PD ABH-262

TERMINAL REPORT

on

The East and Southern Africa Root Crops Research Network
(ESARRN)

Submitted to

The United States Agency for International Development (USAID)

and

The International Development Research Center (IDRC)

by

The International Institute of Tropical Agriculture (IITA)
Ibadan, Oyo State, Nigeria

September 14, 1993

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September 13, 1993

Dr. Rob Bertram
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Dear Dr. Bertram:

Ref: Final Report for Grant Nº LAG-4111-G-00-2027-00:
Phase II of the East and Southern Africa Root Crops
Research Network (ESARRN)

In compliance with Section 1E.2.h. of the grant under reference, please find attached 5 copies of the final report with regard to ESARRN Phase II.

I hope you will find the report satisfactory and should you have questions, do not hesitate to write to me in this regard.

Yours sincerely,

J.P. Eckebil
Deputy Director General
International Cooperation Division

cc: USAID
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ANNUAL REPORT

SEPTEMBER 1992 - SEPTEMBER 1993

Introduction

The East and Southern Africa Root Crops Research Network started informally in 1984, when 15 countries in the region unanimously agreed that their common problems with root crops warranted a regional approach to supplement their national program activities. Its formal birth started in 1987 with funding from IDRC and USAID. The network completed its first phase in 1992.

This year, 1993 is the first year of the second phase of the network and has been marked by several important changes:

1. The financial management of the network changed from REDSO, Nairobi to Washington D.C.

2. Realization of the evolution of ESARRN to two focal points - East Africa Root Crops Network and Southern Africa Root Crops Network.

3. ESARRN successfully solicited support for the establishment of a root crops multiplication and distribution system for cassava and sweet potato in Malawi.

4. Handing over of the initial network coordinator to new coordinators.

In East and Southern Africa, the recent drought, the economic realities and increased consciousness about sustainability have been major factors which have forced increased attention on root and tuber crops. The network has played a useful role in attracting resources for research, multiplication and distribution of these relatively neglected crops.

Overall Project Objectives

The activities of the network for this period as set and approved by the steering committee were:

a) Introduce improved root crops populations with high frequency of desirable genes adapted to the mid-altitude ecologies and other major cassava areas of East and Southern Africa.

b) Establish effective national plant health activities within existing plant protection units of root crops programs and encourage an integrated approach to managing pest and disease problems.

c) Conduct surveys on cassava-based cropping systems in 5 member countries in order to establish adoption rate and impact of released varieties.

d) Develop post-harvest technology in order to increase labour use efficiency, minimize food losses and improve the quality of food products. This will be done through (1) identification, development and adaptation of post-harvest technologies at the household and village levels
(2) establishment of food processing and demonstration centres and
(3) conduct of training programs for users and extension workers.

e) Establish multiplication, distribution and monitoring systems in all collaborating countries in order to hasten the distribution and adoption of improved technology by farmers.

Specific Training Objectives

In an effort to strengthen national programs and ensure sustainability, a limited level of training activity was undertaken. These included:

(a) Non-degree, in service training for root crops researchers in integrated pest management, data collection and analysis designed to increase capabilities in field plot design techniques, propagation and other appropriate study areas. Such courses were organized in collaboration with IITA and/or national programs.

(b) Visit of scientists from the region to IITA or to other national programs and research organizations to improve communication and foster exchange of information and research experiences.

(c) Regional workshops.

(d) Group field visits, monitoring and evaluation.

(e) Farmers' field days and training.

The strength of the network has been its diversity in terms of programs, disciplines and geographic distribution of activities in the region. During the first year of this second phase the network continued to enhance this strength.

Collaborative Planning

During this period a steering committee and a directors' committee meeting was held. This first ESARRN-sponsored joint meeting was held in Kampala and implemented the recommendations earlier suggested by the network coordinators and donors in Nairobi, Kenya. In compliance with their recommendation, the network capitalized on the strengths of the directors in dealing with areas of policy and research direction of the network.

This meeting was an opportunity for the network collaborators to update the research directors and donors on the progress of the network and to solicit their comments and contributions to the new evolution. The decision to have two focal points for the network, represents a positive view of the network for the future. These two focal points will help to maintain focus and facilitate the building on what ESARRN has accomplished in the past.

The meeting ratified the formation of two coordination offices, the workplan and budget for the next year, 1994, of the network activity. The submission that a regional staff be located within the Burundi national program was also approved. The minutes of the meeting are shown in Appendix 1. The list of other meetings and discussions attended is shown in Table 1.

Strategies

The participating national programs share the various objectives based on their respective strengths and in accordance with the program's objectives. The coordinators of the national root crops programs participated fully in developing their strategy and the product of this process is a specific set of objectives, which are still being addressed by the participating programs.

The activities varied according to specific country circumstance, but all project activities proceeded through a two-stage process. The projects were discussed and agreed upon by the national heads of programs, and then approved by the Directors' Committee. The main project areas addressed by directors are shown in Appendix II.

Table 1: Network meetings and monitoring tours attended

Location	Participants/Observing Organizations	Highlight of Meeting
Kampala	INIA; R & D/AGR/IARC USAID/Burundi; REDSO TRIP, ICP, NARS directors research	Review of Phase II Proposal, monitor progress of network
Bujumbura	USAID/Burundi; REDSO, R & D/AGR/IARC	Discussed progress of EARRNET proposal preparation. Monitoring progress of network
Nairobi briefing	DG, IITA; USAID/REDSO,	Courtesy call and about network progress and Uganda regional center idea
Maputo	DG, IITA; ESARRN, EEC, INIA	Discussed IITA's regional grain legume project plan
Lilongwe	DG, IITA; USAID, FAO, Ministry of Agriculture, ICRISAT	Courtesy call by Director General and discussed overall progress of network
Harare	USAID/Harare, DG, IITA ESARRN	Courtesy call and discussed funding possibility of SARRNET

Personnel

Professional staff

The coordination unit was joined by Dr J Ikeorgu in April. He came as the project agronomist to replace to Dr J Otoo.

Support Staff

The project also recruited an administrative assistant in April and a documentation specialist in May. This completed the proposed network staffing. The documentation specialist has joined the project as a United National Volunteer (UNV). One technician left the project to do a Master of Science Degree but was replaced. The project now has two research assistants. Details of staffing and period of service is shown in Table 2.

Table 2:

ESARRN's professional and support staff during 1992-93

STAFF	O	N	D	J	F	M	A	M	J	J	A	S
Coordinator	-	-	-	-	-	-	-	-	-	-	-	-
Agronomist							-	-	-	-	-	-
Documentalist								-	-	-	-	-
Administrative/ Assistant												
A							-	-	-	-	-	-
B			-	-	-	-	-					
Secretary			-	-	-	-	-	-	-	-	-	-
Accounts Assistant	-	-	-	-	-	-	-	-	-	-	-	-
Research Assistants												
A			-	-	-	-	-	-	-	-	-	-
B									-	-	-	-
Drivers												
A	-	-	-	-	-	-	-	-	-	-	-	-
B				-	-	-	-	-	-	-	-	-

Collaborators

There is continued growing support in the national programs for the execution of collaborative activities on root and tuber crops. Many NGO's and national institutions have enhanced the ability of the network to meet the growing demands for root crops technology. The list of institutions and NGOs collaborating with ESARRN is shown in Table 3.

Table 3:

Institutions and Non-Governmental Organizations collaborating with ESARRN

Organization	Area of Activity	Country
- Potato Research Centre (CIP)	Multiplication of of sweet potato	Malawi
- Sweedish International development Agency (SIDA)	Root Crops Population improvement	Zambia
- Kenya Agricultural Research Institute (KARI)	Training and Integrated Pest Management	Kenya
- Institute des Science Agronomique due Burundi (ISABU)	Training and Multiplication and distribution	Burundi
- Institut des Science Agronomique due Rwanda (ISAR)	Population Improvement	Rwanda
- Instituto Nacional de Investigaco Agronomica Mozambique (INIA)	Multiplication and distribution of planting material	Mozambique
- Tanzania Food and Nutrition Centre (TFNC)	Food processing	Tanzania
- Christian Service Community (CSC)	Multiplication and distribution of sweet potato and cassava planting material	Malawi
- Adventist Development and Relief	Multiplication and distribution	Malawi

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Agency (ADRA)	of planting material	
- Baptist Mission	Multiplication and distribution of planting material	Malawi
- Food and Agricultural Organization (FAO)	Multiplication and distribution of planting material	Malawi
- United Nations Children Fund (UNICEF)	Multiplication and distribution of planting material	Malawi
- Southern African Coordination Center for Africultural Research (SACCAR)	Management evaluation and monitoring	Botswana

Outputs

Germplasm Development and Distribution

Germplasm development activities continue to focus on evaluation, recombination, conservation and distribution, with the aim of broadening the germplasm base with a high frequency of desirable genes adapted to the major agro-ecologies. There has been an improvement in the number of crossing blocks (see Table 4) which will result in an increase in the number of new genetic combinations in the region. This is a significant advance in the area of population improvement for the region. Crossing blocks have been established in Malawi, Rwanda, Burundi and Uganda in order to recombine selected parents with desirable characteristics. The target agro-ecologies for recombination are also shown in Table 4. A broad based germplasm constitutes the backbone of population improvement and provides a wide diversity from which collaborating NARS can select for their specific needs. The traits for recombination are shown in Table 5.

Germplasm collection in Zambia has reached 700 lines, 500 being local collection and 200 introduced from IITA. The best selection from the local lines are presently used in the crossing block for recombination and to increase the frequency of desirable genes. For the 1991 and 1992 seasons, 26,000 seeds were produced but during the drought year seed production was low. This seed production was supplemented by 30,000 seeds introduced from IITA.

Evaluation of lines from IITA has resulted in the identification of sources of resistance to cassava mealybug. These lines will be evaluated further and then introduced into the hybridization program. From this evaluation cycle, 5 clones have now reached the stage of multiplication for distribution to farmers and further on-farm testing. The clones are LUC 55, 79, 133, 304 and 327, with a yield range of 24-41 tons/ha.

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Table 4: Major agro-ecologies where crossing blocks have been established

AGRO-ECOLOGY	CHARACTERISTICS		COUNTRY	LOCATION	SOURCE MATERIAL FOR RECOMBINATION
	Altitude (MASL)	AV. Rainfall mm			
Mid-altitude warm/cool	1120	1200	Zambia	Luapula	IITA/Local
Mid-altitude warm/cool	1050	890	Malawi	Chitedze	IITA/Rwanda/Local
Highland cool	1660	1171	Rwanda	Rubona	IITA/CIAT/Local
Highland dry	1350	850	Rwanda	Karama	IITA/CIAT/Local
Lowland dry	510	900	Malawi	Chitala	IITA/Local
Highland cool	1500	1200	Malawi	Bvumbwe	IITA/Local
Lowland wet	600	1400	Malawi	Mkondezi	IITA/Local
Mid-altitude wet	1128	1160	Uganda	Namulonge	IITA/Rwanda/Local
Mid-altitude	1320	1200	Burundi	Moso	CIAT/Local

Table 5.

Desired cassava traits for recombination in different agro-ecologies of the network

Trait	Target Agro-ecology	Country	Specific site for breeding activity
Disease resistance -African Cassava Mosaic virus, Cassava bacterial blight (CBB)	Humid and sub-humid tropical mid-altitude	Uganda Rwanda	Lake Crese-sent Karama
-Brown streak	semi arid, mid-low altitude	Malawi Mkondezi	Chitedze,
High yield	all regions	Zambia	Luapula
Pest resistance -Cassava green mite	Moist savannah	Uganda	SW region
-Cassava mealybug	Semi-arid areas	Malawi	Chitala
		Zambia	Luapula
Low cyanide	all regions	Zambia	Luapula

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It is expected that seed production from these crossing blocks will considerably increase the recombination of desirable genes for adoptability in the region. Besides the populations generated in the region, a considerable quantity of seed populations continue to be introduced from IITA, as a supplement. For this season the older crossing block at Chitedze produced a total of 30,000 seeds representing 15 families (Table 6).

Table 6: Seed populations produced at the Chitedze Station 1992 - 93

VARIETY	SOURCE	NO. OF SEEDS PRODUCED
Mpira	Local	12,000
TMS 91934	IITA	80
TMS 4(2)1425	IITA	186
Phwakatu	Local	60
Kamchizambo	Local	82
TMS 30158 (OP)	Selection from IITA source	161
Korobeka	Local	345
TMS 30395	IITA	8,728
TMS 30158 (OP)	IITA	487
TMS 90059	IITA	516
Gomani	Local	1,256
Chitembwere	Local	514
Nausi	Local	1,410
Kamphunobi	Local	2,201
Bukuni	Local	1,556

Seeds from such recombinations are now available from Rwanda, Zambia and Malawi. These populations are further supplemented by populations from IITA and CIAT through IITA. Evaluations of such populations are currently underway in Burundi, Uganda and Malawi. Besides improved populations, tissue culture material have also been introduced and are currently being evaluated. The list of IITA tissue culture introduced material being evaluated are shown in Table 7. The oldest set of lines now 5 years have reached on-farm test stage. The most popular line TMS 60142 is now being multiplied for on-farm testing. The other lines are at the preliminary yield trial stage and the ones recently received (Table 7) are still at the post-flask nursing stage. Except for TMS 60506, the IITA source lines are giving slightly higher yields than the local checks.

Table 7: Stages of IITA introduced germplasm to Malawi

	LINE	YIELD t/ha*	STAGE OF EVALUATION
1.	4(2) 1425	22.3	Multilocational trials
2.	60506	13.0	"
3.	91934	27.6	"
4.	60142	21.0	"
5.	30572	18.5	"
6.	63397	18.9	"
7.	Mbundumali	18.1	"
8.	Nyasungwi	15.0	"
9.	Gomani	16.5	"
1.	TMS 30555	-	Preliminary yield trials
2.	TMS 40764	-	"
3.	TMS 83672	-	"
4.	TMS 81983	-	"
5.	LCN 8010	-	"
6.	TME 2	-	"
7.	TMS 1095-DC	-	"
8.	LCN 30474	-	"
9.	TMS 85/00066	-	"
10.	TMS 61036	-	"
11.	TMS 84751	-	"
12.	TMS 84/00524	-	"
13.	TMS 820422	-	"
14.	TMS 84776	-	"
1.	88/02346	-	Post-flask nursing stage
2.	84/00524	-	"
3.	84751	-	"
4.	60121	-	"
5.	LCNA 41369	-	"
6.	LCN 30474	-	"
7.	820447	-	"
8.	84/0001	-	"
9.	84563	-	"
10.	CB 81/00202	-	"

11.	84/00029	-	Post-flask nursing stage
12.	85/00066	-	"
13.	87/00609	-	"
14.	84/00045	-	"
15.	61677	-	"
16.	87/0050	-	"
17.	61036	-	"
18.	87/004327	-	"

* Mean from 3 locations in Malawi

Cassava traits of importance to Africa which are being introduced to the continent are introgressed into national adapted germplasm at IITA. Such populations are then distributed to target agro-ecologies represented at the various NARS. Populations which have been introduced from CIAT falls into the following categories:

1. Lowland adapted and mosaic resistant

2. Highland, acid soil adaptation

3. Lowland adapted, high dry matter, high yield

4. Lowland adapted, mite resistant, high yield

ESARRN, in collaboration with FAO and the germplasm conservation unit of Chitedze are currently in the process of planting the cassava and sweet potato collection for conservation, characterization, proper documentation in order to improve its usage.

In connection with the efforts of cultivating new dimensions in germplasm management, the network supported a NARS representative to participate in germplasm meeting in Cali. This was later followed by participation in a steering committee meeting on cassava biotechnology.

The final stage of transferring selected lines to farmers fields is still a major constraint in most programs. However, in the case of Malawi, Uganda and, to some extent, Mozambique efforts are underway in collaboration with NGO's to bridge this gap. The yields of the most promising varieties evaluated on station (Cassava and sweet potatoes) and on-farm (sweet potatoes) are summarized in Tables 8 to 11.

Table 8: Performance of cassava varieties grown at the Lower Shire ecology in sole and mixed cropping systems in 1992

Crop Combination	Biological yields (t/ha)		Total returns (MK)
	Cassava	Maize	
TMS 30158(12)1 Sole	28.36	-	9816.0
TMS 30158(12)2 Sole	25.81	-	8100.0
TMS 30158(12) Sole	24.77	-	7408.0
TMS 58308(15) Sole	24.19	-	8140.0
IB Prelim (1976) Sole	24.42	-	7408.0
Nyasungwi Sole	27.56	-	7876.0
Mbundumali Sole	16.91	-	4680.0
TMS 30158(12)1/Maize	13.66	7.76	5964.1
TMS 30158(12)2/Maize	12.20	7.40	5423.7
TMS 30158(12)/Maize	13.20	7.75	5208.8
TMS 58308(15)/Maize	7.64	7.60	4189.8
IB Prelim (1976)/Maize	6.83	7.64	3755.7
Nyasungwi/Maize	7.52	7.99	3494.0
Mbundumali/Maize	10.07	8.44	4854.4
Sole Maize	-	8.74	2157.3
LSDO.05	5.08	NS	

$1 = MK4.2

Table 9: Tuber yield of some sweet potato varieties evaluation in 1993 for uniformity of yeilds and for selection for 1991 on farm trials

	VARIETY	TUBER YIELD (t/ha)
1.	Kenya	15.79 a*
2.	TIS 2534	15.22 ab
3.	TIS 3290	13.41 abc
4.	LRS 407	12.61 abc
5.	TIS 3017	12.61 abc
6.	Line 358	10.48 abcd
7.	Line 276	9.94 abcd
8.	Line 310	9.60 abcd
9.	TIS 2498	9.14 abcd
10.	Yoyera	7.61 bcd
11.	Line 278	5.57 cd
12.	Kamchiputu	4.38 d
13.	Thambalaji	3.75 d
14.	Line 285	2.73 d

* Means followed by the same letter are not significantly different from each other (Duncan's Multiple Range Test at 5%)

Table 10: Tuber yields of some improved sweet potato varieties grown sole or mixed with maize in four ecologies in Malawi 1992

Crop Combination	Total tuber yields (t/ha)				
	Makoka High*	Chitala Low	Bvumbwe High	Chitedze Medium	Mean
Sole Kenya	0.58 bc+	10.98 ab	29.63 b	14.70 ab	13.97
Sole LRS 407	4.75 ab	17.96 a	28.59 b	5.00 cd	14.06
Sole TIS 2534	2.89 bc	17.50 a	38.66 a	16.67 a	18.93
Sole TIS 3017	-	16.25 a	27.90 b	15.68 a	19.94
Sole TIS 2498	-	-	37.62 a	10.11 abc	23.87
Sole Local (Babache)	2.95 bc	11.06 ab	24.77 b	9.30 bcd	12.02
Kenya/maize	1.33 bc	6.64 bc	17.48 c	9.62 abc	8.77
LRS 407/maize	0.81 c	12.64 bc	15.51 c	1.42 d	7.60
TIS 2534/maize	1.27 bc	15.18 a	12.38 c	10.33 abc	7.79
TIS 3017/maize	7.89 a	6.34 bc	15.97 c	7.21 cd	9.35
TIS 2498/maize	2.08 bc	0.49 c	14.47 c	3.55 bcd	5.15
Babache/maize	0.81 c	3.38 c	16.55 c	4.41 cd	6.29

Maize variety = MH 18

* High, medium and low refer to the altitudes of the respective sites.
\+ column means followed by the same letter are not significantly different from each other (DMRT at 5%)

Table 11: Tuber yields of sweet potato varieties within and across location in on-farm trials conducted in 1993 - Central Region, Malawi

	Locations			
Variety	Unit 6	Unit 8	Unit 9	Combined means
TIS 2534	8.28 a	12.96 a	5.83 a	9.02 ab
Kenya	5.79 a	14.13 a	9.39 a	9.77 a
LRS 407	4.72 a	9.28 b	4.54 a	6.18 b
Local	1.25 b	3.34 c	1.47 b	2.02 c

Mean followed by the same letter(s) within a column do not differ at 5% level according to Duncan's Multiple Range Test

Baseline Surveys

During this year a preliminary baseline survey was conducted in the area where the network has been most active in Malawi. This was to ensure that the appropriate and relevant information will be obtained and to properly test the instrument design and the survey logistics.

The interaction with the extension staff and area based team is also necessary for the data analyst. This collaborative approach was strongly supported by the national program.

This study looked at the adoption rate and assessed the seed material distribution system as well as obtained first-hand farmers feed-back about the new varieties. This included their preference and the perceived constraints of the new technology. An attempt at assessing the benefit-cost ratio was also made.

Refining this study and information generated from it will permit the assessment of increased productivity resulting from research results use. It will also identify areas where other interventions are needed to maintain and improve further the productivity as well as the multiplication and distribution system.

The main findings from this preliminary survey in the Lilongwe Agricultural Development Division (LADD) are as follows:

- The main secondary food crop in the area is sweet potato and cassava. There is a trend of increase in production based on the increase in demand for planting material. Besides the increase in hecterage there is also an increase in yield per hectare because of the introduction of high yielding varieties and the shift from using it as a purely subsistence food or cash crop to use as both food and cash. (Fig. 1)

- The rate of increase in area for sweet potato is greater than for cassava. A total of 63% of sampled farmers grew sweet potato as opposed to 13% growing cassava; while 25% grew both crops. Further increase in the rate of expansion is limited primarily by the availability of planting material. Forty-seven percent of sweet potato growers and forty-three percent of cassava growers indicated that the lack of planting material limited their hecterage of production. The second most important constraint factor was insufficient land. Twenty-seven percent of sweet potato growers and nineteen percent of cassava growers, identified land as a constraint. The comparison of pre-drought percentage of farmers growing these crops with that of the post-drought period shows a shift in favour of sweet potato, while that of cassava remained stable. This might reflect the ease of handling of the sweet potato and the slow rate of multiplication of cassava (Fig. 2)

There has been an increase in the proportion of farmers growing improved sweet potato varieties. Compared to the initial stage of on-

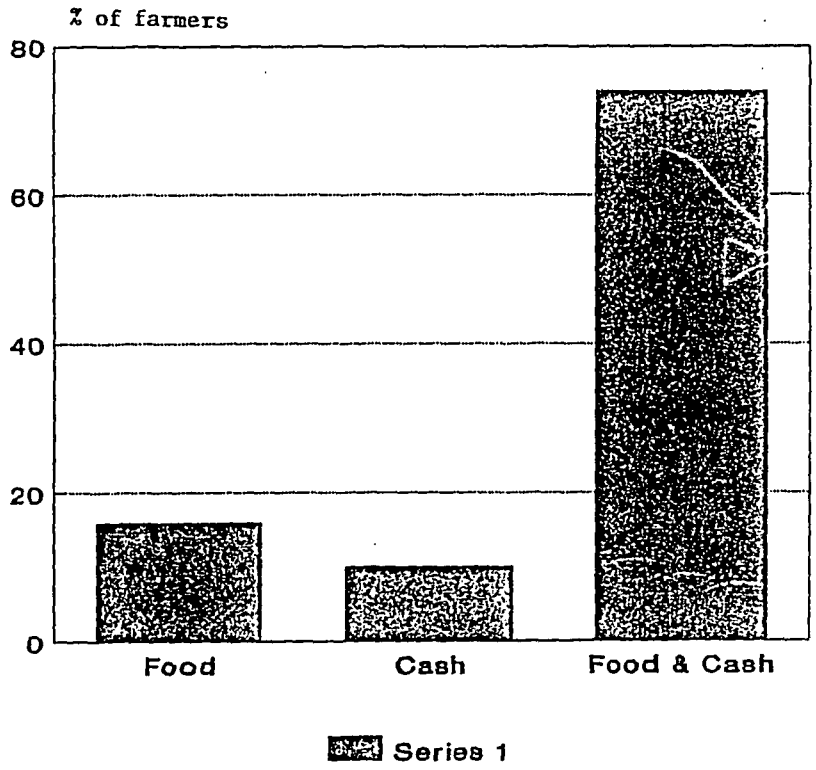
farm testing and the beginning of the multiplication and distribution activity, there has been a rapid increase in the rate of adoption of the improved lines. At the time of the COSCA survey in 1990, it was shown that sweet potato was grown throughout the country but only Lilongwe Agricultural Development Division had one improved line among 3% of farmers sampled. This preliminary post-drought survey showed that 29% of the farmers sampled were now growing the improved lines and all three improved varieties were found in the survey area. Of the remaining 70% of farmers, most knew of the improved lines but had no access to obtain them. As a result those farmers already with the varieties were distributing to other interested farmers.

The survey result showed that of those who grew improved varieties, 43% obtained their planting material from the network initiative in collaboration with the national program and another 50% obtained directly from farmer friends or relatives (Fig. 3). Most farmers, 96%, expressed willingness to expand production hecterage if they obtained planting material. All farmers also indicated interest to be involved in some form of multiplication and distribution scheme for sweet potato but only 90% for cassava.

Of interest to note is that the 96% of farmers who want to expand production are all prepared to put more land to cassava than sweet potato. On the average farmers are prepared to put more than 1 ha of land in cassava as compared to 0.8 ha for sweet potato.

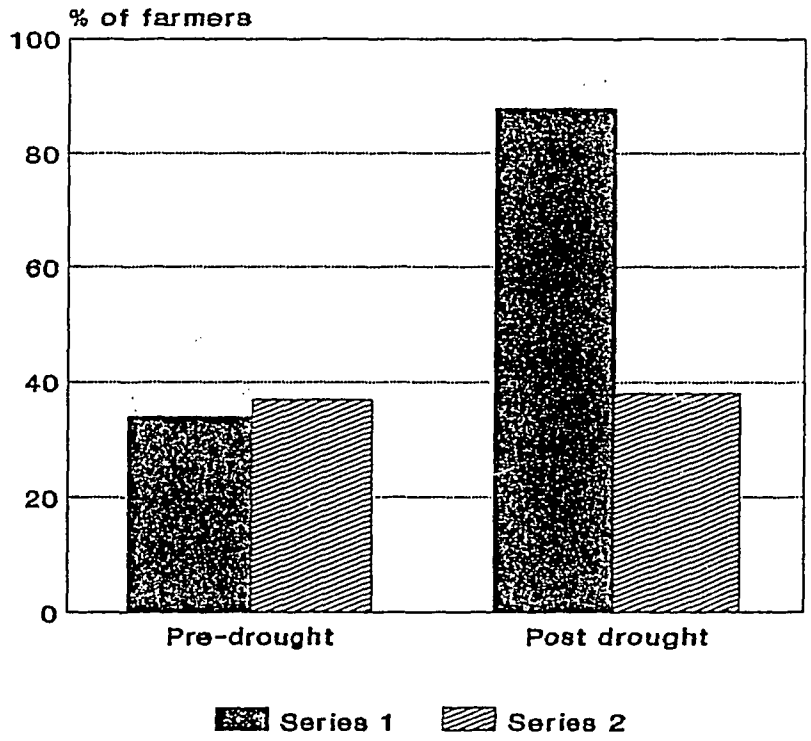
Since the involvement of the project with extension agents in on-farm testing and multiplication and distribution activities, there has been a noticeable increase in contact between farmers and extension agents about issues on root crops. More sweet potato growers were visited than cassava growers (ratio of 74:26). This is a reflection of the fact that the project activity was more involved with sweet potato than cassava in this division. This could also be a reflection of the increase in the number of sweet potato growers over cassava growers.

Several training courses were held in this division during the drought year to raise awareness further about these crops and what is available. The number of participants is shown in Table 12. The survey showed that fifty-three percent of the farmers growing sweet potato indicated that they had received training on growing sweet potato while only 38% of cassava growers had received similar training. This kind of grower education was conducted in the division in order to present crop production, nursery management and planting material handling information. These were conducted several times during the season with various grower groups and extension agents.



Series 1 = % of farmers

Fig: 1



Series 1 = Sweet Potato
Series 2 = Cassava
Fig. 2

SOURCE OF PLANTING MATERIAL FOR IMPROVED SWEET POTATO VARIETIES

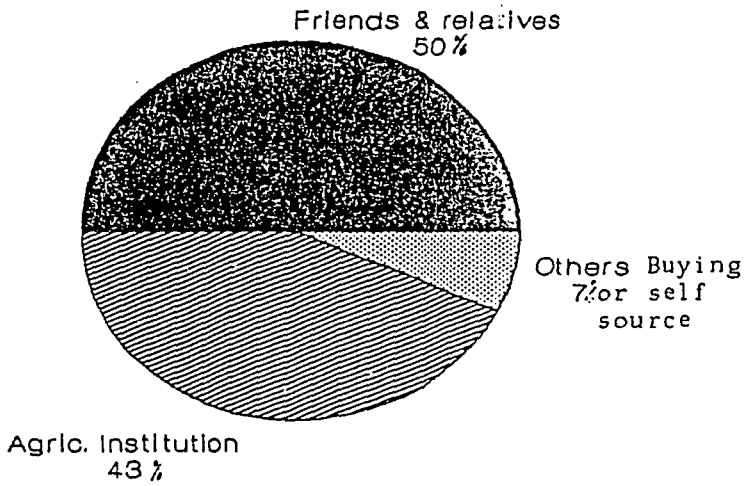


Fig: 3

28

PROPORTION OF FARMERS VISITED BY EXTENSION WORKERS IN THE DIVISION

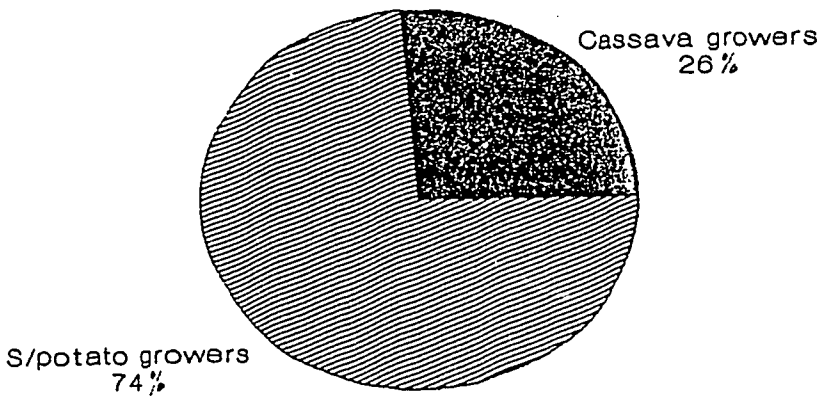


Fig: 4

Table 12

Participants to farmers field day/training workshops in Lilongwe Agricultural Development Division (LADD), Malawi

Location	Number of Farmers		Extension Workers	
	Male	Female	Male	Female
Mpingu	46	65	10	5
Chitipi	26	13	3	3
Likuni	20	33	5	3
Dedza	28	47	3	-
NRC	175	37	8	2
ICRAF	23	40	1	-
MYP	50	4	2	1

The effectiveness of this approach seems to have been realized as the survey result indicated. The major developments which were realized could be summarized as follow:

* Increase in hectarage and percentage of growers.

  Sweet potato growers in the division had doubled and continues to increase at a fast rate. The principal growers who were the main champions of the increase in production and interest were the participants to workshops and field days.

* More confident and knowledgeable growers.

  Growers who participated in the field days, demonstrations and on-farm testings now have a better understanding of the handling of the crop and appreciation for the greater potential of improved varieties. They now understand how to manage their own nurseries and handle planting material.

* Increased awareness among other farmers.

  Other farmers who may not have been involved directly in trainings are now more aware of the production potential of the improved varieties. Many new potential growers are making efforts to obtain planting material.

* Increased Government, University and NGO awareness.

  Extension agents were participants and observers to the

technology transfer activities and are now aware of the production potential of improved varieties as well as the impact on the economic well being of farmers and country. The University of Malawi, Bunda College, which is the college with which we work closest is now more aware of the technical needs and opportunities in improved production of planting material. NGO's have been trained and has resulted in considerable team effort in the execution of this project.

Linkages

The network has developed effective linkages and relationships with NGOs across the country. The growing strength of the network in-country is proportional to the strength of the relationship with the NGO's.

Production economics

To determine the potential for profit of growing cassava and sweet potato a budget estimate was discussed with the farmers interviewed. The figures were based on the known acceptable market price for the crops and cost of labour. Based on these estimates, the potential for profitability is shown in Table 13.

Table 13.

Estimated costs and return of growing sweet potato and cassava

Crop	Estimated expenditure (MK/ha)	Estimated gross returns MK/ha	Estima. gross margins MK/ha
Improved sweet potato variety	80.00	475.00	395.00
Local sweet potato variety	75.00	278.00	203.00
Local cassava	116.00	602.00	486.00

The estimated gross margins on these crops is relatively large as compared to other food crops such as maize because of their limited input requirement. This has made the growing of these secondary crops potentially profitable. This could be a reason for the farmers' willingness to expand in production and even to invest more land in cassava production. All farmers growing improved sweet potato indicated that it was a profitable venture. Similarly 95% of cassava growers indicated that it was profitable. The overall assessment of the varieties based on characteristics of interest to farmers is shown in Table 14.

Table 14:

Farmers comparative analysis on the performance of improved and local improved sweet potato varieties

Characteristics assessed	% of farmers indicating preference for:		
	Local	Improved	No difference
Inputs required	14	21	64
High yield	-	100	-
Disease resistant	36	64	-
Pest resistant	29	43	29
Drought tolerant	21	14	64
Good storage ability	86	7	7
Good processing ability	29	50	21
Good taste	36	57	7
Good quality	14	71	14

The involvement of farmers/producers, extension agents and professional NGOs in this technology transfer has picked up momentum. This approach to the multiplication and distribution system is being adapted and farmers are rapidly increasing their participation in the process. However, there is still a need to accelerate the use of resources such as farmers' groups and hydromorphic areas to hasten the establishment of the system to meet the ever growing demand.

Several lessons have been learnt from the analysis of the data gathered in one division. Some of these are:

a) This data shows the trend in expansion patterns in the division. There has been a rapid adoption in hectarage and location. (The collection of data for a national profile will now be attempted and also projections of demand for the coming season)

b) This type of sample survey is feasible and based on the experience in Malawi, this model will be tested in Mozambique and Zambia.

c) The strong interest and adoption is probably a fair indicator of the potential profitability of growing these crops and increases the probability of sustainability of the technology.

There has been a change in government policy towards root crops and cassava in particular as far as resource allocation for research is concerned. Cassava is now considered the second most important food crop after maize. There is a possibility that this could translate into a comparative cost advantage for the crops.

Development of Improved Technology for processing and utilization

During this period intensive efforts were made towards sensitizing users about the various potential products from cassava. Throughout the region cassava consumption is limited to two basic forms, namely after boiling for the low cyanide varieties and as fermented flour for the high cyanide types. The varied forms of using cassava still needs to be popularized and demonstrated.

In addressing this specific area of creating an awareness and demonstrating the preparation of different types of new cassava products, a team of two, Dr Bokanga and Ms P Omoaka, from the Biochemistry/Food Technology unit of IITA visited seven ESARRN countries in order to conduct training workshops on cassava utilization/product development. The countries visited and the number of participants are shown in Table 15. This table shows that ninety-three participants, of which 64% were women, and thirty-one organizations participated in the workshops.

The workshops consisted of lectures, demonstrations and practicals. The participants made their own products using the cassava flour or chips which they had prepared during the workshop.

Following the group tour to the seven countries in the region, a consultant with expertise in human nutrition and especially in the area of making cassava based composite products as weaning food also visited the network. She demonstrated the making of gari at a training course in Burundi. In Malawi she trained the technicians and demonstrated to housewives and other interested groups.

Table 15: Countries visited and number of participants to the cassava utilization training workshop

COUNTRY	NO. OF PARTICIPANTS	NO. OF INSTITUTIONS INVOLVED
Burundi	10	2
Malawi	18	14
Rwanda	7	5
Tanzania	16	1
Uganda	23	3
Zambia	7	3
Zimbabwe	12	3
Total	93	31

Using this strategy, a large number of potential users and other interest group in cassava utilization were contacted. Classrooms, laboratories, bakeries and other facilities were offered by national programs to undertake this activity. Most participants and policy makers indicated strong commitment to train staff in this field and to strengthen the post-harvest sector in their countries.

The tour dispersed the message to more than thirty different kinds of organizations representing industry, universities, nutrition centers, extension and research groups as well as private individuals and NGOs in seven collaborating member countries. Ninety-five percent of those who were made aware of the various (more than 12) cassava products and those who actually participated reacted very positively. Since that orientation/demonstration workshops, several private individuals and potential industrial users have contacted the coordination office for additional information.

This strategy of group approach to creating awareness and illustrating the varied use of products from cassava has been effective.

One post-harvest machinery specialist Mr Kazembe Phiri from Malawi was trained at IITA, and has since been involved in the strengthening of this area at the processing shed established at Chitedze by the network. He has been visited by the chief post-harvest engineer from IITA Dr Jeon and he has reviewed the potential for developing the local capacity to manufacture simple processing equipment. The Malawian Entrepreneurs Development Institute (MEDI) has already developed prototype processing machines that need further testing and improvement.

During this period, the network has continued to evaluate the performance of different processing equipment and is now moving ahead to explore the possibility for training and developing the capacity of national manufacture. There is enough indication that the time is ripe to develop a clear strategy for the various root crops processing needs of the region.

The introduction and promotion of new food products besides creating new dimensions for industry also provided insights into new potential pathways for nutritional impact at the household level. Cassava has traditionally been conceived as having low nutritional value. However, this technology will open up avenues for the simple improvement of the biological value of the crop at household level.

Ecologically Sustainable Plant Protection (ESPP)

The execution of this component of network activities was done in close collaboration with the International Institute of Biological Control (IIBC). The funding for this activity is also supplemented by IDRC. The overall objective of this component wa
s to assist national programs in ESARRN countries to develop effective research programs on integrated pest management for root crops.

During this period workshops were held in Kenya in collaboration with KARI as follow:

1) National workshop on Integrated Pest Management of Root and Tuber Crops: 5 days - 21 participants

2) Regional workshop on Integrated Pest Management of Root and Tubers: 5 days - 29 participants and 11 national programs represented.

The cassava mealybug continued to spread within the countries and across the region, the latest country to be invaded being Uganda. However, most national programs now have ample expertise as well as regional experience to help in dealing with the problem. Several national programs have now developed the capacity to rear natural enemies and predators for the cassava mealybug. The programs with this capacity are: Burundi, Malawi, Rwanda, Tanzania and Uganda. This has assisted considerably in reducing the trans-continental shipment of natural enemies from West Africa to East Africa. Furthermore, it seems that establishment from early releases have persisted and continue to be present with the mealybug. Summary of achievements in this area are shown in Appendix IV. From Annual Report on Integrated control of arthropod pests of root crops.

Another area of concern was the continued spread of the African Cassava Mosaic Virus (ACMV) and that of Cassava Brown Streak Virus (CBSV) in the region. While most evaluations have been for ACMV, the region has limited expertise on CBSV. In dealing with this situation the IITA virologist Mr H Rossel and Dr M Thresh from NRI visited the region and confirmed the extent of CBSV in Malawi. A strategy is now being developed to address this problem. Actions already taken include:

1. Samples of diseased plants have been sent to advance laboratory at IPO, Wageningen. IITA virology unit is collaborating and following up in order to clarify the etiology of the disease.

2. Researchers from the region will attend the Monoclonals training workshop at IITA in October, 1993.

Little information is available to breeders on resistance or differential reaction to genotypes to CBSV virus. Reasons for this lack of data include the limited area of occurrence and means of transmission. The network is now working on ways of obtaining seedling information and compare the performance of symptomatic and asymptomatic plants.

Rapid multiplication and distribution of improved planting material

Many programs are now improving and expanding their ability to multiply and distribute clean planting material of improved varieties to their farmers. The bulkiness and slow multiplication rate of cassava is gradually being overcomed by applying different techniques and models to bridge the demand - supply gap for planting material. New alliances are being formed and greater awareness of importance and other potential uses being recognized.

The Malawi National Multiplication and Distribution System (NMDS) for cassava and sweet potato is an initiative that is adding new dimensions to the initial efforts of the Malawi national program to multiply cassava and sweet potato. The establishment of NMDS through collaborative effort of the network, the national program, NGOs and additional donor support, has provided exciting opportunities for the involvement of all interested groups in multiplication. The progress report of this strategy is in Appendix V.

Similarly in Mozambique and Uganda, varying types of multiplication and distribution models are being developed. Each with its unique style and advantages. These new developments are having impact in the production of high quality planting material at easy and timely access to the farmers. This results in the expansion of production areas with better quality material.

Besides the impact on production these models also offer unique opportunities for training and modeling by other collaborating programs. These models are worthy of study because of the need for their improvement as the pressure for efficient, sustainable production becomes critical.

Training

In addressing the need to develop the manpower needs for improved management of research activities at NARS, several in-service/in-country trainings were undertaken. The training undertaken during the period are listed in Table 16.

Table 16: Root Crops Training activities initiated and co-sponsored by ESARRN

Type	No. of participants	Location	Co-sponsoring organizations
In-country	25	Machakos, Kenya	KARI, FAO, CIP, IITA
In-country	20	Bujumbura, Burundi	ISABU, CIP, FAO, ISAR, IITA
Regional	93	7 NARS	Various 31
Multiplication Management	25	Mkondezi, Malawi	National Program, FAO
Regional	3	Gambia	Programs represented were Malawi and Mozambique
On-the-job training	3	IITA	INIA, Uganda National Program

During these training courses much emphasis was placed on multiplication management and post-harvest technology. The resource persons were drawn primarily from the national programs and a few were brought from collaborating programs IITA headquarters, and/or CIP's regional office. The bulk of the responsibility of managing these courses was given to the national program staff involved.

It has become more important than ever before for participants and program technicians to have a broader understanding of the regional networking prospective. In their work they must understand and appreciate regional issues facing root crops research and encouraged to direct their solutions not only to the local situation but to regional level as well. In dealing with this need, the network sponsored the participation of 2 regional scientists and three technicians for specialized on-the-job training at IITA and in-country training at Gambia. The breeder from the Uganda National Root Crops Program spent a period of 2 weeks working on specialized techniques on population management, breeding techniques and evaluation strategies.

Within this regional framework idea, a 4 - 6 weeks regional training course is being planned for 1994 in Malawi. All regional collaborating programs will be represented. There is still much to be done to encourage more kinds of training and ensure that the research knowledge and the transfer of root crops technology remains at a steady and appreciable pace. The networks special challenge

continues to be to strengthen the linkage between research, extension and its technology transfer mission.

Backstopping: Institutional Support Activities

The backstopping support from the various organizations involved with the network continue to add new dimensions to the international cooperation in networking. There have been various visitors to the coordination including other collaborating NARS, the private sector, appropriate government agencies (donors) scientific and educational institutions and International center representatives.

This opportunity for the international involvement in the diverse dimensions of the network activities continue to be an area of strength for the network. The various visitors to the network and purpose are listed in Table 17.

In response to increased awareness by NGOs, donors and policy makers of the importance of root crops and the roles they play in the food economies of the region, the network forged ahead with collaborative activities with various interest groups. Another proposal was presented to USAID Malawi soliciting support for multiplication Appendix VI. Another draft pre proposal was prepared jointly with UNICEF, IITA/ESARRN, ICRISAT and IFRI, ICRAF. The interest of UNV to continue its collaboration with the network is shifting from interest just in Malawi to that of the region.

Table 17: Backstopping visits to ESARRN

Visitor(s)	Organisation(s) represented	Purpose of visit
Dr A P Uriyo	IITA, ICP	Administrative matters and progress of project implementation
Dr L Brader	IITA	Consultation with donors review of project progress
Mrs M Okelo	Board of Trustee IITA	Accompany D.G. in orientation visit and review project progress
Dr M Tresh	Virologist NRI	Virology fact finding mission
Mr H Rossel	Virologist IITA	Virology fact finding mission
Mr E Nwulu	Documentation	Documentation of project

	Specialist IITA	progress
Mr H Masambu	REDSO USAID/ Nairobi	Monitoring and evaluation of project progress
Dr P Anandajayasikeram, Mr C T Nkwanyana & C L Kwalombota	SACCAR	Monitoring and evaluation fact finding tour
Dr J P Eckebil	IITA, ICP	Consultation with donors, administration matters and progress of project implementation
Drs S Nganga, P Ewell, H Kidanemariam	CIP	Consultation about SARRNET and monitor of project implementation
Dr Bokanga and Mrs P Omoaka	IITA Biochemistry	Conduct workshop/training on cassava products, resource person in training course
Dr & Mrs Jeon	IITA post-harvest	Evaluation of post-harvest mechanization potential and facilities for training
C Levin	R & D	Monitoring and evaluation of network activities
Dr E Rice	R & D	"

Conclusion

There has been an overall shift towards an increase in the production of root and tuber crops. The drought period in Southern Africa has been a stimulus to both cassava and sweet potato production. The network played its role in addressing constraints to production and utilization in order to facilitate the continued increase.

The preliminary impact assessment study conducted in Malawi has provided a clear picture of the demand potential for both crops. There is no doubt that they are on the way to consolidate their positions in Southern Africa as major crops for food-security. With

increased recognition of the importance of the multiplication and distribution system by farmers and policy makers, it is safe to predict that this system will remain sustainable once it is established. We believe that some of the strategies and experiences learnt in Malawi and other programs will encourage the network to continue to play a role in this kind of technology transfer activity.

Root crops in this drought prone region are invaluable agricultural resources that are only now begining to realize a tiny fraction of their potential in providing food and nutrition to a rapidly growing population. The network must continue to play its role to make sure that their increased production and use become sustainable, especially for the limited resources farmers.

As we approach an expansion phase of the network, collaboration with all interested parties must continue with dedication towards alleviating hunger and conserving the environment.

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APPENDIX I.

Minutes of the 2nd ESARRN (now EARNNET) Phase II Steering Committee Meeting held in Kampala, Uganda May 3 to 5, 1993

Appendix I.

MINUTES OF THE 2ND ESARRN (NOW EARNNET) PHASE II STEERING COMMITTEE MEETING HELD IN KAMPALA, UGANDA MAY 3 TO 5 1993

Present:

1.	Dr. R. Asiedu	:	IITA, Nigeria
2.	Dr. M.N. Alvarez	:	IITA/ESARRN, Malawi
3.	Mr. Y.K. Baguma	:	Namulonge, Uganda
4.	Mr. A. Bua	:	Namulonge, Uganda
5.	Dr. M. Gethi	:	KARI, Kenya
6.	Dr. J.E.G. Ikeorgu	:	IITA/ESARRN Malawi
7.	Dr. B. Khizzah	:	Namulonge, Uganda
8.	Mr. M. Ntimpirangeza	:	ISABU, Burundi
9.	Dr. J.A. Ogwang	:	Namulonge, Uganda
10.	Mr. S. Nandy	:	Kwanda, Uganda

Observer Members:

1.	Mrs. Anabella M. Zacarias	:	INIA/DASP, Mozambique
2.	Mr. Jeremiah Simon	:	Ukiriguru, Tanzania

As EARRNET concerns only collaborating countries in East Africa, ESARRN members from Tanzania and Mozambique who attended this meeting were regarded as observers.

Agenda

1. Opening remarks

2. Business Session

3. Matters arising:
   - Budget for ESARRN (now EARRNET) Phase II
   - Financial and Progress Report
   - Madagascar
   - Mozambique Workshop

4. Other Issues

5. Amendments in Budget Items

6. Country Reports (Summary)

B. Opening

The meeting formally opened at about 9:30 a.m. local time as a joint session of Committee of Research Directors (CD) and members of the Steering Committee (SC) at the Conference Hall of Hotel Equatoria. An introductory address was given by the Director of Namulonge Research Station, Mrs Theresa Sengooba. She briefly reviewed research activities and progress made in her station in specific area where network support have been received. These include integrated pest management, post-harvest, germplasm development and technology transfer/rapid multiplication of improved planting materials. She thanked the USAID and IDRC for their contributions and added that despite the fact that some crop production constraints such as the African Cassava Mosaic Virus still exists, there is now greater scope for their solution through a sustainable and collaborative regional networking.

Professor J.K. Mukiibi, Director General of Uganda's National Agricultural Research Organization (NARO) gave the welcome address. He welcomed members to Uganda and pledged Uganda's commitment to regional cooperation. He affirmed that the East African community has gained a lot working together citing the example of several improved cassava varieties which were acquired through collaborative networking. He informed members of plans to form a central coordination of all the four networks in the region in order to make them more sustainable. This is mainly because they involve the same Directors, the same members of the Steering Committee, the same Scientists, etc. He said that CGIAR is therefore considering that the Networks should be coordinated by the NARS themselves so as to make them more cost-effective and cut down on operational and travel costs.

Professor Andrew Uriyo, Project coordinator from IITA, conveyed the IITA Director General's concern to see visible progress in cassava research in East Africa. He informed members that ESARRN Phase II was approved in principle and funds for the first year (1992/93) released. The Phase II (1993-1995) proposal was drafted by IITA after a meeting of the Committee of Directors in Kenya and sent to USAID. The understanding is that funds for ESARRN will now belong to EARRNET according to the advice of USAID. He also said that the SARRNET proposal was prepared by IITA and submitted to SACCAR and that this proposal has been approved in principle. Finally Dr. Uriyo informed members that the posts of the EARRNET Coordinator and that of the Regional Scientist as well as that of Dr M.N. Alvarez who will leave in October 1993, are vacant. He urged SC members to ensure that final corrections are made on the proposal so as to forward the corrected Phase II proposal to USAID by mid-May.

Business Session

After a group photograph and tea break, the CD separated from the SC and each group went into a business session. The SC business session was chaired by Mr A. Bua, Root Crops Program Leader in Namulonge Research Station, Uganda. He called for the minutes of the last Steering Committee of November 27 to 28, 1992. This was read by the ESARRN coordinator Dr. M.N. Alvarez (copies were distributed to members) and matters arising treated as follows:

C. Matters Arising

i) Budget for ESARRN (now EARRNET) Phase II:

The sum of US$ 470,000 was approved by USAID for the first year (1992/93) but for the remaining two years (1993/94) and 1994/95), USAID has put a ceiling of US$900,000. EARRNET and the Coordinator have been directed to ensure that a significant proportion of this amount be used for networking activities rather than for the Coordination office as was the case in previous years. The coordinator explained that the budget allocation has been corrected such that funds for the coordination office: Networking activities is approximately 45% : 55%.

ii) Financial and Progress Report:

Network SC members agreed that there have been lapses in prompt and regular submission of progress reports to the coordination office. This has resulted in the coordination office sending reports late to Washington and/or sending incomplete reports. The Steering Committee decided that quarterly progress reports of financial and progress reports of networking activities from member countries will be submitted to the Coordinator regularly beginning from May 1993. The progress report will be both technical and narrative and should also reflect the percent contribution of USAID fund towards achieving the overall program objectives.

Uganda, Tanzania and Burundi indicated they will submit their reports before the end of May 1993. It should be noted that such reports must be submitted about a month before the Coordinator's quarterly (December, March, June, September); Semi-annual (March) and Annual (September) reports.

iii) Madagascar:

The SC agreed that it was necessary for a "state of the art" survey be carried out in Madagascar to know their constraints and needs before any meaningful intervention is made in establishing a viable root crops program. It was suggested that the network can initiate a root crops program in Madagascar, especially in germplasm collection. Because of the present level of Madagascar's root crops program, it may be necessary to state in the proposal that Madagascar is just beginning from germplasm collection. IITA will backstop Madagascar to ensure this plan succeeds.

iv) Mozambique Workshop:

The committee considered that since ISTRC meetings were held in Ghana (1991) and Uganda (1992), it may not be necessary to hold another one in 1993 as little new research information will be reported. It was rather suggested that the workshop should be a kind of brainstorming session in which collaborators and team leaders review their proposals on specific projects and where resource persons present papers relating to that project. The topic chosen for the proposed workshop was "Technology transfer and Impact Assessment". Tentative date was fixed for the last week in October, 1993.

D. Other Issues

i) Regional Focus:

USAID Washington raised some issues to be addressed while submitting a final version of the Phase II proposal. One of the issues was for the proposal to reflect East Africa region and not East and Southern Africa. The proposal has been corrected to read "East Africa Root Crops Research Network (EARRNET)". The location of EARRNET coordination office will be at the IITA Regional Centre, Namulonge Research Station, Kampala, Uganda. EARRNET member countries include Burundi, Kenya, Madagascar, Rwanda and Uganda. The MOU for the IITA Regional Centre in Namulonge Research Station was signed between IITA and the Government of Uganda on May 7, 1993.

Agreement between Kenya and IITA has not been signed but it was reported that efforts are being made to get the Kenya Government sign the MOU. There is still no MOU between IITA and the Government of Burundi. The Burundi network collaborators were asked to work this out with their Government.

ii) Correction of the Phase II Proposal and Budget Allocation:

Extensive corrections were made in the proposal, for the final version. The SC devoted a whole day for this purpose as well as for budget allocation to projects. At the end, it was decided that 95% of USAID funds will be used for regional projects while the remaining 5% will be devoted to special projects. All the IDRC funds will continue to go into country specific activities.

Of the funds allocated for regional projects, 10% will be devoted to germplasm development and distribution, 20% will go for Ecologically Sustainable Plant Protection (ESPP), 50% will be devoted to technology transfer, impact assessment and multiplication and distribution of improved varieties, 20% will be used for development of post harvest technologies.

Criteria for award of grant for execution of special projects were outlined as follows:

a) Project must be achievable in the short term.

b) Resources must be available for efficient execution of the project.

c) Project cost must be reasonable.

d) Results achieved must be publishable in a referred journal.

The 95% USAID funds set aside for regional projects were allocated to collaborating countries for special lead projects. Allocations were based on percentages not real cash value. The Government contributions to the projects in each collaborating country were also given by the collaborators. These are shown in Table 1.

Table 1: Budget allocation to countries for specific lead projects as agreed by the SC.

COUNTRY	ACTIVITY	CONTRIBUTORS EARRNET(%)	GOVT($)
BURUNDI	1. Tech. transfer, impact assessment and Rapid multiplication	10	
	2. Post harvest	6.7	120.000
KENYA	1. ESPP	10	
	2. Post harvest	6.7	
	3. Tech. transfer. impact assessment and Rapid multiplication	10	220.000
RWANDA	1. Germplasm development	5	
	2. Tech transfer. impact assessment and Rapid multiplication	10	
UGANDA	1. Germplasm development	5	
	2. ESPP	10	
	3. Post harvest	6.7	
	4. Tech. transfer. impact assessment and Rapid multiplication	10	254.000
MADAGASCAR	1. Germplasm development	10	

E. Amendments in Budget Items

In order to increase the funds allocated for regional research activities. the SC proposed the removal of the following items previously budgeted:

a) MSc degree training for two years.
b) Funds for regional workshop for the first year.
c) Removal of the regional scientist position.

The ammended budget is presented in Table 2.

Table 2:

FINANCIAL RESOURCES TO BE CONTRIBUTED TO THE EAST AFRICAN ROOT CROPS RESEARCH NETWORK (EARRNET)

September 30, 1993 to September 30, 1995

REQUESTED FROM USAID (000 US$)

		93-94	94-95	TOTAL
A.	COORDINATION OFFICE			
1.	PERSONNEL			
i)	Senior Staff	105.00	110.00	215.0
ii)	Support Staff	25.00	25.00	50.0
2.	MANAGEMENT ADMINISTRATION			
i)	Uganda Coordination Office	20.00	20.00	40.0
ii)	External Audits	10.00	10.00	20.0
3.	INFORMATION EXCHANGE COORDINATION			
i)	Publications and Reports	5.00	5.00	20.0
ii)	Travel	15.00	10.00	25.0
	SUB TOTAL	180.00	180.00	360.0

B.	NARS NETWORKING ACTIVITIES			
1.	Staff support to strengthen NARS			
i)	Senior staff (regional)	40.00	45.00	85.0
ii)	Support Staff	18.00	18.00	36.0
2.	Training			
i)	MSc Degree training	-	-	-
ii)	In-country training	20.00	20.00	40.0
3.	Technology generation and assessment			
i)	Regional sub-projects	80.00	55.00	135.0
ii)	Impact monitoring and assessment	15.00	15.00	30.0
iii)	Travel	10.00	10.00	20.0
4.	Regional meeting and workshops			
i)	Regional workshops	-	20.00	20.0
ii)	Directors meetings	6.00	6.00	12.0
iii)	Steering Committee meeting	10.00	10.00	20.0
	Sub-Total	199.00	199.00	398.0
	Total A + B	379.00	379.00	758.0
5.	Indirect costs 18.8%	71.00	71.00	142.0
	Grand Total	450.00	450.00	900.0

F. Country Reports (Summary)

i) BURUNDI

Engaged in rapid multiplication and distribution of cassava planting materials. Has established 4.5 ha of improved varieties at Moso and is selling to farmers. Has already realized 1.5 million BF from sale of cassava cuttings. Plans to establish 4 ha of primary multiplication sites in the coming season.

ii) KENYA

Is monitoring the release of natural enemies as well as releasing E. Lopezi parasitoids in other locations. Evaluating cassava for tolerance to CM and CGM. Conducting on-farm trials to evaluate performance of cassava varieties in cassava-based cropping systems so as to determine extent of pest damage by pests. Post-harvest activities involve evaluating various compositions of cassava and maize flours and cassava and sorghum flours for production of composite FLOURS.

iii) Rwanda and Madagascar were not present.

iv) UGANDA

Ten (10) high yielding ACMV tolerant cassava varieties were developed and tested in 14 of the 38 districts. Five (5) of the 10 are ready for multiplication and distribution after being selected by farmers. Cassava spacing of 1 m x 1 m and 25-30 cm stake lengths have been developed and recommended. Work still on in germplasm collection, screening, multiplication and distribution. Crossing blocks established at Namulonge Research Station for controlled crosses this season. Seeds from IITA still at clonal stages of evaluation. Pre and post natural enemy release monitoring surveys carried out in Tororo and Masindi districts. Results were satisfactory for only Tororo district. Further releases planned for Masindi. A new consignment of physoteiids from Cotonu (IITA) is expected because previous releases did not establish. Need to train plant protection officers on symptom identification for CM and CGM. Post harvest project planned is to extend shelf life of cassava in plant based storage media for urban and rural populations.

Joint CD and SC Session

G. The final day was a joint session between the SC and the CD. The SC presented their recommendations to the Committee of Research Directors. The CD finally approved the removal of the MSc degree budget item for two years as well as that of regional workshop for the first year. The CD did not however approve the removal of the regional scientist position. The CD Chairman concluded that this matter will still be revised. The CD also approved the budget allocations and ammendments as presented in Tables 1 and 2.

IITA was requested by the CD to advertise for the positions of he Coordinator and Regional Scientist and shortlist. Both IITA and CD chairman will conduct the interview at IITA on an agreed date.

In his closing remarks, the ESARRN Coordinator Dr M N Alvarez thanked the TRIP Leader Dr R Asiedu and Dr A Uriyo from International cooperation Program IITA, for attending this meeting and also paid tribute to Professor Mukiibi and the Uganda Government for hosting the meeting. The meeting adjourned at 5.05 local time.

APPENDIX II.

Minutes of the 1st EARRNET Directors Committee Meeting held in Kampala, Uganda May 5th 1993

Appendix II.

MINUTES OF THE 1ST EARRNET DIRECTORS COMMITTEE MEETING HELD IN KAMPALA, UGANDA MAY 5TH 1993

Present:

1.	Professor J Mukiibi	:	Uganda, Director General, National Agricultural Research Organization (NARO)
2.	Mr A Nivyobizi	:	Burundi, Director General, Institut des Sciences Agronomiques du Burundi (ISABU)
3.	Dr A Mailu	:	Kenya, Assistant Director (Food crops) Kenya Agricultural Research Institute (KARI)
4.	Dr A Uriyo	:	Nigeria, IITA representative, Projects Coordinator
5.	Dr M N Alvarez	:	Malawi, Network coordinator
6.	Ms C Levin	:	USAID, R&D/AGR/IARC Staff Washington

Regrets:

Mr N Ntahontuye	:	Rwanda, Director General, Institut des Sciences Agronomiques du Rwanda (ISAR)

Observer Member:

7.	Dr M Msabaha	:	Tanzania, Zonal Director of Research and Training, Lake Zone

Agenda

1. Welcome remarks by Director General, NARO
2. Opening Statement by IITA
3. Review of EARRNET proposal
4. Ratify:
   - Evolution of ESARRN into EARRNET and SARRNET
   - Policy matters regarding the new structure
   - Additional regional activities
   - Review/ratify collaborative projects and budget allocations

May 5th 1993

Introduction to the Meeting:

The meeting was opened by the host, the Director General of NARO, who acted as interim Chairman for the first Directors Committee Meeting. The projects coordinator introduced the meeting and emphasized the need for the committee to address issues which were brought up by the AID-IARC office about the ESARRN network proposal.

Introduction of EARRNET Proposal:

The committee reviewed the EARRNET proposal within the framework of the issues brought out by the AID/IARC memo of April 12 1993. The meeting therefore, addressed the following:

1. Regional focus

The committee agreed that the network should consist of five countries: Burundi, Kenya, Madagascar, Rwanda, Uganda. However, it was agreed that any other country in the region which is not a member of SADC could become a member of EARRNET. It was proposed that the EARRNET coordination office would be located at the IITA Regional Center at the Namulonge Research Station. It was explained that with such an arrangement, the coordination unit will benefit from the organizational infrastructure of the center in carrying out its activities. It will benefit from the secretarial pool, such services as accounting, communication services, administrative support and other research services at marginal cost to the network.

It was further explained that besides the coordinator, who will be based at the center, a regional agronomist will be assigned to the Burundi program and located at ISABU. This agronomist will complement the national breeding expertise in the cassava program. The agronomist would cover both Burundi and Rwanda while the coordinator would work with Kenya, Uganda and Madagascar.

It was explained to the committee that ESARRN is making progress in seeking support for the Southern Africa Network and that the implication of succeeding would be the evolution of ESARRN to EARRNET and SARRNET.

The committee approved:

1. The focus on the 5 countries and stated that efforts be made to strengthen the linkage and get more information on Madagascar.

2. IITA regional center to house the coordination office.

3. For a regionally recruited staff to be stationed in Burundi with ISABU.

4. The evolution of ESARRN to EARRNET and SARRNET.

2. Responsibility

The committee agreed that the Directors Committee shall be the governing body of the network and that the terms of reference to be adapted will be the same as those adapted for PRAPACE Directors Committee. These terms of reference, including that for the steering committee are as follows:

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BYLAWS OF THE EARRNET NETWORK

INTRODUCTION

The East Africa Root Crops Research Network (EARRNET) is a research and development network for cassava improvement in East Africa. It was established in 1993 as an extension of the East and Southern Africa Root Crops Research Network (ESARRN).

The main objective of the network is to improve the production of cassava in the region through promotion of research, institutional development (training and facilities) and technology transfer.

The network include at present the following countries: BURUNDI, KENYA, RWANDA, UGANDA and MADAGASCAR with headquarters to be based in kampala, Uganda.

EARRNET has two governing bodies: the Directors Committee and the Steering Committee. The first is a policy-making body. The second is a research and other activities management body. It also has a Coordinator who is responsible for the general management of the network and an Assistant Coordinator.

The International Institute of Tropical Agriculture is the institution that provides the technical and management backstopping and serves as a liaison between the network countries and the donors.

EARRNET GOVERNING BODIES

The Terms of Reference (TOR) of the various bodies involved in the execution of EARRNET activities are:

1. Directors Committee

1.1 The EARRNET Directors Committee is formed by the National Directors of Agricultural Research of the network countries and a representative of the International Institute of Tropical Agriculture.

1.2 Takes overall responsibility for the proper functioning of the network and its coordinating office including the recruitment of the Coordinator and other internationally or regionally recruited staff, ensuring the progress and success of the network.

1.3 Establishes the general policies and priorities of research in cassava in the network countries.

1.4 Defines the working relationship between IITA and EARRNET.

1.5 Considers and approves the annual plan of work, budget and any suggestions submitted to it by the Executive committee.

1.6 Ensures the timely preparation of progress and annual reports and approves their release for the public as well as donors.

1.7 Organizes and implements a schedule for monitoring and evaluation of the programmes.

1.8 Encourages the publication in referred journals of research results by national scientists engaged in the network.

1.9 Takes any other measures deemed necessary to attain the objectives of the network.

1.10 Appoints a Chairman and Vice-Chairman for the committee among the member Directors, to serve for a period of one year. The chairman is appointed on rotational basis and on alphabetical order of the name of member countries. The vice chairman is the Director of the country next in order for the chairmanship.

1.11 The Chairman directs the network activities and reports to the Directors' Committee. The Vice Chairman replaces the Chairman in case of absence.

1.12 The EARRNET Directors' Committee meets twice a year. The progress appraisal meeting is in the month of April. The planning and evaluation meeting is in the months of August to October to enable the visit to various countries during the growing season.

1.13 Extraordinary Directors' Committee meeting are called by the Chairman or at the request to the Chairman by two thirds of the members of the Directors Committee.

1.14 The venue of the first meeting rotates among the EARRNET countries in the same order as for the appointment of the chairmen. The venue of the second meeting is agreed by the Directors during the first meeting.

1.15 Quorum is established as half plus one the number of members of the Directors Committee.

1.16 The Director of IRAZ (Institut de Recherche Agronomique et Zootechnique de la CEPGL), the Donor(s) representative, and the chairman of the EARRNET Steering Committee may participate, as observers in the Directors Committee meetings.

1.17 The EARRNET Coordinator is the secretary of the meetings of the Directors Committee.

2. THE STEERING COMMITTEE

2.1 The EARRNET Steering Committee is formed by the heads of the national cassava programs of each country of the network, the Coordinator and Agronomist.

2.2 Serves as the technical arm of the EARRNET network towards the attainment of the objectives.

2.3 Prepares and submits medium and long term plans for cassava research for the consideration and approval by the Directors Committee.

2.4 On the basis of long term plans, prepares and submits on timely basis, annual programs and budgets for the Directors committee.

2.5 Executes approved annual plans and submits progress and annual reports through the office of the Coordinator.

2.6 Prepares new projects to further strengthen the EARRNET network.

2.7 Carries out other activities when requested by the Directors committee.

2.8 Appoints a chairman of the meetings to serve for a period of one year. The Chairman is appointed on a rotational basis and on alphabetical order of the member countries.

2.9 The chairman conducts the meetings of the steering committee.

2.10 The Steering committee meets twice a year. The first meeting is in the month of February. Its main objective is to examine the results of research and other activities carried out during the previous agricultural year and on the basis of those results to develop the workplans for the next agricultural year. The second meeting is in the month of August. Its main objective is to examine the progress of the network activities during the previous agricultural season.

2.11 For the analysis of the results to be made during the first meeting each country presents a written report on the previous year.

2.12 Extraordinary meetings of the steering committee may be called upon in case that important issues to be studied develop. These meetings may be called by the Coordinator or at the request to the Coordinator by two thirds of the number of steering committee members.

2.13 The venue of the meetings rotates among the EARRNET countries in the form of one country per meeting, following the alphabetical order of the name of the member countries.

2.14 Quorum is established as half plus one the number of members of the steering committee.

2.15 The Secretary of the meetings of the steering committee is the Coordinator.

3. THE SARRNET COORDINATOR

3.1 The Coordinator is directly accountable to the Directors committee of the EARRNET network.

3.2 Is responsible for the proper organization and functioning of the EARRNET coordinator office and provides dynamic and professional service or effective and efficient implementation of its assigned responsibilities.

3.3 Serves as facilitator in the preparation and execution of annual programmes at national and regional levels.

3.4 Prepares and submits for approval by the Director's committee an annual workplan, including visits to member countries.

3.5 Organizes or helps organize trainings, workplans, seminars etc. in relation to the commodity of the network.

3.6 Helps national programmes in identifying and procuring materials and services relevant for the execution of EARRNET activities.

3.7 Organizes the meeting and field visits of the Directors and Steering Committees.

3.8 On the basis of reports obtained from national program leaders and IITA prepares harmonized technical and financial reports for submission to the Directors Committee on a twice a year basis.

3.9 Prepares and submits, on a timely basis, a quarterly and an annual report of the EARRNET network activities to the Committee of Directors.

3.10 Maintains close contact with the Chairman of the EARRNET network, National Directors of Research of member countries and members of the Steering Committee.

3.11 Assembles and maintains an update data base of network activities.

3.12 Carries out other activities as requested by the Directors Committee and/or coordinator of EARRNET.

3.13 The network Coordinator will be appointed by the Directors Committee for a period of three years, renewable if found satisfactory.

3.14 The Coordinator attends the steering committee meetings as an inherent member and as resource person and provides active support to their deliberations.

3.16 The Coordinator is the liaison between the Directors and steering committees.

4. THE INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE (IITA)

4.1 Provides technical backstopping in the planning, implementation, monitoring and/or evaluation of research programs in cassava within the multi-disciplinary teams in the Region.

4.2 Participates actively in collaborative research with NARS Scientists.

4.3 Facilitates the implementation of training programs of network scientists and technicians.

4.4 Makes available its facilities and expertise in procuring materials and services to the network.

4.5 Assists in identifying and recruiting a network coordinator as and when requested by the Directors committee.

4.6 Assists in any other matter that strengthens the effectiveness of the EARRNET network.

With regards to the recruiting of staff for the network, the directors agree that since the directors committee is not yet a legal entity, it is giving the responsibility to IITA to hire the network's staff in consultation with the committee. The Chairman would be a member of the interview panel.

In compliance with the adapted bylaws of the EARRNET network, the next chairman for the committee was Kenya. Kenya accepted the chairmanship for the one year. Ethiopia is not a member of EARRNET and the next country in alphabetical order was Kenya.

The mechanism for the development of small scale proposals was developed by the steering committee. The committee has set aside 5% of the research budget for special projects or small scale proposals. The criteria established for awarding funds for special projects is as follows:

1. The result must be achievable in the short term.
2. Resource must be available at the NARS for efficient execution of the project.
3. Cost must be reasonable.
4. Result must be published in a referred journal.

3. Priorities, Targets, Assessment

The priority setting mechanism was explained. In the March 1992 steering committee meeting in Lilongwe, each collaborator presented his/her national program's objectives, constraints and priorities. Priorities which were of regional significance were selected as potential topics to be addressed by the network. These were further prioritized based on: Geographical extent of the problem, importance to the farmers, economic impact/potential.
Based on this the priority areas were:

1. Technology transfer and rapid multiplication and distribution of improved planting material.
2. Ecologically sustainable plant protection (ESPP).
3. Impact assessment.
4. Development of post harvest technologies.
5. Germplasm development and distribution.

These priority areas were then shared among the NARS based on its national capacity and resource to undertake the activity and its compatibility with its own objective and priority.

The specific targets and methodologies were spelt out by an inter-Disciplinary working group for each of the five subject areas.

The committee felt that this procedure was an appropriate one to arrive at priorities and to delegate the responsibility to the collaborators.

The capacity of participating programs to multiply and distribute healthy germplasm to their farmers is still a major bottleneck. Most participating countries do not have this capacity for vegetatively multiplied crops. It was further explained that the exchange of vegetative material across borders is prohibited but countries with tissue culture facility can develop this capacity. In the meantime most advance material is coming to the NARS from IITA. However, germplasm material in seed form is exchanged among the countries.

The issue of COSCA survey was discussed and it was explained to the committee that COSCA was looking at general issues on cassava production and processing. The additional surveys being proposed are area specific. For example one of the surveys proposed is to look at the city marketing of fresh cassava root tubers and the various players involved. In the case of Uganda, the COSCA survey has been useful for the design of on-farm test of improved varieties and to design further farm surveys.

4. BUDGET

The Directors Committee reviewed the budget and the cost for Internationally recruited as compared to regionally recruited staff. It was explained that qualified persons from the region are equally eligible for the internationally advertised post. It was further proposed that preference could go to regional persons who meet the qualification for the post.

The committee ratified the revision of the budget. The revisions proposed and ratified we as follows:

1. **Training**

   Because of the short term nature of the project, MSc degree training funds should be converted to regional sub-project funds.

2. **Regional Workshop**

   The regional workshop for 1993-94 has also been converted to regional sub-project funds.

The final total for NARS networking activities is US$398,000 and that for coordination office US$360,000.

The committee wrote an approval note of concurrence with the EARRNET project proposal. A copy of the approval is attached.

The meeting was closed by the current chairman Dr A Mailu.

APPENDIX III.

Workshop on Cassava Utilization

Appendix III.

WORKSHOP ON CASSAVA UTILIZATION
Zimbabwe, Zambia, Malawi, Tanzania, Uganda, Burundi, Rwanda
May 2 - June 3, 1993

OVERVIEW

First Day

Session 1

Cassava processing: Constraints and solutions.

- Lecture: Cassava utilization in Africa.
- Practicals:
  - drying
  - gari making
  - starch production fermentation and post-fermentation processing
  - cassava leaves processing

Session 2

Cassava product diversification:

1. Opportunities in breadmaking

- Lecture: Cassava, food security and income opportunities
- Practicals
  - cassava-wheat composite bread
  - cassava-soy bread
  - cassava starch bread

Second Day

Session 3

2. Novel cassava products

- Lecture: Cassava safety update
- Practicals:
  - cassava biscuits
  - cassava cakes
  - cassava chin-chin
  - cassava chips

Session 4

Wrap up

Equipments and supplies needed for Cassava Utilization Workshop

Oven	- for baking (normal cooking oven)
Food mixer	- one with a bowl and a beater
Kitchen utensils	- baking trays, spoons, spatulas, rolling pin ...

Kitchen scale

Wooden mortar and pestle (traditional design)

Chipping machine (IITA design)

Grating machine (nay design)

Supplies

Cassava flour (any kind)	5 kg
Cassava starch	2 kg
Wheat flour	1 kg
Eggs	48
Margarine	1 kg
Sugar	1 kg
Salt	500 g
Yeast	100 g
Baking powder	100 g

N.B: - Equipments and supplies should be available on the workshop location at least the day before the workshop staring day.

- Participants should be requested to bring as many locally available cassava products as possible.

Schedule of the tour

			Arrival Flight		
May 02 - 09	:	Harare, Zimbabwe	LZ 597	14:35	May 2
09 - 12	:	Lusaka, Zambia	QZ 607	11:25	May 9
12 - 18	:	Lilongwe, Malawi	QZ 562	14:40	May 12
18 - 21	:	Dar-es-Saalam, Tanzania	UM 392	15:05	May 18
21 - 24	:	Kampala, Uganda	BP 252	20:00	May 21
24 - 28	:	Bujumbura, Burundi	PB 705	17:20	May 24
28 - 02	:	Kigali, Rwanda	RY 206	16:30	May 28

APPENDIX IV

Summary and Achievements in Integrated Control of Arthropod Pests of Root Crops

APPENDIX IV.

INTEGRATED CONTROL OF ARTHROPOD PESTS OF ROOT CROPS: SUMMARY AND PROJECT ACHIEVEMENTS

Co-ordination

Visits were confined to those countries who made specific requests for assistance, either in the form of in-country training courses or with specific pest problems. Contacts, however have been maintained with representatives of all ESARRN countries. Attendance at most of the relevant ESARRN meetings has been possible and progress reports have been given where appropriate.

Since the beginning of the programme in February 1989 until November 1992 eleven ESARRN countries were visited including Burundi (six times), Ethiopia (once), Kenya (host country but also specific visits were made, see Annex 1), Madagascar (once), Malawi (twice), Tanzania (three times), Rwanda (five times), Uganda (nine times), Zambia (three times), Zanzibar (once), Zimbabwe (once). Member countries of ESARRN that were not visited included Angola and Mozambique. Visits were also made to IITA Benin (four times), Zaire, Ghana, Brazil, United States and Amsterdam (usually in the form of combined activity visits).

Ms Allard and/or Mr Rangi acted as resource persons in six in-country training courses held in Ethiopia, Kenya, Rwanda, Malawi, Uganda and Zambia.

In total three workshops were organised by IIBC. In August 1992 two workshops were held concurrently in Mombasa, Kenya organised in collaboration with KARI. A National Workshop on Integrated Pest Management of Root and Tubers was held from 3/8/92 - 7/8/92, there were twenty-one participants from Kenya and eighteen papers were presented. A Regional Workshop on Integrated Pest Management of Root and Tubers was then organised from 10/8/92 - 14/8/92, in collaboration with KARI, IITA and CIP. There were twenty-nine participants from Burundi, Kenya, Ethiopia, Tanzania, Zanzibar, Zambia, Uganda, Mozambique, Rwanda, Madagascar, Malawi and representatives from IITA and CIP; twenty papers were presented. Proceedings of both workshops are being published.

Four ESARRN meetings were attended; the Fourth ESARRN Workshop held in Zambia, two Steering Committee Meetings held in Nairobi and Ghana and an impromptu Heads of Root and Tubers Meeting held in Ghana.

Financial and technical support has been provided to National Programmes under this project and provision has been made to continue support of small scale field trials in root crop pest management in Burundi, Zanzibar and madagascar.

Cassava

Collaborative links have been maintained with IITA since the beginning of the programme, but the nature of joint activities has altered in response to the changes in the respective programmes. Initially IIBC was involved in cassava green mite surveys in Uganda, Rwanda and Kenya carried out by national staff members and IITA. IIBC assisted with biological control of cassava mealybug in Kenya and in Rwanda, including both pre and post release surveys and releases of natural enemies.

With an established IITA presence in Uganda, IIBC's involvement when cassava mealybug finally reached Uganda in 1992 was not required. However, prior to the invasion of cassava mealybug IIBC had been involved in survey and training activities associated with the pest.

Burundi, Rwanda and Tanzania now have active rearing units for natural enemies of cassava mealybug, thus the necessity for handling shipments through Nairobi with the co-operation of the Quarantine Department of the National Agriculture Research Laboratories, KARI has not been necessary in the latter phase of the project. A cassava mealybug rearing unit has also recently been erected in Uganda.

The shipments handled through Nairobi throughout the duration of the project are listed in Annex 1. The biocontrol aircraft has now been dismantled and relocated. The last shipments which passed through Kenya quarantine were eight consignments of E. Lopezi for Tanzania and one of natural enemies for Kenya in November 1990. There have been no shipments of predatory mites for control of cassava green mite as this programme is also in a transitional phase awaiting new developments on the introduction of the predatory mite Neoseiulus idaeus from Brazil and on entomopathogenic fungi from Brazil, Neozygites sp. Mr George Odour (KARI Entomologist) is now in Brazil for Ph.D. studies on the application of entomopathogens for control of cassava green mite, sponsored through IITA.

In Kenya, Epidinocarsis lopezi released in Western Kenya in 1990 has been recovered, and identification confirmed by Dr P. Neuenschwander of IITA/BCP. The cassava mealybug is spreading in Western Kenya but Dr Neuenschwander is confident that the infestation is under control. Mr Charles Kariuki, previous Head of Biological Control, KARI Muguga (now on Ph.D. studies in USA), has established that parasitised cassava mealybug are present on the Kenyan coast where no releases of E. lopezi have been made. The nearest release site was on the Island of Pemba and in Tanga, Tanzania. The cassava mealybug is spreading along the coast but the natural enemies are moving with the pest. Since the assistance given to the National Programme with the release of natural enemies in Western Kenya, IIBC's role has become advisory rather than active except for assistance given with a survey along the Kenyan Coast in 1992.

In Rwanda establishment of natural enemies released in 1990 have been confirmed and the situation is now under control although naturally cassava mealybug has spread into new areas. The situation is closely monitored.

Through this programme arrangements were made for one biological control scientist from Kenya and one from Uganda to accompany Ms Allard on a visit to Burundi to observe at first hand the rearing units for cassava mealybug natural enemies. A combined visit was also made to Zaire with ISABU to assist in informal training on cassava mealybug and a linkage has been established between the two countries.

Visits were made to EMBRAPA, Brazil and to the university of Amsterdam Phytoseiid Rearing and Investigation Laboratories to observe at first hand the up-to-date techniques employed. Both these visits were combined with other scheduled activities.

In 1992 the Co-ordinators' time was divided between this programme, the Banana Programme and the Regional Biological Control Programme for Conifer Aphids therefore there was some overlap of activities and country visits were combined. Specific visits for root crops included Burundi (five times), Madagascar, Zaire and Zanzibar.

Sweet potato

Survey sampling methods for sweet potato pests have now been further revised and finalised after extensive testing in the field in Kenya and Malawi in 1990 and Tanzania and Zambia in 1991. The version presented in Annex 2 was finalised at a regional workshop held in August 1992 in Kenya and was the result of intensive discussion by all members of the workshop thus representing the combined efforts of eleven countries. The aim to standardise data collection on the distribution, abundance and damage caused by sweet potato pests throughout the region. CIP and KARI scientists have used these methods extensively in the field and have collected valuable data.

Collections of the pests attacking sweet potato have been made and have been identified by IIE and these are listed by country in Annex 5. Searches by IIBC, CIP and National Programmes for natural enemies of Cylas spp. and other sweet potato pests hav continued and these collections have been identified by IIE (Annex 5).

Methods of collection and mounting have been demonstrated and mounted labelled insects have been dispatched to the appropriate countries.

APPENDIX V.

Progress of Multiplication and Distribution of Cassava and Sweet Potato Planting Material in Malawi

Appendix V.

PROGRESS OF MULTIPLICATION AND DISTRIBUTION OF CASSAVA AND SWEET POTATO PLANTING MATERIAL IN MALAWI

PROGRESS REPORT NO. 2

Introduction

This report focuses on the present post-drought demand and future challenges of the Malawi Root Crops multiplication and distribution system (NRMDS) and the role that is being played by collaborating NGO's in helping to meet this challenge.

There is a rapidly changing atitude among farmers and policy makers as well, towards the important role that root crops can play in meeting the rapidly growing food demand of Malawi. The dynamics of a rapidly growing population and the national economics of food production during a post drought period has curved out a greater role for root crops within the food system.

The base for the establishment of the national capacity is taking roots and is being driven by the farmers' demand. NGOs, extension workers and farmer to farmer linkages have been established and playing a key role in the rapid integration of improved technology in the small-scale farming system of Malawi.

Purpose of the System

The purpose of the National Rootcrops Multiplication and Distribution System (NRMDS) is to develop the national capacity to multiply and supply healthy planting materials of cassava and sweet potato within the framework of a long term action plan, which includes varietal evaluation and selection, development of effective propagation and management protocols, problem diagnoses and information transfer to "seed" producers. The development of an effective multiplication and distribution system is central to the realization of a sustainable food security capacity.

Initial Background Analysis

Following the launching of NRMDS an initial preliminary survey has been conducted in the Lilongwe Agricultural Development Division (LADD). From two Rural Development Projects (RDP), three Extension Planning Areas (EPA) were selected. In each of these EPAs the main staple is maize with sweet potato and cassava as secondary crops. On the average a higher percentage of farmers grow more cassava than sweet potato. The sample of farm size conform to the national classification, in which the household in the sample area are seen to consume root crops as secondary crops.

In these areas after the main maize crop harvest in April - May.

secondary crops take over with sweet potato first and cassava later. The crops being harvested as needed from May to August for sweet potato and up to November - December for cassava. The total number of farm families and the percentages growing cassava and sweet potato in the study area is shown in Table 1.

Table 1

Total number of farm families and percentage of farmers growing sweet potato and cassava in the study area*

EPA	NUMBER OF FARM FAMILIES	PERCENTAGE GROWING	
		SWEET POTATO	CASSAVA
NAMITETE	5,680	27	11
BUNDA	16,367	37	56
DEDZA	1,132	38	44

* Source: Data from EPA Offices in study area

From a cassava and sweet potato survey conducted in Malawi, prior to the drought, more than 22% of the villages surveyed ranked the crops as either the first or second most important crop. This preliminary post drought survey in one agricultural development division revealed that more than 70% of farmers grew cassava and sweet potato for both food and cash. In terms of hectarage under cultivation, the area cultivated by both crops jointly is second to maize (Table 2).

Table 2

Average area under cultivation of various crops grown by farmers in LADD

	AREA UNDER CULTIVATION (HA)	
CROPS	LOCAL	IMPROVED
Sweet potato	.24	.23
Cassava	.44	-
Maize	.72	.65
Other*	.54	.51

* Others include Tobacco, Pulses, Vegetables

Based on results from on-farm testing for sweet potato for the past four years in several locations, there is enough conviction among the farmers about the productivity of improved varieties

(Table 3). It is expected that sweet potato yield will increase because of the introduction of high yielding varieties and increase in area of production. There is also a shift to monoculture of the crop when grown as a cash crop.

Table 3

Performance of sweet potato varieties in on-farm trials in LADD.

VARIETY	MEAN YIELD (T/HA)
Kenya	11.5
TIS 3017	10.8
TIS 2534	8.5
LRS 407	5.3
Local	4.1

While farmers are convinced about the productivity of improved varieties, the availability of planting material remains a leading constraint to adaptation. The reason for limiting the area under cultivation is shown in Table 4. The data reveal that lack of planting material was a major constraint. This means that there is a large increase in the demand for plannting material and is expected to go up during this coming season (1993-94).

Table 4

Limiting factors for cultivating cassava and sweet potato

	% Of Farmers	
Reasons	Sweet Potato	Cassava
Lack of Planting material	47	43
Insufficient land	27	19
Both land and planting material limited	12	10
Pests and diseases	-	5
Others*	14	24

* Others include labour, poor yield, market problem and theft

The distribution of farmers growing the crop in LADD based on this survey is shown in Table 5. It shows that 63% of sampled

farmers grew sweet potato during the past season. 13% produced cassava and 25% grew both crops.

Table 5

Distribution of sweet potato and cassava farmers in the study area

Crop	% OF GROWERS
Sweet potato	62.5
Cassava	12.5
Sweet potato & Cassava	25

The data also showed that there is a shift in the proportion of farmers growing the crops, more farmers were growing more sweet potato than cassava. This is slightly different from the EPA data, indicating that in this post-drought period more farmers are now growing sweet potato compared to earlier years. Of the 87.5% of the respondents more were growing sweet potato either solely or in combination with cassava.

A 1991 survey showed that the survey area had only about 3% of farmers growing improved sweet potato varieties and only 1 variety, Kenya was reported by farmers. This 1993 preliminary survey shows that almost 29% of farmers are now growing improved varieties of sweet potato and the varieties reported were Kenya, LRS 407, TIS 3017 (Fig. 1). This is a confirmation that the technology is spreading and is being adapted. This trend was further reflected in the increase in production as shown in Figure 2. The 1990-91 increase could be attributed to the promotional efforts of the network in collaboration with the national program, extension agents and NGO's in the Lilongwe ADD.

This rapid increase in the spread of sweet potato varieties and the slow pace of cassava is because of the slow multiplication rate of the cassava. However, the demand for improved cassava planting material is high. More than 75% of farmers in the survey area requested for cassava planting material compared to 69 % requesting for sweet potato. Furthermore, the three years of sweet potato on-farm testing with full participation of the farmers and the catalytic role that the network played in bringing research and extension involved in spreading the technology, could have made significant contribution to hasten the adoption of sweet potato.

This shows that most of the target farmers are aware of the improved cassava and sweet potato planting materials (Fig. 3). This awareness along with GoM's encouragement for diversification has created demand for planting material. Under the present circumstances of growing demand and the limited multiplication rate of cassava, availability of planting material is still in short supply.

All the cassava farmers interviewed grew only the local variety, the main reason being the lack of planting material for improved varieties. There is a growing desire among farmers to increase their production of better varieties (Table 6).

Table 6

Reasons for growing local varieties of sweet potato and cassava

REASON	% OF FARMERS	
	Sweet potato	Cassava
High yield	8	10
Good storage ability	22	14
Lack of improved varieties	34	16

Many farmers are now aware of the existence of improved varieties and have expressed interest to obtain them. The farmers who already had the improved varieties were under pressure from other farmers to share. The extent of farmers awareness and farmer to farmer distribution of planting material is shown in Figures 3 and 4.

This survey showed that the main reason given by most of the farmers for growing only small plots of cassava and sweet potato was the unavailability of planting material. These farmers have also expressed their willingness to increase hectarage of both crops if planting material becomes available. Of the fifty six farmers questioned in the survey area, more than 96% indicated that they would be prepared to expand production by more than 1 ha for cassava and .8 ha for sweet potato. All the farmers were prepared to be collaborators in sweet potato multiplication and 90% of the farmers for cassava. In the case of cassava, land shortage was the main reason given for not wanting to multiply cassava.

Of the farmers who have received the sweet potato varieties, 86% considered the yield to be very good as compared to the local check and 14% ranked them as good yielding. No farmer categorized the yield of improved lines as poor. On the other hand, 57% of

farmers considered the local varieties to be poor yielding and only 28% considered them good. Yield results of on-farm trials of sweet potato is shown in Table 3. For cassava, only 43% considered the yield as good.

The analysis of estimated cost and returns for sweet potato and cassava enterprise is shown in Table 7.

Table 7

Estimated costs and Returns of growing sweet potato and cassava

CROP	ESTIMATED		
	Expenditure	Gross Returns	Gross Margins
IMPROVED			
Sweet Potato	79.96	475.03	395.07
LOCAL			
Sweet Potato	74.55	277.79	203.24
Cassava	116.47	601.99	485.52

Figures expressed as MK/ha (US$1.00 ~ 4.2MK)

The highest gross margin of MK485.52/ha was obtained from growing cassava and followed by improved sweet potato with MK395/ha. Although they are not the main crops in the survey area, the analysis shows that they are an important source of food and cash. This was further substantiated by the farmers. Ninety-five percent of farmers considered cassava growing to be profitable while 100% of farmers growing improved sweet potato and 94% of those growing local varieties considered them profitable. In this survey area small farmers can manage to earn more from these secondary crops than from the same area of the primary crop.

The overall comparative analysis of the performance of improved versus the local varieties of sweet potato is shown in Table 8. The analysis by the farmers show that the improved lines have many advantages but ranks below the local lines for storage ability and drought tolerance. These characteristics will be very important traits of new varieties to be introduced into the system.

Table 8

Farmers comparative analysis of the performance of improved and local sweet potato varieties

Criteria Used	Percentage Performance		
	Local	Improved	No Difference
Low input requirements	14	21	64
Good Yield	-	100	-
Disease resistance	36	64	-
Pest resistance	29	43	29
Drought resistance	21	14	64
Good storage ability	86	-	-
Good processing characteristics	29	50	21
Good consumer acceptance	36	57	-
Others*	14	71	14

* Include flavour, fleshy tuber, non fibrous

This preliminary analysis has revealed the extent of interest in these sweet potato and cassava varieties. There is an overwhelming eagerness to obtain both cassava and sweet potato varieties. Despite the present limited supply more than 60% of farmers who already have improved lines are sharing with other farmers. Most farmers are also prepared to expand their root crops production area. This could be a clear indication of its profitability as well as the potential sustainability of this multiplication and distribution system.

Implications

A review of the data from the Division's crop estimate data showed an increase in production during the 1990/91 season. This increase could be a reflection of initial activity of network in collaboration with research and extension in this devision. The impact of the drought during 1991/92 season resulted in a striking reduction in yield and area under production. Fig. 5 shows the profile of production and hecterage under production and effect of the drought year on productivity. There was a decline in production from 78,000 tons to 17,000 tons in the drought year.

The study confirmed that a major problem that needs to be addressed is the lack of planting material. The data from the first year of implementation of a simple multiplication and distribution model is resulting in a rapid increase in production

for exceeding the pre-drought period (Fig. 2). The benefits to farmers of this multiplication and distribution system and its potential sustainability will be studied and documented.

The system is very much in the process of being adapted as most farmers are now aware of improved varieties and the importance of good quality planting material. The performance of root crops during the drought year and their impact in the post-drought period is not only well known to the farmers but is equally attractive to a broad range of NGOs for support. This interest and support has lead to a dramatic increase in efforts in the multiplication and distribution of root crops.

The distribution projection is being met and efforts are in progress to ensure that the service is established and delivering high quality planting material. Today, more than 3 million cuttings have been distributed to farmers, NGO's and collaborating agricultural development divisions ADD's. More than four thousand farmers have benefitted from this service resulting in the planting of an additional 90 ha of sweet potato. The momentum is growing among farmers who have planned to adopt the technology.

The 2 year accumulation of increase in hecterage and locations is shown in Fig. 6. This figure demonstrates the rate of increase of hecterage and number of multiplication sites. The figures show that the rate of increase for sweet potato is higher than that of cassava because of the slow multiplication rate of cassava.

There is now an increasing demand not only for improved varieties but for the development of expanded nurseries as well. This development will bring about a fundamental change in the long term to the increase in production and sustainability of root crops in Malawi and as consequence strengthen the food security.

The network has anticipated and reacted positively to these changes. Understanding the growing needs facing root crops production has helped the network to develop the necessary action steps to deal with them. NGOs and extension staff are collaborating with the network in the transfer of information and technology on root crops.

Monitoring Visits

Health conditions and sanitation practicies are important factors in the vegetative propagation of planting material. These are taken into account in this system. Regular monitoring by pathologist and virologist is done in order to minimize the chances of disease spread. During this period monitoring visit to the major multiplication sites was made by virologist from IITA and NRI. This was within the framework of backstopping support to the network.

Their findings indicated that at the lower altitudes the incidence of Brown Steak Virus in the multiplication plots of cassava is high. Actions are underway to get a better understanding of the etiology of the disease. The sweet potato multiplication plots were all in a clean state.

Expansion Activities

In the lowland hydromorphic/"dambo" areas, which are generally considered less favourable ecologies, "off season" secondary crops are usually grown on a very small scale during the dry cool months. However, during such seasons these secondary crops do play a very important role as a source of cash and contribute to crop diversity.

Generally, these ecologies are underutilized but with proper management could contribute greately to increase overall annual production. In an effort to realize this potential, the multiplication and distribution system will expand its activities to these lowland areas. The objective of the hydromorphic winter nursery intensification is as follows:

1. To enable major growing areas to generate their own planting material in sufficient quantity and at the right time at minimal cost.

2. To establish model nurseries which will be used to demonstrate improve management practices for the production and maintenance of healthy planting material.

3. To suppliment the food supply at the end of the dry season i.e. increase cropping season to 2 or 3 per year.

The network, along with EPA lead farmers, extension workers and other NGOs will establish model village nurseries in order to assess the kind of inputs that might be needed. Resource persons from within the area will be trained in order to take lead role in developing distribution strategies and monitoring.

Fresh cuttings of sweet potato and cassava can deteriorate rapidly with poor handling procedures. These sites will serve as centers for training cooperators and farmers on proper handling methods for storage, packaging, transportation and distribution of the cuttings to ensure that farmers receive high quality, viable planting material.

Table 9 shows the major areas for the expanded activities and Table 10 shows the number of NGOs involved in the NRMDS of Malawi. It is envisaged that the extended use of the wetlands will help the farmers to get more farm income from these secondary crops. This system will enable the farmers to grow up to 3 crops per year and at the same time increase their total crop worth. The proposed

expansion strategy is shown in Appendix 1.

The supply of planting material of improved cassava and sweet potato varieties to farmers in Malawi is receiving more attention. There is a growing trend of increase in area and location of multiplication sites. A strong linkage has been established between the network and NGO's for the multiplication and distribution of planting material. It is envisaged that this will expand and hasten the degree of adoption, cultivation and use of these varieties for both food and cash.

Table 9
Areas targeted for winter nursery expansion in the Central Region

RDP	EPA	No. of Locations	No. of groups Affected	No. of Nurseries	Estimated Area
Lilongwe West	Mpingu EPA 2	-	5	7	.75
	Mlombe EPA 12	3	2	2	.5
	Nathenje	4	4	4	.5
Dedza Hills	Bembeke EPA 8	2	1	2	.1
	Ntcheu	2	2	2	.1
Liwonde/ Malindi	Lungwena	11	8	10	2

52

Table 10.

NGOs INVOLVED IN THE NRMDS OF MALAWI

ORGANIZATION	LOCATION	TYPE OF ACTIVITY
Adventist Development Relief Agency (ADRA)	Blantyre	Nursery establishment and distribution of planting materials
Baptist Mission in Malawi	Balaka	Nursery establishment and distribution of planting materials
Christian Service Community	All Regions	Nursery establishment and distribution of planting materials
Save the Children's Fund	Central	Distribution of planting materials
UNICEF	Central	Nursery establishment and distribution of planting materials
FAO	Northern and Central Regions	Technical and vehicle support: nursery establishment and distributions of planting materials
Several Farmer Groups	All Regions	Nursery establishment and distribution of planting materials
World Vision International	All Regions	Nursery establishment
Evangelical Alliance for and Development	Central Region	Nursery establishment

DISTRIBUTION OF SWEET POTATO ACCORDING TO VARIETY

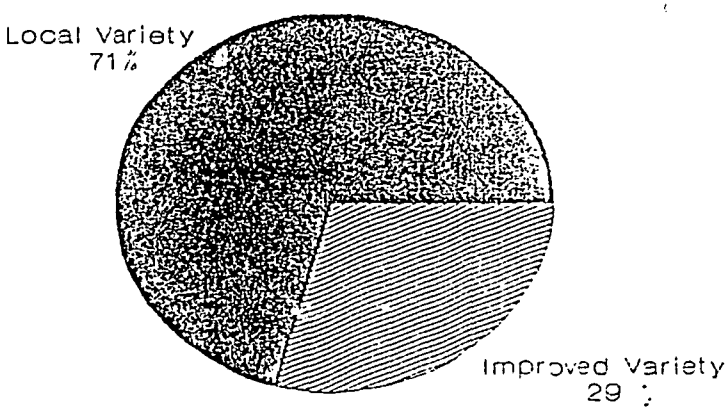


Fig. 1

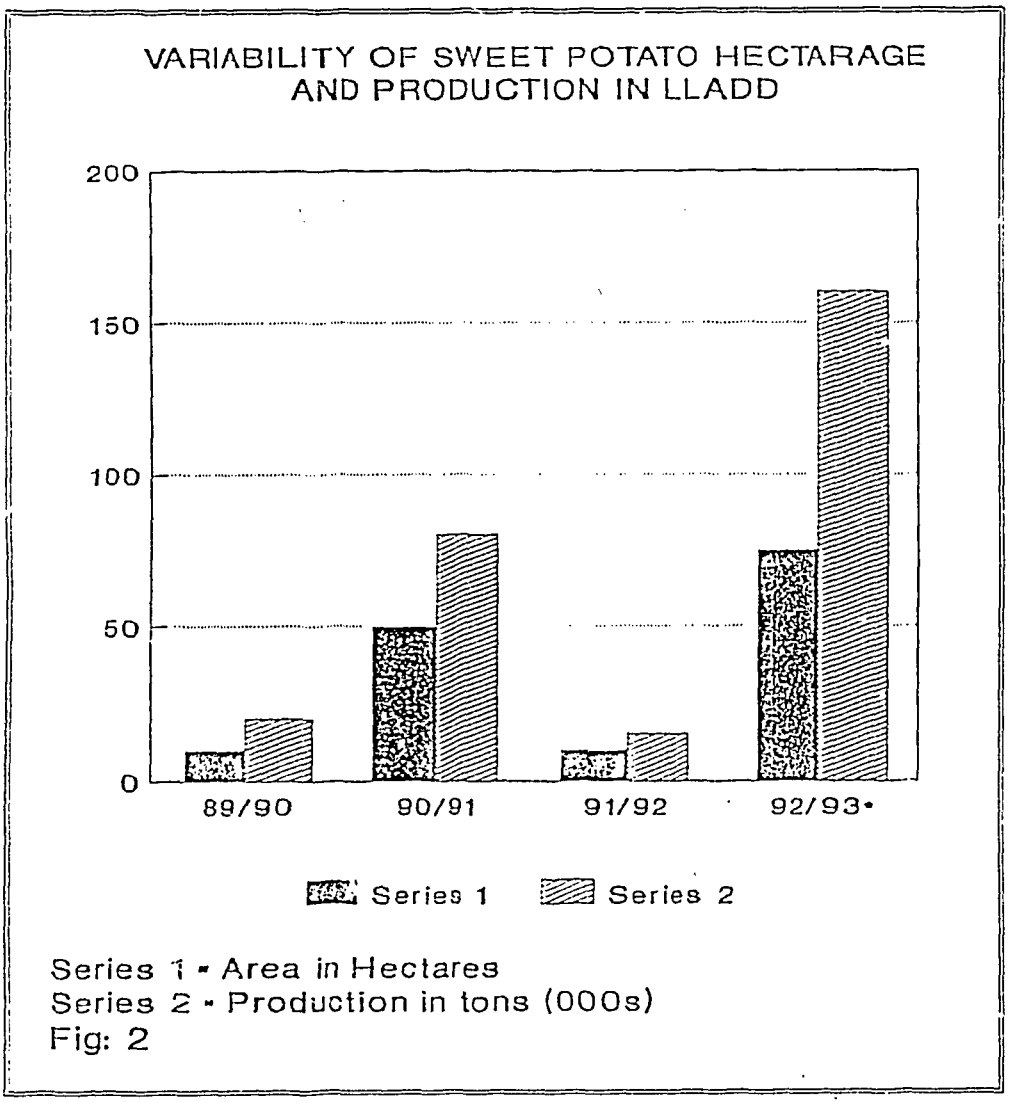


Fig: 2

* 1992/93 FIGURES IS A PROJECTION BASED ON VINES DISTRIBUTED

PERCENTAGE OF FARMERS INDICATING AWARENESS OF AND INTEREST IN THE IMPROVED SWEET POTATO VARIETIES

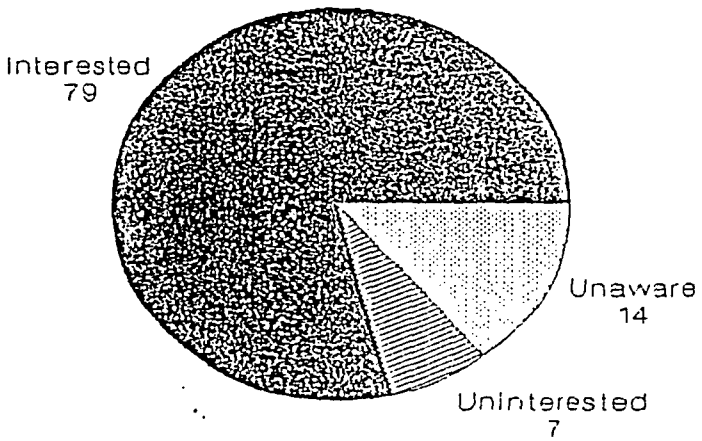


Fig: 3

86

EXTENT OF FARMER TO FARMER DISTRIBUTION OF IMPROVED PLANTING MATERIAL

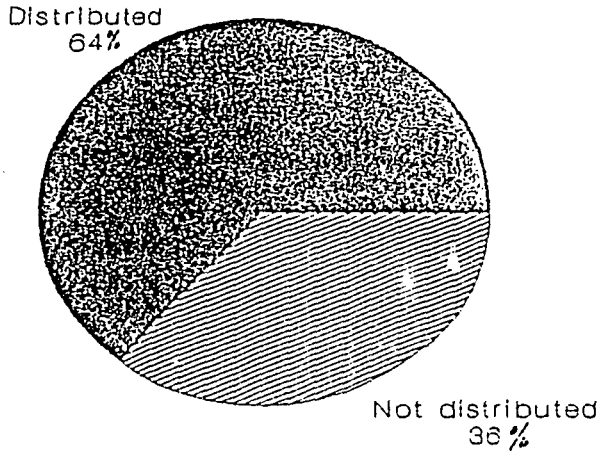
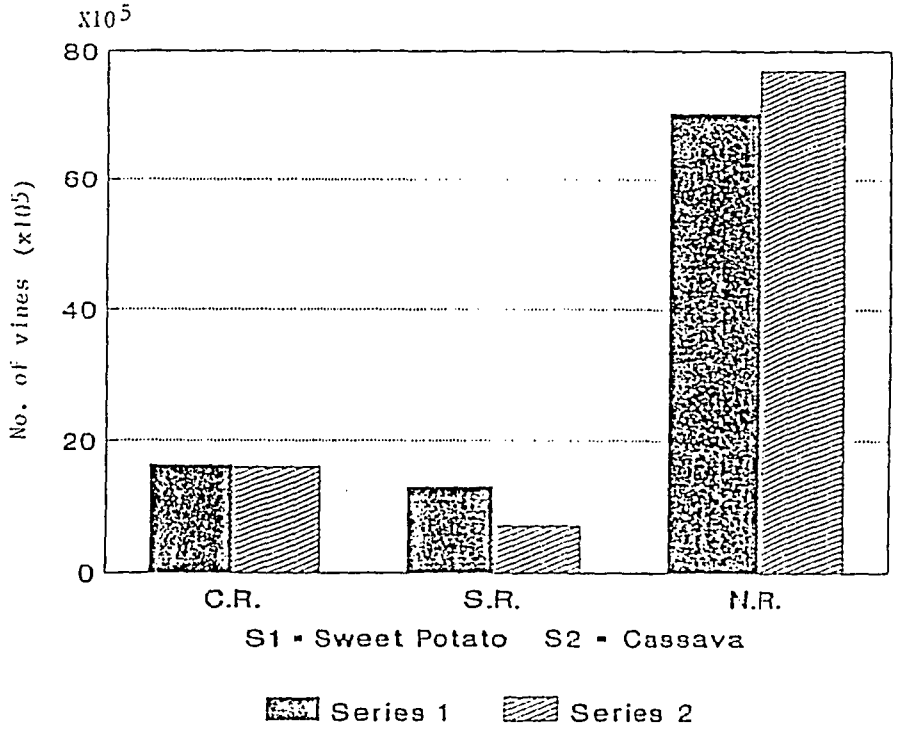


Fig. 4



No. of farmers - >1000
No. of material - >3M

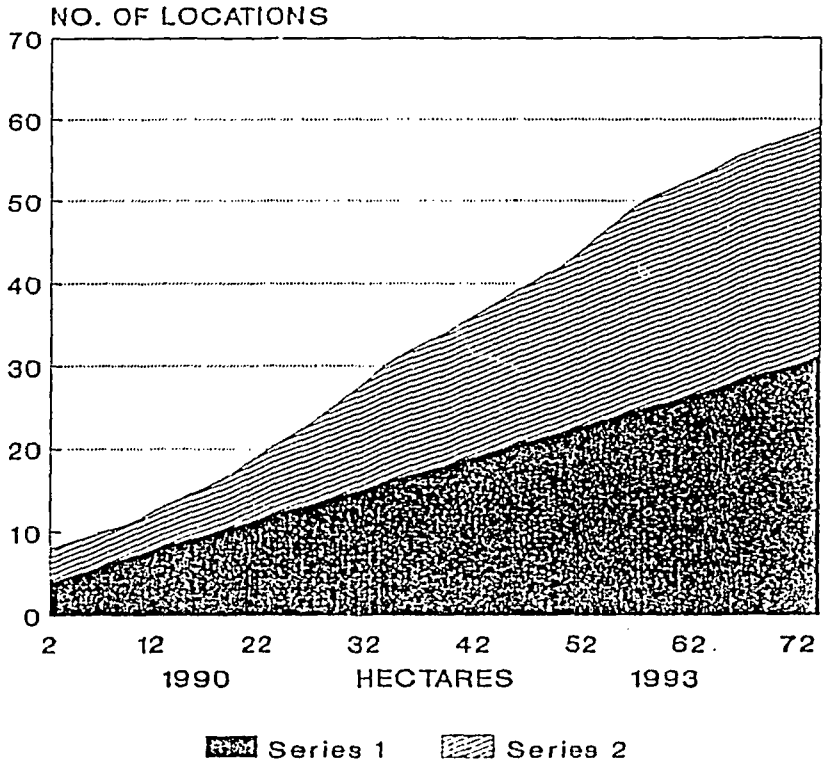
Fig. 5

C.R. = CENTRAL REGION

S.R. = SOUTHERN REGION

N.R. = NORTHERN REGION

CUMULATIVE GROWTH OF HECTERAGE & LOCATIONS OF CASSAVA AND SWEET POTATO PLANTING MATERIAL MULTIPLICATION IN MALAWI



Series 1 = Cassava
Series 2 = Sweet Potato

Fig. 6

PROPOSAL FOR SWEET POTATO AND CASSAVA MULTIPLICATION PROGRAMME

Use of hydromorphic wetlands for intensive nursery production of planting material

Introduction

Recent studies have shown that there is wide range of acceptability by farmers of the improved varieties of especially sweet potato introduced in the country by IITA/ESARRN. Demand for these varieties are ever increasing as more and more farmers are switching into producing them mainly because of their high yielding and early maturing characteristics. For the past 4 years, sweet potato farmers have had to rely mainly on IITA/ESARRN and the National Research Stations in some cases, for the supply of planting material during each growing season. This is because majority of the growers had always discarded their vines at the end of one season and looked forward to receiving fresh planting material at the beginning of the other. The situation has placed great strains on the programme's resources since it had to cater for both the old and new growers each year. As ESARRN's goal is not only focussed on the acceptability of these varieties but also the sustainability of the programme, a new system has to be developed in which farmers will be encouraged and assisted to be self-reliant in planting material. The most feasible system envisaged is the one in which farmers should establish permanent nursery sites for the multiplication of these varieties to meet their yearly needs. IITA/ESARRN in return, should provide the technical and some financial assistance for the establishment and maintenance of these multiplication sites.

Objective

a. To enable major growing areas to generate their own planting material in sufficient quantity and the right time at minimum cost.

b. To establish model nurseries, which will be used to demonstrate improved management practices for the production and maintenance of healthy planting material.

c. To supplement the food supply at the end of the dry season.

Methodology

The main aim of IITA/ESARRN is to achieve the adoption and sustainability of the improved sweet potato and cassava varieties. In the light of this, a number of farmers/groups of farmers will be selected from the numerous sweet potato and

cassava growers. Selection will be based on a number of socio-economic criteria including:

(i) availability of the lowland (dambo) areas to the farmers/groups of farmers for permanent utilization (especially for sweet potato multiplication);

(ii) the number of growers of these crops in the area and importance of these crops in the community;

(iii) the willingness of the farmers/groups of farmers to develop and maintain permanent multiplication sites for future uses;

(iv) the willingness of the growers to be contact farmers for ESARRN for testing future on-farm trials and other innovations;

(v) accessibility of the multiplication sites; and

(vi) the farmers' ability to provide sufficient labour and other inputs required for the programme.

At the end of the selection exercise the selected farmers will have to undergo a short training programme which will focus mainly on nursery management. Thereafter, planting material will be supplied to these farmers/groups of farmers. ESARRN personnel will make effective follow up of all subsequent activities to ensure a successful development of these nurseries. Labour and some other inputs will have to be provided by the farmers. Once successfully developed the farmers will be encouraged to maintain these nurseries for successive uses. They could be used as training sites for would-be interested farmers from other areas. They could also serve as distribution points for planting material for farmers from neighbouring communities. This method of distribution is one of the most effective as recent study showed that over 60% of the farmers obtained their sweet potato planting material through farmer-to-farmer distribution network.

It is hoped that the successful accomplishment of this new system will make the farmers less dependent on ESARRN and NARS for planting material and move the multiplication and distribution system closer to sustainability. Schematic representation is shown on Fig. 1.

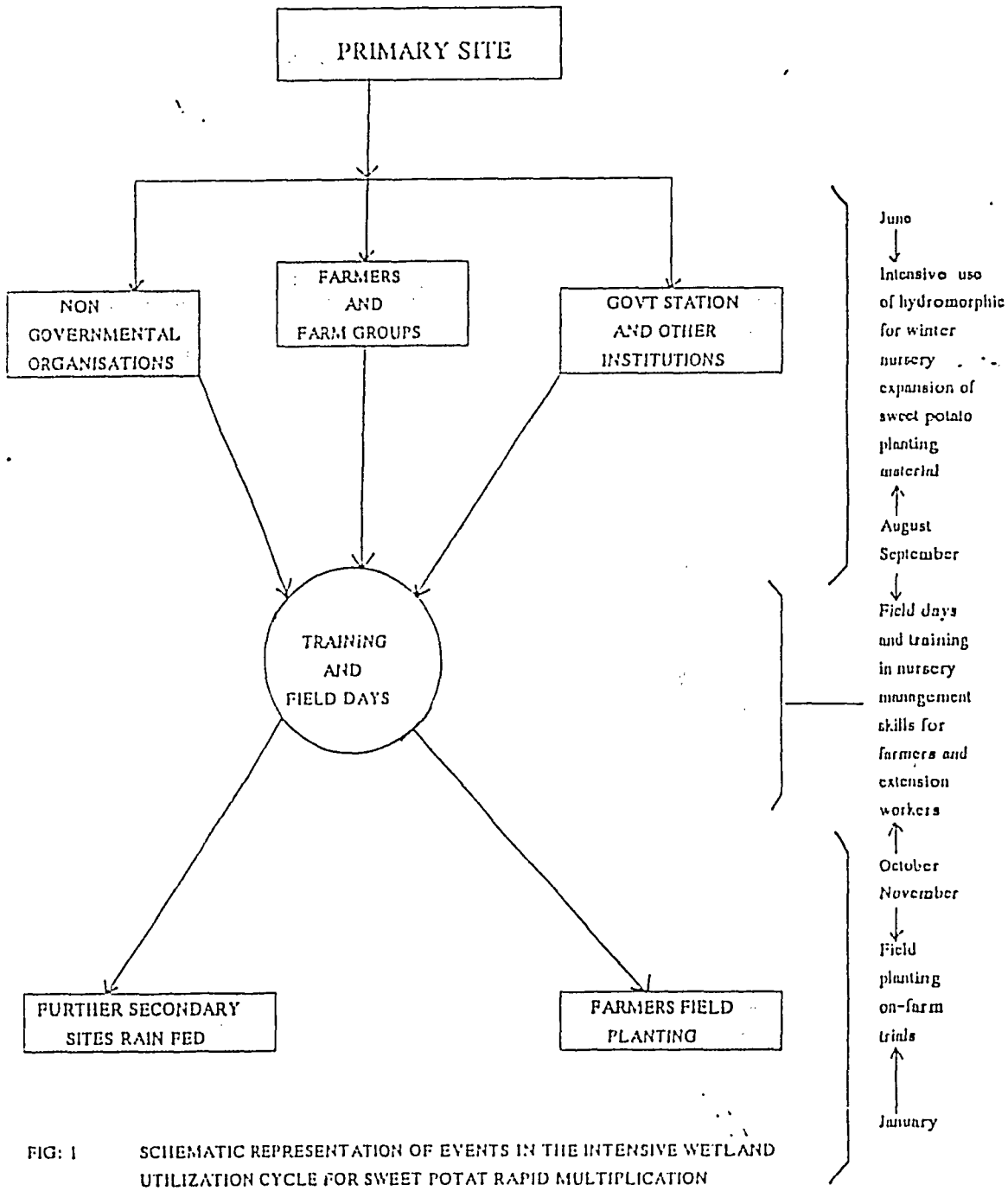


FIG: 1 SCHEMATIC REPRESENTATION OF EVENTS IN THE INTENSIVE WETLAND UTILIZATION CYCLE FOR SWEET POTAT RAPID MULTIPLICATION

APPENDIX VI.

Accelerated Multiplication and Distribution of Improved Cassava and Sweet Potaoto Planting Material as a Drought Recovery Measure in Malawi

Appendix VI.

ACCELERATED MULTIPLICATION AND DISTRIBUTION OF IMPROVED CASSAVA AND SWEET POTATO PLANTING MATERIAL AS A DROUGHT RECOVERY MEASURE IN MALAWI

EXECUTIVE SUMMARY

Cassava and sweet potatoes are traditionally important food security crops for small holder farmers in Malawi. The proven ability of cassava and sweet potatoes to produce substantial amounts (15-20 metric tons) of food/hectare with minimal inputs under poor soil fertility and moisture conditions give them an important role in preventing famine. The Government of Malawi is actively encouraging smallholder farmers to intensify production of these two crops to help alleviate the food and nutrition crisis caused by the devastating drought affecting the region. As a result, the demand for cassava and sweet potato planting material has increased dramatically during the 1992-93 season and is expected to continue in the coming production seasons. However, Malawi's present system of producing planting material is unable to provide the quantities needed to meet the growing demand.

Significant progress has been made in cassava and sweet potato multiplication and distribution by the International Institute of Tropical Agriculture through a $201,780 famine mitigation grant by USDA/OICD. Over 80% of the 20 proposed primary multiplication sites have been planted with cassava (75% of total area) and sweet potatoes (25% of total area). Planting materials from these sites are however still being used to expand multiplication in other sites with the result that farmers' demands for these improved materials are still not being met. Preliminary impact assessment results showed that over 70% of farmers still use local varieties. Most of the farmers planting local varieties have indicated a willingness to be involved in cassava and sweet potato multiplication activities.

The IITA cassava and sweet potato project has also strengthened linkage between the National Root Crops Multiplication System (NRCMS) and non-governmental organizations involved in root crop technology transfer at farm level. Short term training courses were provided to NGOs in collaboration with IITA/ESARRN. The overall effect is that cassava and sweet potato multiplication and distribution activities have intensified, but demand gaps still exist.

This proposal by IITA seeks funding from the United States Agency for International Development (USAID) for a sustainable program to increase capacity and accelerate the production of cassava and

sweet potato planting material in Malawi and to distribute the material to smallholder farmers to help mitigate the impact of drought induced food shortages. This support will expand the multiplication efforts already underway through international organizations such as FAO, UNICEF and NGOs to produce a significant expansion of the cultivated area planted in these two crops.

The International Institute of Tropical Agriculture, through its East and Southern Africa Rootcrops Research Network offices in Malawi, will manage the overall effort in the establishment of multiplication sites. It will provide training, technical advice and support to cooperating organizations, extension agents, NGOs, farmers, etc.

This proposal seeks a total of $250,000 from USAID/Malawi to multiply improved varieties of cassava and sweet potatoes at 20 primary and 50 secondary multiplication sites, distribute sufficient planting materials for resource poor farmers to plant a total of 5,500 more hectares (0.05 ha/farmer) of sweet potatoes and 3,000 more hectares (0.01 ha/farmer) of improved cassava varieties. Part of the funds will be used to train extension agents on modern techniques of cassava and sweet potato propagation, multiplication, and distribution. The project will be implemented in collaboration with Malawi National Root Crops Improvement Program cooperating with international organizations, extension agents, and NGOs to establish and manage the multiplication sites and assist in distribution to farmers.

BACKGROUND

Smallholder farmers in Malawi depend upon root crops, especially cassava and sweet potato, as a dietary supplement and a major source of energy and nutritional requirements. Cassava is second only to maize as a source of dietary carbohydrates.

The production characteristics which make cassava and sweet potato particularly valuable with respect to family food security in Malawi are that:

1. They are tolerant to marginal soil conditions, such as low fertility and high acidity.

2. They tolerate environmental stress, such as drought and insect pest, and recover rapidly when moisture is available.

3. Cassava and sweet potato are relatively high yielding compared to other staple crops and provide an excellent source of carbohydrates.

4. Cassava can be harvested anywhere from 6 to 36 months after planting, and sweet potato anywhere from 3.5 to 8 months

after planting. Both crops remain well preserved underground within these time periods, and can be harvested as needed. They therefore constitute a relatively permanent source of food for resource poor farm families.

The agricultural sector in Malawi provides a livelihood for nearly 90% of the population, most of whom are subsistence oriented. In the best of times access to adequate food supplies for much of the population represents a major challenge. However, the 1991-92 drought made the normal situation much worse, requiring special efforts if Malawi's rural people are to emerge with a relatively stable source of food.

The Government of Malawi (GOM) is currently emphasizing the production of root crops as a means of addressing the food shortage caused by the current drought, as reflected in the following policy statement:

> "Root and tuber crops are important, especially as a source of food and cash. Even in areas where maize is the staple food, root and tuber crops are an important food supplement. They are particularly important as food security crops in seasons of drought, and survive relatively well in marginal soil."

In view of the importance of root and tuber crops, the GOM's stated objective is to increase production in areas where root crops are a staple food and encourage farmers to grow them as security and cash crops. Farmers are being advised to grow root and tuber crops on a regular basis rather than resorting to growing them during times of drought.

CURRENT STATUS OF ROOT CROPS MULTIPLICATION IN MALAWI

Root crops and cassava in particular are now regarded as essential crops for improving food security. From a cassava and sweet potato survey conducted in Malawi, more than 22% of the villages surveyed ranked the crops as either the first or second most important crops prior to the drought year.

A preliminary post drought survey of farmers in Lilongwe Agricultural Development Division (LADD) revealed that more than 70% of farmers grew cassava and sweet potato for both food and cash. In terms of hectarage under cultivation, the area cultivated by both crops jointly is second only to maize. (Table 1).

Table 1

Average area under cultivation of main crops grown by farmers in LADD

	AREA/FARMER UNDER CULTIVATION (ha)	
CROPS	LOCAL	IMPROVED
Sweet Potato	.24	.23
Cassava	.44	-
Maize	.72	.65
Other*	.54	.51

* Others include tobacco, pulses, vegetables.

Based on results from on-farm testing for sweet potato for the past three years in several locations, there is enough conviction among the farmers about the productivity of improved varieties. (Table 2).

Table 2

Performance of sweet potato varieties in on-farm trials in Lilongwe ADD.

VARIETY	MEAN YIELD (t/ha)
Kenya	11.5
TIS 3017	10.8
TIS 2534	8.5
LRS 407	5.3
Local	4.1

While farmers are convinced about the productivity of improved varieties, the availability of planting material remains a leading constraint. Reasons for limited cultivated area is shown below.

Table 3

Limiting factors for cultivating cassava and sweet potato

	% Of Farmers	
Reasons	Sweet Potato	Cassava
Lack of planting material	47	43
Insufficient land	27	19
Both land and planting material limited	12	10
Pests and diseases	-	5
Others*	14	24

* Others include labor, poor yield, market problem and theft.

Base information in the study area showed that many farmers grew sweet potato and cassava (Table 4).

Table 4

Total number of farm families and percentage of farmers growing sweet potato and cassava in the study area*

EPA	NUMBER OF FARM FAMILIES	PERCENTAGE GROWING	
		SWEET POTATO	CASSAVA
NAMITETE	5.680	27	11
BUNDA	16.367	37	56
DEDZA	1.132	38	44

* Source: Data from EPA offices in study area.

A 1991 survey showed that the survey area had only about 3% of farmers growing improved sweet potato varieties and only 1 variety, "Kenya", was reported by farmers. This preliminary survey shows that almost 29% of farmers are now growing improved varieties of sweet potato and the varieties reported were: Kenya, LRS 407, and TIS 3017. (Table 5). This is a confirmation that the technology is spreading and is being adapted.

Table 5

Distribution of sweet potato grown according to variety

Variety	% of growers
Local	71
Improved*	29

* Improved varieties reported were Kenya, LRS 407, and TIS 3017

The rapid increase in the spread of sweet potato varieties and the slow pace of cassava is because of the slow multiplication rate of the crop. However, the demand for improved cassava planting material is high. More than 75% of farmers in the survey area request for cassava planting material compared to 69% requesting for sweet potato. This shows that most of the target farmers are aware of the improved cassava and sweet potato planting materials. This awareness along with GOM's encouragement for diversification has created demand for planting material. Under the present circumstances of growing demand and the limited multiplication system in place, availability of planting material is in short supply. No adequate system currently exists for producing the amount of planting material needed for extensive dissemination. Research-extension linkages are not strong enough to support the transfer of root crops technology to farmers, a situation also constrained by funding availability and manpower shortages.

Training courses have been conducted to broaden the knowledge of extension agents of NGOs in root and tuber crops to prepare them to promote the adoption of root crops technologies. Farmer field days and training workshops on nursery establishment and management have also been organized to transfer the technology for rapid multiplication of planting material.

Primary multiplication sites are already established with at the agricultural research stations in Chitedze, Bvumbwe, Chitala, and Mkondezi with support from OFDA, FAO, the GOM, and IITA/ESARRN,. All these sites continue to be sources of material for further multiplication. However, production from these sites still fall short of current demands. Planting material is being distributed only on a limited scale to farmers, NGOs, UNICEF, and the Chinese Vegetable Projects for further multiplication (secondary sites) and distribution to farmers.

THE CHALLENGE

The present collaborative efforts of ESARRN, MNRCIP, extension agents and NGOs are not enough to reach the goals set by the GOM in its emergency plan. This plan calls for the rapid multiplication and distribution of cassava and sweet potato planting material to thousands of smallholder farmers to mitigate the effects of food shortages caused by the current drought. It also calls for actions to facilitate crop diversification and to enhance food security and food self-sufficiency at the household level. Priority actions have been identified as:

1. Training farmers and extension workers in root crops production and post-harvest technologies.

2. Multiplying and distributing improved cassava and sweet potato varieties to farmers.

3. Expanding on-farm trials and pilot extension efforts to demonstrate the value of improved varieties, and to serve as a primary means to promote and disseminate the varieties.

This proposal focuses on the expansion of accelerated multiplication and distribution of improved cassava and sweet potato planting material as one of the critical elements in meeting the needs of smallholder farmers during the 1993/94 crop season in Malawi.

PROJECT STATEMENT

This project will expand the current multiplication and distribution scheme for root and tuber crops, strengthen the linkage with NGOs, and broaden the capacity of the system to produce planting material. This will permit expanded areas of root crops to be planted and contribute to the household food security, thus assisting Malawians to recover from the effects of the drought.

OBJECTIVES

The overall objective of the project is to expand Malawi's cassava and sweet potato production through: (1) accelerating multiplication, distribution, and adoption of improved cassava and sweet potato 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. This will help improve the contribution of root crops to household food security.

Specifically, the project will:

1. Assist cooperators in the establishment of permanent sustainable multiplication sites in each of the major root crop production areas;

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

3. Multiply improved cassava and sweet potato varieties at 20 primary and 50 secondary multiplication sites throughout the country;

4. Provide financial and technical support to cooperators in the distribution of planting material to an estimated 300,000 smallholder farmers.

5. Produce sufficient cassava and sweet potato planting material to plant an estimated 5,500 hectares of sweet potato and 3,000 hectares of cassava during two subsequent crop years.

COLLABORATING INSTITUTIONS

The multiplication and distribution scheme has attracted the interest of several NGOs. ESARRN currently collaborates on root crops activities with the Christian Service Committee, the National Resources College, the University of Malawi, women's groups, primary schools, and farmers. The Baptist Mission in Malawi and the Adventist Development and Relief Agency (ADRA) have all joined in the scheme. (Table 6). The varieties being multiplied is shown in Table 7.

Table 6

Collaborating Non-Governmental Organizations Involved in the NRMDS of Malawi

Organization	Location	Type of Activity
Adventist Development and Relief Agency (ADRA)	Blantyre	Nursery Establishment and Distribution
Baptist Mission in Malawi	Ntcheu	Nursery Establishment and Distribution
Christian Service Community	All Regions	Nursery Establishment and Distribution
Save the Children's Fund	Central	Distribution
UNICEF	Central	Nursery Establishment and Distribution
FAO	Northern & Central Regions	Technical Experts Vehicles Nursery Establishment
Several Farmers Groups	All Regions	Nursery Establishment and Distribution
World Vision Inter.	All Regions	Nursery Establishment
Evangelical Alliance for Relief and Devt.	Central Region	Nursery Establishment

These Non-Governmental Agencies have played a critical and active role in assuring village-level participation in the National Root Crops Multiplication System. NGOs have put the system in contact with small farmers, rural women and other local communities and organizations. NMRDS provides training and other inputs to get interested NGOs started. Some NGOs involved have provided all the necessary inputs for their operation.

METHODOLOGY

A team of trained personnel in the MOA system based in Chitedze Research Station and other research and farm sites will work in

collaboration with extension agents, NGOs and farmers to execute the project. Cooperating NGO staff, extension workers, and farmers will be trained in the techniques of rapid multiplication, management, packaging, and distribution of propagules. ESARRN will provide technical backstopping for this activity, and establish a collaborative relationship with cooperating NGOs, particularly those with agricultural projects operating in the targeted areas, to continue operating the multiplication sites after the end of this project.

Nurseries will be established at the primary sites to produce clean and healthy planting material for further multiplication at secondary sites. The secondary sites will be established and operated in collaboration with NGOs, farmers, and extension personnel.

The average size of the primary sites will be approximately 1 hectare. Each primary site will be capable of producing sufficient planting material to establish 3-4 secondary sites averaging 8 hectares in size. In total the project plans to establish 50 secondary sites. These secondary sites will in turn produce sufficient material to plant 5,500 hectares to sweet potatoes, and 3,000 hectares to cassava. This will be sufficient for planting .05 ha sweet potato gardens, and .01 ha cassava gardens for a total of 300,000 smallholder farmer plots. Once established this system will be able to provide a continuous year-round supply of healthy planting material to other farmers.

Since fresh sweet potato and cassava cuttings can deteriorate rapidly with poor handling procedures, the project will train cooperators on proper handling methods for storage, packaging, transportation, and distribution of the cuttings to ensure that farmers receive high-quality, viable planting material. Planting material will be distributed using systems established by the NGOs with assistance from IITA.

PROJECT ADMINISTRATION

IITA already has a Memorandum of Understanding with the Government of Malawi and through its ESARRN office in Malawi, will administer and execute the project in collaboration with MNRCIP.

Day-to-day operational and financial management of the project will be the responsibility of ESARRN staff in consultation with the national program. IITA scientists working within ESARRN will be responsible for the technical management of the project. IITA will submit to USAID/Malawi quarterly financial statements and project implementation update reports.

ESARRN is also committed to provide backstop support for the project. Vehicles, computer equipment, and manpower will be made available for the execution of this project. IITA will also

provide short-term technical expertise at the request of ESARRN to respond to technical problems encountered during implementation.

IMPACT

The system for multiplying and distributing healthy cassava and sweet potato planting material in Malawi is currently underdeveloped. This project will: (1) increase that capacity with collaborating NGOs, extension personnel, and private farmers to multiply and distribute planting material; (2) disseminate high yielding, pest resistant, drought tolerant cassava and sweet potato varieties to smallholder farmers to mitigate the food shortages caused by drought; and, (3) ensure that cooperators will have the capacity to continue operation of both primary and secondary multiplication sites after the end of this effort.

These hardy and nutritious crops, in addition to being excellent sources of carbohydrates, can help prevent Vitamin A deficiency and xerophthalmia. Smallholders, the principal growers of cassava and sweet potato, will benefit from replacing low yielding, susceptible local varieties with high-yielding, resistant varieties of cassava and sweet potato, whose increased yield per hectare will improve household food supplied for drought affected farm families.

SCHEDULE OF PROJECT ACTIVITIES

Seventy-five percent (75%) of each multiplication plot (primary and secondary) will be planted to cassava and the rest devoted to sweet potato. The initial propagules for establishing the primary multiplication will be obtained from the existing sites. Two to three node cuttings will be made and nursed during the first month in nurseries established at each primary site and used in subsequent planting. During the period of establishment, locations will be used as training venues for other cooperators, extension agents, NGOs, and farmers in efforts to solicit their interest and increase awareness of the value of cassava and sweet potato as food security crops. Secondary multiplication sites will be sustained by the cooperator with the assistance of IITA, with the strategy for project administration varying according to the crop. However, all cooperators will receive orientation on multiplication techniques, maintenance, and handling methods for packaging, transportation, and distribution at appropriate periods.

The following provides the breakdown of activities scheduled for cassava and sweet potato, respectively, during project implementation.

A:	ACTIVITY: CASSAVA	Project Month
.	Orientation at Chitedze Research Station	1
	Production and nursing of 20.000 to three node plantlets (rapid multiplication technique) at each primary site.	1 - 2
.	Establishment of primary multipli cation sites. Planting at 20.000 plants per ha (pph)	2 - 6
.	Site maintenance and training cooperators	2 - 6
.	Identification of secondary multiplication sites	1 - 3
.	Field preparation of secondary sites	2 - 6
.	Ratoon plants in primary multiplication sites to prepare enough mini-cuttings (3-4 nodes) to plant secondary sites. Approximately 40 mini-cuttings to be obtained from each ratooned stem	7 - 9
.	If necessary, nurse minicuttings before transplanting into secondary sites. Use of clear polyethylene bags for pre-sprouting without soil is most ideal because of ease of transportation to secondary sites. 1.848.000 mini cuttings needed for 64.200 stems to plant all secondary sites at 10,000 pph	
.	Distribute 850.800 stem-cuttings to farmers. Material enough to plant 85.0 ha	7 - 9
.	Site maintenance and training of cooperators at secondary sites	6 - 8
.	Ratoon and distribute all cuttings to farmers. Enough to plant 3.000 ha.	8 - 9

From this schedule a total of at least 3.000 ha will be planted by farmers since ratooned plants normally produce more than 1 stem per plant on regrowth. The larger spacing provided in the secondary site allows for vigorous growth and branching of the cassava crop.

Presently the system can produce enough planting material at the locations on the map to plant the expansion programs planned (see appendix).

B:	ACTIVITY: SWEET POTATO	Project Month
.	Orientation at Chitedze Research Station	1
.	Production and nursing 10.200 two node plantlets at each primary site	1 - 4
.	Establish primary multiplication sites Planting at 30.000 pph at any initial planting	1 - 2
.	After two month growth. ratoon primary. multiplication plots and produce cuttings. Multiplication ratio is 1:10	2 - 5
.	Establish parts of secondary sites with cuttings and allow plants in all established sites to grow for 2 months	2 - 5
.	At end of 4th month. ratoon all multiplication plots. Use 1.335.000 cuttings to complete planting the secondary sites and distribute rest of cuttings to farmers	4 - 9
.	At end of 6th month. ratoon all multiplication plots and distribute to farmers.	6 - 9

A total of about 75 million cuttings will be produced using a conservative multiplication ration of 1:5 after every two month of ratooning the plots during the project period. This would be enough to plant 2.500 ha. However this estimate for distribution refers only to primary material distributed from the multiplication sites. No account is made for subsequent distribution among farmers. which is generally higher. The multiplicative factor is expected to more than triple once the recipients become aware of the value of the improved varieties.

D. BUDGET SUMMARY
(USD x 1000)

USAID CONTRIBUTION

Line Item	1993/94
1. Allowances	
a. Multiplier Associates (5 persons)	24.0
(b) Project Drivers (2)	3.0
2. Site Establishment and Maintenance	
a. Screenhouse (greenhouse) operation	3.0
b. Tractor hire for site preparation	8.0
c. Field and nursery supplies	5.0
d. Labor	10.0
e. Field equipments and materials	10.0
f. Irrigation facilities	16.0
3. Packaging and Distribution	
a. Cutting and Bundling	10.0
b. Distribution Expenses	7.2
4. Operational Expenses	
a. Vehicle Purchase (5 ton truck)	40.0
b. Vehicle operation and Maintenance	21.0
b. Office supplies and communication	5.0
5. Travel	
a. Staff travel (local) to primary and secondary multiplication sites	25.0
b. Consultancies (travel and per diem)	5.0
6. Training	
a. Orientation training, demonstration and field days	10.9
b. Monitoring, supervision and evaluation	7.5
SUBTOTAL	210.6
7. Overhead (18.7%)	39.4
GRAND TOTAL	250.0

DETAILED BUDGET
(USD)

Line Item	1993/94
1. ALLOWANCES	
a. Multiplier Associates (5) @ $4.800 per annum	24.000.00
b. Project drivers (2) @ $1.500 per annum	3.000.00
2. SITE ESTABLISHMENT AND MAINTENANCE	
a. Screenhouse/Greenhouse operation	3.000.00
b. Tractor hire for site preparation 280 hectares @ $28.50/ha	8.000.00
c. Field and Nursery supplies	5.000.00
fencing - 1000	
pesticides - 500	
storage drums - 450	
polythene sheets - 350	
other misc - 2700 (sprayers, protective gear, hose pipe, virals, etc)	
d. Labor	10.000.00
Farm labor @ $1.00/day	
Skilled laborer @ $2.00/day	
Watchman @ $1.20/day	
Tractor operator @ $35.00	
e. Field equipment and materials (hoes, pangas, slashers, cans, sacks, buckets, drums, fertilizer, fungicides)	10.000.00
f. Irrigation facilities	16.000.00
Installation of structures - 2000	
Pumps and piping etc. - 9000	
Sprinklers - 1500	
Maintenance/Labor charges - 3500 (inc. cost of diesel for water pumps)	

3. PACKAGING AND DISTRIBUTION

a.	Cutting and Bundling at primary sites: (scissors, saws, string, loading, etc)	10,000.00
b.	Distribution expenses from primary sites to centers: (fuel cost @ $30/trip x 6 trips per center x 40 centers)	7,200.00

4. OPERATIONAL EXPENSES

a.	Vehicle purchase (5 ton truck CIF)	40,000.00
b.	Vehicle operation and maintenance (fuel, servicing, spare parts, insurance, COF, etc)	21,000.00
c.	Office supplies and communication incl. administrative costs	5,000.00

5. TRAVEL

a. Staff travel 25,000.00

(i) Site visits to Northern Region:

Fuel/oil $300 x 10 trips	- 3000
Per diem $38/5dys/10 trips	- 3800
Driver DSA ($20/5/10)	- 1000
Sub Total (i)	- 7800

(ii) Site visits in Central Region:

Fuel/oil $250 x 10 trips	- 2500
Per diem $36/5dys/10 trips	- 3600
Driver DSA ($20/5/10)	- 1000
Sub Total (ii)	- 7100

(iii) Site visits in Southern Region:

Fuel/oil $455 x 10 trips	- 4550
Per diem $38/5dys/10 trips	- 3800
Driver DSA ($20/5/10)	- 1000
Sub Total (iii)	- 9350

(iv.) Misc. charges - 750

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b.	Consultancies	5.000.00
	Travel - Fuel $360 x 4 trips/annum - 1440 Per diem: Northern Region $38/5dys/4 trips - 760 Central Region $42/5dys/4 trips - 840 Southern Region $38/5/4 trips - 760 Driver DSA - $20/5dys/12 trips - 1200	
6.	TRAINING	10.900.00
a.	Orientation, training demonstration and field days	
(i)	Subsistence allow (10 farmers @ $55/day x3 dys x30 centers)-4950	
(ii)	Resource persons from ADDs @ $25/day x 90 days -2250	
(iii)	Field days/demonstrations for farmers in each region: $1000 per region -3000	
(iv)	Stationery and supplies - 700	
b.	Monitoring, supervision and evaluation (6 trips/region by CIP/SACCAR Research Assistants x 2)	7.500.00
	Travel - Fuel $360 x 6 trips/annum-2160 Per diem: Northern Region $38/5dys x 6 -1140 Central Region $42/5dys/6 trips -1260 Southern Region $38/5dys/6 trips -1140 Driver DSA - $20/5dys/18 trips -1800	
	SUB TOTAL ITEM 1 - 6	210.600.00
7.	OVERHEAD (18.7%)	39.400.00
	GRAND TOTAL	250.000.00

ESARRN CONTRIBUTION

(IN MATERIAL AND KIND)
(USD x 1000)

ITEM	1992/93
1. Technical Backstopping and Support	
a. Data Analysis (Computer Operation)	0.5
b. Library Services	1.0
c. Initial supply of improved cassava and sweet potato planting	7.0
2. ESARRN Resident Scientist Time (10%)	
a. Multiplication Specialist	9.0
b. Root Crops Breeder	9.0
3. Training	
a. Training facility use	2.0
b. Contribution to training, demonstrations and field days	2.0
4. Equipment	
a. Vehicle operation and maintenance	3.0
b. Screenhouse (greenhouse)	2.0
c. Screenhouse materials	2.0
TOTAL	37.5

BUDGET NOTES

USAID CONTRIBUTION

1. PRIMARY AND SECONDARY MULTIPLICATION SITES

Multiplying planting material is labor intensive in nature. Therefore, a large number of field hands will be needed to select and harvest planting material at primary sites, plant it at the secondary sites, maintain the sites, and harvest and package the material for distribution to farmers.

Primary (nursery) sites will be established at 20 different locations. The nurseries will need to be equipped with permanent planting beds and irrigation piping. Each site will also require wheelbarrows, sprayers, shovels, shears, knives, trowels, pruning saws and rakes. Two small irrigation pumps and hoses will be purchased.

The 50 planned secondary sites, covering a total area of 280 hectares, will need to be ploughed and harrowed. The secondary sites will then be hand planted, fertilized and irrigated to encourage vigorous and speedy establishment of the cuttings. Hoes will be needed for weeding and site maintenance.

2. VEHICLES

A vehicle will be purchased in order to supplement the one owned by ESARRN. However, additional vehicles will be needed during periods of peak activity. ESARRN only has two drivers.

There will therefore be a need to also hire additional drivers. The funds budgeted in this line are for vehicle purchase and hire, and for the operation and maintenance of the vehicles. ESARRN also has a large screenhouse (greenhouse) which will be used for rapid micro-propagation of planting material.

4. LOCAL TRAVEL

There will be regular visits to primary and secondary multiplication sites to supervise, monitor and advise project collaborators. This budget line item covers the costs of lodging and per diem for both local staff and consultants.

5. TRAINING, DEMONSTRATIONS AND FIELD DAYS

Innovative farmers, special interest groups, extension agents and collaborating NGOs will be invited to field days to demonstrate specialized skills, and to permit them to observe the use of multiplication techniques at various stages. Special women's organizations will be encouraged to participate in training seasons and demonstrations. These events will be used to interact with collaborating organizations in a broader setting as preliminary to starting multiplication at the secondary sites.

6. OVERHEAD

These costs are calculated at 18.7% in accordance with the current audited overhead rate in effect for the IITA/ESARRN effort.

ESARRN CONTRIBUTION

1. TECHNICAL BACKSTOPPING AND SUPPORT

The sub-item for data analysis is only for computer operating expenses and maintenance.

2. EQUIPMENT

The vehicle sub-item represents operating expenses and maintenance.

3. NOTE

The ESARRN contribution is equivalent to approximately 15.5% of the total project budget.

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Table 7 : Released Varieties being multiplied by NRMDS

CASSAVA

Variety	Characteristic
Mbundumali (Same as Manyokola)	(Low Cyanide) sweet medium (12- 15 months) maturity. Moderate resistance to green mite. yields 15-20 tons/ha.
Gomani	(High cyanide) bitter. early maturing (9-12 months). yields 15-25 tons/ha.
Chitembwere	(Low Cyanide) Sweet. late maturing (15-18 months). field resistant to mosaic. yields 20- 30 tons/ha.
Nyasungwe	(Low Cyanide) medium maturing (12-15 months) moderate resistance to mosaic and green mite. yields 12-20 tons/ha.

SWEET POTATO

Kenya	White skin. yellow flesh. resistant to sweet potato virus. yields 25-35 tons/ha.
LRS 40 (same as Lunyangwa)	Red skin. white flesh. resistant to sweet potato virus. good storage ability. yields 20-30 tons/ha.

Pre-released Varieties

TIS 2534	Red skin. white flesh resistant to sweet potato virus early. Yields 20-35 tons/ha.
TIS 3017	Red skin. white flesh. good storage ability. high yield. resistant to alternaria and sweet potato virus.

Table 8: MULTIPLICATION SITES - AREA TARGETED AND AREA PLANTED

CASSAVA

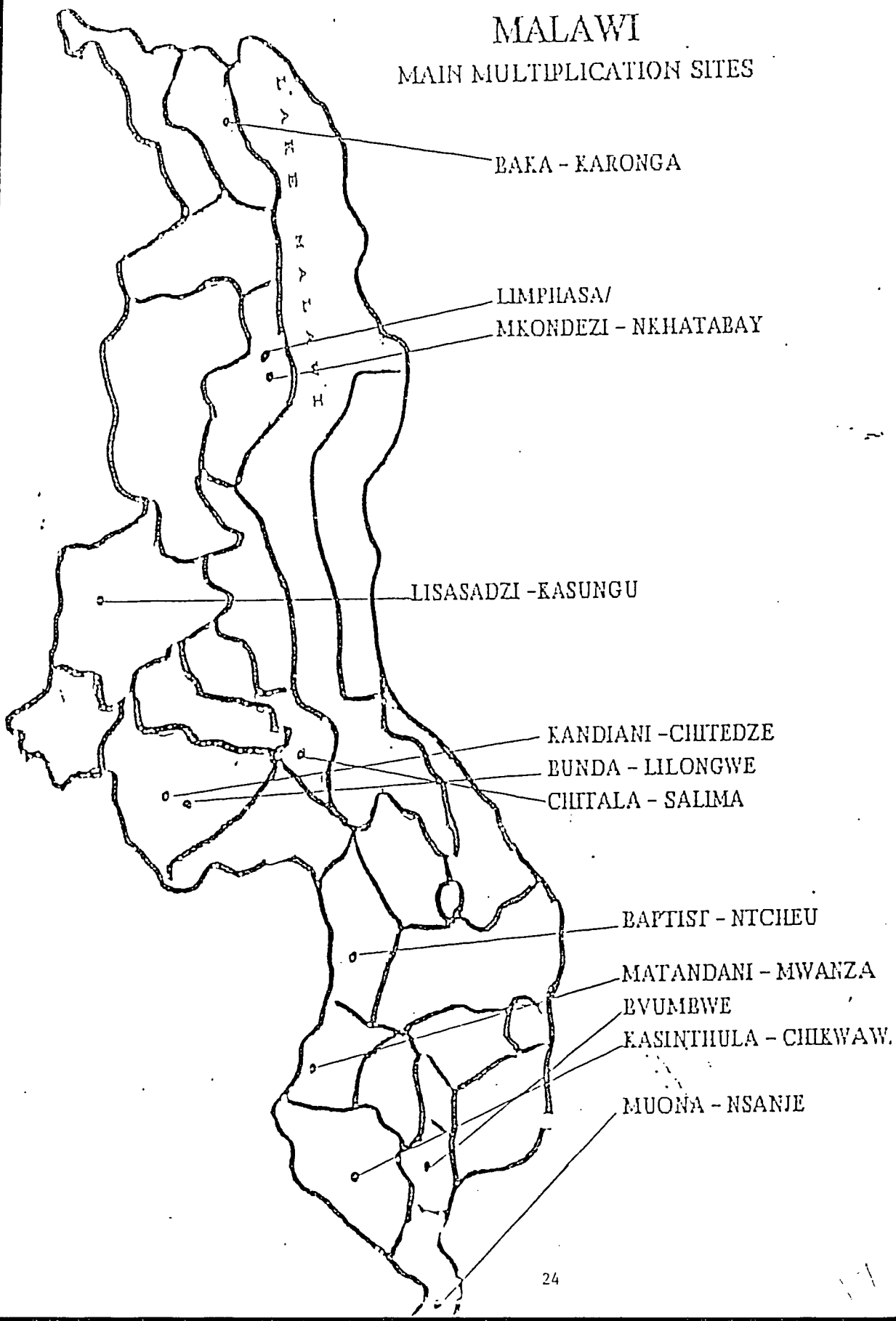
ORGANISATION	PRIMARY	SECO-NDARY	LOCATION	VARIETY OF	HECTARAGE TARGETED	HECTARAGE ACHIEVED	TYPE OF ACTIVITY	REMARKS
Chitala Resea-rch Station			Chitala Salima	Mbundu-mali Gomani Chitembwere	15 Ha	8 Ha	Seed Mul-tiplica-tion	Area Extension and planting still in progress
Chitedze Research Station			Chitedze Lilongwe	Mbundu-mali	12 Ha	8 Ha	Seed Mul-tiplica-tion	Area site extended
Bunda			Bunda Lilongwe	Mbundu-mali	3.5 Ha	1 Ha	Seed Mul-tiplica-tion	Planting in progress
Lisasadzi			Kasungu	Mbundu-mali/ Chimphuno	2.5 Ha	2 Ha	Seed Mul-tiplica-tion	Planting in progress
Baptist Mission			Ntcheu	Mbundu-mali/	2.5 Ha	1 Ha	Multi-plica-tion	Planting in progress
Kasinthula			Chikwawa		10 Ha	5 Ha	Multi-plica-tion	Planting in progress
Makhanga			Chikwawa		20 Ha		Seed Mul-tiplica-tion	Planting in progress

ORGANISATION	PRIMARY	SECO-NDARY	LOCATION	VARIETY OF	HECTARAGE TARGETED	HECTARAGE ACHIEVED	TYPE OF ACTIVITY	REMARKS
Baka			Karonga		5 Ha	3.5 Ha	Multi-plica-tion	Planting in progress
Limphasa			Nkhata-Bay		29 Ha	22 Ha	Seed Mul-tiplica-tion	Planting in progress
Mkondezi			Nkhata-Bay					

NOTE: Source of Cassava material - LUWEREZI (MKHAMENYA AREA)

MALAWI

MAIN MULTIPLICATION SITES



ACRONYMS

ADD	Agricultural Development Division (in Malawi)
AGR	Agriculture
ARPT	Adaptive Research Planning team of MOA Zambia
BCP	IITA's Biological Control Programme, Cotonou, Republic of Benin
CAB	Commonwealth Agency Bureau
CGM	Cassava Green Mites
CIBC	Commonwealth Institute for Biological Control (now IIBC)
CIP	Centro Internacional de la Papa (International Potato Centre), Lima Peru
CM	Cassava Mealybugs
COSCA	Collaboration Study for Cassava in Africa
CRDI	Centre de Recherche et Developpement International (= IDRC)
DANIDA	Danish International Development Agency
DAP	Department of Agricultural Research
DAR	Department of Agricultural Research, MOA, Malawi
DG	Director General
DSA	Department de Statistiques Agricole, MOA, Rwanda
ESARRN	East and Southern Africa Root Crops Research Network
FAO	Food and Agriculture Organisation, United National Organisation, Rome
FINNIDA	Finnish International Development Agency
GTZ	German Agency for Technical Cooperation (Gasellshaft Technisehe Zusammenarbeit)
IAR	Institute of Agronomic Research
IARC	International Agricultural Research Centres

ICRAF	International Centre for Research on Agro-Forestry
IDRC	International Development Research Centre
IFAD	International Fund for Agricultural Development
IIBC	International Institute for Biological Control. Nairobi, Kenya
IITA	International Institute of Tropical Agriculture. Ibadan, Nigeria
INIA	Instituto Nacional de Investigacao Agronomica. Mozambique
IPM	Integrated Pest Management
IRDP	Integrated Rural Development Programme. Zambia
ISABU	Institut des Sciences Agronomiques de Burundi
ISTRC	International Society for Tropical Root Crops
ISTRC-AB	ISTRC - Africa Branch
ISTRC	International Science and Technology Research Centre
KARI	Kenya Agriculture Research Institute
MASL	Metres Above Sea Level
MEDI	Malawian Entrepreneurs Development Institute
MINAGRI	Ministry of Agriculture
MOA	Ministry of Agriculture
MOU	Memorandum of Understanding
MRCIP	Malawi Root Crop Improvement Program
MSc	Master of Science
NARS	National Agriculture Research Systems
NGO	Non-Government Organisation
NRI	Natural Resources Institute. UK
OFT	On-Farm Trials
Ph D.	Doctor of Philosophy
R & D	Research and Development

REDSO/ESA	Regional Economic Development Services Office for East and Southern Africa
RCP	Root Crop Programs
SADDC	Southern African Development Coordination Council
SIDA	Swedish International Development Agency
SP	Sweet Potato
TNRCIP	Tanzania National Root Crop Research Improvement Program
TRIP	Root and Tuber Improvement Program (IITA)
UNDP	United Nations Development program
UNICEF	United Nations Children Education Fund
UNRCIP	Uganda National Root Crop Improvement Program
USAID	United States Agency for International Development

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