned as the second most important cash crop by one third of the villages (Table 8)

Table 8. Number of villages mentioning the following crops as the first, second and third most important cash crops

Rank	Measure -ment	Tobacco	Soya-bean	Rice	Maize	Cotton	Cassava
1st	No.	3	3	2	0	2	1
	%	20	20	13	0	13	7
2nd	No.	1	0	0	5	0	2
	%	7	0	0	33	0	13
3rd	No.	0	2	0	2	0	0
	%	0	13	0	13	0	0

Although rankings of maize, cassava and sweetpotato as cash crops conform exactly with previous studies, these rankings are likely to change quickly given the socio-economic and environmental changes facing Malawi. Cassava and sweetpotato will occupy higher positions as food crops and therefore maize, no longer relied upon so heavily for food, will increase in importance as a cash crop.

2.5 Trends of Major Crops as Perceived by Farmers

Crop trends were best captured through group interviews. Whereas 13 villages (87%) indicated that maize area and production was on the decline, only six villages mentioned decline of cassava hectarage. Sweetpotato was increasing in 8 out of the 15 villages. In general, crops showing increasing trends are sweetpotato, cassava and soya beans in that descending order (Table 9). Although the villages surveyed were those which had received cassava and sweet potato planting materials, the trends are likely to be the same even in other villages, given not only recurring droughts but the escalating prices of fertilizers, both of which severely impact the production of maize.

Table 9: Number of villages that mentioned the production trends of various crops in the villages specified*

Crop	Increase	Decrease	Constant	Total
Cassava	5 (39)	6 (46)	2 (15)	13 (100)
Sweet Potato	8 (53)	7 (47)	0 (0)	15 (100)
Maize	2 (13)	13 (87)	0 (0)	15 (100)
Soya beans	3 (38)	4 (50)	1 (12)	8 (100)
Beans	0 (0)	6 (100)	0 (0)	6 (100)

*Numbers in brackets are percentages of the total number of villages responding. Other villages did not have a particular crop and hence were unable to comment.

It should be noted here that a crop trend is a function of input and output prices, climatic factors, the way the relevant institutions are structured and the method in which they operate. The Team felt that some farmers were equating good prices with increasing trends.

2.6 Adoption of Improved Cassava and Sweetpotato Materials

The Team established that cassava and sweetpotato materials have spread rapidly over a wide area in a relatively short time of three seasons. The spread has occurred in both traditional and nontraditional cassava and sweetpotato growing areas. The village level surveys indicated that in 8 out of 15 villages 25-200 farmers adopted the distributed varieties of cassava. For sweetpotato, in 9 out of 15 villages 25-200 farmers had adopted the new materials (Table 10). The major constraint, frequently noted by all stakeholders, was lack of planting materials.

Table 10. Number of farmers growing new materials of cassava and sweetpotato in surveyed villages

	Number of villages	
No. of Adopters	Cassava	Sweetpotato
0	2	1
-25	5	3
26-50	2	3
51-100	1	2
101-200	0	1
Over 200	4	5

Some farms were as small as 0.1 ha or simply a ridge of 1 x 10m. Villages were found to have on the average 500 farm families. This implies an adoption rate of 25-50%, an impressive statistic given the short time of three seasons. The adoption rate would have been even higher if sufficient planting materials had been available.

The high rates of adoption are partly explained by the divisibility property of the technology. A farmer can plant a few sticks of cassava obtained from a formal or informal source to several ridges. The technology also has low cost and low risk dimensions.

The adoption rate of sweetpotato is higher than that of cassava. Sweetpotato has a shorter life cycle, with the possibility of getting new planting materials from the plants after three months. For cassava, the time can be as long as a year.

The extent of spread of old and new materials together was higher than that of the new materials alone. The survey found that in 10 out of 15 villages, over 75% of the farmers were growing cassava. Sweetpotato was more widely distributed with 12 villages indicating 75% of their farmers growing sweetpotato (Table 11).

Table 11. Number of villages with varying proportions of the population growing cassava and sweetpotato

	Cassava		Sweetpotato	
Proportion	Number	%	Number	%
0	3	20	0	0
1/4	2	13	2	13
1/2	0	0	1	7
3/4	5	33		20
All	5	33	9	60

Farmers ranked the distributed materials highly. The preference for both distributed cassava and sweetpotato over the local materials was clear cut. Mbundumali cassava scored high in production, taste and establishment followed by storage. However it was not viewed to be a very good variety in terms of susceptibility to diseases and pests.

Kenya sweetpotato, on the other hand, was ranked very high in production, taste of tubers and leaves, establishment and maturity time. But farmers disliked Kenya with regard to storage, with 10 out of 15 villages reporting that it is worse than the local cultivars in susceptibility to diseases and lack of sprouting (Annex G). Farmers interviewed individually also gave consistent replies to the high ranking of Mbundumali cassava and Kenya sweetpotato varieties on production. Twenty-four percent of cassava farmers and 21% of sweetpotato farmers confirmed that the respective new materials were yielding more than three times the traditional varieties (Table 12).

Table 12: Number/percent of farmers classifying the yield of new materials compared to traditional varieties as follows:

	1	Less	Same	More	Double	Triple	Cannot compare
Cassava a)	No.	2	4	8	6	8	5
	%	6	12	24	18	24	15
Sweet-potato b)	No.	1	4	17	17	12	5
	%	2	7	30	30	21	9

a) Some farmers had their materials still in nurseries and hence could not carry out the comparisons.

b) The number of farmers responding is less than 60 because not all had cassava and sweetpotato at the same time. Farmers responding were 33 for cassava and 56 for sweetpotato.

Farmers thus confirmed superiority in yield of the new materials over the traditional ones. An in-depth enquiry into the few cases that reported lower performance of the new materials showed that they were damaged by livestock during their establishment.

2.7 Sources of Cassava and Sweetpotato Planting Materials

One of the contributing factors to the high rates of adoption of the cassava and sweetpotato is the fact that there have been numerous dissemination channels for these materials. They range from DAR/SARRNET/IITA, ADDs and their associated RDPs and EPAs, NGOs, neighbors, friends, and relatives and obviously their own supply.

Village interviews indicated informal sources to be the most predominant sources of planting materials. Six out of 15 villages cited receiving materials from neighbors, friends and relatives. Six out of 15 villages indicated that materials on arriving at the village were distributed along women's groups or other forms of groups or clubs (Tables 13a and 13b). Table 14 shows breakdown at farmer level.

Table 13(a) Number of villages obtaining cassava planting materials from various sources in the 1992/93-1994/95 period

	Cassava					
	1992/93		1993/94		1994/95	
	No.	%	No.	%	No.	%
DAR/IITA/SARRNET	5	56	4	40	3	27
NGO	1	11		10	3	27
ADD	0	0	0	0	0	0
NEIGHBOURS, FRIENDS, RELATIVES	6	67	8	80	7	64
n =	9		10		11	

Table 13(b): Number of villages obtaining sweetpotato planting materials from various sources

	Sweetpotato					
	1992/93		1993/94		1994/95	
	No.	%	No.	%	No.	%
DAR/IITA/SARRNET	4	44		36	7	54
NGO	1	11	4	36	11	85
ADD	0		1	9	1	8
NEIGHBOURS, FRIENDS, RELATIVES	5	56	5	46	7	54
n*	9		11		13	

*n is the number of villages responding to the question in the particular year.

It is important to note that villages could receive planting materials from more than one source. It was not unusual to find more than two sources of materials per village.

From Tables 13(a) and 13(b) the following information is noteworthy:

1) Among the villages surveyed, the number receiving materials from various sources increased from nine in 1992/93 to 13 in 1994/95;

2) The involvement of NGOs and neighbors increased over the period, which augurs well for sustainability of the process (Table 14). This was a healthy situation and an indication of interest by other stakeholders. It is not the desire of DAR/IITA/SARRNET to continue to lead in dissemination as it would defeat the whole concept of sustainability at the grassroots level;

3) Many villages indicated they did not receive materials from the ADDs. This should not imply that ADDs are not active in the dissemination process. Whereas the "ownership" of the materials can be ascribed to DAR/IITA/SARRNET, there are many agents who finally take them to the farmer and in the process, the materials change hands several times. One of the possible flows is DAR/SARRNET/IITA --->NGO--->ADD--->NEIGHBOR --->FARMER. Hence, an ADD scoring zero does not necessarily mean that it did not participate in the process. Villages or farmers are prone to mention only the immediate source since that is the one they know best.

In the two-year period 1993-94 to 1994-95, eight cassava farmers supplied on average 230 kg of planting materials to neighbors, friends and relatives. One of the important modes of supply was through selling. As for sweetpotato, 27 farmers supplied an average 103 kg of planting materials to others.

Table 14: Number of farmers receiving planting materials from different sources

	SOURCE	NO. OF FARMERS	% OF FARMERS N=60
1992/93	DAR/IITA/SARRNET	12	20
	NGOs	0	0
	NEIGHBOURS	11	18
	ADDs	3	5
	OWN SUPPLY	7	12
1993/94	DAR/IITA/SARRNET	9	15
	NGOs	6	10
	NEIGHBOURS	7	12
	ADDs	1	2
	OWN SUPPLY	14	23
1994/95	DAR/IITA/SARRNET	4	7
	NGOs	2	3
	NEIGHBOURS	6	10
	ADDs	1	1
	OWN SUPPLY	23	37

A large number of farmers (78%) were preserving cassava, and 80% were preserving sweetpotato materials for the next season. For cassava this is simple because harvesting coincides with the coming of the annual rains, which is also time for planting. (Table 15).

Table 15: Number of farmers preserving planting materials for the next season

Crop	No. of farmers	% of farmers responding
Cassava	40 (n = 51)	78
Sweetpotato	46 (n = 57)	80

The amount of material preserved may be just a few sticks of cassava or a few vines of sweetpotato, so there is a need for supplementation from other sources.

In spite of efforts to ensure that planting materials reach the farmers, materials were not adequately distributed. About 80% of the participating farmers expressed a need to get planting materials from sources outside their farms (Table 16).

Table 16: Farmers expressing requirement of planting materials outside their fields for the next season

Crop	No. of farmers	% of farmers responding
Cassava	43 (n = 54)	80
Sweetpotato	46 (n = 57)	80

About 50% of the farmers who received planting materials indicated that the materials were only 25% adequate (Table 17).

Table 17: Adequacy of planting material obtained against the actual requirement

Proportion of Requirement Received	No. of farmers	% of farmers
Less than 1/4	23	49
1/4 - 1/2	12	26
1/2 - 3/4	9	19
3/4 - 1	3	6
Total	47	100

Table 17 shows that less than 10% of the respondents received materials close to their total requirements.

2.8 Impact of the Improved Cassava and Sweetpotato Materials on Household Food Security

Consumption

In 14 out of 15 villages farmers indicated that all households (100%) consume cassava roots and sweetpotato tubers. Also, in 12 out of 15 and 11 out of 15 villages 100% of farm households consume cassava and sweetpotato leaves, respectively. Thus, it is clear that the crops being promoted have sufficient household

demand, which is a strong impetus for increased adoption. These products have also a high rural and urban market demand (Case Studies No. 1 and 2). Interviews showed that about a quarter of the farmers sell roots and tubers of the two crops.

Farmers spoke very highly of these new materials in regard to production, consumption and sales. For example, 50 farmers (83%) reported that food availability for households had improved to a "better" or "very much better" situation. In general, sales and consumption for cassava and production, and sale and consumption for sweetpotato increased after the harvest of these materials (Tables 18 and 19).

Table 18 Comments by farmers on some cassava attributes after harvest of the improved materials

	Same		Increasing		Decreasing	
	No.	%	No.	%		%
Production	3	6	2	4	3	6
Sales	6	11	16	30	1	2
Consumption	5	9	18	33		6

(Number of respondents was 54.)

Table 19: Comments by farmers on some sweetpotato attributes after harvest of the improved materials

	Same		Increasing		Decreasing	
	No.	%	No.	%	No.	%
Production	5	9	45	84	2	4
Sales	9	16	36	67	3	5
Consumption	7	12	45	80	1	2

(Number of respondents was 57.)

Eighty percent of the farmers mentioned that improved sweetpotato materials had increased sweetpotato consumption. The rate at which both cassava and sweetpotato are being sold is one of the unexpected positive outcomes of the project.

Ninety-one percent of the participating farmers confirmed that they believed they were better off in food security compared to their nonparticipating counterparts (Table 20).

Table 20: Perception of comparative food security between participating and nonparticipating households.

	No. of Farmers Responding	% of Responding Farmers
Same	4	7
Non-participating are worse off	53	91
Non-participating are better off	1	2

(Number of respondents was 58.)

The farmer who reported that nonparticipating farmers were better off was frustrated because his field dried up due to drought.

Length of hunger period in relation to adoption of new cassava and sweetpotato varieties

Hunger months are periods of food shortage which occur when households run out of their food stocks or do not have sufficient cash to purchase food in the markets. During this time the strapped farmers embark on a number of activities ranging from piece work in exchange for food from households which happen to have extra food supplies, to selling firewood or fish (depending on location).

It was evident from both the group and individual interviews that there was a strong positive association between decreasing the number of hunger months and the number of farmers growing the new materials of cassava and sweetpotato (Table 21). Hunger months decreased from 5.0 months in villages where the new sweetpotato materials were not grown at all to about 1.8 months in villages with over 200 farmers growing the crop.

Table 21: Number of farmers growing cassava and sweetpotato in relation to the number of hunger months

No. of growers	Cassava		Sweetpotato	
	No. of villages	Average no. of hunger months	No. of villages	Average no. of hunger months
0	2	5.5	1	5.0
1 - 25	5	3.6	3	4.3
26 - 50	2	3.0	3	3.3
51 - 100	1	2.0	2	2.5
101 - 200	0	-	1	8.0
Over 200	4	2	5	1.8

The number of hunger months was 5.5 months in villages where new cassava material was not grown compared to 2.0 months in villages where there were over 200 farmers growing the crop.

Casual observations by the Team showed that there were few cases of malnourished children and women in heavy cassava and sweetpotato growing villages, whereas in villages where there were still very few farmers growing the crops, cases of severe malnutrition were evident. These observations were made during the village group interviews. The groups comprised 12-46 men and women. The women had with them at the interview children under age five.

Sales and income from new materials

Cassava and sweetpotato become valuable cash crops for food security when they are sold to buy other preferred foods like maize, groceries, medicine, and clothing for the household. The survey established that part of the income from cassava and sweetpotato sales was also being used to pay school fees and purchase fertilizer for maize.

Survey data of participating farmers showed that about 20% of the farmers sold on the average 612 kg and 576 kg of cassava in 1993/94 and 1994/95 respectively (Table 22).

Table 22: Farmers selling the new cassava materials in 1993/94 and 1994/95 seasons

Season	No. of farmers	% of farmers responding	Average kg sold	Average cash income MK
1993/94	7	20	612	381
1994/95	5	14	576	207

(Number of respondents were 35 for 1993/94 and 36 for 1994/95).

Farmers realized an average income of MK381 and MK207 in 1993/94 and 1994/95. For sweetpotato, a larger proportion of farmers (30%) participated in the selling but with less average income received -- MK281 for 1993/94 and MK176 for 1994/95 (Table 23).

Table 23: Farmers selling the new sweetpotato materials in 1993/94 and 1994/95 seasons.

Season	No. of farmers	% of farmers responding	Average kg sold	Average cash income MK
1993/94	16	32	281	319
1994/95	16	32	176	222

(Number of farmers responding for each of the years was 50).

The results of the proportion of participating farmers correspond closely to the average proportion of total harvest sold for both cassava and sweetpotato. Farmers indicated selling about 20% of cassava and 30% of sweetpotato for the 1994/95 harvest (Table 24).

Table 24: Average proportion sold and consumed for cassava and sweetpotato, 1993/94 and 1994/95.

Season	Cassava		Sweetpotato	
	Sold	Consumed	Sold	Consumed
1993/94	1.84	8.16	2.49	7.51
1994/95	1.89	8.11	2.82	7.18

The accuracy of data on yield, production and area for root crops is not expected to be very high given the methods used--chiefly farmer interviews, which depended mostly on memory recall. Production and yield data are particularly difficult for root crops because harvesting is done on a piece-meal basis and it may be extended over a long period--a month for sweetpotato and a year for cassava. The problems of measurement notwithstanding, it is very clear from the survey that the impact of cassava and sweetpotato new materials stretch beyond provision of food to households. Over 20% of the amount produced is now marketed and this proportion is rising (Annex B: Case Studies Nos. 1,2,4,5).

2.9 Gender Issues

Individual farmer interviews, which were by design more detailed and more specific, showed that many of the activities are carried out more by women than by men, including most of the harvesting and selling of cassava and sweetpotato (Tables 25 and 26).

Table 25: Performance of various activities in cassava by gender.

Gender	Planting		Weeding		Harvesting		Selling	
	No.	%hh	No.	%hh	No.	%hh	No.	%hh
Men	11	23	0	0	2	4	5	19
Women	24	50	19	40	37	77	31	79
Both men and women	13	27	29	60	9	19	3	8

(Number of respondents were 48 for planting, weeding and harvesting operations and 39 for selling).

Table 26: Performance of various sweetpotato activities by gender

	Planting		Weeding		Harvesting		Selling	
Gender	No.	%hh	No.	%hh	No.	%hh	No.	%hh
Men	9	15	1	2	2	3	2	4
Women	31	53	24	41	42	72	48	86
Both	19	32	34	58	15	25	6	10

(The number of respondents ranged from 56 to 59).

Women were mostly the ones responsible for making all the decisions regarding where to get materials for planting, area to plant, time to harvest and how much to sell. The lesson learned here is women are dominant in the production and marketing of cassava and sweetpotato. In all efforts to promote these crops through training, multiplication, and design of extension messages, deliberate efforts have to be made to target women.

In the multiplication and distribution of cassava and sweetpotato it was demonstrated that women played a key role through their group and club institutions. The Team found that women's groups work better and have more cohesion than their male group counterparts. Extension workers should capitalize on these characteristics not only for multiplication of cassava and sweetpotato planting materials but also for other technology transfers.

2.10 Knowledge of Cassava and Sweetpotato Husbandry by Farmers

Compared to tobacco, maize, groundnuts and even beans, the knowledge farmers have of cassava and sweetpotato cultural practices is very limited. This is partly because the majority of Field Assistants (FAs) do not know the recommended cultural requirements of these crops (Tables 27 and 28). Tremendous efforts are therefore required to impart this knowledge, particularly through the training of FAs.

Table 27: Farmers' knowledge of various recommendations regarding cassava

Practice	No. of farmers aware of the recommendations	Percentage of the respondents
Planting density	22	41.0
Weeding	31	60.0
Pests and diseases	13	25.0
Harvest time	19	37.0
Storage	17	33.0

(Number of respondents ranged from 52-54.)

Out of five practices only one--weeding--was known by more than 50% of the farmers. Fewer than 50% were aware of the recommendations for planting density, pest and disease control, harvesting, and storage.

Table 28: Farmers' knowledge of various recommendations regarding sweetpotato.

Practice	No. of farmers aware of the recommendations	Percentage of the respondents
Planting density	38	67.0
Weeding	41	72.0
Pests and Diseases	9	16.0
Harvesting	33	58.0
Storage	24	42.0

(Number of respondents was 57.)

Farmers were generally aware of recommendations relating to weeding followed by planting density for both crops (60.0 and 72.0 for weeding cassava and sweetpotato respectively). This fact was confirmed by the Team through field observations: the fields under these crops were fairly free from weeds. Disease and pest awareness scored 25.0 for cassava and 16.0 for sweetpotato (Tables 27 and 28).

2.11 Major Cassava and Sweetpotato Production Constraints

In the group interviews, farmers were asked to identify the four most important constraints to increased cassava and sweetpotato production. Lack of planting materials was the most frequent constraint mentioned followed by erratic rains, theft, and livestock damage (Table 29).

Table 29: Most important constraints to increased cassava sweetpotato production.

Constraint	No. of Villages	% of village respondents
Lack of planting materials	12	80.0
Erratic rains (moisture)	6	40.0
Theft	5	33.0
Livestock damage	3	20.0

These constraints correspond fairly well with those reported by Program Managers at the Mangochi, Club Makokola Workshop in April 1995 (Annex C). Areas where institutions should place emphasis are clear from this table. Farmers are demonstrating that they are doing their best within their means to overcome some of the production problems. For example, informal dissemination of planting materials reduces the shortage of planting materials, while digging shallow wells and using dambos to preserve materials help to reduce the problem of moisture stress.

Dambos, low-lying areas which are seasonal wetlands, are crucial to all types of crop production during the dry season. They are not evenly distributed since they depend on the land formation. Twelve villages (80.0) reported dambo lands that were not sufficient for their needs. Only about half of the villages reported easy access to dambos. The rest were constrained by ownership being tied along heredity lines and the lack of means to rent the land.

Construction of fences around the fields has reduced livestock damage. Two thirds of the villages reported the problem of livestock damage being "extremely serious" while those reporting having no problem with livestock damage were less than a third. Goats were the most destructive animals followed by cattle. Crops most affected were cassava and sweetpotato (73.0%) followed by maize (40.0%). The farm level interviews confirmed the group interview findings on the seriousness of livestock damage on their cassava, sweetpotato and maize fields. Again, goats were identified by about 80.0% of the farmers as being the most destructive animals, followed by cattle. In the lakeshore area of Nkhata Bay and parts of Rumphi and Balaka, monkeys and baboons also play a big role in the destruction of field crops.

Farmers were asked to estimate the proportion of the total crop area damaged using a scale of 1/4 to 1. The average proportion of extent of damage was also estimated using the same scale of 1/4 to 1. If the extent of damage was 100%, it would mean that the farmer would have zero harvest. Averaging the proportion of area damaged and proportion of extent of damage, the results of Table 30 were obtained.

Table 30: Average proportion of area and extent of damage by crop - 1994/95.

Crop	Average Proportion of Total Area Damaged	Average Proportion of Extent of Damage
Cassava	0.33 (n = 13)	0.46 (n = 12)
Sweet Potato	0.39 (n = 14)	0.54 (n = 14)
Maize	0.38 (n = 4)	0.67 (n = 5)

n = the number of persons.

The proportion of the area of field damaged and extent of loss can be quite serious. For example, the proportion of the total area damaged for 13 cassava farmers was about a third and the extent of damage for 12 farmers was about one half, indicating that total production decreased by the same proportion.

Besides construction of fences, farmers are using other preventive measures such as tethering and ensuring that someone (often a herd boy) is permanently in the field to scare off the animals (Table 31).

Table 31: Precautions taken against livestock damage by farmers

Precaution	No. of Farmers	Percentage of Farmers Responding
Fencing	15	50.0
Tethering	11	37.0
Scaring	4	13.0
Total	30	100.0

Steps taken against owners of animals destroying the crops vary widely according to location. Whereas in some locations the animals are killed on the spot by the owner of the field, in other areas a fine of five Malawi Kwacha (MK5) per station of crop destroyed is imposed by the headman. Sometimes there is only a warning from the village headman to the individual. About 20% of the farmers mentioned that the damage was caused by their own livestock or those of immediate relatives.

The Team observed through the group interviews that although owners of livestock are few, they constitute a powerful social group in the villages. In addition, livestock owners have a strong affiliation with the village headmen, which tends to reduce punitive measures against offenders.

2.12 Distribution of Benefits of Cassava and Sweetpotato Among Producers, Traders, Transporters and Consumers

The net benefits of the new cassava and sweetpotato planting materials technology are evenly distributed across the subsector participants, who include producers, traders, transporters and consumers. The market case studies show that sellers of root crops comprise both men and women (Case Studies 1 and 2). In fact, as opposed to other crops and technologies (e.g., tobacco) in Malawi, cassava and sweetpotato are fortunate to have characteristics of free entry and exit in production and marketing: there are no restrictions or regulations preventing new entrants, and there are also no restrictions or strict regulations in the transportation and selling of the products on the market. Cultural barriers restricting women, men or particular age classes to production, marketing and consumption

do not exist. Group interviews showed that in principle, all operations in cassava and sweetpotato can be carried out by either gender. Group interviews also showed that both men and women of all ages eat the roots, tubers and also the leaves of cassava and sweetpotato.

The market case studies (Annex B, No. 1 and 2) demonstrate a fair distribution of the sale price across the various market participants.

Table 32: Distribution of the sale price among participants

Sweetpotato: Nkhata Bay market (Selling Price per bag MK200)	Farmer		Trader		Trans-porter		Mkt fee		Loss	
	MK	%	MK	%	MK	%	MK	%	MK	%
	120	60	52	26	13	7	7	4	5	3
Cassava: Nanjiri Market (Selling price per bag MK260)	160	62	65	25	15	6	3	1	13	5

This table shows that on the average, the trader realizes about 50% of the price paid to the farmer while the transporter gets about 7% of the sale price. From the marketing standpoint, this is an extremely fair distribution. For the time being, promotion of increased cassava and sweetpotato production can continue without much concern about the distribution of benefits from these products to the different subsector participants.

2.13 Competitiveness of Cassava and Sweetpotato in the Farming Systems

This section examines the role and impact of cassava and sweetpotato in the farming system. The objective is to examine the returns to land and labor for cassava and sweetpotato in the different agro-ecological zones in relation to the major competing crops, cotton, rice, tobacco and maize.

Procedure

Several steps were followed to ensure credibility of the final outcome. Nominal input and output prices for three years (1993, 1994 and 1995) for all crops except tobacco were used. Tobacco data refers only to 1995. In addition, three management levels for cassava and sweetpotato were applied in the computation of economic returns.

Source of Data

The Team used the following sources in this computational exercise:

a) Yield data for cassava and sweetpotato were obtained from the participating farmers' questionnaires administered by the Team.

b) Labor requirements for different crops have been adapted from Werner (1987) Crop Field Operation Survey: Labour Requirement and Distribution for Smallholder Crops, Machinga ADD.

c) Rice, cotton, and maize data were obtained from reports by Nyondo (1994 and 1995), an agricultural economist for commodity team in the DAR of MOALD.

d) Information on tobacco was obtained from Steele (1995): Farm Budgeting Handbook, Farm Management Guide No. 3.

Assumptions

a) For tobacco, although Steele (1995) provides two management levels (low and high), the Team decided to consider only the low level management because the high level was too complicated and there was too much capital involved for the ordinary small farmer.

b) For tobacco only 1995 prices were considered since data for 1993 and 1994 were not immediately available.

c) Opportunity cost of labor was taken to be MK10 for 1995, but MK4.94 for 1993 and MK6.42 for 1994, which were the wage rates in those years.

d) Management levels for cassava and sweet potato: These were management levels 1, 2 and 3 reflecting different yield levels of cassava and sweet potato.

Management 1: These were the average yields of the farmers in the sub-sample.

Management 2: These were yields between 1,000-1,999 kg/ha (fresh weight).

Management 3: These were yields per ha of 2,000 kg (fresh weight) and above.

Results

Details of developments of the tables for the three management systems and for the three years are shown in Annex F.

Cassava and sweetpotato give comparatively high gross margins per ha, return per man-day and net profits. Even in cases where prices for these crops are low, cassava and sweetpotato still compete favorably with maize, rice and cotton. Tobacco (burley) is also below cassava for the year under reference (1993/94). The net profit for tobacco is MK5,730 per ha as compared to an average of MK6,622 for cassava under high level management scenario for 1993/94. This does not consider potential sales of cassava leaves and sticks for planting materials. The corresponding net profits for other crops under this management for the same year are sweetpotato MK2,706 (average), maize MK296, cotton MK548 and rice MK1,466. One caveat for considering tobacco competitiveness is in order: The tobacco net profit of MK5,730 is only for direct labor consideration from an individual producing and selling on the auction floor by himself. Otherwise if the tenant production scenario is taken (which is still the main mode of tobacco production), the net payment to the tenant is minus MK30 (Steele 1995).

Cassava and sweetpotato require relatively few inputs compared to maize, rice, cotton and tobacco. Despite the deliberate effort to promote cotton and rice production by increasing the producer price of cotton and doubling that of rice, cassava and sweetpotato still compete favorably and in most cases yield four to five times more net profits than the four alternative crops.

SECTION III: INSTITUTIONAL LEVEL IMPACT

3.1 INTRODUCTION

In assessing the major institutional impacts, the Team was guided by the scope of work for this study, the original Project objectives, and the objectives of the subsequent no-cost extension.

This section examines the institutional level impact of the Accelerated Multiplication and Distribution of Cassava and Sweetpotato Planting Materials as a drought recovery measure in Malawi. As previously noted, many means of verification such as national economic data, quarterly and annual project assessments, and various reports were available to the Team.

An important component of the Project statement was to expand the multiplication and distribution scheme for cassava and sweetpotato while strengthening the linkages with NGOs and broadening the capacity of the system to produce planting materials. Objectives included providing technical and training support to organizations cooperating with IITA/SARRNET in the Project.

Interviews and field visitations with directors of eight of the 12 NGOs and a number of their field agents clearly demonstrated to the Team that the Project has had a dramatic impact on Malawi smallholder farmers. Three Program Managers (PMs) in charge of Extension in ADDs provided important input in terms of beneficiary impact and institutional development. One PM reported: "The cassava/sweetpotato multiplication and distribution project is by far the most effective and well organized effort between research, extension, and NGOs that we have been involved with."

Significant data from all of the eight PMs were obtained through their comments and reports from the workshop held at Club Makokola in April 1995. Field observations and interviews with extension Project Officers, Development Officers, and Field Assistants showed an increasing trend of extension field staff participation in the program.

Additional information relating to institutional impact was obtained through interviews with the DAR, Root and Tuber Commodity Group Team, DAR scientists, and research station technicians. Field observations supplemented data they provided.

The assessment of institutional impact addresses the following areas: policy changes, project organization and management, stakeholder linkages, training, and environmental issues. Capacity building and sustainability are the two primary concepts that the Team focused on during the study.

3.1.1 Donor endorsement

In 1992 USAID recognized the growing importance of root crops in food security in Malawi. USDA/OFDA gave IITA/ESARRN a grant of US $450,000 to multiply and distribute cassava and sweetpotato planting materials during the 1992/93 and 1993/94 cropping seasons. USAID/Malawi provided an additional US $250,000 for the 1993/94 multiplication activities, and approved a no-cost extension through March 1996.

USAID's donor management approach supported host country and implementing agency involvement in management and decision making and refrained from micro-management of Project activities. This approach is essential in sustainable institutional development.

3.1.2 Agricultural policy changes

There is strong evidence, as reported in the current crop estimates, that cassava, sweetpotato and soyabean appear to be the only food crops that are increasing in both area planted and total production in Malawi. Yet it is widely recognized by research and extension staff that the area and production of cassava and sweetpotato have always been underestimated. Apart from the usual problems of data collection and estimation in Africa, the problem of incorrect or insufficient cassava and sweetpotato data in Malawi occurred before 1994 and was associated with the deliberate political overemphasis on maize at the expense of root crops even in obviously nonmaize agroecologies (SARRNET/IITA 1995).

The 1994/95 area under cassava was estimated at 95,000 hectares while that for sweetpotato was estimated at 65,000 ha. Given the dry weight estimates for cassava yields of 3.5 tons per ha and sweetpotato yields of 4.5 tons per ha, these translate into 332.5 thousand and 292.5 thousand tons for cassava and sweetpotato respectively (Minde 1995).

Prior to 1992 GOM policy documents and public fora on crop promotion campaigns bypassed cassava and sweetpotato. Both crops received scarcely more than a footnote in the DAR Research Master Plan prior to 1990. The agricultural extension system spent the vast majority of field worker time on promoting maize and tobacco. For over thirty years a "maize mentality" was encouraged to develop, obscuring the contribution of cassava and sweetpotato to food security.

Currently, cassava and sweetpotato are being addressed through well planned campaigns on the radio, newspapers, meetings and conferences. In November 1994, the Ministry of Agriculture and Livestock Development (MOALD) hosted a Agricultural and Livestock Development Strategy and Action Plan meeting in which the concept of crop diversification was presented and discussed. The official policy statement that evolved was:

"Production of maize in areas that are not suited to productic largely as a result of low rainfall, will be discontinued to gi

room for more drought resistant crops such as cassava and sweetpotato to improve household food security."

Since the release of this major policy statement in late 1994, several statements by high ranking MOALD officials have provided additional support to it. In December 1994 the Controller of Agricultural Services at a field day at Limphasa near Nkhata Bay, a primary cassava growing area, apologized to the farmers of the area for promoting maize there during the past thirty years. He noted that the GOM recognized it was a mistake and was now putting additional resources into a diversification effort appropriate to ecological areas of the country. During the week preceding World Food Day and the Sixth International Society for Tropical Root Crops (ISTRC) symposium in October 1995, the Principal Secretary of MOALD, Mr. Tony Mita, promoted cassava and sweetpotato over the radio and through the press.

The change in GOM policy toward promoting cassava and sweetpotato as food security crops is regarded by the Team as one of the key underpinnings supporting and accelerating the multiplication and distribution of cassava and sweetpotato in Malawi. Without that change, the progress achieved so far would not have been possible.

3.1.3 Project management

There are a number of major stakeholders in the Project. These include: IITA/SARRNET, DAR, Agricultural Extension Department, international donors, NGOs, and farmers and farm groups. Their specific roles and relationships be described more specifically in the section on Stakeholder Linkages. The purpose of this section is to describe the operation and management of the Project in terms of IITA/SARRNET and the MOALD.

IITA/SARRNET in collaboration with the National Root and Tuber Crops Program (NRCP) of the Department of Agricultural Research (DAR) has been implementing and administering the multiplication and distribution of cassava and sweetpotato materials in Malawi since 1992. SARRNET provides technical backstopping and technical advice to cooperators and farmers on the raising of healthy planting materials. In addition, it provides logistical support (office space, secretary, computer, accountant, and communications) and manages a five-ton truck which was purchased under the Project for transporting plant materials and equipment to sites.

The SARRNET Coordinator is the Project Coordinator representing the implementing agency, IITA. SARRNET is responsible for the day-to-day operational and financial management of the program in consultation with the Chief Agricultural Research Officer (CARO) and the Commodity Team Leader of the NRCP of DAR/NARS. SARRNET scientists collaborate with the NRCP in the technical management of the Project. The SARRNET scientists and researchers from the NRCP coordinate the day-to-day field activities across the country. The NRCP Team Leader and

researchers from the unit in coordination with SARRNET are responsible for liaison between NGOs and extension. Additional activities include verification of sites, monitoring, collecting adequate and timely data for the Project, evaluation, supervision of multiplication activities and preparation of progress reports.

IITA/SARRNET receive technical and financial reports from researchers and ADD multiplication sites. Reports are submitted to CARO, SACCAR, and USAID. The expenditure of project funds is accounted for and managed by IITA/SARRNET's Office in Lilongwe.

SARRNET's main thrust is research, training, information exchange, and institutional capacity building. Its research emphasis is germplasm enhancement for wide adaptation, resistance to pests and diseases, high yields and acceptability, processing and utilization and establishing multiplication and distribution systems for planting materials.

MOALD's Department of Agricultural Research (DAR) is composed of a number of National Commodity Teams. The National Root Crops Commodity Team provides the national leadership and coordination of the cassava and sweetpotato multiplication and distribution program within the country. Other major activities include research for genetic enhancement of root crops for processing, acceptability, high yields, and resistance to pests and diseases. The NRCP in close cooperation with SARRNET coordinates the national program with NGOs and the Agricultural Extension Department in the multiplication and distribution of planting materials.

The NRCP Team has had to deal with major obstacles in coordinating the national cassava and sweetpotato multiplication and distribution program. Since GOM policy favored maize research almost to the exclusion of any other crop until the early 1990s, this unit has been understaffed and underfunded. Even today resources have increased only slightly for the unit since 1990.

One of the reasons for the early success of the program was the dedicated leadership of the late Raphael Sauti, Commodity Team Leader. The new Commodity Team Leader since early 1995, Jonathan Mkumbira, faces formidable challenges in sustaining continuity and achievements already made and moving the program forward. The NRCP is stretched thin. It is loaded with additional duties and responsibilities, and it is underfinanced to carry out priority work.

Additional resources for cassava and sweetpotato research, multiplication and distribution of planting materials, and other priority work within the unit must be provided by the GOM. Cassava and sweetpotato together currently supply about 30 percent of the caloric needs of the country. (If the MOALD research budget was allocated on the basis of crop caloric contribution to the citizens of the country, a sizeable increase in the NRCP's budget would probably result.)

3.1.4 Manpower allocations

In 1992 there were six scientists working in the root and tuber crops research program. This number increased to nine in 1995 and includes all scientists with B.S., M.S., and Ph.D. degrees working in the program. Two scientists are on study leave working on advanced degrees. Only two scientists are working over 50% of their time on cassava and sweetpotato programs. The National Root Crops Program currently employs 24 technicians compared to 20 technicians in 1992.

Interviews with ADD Program Managers show that the number of extension field staff working on the Project was small. The same staff were also responsible for other crops, and each ADD has one crops officer responsible for its crops. The Team noted that because many Field Assistants are still fully involved advising farmers on maize and tobacco, they have given little attention to cassava and sweetpotato and are still operating under the "maize mentality" of the past thirty years.

3.1.5 Budgetary contribution of research, extension, and NGOs

A primary impact indicator is the financial contribution of stakeholders to the Project. Given the budgeting procedures adopted by the DAR and the lack of proper record keeping by respective programs, it was difficult to estimate the exact budgetary contribution to cassava and sweetpotato research. However, indication of increased logistical support was definitely noted.

The budget support within extension especially for cassava and sweetpotato multiplication and distribution and farmer advising was also virtually impossible to ascertain. However, several Program Managers indicated that budgetary support has increased by at least 15 percent for these activities since 1992. This estimate was verified by the Team in interviews with field level Project Officers, Development Officers and Field Assistants. The Team feels there is ample evidence to show that the GOM has increased financial allocations by at least 10 percent to support the Project within the extension component.

NGOs are major stakeholders in this Project. Interviews were conducted with the Christian Service Committee (CSC) and the Baptist Agricultural Mission (BAM) for the purpose of estimating cost sharing on the Project. The CSC Agricultural Officer, Martin Banda, estimated that the CSC had contributed a total of MK 201,950 in 1994-95 toward the Project (Table 33).

Table 33: CSC cost sharing to various activities in cassava and sweetpotato multiplication and distribution.*

ACTIVITY	MK
Cassava nursery (labour,fences, etc.)	120,600
Sweetpotato Nursery	7,000
Transportation of sweetpotato vines	12,000
Project supervision	4,900
Field agent time	43,000
Agent transportation	14,450
TOTAL	201,950

*IITA contributed K124,000 for nursery support and MK8,000 for material distribution.

Darrell Garner, Baptist Agricultural Mission in Balaka, reported that BAM had contributed K59,000 toward the Project during the 1994-95 cropping season (Table 34).

Table 34: BAM cost sharing to various activities in cassava and sweetpotato multiplication and distribution

ACTIVITY	MK
Land rental equivalent	1,000
Fence	3,000
Labour	25,000
Fuel for diesel pump-water for garden	6,000
Transportation of materials	22,000
Depreciation on pump	2,000
TOTAL	59,000

These two NGOs represent a sample of the monetary contributions to the Project for one year. CSC is one of the larger NGOs with a field staff of about 12. BAM consists of one field worker. Few NGOs were involved in cassava and sweetpotato prior to 1992.

In a survey of eight of the directors of collaborating NGOs, seven indicated that NGO funding will increase next year, while the other director indicated it would remain the same unless additional external funding could be obtained. Cost contribution or cost sharing is a strong impact indicator supporting the future sustainability of the program.

SARRNET has also provided Project support which includes improvement and upgrading of the research laboratories at the major agricultural research stations at Chitedze, Bvumbwe, Mkondezi, and Lunyangwa. In addition, the Project purchased seven motorcycles to assist in the monitoring of secondary and tertiary sites. A centrifuge was purchased for the Mkondezi Experiment Station. The tissue culture facility of the commodities will also be improved.

3.1.6 Project planning and monitoring

The Team found that formal planning tended to be compartmentalized within specific organizations and units. The DAR, for example, develops a yearly program of work made up of specific subplans of commodity teams. The yearly plan relates to the Five Year Research Plan. The NRCP plan of work generally reflects research priorities although some specific plans in terms of extension outreach with multiplication and distribution of improved cassava and sweetpotato materials were noted.

On the other hand, in extension, which is made up of eight ADDs, 30 RDPs and 135 EPAs, planning is guided by a top-down approach following national agricultural policy guidelines and conditioned by the Five Year Extension Plan. Planning following a "bottom-up" approach is encouraged in the field, with farmer, FA, and field officer input to be reflected in the RDP, ADD, and National Extension Plans of Work (POW). Interviews with both research and extension staff indicate that specific targets for hectarage, varieties of cassava and sweetpotato, numbers of beneficiaries, and educational activities relating to the Project are becoming more widely reflected in POWs.

There is little evidence to suggest that much formal planning in a multi-disciplinary sense is taking place among the various stakeholders. However, interviews and the proceedings from the April 1995 meeting at Club Makokola indicate that a great deal of informal discussion does occur at different levels.

The Project needs effective and coherent data collection on multiplication and distribution of planting materials. Although monitoring was generally successful, there was a wide variation in the recording of data from the various stakeholders due to lack of a uniform method for collecting data.

3.2 Institutional stakeholder linkages

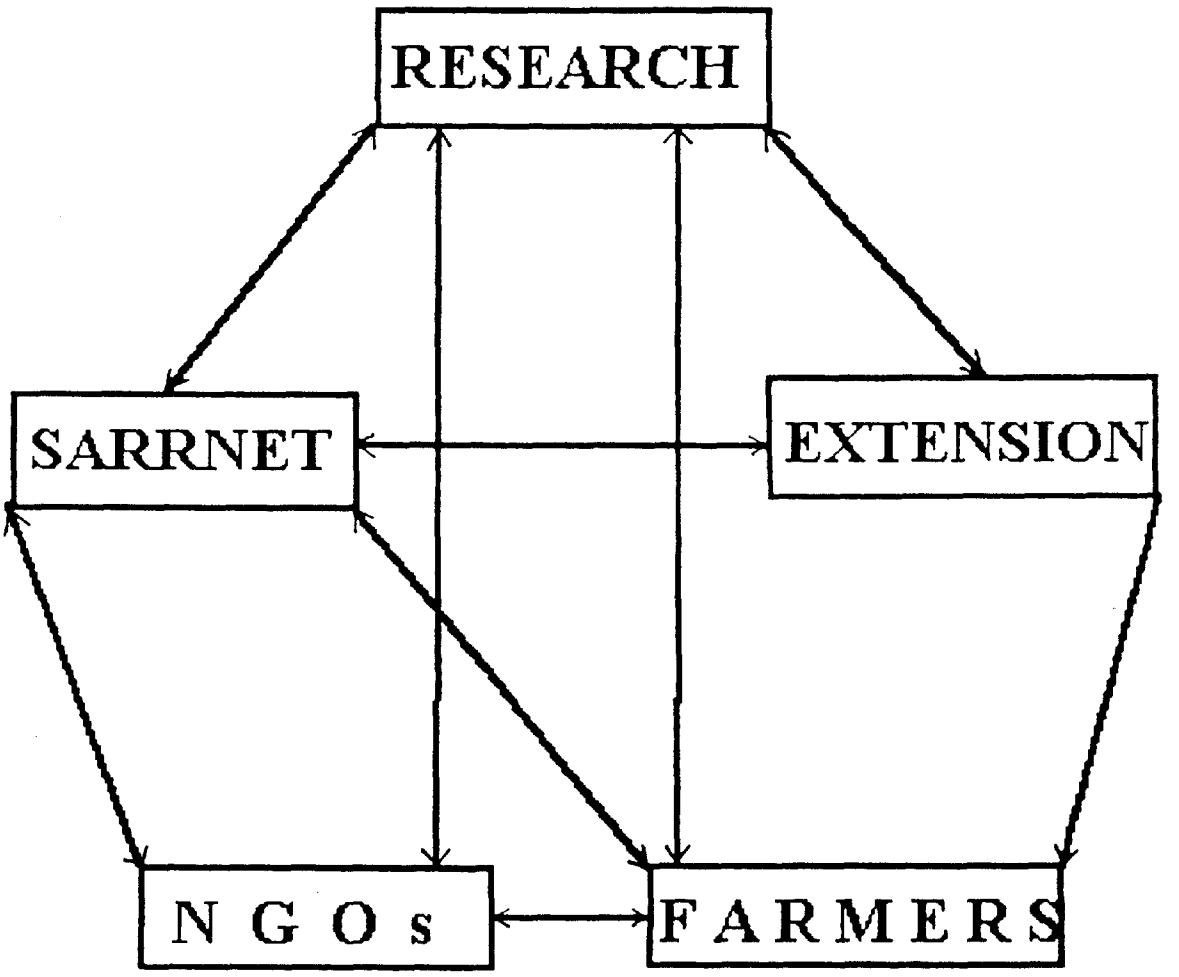
The cassava and sweetpotato multiplication and distribution Project was an excellent example of how various organizations with different mandates and technical responsibilities can work together to solve a common problem affecting a society. Food security was deemed a top national priority by the GOM, donors, and international agencies such as FAO, UNICEF, USAID, and IITA. Individual NGOs and church groups specifically supported the growing of cassava and sweetpotato as food security crops in

drought stricken areas, but focused on specific farmer target groups. For example, UNICEF targeted single women heads of farm households and families with children under five years of age as their target beneficiaries.

It was clear to the Team that the congruence of mission, goals, objectives, and target audience of the various stakeholders greatly contributed to a commonly shared vision of the task to be accomplished. Further, a great amount of goodwill helped the various stakeholders work effectively together (many times in a very informal manner) to realize the outstanding progress and accomplishments of the Project.

Because of the complexity, it is useful to demonstrate graphically the linkages of the various stakeholders. Figure 3 illustrates that the principal target is the farmer. SARRNET has linkages with research as a catalyst and provider of technical and logistical support. Linkages with other stakeholders are also noted.

Figure 3: Interactions among cooperators involved in multiplication and distribution of cassava and sweetpotato planting materials



In Table 35 both the level and responsibility for managing various sites are outlined. Research has responsibility for the national leadership of the program and maintains and operates the primary sites. Extension and NGOs operate and maintain secondary sites. Specific case studies 3, 5 and 6 located (Annex B) demonstrate the various activities involved. Farmers are responsible at the tertiary level, and planting materials are then either given away or sold to other local farmers for their fields.

Table 35 also illustrates the role of all of the institutions and agencies in the accelerated multiplication and distribution of cassava and sweetpotato planting materials. This table lists all of the institutions or stakeholders involved in the Project. It should be noted that both Bunda College of Agriculture and Natural Resources College provide land for multiplication sites and that Crop Science department staff visit these sites and offer technical advice.

Table 35 Roles of institutions/agencies involved in the accelerated multiplication and distribution of cassava and sweetpotato planting materials

Institution	Function
National Agricultural Research System (NARS) USAID	Provides land, irrigation water for nurseries, monitoring and supervision of sites. Training of field and research assistants, farmers groups and farmers on nursery establishment and management. Provides Project financial support.
SADC/IITA/SARRNET	1. Main implementing and coordinating agency. 2. Manages funds for the establishment of sites. 3. Provides technical backstopping. 4. Provides the "certified" material for multiplication. 5. Provides training to research and field assistants, farmers' groups and farmers on nursery establishment and management. 6. Distributes some of the material from primary to secondary and from secondary to tertiary sites. 7. Compiles quarterly reports. 8. Manages some primary sites.
FAO UNICEF	Mobilization role of multiplication groups. Financial support of secondary multiplication sites as well as distribution of material to farmers.

CHURCHES AND NGOs: Christian Council of Malawi; Christian Service Committee of Malawi; Concern Universal; Baptist Mission of Malawi; Livingstonia CCAP; Adventist Development and Relief Agency; Self Help International; CPAR; Action Aid; World Vision International; Save the Children Fund; Evangelical Alliance for Relief and Development	- Provide land - Multiplication of planting material - Supports labour for secondary multiplication - Farmer training/extension agents - Distribute planting material to individuals and groups - Funding multiplication and distribution - Provide some other infrastructure such as irrigation water - Manage secondary sites - Monitor and backstop secondary and tertiary sites
Bunda College (University of Malawi) Natural Resources College	- Provide land - Staff in Crop Science Dept. sometimes visit multiplication sites and offer advise on pest/disease management - Irrigation water to multiplication sites.
Farmers and farmers' groups	- Manage tertiary sites - Multiply material and distribute to other farmers This is a very essential group for sustainability of the activities beyond project life.

Source: Project quarterly reports.

Project quarterly reports also note that there are many unidentified local churches involved as well in the Project. The dynamism of the NGOs at the local level drives the success of the Project. NGOs operate at the grassroots level and have face-to-face contact with farmers and farmer groups. In a number of cases NGOs work with farmers who are members of a particular church.

All of the NGOs surveyed started with the Project in 1992-93. According to the interviews with Directors of NGOs, the goals relating to the Project were to provide food security, assist with food security for the poorest of the poor, help to speed up group development, and help farmers in drought stricken areas. All of these goals are compatible with the Project.

NGOs targeted the smallholder farmer, female heads of household, families with children under five, farmer clubs, and church groups. Seven of eight NGO Directors surveyed indicated an increasing financial commitment to the 1995-96 Project effort.

Responsibilities of NGOs included providing land for secondary sites, multiplication of plant materials, funding labor and logistical support, distributing planting materials to farmers and farmer groups, providing infrastructure, managing secondary sites, monitoring and backstopping secondary sites, and providing technical advice to farmers on cultural practices. It was evident from the dedication and spirit of the NGO field workers that much was being accomplished toward achieving Project goals.

The case study of the NGO field worker in Ekwendeni is an excellent example of how one NGO worker has accelerated the cassava and sweetpotato Project. An interesting aspect of the study is the role of Extension Multiplier Volunteers (EMVs), local farmers who multiply cassava and sweetpotato at tertiary sites under the monitoring of the field worker. The EMVs receive technical training in cultural practices of cassava and sweetpotato with emphasis on maintaining clean seed stock. Each EMV in turn trains between 15-20 other farmers who also agree to establish a nursery. Nine of the EMVs are men and six are women (Annex B, Case Study 6, The Case of the NGO Field Worker).

The Team observed that the current linkages between research, extension, and the NGOs involved in multiplication and distribution activities could be improved. Some of the weaknesses identified by various representatives of stakeholder groups are a lack of proper coordination, interaction of players, and information exchange.

One way of strengthening linkages is to hold one-day coordination and planning meetings at the national level at least twice a year. Issues to be covered might include planning joint activities, exchanging views on pest and disease problems, and reviewing progress of multiplication and distribution of cassava and sweetpotato planting materials. This would also provide an opportunity to work out clear definition of the roles of the various collaborators.

Strengthening the role of the NGOs in the Project will pay great dividends in the future. NGOs have demonstrated their comparative advantage of having grassroots contacts with farmers. The efficiency and effectiveness in the generation, transfer and adoption of the new technology is due in part to the dynamic role of the NGOs. This does not overshadow extension's role in the Project, but complements and enhances the synergy of both partners.

The key stakeholders in the public sector are the estimated 200,000 farmers who have participated in the Project. Smallholder farmers are resource-poor with per capita income of only US$100 per year, and they own only about a 1.0 hectare of land. During the Project farmers quickly realized the benefits

of growing cassava and sweetpotato for food security in drought conditions. Farmers and farmer groups demonstrated their enthusiasm for the Project with increasing contact and request for assistance from NGOs and extension. Case Studies 3, 5 and 6 in Annex B illustrate this point.

The aggregate value of labor in raising the crops, transportation of planting materials to tertiary sites, construction of fences to protect crops, and other crop inputs represent a major contribution from the private sector. It takes about 25 man-days to ridge and plant a hectare of cassava. The cost per man-day is MK10 or a total of MK250 per ha. Multiplying MK250 per ha for labor for land preparation and planting only by the number of ha planted with new materials would yield an impressive figure.

The large tobacco-growing estate sector will probably not be a major stakeholder. Both cassava and sweetpotato are hosts to eelworms, which dramatically reduce tobacco yields, so these root crops will not fit into estate rotations. However, the Dwangwa Sugar Estates are encouraging workers and smallholder sugar growers to multiply and grow sweetpotato since sugar is not affected by this pest.

3.3 Training

Training and education are major strategies in capacity building. In the cassava and sweetpotato multiplication and distribution Project, for example, SARRNET and the NRCP Team have developed and trained extension workers, NGOs, and farmers in the development of an entire system. This is clearly reflective of organizational capacity building. A mostly informal communications network has developed among the various stakeholders which has resulted in planning activities, the exchange of vital information about pest and disease problems, and site monitoring.

Training of agricultural research technicians, extension staff, NGO field staff, and farmers was a major component of the Project. Records available indicate the names of 281 research and extension workers, 312 individual farmers, and 15 farmer groups trained in cassava and sweetpotato multiplication and distribution. The figure is likely to be much higher for extension workers and farmers since many ADD records indicate that training took place, but specific numbers trained were not available.

3.4 Environmental Issues

Generally speaking, cassava and sweetpotato are environmentally friendly crops. Both prevent wind and water erosion. During the windy dry season two-meter high cassava plants protect the soil against wind blast. Sweetpotato has a netting effect on ridges which prevents soil erosion.

Contamination of the soil and water by pesticides and herbicides with resultant residues is not a consideration since none are used by farmers. Plant diseases and insects, however, are still major problems for farmers although simple cultural techniques such as roguing can assist in maintaining healthy plant stock. Other commonly used strategies are developing resistant varieties and biological control.

Both cassava and sweetpotato lend themselves well to diversification. While both crops are planted as monocrops, much intercropping is practiced by farmers utilizing various cropping systems. There are some new trials involving cassava and sweetpotato combined with agro-forestry practices that are just getting under way in the country.

Cassava does well in marginal soils. Since cassava nitrogen requirements are less than for other crops, farmers do not use commercial fertilizer on either cassava or sweetpotato. (Some farmers in the northern region of the country use limited amounts of cassava peelings and animal manure on their cassava.)

3.5 Outputs and Means of Verification

Some of the outputs (and their magnitude where data are available) and means of verification for the Project are outlined as follows:

Outputs	Verification
. An effective collaborative cassava and sweetpotato distribution system established countrywide	Project records Interviews
. Establishment of a synergistic linkage of diverse groups of stakeholders working toward the common goal of food security. The system involved 8 research stations, 8 ADDs, 12 NGOs and many additional church groups, IITA/SARRNET, donor groups, and and estimated 200,000 farmers.	Project records Interviews
. Development of a national agricultural policy supporting diversification with emphasis on sweetpotato and cassava production in drought stricken areas of Malawi.	November 1994 GOM Policy statement. Agricultural Research Master Plan 1995.

. Increased national support for cassava and sweetpotato research and multiplication and distribution activities of NGOs, extension, and farmers. . 10% budget increase for research . 15% budget increase for extension . Significant NGO financial contributions . USAID/USDA $ 700,000 support . Support from FAO and UNICEF . Financial contributions in labor, and resources from the private sector represented by an estimated 200,000 private farmers	MOALD financial records NGO/donor records
. Expansion of cassava/sweetpotato hectarage and yields. The number of hectares in 1994/95 crop year is estimated to be 95,000 for cassava and 62,000 for sweetpotato. This represents a 31% increase for cassava and a 63% increase for sweetpotato over the 1993/94 season.	National Crop Estimates Project records NGO records Interviews
. Reduced length of hunger period in areas where new cassava and sweetpotato varieties were planted. Stakeholders estimate hunger period reduced from 5 to 3 months and even eliminated in some areas.	Farmer interviews
. Increased income in many cases by 25% or more of beneficiaries through cash sales of sweetpotato tubers and cassava roots, leaves, and planting materials. Added income utilized to buy fertilizer for maize, food, medicines, school fees, and other items to improve the quality of life.	Farmer interviews Project records
. Improved nutrition of farm families resulting from added supply of energy from cassava roots and sweetpotato tubers, and Vitamin A, iron, calcium and protein from leaves. Fourteen of 15 village groups interviewed reported widespread utilization of cassava and sweetpotato leaves in their diets.	Village interviews Farmer interviews
. Improved populations and varieties adopted and accepted by farmers	Research and Project records

Adoption of new cassava and sweet-potato planting materials almost 100% if sufficient planting materials available.	NGO records Farmer interviews
. Strengthened research, extension, NGO, and farmer capacity for multiplying and distribution of improved planting materials. proceedings.	Training records Interviews Project records Workshop
.Trained 281 research, extension, and NGO staff .Trained 15 farmer groups .Trained over 350 farmers.	Project records
. Increased national support and participation in regional forums, articles in the press, radio releases, local, district, and national meetings of stakeholders.	Project records Stakeholder interviews
. Socio-economic and agronomic studies carried out by interdisciplinary teams.	Project records
. Cassava, sweetpotato identified as environmentally friendly crops	Project records Interviews with ADD/PMs, ·researchers, NGOs, and farmers.

The impact indicators/outputs of the Project definitely indicate meeting and exceeding the Project goals. There were, in addition, two positive outcomes that were not fully anticipated. The one with greatest impact was that the hunger period was reduced in areas where improved planting materials were introduced. Also, the income flow realized through sale of cassava and sweetpotato was utilized to purchase medicines, pay school fees, buy food, and to purchase fertilizer for the maize. Thus there was a real improvement in the quality of life for the Project beneficiaries.

Capacity building through training and education is an integral part of ensuring sustainability. New knowledge, skills, and practices were taught to farmers to ensure that healthy planting materials are raised and distributed from farmers' nurseries. The simple technique of roguing out diseased plant material every two weeks helps to ensure that vigorous and healthy plant materials will be available for distribution to other farmers.

3.6 Sustainability

Sustainability according to Van Sant (1987) is a development concept that often is identified incorrectly with the continuation of a project or an institution. However, development success depends on the continuation of valued benefit flows or outcomes, with or without the programs or organizations that stimulated those benefits in the first place. The nature of these benefits may change, their source may shift, or responsibility for their costs may be assumed by a new mix of benefactors. What is important is that the benefits or outcomes are valued by the intended beneficiaries and that they continue. A helpful guideline to factors in achieving sustained benefit flows is outlined in the six criteria below.

Donor projects, such as the GOM/IITA/SARRNET Project, are by definition, time bound; one way or another they end. The end of the project is perceived as a termination whereas its end should be seen as a beginning, and what follows, if anything, is ultimately more important than the project itself. The benefits or outcomes that continue are the real fruit of the development seeds that have been planted. In the case of this Project the continued benefits to the farmers are clear-cut: meeting food security and nutrition needs and having added income from crop sales that contribute to the quality of life.

Every planning decision should be made in the light of the sustainability criterion. This is very relevant in looking at the future of the new cassava and sweetpotato program. The following considerations may be useful to the GOM, donors, and other stakeholders.

1. What benefits are to be sustained? A careful distinction should be made between temporary, project related outputs and long-term benefit flows. In terms of the current Project a high priority of ensuring the continuous high standard and quality of plant materials at all multiplication and distribution levels is essential.

2. What resources will be required to fund long-term benefit flows? Will Project systems be self-supporting (for example, will farmer costs for their nurseries be covered adequately by selling the new planting materials?). It is particularly important to distinguish recurrent costs from capital costs in making this analysis. As cassava and sweetpotato become more important as food security crops, the GOM/MOALD should allocate more research and extension funds for these commodities.

   It is encouraging to note that the GOM and NGOs have increased their contributions during the LOP and will do so in the future. Since this Project has an excellent net benefit return, continued donor support for another three to five years coupled with NGO and GOM financing will maximize the potential of meeting food security needs in Malawi.

3. Do projected benefits justify the investment of external resources in light of realistic constraints and opportunity costs? Projects often represent funds in search of activities. Continuation, by contrast, represents activity in competition for funds. The Team strongly feels that given the importance of food security in Malawi, a continued level of support from IITA/SARRNET, NGOs, and external donors is necessary to maintain and accelerate progress achieved.

4. Does the administrative capacity exist (or is it being developed) to maintain essential systems for benefit continuation? Local organizational capacity and leadership along with resource control are key requirements for lasting development. A nonformal system for distributing and multiplying plant materials has been established.

5. Are permanent aspects of service delivery being institutionalized in the government structure or in viable private sector delivery systems? If so, are new administrative resources required or are there available resources in the system? The Team believes that there are sufficient FAs in place to work effectively with farmers in training them with the new technology. Support is needed in terms of allocating more time for FAs to work with farmers on cassava and sweetpotato production. Training will need to be accelerated to prepare Fas and NGO field workers in developing maximum capacity of the farmers in all aspects of multiplication, distribution and production. Utilizing the Extension Multiplier concept as outlined in Case Study 5 (Annex B) of the energetic NGO field worker is a means of strengthening the delivery system at minimal cost.

6. How much of the requirement for both financial and administrative inputs can be undertaken locally? Local inputs, if broadly based, reduce dependency, increase predictability, and serve the interests of local control. The Extension Multiplier model cited above requires minimum NGO inputs and relies on volunteer farmers.

Achieving sustainable benefit flows is an elusive goal, largely because sustainability has been treated as an after-thought in the implementation of most projects. Planning for sustainability requires new ways of thinking about project objectives, implementation, strategies and evaluation.

SECTION IV: CONCEPTUAL FRAMEWORK APPLIED

4.1 Introduction

The Team felt that an overview of some of the work relating to the adoption/diffusion theory would be useful in writing the final Project report. Many of the major project impacts, recommendations, and lessons learned can be related to this major conceptual field.

4.2 Adoption/Diffusion

Everett Rogers (1983) in his classic work on the Diffusion of Innovations provides a model and a number of principles that are relevant to the GOM/IITA/SARRNET Project. Classic adoption studies with maize, for example, indicate that adoption moves over time and that the rate can be plotted on a bell-shaped curve. Rogers classifies five types of adopter: 1) innovator, 2) early adopter, 3) early majority, 4) late majority, and 5) laggard. (The almost completed adoption of maize in the U.S., for example, has taken over 50 years with many laggards resistant to adopting the total technological package.)

Many Malawian farmers are familiar with raising cassava and sweetpotato. However, with thirty years of strong political pressure and government policy, the country's agricultural professionals developed a "maize" mentality. The vast majority of research and extension funds were devoted to the development and the promotion of hybrid maize. Field Assistants spent most of their time teaching farmers to raise hybrid maize, distributing fertilizer, and administering farm credit programs. Little time was provided to basic root crops for food security.

There has been a dramatic change in GOM policy regarding cassava and sweetpotato. The importance of these root crops has been recognized, and the MOALD is now actively promoting the multiplication and distribution of cassava and sweetpotato. Many FAs and Extension administrators have "adopted" and accepted the importance that extension should gear up and actively support the training of farmers. However, there are still many "late adopters" and "laggards" in extension who have not yet fully realized that maize has two important competitors in terms of food security. This attitude is rapidly changing.

The new cassava and sweetpotato varieties are a relatively simple technology. Many farmers have grown these two crops in the past. As Rogers notes, the characteristics of an innovation, as perceived by the members of a social system, determine its rate of adoption. Five attributes of innovations are: 1) relative advantage, 2) compatibility, 3) complexity, 4) trialability, and 5) observability.

Relative advantage is the degree to which an innovation is perceived as better than the idea it supersedes. The degree of relative advantage may be measured in economic terms, but social-prestige factors, convenience, and satisfaction are also important components. The tremendous adoption rate of the new varieties by farmers reflects that cassava and sweetpotato are viewed as superior to maize as being drought tolerant, food security crops. In addition, especially near urban centers they are becoming important cash crops. Interview data with farmers and experience from field visits substantiate that very high adoption rates of the new materials (90-100%) are constrained only by the lack of available planting materials. In one case, farmers traveled over 160 kilometers by bicycle, spending three nights alongside the road, to obtain planting materials at a secondary site. This illustrates the relative advantage seen by farmers of the new varieties.

Both men and women farmers perceive the relative advantage of the low labor input required for cassava and sweetpotato as contrasted with maize and tobacco. The data clearly indicate that knowing severe drought conditions will occur again, farmers are expanding hectarage of cassava, sweetpotato, and soyabeans at the expense of maize and other crops. (The Team also noted the expansion of several other drought resistant crops including cowpeas, pigeon peas, sorghum, and millet.)

Farmers are also aware that cassava and sweetpotato can fill in the gap during the periods of hunger when maize is either no longer available or the cost is too high. Where cassava and sweetpotato are planted, farmers reported less hunger and starvation because of the availability of these crops as food security. Both men and women farmers noted that the cassava and sweetpotato leaves provide an important green vegetable during the dry season when no other vegetables are available. They perceive the leaves as "good" for the health of their families although at present they are unaware that the leaves are sources of Vitamin A, iron, calcium and protein. Leaves are shared with friends and family, and some farmers are selling them.

An additional relative advantage of cassava is that the bundles of plant stems can be sold as planting materials to other farmers. The Team interviewed a number of farmers who sell a bundle (made up of the stems from about 20 plants) for MK10.00 The Bunda farmer in the Case Study (Annex B) estimated that he will sell approximately 600 bundles, thus generating about MK6,000.00 from his 1.0 ha garden. Discarded plant material can be utilized for firewood. Many farmers who are multiplying planting materials at individual or communal nurseries also sell them for additional income.

Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. An idea that is not compatible with the prevalent values and norms of a social system will obviously not be adopted as rapidly as an innovation that is compatible.

The multiplication, distribution and increased production of the new cassava and sweetpotato varieties offer hard evidence of the compatibility of the crops with existing norms and values. Many farmers are already familiar with cultivating cassava and sweetpotato and utilizing the crops for consumption.

Complexity is the degree to which an innovation is perceived as difficult to understand and use. The new cassava and sweetpotato varieties are a simple technology with both relative advantage and compatibility with existing social systems and norms. Therefore this new technology is being adopted relatively quickly.

Cassava and sweetpotato production is a simpler process than maize production, and farmers view cassava and sweetpotato as having much lower risk than maize and other crops under prevailing environmental conditions. Several farmers interviewed noted that cassava and sweetpotato are environmentally friendly crops. They prevent soil erosion, and they are also friendly in that they do not require pesticides or insecticides, so no water or food products are contaminated because of them.

Cassava processing is more complex than that of maize. Cassava must be peeled, soaked and dried to keep it from causing cyanide poisoning when eaten. Malawian farmers are quite aware of the proper procedures needed to ensure the safety of cassava as a food product; however, efforts should be accelerated for Farm Home Assistants (FHAs) and others in extension to teach both men and women farmers who are growing cassava for the first time about proper preparation and processing techniques.

Trialability is the degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on the "installment plan" will generally be adopted more readily than innovations that are not divisible. Since there is only a limited amount of new planting materials available, farmers are trying out new varieties in their small nurseries. The relative advantages are quickly perceived by neighboring farmers, and the technology can be easily transferred with relative ease and low cost. It is technically possible to start cassava and sweetpotato with just one ridge measuring 1 x 10m.

Observability is the degree to which the results of an innovation are visible to others. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt. Visibility also stimulates discussion of the idea among friends and neighbors.

Rogers' diffusion research clearly assists in understanding the reasons for the rapid adoption and demand from entire farming communities for the new varieties. Within a short period of time a simple technology has been enthusiastically adopted where it has been offered. However, stakeholders must remember that certain critical factors of capacity building and sustainability must be dealt with to maintain the momentum achieved.

SECTION V: UNEXPECTED OR UNPLANNED PROJECT IMPACTS

This section examines unexpected or unplanned impacts that emanated from the Project but were not anticipated in the commencement stage.

1. One unexpected outcome noted by the Team was the surprisingly strong sense of ownership and commitment of the stakeholders. This was evidenced by the great degree of cooperation at various levels in a somewhat informal and loosely organized multiplication and distribution system. Stakeholders set high priority on Project activities directed toward the goal of food security.

2. Farmer adoption of the new planting materials was almost 100% in areas where there was sufficient "seed" or planting materials.

3. There is solid evidence that the Project has produced a positive economic impact on farm households. Beneficiaries have been helped to meet food security needs and at the same time lessen the length and impact of the hunger period. Cassava and sweetpotato are four to five times more profitable than maize on a per hectare basis. Unexpected sales of cassava and sweetpotato have generated income to purchase food, fertilizer for maize, school fees and medicine, thus improving the quality of life for the smallholder family.

4. Beneficiaries exhibit a high degree of understanding of the value of cassava and sweetpotato leaves in the diet. Farmers intercrop cassava and sweetpotato with maize, pigeon peas, soyabeans, and a number of other crops.

5. The development of farmer groups involved in the multiplication and distribution process has strengthened religious integration at the local level. This fact was commented on by several NGO field workers. Interested farmers of both the Christian and Muslim faiths are actively involved in farmer groups.

6. There is a definite shift in terms of expanding cassava and sweetpotato hectarage at the expense of maize, tobacco, and other crops. This will probably continue with the increasing importance of these drought resistant crops.

7. The NGOs have performed outstanding work with the Project at the grassroots level. By nature they are more flexible than their MOALD FA counterparts due to lack of organizational constraints. An NGO (CSC) developed the first fact sheets on cassava in the local language, and NGOs have utilized many innovative approaches in working with farmers.

8. The change in GOM agricultural policy toward supporting drought tolerant crops has assisted the development of the Project. A number of MOALD administrators have actively promoted both cassava and sweetpotato, and the fact that all ADD Program Managers attended a national forum on the two crops is illustrative of this support.

9. Project impact has crossed into neighboring Zambia. A field worker at Embangweni reported that sweetpotato materials have reached several farmer groups across the border.

10. The Project has been strongly participatory in nature and utilized a multi-disciplinary approach beyond what might be normally expected under similar project implementation systems. This has improved both the effectiveness and efficiency of the overall effort.

VI. LESSONS LEARNED FROM THE PROJECT AND RECOMMENDATIONS

Along with an examination of the structure and performance of the Project, this section presents the lessons learned and offers recommendations which can be of use in similar projects in the region.

1. There are strong indications of capacity building at all levels although to date the Project has reached only about 20% of the farm families in Malawi. Institution building is a long-term process, and to consolidate the significant gains realized so far, continued assistance is essential.

2. Development of the Project has been assisted by the new GOM policy directed toward supporting drought tolerant crops. MOALD administrators have actively promoted cassava and sweetpotato, and Agricultural Development Division support was shown by all Program Managers attending a national forum on the two crops. Stronger government commitment to sustain the current multiplication and distribution program on root and tuber crops must be secured and integrated into the national agricultural plans and budgets. Line items should be included in the GOM budget to sustain the multiplication and distribution activities.

3. Each ADD has only one crops officer responsible for all its crops. With the government now interested in developing root and tuber crops, additional personnel should be recruited and trained, especially to work on cassava and sweetpotato. Extension administrators need to provide the support and training of FAs so they can shift a higher percentage of their work time to these crops, which received little attention during the prior government. This effort should be reflected in the extension plan of work.

4. Evidence indicates that USAID/USDA funding had a positive impact on all components of the Project. GOM and IITA/SARRNET should seek additional support to continue to strengthen the Project. This support could be arranged through a variety of donors including USAID, FAO and EU.

5. Projects similar to the Accelerated Multiplication and Distribution of Cassava and Sweetpotato Materials should be monitored closely at all stages by a Stakeholder Task Force. At the commencement of the project, the Task Force should make certain that only a limited number of well-targeted activities are undertaken and that these critical components are adequately funded.

6. This Project's coordination went remarkably well considering the number and variety of stakeholders involved. Most of the planning and coordination was carried out on an informal basis. Similar projects would benefit from a Task Force made up of stakeholder representatives including farmers. Some of its goals

would be to improve planning, clarify roles and responsibilities, facilitate the exchange of information, and assist in developing standardized monitoring and evaluation procedures.

7. The National Root Crops Commodity Team provided leadership for the Project. With assistance from IITA/SARRNET, it led a very successful effort despite having limited manpower. Additional manpower support would have facilitated greater Project impact.

8. Processing, marketing and utilization issues involving cassava and sweetpotato need to be firmly integrated into the National Root Crops Program. A full-time section leader should be appointed to strengthen the capacity of the unit.

9. There is a need to embark on an aggressive long-term training program aimed at having at least two cassava and two sweetpotato scientists at the Ph.D. level for the National Root Crops Program within the next three to five years. Support for staffing the unit with three M.Sc. and four B.Sc. scientists is also needed. The majority of their work should be focused on cassava and sweetpotato.

10. Participant training evolved on an informal basis from a reasonable mix of donor, GOM, and NGO funding. These selective training interventions strengthened capacity at the field level for field workers and farmers. However, field workers admit that they know very little about cultural practices for cassava and sweetpotato. Viable training programs should be formulated to give them sufficient confidence and knowledge to provide farmers with advice on cultural practices with emphasis on maintaining healthy seed stock.

11. Short-term training for technicians should also be made a high priority. Short-term in-country courses involving both Malawian researchers and IITA professionals are one solution. Offshore training is another option. This can take place at IITA Headquarters. Technicians and researchers will be the key trainers of extension and NGO field workers in the future. The Study Team observed that in several areas NGO field workers were already much more knowledgeable than their extension counterparts.

12. Extension and NGO staff should be trained with the necessary knowledge and skills for cassava and sweetpotato with emphasis on the maintenance of nurseries for planting materials, maintaining disease-free stock, controlling pests and diseases, cultural practices, processing, and storage methods.

13. Farmer training should cover the same areas as those for extension and NGO staff but with emphasis on preservation of materials, particularly through the dry season. Some farmers expect to receive sweetpotato materials from the Project every year because they find it difficult to maintain them through the dry season.

14. Few extension messages, fact sheets or production guides on cassava and sweetpotato exist in the country. The National Crop Production Guide has two pages of very generalized information regarding cultural practices for cassava and sweetpotato, but the information is not ecological zone-specific.

More written training material and relevant educational material as well as production guides need to be developed. The only fact sheets regarding cassava cultural practices have been developed by the Christian Service Committee. The National Root Crops Team is in the process of publishing a production and training guide for cassava and sweetpotato. In interviews with technicians and field workers specific topics were cited including nursery establishment, field management, diseases and pests, intercropping, post-harvest technology, processing, field layouts, organizing training of farmers, cultural practices, seed multiplication, weed control and biological control of pests.

15. Significant advances in root crops research and extension can be accelerated through the active involvement of Bunda Agricultural College and the National Resources College staff and students. Some involvement already exists, but this needs to be expanded. The crops curricula at both institutions should be strengthened for cassava and sweetpotato. Students interviewed noted that very little material about the crops is covered in their agronomy courses. In addition, primary and secondary schools offering courses in agriculture should be assisted through development of training materials and teacher training.

16. Meetings at local and regional levels should be encouraged to circulate current findings, discuss common problems, and inform participants about such important matters as areas where there are surpluses or deficits of planting materials. Participants at the regional level should include the SARRNET coordinator, crops officers, and representatives from NGOs, extension and farmers.

17. NGOs were a key element in the success of the Project, utilizing many innovative approaches in working with farmers. Their role can be increased with additional assistance and under the technical supervision of the National Root Crops Program. The added support can be used for them to expand secondary multiplication sites, monitor and supervise tertiary sites, and advise farmers. Their collaborative efforts with extension at the field level should be encouraged.

18. NGOs and church groups other than those who participated in the Project should be identified as potential collaborators and given training and support. Several NGO field workers commented on the fact that religious integration was strengthened by the development of farmer groups involved in multiplication and distribution activities. Farmers of both the Christian and Muslim faiths are active participants in farmer groups.

19. The Project has helped to strengthen the activities and the cohesion of women's groups. Groups and clubs are an effective vehicle for other technology transfers as well as the

multiplication and distribution of cassava and sweetpotato. Because these crops are significantly dominated by women, future promotion efforts should target women specifically.

20. Training in the proper processing of cassava is important for farmers and farm families especially in areas where cassava is now being grown for the first time. Educational programs emphasizing both correct processing procedures and nutritional aspects of the crops should be undertaken both by extension and NGOs.

21. Preservation of sweetpotato planting materials is a major challenge because harvesting time coincides with the dry season. Simple, affordable and acceptable technologies and training are needed.

22. Given the low multiplication ratio of these crops vis-a-vis cereals, it will take many years to satisfy the large demand for planting materials. Thus for the short- and medium-term it will be necessary to continue to support current institutional multiplication and distribution.

23. Maximizing efficiency in the distribution of planting materials calls for a more formalized cooperative effort than the informal efforts that occurred. Precise coordination is essential since planting materials are bulky to transport and dry out rapidly. Instructions in terms of pick-up of materials for delivery to various sites should be clear, concise, and understood by all parties to avoid needless confusion and waste.

24. Very high adoption of the new planting materials was limited only by supply. Farmers and farmer groups who were signed up to receive materials often found they had been distributed to others. Closer monitoring would have avoided this problem.

25. Farmers should sell planting materials from tertiary sites to other farmers at a nominal fee. Experience demonstrates that giving away materials creates the expectation that they will be free again next year at the same site.

26. A quality control program should be put in place to ensure that disease-free root crop planting materials are distributed.

27. The current performance of Mbundumali cassava variety and Kenya sweetpotato variety is excellent. However, it is necessary to have in place a calendar program on breeding, on-farm testing and release of varieties. It is also important for the research team to consider what should be done to satisfy the needs of the different agroecologies with regard to cassava and sweetpotato. (For example, the survey indicated that the same variety of cassava which took six months to mature in Nkhotakota was taking over two years in Livingstonia.)

28. Many tertiary sites, even those located in dambos, dried out because of insufficient moisture. Some could have been salvaged if shallow wells had been dug. The cost of a two-three meter

well is about MK500. Financial support to farmers' groups needing assistance for labor to dig the wells should be considered.

29. Damage by wandering goats and cattle was a major problem. Innovative farmers built fences around their fields. The cost to build a fence is reasonable considering the relatively high returns realized from cassava and sweetpotato. Community education, along with sanctions against negligent livestock owners, should also be employed.

30. Efforts to popularize cassava and sweetpotato through radio, newspapers, extension and extension leaflets should be intensified. Word-of-mouth has already been effective in spreading the Project impact. A field worker at Embangweni reported that sweetpotato materials have reached several farmer groups across the border in neighboring Zambia.

31. Marketing facilities should be created to encourage expansion of cassava and sweetpotato agro-industries development in Malawi.

32. Little progress was made on market studies of cassava and sweetpotato. Such studies should be part of future project efforts.

33. Projects of this type should conduct farm analyses at startup so that important data can be utilized and shared with all participants. Such data as cassava's and sweetpotato's profitability when compared to maize, tobacco and cotton should be made known, as well as their net profit being four to five times higher than that of maize.

34. Authoritative data on yields of cassava and sweetpotato on farmers' fields do not exist in Malawi. The 2-3 tons per ha for cassava and 4-5 tons per ha for sweetpotato often quoted in reports are too low to accept. Field interviews conducted by the Team resulted in more or less the same numbers. But casual observation and extrapolation from some of the case studies (e.g., Annex B, No. 4) illustrate that yields are higher than reported.

One reason for the discrepancy is that since cassava and sweetpotato are harvested on a piece-meal basis, it is difficult for the farmer to make estimates based on memory as the Team required. Field area sampling and measurement of area and weighing of harvested products should be conducted as quickly as possible. Thirty man-days is deemed to be sufficient.

However, to be thorough, yields should be determined under scenarios which reflect Malawi farms' real situations. The Team identified three main types of cassava/sweetpotato cropping systems: monocrops, cassava/maize intercrop and cassava/maize/ sweetpotato intercrop. Yield levels must clearly reflect the same cropping systems. The Collaborative Study of Cassava in Africa (COSCA), Part 2, dealt intensively with this in the COSCA countries. Unfortunately it bypassed Malawi.

35. Simple technologies coupled with an effective multiplication and distribution system are rapidly adopted if they have the positive characteristics of (i) relative advantage over other varieties, (ii) compatibility within the social system, (iii) being a simple innovation, easily tried out under farmer conditions, and (iv) observable results. All these criteria were present in the cassava and sweetpotato Project in Malawi, and the adoption fits well into Rogers' diffusion theory.

For future projects, prior analyses should be carried out for technologies that are to be introduced into existing farming systems to determine acceptability and fitness in the system. This Project fortunately succeeded without such analysis; most fail.

36. The successful model and process developed for the accelerated multiplication and distribution of cassava and sweetpotato should be piloted and applied to other countries in the SADC region. IITA/SARRNET should play the key coordinating role in the initial states of planning and implementation of such projects.

ANNEX A

ACCELERATED MULTIPLICATION AND DISTRIBUTION OF CASSAVA AND SWEETPOTATO PLANTING MATERIAL AS A DROUGHT RECOVERY MEASURE IN MALAWI: AN ADOPTION RATE AND IMPACT ASSESSMENT STUDY

SCOPE OF WORK

Background

The Famine Mitigation Activity (FMA) funded an agreement with the International Institute of Tropical Agriculture (IITA) to implement the Accelerated Multiplication and Distribution of Cassava and Sweetpotato Planting Material as a Drought Recovery Measure in Malawi Project. The Project has been implemented in Malawi in collaboration with the NARS of Malawi and NGOs. The project began in October 1992 with a two-year time frame. A no-cost extension was approved in November, 1994 to March, 1996. An internal evaluation of the Project was conducted in October 1994 chiefly aimed at determining the strengths and weaknesses in the planning, organization and management of the Project. The impact assessment will build from the evaluation findings to look deeper at the project's impact at the farm/household and institutional level. IITA and FMA are jointly organizing the assessment.

Purpose of the Study

The adoption rate and impact assessment study will be conducted to determine the contributing factors and the constraints to:

- the efficiency of the technology generation;
- the effectiveness of the technology transfer;
- the impact of investing in this Project at the farm and institutional levels;
- sustainability of the project; and,
- in general, the "lessons learned" to improve similar programs in other countries.

Terms of Reference for the Study

- Assess the proportion of farmers in selected project villages who are growing materials distributed by the Project including the proportion of the total farm area covered by these crop materials.

- Establish who (and by what magnitude) is distributing the materials at different levels. It is hypothesized that farmer distribution is very significant but it is not well documented.

- Establish the characteristics of farmers who are mostly adopting these materials: age, family composition, gender of household head, etc.

- Establish yield differences between the improved and old varieties and ascertain how the difference translates to increased consumption, improved nutrition, sales and income as opposed to non-participating households.

- Establish net-benefits, if any, and how these are distributed spatially, within and between households, producers and consumers, and between men and women.

- Determine the institutional level impact with specific reference to: training in various cassava and sweetpotato aspects, improvement in research infrastructure, improvement in technology development and management capability, and improvement in cooperation and linkages among stakeholders.

- Establish the impact on the environment emanating from the Project in terms of land use, environmental degradation, soil fertility, erosion, and pest/disease management.

- Determine factors in the Project which tend to accelerate or decelerate sustainability aspects for the program.

ANNEX B: CASE STUDIES

CASE STUDY 1

MARKETING OF SWEETPOTATO IN THE NKHATA BAY MARKET

The Team interviewed Mr. Lameck Simbeye, a sweetpotato trader in the Nkhata Bay market. The sweetpotato heaps were spread on the ground in the open air in an area sandwiched between the main road to the market and an undeveloped building plot. Mr. Simbeye lamented that the location was a great inconvenience. At times he would be chased away by heavy trucks negotiating to enter the market premises. He also faced a risk of losing the space if the owner of the undeveloped plot begins construction.

Sweetpotato were arranged in heaps by varieties and by size. At the time of the interview the trader maintained four varieties; Nakakomeni/Karonga, Kenya, Bwatanyina and Kacholola. The most preferred by consumers was Nakakomeni/Karonga followed by Kenya, Bwantanyina and lastly Kacholola. Nakakomeni/Karonga sold fastest and also fetched highest price per unit volume chiefly because of its taste.

The shelf life of sweetpotato is about one and a half weeks but Nakakomeni/Karonga is known to lose moisture faster. Mr. Simbeye sold two forms of sweet potatoes: fresh and boiled tubers. The mode of selling was different too. Whereas the fresh tubers were sold in heaps of MK5 (approximately 1.5 kg per heap) the boiled tubers were sold per tuber ranging from 10 tambala to 70 tambala based on the size.

The trader had two main sources of supply for the tubers--Mphamba and Limphasa villages. The cost of the materials would vary depending on the source.

Limphasa Village: This village is about 6 km from Nkhata Bay. He normally buys a bag of 90 kg at MK80-90. He would pay MK8 per bag for transportation and MK4.90 as fare for himself. He also supplies the labor for digging the tubers.

Mphamba Village: This village is about 12 Km from Nkhata Bay along the Mzuzu-Nkhata Bay road. One bag (90 Kg) of roots would cost MK120-130 and transport would be MK10 per bag with an additional MK6 for fare. He estimated that on the average he makes MK200 per bag of 90Kg. He also estimated making 1-3 trips a week to the supply villages carrying 1-2 bags for each trip. On the average, he sold 2 bags a week.

Mr. Simbeye also indicated that he has to pay tax of MK2 to the market master for each day of sale. He also encounters a loss due to spoilage of about half a tin (about 10 Kg) each week.

These losses would be tubers not purchased because of damage (bruised or spoiled). The trader would reduce the price for old tubers but some could still remain. He estimated making MK200 per bag of sweetpotato.

A simple calculation of profit margins for 2 bags per week for the two sources indicate the following:

From Mphamba Village:

Selling Price of 2 bags:	200x2	400
Buying price (120 x 2)	240.00	
Transport charge (10x2)	20.00	
Fare for the trader	12.00	
Market tax (MK2/daysx7)	14.00	
Losses (1/12 bag x MK120/bag)	10.00	-296
Total cost	296.00	104

Profit margin MK104
Return per man-day (104/7) MK 15

From Limphasa Village

Selling price of 2 bags	200 x 2	400
Buying price (80 x 2)	160.00	
Transport charges	16.00	
Fare for the trader	9.60	
Market tax (MK2/days x 7)	14.00	
Losses (1/12 bag x 80)	6.70	206.40
Total cost	206.40	293.00

Profit margin MK193.60
Return per man-day (193.60/7) MK 28.00

Traders make more profit if they can afford to get the product from Limphasa where the cost is relatively lower partly due to more abundant supply.

Consumers do not mind about soil on the fresh tubers but they would mind it in the boiled tubers. Although large tubers are preferred, consumers believe that the smaller the tuber the sweeter they become as they dry up. Mr. Simbeye mentioned that there are, on average, about 10 regular traders of cassava and sweetpotato per day in that market. The number of cassava traders is always smaller. He indicated that cassava (Mbundumali) has a higher demand than sweetpotato. Farmers prefer to sell the cassava themselves instead of going through a middle man. On the day of the interview there were about 300kg of sweetpotato and less than 5kg of cassava.

Mr. Simbeye expressed dissatisfaction on a number of things: 1. the market fee of MK2 per day was too high compared to the day's sales; 2. he raised concern about the lack of market space for cassava and sweetpotato. Other commodities were provided with stalls in the market.

This case study helps to indicate the high demand for root crops in the market place particularly cassava. Consumers have a higher preference for the materials being multiplied by the project i.e. Mbundumali and Kenya varieties. Traders also make good money from the business. Return per man-day ranges from MK15-28 depending on the source of the supply. This amount is far above the minimum wage rate of MK10 per day. Given the low institutional position which root crops were deliberately made to maintain for the last 30 years, it is not surprising that in urban markets like Nkhata Bay root crops -- even boiled tubers ready for consumption are not allocated stalls. But given the current increasing importance of these root crops, a reverse of the institutional arrangements need to come quickly.

CASE STUDY 2

MARKETING OF CASSAVA IN THE NANJIRI MARKET

The Team interviewed Mr. Zephaniah Chapweteka, a regular trader of cassava roots at Nanjiri market. He hails from Mnjolo Village, Traditional Authority Kalumba.

Mr. Chapweteka arranged the cassava roots on the ground because apart from the meat section, Nanjiri is an open air market. He had four different heaps arranged on the ground and each heap had a different price per root. The prices per root were MK0.50, MK1.00, MK1.50, MK2.00 and MK3.00. Mr. Chapweteka mentioned that he is one of the four regular cassava traders at the market.

The harvesting in the field of the farmer is done by the trader. Methods of buying from the farmer are two: After harvesting, cassava is packed into 70 kg bags and the farmer receives MK160.00 for each bag. The other method is selling per plant, currently at MK5.00, implying MK75,000 for a conservatively low plant density of 15,000 plants per hectare. He would usually harvest up to three bags per market day. He cannot exceed three bags per market day because as he put it, cassava roots go bad after two days. Thus, if he does not sell on the same day, the balance is partially a loss. He mentioned that he would take the balance home and share with relatives. Over time he has come to establish that the operating volume should be three bags per market day. Since Nanjiri market operates twice per week--Wednesday and Saturday, the bags sold per week total six.

Mr. Chapweteka usually uses his bicycle to transport the cassava to the market. Alternatively, he would hire other people to

transport his cassava using their bicycles and pay MK15 per bag. The market tax is MK5 per station which he feels is very costly. He pays MK10 because he maintains two stations.

He mentioned that Manyokola is the most common variety traded at the market. In the area, Manyokola is used synonymously with Mbundumali which is the recommended local variety multiplied by the Project. The peak hours for cassava purchase at the market are 00900 to 1100 and again at around 1300 hours. Mr. Chapweteka mentioned October to December as the period of highest market activity for cassava. This coincides with the harvesting period of cassava which is the beginning of the rains enabling easy availability of planting materials for the next season.

Whereas the estimated amount of cassava in the market on the day of the visit was about one ton, there were only about 25 kg of sweetpotato. We were informed that the time was off season for sweetpotato. In fact, Mr. Chapweteka deals with both cassava and sweetpotato with the volume of each at any one time depending on the season. He mentioned that whereas the buyers are both men and women, the sellers are on the average in the ratio of 3:1, men:women. Mr. Chapweteka who started root crops trading business in 1976 confirmed that there have been fluctuations in the volume of cassava traded in the market over the years. At the moment, however, he is observing more market flows of cassava to the market.

A simple calculation of the marketing spread and margins indicate the following:

1.	Selling price for 6 bags @ MK260.00	1560.00
2.	Buying price of 6 bags @MK160....960 (includes harvesting costs)	
3.	Transport 6 bags @ MK15.00.....90	
4.	Fare, 4 times @MK5.00 20	
5.	Wastage, 1 bag of 70 kg (1/2*160).80	
6.	Market fee, MK5*2 days/stations...20	1170.00
Profit margin		390.00

Return per man-day (390/2) = 195.00

NOTES:

The trader spends two full working days at the market while using the rest of the week for other activities.

The amount returned home is not a total loss because it is shared with relatives. The loss incurred in this case is therefore halved.

In addition to interviewing Mr. Chapweteka, a quick price survey was conducted at the same market place. In an attempt to calculate the actual price per kg for cassava fresh roots and cassava leaves, 14 roots and 2 lots of cassava leaves were purchased at various stations in the market. These roots which were individually marked were carried to Chitedze Research Station and weighed.

The buying and selling was accomplished within two hours and the leaves were packed in small plastic bags, closely secured to safeguard against shrinkage in order to ensure that the weight recorded is the weight which was bought. The weights are recorded below:

Serial No.	No. of Station	Weight per Root (gm)	Price per Root (MK)	Price per Kg (MK/Kg)
1	1	425	2.00	4.71
2	1	325	0.50	1.54
3	1	325	1.00	1.44
4	1	175	0.20	1.14
5	2	800	4.00	5.00
6	2	375	2.00	5.33
7	3	300	2.00	6.67
8	3	150	1.00	6.67
9	3	75	0.50	6.67
10	4	450	2.00	4.44
11	4	75	0.50	6.67
12	4	600	3.00	5.00
13	5	200	1.00	5.00
14	4	300	1.20	4.00

Cassava Leaves

Serial No.	No. of Station	Weight per Portion (gm)	Price per Portion	Price per Kg (MK/kg)
1	1	100	1.00	10.00
2	1	75	1.00	13.33

The inferences that can be drawn from the calculations are the following:

1. Cassava fresh root is currently a very valuable product. The average price for 12 roots per kg was MK5.38. (Two cases No. 2 & 4 were dropped because they were significantly out of range suggesting that the sellers were probably new to the market). Cassava fresh roots are about 70% water implying that the price of a kg of dry matter cassava equivalent to maize flour would be about MK37.00. This suggests high incomes for growers and traders.

2. Cassava leaves were surprisingly expensive on a kg basis. The unit of sale was a handful. The traders would grab the leaves from the basket with their hand and that lot would be MK1.00. When the lots were weighed, the average weight per kg was MK11.70 It was not possible to estimate how much leaf could be harvested from one hectare. Taking a conservative estimate of 100 kg of leaf per ha, the revenue turns out to be MK1,170 per hectare.

CASE STUDY NO. 3

THE ROLE OF THE LIVINGSTONIA CCAP MISSION IN MULTIPLICATION AND DISTRIBUTION OF CASSAVA AND SWEETPOTATO PLANTING MATERIALS

The drought of 1991/92 raised the eyebrows of many stakeholders who are concerned with food security for Malawians. One such stakeholder is the Livingstonia CCAP Mission. Through its hospitals, Primary Health Care Units were established to cater for malnourished children. Such units were established at the Embangweni and Livingstonia Mission hospitals.

Realizing that health coverage would be inadequate, public health committees were established in various villages. These committees were composed of both men and women. When the program of cassava and sweetpotato multiplication and distribution started, materials were initially being multiplied at the hospitals' central nursery before being distributed to the public health committees for onward transmission to the various women groups. A well known and popular extension worker employed by the mission covers the majority of the areas.

The development officer at Mbawa EPA caters for Embangweni did not realize that the mission started distributing cassava and sweetpotato planting materials a long time ago. It was surprising to learn that farmers had benefited from the materials from as far back as 1992. The Team was accompanied by a hospital extension worker to see farmers who had benefited from the program. Later on the Team was joined by the Christian Service Committee development worker. It was clear that the NGOs were taking the lead in the program in the area. It was learnt that the materials distributed had even crossed the borders in Zambia, thanks to the efforts of the Livingstonia Mission.

A visit to Mphande Village at Livingstonia revealed that the government extension worker had not visited the village for the whole year. Farmers frequently mentioned the extension worker employed by the mission as the one who has been assisting them. In this village, two groups have been formed and are working with the multiplication of cassava and sweetpotato planting materials. There is great potential in the village since every farmer has

access to the dambo land. Cassava which used to take 4 to 5 years to mature, now takes only 2 years because of the early maturing varieties that have been introduced in the area through the efforts of the mission. The farming areas of the mission are located at between 2,000-2,500 m.a.s.l. The high elevation has a great impact on the length of maturity for cassava. Some farmers are getting materials straight from the mission hospital.

The mission has groups in Chiweta and Mlowe villages. The mission extension worker is the one who imparts most of the knowledge and skills on root crop production. In fact the government extension worker left Mlowe a long time ago and is now residing at Chiweta which is about 10 km from his work station. Due to inadequate dambos in Chiweta and Mlowe, multiplication of these materials has not been fast enough. Sometimes due to extended hunger period, farmers have been forced to harvest the cassava very early in the dry season, and the materials cannot be preserved so they dry out. Chiweta, which has an ADMARC market very far away could be made more food secure if extension efforts were geared towards root crops.

There is need to intensify on these root crops particularly in areas that are stony and dry such as Chiweta and Mlowe. Having mission extension workers should not be seen as a role of conflict with government extension agents. The two should work in a complementary effort.

The use of groups to multiply planting materials is a very effective way of spreading them in various mission areas. The mission through its extension workers has distributed materials far and wide.

CASE STUDY NO. 4

THE BUNDA FARMER

The Evaluation Team interviewed Mr. Enosi Chinku, a cassava farmer located near the Bunda Road about 15 km from Lilongwe. The farmer planted his 1.0 ha patch to cassava in November, 1994. He supplied the total labour to prepare the field and to plant the crop.

The decision to plant cassava instead of maize has been impacted by several factors. Maize in the immediate area has yielded poorly during the past three years due to drought. The high cost of fertilizer has been another constraint plus the added labour inputs needed to produce a maize crop. The farmer had neither money to pay for the high cost of hybrid seed of maize, fertilizer or labour.

Cassava planting materials were obtained from the farmer's father. He also learned how to cultivate cassava from his father. The cassava was a local recommended variety. The stand

looked vigorous, healthy and clean of disease except for minor green spider mite damage. This damage was not of economic importance.

The farmer planted in November 1994. The plant spacing was closer than recommended. The Team estimated there were about 20,000 plants in the 1.0 ha field. The farmer constructed a fence from local materials to protect the field from goats. This has been an excellent investment and goats have not damaged the crop as in many local fields. The farmer estimated it took 30 days of his labour to construct the fence and including the collection of the local materials and his labour. The fence cost about MK3,000.

Harvest will commence at the start of the rainy season i.e. any time in November or December, 1995. Each plant will yield between 1 - 1 1/2 kg of roots. Middlemen coming from town are paying MK3 per plant. Some plants with bushy yields with big roots are going for MK6. The middlemen harvest the cassava roots thus saving the farmer the cost of labour in digging the roots and also the cost of transport to the local market.

The Team estimated the potential crop value at MK60,000 for the roots at current market prices. The current price of maize is very high and in low supply so the price of cassava should remain relatively stable through harvest period. With the hunger period fast approaching, the price for cassava may increase.

There are two other sources of income from the field. The farmer sells the cassava stems for planting materials. He gets MK10/bundle of stems made up from 20 plants. The Team estimated that there is a potential sale of from 500 - 700 bundles after sorting out inferior material (which can still be used for firewood). The potential value could be MK5,000 - MK7,000. The farmer reported that many farmers want to buy the planting materials. The second source of income is the selling of the cassava leaves. The farmer has sold about MK40 of fresh leaves (1 handful of fresh leaves is worth MK1.00). Neighbors and relatives pick leaves from the field for their relish free of charge and the farmer utilizes the leaves in the family diet. The leaves are high in Vitamin A, iron calcium and protein.

The farmer indicated that many farmers in local areas are shifting from maize to cassava. The reason for this shift is that farmers see cassava as a low input crop which is drought resistant. This represents both low material costs and labour inputs as contrasted with maize and tobacco. The farmer estimated labour requirements for a comparable 1.0 ha field as five times more labour as required for maize and 10 times for tobacco. Another asset as a crop is that cassava protects the field from both water and wind erosion and no harmful insecticide are applied.

The added income from the field will be used to pay for driving lessons so that the farmer can get a driver's license. Most cassava farmers interviewed reported increase income to be used

for school fees, household goods, clothes, needed medicines and doctors' fees, and buying fertilizer for maize. Also recognized is the value of cassava as a food security crop helping to lessen the impact of the hunger period.

Extension has not been active in this area. The farmer reported he had attended field days at Bunda Agricultural College and learned about sweetpotato. He requested some new sweetpotato planting materials form the Project, and indicated he would share these with his neighbors.

It should be noted this farmer is an innovator. He was not aware of the new cassava and sweetpotato program. Production was outside of any extension contact. Neighbors observing his success were also eager to purchase planting materials. The farmer also indicated his willingness to participate in the new cassava/sweetpotato program and distribute materials to neighbors. This case study points out the importance of innovative cassava and sweetpotato farmers currently outside of the GOM/IITA/SARRNET Program. Identification and inclusion of similar farmers within extension and NGO agricultural development efforts for cassava and sweetpotato multiplication is apparent.

CASE STUDY NO. 5

LILONGWE EAST RURAL DEVELOPMENT PROJECT AND THE NATHENJE RURAL TRAINING CENTRE

The case study of the Lilongwe East RDP and the Nathenje RTC illustrates effective institutional capacity building and sustainability through the leadership of Government of Malawi Ministry of Agriculture officers. The Nathenje Rural Training Centre is located within the Lilongwe East RDP south of Bunda turnoff. This has been a key secondary site for the multiplication and distribution of new cassava varieties.

Mr. Warren Mkupu is the Farm Manager. The nursery is a secondary site consisting of 3.5 ha of cassava. Plant density is approximately 20,000 plants per hectare. Planting of cassava is coordinated with the rainy season usually in November or December. One of the major constraints with the severe drought is water available to do a bit of irrigating of the cassava and a small nursery of sweetpotato. A new well has been dug and hopefully within the next month water from the well will be available. The stand of cassava appears tall and vigorous. It is a very clean stand and free from disease.

The first cassava was planted in 1993-94 in the nursery, and distributed to farmers for the 1994-95 crop year. Mr. Mkupu estimates that planting material was distributed directly to over 300 farmers in the surrounding area of the RTC. A great deal of material was distributed through other RDPs and EPAs within the ADD. The demand for planting material was so great the first

year that farmers unable to obtain material at the RTC travelled by bicycle an additional 80 km to the Dedza Hills EPA to see if they could obtain cassava planting materials. The lack of planting materials was cited as a major constraint to satisfying farmer needs. The fact that farmers with scarce resources travelled more than 80 km seeking the planting material is a direct indicator of importance of cassava as drought resistant and food security crop.

For the 1995-96 crop season a total of 3.5 ha is available from the nursery. This should be sufficient to plant about 60 ha and establish small nurseries for over 1,000 farmers. In addition, the planting material from the nurseries of the beneficiaries from the previous year should also be available. The RDP Project Officer, Mr. Watson Musonje, noted that extension works closely with NGOs through Field Assistants to distribute planting material to farmers.

The Project Officer reported that the program during the 1994-95 cropping season created a great awareness of the value of the new cassava varieties. Many farmers visit the EPAs and the RTC every day asking to be put on the list to receive the new cassava planting materials when they are ready. With the nursery at the RTC and smaller nurseries established by farmers and farmer groups, there should be enough material to significantly expand the hectarage this crop year.

There are 22 communal gardens or nurseries maintained by farmer groups within the Nathenje EPA. Many of these are women's groups. It is anticipated these 3rd level nurseries will become permanent multiplication and distribution sites. Mr. Musonje estimates that if there is normal rainfall more than 1,000 farmers will benefit from the new cassava materials at the RDP level. The policy is for farmers who establish the first nurseries to give away plant materials free, but thereafter charge for the materials. This will assist in getting away from the development of becoming dependent on free cassava planting materials year after year. Action Aid works closely with the FAs in the distribution process in the RDP.

The Project Officer mentioned that the RDP has not been a traditional cassava growing area, but with several years of severe drought farmers realize that maize is not a food security crop they can depend on. In addition, farmers cannot afford the cost of inputs such as hybrid maize seed and fertilizer. Farmers report that the labour inputs for maize and tobacco are significantly higher compared to cassava.

During the 1994-95 crop year the best estimates are that 1,280 farmers grew cassava. The approximate hectarage was probably 400 hectares. Average land holdings for smallholder farmers in the RDP are 0.4 hectares. The average cassava yields probably run about 3.0 metric tons per hectare. The Project Officer notes that a significant number of farmers who grew cassava during the 1994-95 crop period were those who received new cassava plantings. It is evident according to the PO that a grea

majority of the farmers in the RDP would adopt the new technology if materials were available.

There are certain indications that cassava is starting to make an impact in what was a nontraditional cassava growing area. Piles of cassava are now found along the road sides where none were seen last year. Middlemen come directly to the fields to buy and harvest the roots (MK2.00 per plant). One can now see loads of cassava being transported to Lilongwe on bicycles, trucks and buses. Cassava is becoming an important cash crop and competing very favorably with maize and wheat products in the market place. While important in its own right as a basis of food security crop, cassava is generating a positive cash flow that is being used to purchase food and household goods, fertilizer for maize, school fees, and medicines for family members. This is improving the quality of life for the Malawi farm family within the RDP.

Only a limited amount of training has been conducted for either FAs or farmers. However, a major basic training program for FAs and NGOs field workers will be held in November. The training will cover various aspects of cassava multiplication, distribution, and cultural practices. The training will be conducted by Mr. Mwale, Lilongwe ADD Crop Specialist, researchers, and experienced field workers. World Vision, Action Aid, Inter Aid and CPAR field workers will be included.

The training will also involve the Women's Program Section. This training will focus on the preparation and processing aspects of cassava. Since cassava is a relatively new food crop in the RDP efforts must be made to assure that women know how to properly prepare it. This will insure safety standards. The PO identified training regarding cassava multiplication, distribution, and cultural aspects as a major gap. He recommended that major training efforts beginning at the FA and NGO field worker level be initiated for the coming crop year. (In fact he is providing the leadership to mount a major training course in the RDP). He also suggested that training materials need to be developed, and that the curriculum be upgraded regarding cassava cultural practices at all educational levels.

The Lilongwe East RDP and the Nathenje RTC Nursery as secondary sites are illustrative of the changes taking place in a non-traditional cassava growing area. Almost all farmers in the RDP want to obtain new cassava planting material. Cassava hectarage is expanding at an impressive rate, and cassava is becoming an important cash crop as well as a basic food security crop.

The leadership in the RDP is taking an assertive role in promoting the multiplication and distribution of cassava, and working closely with the four NGOs operating within the RDP. The Project Officer and staff have identified major training gaps and are organizing essential training for FAs and NGO field workers in November. There are obviously positive indicators of building capacity at both the beneficiary and institutional levels within the RDP. With continued support from the GOM, NGOs, donors and

farmers, the continued benefit sustainability can be assured. An important indicator of sustainability is cost sharing. All of the listed organizations are contributing manpower, transportation, and other types of support to promote the new cassava varieties with farmers. The contributions of the farmers should not be overlooked. Their contribution is reflected in their labor in the establishment of nurseries, the use of their land for nurseries, and their time and cost of transport to seek out planting materials. The cost sharing as reflected from both institutions and the primary beneficiaries is positive evidence of the success of the program. IITA/SARRNET continues to play a major role in supporting the Nathenje RTC secondary multiplication and in working with the RDP in the formation and supervision of the farmers' groups.

CASE STUDY NO. 6

BUILDING BENEFICIARY AND INSTITUTIONAL CAPACITY AND SUSTAINABILITY

Christian Service Committee Agricultural/Development Worker

It is reported that NGO field workers play an important role in the multiplication and distribution of new cassava and sweetpotato materials. Mr. Bernard Kanjakao of the Christian Service Committee (CSC) stationed in Ekwendeni is one such field worker. Mr Kanjakao worked 20 years with the Ministry of Agriculture before his retirement. He has worked for the CSC during the past three years, headquartered at Ekwendeni. He operates in an area of approximately 20x30 km with a motorcycle for transportation.

Mr. Kanjakao supervised the establishment of a 0.2 ha nursery for sweetpotato at Zombwe. The financial support in the establishment and management in regard to labor came from IITA/SARRNET. The nursery is located in a dambo area. Sufficient materials have been distributed from the nursery to plant an estimated 20 hectares. This assumes two cuttings during the year with sufficient dambo water. In addition, he has assisted in the establishment and monitoring of several homestead nurseries which utilize waste dish water from the household. During the 1994-95 crop year new sweetpotato materials were distributed to an estimated 1,000 farmers. New materials introduced were from varieties Kenya and Lunyangwa. Yields from the new varieties were reported to be 50-100% higher than from traditional varieties. Most farmers are establishing nurseries in their fields. The agreement with each farmer is that he/she will share the new materials with three other farmers.

This becomes a problem if farmers want to expand their own area thus running into a shortage of planting materials. Mr. Kanjakao also distributed the new cassava variety Mbundumali to an estimated 300 farmers during the 1994-95 crop year. These

planting materials were utilized to establish small nurseries from which planting materials will be distributed to 3-5 farmers for the 1995-96 crop year. Each of the new farmers are encouraged to share their materials with additional farmers for the 1996-97 crop year. There is a great demand from farmers for the new planting materials but the major constraint is current lack of materials.

Mr. Kanjakao utilizes an interesting extension approach. He works directly with 15 Extension Multipliers (EMs). The EMs are progressive farmers in different areas who agree to establish nurseries for the new plant materials, attend bi-weekly training session on cassava, sweetpotato, and other agricultural subjects, and to share their new knowledge with 15 other farmers. Six of the EMs are women and nine are men. The EMs nurseries serve as demonstration plots. The EMs visit cooperating farmers on a regular basis teaching them all aspects of crop management. In addition, the EMs organize farmers through church groups to distribute and multiply new cassava and sweetpotato varieties. Part of their dedicated motivation to provide this voluntary work is due, in part to their association with the religious community.

The approach utilized by Mr. Kanjakao is a very effective method to build "capacity" among the EMs and other farmers and is a positive element in building towards sustainability. Mr. Kanjakao also serves as a facilitator in building capacity and sustainability at the institutional level. He has developed excellent relationships with the Mzuzu ADD. As a source of new planting materials, he works through the FAs in the multiplication and distribution of new planting materials. He assists the FAs in organizing Farmer Groups to establish communal nurseries and distribute materials, trains the FAs in cassava and sweetpotato cultural practices, and assists FAs in training farmers at the EPA day training centres.

Mr. Kanjakao also facilitates capacity building and sustainability with other NGOs and through the churches. He works through World Vision, Adventist Development Relief Agency, and local churches in the multiplication and distribution of new cassava and sweetpotato varieties quite amicably. In our opinion, he is well accepted by the community. Action Aid has assisted him in funding for multiplication and distribution and the training of farmers in crop management of the two root crops.

The CSC agricultural field worker notes that he learned most of his knowledge of cassava and sweetpotato from root crop researchers. He noted that a major training gap exists within the MOALD concerning recommended extension messages for low input crops and the requisite cultural practices. This is due to the heavy emphasis placed on maize production, distribution of fertilizer, and supervision of credit programs under the previous administration. GOM policy has now shifted to support the growing of food security crops such as cassava and sweet potato. However, the vast majority of FAs need basic upgrading training in all aspects of new cassava/sweetpotato multiplication,

distribution, and cultural practices. Such training should be mounted in time for the 1995-96 crop year.

He recommends that appropriate researchers, crop specialists, and field workers including NGOs develop the essential training programs. NGO field workers should be invited to attend. Training should be held at the field level to focus multiplication and distribution of new plant materials as well as cultural practices. Maintaining disease free material is a high priority. Most farmers, for example, do not recognize the importance of pest or plant disease problems. Learning how to rouge out diseased plants, for example, would greatly assist in maintaining clean plant stock.

A long term training strategy is to upgrade the curriculum at primary, secondary and training levels in terms of recommended cassava and sweetpotato cultural practices. As Mr. Kanjakao notes, " a crop that provides more than 30% of the total energy requirement of a nation should be emphasized in the agricultural curriculum of Malawi's educational institutions". Training materials also need to be developed. CSC publishes local language fact sheets on cassava and sweetpotato cultural practices and a training manual for cassava and sweetpotato multiplication and distribution will soon be published by MOALD/SARRNET.

Mr. Kanjakao is working on several appropriate technology projects. One effort includes the utilization of cassava peelings as organic matter for crops. Another innovative idea is the combination of cow manure, corn husks, and ash. This combination is placed in a sack and fermented for two-weeks. Ammonium is produced through this process and the resultant product is applied to the crops.

NGOs offer more flexibility to their field workers to respond to farmer needs; however, the high level of motivation and extensive experience of Mr. Kanjakao is greatly responsible for his success in building both institutional capacity and sustainability. He notes that "farmers engaged with new cassava and sweetpotato varieties are assuring food security for their families and that cash sales of excess production is being used to purchase items to improve their quality of life". Consumption of sweetpotato and cassava leaves is providing much needed iron, calcium, vitamin A and protein for Malawi families.

CASE STUDY NO 7

MS. MALIAS CHAVUKULA: LEADER NKHOMA-CHABUKA WOMEN'S GROUP

Ms. Chavukula is a single head of household farmer living near the Limphasa Rice Project outside of Nkhata Bay. She has six children and farms 3.0 hectares. The principal crops are rice, maize, sweetpotato, and cassava.

Ms. Chavukula is leader of the Nkhoma-Chabuka Village Women's Group. The membership consists of 25 women in the local area. The club has established a sweetpotato tertiary nursery so that members can obtain planting materials for their own gardens in December. The nursery was planted in July. The nursery is located near a large dambo which guarantees a constant supply of water. Once enough sweetpotato planting materials are available club members will plant their own gardens. Excess materials will be sold to other farmers.

The club received assistance from Mr. Osman Nkhoma, Research Field Assistant located at the Mkondezi Research Station. The club received sweetpotato planting materials from the GOM/IITA/SARRNET nursery located at Limphasa. The variety was Kenya. Several cassava nurseries were established with local varieties; however, severe infection of African cassava mosaic virus disease was a major problem. Using the expertise within the Team, she was advised to abandon all the plantlets and have a fresh start with clean materials form the Limphasa nursery. During a visit in October 1995, Mr. Nkhoma had advised club members to rogue out infected plants. He also made arrangements for club members to get new improved cassava planting materials at the primary multiplication site at Limphasa. Club members are very enthusiastic about the new planting materials.

The club also has contact with the local Extension Field Assistant. This FA has assisted the club establish a communal garden and maize trials; however his knowledge of sweetpotato and cassava cultural practices is very limited. The club has built a model home. Club members make clothes that are sold to generate additional income. Ms. Chavukula serves as a contact farmer for the extension FA and teaches other local farmers various agricultural skills.

This case study clearly demonstrates the enthusiasm of Ms. Chavukula and the members of her club. They are eager to participate in the multiplication of sweetpotato and cassava nurseries. Fortunately, they now have access to new improved varieties of cassava. A key link has been the assistance of Mr. Nkhoma. A key strategy in the multiplication and distribution of new planting materials is the utilization of organized farmer clubs. A club normally has access to land and water and provides the labor for the nursery. Each club member in turn can distribute materials to friends, relatives and neighbors and encourage them to establish their own nurseries.

An additional lesson is the importance of maintaining clean planting materials from primary to tertiary nurseries as the top priority strategy to ensure that farmers in the future receive and know how to maintain good stock. There is also an educational lesson here. Farmers need to be trained in simple techniques to control disease. An example is that of roguing. Farmers also need training in a wide range of sweetpotato and cultural practices. There is a tremendous need to increase the capacity of extension and NGO field workers in terms of knowledge, skills, and practices associated with cassava and

sweetpotato production. The highest and immediate priority is the training through in-country courses to upgrade production skills. Only then can the field workers assist the farmers with the appropriate and correct recommendations. Trainers should be those researchers, research technicians, knowledgeable extension and NGO technicians and master farmers.

ANNEX C

REPORTS AND DOCUMENTS REVIEWED BY THE STUDY TEAM

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19. _____ (undated). Impact assessment of cassava and sweetpotato program in the Central Region of Malawi.

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ANNEX D

PERSONS CONTACTED BY THE STUDY TEAM

Name	Designation	Station
1. Mr. C.K. Tony Mita	Principal Secretary (II) MOALD	Capital Hill
2. Dr. A.S. Kumwenda	Chief Agricultural Research Officer	Capital Hill
3. Prof. J.M. Teri	Coordinator for SARRNET	Development House, Lilongwe
4. Mr. S. Shumba	Agricultural Development Specialist	USAID, Lilongwe
5. Mr. Kurt Rockeman	Agricultural Development Officer	USAID, Lilongwe
6. Mr. F. Vergos	Agricultural Development Officer	European Union, Lilongwe
7. Dr. Natalie Hahn	Country Representative UNICEF	Lilongwe
8. Mr. Francis M'bukwa	Agricultural Officer World Bank	Lilongwe
9. Mr. M. Banda	Agricultural Officer Christian Service Committee Agricultural Program	Blantyre
10. Mr. Mwanda	Executive Officer	Nkhotakota RDP
11. Mr. F.S. Mbuluka	Development Officer	EPA 4 Ndolela Dowa West RDP
12. Mr. J.H. Phiri	Assistant Development Officer	EPA 4 Ndolela Dowa West RDP
13. Mr. K.L.B. Mkupu	Farm Manager	Nathenje RTC
14. Mr. G.H. Gamulani	Field Assistant	Mpingu EPA
15. Mr. C.C. Nkhoma	Field Assistant	Mpingu EPA
16. Mr. K.B. Kakunga	Development Officer	Mpingu EPA

17.	Mr. Mkandawire	Veterinary Assistant	Nkhunga EPA, Nkhotakota RDP
18.	Dr. A.B.M. Bannaga	Agricultural Extension Technical Adviser	FAO, Lilongwe
19.	Mr. Edward Chisalla	Program Officer	UNICEF, Lilongwe
20.	Mr. Edson Musopole	Agricultural Officer	Action Aid, Lilongwe
21.	Mr. S. Sumani	Bookkeeper	World Vision International Nkhotakota
22.	Mr. R.P. Samson	Agricultural Development Officer	Chinguluwe EPA
23.	Mr. D.S. Katungu	Development Officer	Chinguluwe EPA
24.	Mr. E.P. Ching'amba	Program Manager	Salima ADD
25.	Mr. Moyo	Development Officer	EPA 6 Mayani
26.	Mr. W.K.G. Kanthonga	Field Assistant	EPA 6 Mayani
27.	Mr. E. Chunga	Field Assistant	EPA 6 Mayani
28.	Mr. D. E. Garner	Missionary-in-Charge	Balaka Baptist Mission
29.	Mr. G.F. Bakali	Technical Assistant	Bvumbwe Research Station
30.	Mr. M.N. Msanjama	Deputy Chief Agricultural Research Officer	Bvumbwe Research Station
31.	Mr. E.S. Matabwa	Senior Technical Officer	Bvumbwe Research Station
32.	Mr. Lita	Assistant Project Officer	Mulanje RDP
33.	Mr. A.M. Khauke	Horticultural Assistant	Mulanje RDP
34.	Mr. Nyoni	Development Officer	Mulanje West

			EPA
35.	Mr. L.D. Chanza	Field Assistant	Thuchila West Section, Mulanje West EPA
36.	Mr. L.D. Kaliyati	Land Husbandry Supervisor	Chikwawa RDP
37.	Mr. R. Mulolo	Horticulturist	Chikwawa RDP
38.	Mrs. M. Namagowa	Women's Program Supervisor	Chikwawa RDP
39.	Mr. W.J. Msiska	Development Officer	Mbewe EPA, Chikwawa RDP
40.	Mr. Y. Mchenga	Field Assistant	Chafuzila Section, Mbewe EPA
41.	Mr. G.G.K. Phiri	Development Officer	Mombezi EPA
42.	Mr. D.D.V. Sakhutamoyo	Field Assistant	Njuli Section Mombezi EPA
43.	Mr. F.B. Nkhondoyachepa	Assistant Development Officer	Malosa EPA
44.	Mr. D.M. Chanza	Development Officer	Malosa EPA
45.	Mr. A.S. Sakwata	Field Assistant	Malenya 2 Section, Malosa EPA
46.	Mr. B.G.J. Kwangwani	Field Assistant	Makungwa Section, Thyolo North EPA
47.	Mr. Namanja	Assistant Dev. Officer	Thyolo North EPA.
48.	Mr. Max Church	Director, ADRA	ADRA, Blantyre
49.	Mr. P. Chimutu	Head of Agricultural Development and Relief Department	Christian Service Committee, Blantyre
50.	Mr. M. Luhanga	Head of Agricultural Development and Relief Department	Christian Council of Malawi

51. Mr. F. Ngulube	Acting Officer-in-Charge	Lunyangwa Research Station
52. Mr. J.C. Ngoma	Acting Officer-in Charge	Mkondezi Experiment Station
53. Mr. E.A.N. Gondwe	Technical Assistant	Mkondezi Experiment Station
54. Mr. O.D.K. Nkhoma	Technical Assistant	Mkondezi Experiment Station
55. Mr. H.K.T. Mvula	Technical Assistant	Mkondezi Experiment Station
56. Mrs. M.A. Mpaso	Scheme Manageress	Limphasa Settlement Scheme
57. Mr. Mpaso	Acting Officer-in Charge	Limphasa Settlement Scheme
58. Mr. Mkumbwa	Technical Officer	Limphasa Settlement Scheme
59. Mr. E.B.L. Julio	Development Officer	Mpamba EPA
60. Mr. S.O. Mwalungila	Assistant Development Officer	Mpamba EPA
61. Mr. E.N.S. Kanyika	Field Assistant	Mpamba Section Mpamba EPA
62. Mr. Mnyenyembe	Divisional Agricultural Officer	Mzuzu ADD
63. Mr. B.O. Nyirenda	Development Officer	Mbawa EPA
64. Mrs. F. Mwandira	Health Worker	Embangweni CCAP Hospital NRU
65. Mr. R.E. Chalira	Field Assistant	CSC, Embangweni

66.	Mr. F.F. Msiska	Agricultural Extension Officer	Mulowe, PHC under Livingstonia Mission, Muhuju EPA
67.	Mrs. S. Luhanga	Farm Home Assistant	Muhuju EPA
68.	Mr. B.T. Sakire	Field Assistant	Phwamphwa Section, Muhuju EPA
69.	Mr. F.S. Zgewo	Primary Health Coordinator	Mkhondowe, Livingstonia Hospital, Muhuju EPA
70.	Mr. J.M.G. Mkombezi	Development Officer	Zombwe EPA
71.	Mr. O.M. Phiri	Field Assistant	Zombwe EPA
72.	Mr. B.M. Kanjakao	Development Worker	C S C , Ekwendeni
73.	Mr. P.N. Nyasulu	Technical Assistant	Lunyangwa Research Station
74.	Mr. S. Nyirenda	Technical Assistant	Lunyangwa Research Station
75.	Mr. L.L. Mwakanema	Field Officer	Blantyre ADD
76.	Mr. S.K. Mkhutche	Technical Officer	Chitedze Research Station
77.	Mr. V.S. Sandifolo	Professional Officer	Chitedze Research Station
78.	Mr. D. Muwowo	Senior Technical Assistant	Chitedze Research Station
79.	Mr. J.E. Dzuunde	Senior Technical Assistant	Chitala Experiment Station
80.	Mrs. M.A. Mgomezulu	Senior Agricultural Extension Officer	Lilongwe ADD

81. Mr. J. Mkumbira	Commodity Team Leader, Root and Tuber	Lunyangwa Research Station
82. Mr. Watson Musonje	Project Officer	Lilongwe East RDP

ANNEX E

LIST OF REPORTS PRODUCED UNDER THE PROJECT

1. IITA/SARRNET, 1993-95
   Cassava and sweetpotato planting materials in Malawi. Quarterly Progress Reports No. 1-7.

2. V.W. Saka and I.J. Minde, 1994
   Evaluation Report: The accelerated multiplication and distribution of cassava and sweetpotato planting material as a drought recovery measure in Malawi, October, 1994, IITA/SARRNET, Lilongwe.

3. IITA/Government of Malawi 1993
   Proposal for accelerated multiplication and distribution of cassava and sweetpotato planting material as a drought recovery measure in Malawi. A proposal submitted to USAID/Malawi.

4. IITA/SARRNET 1995
   Completed and proposed activities in the extension period of the project on accelerated multiplication and distribution of cassava and sweetpotato planting material as a drought recovery measure in Malawi.

5. J.M. Teri, I.J. Minde and V.W. Saka 1995 (eds)
   "Cassava and Sweetpotato in Malawi". Proceedings of a national workshop held at Club Makokola, 3-4 April 1995. IITA/SARRNET, Lilongwe.

6. Sheku Sam 1994
   Status of root crops based collaborative trials for 1993/94 season. Paper presented at the Annual Horticultural Croup Meetings, Bvumbwe Agricultural Research Station, 15-20 August 1994.

7. Sheku Sam 1994
   Sweetpotato production in the Central Region of Malawi. Paper presented at the Annual Horticultural Group Research Meetings, Bvumbwe Agricultural Research Station 15-20 August 1994.

8. Sheku Sam (undated)
   A summary of cassava production, processing and marketing activities along the lakeshore areas of Malawi.

9. Sheku Sam (undated)
   Impact assessment of cassava and sweetpotato program in the Central Region of Malawi.

ANNEX F: DATA USED IN THE DETERMINATION OF COMPETITIVENESS OF CASSAVA AND SWEETPOTATO IN THE CROPPING SYSTEMS.

i- **Estimates of Unit Prices of Cassava from the Survey Data**

1993				1994				1995			
Number	Sales (KGS)	Revenue (Kwacha)	Price (T/Kg)	Number	Sales (Kgs)	Revenue (Kwacha)	Price (T/Kg)	Number	Sales (Kgs)	Revenue (Kwacha)	Price (T/Kg)
2	90	29	31	5	225	50	22	5	270	120	44
15	45	64	142	9	900	500	56	7	90	35	39
20	270	260	96	12	450	400	89	9	1350	600	44
30	225	400	178	15	90	86	96	12	270	210	78
33	1080	420	39	29	23	20	87	35	1440	1470	102
34	450	225	50	33	810	450	56	39	540	144	27
37	900	400	44	34	270	112	41	40	1620	1200	74
43	405	375	93	35	360	150	42	43	450	500	111
51	540	300	56	40	720	600	83	51	360	400	111
Mean price =			81	42	270	300	111	54	180	170	94
Avg. price = 50t/kg			102	43	90	250	278	Mean price =			73
Avg. price = 100t/KG			160	44	1350	1050	78	Avg Price = 50t/kg			95
				51	270	200	74	Avg price = 100t/kg			108
				Mean price =			86				
				Avg. price = 50t/kg			101				
				Avg. price = 100t/kg			194				

ii. **Estimates of Unit Prices of Sweetpotato from the Survey Data**

1993				1994				1995			
Number	Sales	Revenue	Price	Number	Sales	Revenue	Price	Number	Sales	Revenue	Price
1	540	150	28	3	720	230	32	1	1800	600	33
2	270	63	23	8	180	90	50	7	180	53	29
3	450	190	42	12	270	180	67	12	180	120	72
13	180	86	48	19	200	350	175	29	180	120	67
19	100	200	200	20	225	240	107	30	180	300	167
29	900	100	11	29	540	250	45	31	90	120	133
30	270	365	135	30	360	675	188	32	68	180	265
31	180	100	56	31	135	90	67	38	540	570	106
34	500	300	60	37	900	600	67	40	1620	1400	86
37	630	500	79	38	540	570	106	41	540	190	33
43	90	100	111	40	900	770	86	42	90	80	89
51	180	100	56	41	630	210	33	43	90	200	222
Mean price =			71	42	270	240	89	44	900	1500	167
Avg price = 50t/kg			100	43	45	96	211	46	45	40	89
Avg price = 100t/kg			149	44	900	400	44	51	270	300	111
				51	180	200	111	54	135	60	44
				54	30	24	80	55	270	100	37
				58	270	160	56	56	180	105	58
				60	630	210	33	57	68	83	122
				Mean price =			87	58	180	100	56
				Avg price = 50t/kg			104	59	45	60	133
				Avg price = 100t/kg			149	60	1350	750	56
								Mean price =			99
								Avg price = 50t/kg			118
								Avg price = 100t/kg			154

iii **Estimates of Cassava Yields from Some of the Survey Farmers**

Number	Area (Acres)	Prod(Kgs)	Yield (Kg/ha
7	0.50	100	500
8	3.00	3150	2625
12	2.00	1440	1800
15	1.00	180	450
20	0.75	540	1800
29	0.50	180	900
33	4.00	1640	1025
34	1.00	270	675
35	2.00	1530	1913
38	0.25	720	7200
42	0.25	720	7200
43	1.00	2250	5625
Mean yield =			2643
Avg yield ≥	1000		3648
Avg yield ≤	2000		5663

iv Estimates of Sweetpotato Yields from Some of the Survey Farmers

Number	Area (Acres)	Prod (Kgs)	Yield (Kg/ha)
7	0.50	500	2500
8	0.50	160	900
12	0.50	180	900
13	0.25	180	900
15	0.50	135	675
17	0.50	630	3150
20	0.50	630	3150
22	0.25	23	230
25	0.25	45	450
27	0.50	23	115
29	0.50	450	2250
33	0.25	15	150
35	0.25	69	690
38	1.00	1080	2700
42	0.75	1080	3600
43	0.25	135	1350
Mean yield =			1882
Avg yield >	1000		2671
Avg yield >	2000		2892

v Gross Margins under High Management Levels Using 1992/93 Input and Output Prices and Wage Rates

	CASSA 1	CASSA 2	CASSA 3	SWEETP 1	SWEETP 2	SWEETP 3	MAIZE	COTTON	RICE
YIELD	5663	5663	5663	2892	2892	2892	2911	1918	4110
PR/UNIT	0.81	1.02	1.60	0.71	1.00	1.49	0.43	0.90	0.47
TOT REV	4587	5776	9061	2053	2892	4309	1252	1708	1932
VAR COST	0	0	0	0	0	0	387	999	401
GRO MAR	4587	5776	9061	2053	2892	4309	865	709	1531
MD/HA	81	81	81	89	89	89	101	227	271
RET/MD	57	71	112	23	32	48	9	3	6
COST/MD	4.94	4.94	4.94	4.94	4.94	4.94	4.94	4.94	4.94
TOT OPP COST	400	400	400	440	440	440	499	1121	1339
NET PROFIT	4187	5376	8661	1614	2452	3869	366	-412	192

NOTE: THE PRICE OF COTTON WAS K0.9 PER KG FOR GRADE A AND K0.45 FOR GRADE B

vi Gross Margins under Medium Management Levels Using 1992/93 Input and Output Prices and Wage Rates

	CASSA 1	CASSA 2	CASSA 3	SWEETP 1	SWEETP 2	SWEETP 3	MAIZE	COTTON	RICE
YIELD	3848	3848	3848	2671	2671	2671	2380	1501	3620
PR/UNIT	0.81	1.02	1.60	0.71	1.00	1.49	0.43	0.90	0.47
TOT REV	3117	3925	6157	1896	2671	3990	1023	1326	1701
VAR COST	0	0	0	0	0	0	229	399	301
GRO MAR	3117	3925	6157	1896	2671	3990	794	927	1400
MD/HA	81	81	81	89	89	89	101	217	271
RET/MD	38	48	76	21	30	45	8	4	5
COST/MD	4.94	4.94	4.94	4.94	4.94	4.94	4.94	4.94	4.94
TOT OPP COST	400	400	400	440	440	440	499	1072	1339
NET PROFIT	2717	3525	5757	1457	2231	3540	295	-145	62

NOTE: THE PRICE OF COTTON WAS K0.9 PER KG FOR GRADE A AND K0.45 FOR GRADE B

vii Gross Margins Under Low Management Levels Using 1992/93 Input and Output Prices and Wage Rates.

	CASSA 1	CASSA 2	CASSA 3	SWEETP 1	SWEETP 2	SWEETP 3	MAIZE	COTTON	RICE
YIELD	2643	2643	2643	1482	1482	1482	1561	194	2670
PR/UNIT	0.81	1.02	1.60	0.71	1.00	1.49	0.43	0.90	0.47
TOT REV	2141	2696	4229	1052	1482	2208	671	156	1255
VAR COST	0	0	0	0	0	0	82	0	62
GRO MAR	2141	2696	4229	1052	1482	2208	589	156	1193
MD/HA	65	65	65	73	73	73	94	211	264
RET/MD	33	41	65	14	20	30	6	1	5
COST/MD	4.94	4.94	4.94	4.94	4.94	4.94	4.94	4.94	4.94
TOT OPP COST	321	321	321	361	361	361	464	1042	1304
NET PROFIT	1820	2375	3908	692	1121	1848	125	-886	-111

NOTE: THE PRICE OF COTTON WAS K0.9 PER KG FOR GRADE A AND K0.45 FOR GRADE B

viii Gross Margins Under High Management Levels Using 1993/94 Input and Output Prices and Wage Rates

	CASSA 1	CASSA 2	CASSA 3	SWEETP 1	SWEETP 2	SWEETP 3	MAIZE	COTTON	RICE	TOBACCO
YIELD	5663	5663	5663	2892	2892	2892	2911	1918	4110	1000
PR/UNIT	0.86	1.01	1.94	0.87	1.04	1.49	0.47	1.00	0.90	VARIABLE
TOT/REV	4870	5720	10986	2516	3008	4309	1368	1908	3699	17100
VAR COST	0	0	0	0	0	0	424	999	493	8585
GRO MAR	4870	5720	10986	2516	3008	4309	944	909	3206	8515
MD/HA	81	81	81	89	89	89	101	227	271	267
RET/MD	60	71	136	28	34	48	9	4	12	32
COST/MD	6.42	6.42	6.42	6.42	6.42	6.42	6.42	6.42	6.42	10.43
TOT OPP COST	520	520	520	571	571	571	648	1457	1740	2785
NET PROFIT	4350	5200	10466	1945	2436	3738	296	-548	1466	5730

NOTE: THE PRICE OF COTTON WAS K1 PER KG FOR GRADE A AND KO.75 FOR GRADE B
: DUE TO INAVAILABILITY OF INPUT PRICE DATA FOR COTTON VARIABLE COSTS WERE MAINTAINED AT THE 1992/93 LEVEL.

ix Gross Margins Under Medium Management Levels Using 1993/94 Input and Output Prices and Wage Rates

	CASSA 1	CASSA 2	CASSA 3	SWEETP 1	SWEETP 2	SWEETP 3	MAIZE	COTTON	RICE
YIELD	3848	3848	3848	2671	2671	2671	2380	1501	3620
PR/UNIT	0.86	1.01	1.94	0.87	1.04	1.49	0.47	1.00	0.90
TOT REV	3309	3886	7465	2324	2778	3990	862	1088	2875
VAR COST	0	0	0	0	0	0	257	399	383
GRO MAR	3309	3886	7465	2324	2778	3990	862	1088	2875
MD/HA	81	81	81	89	89	89	101	217	271
RET/MD	41	48	92	26	31	45	9	5	11
COST/MD	6.42	6.42	6.42	6.42	6.42	6.42	6.42	6.42	6.42
TOT OPP COST	520	520	520	571	571	571	648	1393	1740
NET PROFIT	2789	3366	6945	1752	2206	3408	213	-305	1135

NOTE: THE PRICE OF COTTON WAS MK1 PER KG FOR GRADE A AND MK0.75 FOR GRADE B
: DUE TO INAVAILABILITY OF INPUT PRICE DATA FOR COTTON VARIABLE COSTS WERE MAINTAINED AT THE 1992/93 LEVEL.

x Gross Margins Under Low Management Levels Using 1993/94 Input and Output Prices and Wage Rates

	CASSA 1	CASSA 2	CASSA 3	SWEETP 1	SWEETP 2	SWEETP 3	MAIZE	COTTON	RICE
YIELD	2643	2643	2643	1482	1482	1482	1561	194	2670
PR/UNIT	0.86	1.01	1.94	0.87	1.04	1.49	0.47	1.00	0.90
TOT/REV	2273	2669	5127	1289	1541	2208	734	184	2403
VAR COST	0	0	0	0	0	0	100	0	111
GRO MAR	2273	2669	5127	1289	1541	2208	634	184	2292
MD/HA	65	65	65	73	73	73	94	211	264
RET/MD	35	41	79	18	21	30	7	1	9
COST/MD	6.42	6.42	6.42	6.42	6.42	6.42	6.42	6.42	6.42
TOT OPP COST	417	417	417	469	469	469	603	1355	1695
NET PROFIT	1856	2252	4710	821	1073	1740	30	-1171	597

NOTE: THE PRICE OF COTTON WAS MK1 PER KG FOR GRADE A AND MK0.75 FOR GRADE B

xi Gross Margins Under High Management Levels Using 1994/95 Input and Output Prices and Wage Rates

	CASSA 1	CASSA 2	CASSA 3	SWEETP 1	SWEETP 2	SWEETP 3	MAIZE	COTTON	RICE
YIELD	5663	5663	5663	2892	2892	2892	2911	1918	4110
PR/UNIT	0.73	0.95	1.08	0.99	1.18	1.58	0.72	2.50	1.80
TOT/REV	4134	5380	6116	2863	3413	4569	2096	4775	7398
VAR COST	0	0	0	0	0	0	584	999	744
GRO MAR	4134	5380	6116	2863	3413	4569	1512	3776	6654
MD/HA	81	81	81	89	89	89	101	227	271
RET/MD	51	66	76	32	38	51	15	17	25
COST/MD	10.43	10.43	10.43	10.43	10.43	10.43	10.43	10.43	10.43
TOT OPP COST	845	845	845	928	928	928	1053	2368	2827
NET PROFIT	3289	4535	5271	1935	2484	3641	458	1408	3827

NOTE: THE PRICE OF COTTON WAS MK2.50 PER KG FOR GRADE A AND MK2.00 FOR GRADE B
: DUE TO INAVAILABILITY OF INPUT PRICE DATA FOR COTTON VARIABLE COSTS WERE MAIANTAINED AT THE 1992/93 LEVEL.

xii Gross Margins Under Medium Management Levels Using 1994/95 Input and Output Prices and Wage Rates

	CASSA 1	CASSA 2	CASSA 3	SWEETP 1	SWEETP 2	SWEETP 3	MAIZE	COTTON	RICE
YIELD	3848	3848	3848	2671	2671	2671	2380	1501	3620
PR/UNIT	0.73	0.95	1.08	0.99	1.18	1.58	0.72	2.50	1.80
TOT REV	2809	3656	4156	2644	3152	4220	1714	3725	6516
VAR COST	0	0	0	0	0	0	360	399	546
GRO MAR	2809	3656	4156	2644	3152	4220	1354	3326	5970
MD/HA	81	81	81	89	89	89	101	217	271
RET/MD	35	45	51	30	35	47	13	15	22
COST/MD	10.43	10.43	10.43	10.43	10.43	10.43	10.43	10.43	10.43
TOT OPP COST	845	845	845	928	928	928	1053	2363	2827
NET PROFIT	1964	2911	3311	1716	2224	3292	300	1063	3143

NOTE: THE PRICE OF COTTON WAS MK2.50 PER KG FOR GRADE A AND MK2.00 FOR GRADE B
: DUE TO INAVAILABILITY OF INPUT PRICE DATA FOR COTTON VARIABLE COSTS WERE MAIANTAINED AT THE 1992/93 LEVEL.

xiii Gross Margins Under Low Management Levels Using 1994/95 Input and Output Prices and Wage Rates

	CASSA 1	CASSA 2	CASSA 3	SWEETP 1	SWEETP 2	SWEETP 3	MAIZE	COTTON	RICE
YIELD	2643	2643	2643	1482	1482	1482	1561	194	2670
PR/UNIT	0.73	0.95	1.08	0.99	1.18	1.58	0.72	2.50	1.80
TOT/REV	1929	2511	2854	1467	1749	2342	1124	465	4806
VAR COST	0	0	0	0	0	0	136	0	129
GRO MAR	1929	2511	2854	1467	1749	2342	989	465	4677
MD/HA	65	65	65	73	73	73	94	211	264
RET/MD	30	39	44	20	24	32	11	2	18
COST/MD	10.43	10.43	10.43	10.43	10.43	10.43	10.43	10.43	10.43
TOT OPP COST	678	678	678	761	761	761	980	2201	2754
NET PROFIT	1251	1833	2176	706	987	1580	8	-1736	1923

NOTE: THE PRICE OF COTTON WAS MK2.50 PER KG FOR GRADE A AND MK2.00 FOR GRADE B

Annex G.

RANKING OF CASSAVA AND SWEETPOTATO VARIETIES BY FARMERS: NEW VERSUS TRADITIONAL VARIETIES

Mbundumali (cassava)

	Attributes									
	Production		Taste		Storage		Susceptibility to disease		Establishment	
	No.	%	No.	%	No.	%	No.	%	No.	%
Better	5	83	5	83	3	60	2	33	5	83
Same	0	0	0	0	0	0	0	0	0	0
Worse	1	17	1	17	2	40	67	67	1	17

n ranged from 5-6 villages

Kenya (Sweetpotato)

	Attributes															
	A		B		C		D		E		F		G		H	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Better	12	92	13	100	10	100	1	9	3	21	13	100	0	0	9	90
Same	0	0	0	0	0	0	0	0	1	7	0	0	5	36	0	0
Worse	1	8	0	0	0	0	10	91	10	72	0	0	9	64	1	10

n ranged from 10-14 villages

A = Production
B = Taste of tubers
C = Taste of leaves
D = Storage
E = Susceptibility
F = Establishment
G = Sprouting
H = Time to maturity

ANNEX H

DESCRIPTION OF CASSAVA AND SWEETPOTATO VARIETIES MULTIPLIED AND DISTRIBUTED BY THE PROJECT IN MALAWI

VARIETIES	CHARACTERISTICS
Cassava	
Mbundumali	- Released local variety of the sweet type - Grown throughout the country - Low cyanide content in roots (less than 3mg/100g fresh weight) - Early to medium maturing variety 9-15 months after planting - High yielding 15-20 tons per ha with high dry matter 33-35% - Less susceptible to Cassava Green Mite but very susceptible to African Cassava Mosaic Disease and mealybug
Gomani	- Selected local variety of the bitter type early to medium maturing - Popular variety along the lakeshores of Lake Malawi - High cyanide content in root (over 10mg/100g fresh weight) - Early to medium maturing variety 9-15 months after planting but can maintain root quality if left unharvested up to 24 months - High yielding variety 15-25 tons per hectare - Very susceptible to Green Spider Mite, ACMD, mealybug.
Chitembwere	- Low in cyanide (3-5 mg/100g fresh weight) - Late maturing 15-18 months after planting - Usually sets roots deeper in soil - Yields 20 tons per hectare - It stands better against CGM and ACMD but susceptible to CMB.
Sweetpotato	
LRS 407	- This is "Lunyangwa Research Station 407". It was bred at Lunyangwa Research Station in Malawi. It is low in starch and fairly rich in carotene. It yields 15-20 tons per ha and has a good taste.

Babache	-	This is a selected local variety. It is high in starch, yields 15-25 tons per ha and matures in 4-6 months. It has good sprouting ability.
TIS 3017 and TIS 2534	-	These are improved ex-IITA clones. They are high yielding and early maturing.
Kenya	-	This is the most popular variety in Malawi. It was originally developed at Amani, Tanzania, as Sweetpotato Variety Number Zero (SPN/O) from where it spread to neighboring countries. It was introduced into Malawi through Kenya. It has a white skin, yellow flesh, fairly resistant to sweetpotato virus complex diseases and it is high yielding 20-30 tons per hectare.

<u>Pre-released varieties</u>

TIS 2534	-	Red skin, white flesh, resistant to sweetpotato virus complex diseases, early maturing and yields 20-35 tons per hectare.
TIS 3017	-	Red skin white flesh, good storage ability, high yielding 25-30 tons per ha, resistant to alternaria and sweetpotato virus.
Nyasungwi (cassava)	-	Low cyanide content in roots 3-5mg/100g fresh weight
	-	Medium maturing 12-15 months after planting
	-	Yields between 12 and 20 tons per hectare
	-	Stands better against Bacterial Blight, CGM, and ACMD.