FARMING SYSTEMS INTEGRATED PEST MANAGEMENT PROJECT: SELECTED REPORTS 1996 - 2000

Volume 1

REPUBLIC OF MALAWI

MINISTRY OF AGRICULTURE AND IRRIGATION

DFID Department for International Development

Natural Resources Institute

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Volume 3. Farmer participation in development of IPM strategies. 548 pp.

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Volume 1. Farming Systems Research

Compiled by

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March 2000

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FARMING SYSTEMS INTEGRATED PEST MANAGEMENT PROJECT

SELECTED PROJECT REPORTS 1996-2000

VOLUME 1: Farming Systems Research.

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ODA/Malawi Government

BDDCA May 1995

FARMING SYSTEMS INTEGRATED PEST MANAGEMENT PROJECT

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PROJECT HEADER SHEET

COUNTRY:MALAWI FILE REF:037/312/013

PROJ. TITLE (MAX 60 CHARS):FARMING SYSTEMS INTEGRATED PEST MANAGEMENT PROJECT

PROJECT DESCRIPTION - WHAT PROJECT IS DESIGNED TO ACHIEVE (MAX 3 LINES):
To develop the capacity of DAR to undertake Farming Systems Integrated Pest Management Research and to provide Government and NGO extension systems with PMS recommendations suitable for resource-poor farmers.

	MIS CODE	--------COMMITMENT (£)-------- TOTAL COSTS	LOCAL COSTS
ODA FINANCIAL AID:	037-006-010	248,806	
ODA TC:	037-501-026	1,715,619	

IS PROJECT COFINANCED WITH OTHER DONORS? (Y OR N):N

IF YES, ENTER TOTAL PROJECT VALUE:		

PERIOD OF ODA FUNDING FROM:June 1995 TO:May 1999
ECON SECTOR CODE:11890 ESC DESCRIPTION:Pest Management Research

POLICY MARKERS (mandatory for projects over £100,000)

Priority Objectives
01 ECONOMIC LIBERALISATION :
02 ENHANCING PRODUCTIVE CAPACITY :4
03 GOOD GOVERNMENT :
04 POVERTY REDUCTION :4
05 HUMAN DEVELOPMENT - EDUCATION :
06 HUMAN DEVELOPMENT - HEALTH :
07 HUMAN DEVELOPMENT - CHILDREN BY CHOICE :
08 WOMEN IN DEVELOPMENT :2
09 ENVIRONMENT :

Other Markers
10 ILLICIT DRUG CONTROL :
11 HIV/AIDS :
12 URBAN DEVELOPMENT :
13 PRIVATE SECTOR DEVELOPMENT :
14 RESEARCH :4

Rio Markers
15 ENERGY EFFICIENCY :
16 SUSTAINABLE FOREST M'GMENT :
17 BIODIVERSITY :
18 SUSTAINABLE AGRICULTURE :4

ASSOCIATES (mandatory for food aid, disaster & refugee relief, JFS)
MANAGING AGENT(S) :NRI
PROCUREMENT AGENT(S) :Balfour Williamson
COFINANCIER(S) :
NGO(S) JOINTLY FUNDING :
EDUCATION LINK/PARTNER :

TYPE OF ENVIRONMENTAL ASSESSMENT (IS,EA,EIA) :IS
DATE ENVIRONMENTAL ASSESSMENT COMPLETED :August 1994

APPROVAL DATE: APPROVAL LEVEL:HODD

DATE PROJECT DOCUMENTS SIGNED:

I approve this project as described in this document and confirm that the commitment, economic sector, policy markers and associates have been checked for accuracy in line with the PIMS guidance.

Signed [signature] Name [illegible] Date [illegible]

ANNEXES

FARMING SYSTEMS INTEGRATED PEST MANAGEMENT PROJECT

Project Logical Framework

Narrative Summary	Measurable Indicators	Means of Verification (MOV)	Important assumptions
Goal: 1. Improved incomes for resource-poor farmers through use of low-cost, sustainable Pest Management Strategies (PMS).	 1.1 Yields improved through increased use of PMS strategies by smallholders.	 1.1 ADD Monitoring & Evaluation surveys	(Goal to Supergoal)
Purpose: 1. Develop the capacity of DAR to undertake Farming Systems IPM research, and provide Government and NGO extension systems with PMS recom-mendations suitable for resource-poor farmers.	 1.1 DAR cereals, roots and tubers, oilseeds and fibres, and technical services research programmes incorporate significant on-farm IPM research components, relevant for farmers under 1 ha, in each of Malawi's three regions by Year 4.	 1.1 DAR annual reports	(Purpose to Goal) 1.1 Effective extension mechanisms to extend recommendations
Outputs: 1. Research capacity in DAR capable of farming systems research in place.	 1.1 DAR has at least 8 postgraduate qualified scientists with at least four years experience in implementing on-farm IPM research by the end of the project	 1.1 Project reports	(Output to Purpose)
2. IPM strategies suitable for resource-poor farmers identified for major crops.	2.1 IPM strategies demomstrated by on-farm research to be attractive to farmers with holdings under 1 ha: for maize and at least two other major crops (not tobacco) in Zone 1 (Shire Highlands) by end Year 2, for Zone 2 by end Year 3 and for Zone 3 by end Year 4.	2.1 Project reports	2.1 Research staff continue to develop and refine IPM strategies.
3. Improved extension materials prepared for dissemination by both formal and informal extension networks.	Extension broadsheets prepared on maize and at least least two other major crops (not tobacco) in Zone 1 (Shire Highlands) by end Year 2, for Zone 2 by end Year 3 and for Zone 3 by end Year 4.	3.1 Project Reports and extension materials	3.1 Formal and informal extension networks continue to function effectively.

Narrative Summary	Inputs/Resources	Means of Verification	Important assumptions
Activities:			**(Activity to Output)**
1.1 Prepare plans and issue contracts for buildings	See budget and staffing schedule.	1.1 Site Manager's report.	1.1 MoW cooperate.
1.2 Construction of buildings		1.2 Site manager's evaluation, visit by BDDCA.	1.2 Contractor completes work on timely basis.
1.3 Furnish and equip buildings		1.3 Project reports.	1.3 Equipment ordered and delivered on time.
1.4 Train research staff in farming systems and participatory research methods.		1.4 Numbers trained and trainee's course evaluation.	1.4 Research staff assigned to and remain with the project.
1.5 Redirect crop protection research activities to IPM approach.		1.5 Project reports.	1.5 DAR accepts benefits of IPM approach to crop protection.
1.6 Train eight Msc students at University of Malawi.		1.6 Numbers registered and supervisor's reports.	1.6 Suitable candidates identified.
1.7 Train three staff on Msc courses in the UK.		1.7 Numbers registered and supervisors' reports	1.7 Suitable candidates identified.
1.8 Use consultancies for specialist inputs.		1.8 Project reports.	1.8 Good consultants available on timely basis.
2.1 Select agro-economic zones (one per year: total three)		2.1 Project reports.	2.1 Background information available.
2.2 Identify and select participating farmers.		2.2 Project reports.	2.2 Farmers keen to participate.
2.3 Conduct baseline surveys on crop losses of farmers in the selected areas.		2.3 Project reports.	2.3 Farmers collaborate.
2.4 Review existing data on crop protection.		2.4 Review document.	2.4 Literature available.
2.5 Determine reasons for crop losdses at farm level.		2.5 Project reports.	2.5 Farmers assist with data collection.
2.6 Develop PMS with farmers to reduce crop losses.		2.6 Project reports and collaborators' evaluations.	2.6 Farmers actively involved.
2.7 Assess effectiveness and impact of PMS.		2.7 Project evaluation report.	2.7 Farmers collaborate.
2.8 Prepare recommendations.		2.8 Project reports.	2.8 Appropriate PMS identified.
3.1 Identify formal and informal communication networks in the three project areas.		3.1 Project report.	3.1 Socio-economic conditions in the three areas do not change enough to alter communication networks significantly.
3.2 Develop informal extension mechanisms in collaboration with NGOs.		3.2 NGO's evaluations.	3.2 NGOs willing to collaborate.
3.3 Prepare training and extension materials for extension workers.		3.3 Project reports. reports from collaborating agencies.	3.3 Appropriate PMS identified.
3.4 Train extension workers.		3.4 Numbers trained and collaborator's reports.	3.4 Links with ADDs allow training.
3.5 Prepare extension materials for smallholder farmers.		3.5 As above.	3.5 Appropriate PMS identified.

ACRONYMS

ACTS	Annual Country Training Specification
ADD	Agricultural Development Division
ART(s)	Adaptive Research Team(s)
ASP	Agricultural Services Project
BDDCA	British Development Division in Central Africa
BHC	British High Commission
CARO	Chief Agricultural Research Officer
CIAT	Centro Internacional de Agricultura Tropical
CYMMIT	Centro Internacional de Mejoramiento de Maíz y Trigo
DAET	Department of Agricultural Extension and Training
DAR	Department of Agricultural Research
FAO	Food and Agricultural Organisation
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit GmbH
IARC	International Agricultural Research Centre
ICRAF	International Council for Research on Agro-forestry
ICRISAT	International Centre for Research in the Semi-arid Tropics
IDA	International Development Association
IDRC	International Development Research Centre
IIBC	International Institute of Biological Control
IITA	International Institute of Tropical Agriculture
IPM	Integrated Pest Management
MG	Malawi Government
MOA	Ministry of Agriculture
NGO	Non-governmental Organisation
NRDP	National Rural Development Programme
NRI	Natural Resources Institute
OACD	Overseas Appointments and Contracts Department
ODA	Overseas Development Administration
PMS	Pest Management Strategy/ies
PPS	Plant Protection Services
PRA	Participatory Rural Appraisal
RDP	Rural Development Programme
RRA	Rapid Rural Appraisal
SACCAR	Southern Africa Centre for Cooperation in Agricultural Research
SADC	Southern African Development Community
SPP	Soil Pests Project
TC(O)	Technical Cooperation (Officer)
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
WB	World Bank

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PROJECT MEMORANDUM

COUNTRY: MALAWI

PROJECT TITLE: FARMING SYSTEMS INTEGRATED PEST MANAGEMENT PROJECT

PROJECT COST:
TC: £1,715,619
CAPITAL: £248,806

DURATION: June 1995 to May 1999

1. SUMMARY

1.1 The project aims to improve the welfare of poor farm families by reducing on-farm crop losses from pests, weeds and diseases. Participatory research methods will be used to develop appropriate Pest Management Strategies (PMS) which reduce crop losses and are sustainable within the constraints of the smallholder farming systems. The project will also strengthen the capability of the Department of Agricultural Research (DAR) to conduct farmer-based integrated pest management research, increase the understanding of smallholder farming systems and identify the key constraints which can be addressed by research. Specific emphasis will be placed on improving linkages between DAR, the Department of Agricultural Extension and Training (DAET) and the NGOs to ensure the rapid widespread dissemination and adoption of recommendations.

1.2 The project will be implemented by DAR, assisted by the Natural Resources Institute (NRI) in the UK. It will be based at Bvumbwe Research Station.

1.3 The project will cost £1,964,425 cash and will be implemented over four years.

1.4 The Project Officer will be John Hansell, Senior Natural Resources Adviser in BDDCA. He will be supported by the Economic Adviser and Social Development Adviser in BDDCA.

2. RECOMMENDATION

2.1 It is recommended that £1.716 million is allocated from TC funds and £0.249 million from Capital Aid for the purposes set out in this memorandum.

3. SPECIAL CONDITIONS

Malawi Government undertakes:

(a) to provide the following full-time senior staff for the project, and associated housing, by June 1995:

1. A Pest Management Specialist who will also act as the Project Manager;
2. An Agronomist;
3. An Entomologist;
4. A Pathologist.

(b) to provide the following full-time junior staff for the project:

1. One Technical Officer at the start of the project increasing to four by the fourth year;
2. Two Field Technical Assistants in Year One, increasing to six in Year Four;
3. One Laboratory Assistant in Year One, increasing to four by Year Four;
4. Up to 12 Field Assistants by the end of the project;

5. Necessary drivers and office support staff.

(c) to provide three offices and temporary laboratory space for project staff at Bvumbwe until the laboratory has been refurbished by the project;

(d) to facilitate the visits of scientists from Africa and elsewhere to the project and of project staff to other countries as agreed by the Project Manager.

4. PROJECT DESCRIPTION

Goal and Purpose

4.1 The **goal** of the project is to improve incomes for resource-poor farmers through the adoption of low-cost, sustainable pest management strategies.

4.2 The **purpose** of the project is to develop the capacity of DAR to undertake Farming Systems Integrated Pest Management Research and to provide Government and NGO extension systems with PMS recommendations suitable for resource-poor farmers.

4.3 The main **outputs** of the project will be a team of DAR scientists with experience in farming systems IPM research, a series of IPM recommendations for major crops grown by resource-poor farmers in three agro-ecological zones of Southern Malawi, and a set of improved extension materials.

4.2 The project will re-orient the Plant Protection Services (PPS) of DAR towards a farming systems IPM approach. It will do this by an injection of ODA-funded resources over a four-year period to develop techniques for on-farm IPM research and to permit an intensive programme of such research to be carried out. After project completion, the scale of PPS research work will reduce to a level which will be easier for MG to sustain but the project will have significantly enhanced the capacity of the PPS to produce recommendations relevant to resource-poor farmers.

Inputs

4.3 The ODA long-term staff inputs will be:

1. a TCO Agronomist with IPM expertise for four years;
2. a TCO Farming Systems Economist for four years;
3. a TCO Social Anthropologist for four years;
4. a Malawian Economist for two years.

ODA will also provide funding for:

5. a total of 17 person months of short-term consultancies;
6. eight vehicles and nine motorcycles;
7. laboratory construction and equipment;
8. rehabilitation of quarantine facilities at Bvumbwe;
9. hostel accommodation at Bunda College of Agriculture;
10. four UK MSc and eight Malawi University combined MSc training awards.

4.4 The Malawi Government will provide senior and junior staff, offices, temporary laboratory space, trial sites and some consumables.

Project Approach

4.5 The project will use an interdisciplinary farming systems approach to ensure that the research meets the needs of resource-poor farmers, with particular emphasis being placed on the high proportion of women farmers and female-headed households. The research programme will be planned in consultation with the TCO Farming Systems Economist and Social Anthropologist, who will together use a variety of techniques, including Participatory Rural Appraisal (PRA) methods, to understand farming and rural social systems, farmers' perceptions of pest problems, their objectives and constraints in pest management and the economic and social values of crop losses. Other constraints and problems affecting the smallholders will be fed back into the wider research programme within DAR.

Project Activities

4.6 Project fieldwork will start in the Blantyre/Shire Highlands Rural Development Programme area in Year 1, be extended to a second agro-ecological zone in Year 2 and a third zone in Year 3. In each zone, the emphasis of project work will be on investigating and testing possible IPM strategies on the fields of 30 farmers. Additional data will be collected from 70 other farmers in each zone.

4.7 The project will build on the methods and findings of the University of Malawi (Chancellor College)/NRI Soil Pests Project (SPP) which has been researching soil pests, including weeds and diseases, on smallholder crops in Southern Malawi since 1990. The SPP has identified the major pest problems and has begun a modest work programme to investigate possible IPM strategies on farmers' fields and research substations.

4.8 While the SPP is likely to produce results relevant to significant numbers of farmers, its resources and mandate are limited. The present project will promote the adoption of the IPM research approach by DAR and permit a larger IPM research programme to be developed in collaboration with the other commodity teams in DAR. It will, however, be necessary to focus on the major crops in the farming systems and their related pest problems if the project is to have an impact.

4.9 Existing sources of information will be fully utilised but, where additional information is required, specific studies will be undertaken using Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA) survey methods where necessary.

4.10 Socio-economic criteria, combined with stratified random sampling in consultation with extension staff and NGOs, will be used to select farmers from a representative range of farming conditions. The selection will be undertaken jointly by the Farming Systems Economist and the Social Anthropologist. Participants will be drawn from all strata in the zone, with the majority coming from the poorer groups. Care will be taken to avoid producing a privileged group of participants and, as far as possible, to ensure that more than 50% are female.

4.11 The on-farm trials will be undertaken in conjunction with DAET and interested NGOs (eg ActionAid and Concern Universal) from the first year of the project. NGOs have been consulted during the project design and are interested in participating.

4.12 In the on-farm trials, the IPM strategies to be included will be selected in consultation with the farmers and field operations will be carried out by the farmers. DAR will provide suitable field assistants and extension staff who will visit the farmers to record progress during the growing season and help ensure that management practices are in line with the agreed research programme. These people will receive training at Chancellor College from members of the SPP before being posted to the field. Enumerators will be employed by the project to collect information for the economist and social anthropologist. In the event of significantly lower crop yields being harvested from on-farm trial plots, the project will provide suitable compensation to the farmer for the estimated loss incurred.

4.13 It is expected that the IPM strategies to be tested will include:

a. timing and method of tillage activities;
b. crop variety;
c. intercrop combinations;
d. crop spacing;
e. cultural control methods;
f. seed dressing;
g. choice and timing of chemical application;
h. timely application of the correct dosage of fertiliser;
i. management of crop residues;

j. traditional technologies using locally-available materials;
k. storage technologies.

4.14 Although the emphasis in the work programme will be on the on-farm trials, some replicated trials will need to be undertaken on DAR research stations and the fieldwork will need to be supported by laboratory investigations at Bvumbwe, eg to assist with identification of pests.

4.15 The project will not provide direct inputs to strengthen or modify the structure of the Department of Agricultural Extension and Training (DAET), since the IDA Agricultural Services Project is providing substantial financial support for reforms to increase the coverage, efficiency and effectiveness of extension services. Extension materials on soil pests and IPM recommendations will be prepared in collaboration with the Extension Aids Division of DAET and training courses and meetings held for ADD and NGO staff as soon as there are appropriate results. The project will work very closely with ADD extension staff in the areas where trials are being undertaken. Promising results will be extended as rapidly as possible in these areas through these direct contacts but also more widely within the ADD once farmer acceptance has been proven.

4.16 The TCO Social Anthropologist, supported by a consultancy in Year 1, will study the formal and informal communication networks between farmers and between villages and the way they are structured by gender, ethnic group and socio-economic status. This information will be used to assess the capability of utilising existing traditional networks to spread the knowledge of project activities, findings and recommendations and to develop low-cost methods for improving access to information for the different categories of farmers. Emphasis will be given to devising effective extension methods which are appropriate for the main categories of project participants.

5. BACKGROUND

5.1 ODA's 1995 Malawi Country Strategy Paper states that the Malawi Country Programme will primarily address four of ODA's objectives: economic reform, good government, poverty reduction; and human development. All new projects will fall within the sectors of economic reform, good government, education, health and population and renewable natural resources. It is an objective of the CSP that this IPM project document is finalised and that implementation starts by June 1995.

5.2 The purpose of the ODA RNR Strategy for Malawi (November 1994) is to improve household food security on a sustainable basis, with particular reference to smallholder farmers. In achieving this, ODA's Departmental objective of *assisting with the sustainable reduction of poverty* will be addressed. One of the initial interventions that directly addresses the needs of the smallholder farmers will be:

> *"area-based participatory farming systems research and technology transfer, working through DAR, other Government agencies, NGOs and community groups. One component of this programme will be the pipeline IPM project, amended to ensure a rapid feedback of the lessons of experience."*

5.3 There will be close collaboration with ODA's research programme, funded by NRRD, and it is anticipated that specific research activities in support of the IPM project will be developed. Discussions on this are underway.

5.4 The project will develop links with the International Agricultural Research Centres (IARCs) with specialised interests in IPM, eg cassava (IITA), maize (CYMMIT), beans (CIAT) and groundnuts (ICRISAT).

5.5 The initiative for the project started when the previous Minister for Overseas Development launched an initiative to reduce crop losses by using an IPM approach. This was followed by visits to Malawi by staff from NRI who, together with staff from the DAR, prepared draft proposals for ODA's consideration.

6. THE PROJECT AND MALAWI'S DEVELOPMENT POLICIES AND PROGRAMMES

6.1 On 25 August 1994, the President of Malawi launched the *Poverty Alleviation Programme*. He stated that the principal aim of the programme is to provide the productive means for generating improved incomes. This is reflected in the Mission Statement of the Ministry of Agriculture and Livestock Development (The Agricultural and Livestock Development Strategy and Action Plan, December 1994) which is to:

> *"improve the wellbeing of Malawians through poverty alleviation, especially among rural people, by promoting broad-based and rapid agricultural and livestock development."*

6.2 Other MOA objectives include:

1. improving food self sufficiency and the nutritional status of the population;
2. expanding and diversifying agricultural and livestock exports; and
3. raising farm incomes and promoting economic growth while conserving natural resources.

6.3 The World Bank-funded Agricultural Services Project (ASP) aims to improve the focus, cost-effectiveness and impact of agricultural research and extension, to support fertiliser supply and policy reform and to strengthen agricultural sector institutions. US$18.1 million is allocated to the research component of ASP, which is mostly for incremental non-salary operating costs. Research is to be in line with action plans which are consistent with the National Research Master Plan and realistic budgetary ceilings and takes account of the existing state of knowledge and expected farm-level impact.

6.4 The ASP was prepared with the expectation that ODA would assist DAR to improve and re-orientate its Crop Protection Research Programme towards an Integrated Pest Management approach. It was approved in November 1993 and research activities are being implemented according to plan. Some extension activities have been hindered by a lack of transport.

6.7 The ASP also places special emphasis on Research-Extension-Farmer linkages. The DAR, in collaboration with DAET, has prepared an action plan based on the following elements: making a senior researcher responsible for routine contacts with defined group of ADDs; conducting on-farm trials; increasing the number of field days at research stations; establishing joint committees to review experimental results; and the prompt dissemination of results. The project will support many of these initiatives.

7. TECHNICAL APPRAISAL

Agricultural Research

7.1 Agricultural research in Malawi has more recently been characterised by research station-based investigations geared to increasing yields of pure stand cash crops (including hybrid maize). There has been very little work on traditional varieties of other food crops, on intercropping or on technology changes requiring minimal cash outlay. The effort to conduct on-farm research through the regional Adaptive Research Teams (ARTs) has been largely unsuccessful. These were managed by DAET and were not accorded a high priority or provided with adequate staffing. In the future, on-farm research will be undertaken by DAR staff. This will ensure that the research scientists maintain direct contact with farmers and have greater control over the on-farm research programmes. The project will seek to improve the links with DAET.

7.2 Under the Agricultural Research Master Plan, being supported by the IDA Agricultural Services Project, research activities have been reorganised into seven major groups or Commodity Research Teams: cereals; oilseeds and fibres; roots and tubers; horticulture; livestock and pastures; soils and agricultural engineering; and technical services. Each research group is headed by a National Research Coordinator, under whom a number of Commodity Team Leaders are responsible for the range of research programmes.

7.3 The Plant Protection Service, which is one of the seven major groups comprises, entomology, plant pathology, nematology, crop storage and plant inspection and quarantine. The PPS currently has 17 graduate staff and 48 technical staff. The National Research Coordinator of PPS is located at Bvumbwe Research Station where there is the highest concentration of PPS staff. However, several PPS staff are outposted to other research stations where they work as part of other Commodity Research Teams. This includes the cotton entomologist, the sorghum entomologist, the grain legume pathologist and the maize entomologist (shortly returning from overseas training).

7.4 Traditionally, plant protection research work has concentrated on chemical methods of insect control but few resource-poor farmers can afford to use such technologies.

7.5 The challenge the project addresses is to help shift the balance of DAR research in two ways: firstly, to give greater research emphasis to improving crop productivity significantly using crop protection methods which are not only environmentally sensitive but also attractive to resource-poor farmers and, secondly, to make greater use of on-farm research methods in order to improve the sensitivity of research to farmers' objectives and constraints.

7.6 The project's approach has three key features:

1. It is **holistic**, encompassing insect pest, weed and disease problems in the whole-farm context;

2. It is **integrated**, covering the range of options for pest control using cultural, biological and chemical strategies;

3. It is **participatory**, listening to farmers and involving them actively throughout the research and dissemination process, alongside researchers and extension officers.

Dissemination

7.7 The linkage between research and extension has always been weak. Extension staff reach only about 25% of smallholders and have largely by-passed farmers with holdings below 1.5 ha as well as women farmers and those with poor access to credit. The project will develop close linkages with the ADD staff both in the areas where trials are being undertaken and also in Headquarters. The extension methodologies identified from the studies outlined in para 4.15 will be developed in collaboration with the ADD and, where appropriate, will be used to improve dissemination to the smallholders. Other dissemination activities will include the production of extension leaflets, training manuals and scientific papers.

7.8 There are two main mechanisms by which the IPM approach and the on-farm research methodologies will be spread to DAR programmes outside the Plant Protection Services. One will be through the annual DAR Technical Meetings where all DAR National Research Coordinators and Commodity Team Leaders review each Commodity Research Team's research programme results for the past year and proposals for the coming year. The second mechanism is the outposting arrangement for plant protection specialists in the commodity-based Research Teams.

7.9 The project's findings will also be disseminated through meetings of the Task Force on Maize Productivity and Soil Pests, which bring together the Chief Agricultural Research Officer, the DAR Maize Commodity Research Team, the Chief Agricultural Extension and Training Officer, the Programme Managers of each of the Agricultural Development Divisions and the Director of the Chancellor College/NRI Soil Pests Project.

7.10 Workshops are planned at the end of the second and third years of the project to ensure the wider dissemination of project findings. The project will support participation by project and DAR staff in in-country and regional workshops, seminars and symposia to ensure wider benefit from the project's findings.

In these activities, the role of SACCAR and scientists and students in Southern Africa will be considered. Links will be developed with the SIDA-funded SADC Plant Protection Programme covering Botswana, Tanzania and Zambia.

Target Farming Systems

7.11 The project activities will take place in Southern Region, where half of Malawi's population lives and where average population pressure on smallholder land is highest.

7.12 The reasons for choosing the Blantyre/Shire Highlands Rural Development Programme (RDP) area as the geographical focus for Year 1 activities are:

1. Bvumbwe Research Station lies in this RDP area, facilitating access;
2. about 900,000 people, or roughly 10% of Malawi's smallholder population, live in this RDP;
3. over 75% of smallholders in this RDP have holdings under 1 ha;
4. the Soil Pests Project has already collected data in this RDP;
5. the FAO/UNDP Land Resources Evaluation Project has collected land resource data including basic farm management data (see Annex 11).

7.13 The choice of agro-ecological zones in which to start new Year 2 and Year 3 programmes will take into account the replicability of findings. This will probably mean focusing on zones where there are large numbers of smallholders and similar farming systems.

7.14 In Year 1, the major focus of the IPM research will be in maize-based cropping systems, because maize (pure stands and intercropped) is planted on 80% of the smallholder cropped area in Blantyre ADD. Other prime candidates for attention are sorghum and millet, pulses (principally beans, cowpeas and pigeon peas) and roots and tubers (mainly cassava and sweet potato, which account for 20% and 7% of cropped area respectively).

7.15 Farmers surveyed in the Soil Pests Project identified termites and wireworms as the most serious insect pests in maize and pulses and witchweed ("striga") as the worst weed. A more detailed review of SPP findings is included in Annex 10.

8. LABOUR, INPUTS AND SERVICES REQUIRED

8.1 Temporary offices at Bvumbwe Research Station will be made available by DAR until the plant protection laboratory block is rehabilitated by the project. Water, electricity, telephones and sewerage are available and can be connected to the laboratory.

8.2 DAR staff at several levels will be attached to the project (see para 3b). Individual people have already been identified. The cessation of the Adaptive Research Team (ART) activities has released suitable field staff with experience of field trials for re-assignment.

8.3 Land is available for trials at Bvumbwe and the experience of the SPP indicates that farmers will be willing to collaborate and provide land for on-farm trials.

8.4 The vehicles will be serviced at Bvumbwe and at private garages.

9. ECONOMIC JUSTIFICATION

9.1 Although the SPP has collected data on incidence of pests, and the FAO Land Resources

Evaluation Project reports provide data on cropping patterns and yields, there is limited recent information on the economic extent of crop losses due to pests. However, crude calculations for IPM strategies in maize in the Blantyre/Shire Highlands zone, shown at Annex 2, suggest there are good prospects that the benefits from the project will exceed incremental costs, provided that work is concentrated on the crops and pests which are most important to smallholders.

10. FINANCIAL APPRAISAL

10.1 Many of the IPM strategies to be investigated by the project will involve changes in cultural practice which require little or no cash inputs (although they may require extra labour inputs) so, financially, they should be attractive to farmers if they are technically effective. The involvement of agricultural economists, as well as the use of participatory methods of research, will help ensure that the recommendations to be extended are financially appropriate.

10.2 There will be no incremental staff costs to be borne by MG, either during the project or subsequently, as the local staff to be attached to the project already fill established posts. The project will be part of the revised activities of the Plant Protection Service. Given the financial constraints facing all Ministries, funding for fieldwork will always be a constraint in the Department of Agricultural Research. This is recognised and it will be necessary during the project to ensure that field activities are restricted to sites which are not too distant from Bvumbwe and are more easily accessible.

10.3 Funding of DAR is tight but under normal budgetary stringency allows funding of wages and salaries plus operating costs for most core activities.

11. SOCIAL AND INSTITUTIONAL APPRAISAL

Social

11.1 The project will have a positive impact on the farm incomes of the poorest groups of farmers, particularly those with less than 0.7 ha of land, who are unable to meet their subsistence needs from agriculture alone.

11.2 Female farmers will actively participate in the project and their specific problems will be considered both separately and as part of the wider farming system. Approximately one-third of rural households are headed by women and, in most areas, women spend more time in the fields than men; in many households women and children play a major role in tasks such as weeding. MOA is aware that a lower proportion of women than men are reached by the extension services and will be making increased efforts under the WB project to redirect its activities towards women.

11.3 The participatory nature of the work recognises the need for a strong sociological and communications/extension research input, combined with a detailed knowledge of village and household level economics, farm management and gender issues. The project will benefit from the information collected by Dr Pauline Peters of Harvard Institute for International Development, who has been collecting detailed household data in the Blantyre/Zomba area since 1988.

11.4 Farming families in the smallholder sector are continually adapting their methods to changing personal, economic and environmental circumstances. Village "experimenters" will be identified and an understanding of their methods, tests and criteria of success developed.

Institutional

11.5 DAR is well managed. However there is a shortage of economists and social scientists in DAR and provision is made to train additional staff. Five of the MSc training awards are scheduled for either agricultural economics or rural sociology and, where feasible, female staff attached to DAR will be given a priority in the allocation of the training awards. Staff from Chancellor and Bunda Colleges will collaborate with the project and will be involved in the training activities. By the end of the project, the staff should be capable of continuing the farming systems work without further long-term technical assistance. However, given the problems of recruiting and retaining economists and social scientists in DAR in the past, it is important that all the scientists trained by the project are exposed to a farming systems approach and become more aware of the social and economic considerations affecting farmer uptake of new technologies.

11.6 Retention and motivation of DAR professional staff is problematic because of low Government salaries. There are 13 Professional Officer vacancies in DAR at present, which represents almost 15% for the total establishment (see Annex 6 on Human Resources). Under the Agricultural Services Project, Government has undertaken to address these difficulties: by improving the career structure for professional and technical staff by implementing mechanisms to make researcher performance a basis for promotion and incentives such as training, sabbatical leave, secondment, participation in workshops/seminars and consultancies; and by providing adequate non-salary recurrent funding for priority research. This project follows this approach. Donor-funded projects assist in improving morale by providing additional resources and equipment for undertaking research.

12. ENVIRONMENTAL APPRAISAL

12.1 It is anticipated that the project's low input approach will have a beneficial impact on the environment. The project will promote the minimum use of pest control chemicals, while encouraging their safe and efficient use. Indigenous methods and the possibility of enhancing cultural practices will encourage improved land management and conservation.

12.2 The project's integrated approach, together with the informed participation of farmers, will ensure that PMS are not environmentally deleterious but will contribute towards stable and sustainable levels of increased crop production.

13. FINANCE

13.1 The cash cost to ODA, including 10% contingencies, is £1.96 million. Construction and laboratory equipment costs will be met from Capital Aid (1986 Grant) and the remainder will be funded from TC funds.

13.2 Project expenditure will occur over four UK financial years, 1995/96 to 1998/99, according to the following schedule.

Table 1: Summary of Expenditure

£ Sterling						
YEAR	95/96	96/97	97/98	98/99	Total	Offshore
Technical Cooperation Costs						
Constant Prices	417,900	388,600	384,550	290,035	1,481,085	1,056,200
Cash prices	417,900	401,812	414,325	325,616	1,559,654	1,112,229
Total TC Cost including 10% contingencies: £1,715,619						
Financial Aid Costs						
Constant Prices	182,200	42,500	0	0	224,700	120,200
Cash prices	182,200	43,988	0	0	226,188	120,996
Total Financial Aid Cost including 10% contingencies: £248,806						
GRAND TOTAL INCLUDING 10% CONTINGENCIES: £1,964,425						

13.3 A detailed breakdown of all costs is given in Annex 1.

14. ARRANGEMENTS FOR IMPLEMENTATION

14.1 The project will be implemented by DAR, assisted by NRI. Terms of reference for NRI are given at Annex 3. NRI inputs fall into two categories: technical back-up and administrative back-up. The technical component will include:

1. provision of a Project Officer in NRI to oversee project activities, including at least one visit per year to the project and participation in the annual review;
2. identification of potential long-term TCOs and consultants;
3. briefing of long-term TCOs and consultants;
4. provision of bibliographic and library services;
5. responses to technical queries from the project team.

The administrative function will include:

1. recruitment of short-term consultants and long-term staff in collaboration with OACD;
2. arranging for procurement with Balfour Williamson;
3. financial reporting;
4. distribution of project technical reports.

For these and other services, standard NRI charges to the project will be made, as indicated in Annex 1.

14.3 The DAR Project Manager, assisted by the TCO Team Leader, will be responsible for the day-to-day management of the project and will report directly to the Chief Agricultural Research Officer in DAR.

14.4 During project implementation the TCOs will pass on responsibilities to Malawians being trained. Annex 5 gives a timetable of senior staff inputs and Annex 3 gives TORs for the TC staff. The TCOs will be identified by NRI but will need to be approved by MG and BDDCA before they can be offered contracts. Malawian staff will be assigned to the project from DAR or directly employed.

14.5 BHC will be responsible for obtaining the official clearance of TCOs, TC equipment and consultants. BHC will also offer guidance on the contractual arrangements of Malawian staff to be employed by the project.

14.6 TORs for the short term consultants will be drawn up by the Project Manager and the TCO Team Leader and will be agreed by the ODA RNR Field Manager in Malawi and by DAR. The consultants will submit reports to DAR, BDDCA, BHC and NRI.

14.7 A Project Steering Committee will be established, chaired by the Chief Agricultural Research Officer. Other members of the Committee will be the Head of Bvumbwe Research Station, a representative from DAET in HQ, the ODA NR Field Manager, the Directors of the ADDs where there are on-going project activities, the NRI Support Officer (if available) and the TCO Team Leader. The Committee will meet three times per year during the first year of the project and then once every six months.

Training

14.8 In-service training of junior staff will be undertaken by the TCOs and senior project staff, particularly in the early stages of the project. Training will also be provided for extension workers, NGOs and farmers as the project progresses.

14.9 There is provision for four MSc places outside the country (Annex 4) of which one is for agricultural economics and another for rural sociology. Suitable candidates will be finally selected by the Project Manager and the TCO Team Leader, who will submit applications through MOA and the Department of Human Resources and Manpower Development. This training will be administered by the British Council under the local arrangements for the ACTS. Malawi does not have the capacity to handle all the MSc training.

14.10 The training model developed by the Soil Pests Project at Chancellor College, whereby the MSc is undertaken by research within the country, will be used by the project. This will ensure that the training is directly relevant to the problems in Malawi and that future staff are more likely to remain within DAR. A schedule of eight MSc places to be provided at the University of Malawi is given in Annex 4. The students will make a major contribution to the project research effort and their work will be closely coordinated with that of other project staff. Funds are provided for a small student hostel at Bunda and for the upkeep and supervision of the students at either Bunda or Chancellor Colleges.

Finances

14.11 The TCO Team Leader will be responsible for managing an ODA imprest account to cover the vehicle operating costs, office costs and local consumables, as required. Precise arrangements and financial limits will be set out in writing by ODA's Finance Department. The four TC-funded vehicles will be registered with the British High Commission.

14.12 All construction work at Bvumbwe and Bunda will be funded from Financial Aid. The Ministry of Works will undertake the design, specifications for the contracts and supervision of all the agreed work. ODA will arrange for the direct payment of the contractor through the Crown Agents Capital Account upon receipt of monthly certificates of work completed and the final certificate for overall completion. These will be countersigned by an independent firm of quantity surveyors approved by the BDDCA Engineering Adviser. The BDDCA Engineering Adviser has been consulted and recommends this method of supervision and payment. He will also make a qualitative check at the end of structural construction.

Consultancies

14.13 Where appropriate, local consultants will be used to undertake short-term assignments but, for some specialist tasks, it will be necessary to recruit from outside Malawi. UK consultants (up to five operational months a year) will be employed to investigate particular specialist problems as they arise. Likely subjects for consultancies include specialist social development inputs, grasshopper (*Zonocerus*) control, pheromones for cotton pest management, cassava disease pathology, *Striga* control, pesticide application, crop storage measures, extension methodology, statistics, institutional analysis and pest management economics. The need for each consultancy will be scrutinised carefully by the steering committee during project implementation.

15. ARRANGEMENTS FOR OPERATION OF THE COMPLETED PROJECT

15.1 After the completion of the project, the activities will be continued by Plant Protection Services within DAR and specifically by staff located at Bvumbwe where plant protection work is focused . The same scale of field activities undertaken during the period of the project will not be continued without donor assistance. It is essential that trial sites and other project activities are not too distant from Bvumbwe and that staff based at sub-stations are involved in the field activities so that vehicle operating costs and other recurrent costs can be kept to a minimum.

15.2 During the project, it is anticipated that basic work for the development of PMS will be developed for the major smallholder crops (excluding tobacco) and that future work will be undertaken to fine-tune and update them. The project will ensure that there is the capacity to continue the work and that, in future, priority will be given to ensuring a better balance between on-farm research and trials located only at research stations. The experience gained during the project will also ensure that the research officers are more aware of farm-level constraints and that future research programmes are designed accordingly.

15.3 The DAR staff trained during the project should be capable of continuing with the farming systems IPM approach after its completion. Throughout the project, there will be close contact with the commodity-based teams and PPS staff working directly with them will continue to develop IPM approaches. It is anticipated that some of the newly-trained staff will work with the other commodity teams and assist with the development of farming systems approaches.

16. MONITORING ARRANGEMENTS

16.1 The project will be monitored on a six-monthly basis by the ODA Field Manager based in Malawi and then annually by BDDCA and MG jointly. Annual monitoring will be undertaken by a group comprising the BDDCA Senior Natural Resources Adviser, the BDDCA Economic Adviser, the BDDCA Social Development Adviser (or consultant substitute), representatives from MOA and ex-officio co-opted members (eg University of Malawi, NRI), as required. The annual monitoring will usually be in July/August each year, at the same time as the Project Steering Committee, to assess progress and to assist with forward planning.

16.2 A major ODA/MG project review will take place after two complete cropping seasons. By then, information will have been collected to allow a more detailed economic appraisal of the project. This will be used to determine the future direction of the project. A decision on whether or not to continue with the project as presently designed will be made then by BDDCA. This will take into account project progress, information on crop losses, estimated future benefits to smallholders and dissemination of findings.

17. RISKS

17.1 One risk might have been that DAR would not fully adopt the researcher-farmer participatory approach but, during the process of project preparation and discussions, the staff of DAR and the Department of Agricultural Extension and Training gave a firm commitment to this approach.

17.2 It is possible that progress in developing new PMS will not be satisfactory and closure of the project could be considered at the end of the second cropping season. The project will build on the results of the SPP at Chancellor College where PMS strategies are already being tested. However, given the importance of developing low-cost technologies to increase yields, the success of the IPM approach is critical to the long-term future of the resource-poor smallholders in Malawi.

17.3 There is the possibility that staff trained by the project will not be retained or may be moved. This is an issue which has received attention in the ASP and the Government is actively looking at ways to ensure improved career prospects in key institutions such as DAR.

BDDCA
May 1995

ANNEX 1

FARMING SYSTEMS INTEGRATED PEST MANAGEMENT PROJECT

SUMMARY OF UK COSTS

TABLE 1A

TECHNICAL COOPERATION COSTS Constant prices;	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)	LOCAL COSTS (£)
Long term TCO costs	199,100	183,000	183,000	183,000	748,100	640,000	108,100
Short term consultancy costs	52,950	51,200	54,700	17,285	176,135	156,500	19,635
NRI support costs	26,100	13,650	13,750	13,750	67,250	67,250	0
Equipment costs	30,300	7,200	7,100	4,100	48,700	43,700	5,000
Vehicle purchase costs	54,000	18,000	0	0	72,000	72,000	0
Vehicle operating costs	7,500	12,000	12,000	12,000	43,500	0	43,500
Local office costs	9,500	12,500	10,500	9,000	41,500	12,750	28,750
Locally engaged staff salaries	24,700	26,700	28,700	12,600	92,700	0	92,700
Local staff allowances	4,750	11,850	16,300	15,300	48,200	0	48,200
Local training costs	9,000	28,500	26,500	15,000	79,000	0	0
UK Training costs	0	24,000	32,000	8,000	64,000	64,000	0
Total TC costs (constant prices)	417,900	388,600	384,550	290,035	1,481,085	1,056,200	345,885
Cash prices;							
Inflators	1.000	1.034	1.042	1.042			
Total TC costs	417,900	401,812	414,325	325,616	1,559,654	1,112,229	447,424
TOTAL TC COSTS PLUS 10% CONTINGENCIES					£1,715,619		

FINANCIAL AID COSTS Constant prices;	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)	LOCAL COSTS (£)
Construction costs	71,000	31,000	0	0	102,000	0	102,000
Equipment costs	47,200	4,000	0	0	51,200	48,700	2,500
Vehicle purchase costs	64,000	7,500	0	0	71,500	71,500	0
Total Financial Costs (constant prices)	182,200	42,500	0	0	224,700	120,200	104,500
Cash prices;							
Inflators	1	1.035	1.033	1.033			
Total financial aid costs	182,200	43,988	0	0	226,188	120,996	105,192
TOTAL FINANCIAL AID COSTS PLUS 10% CONTINGENCIES					£248,806		

TOTAL PROJECT COST	£1,964,425

MALAWI GOVERNMENT FINANCIAL COSTS (Kwacha) TABLE 1B

Staff salaries	number required	Year 1 95/96 (K)	Year 2 96/97 (K)	Year 3 97/98 (K)	Year 4 98/99 (£)	TOTAL (K)
Professional Officers	4	240,000	240,000	240,000	240,000	960,000
Technical Officers	4	40,000	80,000	160,000	160,000	440,000
Technical/Field Assistants	22	110,000	154,000	220,000	240,000	724,000
Typist	1	8,000	8,000	8,000	8,000	32,000
Messenger	1	6,000	6,000	6,000	6,000	24,000
Drivers	6	48,000	48,000	48,000	48,000	192,000
Total staff contribution	-	452,000	536,000	682,000	702,000	2,372,000

SUMMARY OF TC EXPENDITURE

TABLE 2

	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)
UK TC staff;						
Pest Management	75,600	68,000	68,000	68,000	279,600	240,000
Farming systems economist	62,750	57,500	57,500	57,500	235,250	200,000
Sociologist	60,750	57,500	57,500	57,500	233,250	200,000
Short term consultancy costs (indicative);						
Weed scientist (Long Ashton)	10,940	0	10,940	0	21,880	19,500
Pheremones/cotton pests	20,130	20,130	20,130	10,940	71,330	63,000
Pesticide Management	0	20,130	0	0	20,130	17,750
Social Science	10,940	0	10,940	2,345	24,225	21,250
Biometrics (ODA)	10,940	0	6,345	4,000	21,285	19,500
Ag Extension	0	10,940	6,345	0	17,285	15,500
NRI support costs;						
Co-manager (G6)	4,750	4,750	4,750	4,750	19,000	19,000
SSO/SRO	3,400	3,300	3,400	3,400	13,500	13,500
AO/AE	2,600	2,600	2,600	2,600	10,400	10,400
Startup support	12,350	0	0	0	12,350	12,350
G6 travel	3,000	3,000	3,000	3,000	12,000	12,000
Purchase of equipment and vehicles;						
Equipment	30,300	7,200	7,100	4,100	48,700	43,700
Vehicles	54,000	18,000	0	0	72,000	72,000
Local operating costs;						
Office and lab costs	9,500	12,500	10,500	9,000	41,500	12,750
Vehicle operating costs	7,500	12,000	12,000	12,000	43,500	0
UK Training costs;						
Weed science MSc	0	8,000	8,000	0	16,000	16,000
Crop protection MSc	0	0	8,000	8,000	16,000	16,000
Agricultural Economics MSc	0	8,000	8,000	0	16,000	16,000
Rural Sociology MSc	0	8,000	8,000	0	16,000	16,000
Malawi training costs;						
Malawi training costs	9,000	28,500	26,500	15,000	79,000	0
Local staff costs;						
Salaries	24,700	26,700	28,700	12,600	92,700	0
Allowances	4,750	11,850	16,300	15,300	48,200	0
TOTAL TC COSTS	417,900	388,600	384,550	290,035	1,481,085	1,056,200

SUMMARY OF FINANCIAL AID COSTS

TABLE 3

	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)
Construction costs:						
Laboratory/Offices at Bvumbwe	40,000	10,000	0	0	50,000	0
Quarantine house refurbishment	11,000	1,000	0	0	12,000	0
Hostel accomodation at Bunda	20,000	20,000	0	0	40,000	0
Equipment and vehicles;						
Equipment	47,200	4,000	0	0	51,200	48,700
Vehicles	64,000	7,500	0	0	71,500	71,500
TOTAL FINANCIAL AID COSTS	182,200	42,500	0	0	224,700	120,200

TCO STAFF COSTS

TABLE 4

Full costs	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)
Pest Management	75,600	68,000	68,000	68,000	279,600	240,000
Socio-economist	62,750	57,500	57,500	57,500	235,250	200,000
Sociologist	60,750	57,500	57,500	57,500	233,250	200,000
TCO costs	199,100	183,000	183,000	183,000	748,100	640,000

Unit costs per year	Unit Cost	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)
	-						-
Long term inputs							
Pest Management	£60,000	60,000	60,000	60,000	60,000	240,000	240000
Socio-economist	£50,000	50,000	50,000	50,000	50,000	200,000	200000
Sociologist	£50,000	50,000	50,000	50,000	50000	200,000	200000
		160,000	160,000	160,000	160,000	640,000	640,000
Housing costs							
Pest Management	£500/mth	6,000	6,000	6,000	6,000	24,000	0
Socio-economist	£500/mth	6,000	6,000	6,000	6,000	24,000	0
Sociologist	£500/mth	4,000	6,000	6,000	6,000	22,000	0
		16,000	18,000	18,000	18,000	70,000	0
House Furniture							
Pest Management	£8,000	8,000	0	0	0	8,000	0
Socio-economist	£6,000	6,000	0	0	0	6,000	0
Sociologist	£6,000	6,000	0	0	0	6,000	0
		20,000	0	0	0	20,000	0
Field allowances							
Pest Management	£40	1,600	2,000	2,000	2,000	7,600	0
Socio-economist	£15	750	1,500	1,500	1,500	5,250	0
Sociologist	£15	750	1,500	1,500	1,500	5,250	0
		3,100	5,000	5,000	5,000	18,100	0

Notes;

Team leader at £40/d for 50 days (mainly in LLW)

Socio-econ at £15/d for 100 days (mainly in field)

Sociologist at £15/d for 100 days (mainly in field)

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SHORT TERM CONSULTANCIES TABLE 5

Total costs	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)
Weed scientist (Long Ashton)	10,940	0	10,940	0	21,880	19,500
Pheremones/cotton pests	20,130	20,130	20,130	10,940	71,330	63,000
Pesticide Management	0	20,130	0	0	20,130	17,750
Social Science	10,940	0	10,940	2,345	24,225	21,250
Biometrics (ODA)	10,940	0	6,345	4,000	21,285	19,500
Ag Extension	0	10,940	6,345	0	17,285	15,500
Short term consultancy costs	52,950	51,200	54,700	17,285	176,135	156,500

	Unit Cost	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)
Consultants Fees							
Weed scientist (Long Ashton)	£8000/om	8,000	0	8,000	0	16,000	16,000
Pheremones/cotton pests	£8000/om	16,000	16,000	16,000	8,000	56,000	56,000
Pesticide Management	£8000/om	0	16,000	0	0	16,000	16,000
Social Science	£8000/om	8,000	0	8,000	0	16,000	16,000
Biometrics (ODA)	£8000/om	8,000	0	4,000	4,000	16,000	16,000
Ag Extension	£8000/om	0	8,000	4,000	0	12,000	12,000
		40,000	40,000	40,000	12,000	132,000	132,000
Note; Monthly cost based on NRI average between G7 and SSO							
Airfares							
Weed scientist (Long Ashton)	£1750 rtn	1,750	0	1,750	0	3,500	3,500
Pheremones/cotton pests	£1750 rtn	1,750	1,750	1,750	1,750	7,000	7,000
Pesticide Management	£1750 rtn	0	1,750	0	0	1,750	1,750
Social Science	£1750 rtn	1,750	0	1,750	1,750	5,250	5,250
Biometrics (ODA)	£1750 rtn	1,750	0	1,750	0	3,500	3,500
Ag Extension	£1750 rtn	0	1,750	1,750	0	3,500	3,500
		7,000	5,250	8,750	3,500	24,500	24,500
Daily Allowances							
Weed scientist (Long Ashton)	£1190pm	1,190	0	1,190	0	2,380	0
Pheremones/cotton pests	£1190pm	2,380	2,380	2,380	1,190	8,330	0
Pesticide Management	£1190pm	0	2,380	0	0	2,380	0
Social Science	£1190pm	1,190	0	1,190	595	2,975	0
Biometrics (ODA)	£1190pm	1,190	0	595	0	1,785	0
Ag Extension	£1190pm	0	1,190	595	0	1,785	0
		5,950	5,950	5,950	1,785	19,635	0

NRI SUPPORT COSTS

TABLE 6

	Unit cost	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)
Co-ordinator (G6)	£475	4,750	4,750	4,750	4,750	19,000	19,000
SSO/SRO	£340	3,400	3,300	3,400	3,400	13,500	13,500
AO/AE (Travel/recruitment etc)	£260	2,600	2,600	2,600	2,600	10,400	10,400
Startup support (2 months)		12,350	0	0	0	12,350	12,350
Travel to Malawi for G6		3,000	3,000	3,000	3000	12,000	12,000
NRI management costs		26,100	13,650	13,750	13,750	67,250	67,250

Notes;

G6, SSO and AO for 10 days per year

Dr Wood at Chancellor (SPP) will spend up to 2 months in the 1st year assisting with startup

TC EQUIPMENT COSTS

TABLE 7

	Unit cost	m ui	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)
Computers and hardware	£6,000	2	12,000	0	1,000	0	13,000	13,000
Laptop computers	£2,000	4	8,000	0	0	0	8,000	8,000
Publishing costs			1,000	1,500	1,500	1000	5,000	0
Books/Manuals/Journals	£2,000		1,500	1,500	1,500	1000	5,500	5,500
Literature searches			300	200	100	100	700	700
Miscellaneous			7,500	4,000	3,000	2000	16,500	16,500
Equipment costs			30,300	7,200	7,100	4,100	48,700	43,700

TC VEHICLE PURCHASE COSTS

TABLE 8

	Unit cost	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)
Landrovers	£18,000	54,000	18,000	0	0	72,000	72,000
Vehicle purchase costs		54,000	18,000	0	0	72,000	72,000

VEHICLE OPERATING COSTS TABLE 9

	Unit cost	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)
Landrovers	£3,000	7,500	12,000	12,000	12,000	43,500	0
Vehicle operating costs		7,500	12,000	12,000	12,000	43,500	0

OFFICE OPERATING COSTS TABLE 10

	Unit cost	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)
Stationery/office supplies		1,500	1,500	1,500	1,000	5,500	1,375
Field supplies		6,000	8,000	7,500	5,000	26,500	6,625
Laboratory supplies		2,000	3,000	1,500	3,000	9,500	4,750
Local office costs		9,500	12,500	10,500	9,000	41,500	12,750

LOCAL STAFF COSTS TABLE 11

SALARIES	Unit cost	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)
Agricultural economist	£7000 p yr	7,000	7,000	7,000	0	21,000	0
Local consultancies	£7500 p yr	7,500	7,500	7,500	2,000	24,500	0
Admin secretary (Dip)	£3200 p yr	3,200	3,200	3,200	2,600	12,200	0
Enumerators	£1000 p yr	2,000	4,000	6,000	6,000	18,000	0
Casual Labour	£1000 p yr	5,000	5,000	5,000	2,000	17,000	0
Locally engaged staff salaries		24,700	26,700	28,700	12,600	92,700	0

ALLOWANCES FOR LOCAL STAFF

TABLE 12

	Unit cost	b s	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)
Agricultural economist	£10	*	500	1,000	1,000	0	2,500	0
Project Manager	£15	*	750	750	750	750	3,000	0
Agronomist	£10	*	500	1,000	1,000	1,000	3,500	0
Pathologist	£10	*	500	1,000	1,000	1,000	3,500	0
Entomologist	£10	*	500	1,000	1,000	1,000	3,500	0
Field assts (9 staff)	£5	*	1,000	3,000	4,950	4,950	13,900	0
Enumerators	£5	*	1,000	3,000	4,950	4,950	13,900	0
Agr-economics	£5	*		550	550	550	1,650	0
Weed science	£5	*		550	550	550	1,650	0
Crop protection	£5	*			550	550	1,100	0
Local staff allowances			4,750	11,850	16,300	15,300	48,200	0

LOCAL TRAINING AND STAFF DEVELOPMENT COSTS

TABLE 13

	Unit cost	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)
Entomology MSc	£3000 p yr	1,500	3,000	1,500	0	6,000	0
Pathology MSc	£3000 p yr	1,500	3,000	1,500	0	6,000	0
Weed science MSc	£3000 p yr	1,500	3,000	1,500	0	6,000	0
Rural Sociology MSc	£3000 p yr	1,500	3,000	1,500	0	6,000	0
Agricultural Economist MSc	£3000 p yr	0	1,500	3,000	1,500	6,000	0
Pathology MSc	£3000 p yr	0	1,500	3,000	1,500	6,000	0
Weed science MSc	£3000 p yr	0	1,500	3,000	1,500	6,000	0
Rural Sociology MSc	£3000 p yr	0	1,500	3,000	1,500	6,000	0
Supervision		1,000	1,000	1,000	1,000	4,000	0
Regional travel		1,000	2,000	2,000	1,000	6,000	0
Project courses (e.g. PRA)		500	1,000	1,000	1,000	3,500	0
Field staff training		500	500	500	0	1,500	0
Regional workshop		0	0	4,000	0	4,000	0
Crop Protection course		0	6,000	0	6,000	12,000	0
Local training costs		9,000	28,500	26,500	15,000	79,000	0

UK TRAINING COSTS

TABLE 14

	Unit cost	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)
Weed science MSc	£16,000		8,000	8,000	0	16,000	16,000
Crop protection MSc	£16,000		0	8,000	8,000	16,000	16,000
Agricultural Economics MSc	£16,000		8,000	8,000	0	16,000	16,000
Rural Sociology MSc	£16,000		8,000	8,000	0	16,000	16,000
UK Training costs		0	24,000	32,000	8,000	64,000	64,000

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FINANCIAL COSTS

CONSTRUCTION COSTS

TABLE 15

	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)
Laboratory/Offices at Bvumbwe	40,000	10,000	0	0	50,000	0
Quarantine facility refurbishment	11,000	1,000	0	0	12,000	0
Hostel accomodation at Bunda	20,000	20,000	0	0	40,000	0
Construction costs	71,000	31,000	0	0	102,000	0

EQUIPMENT COSTS

TABLE 16

	Unit cost	m ui	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)
Refrigerator -Large	£1,000	2	2,000	0	0	0	2,000	£0
Refrigerator -small	£500	1	500	0	0	0	500	£0
Zoom Microscope	£700	6	4,200	0	0	0	4,200	£4,200
Compound microscope	£1,000	1	1,000	0	0	0	1,000	£1,000
Field microscopes	£500	6	3,000	0	0	0	3,000	£3,000
Camera Kit	£1,500	2	3,000	0	0	0	3,000	£3,000
Computers and hardware	£6,000	2	12,000	0	0	0	12,000	£12,000
Laptop computers	£2,000	6	8,000	4,000	0	0	12,000	£12,000
Internet connection	£1,500	1	1,500	0	0	0	1,500	£1,500
Photocopier	£6,000	1	4,000	0	0	0	4,000	£4,000
Electronic balance	£2,000	4	8,000	0	0	0	8,000	£8,000
Equipment costs			47,200	4,000	0	0	51,200	48,700

VEHICLE PURCHASE COSTS

TABLE 17

	Unit cost	m ui	Year 1 95/96 (£)	Year 2 96/97 (£)	Year 3 97/98 (£)	Year 4 98/99 (£)	TOTAL (£)	OFFSHORE COSTS (£)
Landrover	£18,000	1	18,000	0	0	0	18,000	18,000
Minibus	£20,000	1	20000	0	0	0	20,000	20,000
Pickup	£10,000	2	20000	0	0	0	20,000	20,000
Motorcycles	£1,500	9	6,000	7,500	0	0	13,500	13,500
Vehicle purchase costs			64,000	7,500	0	0	71,500	71,500

ANNEX 2

POSSIBLE ECONOMIC IMPACT OF IPM PROJECT

It is difficult at this stage to estimate the likely economic impact of the IPM project because of uncertainty about how quickly suitable IPM recommendations can be identified and disseminated. However, an indication of the possible value of the project is given below.

In Year 1, the project will start field investigations of IPM in maize in the Blantyre/Shire Highlands Rural Development Programme area. This area contains roughly 10% of Malawi's smallholder population and grows 85,000 ha of maize. Assuming an average yield of 1 t/ha, and an economic value of US$200/t (as assumed by the World Bank for Malawi's maize imports in 1994, cif Blantyre), the RDP's maize production is worth roughly £11.3 million.

The Soil Pests Project's on-farm investigations in two localities in this RDP found in 1991/92 that an average of 14% of maize plants were so damaged by termites at the vegetative growth stage that they produced no yield.

Assuming that:

(a) this is a representative indication of the yield loss;

(b) the IPM project identifies a pest management strategy which will increase maize yields for adopting farmers by 5%; and

(c) the proportion of farmers adopting this new strategy in the Blantyre/Shire Highlands RDP is (for simplicity's sake) 30% in Years 6-10, 50% in Years 11-15 and 70% in Years 16-20;

the NPV (at 12% discount) of the production increase over 20 years will be £934,000.

Bearing in mind (1) the likelihood that recommendations suitable for maize in Blantyre/Shire Highlands RDP will be appropriate elsewhere in the country; and (2) the project work programme offers the potential for identifying suitable IPM strategies for other major smallholder crops too, there are reasonable prospects that the incremental benefits from the project will exceed the incremental costs.

ANNEX 3

TERMS OF REFERENCE FOR SENIOR TC AND LOCALLY ENGAGED STAFF

Note The terms of reference set out below are short forms of the final job descriptions, which will depend for their exact phrasing upon:

1. the range of technical skills that will be provided by the MG counterparts and the corresponding balance required from the TCOs. MG have indicated that there is not likely to be an economist available for the counterpart farming systems economist position and the project will recruit a locally-engaged agricultural economist. MG will provide a pest management specialist who will be the Project Manager, an entomologist, a pathologist, an agronomist, plus up to 14 technical staff by the end of the project;

2. the TCO Team Leader will be the TCO with the most experience in a farming systems approach to research and will not necessarily be the Pest Management Specialist. The TCO Team Leader will assist with management and co-ordinating duties, as set out below, over and above his/her technical responsibilities.

TCO TEAM LEADER (ONE OF THE THREE TCOS)

Reports to: The Malawian Project Manager (DAR) and BDDCA.

Duration of assignment: Four years from start of project.

Functions:

i) Coordination of the project, particularly the ODA inputs.

ii) Team Leader of the TCO staff team and assistance to the Malawian Project Manager with day-to-day management of the project.

Duties/General:

a) Assist the Project Manager to coordinate and scientifically direct the project to achieve the project objectives; ensure that all TCO staff participate in relevant programmes and that good relations and discipline are maintained.

b) Administer the ODA-funded elements of the project, including vehicles and equipment. Manage and be responsible for the TC project imprest accounts; monitor and report on project budget expenditure.

c) In conjunction with the Project Manager and other members of the team, prepare work plans which are consistent with the objectives of the project and produce quarterly and annual project reports; maintain regular contact with NRI, BDDCA and the BHC.

d) Liaise with BDDCA and DAR on recruitment of consultants and coordinate their inputs to the project; make necessary logistical arrangements for personnel visiting the project.

e) Liaise with BDDCA, BHC and OACD on conditions of service and other personnel matters (including accommodation) for TCOs and their families.

f) Supervise training programmes, including the recruitment, processing and academic supervision of students attached to the project.

g) Establish linkages with MG senior management, national and regional institutions, development projects, NGOs and private companies.

h) Liaise with BHC on clearance of personnel and equipment, residence permits, vehicle registration and other administrative matters.

i) Coordinate project review missions in consultation with BDDCA, BHC and MG.

Note The TCO Team Leader will be assisted in certain of these duties by an Administrative Secretary.

PEST MANAGEMENT SPECIALIST

Reports to: The Project Manager through the TCO Team Leader.

Duration of Assignment: Four years from start of project.

Function: Supervision and coordination of the agronomic and pest management research programme.

Duties:

a) In collaboration with the MG pest management specialist and other project staff, design, implement and analyse crop loss assessment and pest management strategy trials.

b) Develop crop yield/pest damage profiles for pests, weeds and diseases and strategies for reducing crop losses.

c) Supervise students as required in collaboration with University supervisors at Bunda and Chancellor Colleges in Malawi.

d) Assist in the design and implementation of training courses and production of pest management manuals and handbook for Malawi.

TCO FARMING SYSTEMS ECONOMIST

Reports to: The Project Manager through the TCO Team Leader.

Duration of Assignment: Four years from start of project.

Function:

Supervision, coordination and implementation of the socio-economic project component in collaboration with the locally-engaged Agricultural Economist and the TCO Sociologist.

Duties:

a) In collaboration with other team members, design, implement and analyse a programme of research to characterise the farming systems and understand the socio-economic conditions in the project areas.

b) Examine farmers' perceptions of pest management problems and responses to these problems. Quantify the social and economic values of crop losses and identify farmers' socio-economic constraints to implementation of pest management strategies. Use this knowledge to contribute to the overall direction of the project.

c) Contribute to the formulation, implementation and analysis of the pest management, crop loss and on-farm trials programmes, ensuring active participation of farmers throughout the process.

d) Work with the TCO Sociologist and the locally-engaged Agricultural Economist to identify farmer groups with whom the project will work and integrate into the project activities.

e) Ensure that adequate data is collected (including baseline data) and analysed for the effective monitoring and evaluation of all project activities.

f) Develop close working links with ADD staff and other institutions, including NGOs, working in the project areas.

g) Carry out staff and student supervisory and training duties as required.

h) In consultation with other Team Members, prepare a work plan for the current year within two months of arriving in the country.

i) Contribute to quarterly and annual reports and undertake administrative, financial and organisational duties as required by the TCO Team Leader and the Project Manager.

TCO SOCIAL ANTHROPOLOGIST

Reports to: The Project Manager through the TCO Team Leader.

Duration of Assignment: Four years from the start of the project.

Functions:

i) To provide the project and its staff with a sound basis of anthropological concepts and techniques.

ii) To ensure that all the research work undertaken is directed towards solving pest problems identified by farmers and that the proposed solutions are within the resources of the majority of farmers.

Duties:

a) In collaboration with the TCO Farming Systems Economist and the locally-engaged Agricultural Economist, build up an understanding of the general socio-cultural characteristics, including identification of interest groups, of the areas of project activity and develop guidelines for work in other areas.

b) Assist the TCO farming systems economist to describe and quantify, where possible, the social values of crop losses and identify farmers' social and non-economic constraints to the implementation of pest management strategies.

c) Train other project staff (including the TCO Farming Systems Economist, if necessary) in sociological research techniques, so that similar studies can be continued as necessary in subsequent years.

d) Explore different ways of involving farmers in the implementation of the project (through meetings, exchange visits, field days, participatory data collection etc); make recommendations as to the most appropriate methods to be used for different purposes. Develop structures for participation of farmers in project development at all stages.

e) In conjunction with the TCO Farming Systems Economist (and with inputs from natural scientists, as necessary), examine farmers' perceptions of pest control and of the relative importance of pests and other constraints.

f) Contribute to quarterly and annual project progress reports.

g) In consultation with other team members, prepare a work plan for the current year within two months of arriving in the country.

h) Undertake other tasks as specified by the Project Manager and the TCO Team Leader.

AGRICULTURAL ECONOMIST (MALAWIAN)

Reports to: The Project Manager through the TCO Farming Systems Economist.

Duration of Assignment: Three years from the start of the project.

Function: To work with the TCO Farming Systems Economist and the TCO Social Anthropologist in supervising and implementing the socio-economic components of the project.

Duties:

a) In collaboration with other team members, the Agricultural Economist will design, implement and analyse a programme of research to characterise and understand the economic conditions in project areas.

b) Assist the TCO farming systems economist to describe and quantify, where possible, the economic values of crop losses and identify farmers' economic constraints to the implementation of pest management strategies; use this knowledge to contribute to the overall direction of the project.

c) Contribute to the formulation, implementation and economic analyses of the pest management, crop loss and on-farm trials programmes, ensuring active participation of farmers throughout the process.

d) Work with the TCO Sociologist to identify farmer groups with whom the project will work and integrate into the project activities.

e) In collaboration with the TCO farming systems economist and other team members, build up a detailed understanding of the economic characteristics and the farming systems of the farming households participating in the project and more generally in the project area.

f) In collaboration with the TCO farming systems economist and other team members, build up an understanding of the economic characteristics of the areas of project activity and develop guidelines for work in other areas in subsequent years.

g) Assist with the collection and analysis of adequate data for the effective monitoring and evaluation of all project activities.

h) Develop close working links with ADD staff and other institutions working in the project areas.

i) Contribute to quarterly and annual reports and undertake other duties as required by the TCO team leader and the Project Manager.

NATURAL RESOURCES INSTITUTE: SUPPORT SERVICE

Reports to: BDDCA

Duration: Project duration.

Function:

To assist with the successful project implementation from technical and administrative standpoints, through the provision of support services from UK, in close liaison with BDDCA and project field staff.

The services will include:

Technical

a) Provision of a senior staff member of NRI who can provide technical back-up in the UK.

b) Specialist support (including bibliographic and advisory services) as requested.

c) Monitoring of professional standards through reports and an annual visit to the project.

Administrative

a) Identification, recruitment, briefing and personnel management as required for long-term TCOs and short-term consultants for the project, through liaison with the Overseas Appointments and Contracts Department (OACD) of ODA.

b) Provision to BDDCA, BHC and MG of (i) financial and technical progress reports at quarterly intervals; (ii) reports from short-term contracts/visits within six weeks of completion of the contract or visit.

c) Arrangement of all travel to and from Malawi for all TC staff in accordance with current ODA procedures.

d) Arrangement of all project procurement and related shipping in accordance with current ODA procedures.

Fees for carrying out these services are included in the project budget at Annex I.

FARMING SYSTEMS INTEGRATED PEST MANAGEMENT PROJECT

PROPOSED REVISED SCHEDULE OF TRAINING **ANNEX 4**

UK TRAINING

	Type	Location	95/96	96/97	97/98	98/99
Agricultural Economics	MSc	Wye College		xxxxxx	xxxxxx	
Crop Protection	Diploma/ MSc	Reading	xxxxxx	xxxxxxxxxx xx	xxxxxx	
Weed Science	MSc	Bristol (Long Ashton)			xxxxxx	xxxxxx

MALAWI TRAINING (BUNDA COLLEGE)

	Type	Location	96/97	97/98	98/99	99/00
Agronomy (Entomology)	MSc -	Bunda	xxx	xxxxxxxxx xxx	xxxxxxxxx	-
Agronomy (Weeds)	MSc	Bunda	xxx	xxxxxxxxx xxx	xxxxxxxxx	
Agronomy (Pathology)	MSc	Bunda		xxx	xxxxxxxxx xxx	xxxxxxxxx
Agricultural Economics	MSc	Bunda	xxx	xxxxxxxxx xxx	xxxxxxxxx	
Rural Sociology	MSc	Bunda		xxx	xxxxxxxxx xxx	xxxxxxxxx
Rural Sociology	MSc	Bunda		xxx	xxxxxxxxx xxx	xxxxxxxxx

Notes:

1. Years are Financial Years (Beginning in April).
2. The 'x' indicates a month of training in a given year.
3. Bunda courses start in January. UK courses start in October.
4. UK courses are for one year (except diploma+MSc = 2 years)
5. Bunda courses are 2 years: first year mainly course work, second mainly thesis project

ANNEX 4

TRAINING SCHEDULE

	Type	Location	95/96	96/97	97/98	98/99
UK TRAINING						
Agricultural Economics	MSc	Wye		xx	xxxx	
Crop Protection	MSc	Wye			xx	xxxx
Weed Science	MSc	Bristol		xx	xxxx	
Rural Sociology	MSc	Not yet decided		xx	xxxx	
MALAWI TRAINING						
Entomology	MSc	Bunda	cccfff	ffffff	cc	
Pathology	MSc	Chancellor	cccfff	ffffff	cc	
Weed Science	MSc	Chancellor	cccfff	ffffff	cc	
Rural Sociology	MSc	Chancellor	cccfff	ffffff	cc	
Agricultural Economics	MSc	Bunda		cccbb	bbbbbb	cc
Pathology	MSc	Bunda		cccbb	bbbbbb	cc
Weed Science	MSc	Bunda		cccff	ffffff	cc
Rural Sociology	MSc	Chancellor		cccff	ffffff	cc

Notes:

1. **cccc** refers to course work which is required for a research MSc by the University of Malawi.

2. **ffff** refers to field work which will be done with the project at Bvumbwe.

3. **bbbb** refers to field work which will be done in collaboration with the project at Bunda.

ANNEX 5

STAFFING SCHEDULE

	95/96	96/97	97/98	98/99
UK TC INPUTS				
Pest Management	111111	111111	111111	111111
Farming Systems Economist	111111	111111	111111	111111
Social Scientist	111111	111111	111111	111111
Locally recruited Agro-economist	1111	111111	111111	
MALAWI SENIOR STAFF INPUTS				
Pest Management (Nematology) and Project Manager (70% of time allocated to the project)	111111	111111	111111	111111
Pathology	111111	111111	111111	111111
Agronomy	111111	111111	111111	111111
Entomology	111111	111111	111111	111111
Crop Protection (ex UK MSc)			111	111111
Weed Science (ex UK MSc)			111	111111
Socio-economist (ex UK MSc)				111
Technical Officers	111222	222333	333333	444444
Technical assistants (field)	222333	333444	555666	666666
Technical assistants (lab)	111222	222333	333444	444444
Field assistants	112244	446688	88 10 12	12

ANNEX 6

HUMAN RESOURCES IN THE DEPARTMENT OF AGRICULTURAL RESEARCH

(Source: Agricultural Research Masterplan July 1993)

In December 1992, the levels of academic qualifications of research staff in DAR were as shown in Table 1. Between 1978 and 1993, DAR lost 12 PhD scientists and 15 MSc holders to other departments, private sector and international organisations.

Included in Table 1 are 12 MSc scientists pursuing graduate training leading to PhD degrees at overseas universities, plus seven BSc scientists pursuing MSc degrees. The number of staff currently in training represents about 17% of the DAR professional staff establishment (in 1993).

Table 2 presents a breakdown of DAR's professional staff amongst major research disciplines.

Table 3 indicates the distribution of staff between the research stations and the Adaptive Research teams that existed in the country. The ARTs have since been disbanded and staff are being absorbed into the main commodity teams.

Table 4 indicates the staff projections from the year 1993 to 2000. These figures were contained in the 1993 Research Master Plan but will need revision. Many of the staff included in the ARTs are being assimilated into the Agricultural Sciences Group. In August 1994, the Technical Services were split into Plant Protection Services and Agricultural Services.

Table 5 indicates the staffing establishment in Plant Protection Services and the number of staff that will be working with the IPM project.

Table 1: Research Staff of DAR as at December 1992

QUALIFICATIONS							
	PhD	MSc	BSc	Non Degree	Total	Establ-ishment	Vac
P8 and above	5	13	1	-	26	33	7
PO	12	37	16	-	65	81	16
CTO	-	-	-	4	4	8	4
STO	-	-	-	9	4	16	7
TO	-	-	-	60	60	68	8
STA	-	-	-	27	27	33	6
TA	-	-	-	197	228	197	(31)
TOTAL	19	55	22	354	424	438	17

Note The figures in the table do not include expatriate staff working in DAR on short-term contracts.

Table 2: Distribution of DAR Scientists Among Major Research Disciplines, December 1992

DISCIPLINE SCIENTISTS	NO OF SCIENTISTS	% OF TOTAL
Library	2	2.7
Soil Science	7	7.95
Soil Microbiology	2	2.27
Crop Agronomy	31	35.23
Plant Breeding	12	13.64
Entomology	7	7.96
Plant Pathology	5	5.68
Seed Technology	2	2.27
Farm Machinery	2	2.27
Animal Science	6	6.82
Statistics	2	2.27
Agroforestry	3	3.41
Agric. Economics/Anthropologist	5	5.68
Plant Genetic Resources	2	2.27
	88	100.00

Table 3: Summary of Current Research and Technical staff in the DAR excluding Headquarters

INSTITUTIONS	SENIOR SCIENTISTS	RESEARCH OFFICERS	TECHNICIANS GRADE	FIELD ASSISTANTS	TOTAL
a. Research station					
Bvumbwe	2	18	18	57	96
Chitedze	13	22	28	78	140
Lunyangwa	2	5	4	13	24
b. Experimental station					
Makoka	1	3	7	29	40
Mkondezi	-	1	-	14	15
Kasinthula	-	4	1	12	17
Lifuwu	1	2	2	11	16
c. Sub-stations					
Bembeke	-	-	-	1	1
Tsangano	-	-	1	1	2
Bolero	-	-	-	1	1
Chitala	-	-	1	11	12
Mbawa	-	-	1	6	7
Meru	-	-	1	16	17
Nchenachena	-	-	-	3	3
Ngabu	-	1	2	9	12
Baka	-	-	2	15	17
d. Adaptive research ADD's					
Karonga	-	2	1	2	5
Mzuzu	-	1	-	1	2
Lilongwe	-	1	-	5	6
Kasungu	-	2	-	3	5
Liwonde	-	1	2	2	5
Salima	-	1	-	-	1
Blantyre	-	1	-	1	2
Ngabu	-	-	-	-	-
TOTAL	19	65	71	291	446

Table 4: DAR Professional Staff Projection for the period 1993-2000

	YEAR							
COMMODITY GROUPS	1993	1994	1995	1996	1997	1998	1999	2000
Cereals	11	13	13	13	13	13	13	13
Grain, Legumes, Oilseeds and Fibres	12	15	15	15	15	15	15	15
Horticulture	12	12	16	16	16	16	16	16
Soils and Agricultural Engineering	16	19	19	19	19	19	19	19
Livestock and Pastures	7	8	8	8	8	8	8	8
Agricultural Service	25	38	38	38	38	38	38	38
Adaptive Research	10	16	16	16	16	16	16	16
Administrative Staff	6	10	10	10	10	10	10	10
TOTAL	99	131	135	135	135	135	135	135

Table 5: Plant Protection Services Staff (includes staff on study leave)

	GRADE			
DISCIPLINE	PO	STO	TO	TA
Nematology	1	1	0 (T)	2
Pathology	7	2	2 (1)	6
Entomology	7 (1)	4	1 (1)	11
Produce Inspectorate	0 (1)	8	1 (1)	3 (1)
Crop Storage	2 (1)	2	0 (2)	4
TOTAL	17 (3)	17	5 (5)	26 (1)
IPM Requirements (end of project)	6	1	3	10

Notes The figures in brackets indicate vacancies

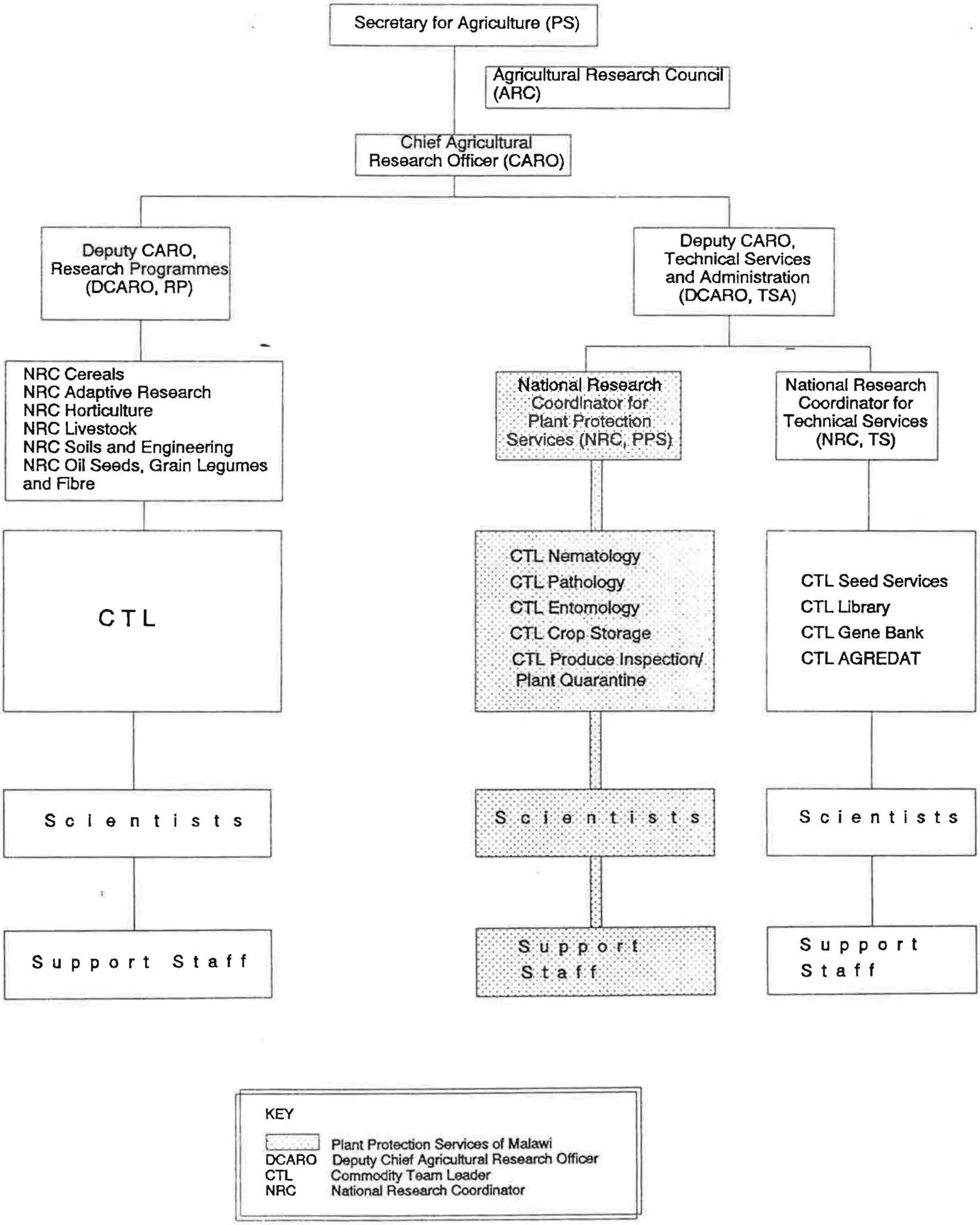
Other staff could be transferred from the disbanded ARTs or HQ

The following staff are still on study leave or secondment:

P Ngwira - Senior Pathologist
Mr Kapeya - Assistant Chief Entomologist
A D Gadabu - Senior Entomologist

ANNEX 7

DEPARTMENT OF AGRICULTURAL RESEARCH



INSTITUTIONS IN AGRICULTURAL RESEARCH AND DEVELOPMENT

1. Introduction

The National Rural Development Programme of the Malawi Government is the primary instrument to promote broadly-based rural development. The country is divided into eight Agricultural Development Divisions (ADDs) which are subdivided into Rural Development Project areas (RDPs) containing between 30,000 and 40,000 farm families. Many of these integrated projects were funded by donors; ODA supported the Phalombe RDP in Blantyre ADD between 1979 and 1985. RDPs are divided into Extension Planning Areas (EPAs), containing around 5000 farm families, which are the basic units for field activities. In some areas they have been combined due to staff shortage problems. The national average ratio of extension workers (Technical Assistants or TAs) to farm families is 1:800 but this varies substantially from place to place.

Despite the high levels of investment under previous phases of NRDP in rural infrastructure, staff training, provision of services and facilities for smallholders, there is considerable disillusion with the impact to date on smallholder productivity and incomes. The farmers to benefit have been those with above average resource endowments and who have had access to credit. The Malawi Government has made clear its desire to extend the impact to include all categories of farm families.

2. Department of Agricultural Research

The Department of Agricultural Research was reorganised in 1985. The Department is headed by the Chief Agricultural Research Officer (CARO) who has two deputies, one for Research Programmes, the other for Technical Services. Research is organised into seven commodity groups, each headed by a National Research Coordinator. The groups consist of a number of multidisciplinary teams. The Agricultural Research Council was established in 1985 to set policy guidelines within which the DAR operates and approve annual research programmes and projects. The Council's members are drawn from a range of institutions in the agricultural sector.

The research station network consists of four main stations, seven experimental stations and seven substations. The four stations serve the different regions of the country: Lunyangwa in the north, Chitedze in the centre and Makoka and Bvumbwe in the south. Chitedze and Bvumbwe have undergone considerable improvement and expansion with World Bank funding.

Under the terms of World Bank assistance, the Department of Agricultural Research has drafted a Research Master Plan which outlines research plans for the five-year period 1993-98 and attempts to prioritise commodity research nationally and by ADD. The Plan has received criticism as being over-ambitious given the limited resources which will be available for research. It will need to be revised in the light of the Government's policy on Poverty Alleviation.

A high proportion of research effort in the past has been devoted to maize variety work, particularly the production of hybrids. Dent hybrids produced have not gained widespread acceptance by smallholders. Attention has more recently turned to flinty hybrids and it is hoped that some will be available for release next season. The introduction of higher-yielding maize varieties still remains the Government's first priority. Complementary work in maize agronomy, pathology and entomology is also being conducted by the maize commodity team, with long-term support for operational expenditure from the Rockefeller Foundation and short-term technical assistance. A ten-year Action Plan has been prepared by the team, with support from CIMMYT, Zimbabwe.

Research on other commodities has been less intensive. One of the main problems in recent years has been acute staff shortages. A high proportion of Ministry personnel have been overseas for training (USAID) and, although many have returned, there are still high attrition rates. Support is provided by a number of agencies for different aspects of the programme, eg ICRAF - agroforestry; ICRISAT - groundnuts; IITA - root crops; CIAT - beans.

3. University Participation in Agricultural Research

Bunda College of Agriculture plays an active role in agricultural research and relations with the DAR are generally good. The College collaborates on the national bean research programme and is also prominent in livestock research. Other research topics include farm equipment, animal traction and crop storage. The DAR is keen to develop additional links with the College.

The Department of Rural Development at Bunda offers undergraduate courses in rural development, including a major extension/communications component. Most of the graduates go on to work in the Ministry of Agriculture but there is not any direct research collaboration. Staff members are sometimes contracted to undertake specific items of research by Government or donor projects. A masters course has recently been established with support from IDRC.

Chancellor College at Zomba also has research projects in agriculture. NRI began an extra-mural contract with the college in 1989 for research on the IPM of soil pests. The Departments of Sociology and Economics have research interests in rural development but suffer from a lack of resources to support student field projects. The Centre for Social Research (an autonomous institution within the University) employs economists, sociologists and a statistician and mostly responds to outside requests for specific pieces of commissioned research, eg project evaluations, baseline surveys, nutrition studies etc. Most of this work concerns the rural sector.

4. The Department of Agricultural Extension and Training

The structure of the NRDP has been described above and is the main vehicle for the provision of extension services to farmers through the Department of Agricultural Extension and Training (DAET). The Ministry of Agriculture's Chief Agricultural Extension Officer has overall responsibility for extension. Within the Department, there are nine technical sections, each headed by a subject matter specialist. At ADD level, there are also subject matter specialists to provide back-up to extension workers and to initiate programmes.

The upgrading of the extension service has been a focal point of NRDP, with the posting of field assistants and professional officers to ADDs and substantial infrastructural development in the form of offices and housing. Training centres have been established for extension workers and farmers, both at day centres and at residential centres for longer courses.

Much of the extension methodology is based on block gardens to demonstrate recommended practices, where farmers attend meetings at the block garden to observe the demonstration. The problem has been the inappropriateness of most practices to the circumstances of the majority of smallholders and the low rates of participation in these demonstrations. In the Annual Survey of Agriculture (1987/88), only 10% of farmers had attended a demonstration. In Blantyre ADD, the ratio of families to block gardens ranged from about 500 to nearly 9000 (between RDPs).

Extension staff actively promote the formation of farmers' credit clubs. The content of demonstrations, and extension messages in general, are biased to the needs of these farmers, with a heavy emphasis on the use of purchased inputs inaccessible to the majority. There is therefore a need for improvement both in the content of extension messages and in the way in which they are delivered.

5. Other services for smallholders

The Agricultural Development and Marketing Corporation (ADMARC) is the national marketing parastatal, with buying points throughout the country. It offers a guaranteed price for major smallholder crops but farmers are also free to sell all crops except cotton to private traders. Tobacco can be sold to other estates and directly on the auction floors. ADMARC also supplies inputs, particularly fertiliser. Fertiliser has been, and continues to be, subsidized by Government but there are plans to remove the subsidy during 1995/96.

SIGNIFICANCE OF PESTS

1. Maize

Flint varieties are mainly grown for home consumption and local marketing. There is little fertiliser use on these "traditional" varieties and yields tend to be only around 1t/ha. Dent varieties are generally grown for sale to ADMARC and are generally fertilised (though often not at the recommended rates). Farmers with smaller holdings tend to grow a higher proportion of traditional varieties, although the recent introduction of flint hybrids seems to have been greeted enthusiastically and up to 25% of smallholders could be growing them. It remains to be seen if fertiliser use will increase with the adoption of flint hybrids. The demise of the credit system is likely to impact on the use of hybrids and fertilisers in normal years.

Rusts, stemborers, whitegrubs, cutworms, termites and wireworms are locally important field pests throughout the growing season. Armyworm can be locally severe in some seasons and streak is common even though farmers do not generally recognise it as a problem. Weed control demands high labour inputs and, where weeding is not done on time, the effect of weed infestation can be severe. Where adequate labour is available, weed control can be very effective. Witchweed (Striga asiatica), widespread in southern Malawi, can be locally devastating and in many areas is considered along with termites as the most important pest problem in maize. Infestation is associated with low soil fertility which has resulted from continuous cropping in many smallholder areas. Some fields have been abandoned because infestations are so severe. The majority of fields are continuously cropped and this may lead to yield loss due to nematode attack. Cob rots and bollworms (Heliothis) are important as the maize ears ripen: the cobs are often not fully sheathed permitting damage by these pests.

Termites, weevils, rats and diseases are serious problems in the stores, often destroying up to a quarter of the grain each year. "Flint" local or new hybrid types are preferred because of greater pest resistance in storage. Termites tend to attack both the crib and the stored grain but their damage allows other pests in.

2. Phaseolus beans

Beans are generally intercropped with maize during the rainy season but, in areas where winter production is feasible (eg the Chiradzulu highlands, Dedza, Ntcheu, Rumphi, Chitipa and the Namwera region), farmers also sole crop beans on the residual moisture as the maize is coming up to harvest. Both bush and climbing beans are grown throughout Malawi, though local preferences may dictate the relative proportions of each in different regions. CIAT are assisting the national bean research programme and there is increased potential for identifying resistant strains.

Intercropped beans are planted with one to three plants per maize station. The density is often determined by the availability of seed. Weeds are a problem throughout maize/bean systems but specific pests include beanfly (Ophiomyia spp.) and weevils (Alcidodes spp.) which, between them, can cause serious losses. Farmers in Namwera often do not attempt to grow a first crop of beans due to the combination of beanfly and heavy rains causing flower shedding. Beanfly is often associated with Fusarium and Sclerotium rolfsii, but the relationship is not well understood. Various leafspots, pathogens and pod borers also damage the bean plant but there have been few estimates of crop losses. There will be close collaboration with the CIAT programme.

3. Groundnut

Groundnuts are widely grown throughout Malawi, both for consumption and for sale. Chalimbana variety, once the most popular, has been superseded by higher-yielding varieties. Groundnuts are both sole cropped and intercropped and, as with beans, are planted after early season operations for maize are completed. Plant densities tend to be low and this, combined with late planting, means that yields under traditional management tend to be low.

Termites damage the roots and pods and increase the chances of contamination by Aspergillus and aflatoxin residues. Hilda patruellis can be sporadically disastrous but there are few estimates of crop losses. Leafspot is often very obvious but spraying is often uneconomic unless other management practices are optimal. Aphid-transmitted rosette is local and sporadic. The parasitic weed Alectra vogelii is locally severe.

4. Cowpea

Cowpeas are widely grown for consumption, particularly in the Southern Region, although they are in general not as important as groundnuts in the cropping system. Termites, Alcidodes spp., whitegrubs, pod borers and pod rots affect both the creeping ("khobwe") and the determinate ("nseula") types. The parasitic weed Alectra vogelii is of sporadic importance on the crop in southern Malawi.

5. Pigeonpea

Pigeonpea is being grown more extensively throughout the Southern Region, especially towards Mulanje. Fusarium wilt is the main problem on traditional varieties but increasing amounts of the wilt-resistant cultivar, ICP9145, are being grown for sale. Work is being conducted to see if the resistance breaks down in the presence of the root-knot nematode, Meloidogyne javanica, and work is currently under way to see if a similar situation occurs in the field. Pigeonpea also suffers from pod rots, pod borers (particularly Heliothis) and other insect pests.

6. Cassava

Cassava is grown throughout Malawi and is the second most important crop after maize. Production is concentrated in the northern part of the country and along the lakeshore where it is the crop best suited to the hilly, rocky slopes. In maize-dominant areas, it is often grown as a security crop but, close to the main urban centres, it is becoming an important cash crop. In either production system, it is generally sole cropped or used as an edging for fields. Many different varieties are grown. With the increasing incidence of drier years, cassava is being planted more widely and is becoming an increasingly important food crop.

The most important pests are mealy bug and mosaic virus (transmitted by whitefly). The mealy bug problem is not just a concern for Malawi but is being addressed Africa-wide by GTZ and IIBC through a programme of biological control by breeding and releasing hymenopterous parasites. In Malawi, there appears to be a lack of effective monitoring of the mealy bug and its parasites and, not surprisingly, conflicting views of progress. A World Bank report (1989) stated that it was confined to 8% of cropped area but, according to the Department of Agricultural Research (personal communication), some areas have abandoned growing it altogether.

7. Sweet potato

This is grown throughout the country and is an important security crop, especially after drought years. Many different varieties are grown, for both production and sale, especially close to the main towns. The main pest is Cylas puncticollis, the sweet potato weevil, which can cause losses of up to 50%. Farmers are unaware of possible control methods and tend to harvest early to avoid damage. Damping off is a minor problem: other pests include mice, wireworms, termites, whitegrubs and other insect pests.

8. Sorghum/millet

These crops are confined to the drier parts of the country, mostly in the south. The area under cultivation has declined and a significant proportion of production is used for making beer, an important nutritional supplement. There is very little information on pests of these crops except for consistent references to stem borers and the parasitic weed Striga asiatica. The elegant grasshopper Zonocerus elegans can devastate early season plantings necessitating total re-sowing. With the drier seasons, the area being planted could increase.

9. **Cotton**

Cotton is a cash crop for some 60,000 smallholders, mostly in the south and the lakeshore areas. Treated seed is free from ADMARC. Yields of 250-450 kg/ha are normal but pest management is generally poor and, if improved, could give as much as 1t/ha. The most important constraints are weeds and various bollworms, principally Pectinophora, Diparopsis and Earias with some Heliothis. Applications of pyrethroid insecticides to control these bollworms (particularly early-season Diparopsis) have led to an increase in whitefly. Farmers know that control of insect pests on cotton is essential to increasing yields. Many possess knapsack sprayers, which are cumbersome and require large amounts of water. ULV sprayers were eagerly adopted initially but their use has declined due in part to poor availability of batteries. It has been suggested that solar batteries, installed at village level, could offer a solution but the economics of smallholder cotton production in Malawi have received little study.

10. **Rice**

Rice is grown in the Central and Southern Regions, as either the upland rainfed variety (Faya) or the lowland irrigated variety (Blue Bonnet). There is little information on upland rice, although rice blast is thought to be serious, lodging was mentioned (possibly caused by termites) and weeds are almost certain to cause problems.

11. **Mango**

Mangoes are widespread and are used for both food and cash. They are damaged by scale insects and anthracnose but severity and losses have not been estimated.

12. **General**

There is little quantitative information on crop losses to the different pests, although data is being collected on the relative infestations in different cropping systems and farmers' perceptions of the importance of the different pest problems. A SADC survey of factors constraining crop production in Malawi (Manda, Dowela & Johnson, 1985) ranked pests, weeds or diseases, amongst 13 physical/biological factors, as follows:

Cassava	1st
Cotton	1st
Fruit	1st
Sorghum	2nd
Pulses	2nd
Wheat	4th
Maize	6th
Rice	7th

Four of the thirteen factors - climate, annual rainfall, rain distribution and soil topography - cannot be manipulated, emphasising the significance of pest management in crop production practices.

ANNEX 10

SOIL PESTS PROJECT (CHANCELLOR COLLEGE/NRI)

Project Background

The Soil Pests Project, based at Chancellor College, Zomba, is a multidisciplinary project aimed at investigating the impact of soil pests, pathogens and weeds in the Southern Region of Malawi. The project adopted a farming systems approach and uses information obtained from socioeconomic farmer field surveys in Blantyre, Liwonde and Ngabu Agricultural Development Divisions (ADDs) to develop suitable methods of solving the farmers' crop protection problems. In addition, detailed laboratory studies are conducted with the objective of understanding the farmers' insect, disease and weed problems and thus help in devising the most suitable strategies for improving the farmers' approach to crop protection.

The core of the project is based on five postgraduate trainees, including PhD studies in entomology and weed science and MSc studies in entomology, weed science and plant pathology, with supporting field and laboratory assistants.

The project is funded from the ODA-RNRRS Integrated Pest Management programme managed by NRI (Mr Perfect). It comprises:

- an Extramural Contract at Chancellor College
- an Extramural Contract at Reading University
- NRI (Entomology, Pathology, Weed Science and Socioeconomics)

General and Socioeconomic Information

The annual reports provide the results of surveys of insect pathogens, nematodes and weeds which affect small-scale farmers' crops in the Southern Region of Malawi. They also contain information on the socioeconomic status of the farmers interviewed during the study and descriptions of the major characteristics of this farming community.

The geographic location of the study is between latitude 13° 30' and 17° 2' and longitude 34° 2' and 35° 58'. The study sites are located in three agro-ecological zones; the high altitude/high rainfall zone in the Shire Highlands, which is about 900m above sea level and receives 1,041mm annual rainfall; the medium altitude/high rainfall Chilwa plain, which is about 700m above sea level and receives 1,031mm annual rainfall and the low altitude/low rainfall rift valley floor (in the Lower Shire), which is about 100m above sea level with only 500mm annual rainfall.

The study area has only one major rainy season, normally between November of one year and March of the next, followed by light winter showers (between May and July). The winter rains are used to grow fast-maturing crops such as Phaseolus vulgaris (phaseolus beans) and Avena sativa (garden peas). However, where perennial rivers such as the Shire exist, the residual moisture along the banks is used to produce a second maize crop (the winter crop). Seventy percent of the surveyed farming families grew a winter crop and 30% only grew the summer crop during the main rainy season.

Most farmers own upland gardens, some also own homestead gardens and river valley (dambo) gardens. However, because of shortage of land, few farmers (16% in BLADD, 23% in LWADD and 46% in NADD) practise crop rotation.

All the farmers in the study area grow Zea mays (maize), intercropped with one or more pulses. The main pulses grown include phaseolus beans, Vigna unguiculata (cowpeas) and Cajanus cajan (pigeon peas). Arachis hypogea (groundnuts) are also grown in the more sandy lakeshore plains. Other cereals grown include Oryza sativa (rice) on the Lake Chilwa plain, along the rivers that flow into this lake and also along the banks of the Shire River in the Lower Shire. Sorghum vulgare (sorghum) and Pennisetum and Eleusine (millet) are widely grown in the low rainfall areas of the Lower Shire. Small-scale farmers in NADD and

Chingale in BLADD grow Gossypium hirsutum (cotton) as a commercial crop. A few farmers in NADD also grow Helianthus annuus (sunflower). Cassava and sweet potatoes are important staple food crops in BLADD and LWADD and sweet potatoes in parts of NADD.

The soils in NADD are so fertile that farmers are able to obtain good yields without application of any artificial fertilizers. However, the soils in BLADD and LWADD are of low fertility so farmers need to apply fertilizers in order to obtain reasonable yields of maize. Shortage of cash was found to limit the use of fertilizers by the farmers in these ADDs.

The literacy rate among the farmers was highest in BLADD (885), followed by LWADD (76%) and lowest in NADD (32%). The packaging and delivery of any technologies for farmers in these ADDs would need to take this factor into consideration.

The farmers included in this research programme were randomly selected from lists provided by Extension staff of the Ministry of Agriculture based in each Extension Planning Area (EPA). The sample included male- as well as female-headed households, some of whom belonged to farmers' clubs while others did not. The majority of the farming families studied (82.3%) were male-headed. All farmers used family labour to accomplish their farming tasks. However, 58% in LWADD, 78% in BLADD and 91% in NADD supplemented family labour with hired workers, especially during the peak weeding or harvesting periods.

Soil Insect Pests

Farmers identified the most important soil insect pests as termites, wireworms,whitegrubs and grasshoppers (Zonocerus). Several species of termites belonging to the genera Allodontermes, Ancistrotermes, Hodotermes, Macrotermes, Microtermes, Odontotermes, Pseudacanthotermes, Trinervitermes and Synacanthotermes were found to attack maize. Some of these species were also found to attack phaseolus beans, cowpeas, pigeon peas, groundnuts, cotton, sunflower and sorghum; Hodotermes sp. attacked cotton; Macroterms sp. attacked pigeon peas, groundnuts, cotton, sunflower and sorghum; Microterms sp. attacked pigeon peas, cotton, sunflower and sorghum, Odontotermes sp. attacked cotton and sorghum; Pseudacanthotermes sp. attacked phaseolus beans, cowpeas and groundnuts; while Trinervitermes sp. attacked cotton, sunflower and sorghum. Termites infested all growth stages of these crops. Termites were generally most damaging in NADD and Katuli EPA in LWADD. Other important soil insect pests of maize included whitegrubs and wireworms. The most common were Gonocephalum simplex, Schizonycha sp., Orphnus sp. and Zophosis sp. Zonocerus was an important early seasin pest of sorghum. The major soil insect pests of phaseolus beans were Ophiomyia sp. and Alcidodes sp. while those on cowpeas were Alcidodes sp.. Alcidodes leucogrammus was the most common on both crops. Hilda patruelis was important on groundnuts and was also found to attack cowpeas and phaseolus beans. Apart from termites, the most common insect pest of cotton was Microcerus spiniger.

Alcidodes leucogrammus, Alcidodes erthropterus, Microcerus spiniger, whitegrubs, wireworms, Schizonycha sp., Oxyrachis tarandus, Agrotis sp., Orphnus sp., Gonocephalum simplex and Zonocerus elegans were studied in the screenhouse at Chancellor College. Cyclas weevils were the most important pest of sweet potatoes.

Weeds

Seventy-four weed species were found in farmers' fields during the 1990/91 cropping season. The largest number of species (54) was found in Mombezi EPA while the smallest (37) was in Katuli EPA. The most abundant species in BLADD were Galinsoga parviflora, Commelina benghalensis, Cyperus rotundus, Bidens pilosa and Digitaria barbonica while the most abundant in LWADD were Cyperus rotundus, Commelina benghalensis, Bidens pilosa, Rhynchelytrum repens and Acanthospermum hispidum. The most abundant species in NADD were Corchorus olitorius, Cyperus rotundus, Boerhavia diffusa, Commelina benghalensis and Mullogo cerviana. Striga asiatica (witch weed) seriously affected maize and sorghum while Alectra vogelii parasitised cowpeas.

The growth characteristics of the weeds found in the farmers' fields are being studied in the screenhouse. The seed bank in the soils obtained from different EPAs is also being assessed.

Plant Pathogens

Twelve species of fungus were found infecting parts of Phaseolus vulgaris below the soil surface. These included Macrophomina phaseolina, Fusarium solani, F. oxysporum, F. equiseti, F. gramineanum, Fusarium sp., Rhizoctonia solani, Rhizoctonia sp., Alternaria sp., Sclerotium rolfsii and Penicillium sp. The greatest number of species (six) was isolated from bean plants collected from Livunzi EPA while the lowest number (two) was from Chingale and Katuli. Three plant pathogens, including Penicillium sp., an unidentified fungus and a bacterial pathogen, were isolated from cowpeas. Two pathogens (Fusarium udum and a bacterium) were isolated from pigeon peas, one pathogen (a bacterium) infested groundnuts, while one fungal pathogen (Fusarium moniliforme) was isolated from maize.

Nematodes were found in or around parts of most crops but their density varied with location. Pratylenchus zea was most widespread in maize and also infested beans and pigeon peas. Other plant parasitic nematodes included other species of Pratylenchus, Scutellonema sp., Aphelenchus avenae, Helichotylenus sp., Trichodorus sp. and root knot nematodes (Meloidogyne spp.).

PHYSICAL CHARACTERISTICS, POPULATION AND FARMING SYSTEMS

1. Physical characteristics

Malawi is a landlocked country, lying between 9° and 17° south, with an area of approximately 120,000km^2 (of which some 20% is inland water). It is bordered on the north and northeast by Tanzania, on the east, south and southwest by Mozambique and on the west by Zambia.

Topographically, the country can be divided into four main regions (SADCC/DEVRES 1985):

- The East African Rift Valley passes through the country, containing Lake Malawi, the lakeshore zone, and the Upper and Lower Shire Valley. Altitude in the valley floor zone ranges from 100m to about 500m.

- Medium altitude plateau areas cover around three-quarters of the land area, mostly in the central region, ranging from around 800m to 1600m.

- Highland areas rising to 2300m in the north (Nyika and Viphya), centre (Dowa and Dedza) and southeast (Shire).

- Isolated mountains and plateaux of Mulanje (3000m) and Zomba (2400m) in the east.

Climate ranges from semi-arid to sub-humid, reflecting the topographic differences. The Lower Shire valley (100-250m) is the hottest and driest area, with least reliable rainfall (often less than 500mm). The Lakeshore and Upper Shire Valley (300-600m) have both high and low rainfall areas, with some parts vulnerable to drought. The mid-altitude plateau is the most agriculturally productive area, receiving rainfall of between 700mm and 2000mm per annum, with less year-to -year variation. The highlands are high rainfall areas, subject to occasional frosts.

Between 80 and 90% of the annual rainfall occurs in the warm season between December and March/April, followed by a cool dry season until August and a hot dry season through to the start of the next rains in November. Mean annual temperatures vary considerably with altitude, from 13°C in the Nyika Highlands to 25°C in the Shire Valley.

2. Population

The population of Malawi was estimated at 8.8 million (1991) and is growing at an annual rate of about 3.5%. The country has one of the highest population densities in Africa, with 93 inhabitants per square kilometre of land surface and 170 inhabitants per square kilometre of arable land. Average family size is about five persons.

Population distribution is very uneven, with the highest densities occurring in the southern region. Nearly 40% of the total population is found in Blantyre and Liwonde Agricultural Development Divisions (ADDs).

3. Agriculture and Farming Systems

According to World Bank statistics, agriculture contributes 35% of GDP, accounts for 90% of foreign exchange earnings and supports 85% of the population. It therefore plays a central role in the economy. Malawi's agriculture has often been hailed as a success story in the sub-Saharan Africa context, having attained real growth at an annual average rate of 5% during the 1970s, 1% during the early 1980s and 2.7% during 1987-90. This has mainly been achieved through the expansion of the area under cultivation. In future, due to acute land shortage and low use of fertilisers, future growth will have to come from the introduction of higher-yielding technologies.

Various studies have shown that the aggregate rate of growth masked significant differences in performance between the two subsectors of agriculture - the estates and the smallholders. Estate agriculture, producing tobacco, tea, sugar and coffee for the export market, thrived, whilst smallholder agriculture - the means of livelihood for the majority of the rural population - made little headway. Government, assisted by donors, has attempted to redress the imbalance by modifying policy and directing investment towards the smallholder sector, particularly since the instigation of the National Rural Development Programme (NRDP) in 1978. Malawi has nonetheless been able to maintain national food self-sufficiency in most years during the 1980s although droughts in the early 1990s have resulted in the need to import maize.

It is estimated that, of the 9.4 million hectares total land area, 0.85 million ha are occupied by estates and contribute 25% of the agricultural GDP, while 3.5 million ha are available for use by smallholders and account for 75% of agricultural GDP (1987/88 Annual Survey of Agriculture). Overall, this gives 0.41 ha available per head of population. In any one year, perhaps 1.7 million ha are actually cultivated.

Mean holding size varies by district, the highest being in Kasungu ADD in the Central Region (at 1.75 ha) and the lowest in Blantyre ADD in the South (at 0.88 ha). The overall mean is 1.17 ha. Fifty-five percent of all holdings are <1 ha, a further 30% of holdings are in the 1-2 ha category and only 14% are over 2 ha.

Because of small farm size, families were encouraged by the Extension Services to plant the bulk of the holding (up to 90%) to maize for domestic consumption. The preferred varieties are the local flinty types; yields are around 800-1000kg per hectare. Only some 5% of maize area is planted to higher yielding hybrids (2.5-3 tons per hectare) and this is normally treated as a cash crop by farmers with larger-than-average holdings.

The vicious circle faced by Malawian smallholders is widely recognised. There is little opportunity to fallow land in the densely populated areas of the central and southern regions, nor to use rotations. Continuous cropping causes soil fertility to decline and certain pest problems to increase and, with no cash resources to purchase fertiliser or inputs and few animals to provide manure, the farm family is faced with ever-decreasing yields. Maize production is commonly insufficient to meet family food requirements for the year; family members are therefore forced off the farm to find cash employment. This may cause labour shortages at critical times in the cropping season, such as planting and weeding, further depressing yields. Appropriate mechanisation is not available nor could be afforded to ease labour constraints; cultivation is overwhelmingly by hand.

There are undoubtedly many departures from this characterisation. In particular, those farmers with larger holdings have benefitted from credit to purchase fertiliser and other inputs but the majority of farm families have been unable to participate in these schemes.

Intercropping is widely practised, especially in areas of high land pressure. Food crops grown throughout the country with maize, and also in pure stands, include beans, pigeon pea and other pulses, groundnuts and sweet potato. Cassava is grown in the lakeshore zone where there are also pockets of rice cultivation. In the lower Shire valley, sorghum and millet are important although maize still occupies the largest area. Millet is also grown elsewhere for beer brewing.

Cash cropping amongst smallholders is secondary to food production; only a small area is devoted to cash crops and many families have none at all. Groundnuts and tobacco are the principal cash crops in the central plateau area, along with some hybrid maize. Cotton is grown on the lakeshore to the west of the Zomba plateau and in the lower Shire and is an important small farmer cash crop. There are areas of horticultural production in higher areas and of sunflowers along the Zambian border. Potatoes and wheat are grown in some high altitude areas. Smallholder production of the traditional estate crops (sugar, flue-cured tobacco, tea and coffee) has been allowed only in special "Crop Authority" schemes.

Livestock ownership is skewed in favour of the larger landholders. Animal traction is used more widely in the northern region where population pressure is lower. There is some small-scale dairying near urban areas. Goats are more widespread amongst smallholders, kept as an insurance for emergency cash needs; they are not raised for milk production.

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SHEET 1

SUGGESTED FORMAT FOR PROGRESS REPORTS BY PROJECT MANAGER

COUNTRY: ....PROJECT TITLE........................... MIS CODE: ....
PROJECT TITLE: ....
PERIOD COVERED: .... PREPARED BY: ....POSITION:............

INPUTS

(a) STAFF CHANGES (including contract renewals, arrivals, objectives, change in post title, etc, with dates)

....
....
....
....
....
....

(b) **CONSULTANTS** and visitors out to the country during this period, or planned for next period, with status (possible or firm)

STATUS	START DATE	DURATION	NAME(S)	HOME INSTITUTION	TASK

....
....
....
....
....
....
....

o TC TRAINEES and visitors from the country, during this period, or planned for next period, with status (possible or firm); In-country or Third Country Training

STATUS	START DATE	DURATION	NAME(S)	INSTITUTION	COURSE

....
....
....
....
....
....
....
....

(d) EQUIPMENT AND BOOKS (orders and receipts)

ITEMS	COST(£)	SUPPLIER or AGENT	DATE ORDERED	DATE RECEIVED	BALANCE NOT RECEIVED	ACTION TO BE TAKEN

....
....
....
....
....
....
....

SHEET 2 PROGRESS REPORT

COUNTRY: .... PROJECT TITLE: ....MIS CODE: ....

PERIOD COVERED .... PREPARED BY: .... POSITION: ....

COMMENTS ON INPUTS (any points about which ODA and the recipient project management should be aware, particularly in regard to any problems encountered):

OTHER COMMENTS (any other points about which ODA and the recipient project management should be aware, especially any comments in relation to the assumptions/risks indicated in the logical framework.

GUIDANCE/DECISION REQUIRED (Identify these with target dates for action)

Signed: .... Date ....

****

COMMENTS BY FIELD MANAGER (Background to any comments included above, including steps taken to overcome any problems)

Signed: .... Date: ....

Attach sheets 3 and 4 giving statement of progress against the activities and inputs and the outputs, with continuation sheets and appendices where necessary.

SHEET 3 PROGRESS/MONITORING REPORT

COUNTRY: .... **PROJECT TITLE:** .... **PERIOD COVERED:** ....
MIS CODE: .... **DATE PREPARED** ....

PROJECT STRUCTURE	MEANS OF VERIFICATION	PROGRESS	COMMENTS AND RECOMMENDATIONS
ACTIVITIES (Insert activities and inputs from logical framework)	(For each activity and input insert from the logical framework means of quantifying/ assessing.)	Provide a report against each activity and input.	Provide comments against each activity and input plus recommendations where appropriate. Comment on the extent to which assumptions are being met.

SHEET 4 PROGRESS/MONITORING REPORT

COUNTRY:.................... PROJECT TITLE:................. PERIOD COVERED:................

MIS CODE: .... DATE PREPARED ....

PROJECT STRUCTURE	INDICATORS OF ACHIEVEMENT	PROGRESS	COMMENTS AND RECOMMENDATIONS
OUTPUTS (Insert outputs from logical framework)	(For each output, insert from logical framework the indicators of achievement and the means of quantifying/ assessing)	Provide a report against each indicator of achievement	Provide comments gainst each output and recommendation if appropriate. Comment on the extent to which assumptions are being met.

SHEET 5 MONITORING/OUTPUT TO PURPOSE REVIEWS REPORT

COUNTRY .... PROJECT TITLE ....PERIOD COVERED...................
MIS CODE: .... DATE PREPARED ....

PROJECT STRUCTURE	INDICATORS OF ACHIEVEMENT	PROGRESS	COMMENTS AND RECOMMENDATIONS
PURPOSE (Insert immediate objectives/purpose from logical framework together with each ODA priority objective assigned together with the PIMS markers	(For each immediate objective/purpose insert from logical framework indicators of achievement with means of quantifying/assessing.)	Provide a report against each indicator of achievement. For Output to Purpose Reviews also provide a rating for each immediate objective and an assessment against each PIMS marker using * below	Provide comments against each immediate objective/ purpose and recommendations if appropriate. Provide comments on the extent to which assumptions are being met.

* 1. = likely to be completely achieved
2. = likely to be largely achieved
3. = likely to be partially achieved
4. = only likely to be achieved to a very limited extent
5. = unlikely to be realised
x = too early to judge the extent of achievement

SHEET 6 OUTPUT TO PURPOSE REVIEWS REPORT

COUNTRY...................... **PROJECT TITLE**................ **PERIOD COVERED**...................

MIS CODE.................... **DATE PREPARED** ....

PROJECT STRUCTURE	INDICATORS OF ACHIEVEMENT	PROGRESS	COMMENTS AND RECOMMENDATIONS
GOAL (Insert wider objectives/goal from logical framework)	(For each wider objective/the project goal, insert from logical framework indicators of achievement with means of quantifying/assessing)	Provide a report against each indicator of achievement with a rating for each wider objective, see * below	Provide comments against the wider objectives/project goal and recommendations if appropriate. Provide comments on the extent to which assumption are being met.

* 1. = likely to be completely achieved
2. = likely to be largely achieved
3. = likely to be partially achieved
4. = only likely to be achieved to a very limited extent
5. = unlikely to be realised
x = too early to judge the extent of achievement

TITLE SECTOR FILE REF. PATH		Last Update From MACS	Country:-

MIS CODES	ITEM	ALLOCATION (£000's)	S T A T	SPENT TO THE END OF LAST F.Y. (£000's)	SPENT SO FAR 95/96 (£000's)	FORECASTS (£000's)				Notes
						95/96	96/97	97/98	98/99 & BEYOND	
	Contingency (enter value)									
	Total									

Forecasts Last Amended

TOTAL ALLOCATION	Includes contingency.	
Total spent	Previous years plus this year-to-date.	
Balance		DATE APPROVED
Allocation spent (%)		DATE OF E.o.L.
Total forecasted spend	Total forecasts plus past expenditure.	EXTENSIONS
Potential overspend	Difference between forecast spend and allocation.	
Potential overspend (%)		

Print date:

05-Dec-95

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FARMING SYSTEMS INTEGRATED PEST MANAGEMENT PROJECT

STAKEHOLDER PLANNING WORKSHOP

SHIRE HIGHLANDS HOTEL

LIMBE

TUESDAY 4 - THURSDAY 6 JUNE 1996

WORKSHOP SUMMARY REPORT

Dr J. Mark Ritchie
TC Team Leader
IPM specialist

Ministry of Agriculture and Livestock Development
Department of Agricultural Research
Farming Systems IPM Project
Bvumbwe Research Station
P.O. Box 5748
LIMBE

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CONTENTS

EXECUTIVE SUMMARY

This report documents the findings of the Farming Systems IPM Project Stakeholder Workshop held in Limbe from 4-6 June 1996. The FSIPM Project is financed by the UK Overseas Development Administration to develop capacity in Farming Systems Integrated Pest Management and to devise pest management strategies for subsistence farmers. 29 participants attended from 11 interested agencies. The purpose of the workshop was to strengthen design and implementation of the Farming Systems Integrated Pest Management Project with the commitment and understanding of key participating individuals and organizations. Objectives focused on reviewing and refining the logical framework as a project design and management tool and on establishing priority crops and pests for field trials.

The results of a Stakeholder analysis are presented as a table of Stakeholder interests and a Stakeholder transaction matrix. A crop choice matrix was developed to determine priorities. A revised logical framework for the FSIPM Project is proposed with a list of recommendations to the FSIPM Project Steering Committee. The workshop was successful in accomplishing its main objectives. The approach was highly participatory and led to a greater understanding of the project rationale and design and responsibilities for implementation. The commitment and sense of ownership and consensus generated during the workshop were critical to its success and will need to be maintained if the FSIPM Project is to accomplish its purpose of developing national capacity for Integrated Pest Management with the goal of farmer adoption of low-cost sustainable crop pest management systems.

b

INTRODUCTION

The Farming Systems Integrated Pest Management (FSIPM) Project is a 1.96 million pound project financed by the UK Overseas Development Administration and the Government of Malawi, to develop the capacity of the Department of Agricultural Research to undertake Farming Systems Integrated Pest Management Resarch and to provide government and NGO extension systems with pest management recommendations suitable for resource-poor farmers. The FSIPM Project Stakeholder Workshop was conducted in Limbe, Malawi, from Tuesday 4 - Thursday 6 June 1996. The workshop involved 29 participants from 11 agencies either directly involved, or with a direct interest in the outcomes of the FSIPM Project.

This report summarises the significant outcomes of the workshop with implications for the design and implementation of the FSIPM Project. A separate accompanying report describes the content and process of the workshop and this should be read in conjunction with the original Project Memorandum and the 92-page resource pack issued to all workshop participants. The resource pack, prepared by Dr Ritchie, TC Team Leader, and Dr Orr, Farming Systems Economist, provided background information for participants with sections covering stakeholder analysis, the use of the logical framework in project design and implementation, the socio-economic context of the Blantyre-Shire Highlands Rural Development Project Area and pests and diseases of major crops in Southern Malawi with some potential control options.

WORKSHOP RATIONALE AND PREPARATION

The Project Management Team and the former ODA Field Manager (Mr Tom Barrett) initiated the workshop process because of a perceived need to increase participation in the project by Malawian organizations and individuals with a significant stake in the outcomes of the Project. Such workshops are becoming a routine tool in the design and management of ODA projects using the TeamUp approach developed by Team Technologies Inc. In particular the initiators perceived a need to reach a common understanding of the project rationale, its design and implementation responsibilities among the partner agencies. In preparation for the workshop the TC Team Leader conducted a "stakeholder analysis", through review of project and other relevant documents to identify groups and agencies involved in project implementation. These groups were contacted and asked to send representatives to the workshop. Dr Felix Jere, a veterinarian with experience of process facilitation with various agencies in Malawi, was invited to facilitate the workshop and worked with the Project Team to finalise the Programme. Co-facilitation of technical sessions was provided by the Project Team.

WORKSHOP PURPOSE

To strengthen design and implementation of the Farming Systems Integrated Pest Management Project with the commitment and understanding of key participating individuals and organizations.

WORKSHOP OBJECTIVES

The workshop objectives were to:

1. Review the Logical framework approach to project management;
2. Review the FSIPM Project Goal and rationale;
3. Review the project design;
4. Refine the project activities and output performance indicators;
5. Set scope for the project fieldwork: select locations, priority crops and key pests to investigate;
6. Refine the project's management, monitoring and evaluation plans;
7. Resolve any other key issues for project implementation; and
8. Prepare recommendations for Project Steering Committee.

These objectives centred on understanding, reviewing and refining the Project Framework (PF) for the Project (objectives 1-4, 6, above), and proposing modifications of the PF and any other recommendations (objectives 7, 8) to the Steering Committee. A separate objective (5) was to establish clear priorities for field research trials in relation to crops, pests and geographical areas.

STAKEHOLDER ANALYSIS

As a preliminary to reviewing the FSIPM Project Goal and rationale, the Workshop participants developed a revised presentation of FSIPM Project Stakeholders Interests (Figure 1) and a modified Stakeholder Transaction Matrix (Figure 2). This exercise highlighted the significance for the Project of traditional leaders, and International Agricultural Research Institutes (IARCs) as external stakeholders.

CHOICE OF CROPS AND PESTS

A Workshop group completed an extended version of the crop choice matrix provided as a proforma in the workshop resource pack (Figure 3). The clear message of this document, based on participants' professional expertise and literature sources compiled in the resource pack, was that the Project should concentrate initially on maize, pigeon-pea and common beans as the principal crops in the Blantyre/Shire Highlands RDP which have major pest problems for which potential candidate pest management strategies exist which can be tested with farmers.

The geographical focus of the Project had been defined in the Project Memorandum as the Blantyre Shire Highlands and participants supported this choice. However, no specific EPA was recommended by the Workshop and the Project Team were left to make an informed choice on the basis of knowledge gained from literature sources (see resource pack), reconnaissance visits to the seven EPAs of the RDP and discussions with ADD staff.

Figure 1

FSIPM Project Stakeholders' interests

Primary stakeholders	Interests	Potential impact of project	Relative priority of interest
Smallholder farming families	• improved food security & nutrition • access to inputs • new technologies • increased DAET support	(+) (+) (+) (+)	=1
Women heads of households	• improved food security & nutrition • access to inputs • new technologies • increased DAET support	(+) (+) (+) (+)	=1
Farmers with <1 hectare	• improved food security & nutrition • access to inputs • new technologies • increased DAET support	(+) (+) (+) (+)	=1
Secondary Stakeholders			
Farmers with > 1 hectare	• access to inputs • new technologies • loss of labour from poorer farmers	(+) (+) (-?)	=2
DAR	• achieve MoALD Strategy Action Plan targets • reorient staff skills to Farming Systems approach • increased physical resources • increased competition for staff • enhanced public image	(+) (+) (+) (-) (+)	=2
Bvumbwe Res. Station	• buildings/equipment • upgraded staff skills/status • competition for scarce staff resource	(+) (+) (-)	=2
DAET	• upgraded staff skills/status • increased staff field mobility • exchange of ideas/information • enhanced profile with farmers • upgraded staff skills • audio-visual materials	(+) (+) (+) (+) (+) (+)	=2
ODA	• institutional learning • NR policy objectives • conserving staff inputs • cost control • enhanced public image	(+) (+) (+) (-) (+)	=3
University of Malawi	• buildings • income • students • publications	(+) (+) (+) (+)	=3
NGOs	• exchange of ideas/information • complementary inputs to farmers • joint activities may strain resources • improved links with MoALD staff	(+) (+) (-?) (+)	=4
UK Training Institutions	• income • students • publication of students findings	(+) (+) (+)	=4
Consultants	• experience • income	(+) (+)	=4
Ministry of Works	• control over funds/activities • access to contracts • denial of contracts	(+) (+) (-)	5
Economic Planning Division	• evaluation & approval of project	(+)	=6
"External " stakeholders			
Chemical Companies	• sales increased/decreased	(+/-?)	=7
Political/Traditional Leaders	• improved image	(+)	=7
MOREA	• reduced environmental degradation	(+)	=7
ADMARC	• sales to/buying from farmers	(+)	=7

Fig.2.

Farming Systems IPM Project Stakeholder Transaction Matrix:
Who controls important resources
for implementation?

TRANSACTIONS	Financing	Physical inputs	Political support	Approvals	Technical assistance	Service delivery	Training	Extension staff inputs	Research and Development	Access to farmer's fields	Information sources	Produce purchases
STAKEHOLDERS												
ODA	✓		✓	✓								
DAR	✓	✓	✓	✓					✓		✓	
Bvumbwe Res. Station		✓				✓			✓		✓	
DAET	?		✓	✓				✓	✓	✓	✓	
NGOs								?	✓		✓	✓
Smallholder farming families									✓	✓	✓	
University of Malawi			✓	✓		✓	✓		✓		✓	
UK Training Institutions						✓	✓					
Consultants					✓	✓		✓	✓		✓	
Ministry of Works				✓		✓						
Blantyre ADD						✓			✓			
Treasury												
Intermediate buyers/ADMARC						✓						✓
Chemical companies			✓			✓			✓		✓	
MoALD	✓		✓	✓					✓			
IARCs					✓		✓		✓		✓	
Traditional leaders			✓							✓	✓	

Figure 3. Matrix for choice of crops for FSIPM Project

Variable	Maize	Beans	Pigeon-pea	Cowpea	Cassava	Sweet Potato	Sorghum	Millet	Soyabean	Chickpea	Groundnut
Major pest(s)	1- *Striga* 2- termites 3- stemborers 4- head smut	1- beanfly 2- angular leaf spot 3-*Ootheca*	1-*Fusarium* wilt	1- blight	1- mosaic virus 2- mealy bug 3-green mite	1- S P weevil 2- S P mosaic virus	1- stem borers 2- *Striga*	1- stem borers 2- *Striga*	1- bacterial blight	1- Fusarium wilt	1- rosette virus 2-foliar diseases
Candidate PMS available ?	1-3 cultural	1 cultural, seed dressing	1 resistant varieties	1 varietal mixtures ?	2-3 biocontrol	1 filling soil cracks	?	?	N/A	N/A	1- resistant vars, cultural, chemicals
Area planted in RDP (approx.)	50%	13%	17%	4%	4%	2%	4%	<1%	<1%	<1%	4%
Food security	✓✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓	✓		✓
Cash income	✓	✓✓	✓✓	✓	✓✓	✓	✓	✓	✓✓	✓✓✓	✓✓
NGO linkages	✓	✓	✓		✓✓✓	✓✓✓	✓	✓	✓		✓
Research linkages (eg. IARCs)	✓	✓	✓		✓	✓	✓	✓	✓		✓
Male/female decision-maker ?	M/F	F	F	F	M/F	M/F	F	F	M	M	F
Overall priority for FSIPM	1	3	2	5	4	6	7				

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RECOMMENDATIONS TO FSIPM PROJECT STEERING COMMITTEE

Most of the recommendations to the Steering Committee are embodied in a modified Logical Framework for the Project (Figure 4) which can be compared with the original LogFrame from the Project Memorandum (Figure 5).

Project purpose. The project logframe as originally drafted had been shown to have two separate Purposes which is not permissible for good project design. This was resolved by making the purpose development of capacity and making the the Goal adoption by farmers of IPM approaches. The existing Goal therefore becomes a Supergoal.

Geographical scope. Changes proposed include the removal of references to working in three zones and each of Malawi's three regions by year 4 (OVIs for Purpose and Outputs 2 and 3) which had been felt to be quite unrealistic, given the very different conditions and large distances involved. It was suggested that this issue might be examined by the project review team during the Mid-term Review in year 2/3.

Capacity building. Output one has been amended to indicate that local capacity building is not to be restricted solely to DAR. This was felt to be important because of the pool of agricultural talent in DAET, the university and NGOs and their developing interest in pest management for smallholders. Additionally it is evident that recent restructuring in the MoALD has imposed severe staffing limitations on DAR.

Dissemination. The dissemination emphasis has been made more explicit in the wording of Output 3 corresponding to the extension dissemination activities already included in the LogFrame.

Project Management. A fourth Output and associated activities are proposed, detailing project management systems. The need for this was identified by applying the Project Design Checklist (See Workshop Process Report, Annex 10, item 28: *"The output strategy includes a description of the project management systems"*).

Consultants. Local consultants should be used where suitably qualified personnel are available. Where possible local co-consultants should be appointed to work with international consultants.

Provision of DAR staff. Attachment of DAR staff to the project needs to be addressed by the Steering Committee in line with the agreement contained in the Project Memorandum (Special Conditions, paragraph 3) and the budget for Malawi Government Financial Costs given in Table 1B.

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Consultation. The workshop recommended that wide consultation with interested individuals should take place in formulation of future projects.

Resource allocation. The workshop asked the Steering Committee to review allocation of vehicles and equipment and scale of allowances for local counterparts.

CONCLUSION

The workshop was felt by participants to have been well-organized and successful in meeting its objectives and most of their legitimate expectations. While no substantive changes were made to the intended aims of the project, the workshop proposed a number of modifications to the logframe (detailed above) which were felt to clarify the aims and approaches of the project and improve the logic and coherence of their presentation, making it easier to evaluate the achievements of the project. The Workshop provided an opportunity for a diverse group of concerned professionals to think through the Project design and rationale and to develop a sense of ownership of its Purpose and Goal. It also provided guidance for the Project team on priorities for crops and pests to be investigated through field trials.

ACKNOWLEDGEMENTS

The Project team would like to express their sincere thanks to Dr Felix Jere for his sensitive and effective leadership in the process of the workshop. We are also grateful to the workshop participants listed below who displayed great commitment to complete challenging assignments in a limited time. The level of attendance and participation was of a high order throughout.

GLOSSARY

ADD	Agricultural Development Division
ADMARC	Agricultural Development and Marketing Corporation
BDDCA	British Development Division in Central Africa
DAET	Department of Agricultural Extension and Training (MoALD)
DAR	Department of Agricultural Research
EPA	Extension Planning Area
FSIPM	Farming Systems Integrated Pest Management
IARC	International Agricultural Research Centre
IPM	Integrated Pest Management
MoALD	Ministry of Agriculture and Livestock Development
MoREA	Ministry of Research and Environmental Affairs
MoW	Ministry of Works
NGO	Non-governmental Organization
NR	Natural Resources
ODA	United Kingdom Overseas Development Administration
OVI	Objectively Verifiable Indicator
PF	Project Framework
PMS	Pest Management Strategy
RDP	Rural Development Project
TC	Technical Cooperation

Fig. 4. Proposed revision of FSIPM Project Logical Framework

Narrative summary (NS)	Measurable indicators (OVI)	Means of Verification (MOV)	Important assumptions
Supergoal: 1. Improved incomes for resource-poor farmers.			
Goal: 1. Farmers adopt low cost sustainable integrated pest management strategies.	1.1 'X' percent of farmers in zone adopt by year 'y'.	1.1 ADD Monitoring and Evaluation Surveys.	**(Goal to Supergoal)** 1.1 Economic environment remains favourable.
Purpose: 1. Local capacity for IPM improved.	1.1 Commodity Teams incorporate IPM PMS for maize and two other major foodcrops.	1.1 DAR annual reports and CT reports.	**(Purpose to Goal)** 1.1 Extension system continues to function effectively.
Outputs: 1. Research capacity for farming systems IPM research strengthened.	1.1 At least 6 Malawian postgraduate scientists trained in IPM by end of project. 1.2 Three seasons on-farm IPM research experience for staff attached to project by end of project. 1.3 Two seasons on-farm IPM research experience for returned graduates by end of project. 1.4 Buildings completed according to contract date.	1.1 Project reports. 1.2 Project reports. 1.3 Project reports. 1.4 Quantity surveyor's reports.	**(Output to purpose)** 1.1 Suitable staff are identified, assigned to the project, and retained by DAR . 1.2 Adequate budget. 1.3 Returned graduates remain attached to project. 1.4 Building costs remain stable.
2. IPM strategies suitable for resource-poor farmers developed.	2.1 At least one PMS per crop by end year 2.	2.1 Project reports.	2.1 Stakeholders continue to develop and refine IPM strategies.
3. Improved extension materials prepared and disseminated by both formal and informal extension networks.	3.1 Three packages of extension materials (one per crop for verified PMS) developed by end year 3.	3.1 Project reports and extension materials.	3.1 Informal and formal networks willing and able to cooperate. 3.2 Timely approval of IPM strategies by Technology Clearing House.
4. Project management systems implemented.	4.1 List of management responsibilities. 4.2 Schedule of activities. 4.3 Accounting systems.	4.1 Project document (Annex), job descriptions. 4.2 Work plans, GANTT charts. 4.3 Accounting records.	4.3 Timely financial information available to management

Narrative summary	Inputs/resources	Means of verification	Important Assumptions
Activities			(Activity to output)
1.1 Prepare plans and issue contracts for buildings.	See budget and staffing schedule.	1.1 Site manager's report.	1.1 MoW cooperate.
1.2 Construction of buildings.		1.2 Site manager's evaluation, visit by BDDCA.	1.2 Contractor completes work on timely basis.
1.3 Furnish and equip buildings.		1.3 Project reports.	1.3 Equipment ordered and delivered on time.
1.4 Train research and extension staff in farming systems and participatory research methods.		1.4 Numbers trained and trainees course evaluation.	1.4 Research staff assigned to and remain with the project.
1.5 Train 6 M.Sc. students at University of Malawi.		1.5 Numbers registered and supervisors' reports.	1.5 Suitable candidates identified.
1.6 Train 3 MoA staff on M.Sc. courses in UK.		1.6 Numbers registered and supervisors' reports.	1.6 Suitable candidates identified.
1.7 Use consultancies for specialist inputs (local where possible; co-consultants if otherwise).		1.7 Project reports.	1.7 Good consultants available on timely basis.
1.8 Procurement of vehicles and equipment.		1.8 Procurement agents reports.	1.8 Vehicles available in price range.
2.1 Select agro-ecological zones (one per year; total three).		2.1 Project reports.	2.1 Background information available.
2.2 Review existing data on crop protection.		2.2 Review document.	2.2 Literature available.
2.3 Conduct baseline surveys on crop losses and PMS of farmers in the selected zones.		2.3 Project reports.	2.3 Farmers collaborate.
2.4 Determine reasons for crop losses at farm level.		2.4 Project reports.	2.4 Farmers assist with data collection.
2.5 Identify and select participating farmers.		2.5 Project reports.	2.5 Farmers keen to participate.
2.6 Develop PMS with farmers to reduce crop losses.		2.6 Project reports and collaborators' evaluations.	2.6 Farmers actively involved.
2.7 Assess effectiveness and impact of PMS.		2.7 Project evaluation report.	2.7 Farmers collaborate.
2.8 Prepare recommendations.		2.8 Project reports.	2.8 Appropriate PMS identified.
3.1 Identify formal and informal communication networks in the three project areas.		3.1 Project reports.	Socio-economic conditions in the three areas do not change enough to alter communications networks significantly.
3.2 Develop informal extension mechanisms in collaboration with NGOs.		3.2 NGOs' evaluations.	3.2 NGOs willing to collaborate.
3.3 Prepare training and extension materials for extension workers.		3.3 Project reports, reports from collaborating agencies.	3.3 Appropriate PMS identified.
3.4 Train extension workers.		3.4 Numbers trained and collaborators' reports.	3.4 Links with ADDSs allow training.
3.5 Prepare extension materials for smallholder farmers.		3.5 As above.	3.5 Appropriate PMS identified.
4.1 Develop and maintain project management reponsibilities chart (PMS).		4.1 PMS document, job descriptions.	4.1 Secure electronic and hardcopy storage of records.
4.2 Prepare job plans.		4.2 Project documents and reports.	
4.3 Set up and maintain financial accounting systems.		4.3 Monthly imprest account summaries and cash book audits.	
4.4 Set up and maintain assets register.		4.4 Assets register.	

Fig. 5. Original Project Logical Framework for the Farming Systems IPM Project

Narrative Summary	Measurable Indicators	Means of Verification (MOV)	Important assumptions
Goal: 1. Improved incomes for resource-poor farmers through use of low-cost, sustainable Pest Management Strategies (PMS).	 1.1 Yields improved through increased use of PMS strategies by smallholders.	 1.1 ADD Monitoring & Evaluation surveys	(Goal to Supergoal)
Purpose: 1. Develop the capacity of DAR to undertake Farming Systems IPM research, and provide Government and NGO extension systems with PMS recom-mendations suitable for resource-poor farmers.	 1.1 DAR cereals, roots and tubers, oilseeds and fibres, and technical services research programmes incorporate significant on-farm IPM research components, relevant for farmers under 1 ha, in each of Malawi's three regions by Year 4.	 1.1 DAR annual reports	(Purpose to Goal) 1.1 Effective extension mechanisms to extend recommendations
Outputs: 1. Research capacity in DAR capable of farming systems research in place.	 1.1 DAR has at least 8 postgraduate qualified scientists with at least four years experience in implementing on-farm IPM research by the end of the project	 1.1 Project reports	(Output to Purpose)
2. IPM strategies suitable for resource-poor farmers identified for major crops.	2.1 IPM strategies demomstrated by on-farm research to be attractive to farmers with holdings under 1 ha: for maize and at least two other major crops (not tobacco) in Zone 1 (Shire Highlands) by end Year 2, for Zone 2 by end Year 3 and for Zone 3 by end Year 4.	2.1 Project reports	2.1 Research staff continue to develop and refine IPM strategies.
3. Improved extension materials prepared for dissemination by both formal and informal extension networks.	Extension broadsheets prepared on maize and at least least two other major crops (not tobacco) in Zone 1 (Shire Highlands) by end Year 2, for Zone 2 by end Year 3 and for Zone 3 by end Year 4.	3.1 Project Reports and extension materials	3.1 Formal and informal extension networks continue to function effectively.

Narrative Summary	Inputs/Resources	Means of Verification	Important assumptions
Activities:			**(Activity to Output)**
1.1 Prepare plans and issue contracts for buildings	See budget and staffing schedule.	1.1 Site Manager's report.	1.1 MoW cooperate.
1.2 Construction of buildings		1.2 Site manager's evaluation, visit by BDDCA.	1.2 Contractor completes work on timely basis.
1.3 Furnish and equip buildings		1.3 Project reports.	1.3 Equipment ordered and delivered on time.
1.4 Train research staff in farming systems and participatory research methods.		1.4 Numbers trained and trainee's course evaluation.	1.4 Research staff assigned to and remain with the project.
1.5 Redirect crop protection research activities to IPM approach.		1.5 Project reports.	1.5 DAR accepts benefits of IPM approach to crop protection.
1.6 Train eight Msc students at University of Malawi.		1.6 Numbers registered and supervisor's reports.	1.6 Suitable candidates identified.
1.7 Train three staff on Msc courses in the UK.		1.7 Numbers registered and supervisors' reports	1.7 Suitable candidates identified.
1.8 Use consultancies for specialist inputs.		1.8 Project reports.	1.8 Good consultants available on timely basis.
2.1 Select agro-economic zones (one per year: total three)		2.1 Project reports.	2.1 Background information available.
2.2 Identify and select participating farmers.		2.2 Project reports.	2.2 Farmers keen to participate.
2.3 Conduct baseline surveys on crop losses of farmers in the selected areas.		2.3 Project reports.	2.3 Farmers collaborate.
2.4 Review existing data on crop protection.		2.4 Review document.	2.4 Literature available.
2.5 Determine reasons for crop losdses at farm level.		2.5 Project reports.	2.5 Farmers assist with data collection.
2.6 Develop PMS with farmers to reduce crop losses.		2.6 Project reports and collaborators' evaluations.	2.6 Farmers actively involved.
2.7 Assess effectiveness and impact of PMS.		2.7 Project evaluation report.	2.7 Farmers collaborate.
2.8 Prepare recommendations.		2.8 Project reports.	2.8 Appropriate PMS identified.
3.1 Identify formal and informal communication networks in the three project areas.		3.1 Project report.	3.1 Socio-economic conditions in the three areas do not change enough to alter communication networks significantly.
3.2 Develop informal extension mechanisms in collaboration with NGOs.		3.2 NGO's evaluations.	3.2 NGOs willing to collaborate.
3.3 Prepare training and extension materials for extension workers.		3.3 Project reports, reports from collaborating agencies.	3.3 Appropriate PMS identified.
3.4 Train extension workers.		3.4 Numbers trained and collaborator's reports.	3.4 Links with ADDs allow training.
3.5 Prepare extension materials for smallholder farmers.		3.5 As above.	3.5 Appropriate PMS identified.

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FARMING SYSTEMS INTEGRATED PEST MANAGEMENT PROJECT

STAKEHOLDER PLANNING WORKSHOP

SHIRE HIGHLANDS HOTEL

LIMBE

TUESDAY 4 - THURSDAY 6 JUNE 1996

WORKSHOP PROCESS REPORT

Prepared by
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TABLE OF CONTENTS

LIST OF ANNEXES

1. INTRODUCTION

A two and a half day workshop on the Farming Systems Integrated Pest Management Project (FSIPM) was held from 4th to 6th June. 1996 at Shire Highlands Hotel. Limbe. The Programme is given in Annex 3.

DAY 1

HOUSE KEEPING

Participants agreed on the proposed time table and worked out norms to be observed during the workshop.

See Annex 2 for norms and agreed time table.

2. PURPOSE

The purpose of the workshop was to strengthen design and implementation of the Farming Systems Integrated Pest Management Project with the **commitment** and **understanding** of key participating individuals and organizations.

3. WORKSHOP OBJECTIVES

The workshop had eight objectives to achieve the purpose:

1. Review the Logical Framework Approach to project management;
2. Review the FSIPM project Goal and rationale;
3. Review the Project design;
4. Refine the project activities and output performance indicators;
5. Set scope for the project field work: select locations. priority crops and key pests to investigate;
6. Review the project's management. monitoring and evaluation plans;
7. Resolve any other key issues for project implementation. and
8. Prepare recommendations for project Steering Committee.

4. PROCEDURE

The workshop was officially opened by the Acting Chief Agricultural Research Officer.

See Annex 1 for the official speech.

5. INTRODUCTION OF PARTICIPANTS

Participants introduced each other in pairs after interviews on the following criteria:

- name;
- personal interests;
- your interest in FSIPM; and
- workshop expectations.

See Annex 4 for a list of participants and their interest in FSIPM.

6. THE FARMING SYSTEMS IPM PROJECT OVERVIEW

Dr J.M. Ritchie

The focal problem addressed by the project and an overview of project objectives was presented by the Project team Leader.

The core problem of smallholder farmers in the project area was defined as **significant loss of income due to crop loss caused by pests, weeds and diseases.**

The project strategy was spelt out as **development of appropriate farmer-oriented integrated pest management systems to reduce the losses.**

Highlights of the presentation are in Annex 5.

7. PRESENTATION OF THE SOCIO-ECONOMIC CONTEXT Dr A. Orr

The **socio-economic status of farmers** in the Blantyre Shire Highlands Rural Development Project (RDP) was presented by the Project Economist. The RDP was notable for a high population density of 267 persons per square kilometer with the following characteristics:

- 61% owning less than 0.5 ha;
- majority of poorest 40 % of households in southern region are female-headed;
- farmers with less than 0.5 ha of land have maize for only 5 months; and
- 47 % of income comes from outside through piece work (ganyu).

See Annex 6 for further highlights of the presentation.

8. INTRODUCTION TO EFFECTIVE TEAMS AND EFFECTIVE PROJECT DESIGNS

Participants developed **characteristics of effective project designs and effective project teams** and reported their findings in plenary.

The results were then compared to results of a planning workshop in India followed by some explanation of each characteristic.

The results are in Annexes 7 and 8.

DAY TWO

9. STAKEHOLDER REVIEW Dr. F. Jere

After a concept input three groups were assigned to review the resource pack on project stakeholders using the following guidelines:

- checklist for identifying stakeholders;
- checklist to assess which stakeholders are important for a project's success; and
- stakeholders interests.

The amendments to the stakeholder matrix are in Annex 9.

10. SETTING AND ACHIEVING PROJECT OBJECTIVES: *What is the logical framework for?* Dr. F. Jere

There was a theory presentation on uses of the log frame in project design implementation and evaluation.

The objective/narrative summary and assumptions were presented followed by an exercise on linked hypotheses and assumptions.

Logical framework

A tool to strengthen project design, implementation, and evaluation.

- A 4 x 4 matrix that summarise objectives, indicators, means of verification, assumptions and risks.

Objectives must be

S - Specific
M - Measurable
A - Achievable
R - Realistic
T - Timely

GOAL	-	Higher order objective to which the project contributes.
PURPOSE	-	Effect or impact of the project.
OUTPUTS	-	The deliverables of the project or terms of reference.
ACTIVITIES	-	Main activities that must be undertaken to accomplish outputs.

Exercise on cause and effect relationship to rank statements.
* The more levels you have the more difficult it is to rank.

11. PRESENTATION OF THE LOGICAL FRAMEWORK FOR THE FARMING SYSTEMS INTEGRATED PEST MANAGEMENT (FSIPM) Dr. J.M. Ritchie

The Team Leader presented the **Project Matrix** highlighting the **Goal, purpose, outputs** and **activities.**

Three groups were each assigned to look at one output/objective and check for vertical logic and whether the activities were sufficient to achieve the stated objective.

FSIPM Project

GOAL
Improved food security and income for resource poor farmers.

PURPOSE
Reduced crop losses through adoption of low-cost sustainable pest management strategies.

OUTPUTS
1. FSIPM research capacity in DAR is strengthened.
2. FSIPM strategies suitable for resource poor farmers developed for major crops.
3. Improved IPM extension materials prepared and disseminated by both formal and informal extension networks.

Activities discussed by groups

GROUP 1. ADDITION

a. Acquisition of vehicles.
b. Training to include extension staff in FS and PRM.

AMENDMENTS

1.8 Consultants - locals for specialist inputs. Where no local expertise available. expatriates should do the consultancy.
1.5 May have to go to output No. 2 (Redirect crop protection research activities to IPM approach).

RECOMMENDATION
All expatriate consultants should have local counterparts.

GROUP 2
Had same activities as in resource pack but they rearranged the order.

GROUP 3
Added 1 - Farmers should be trained.

Discussion issues
Modalities of DAR staff to be involved in the FSIPM Project. Is it gratis? Remuneration? Is it budgeted for? Are conditions spelt out?

- Steering Committee has the responsibility to see how the project runs.
- However. the workshop will make recommendations to the Steering Committee on pertinent issues e.g. staffing issues. training of DAET Staff. consultancy etc.
- A bilateral agreement was made.

DAY 3

12. INDICATORS OF ACHIEVEMENT AND MEANS OF VERIFICATION: ***How will we know we are successful?*** **Dr F. Jere**

The concept of indicators and means of verification was presented and two groups were assigned to review indicators of output 1 and 3 with their means of verification. The adjustments to the projects logical framework suggested on the previous day were not approved because adoption is very hard to achieve during the lifetime of the project and is not within the control of the project.

- The Purpose in the narrative summary of Project "Logical Framework" moved up to Goal and the previous Goal became a Supergoal (Re-arrangement);
- The Purpose was altered to be "local capacity for IPM improved";
- The modifications and additions had approval of all.

13. REFINING PROJECT ACTIVITIES: ***Setting a realistic program of fieldwork.*** **Dr A. Orr**

How much can we do?

After a brief input by the Project Economist the third group was assigned to prioritize crops and pests and locations for field work. The group looked at major crops/major pests and ranked them in FSIPM Project area in order of importance.

- Variable for who is responsible for decisions added;
- Groundnuts important in target area;
- Where IPM strategy involve P. Peas ICP9145 will be used;
- Sugarcane available to those with dambos;
- Sweetpotato mosaic virus on varieties liked by farmers: yoyera, kamchiputu;
- Include IR centres collaborating in priority crops; and
- Bean beetle noted as problem in Matapwata.

14. CHECKLIST FOR PROJECT DESIGN

The adjusted FSIPM logical framework was subjected to project design checklist. The result is in Annex 10.

The logframe was then adjusted to reflect the changes and an additional Output on project management systems was made

- Output No. 4 - Project Management Systems.
- Other important assumptions added on Log Frame:
    - Economic environment will remain favourable to achieve goal;
    - For output to be achieved formal and informal Extension networks will be willing and able to co-operate; and
    - Timely approval of IPM technology by Technology Clearing House.

15. DISSEMINATION PATHWAYS FOR NEW TECHNOLOGIES

Dr A.T. Daudi

The Project Manager outlined existing pathways for new technologies as listed:

- Direct with farmers;
- Annual Project Meetings;
- Technology clearing house;
- Messages through Extension; and
- Field days and Demonstrations.

* Note The FSIPM would follow the same pathway in dissemination of its new technologies.

16. PROBLEM AREAS IDENTIFIED DURING THE DISCUSSIONS

- Delivery of IPM packages not addressed by project - taken care of;
- Local capacity building in FSIPM confined to DAR - taken care of;
- Expatriate consultants to have co-consultants where local consults not available; and
- Need for wider involvement of DAR Staff in future project preparation, including design of logframe.

17. WORKSHOP RECOMMENDATIONS

The workshop recommended that the Steering Committee should look at:-

- Allowances for Malawi project Counterparts:
- Allocation of resources i.e. vehicles. computers:
- An adjusted logical framework which will be used by the Project management team to work out the Plan of Operation.

18. WORKSHOP EVALUATION

Using participants **workshop expectations** and **workshop objectives** an evaluation of the effectiveness of the workshop was carried out:

Participants' expectations:

OK 1. Come up with practical strategies of IPM on major crops for smallholders that can be tried in the coming season.

OK 2. Proper project implementation standards and activities to be detailed and recommended.

? 3. Come up with strategies that will improve the smallholder farmers.

OK 5. a) To clarify ideas about DAR'S expectations of this FSIPM.

b) To use their expertise to narrow down specific crops and pest problems which the project can address.

N/A 6. ? a) Hope to get funding for research operations.

? b) Funding for research facilities.

(The project was not meant to provide funding for all research work, but to solve specific pest management problems as outlined in the agreement)

OK c) Fully involved in the Project - in one way or another.

OK 7. Learn how Smallholder farmers are going to benefit.

OK 8. Share experience in IPM.

? 9. Will look at nature of Pest and diseases and come up with tangible research strategy.
* Note Group 2 in their discussion addressed this expectation on Day 3 but not all participants appreciated it

OK 10. To learn how improved messages can be delivered to farmers.

11. OK a) Project to help Smallholders farmers with environmentally friendly control of pests. diseases..

? b) Good extension messages.

OK 12. Agreement on Project operations.

? 13. The project to reduce costs by approximately 15% - at least by the second season.

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OK	14.	Development of a Project Plan that will enable effective implementation to the benefit of the Smallholder farmers.
?	15.	Appreciate how Smallholders can economically control pest in their crops.
OK	16.	To know more about the Project e.g. how the Project plan to control pests and diseases using IPM approach.
?	17.	Learn more about IPM. mainly on control of soil pests particularly on bananas.
OK	18.	a) To have a transparent Work Plan which will smoothly integrate with other plant protection activities.
		b) To learn what is his contribution to FSIPM.
OK	19.	Learn concept of IPM in farming systems.
OK	20.	Expect to get information in IPM Methodology that will be used to meet the goals of the Project.
OK	21.	Practical suggestions on how IPM can be applied under Smallholder conditions.

19. CONCLUSION

The workshop was very successful and this can be attributed to the team spirit and constructive criticism participants made to adjust the FSIPM LOG FRAME. The daily evaluation teams captured every little detail of the discussion and special thanks go to them. The Project Team particularly the Team Leader was very supportive in the final preparation of the workshop. He deserves special thanks from the facilitator and indeed the rest of the participants. This workshop was rated the first of its type in DAR and I therefore wish the project team every success in the implementation of the project plan.

ANNEX 1. OPENING SPEECH BY DR C. MATABWA, A/G CHIEF AGRICULTURAL RESEARCH OFFICER

Mr Chairman
Representative of the ODA
Ladies and Gentlemen

On behalf of the Ministry of Agriculture and Livestock Development it gives me great pleasure to welcome you all to this **Stakeholder Workshop** for the **Farming Systems Integrated Pest Management Project**. For some of you this may be your first introduction to the new Farming Systems IPM Project which has been gathering momentum since the beginning of 1996, based at Bvumbwe Research Station. Others of you are already involved with the Project in one way or another. I myself am now the Chairman of the Project Steering Committee.

We are all familiar with the philosophy of **Integrated Pest Management (IPM)** which seeks to apply all suitable techniques in a compatible manner to maintain pest populations at a non-economic level without adversely affecting the environment.

There are a number of problems to overcome if the IPM approach is to be applied to the needs of smallholder farmers. At present there are few IPM recommendations suitable for small-scale farmers. Some instructions for monitoring of pests (e.g. in cotton) are very complicated. Some strategies, such as the observance of a closed season for cotton growing, need to be implemented across whole communities and in practice have broken down due to socio-political factors.

Farmers themselves are more aware of some pests than others, and this may affect their priorities for allocating resources and their willingness to adopt particular practices. There is often a lack of quantitative information on pest population dynamics and associated crop losses and such data are very difficult and expensive to collect. The declining size of farmers' plots renders some practices, such as rotation, impracticable. Poorer farmers lack resources to purchase inputs such as pesticides where these could be of value and are often unable to obtain credit.

The Farming Systems IPM Project will seek to address some of these difficulties in partnership with farmers with the aim of providing them with safe, effective and affordable pest management strategies.

The purpose of this meeting is to build the project implementation team and to develop operational plans for the first field season of the Farming Systems Integrated Pest Management Project with the commitment and understanding of key participating individuals and organizations. This will involve you over the next two and a half days in reviewing the rationale and design of the project and in refining the project approaches and its management, monitoring and evaluation plans. In particular the project team needs your advice to establish the best locations and the priority crops to work with initially and the key pests to investigate.

This is no theoretical ivory tower activity. The Project Steering Committee will meet on Friday morning to discuss the findings of this group and to guide the project team as they begin to develop specific, measurable, achievable and time-bound targets for the next year. During this workshop you will be playing a key role in laying the groundwork for the participatory planning process of the project.

Looking around this room it is clear that the Workshop has brought together a significant number of individuals who have a particular interest or "Stake" in the application of integrated pest management, or IPM, to the needs of our smallholder farmers.

Some of you have specialist expertise in management of particular types of pests and diseases while others have extensive knowledge of the agronomy of major food crops. As a group you have many years of experience in assessing and addressing the crop protection needs of the farming community. Everyone here is a participant and none of us is a spectator.

Our efforts to develop viable pest management strategies for small farmers are fired by our knowledge of the urgent problems they face. As rising population has led to the cultivation of more marginal land on steeper slopes, erosion has increased and yields have fallen. In parts of Blantyre ADD family land holdings are now on average less than half a hectare. Per capita daily calorie consumption is falling and more than half of our population are officially classified as poor.

As you all know, the Government of Malawi has responded to these challenges by produced an **Agricultural and Livestock Development Strategy and Action Plan** which has as its central aim *"to improve the well being of Malawians through poverty alleviation, especially among rural people, by promoting broad-based and rapid agricultural and livestock development."*

Other objectives of the strategy include improving food self-sufficiency and the nutritional status of the population, and raising farm incomes and promoting economic growth while conserving natural resources.

It is noteworthy that a section of the **Action Plan** specifically commits the MoALD to the development of a multidisciplinary IPM programme involving researchers, extensionists and the farmers themselves. This **participatory approach** is further developed in the section of the Plan dealing with **Research-Extension-Farmer Linkages**. I quote:

> *"MoALD will encourage a participatory approach which will allow research scientists and extension staff to conduct surveys together with farmers to identify current farmer socio-economic circumstances (farmers needs and constraints) in order to set priorities together with the farmer. This 'bottom up' approach as opposed to the 'top down' approach will ensure that technologies generated are demand-driven, and MoALD will ensure that funds will be made available for priorities that are addressing farmers interests. MoALD recognises the need for training both the research and extension staff in the new participatory approach."*

This brief summary of Government Policy for agricultural development provides the context within which we can assess the overall relevance of the objectives of the FSIPM Project.

The Goal of the FSIPM Project is to improve incomes for resource-poor farmers through the use of low-cost, sustainable Pest Management Strategies.

The Purpose of the Project is to develop and strengthen the capacity of the Department of Agricultural Research to carry out farmer-based integrated pest management research, increase the understanding of smallholder farming systems and develop pest management recommendations for the extension system which are genuinely appropriate to the needs and resources of small-holder farmers.

The project is based on a participatory approach and is targeted at families farming less than one hectare of land with a special emphasis on the needs of female-headed households. Training in the social and agricultural science disciplines necessary for Farming Systems Research forms a major part of the project which also includes an element of infastructure strengthening.

I think you will agree with me that there is a very close correspondence between the national priorities I have outlined and the declared aims of the Farming Systems IPM Project. I would like to thank the Overseas Development Administration of the United Kingdom for assisting us in realizing our national objectives through this project and also for supporting the costs of this Workshop.

Ladies and Gentlemen, I wish you all success in your deliberations and I now declare this Workshop officially open.
Thank you very much.

ANNEX 2 GROUP NORMS

- Punctuality
- Soberness
- Full participation + No absenteeism
- No smoking
- No newspaper reading
- One person speaking at a time

AGREED DAILY TIMETABLE FOR WORKSHOP

Starting (Wednesday & Thursday) :	08:30 hrs
Tea/Coffee break :	10:15 - 10:30 hrs
Lunch break :	12:30 - 13:30 hrs
Afternoon Tea/Coffee break :	15:15 - 15:30 hrs.
Closing round :	17:00 hrs (17:30 Thursday)

ANNEX 3. WORKSHOP PROGRAMME, FSIPM PROJECT STAKEHOLDER WORKSHOP

Tuesday 4 June. 14.00 - 17.30

Welcome by CARO

Agree Workshop Objectives and proposed programme

Introductions and expectations

Agree Group norms/responsibilities

Tea/coffee break 15.15 - 15.45

The Farming Systems IPM Project: Overview presentation. **Why do we need this project?**

Outline of Focal Problem addressed by the project and overview of project Objectives and the socio-economic context. Plenary discussion.

Introduction to Effective Teams and Effective Project Designs. **What makes a good project?**

2 groups spend half an hour developing key characteristics of effective project designs and effective project teams. Groups report back to plenary using poster presentations.

Closing round

Wednesday 5 June. 08.3.0 - 12.30

Yesterday in Review

Stakeholder analysis review. **Who are the IPM Project Stakeholders?**

Short concept presentation by facilitator on project stakeholders. Group exercises.

Setting and Achieving Project Objectives. **What is the logical framework for?**

Short concept presentation by facilitator on the hierarchy of objectives as used in the FSIPM Project. Introduction to Goal, Purpose, Outputs and Activities. Short group exercises on linked hypotheses and hierarchy of objectives.

Tea/Coffee break 10.15-10.30

Presentation of the FSIPM Project Objectives. **What is this project intended to achieve?**

The project goal, purpose and outputs presented and discussed.

Responsibilities of the Project Manager and the implementing Groups. **Who does what?**

Organogram and monitoring and evaluation systems.

Lunch 12.30-13.30

Assumptions and risks. **What are the conditions for success?**

Review of FSIPM Project Design Framework. **Can we improve the design?**

Objectives: to gain better understanding of the overall FSIPM and identify areas needing strengthening. Groups instructed to first read framework and then work through each of the checklist items. After one hour teams present findings to plenary. Discussion using flipcharts to strengthen logical linkages.

Tea/coffee break 15.15 - 15.30

Indicators of Achievement and Means of Verification. **How will we know we are successful?**

Short concept presentation to introduce QQT objectives. Small groups work on developing indicators and means of verification for IPM project Goal, purpose and Output 1.
Groups report back to plenary on flip charts and general discussion to refine criteria.

Closing round

Thursday 6 June. 08.30 - 12.30

Yesterday in Review

Refining Project Activities: Setting a realistic programme of fieldwork. **How much can we do?**

Presentation of background material on Blantyre Shire Highlands RDP and Group work on identifying priority zones, crops and pests for first season's surveys and trials. Specific indicators for pest management strategies (Outputs 2 and 3). Discussion of realistic scope of project fieldwork.

Tea/coffee break 10.15-10.30

Dissemination pathways for new technologies (Pest management strategies). **How do we tell them?**

Review process of formulating and approving recommendations and responsibilities for extension to farmers. Are there additional assumptions here? What linkages can we use?

Roundup of problems identified in previous sessions. **...but what about...?**

Lunch 12.30 - 13.30

Prepare final recommendations and Next Steps. **So ...What next?**

Group work.

Present recommendations and Next Steps to Workshop.

Tea/coffee break 15.15 - 15.30

Review of achievement of Workshop Objectives. **Did we do what we set out to do?**

Plenary discussion.

Review of expectations. **Were your expectations met?**

Plenary discussion.

Closing Session.

Plenary discusion. Final statements and thanks.

18.00-20.00 Closing Reception.

ANNEX 4. LIST OF PARTICIPANTS

NAME	Interest in IPM
1. DR MARK RITCHIE	Finding ways to increase the yield and income of Smallholder farming families.
2. DR CHARLES J. MATABWA	Stakeholder, (soils and farming systems).
3. CAIPHAS KANAVENTI	Can project assist maize breeders breed resistance to maize streak virus /screening
4. DR ALASTAIR ORR.	Make sure the project meets its Socio-economic objectives.
5. DR C. KISYOMBE	a) Disease; b) Crop husbandry
6. MR A.C.Z.G. NJONJO GONDWE	Disease Management.
7. MR S.D.T. PHIRI	Management of pests.
8. DR ANDREW DAUDI	Reduction in pesticide use.
9. MR NOEL NSANJAMA	Control of termites in a variety of crops.
10. DR DEFREA V. KAMPANI	Generation of IPM Packages.
11. MR ALBERT J. KAUNDA	Role and use of chemicals in FSIPM.
12. MR NOAH ANTHONY PHIRI	Integrated control of disease.
13. MR GRACIANO SIMION BINIFOLO	Pests of tobacco, pests of dairy
14. DR PENJANI K.J. THEU	Disease control
15. MR GODFREY CHING'OMA	Lots of interest in FSIPM because of concern for environment. He feels its time to use biological measures, as cultural control measures and possible resistant varieties with aim of protection of the environment.
16. MR WICKSON T. KAWONGA	High interest, Experience in FS research in extension on all crops particularly maize (emphasis).
17. MR RON MWENDA	Production of Technologies which will reduce heavy dependence on chemicals for Agricultural production.
18. DR HARRY POTTER	Support project to help farmers with environmentally friendly control of Pests and diseases and develop good extension messages.
19. DR PALA SUBRAHMANYAM	Plant Pathology.

ANNEX 5. THE FARMING SYSTEMS IPM PROJECT: OVERVIEW PRESENTATION

WHAT IS THE CORE PROBLEM TO BE ADDRESSED?

Smallholder farmers suffer significant loss of income due to crop loss caused by pests. weeds and diseases.

HOW TO ADDRESS THE PROBLEM

By developing integrated Pest Management strategies which are appropriate for the Smallholder farming systems.

DEFINITION OF IPM

Multidisciplinary approached to crop protection where all available methods of reducing the pest population in a given crop production system are integrated.

COMPONENTS OF IPM

- Host plant resistance
- Quarantine
- Chemical control
- Biological control
- Pheromones
- Cultural practices
    - Crop rotation
    - Choice of crop
    - Farm sanitation
    - Early planting
    - Intercropping
    - Roguing
    - Weeding
    - Sorting seed
    - Observing closed season

DEFINITION OF FARMING SYSTEMS

A pattern of resources and processes of resource use in a farming unit.

FARMING SYSTEMS APPROACH

Sees the activities and resources of the farm as the connected whole including:

- Human and natural resources
- Capital inputs

ANNEX 6. SOCIO-ECONOMIC CONTEXT

PROBLEMS:

- High population density: 267 (approximately 300) persons/sq. km.

- Problems caused by small farm size: Majority of Smallholder farmers in target group in the area (61%) have less than 0.5 ha.

- Poverty and Gender: 32% of the poorest households in the Southern Region are female-headed households (1992/93). Of the poorest 40% of households in the Southern Region. 59% were headed by women and only 32% by men.

- The Agrarian transition in Blantyre Shire Highlands (see Figure). Farming systems in the ADD are changing as average farm sizes become smaller. This influences food security (MPA). Farmers with < 0.5 ha have a maize provision ability (MPA) of only 5 months. How do they find food so that they survive? High proportion of income (47%) has to come from outside (e.g. through "ganyu" or piece work).

- Project will recruit an anthropologist who will find out if farmers understand or know diseases. Example of Mulanje farmers seem to know pests, weeds, but not diseases.

IMPLICATIONS FOR THE FSIPM

- Small farm size - intensification of build up of weeds, pests or disease.

- Labour availability - off farm income
  - competing tasks

- Low cash incomes - visible pests. Farmers will need to understand pests and diseases. Project will work closely with extension personnel.

- Project to come up with IPM packages by research

CONCERN: IPM Packages should go to the farmer. (Delivery of IPM Packages not Addressed by project)

- Project is on crop protection mainly.
- Information from soil pest project is included in this project.

ANNEX 7. KEY CHARACTERISTICS OF EFFECTIVE PROJECT TEAMS

1. Members should agree to objectives of the project.

2. Their composition should be multi-disciplinary.

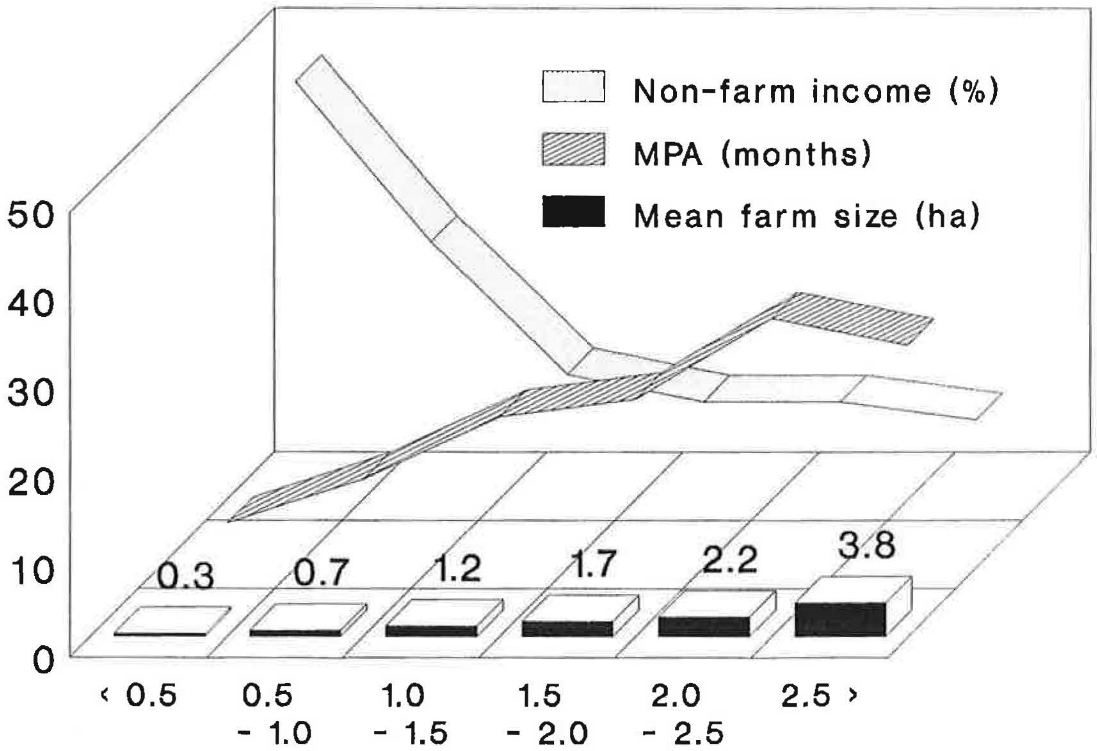
3. They should respect and support other disciplines.

4. They should exercise good leadership.

5. They should share resources and collaborate.

6. Accountability and responsibility among members.

The agrarian transition in Blantyre Shire Highlands



Non-farm income (%)	47	29	14	11	11	9
MPA (months)	5	10	17	19	28	25

Farm size (ha)

Source: ASA, BLADD, 1987/88

7. Team members should be well trained in their disciplines.

8. Team should have relevant experience and be willing to share.

9. The team should be well motivated.

10. The members should be committed to the success of the project (execution).

ANNEX 8. KEY CHARACTERISTICS OF EFFECTIVE PROJECT DESIGNS

1. Background information
2. Goal
3. Objectives
4. Purpose/Target audience
5. Implementation plan
6. Budget and source of funds
7. Targets
8. Verifiable indicators
9. Monitoring and evaluation
10. Sustainability
11. Project duration
12. Must be clearly defined
13. Should have a definite time frame i.e. beginning and ending
14. Should have clear set objectives and goals
15. Proper resource allocation and management

ANNEX 9. STAKEHOLDER ANALYSIS

9.1 STAKEHOLDER TRANSACTION MATRIX

ADDITIONAL STAKEHOLDERS	TRANSACTIONS
IARCs	- Technical assistance - Training - research staff inputs - Information sources
TRADITIONAL LEADERS	- Political support - Access to farmer's fields
CHEMICAL COMPANIES	- Technical assistance - Information sources
ADMARC	- Service delivery - Produce purchase (additional column)
PRODUCE TRADERS	- Produce purchase
MOA	- Financing - Political support - Approvals
BLADD	- Approvals - Service delivery - Training - Extension staff inputs - Access to farmers - Information
TREASURY /EPD	- Financing - Approvals
INTERMEDIATE BUYERS (IB)	- Service delivery - Information
CHEMICAL COMPANIES	- Political support - Service delivery - Information

One transaction column (RESEARCH STAFF INPUTS) was cancelled and replaced by RESEARCH AND DEVELOPMENT COLUMN. All ticks that appeared on (RESEARCH STAFF INPUTS) should also appear under NEW COLUMN

Stakeholders involved in **research and development** column are:

1. DAR
2. BVUMBWE
3. DAET
4. NGOs
5. SMALL FARMERS
6. UNIVERSITY OF MALAWI
7. CONSULTANTS
8. MOA
9. BLADD
10. CHEMICAL COMPANIES

9.2 DRAWING OUT STAKEHOLDERS' INTERESTS. ADDITIONS TO THE LIST.

A. SECONDARY STAKEHOLDERS
- Economic Planning Division (EPD)

B. EXTERNAL STAKEHOLDERS
- ADMARC/Intermediate Buyers
- Political/Traditional Leaders

C. THE ENVIRONMENT - Silent Stakeholder
MOREA

9.3 ADDITIONAL STAKEHOLDERS' INTERESTS

1. ALL PRIMARY STAKEHOLDERS
   - Improved food security and nutrition

2. SECONDARY STAKEHOLDERS
   - DAET - Audio visual material
   - UNIVERSITY OF MALAWI - Publications
   - NGOS - Improved linkages with MOALD Staff.
   - U.K. TRAINING INSTITUTIONS - Publications of students findings
   - EPD - Overall evaluation of projects
     Approval of projects

3. EXTERNAL STAKEHOLDERS

   - Political/Traditional Leaders - Improved image
   - MOREA - Reduced environmental degradation

ANNEX 10. PROJECT DESIGN CHECKLIST

✓ 1. The project has one purpose.
✓ 2. The purpose is not a reformulation of the outputs.
✓ 3. The purpose is outside the direct management control of the project team.
✓ 4. The purpose is clearly stated.
✓ 5. All the outputs are necessary for accomplishing the purpose.
✓ 6. The outputs are clearly stated.
✓ 7. The outputs are stated as results.
✓ 8. The activities define the action strategy for accomplishing each output.
✓ 9. The goal is clearly stated.
✓ 10. The if/then relationship between the purpose and goal is logical and doesn't skip important steps.
✓ 11. The assumptions at the activity level do not include any conditions precedent.
✓ 12. The output plus the assumptions at that level produce the necessary and sufficient conditions for achieving the purpose.
✓ 13. The purpose plus assumptions at that level describe the critical conditions for achieving the goal.
✓ 14. The relationship between the outputs and the purpose is realistic.
✓? 15. The relationship between the activities and inputs/resources is realistic.
✓ 16. The vertical logic among activities, outputs, purpose and goal is realistic as a whole.
✓ 17. The indicators at the purpose level are independent from the outputs. They are not a summary of outputs but a measure of the purpose.
✓ 18. The purpose indicators measure what is important.
✓ 19. The purpose indicators have quantity, quality and time measures.
✓ 20. The output indicators are objectively verifiable in terms of quantity, quality and time.
✓ 21. The goal-level indicators are objectively verifiable in terms of quantity, quality and time.
? 22. The inputs described at the activity level define the resources and costs required for accomplishing the purpose.
✓ 23. The Means of Verification column identifies where the information for verifying each indicator will be found.
✓ 24. The activities identify any actions required for gathering Means of Verification.
✓ 25. The outputs define the management responsibility of the project.
✓ 26. When reviewing the Logical Framework, you can define the evaluation plan for the project.
✓ 27. The purpose indicators measure the project impact to be sustained.
✓ 28. The output strategy includes a description of the project management systems.

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FARMING SYSTEMS INTEGRATED PEST MANAGEMENT PROJECT

DIAGNOSTIC SURVEYS IN MATAPWATA AND CHIRADZULU EPAs

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October 1996

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LIMBE

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Abbreviations

ADMARC	Agricultural Marketing and Development Corporation
DO	Development Officer
EPA	Extension Planning Area
FA	Field Assistant
FSIPM	Farming Systems Integrated Pest Management
FSR	Farming Systems Research
GTZ	German Technical Cooperation
IPM	Integrated Pest Management
MGPPP	Malawi German Plant Protection Project
PMS	Pest Management Strategy
PRA	Participatory Rural Appraisal
RRA	Rapid Rural Appraisal
UDF	United Democratic Front

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EXECUTIVE SUMMARY

- This report presents the findings of participatory diagnostic surveys conducted by the FSIPM Project in four villages in Matapwata and Chiradzulu North EPAs, Blantyre Shire Highlands RDP, between June-August, 1996.

- Agricultural intensification has produced a smallholder farming system characterised by low soil fertility, poor crop productivity, and pest build-up. Village histories, transect walks, and other data provided ample evidence of these trends. New intensification pathways (cash cropping, fertiliser-hybrid-seed technology) are still in an early stage of development and limited by capital constraints.

- Crop production is seasonal with peak periods in October and August, and four 'hungry' months between November and February when food is scarce and disease more common.

- Maize, common beans, and pigeonpea were ranked among the most important five crops by farmers, confirming the decision to focus IPM interventions on these three crops.

- Women have primary responsibility for cultivation of pigeonpea and a major share of responsibility for common beans while responsibility for maize is shared by both men and women.

- Whitegrubs, termites, and *striga asiatica* were ranked among the five most important pests of maize. Wilting from beanfly was ranked the most important pest of beans, and fusarium wilt the most important pest of pigeonpea.

- Indigenous technical knowledge of pests was strong on entomology but weak on pathology. Two indigenous pest management strategies (seed dressing for maize, side-planting for pigeonpea) were identified for testing in on-farm trials during 1996/97.

- Farmer participation in the design of on-farm trials for 1996/97 was critical in determining the location of trials, choice of bean varieties, and timing of new cultural practices.

INTRODUCTION

This report presents the results of diagnostic surveys conducted by the FSIPM Project at two field sites in Blantyre Shire Highlands RDP between July-August, 1996.

The general objective of the diagnostic surveys was to provide information about the farming systems in the Project area useful for the design and implementation of on-farm trials in the 1996/97 season. The specific objectives were to obtain:

- information on study villages, particularly on agricultural issues;
- farmers' perceptions on pests (insects, diseases, and weeds) of major crops; and
- farmers' views on the design of IPM interventions to be tested during the 1996-97 agricultural year.

2. METHODS

Choice of research sites The Stakeholder Workshop for the FSIPM Project pointed to Matapwata and Chiradzulu EPAs as suitablefor Project research sites. The major reasons for this choice were: (1) reasonable road access from Bvumbwe Research Station; (2) a representative mixture of landtypes, including hillslope, upland, and dambos (3) prior knowledge of the existence of serious pest problems, gained from earlier reconnaissance surveys. We discussed this choice of EPAs with Mr. Gondwe, Project Officer, Blantyre Shire Highlands RDP, who gave his approval and arranged meetings with the DOs of these two EPAs in order to select villages for fieldwork.

On 17 June we visited the EPA Headquarters at Matapwata to discuss the selection of village sites with the DO, Mr. Munthali and the ADO, Mr. Gwembere. Three areas were visited: Chawasuwa, Chingazi, and Muonakera. Of these, we selected Nansadi section in Chingazi, which met all three criteria listed above and in addition was not located on a main road. Following discussions with the FA, Mr. Msonkho, we selected the villages of Kujawo, Kambuwa, and Chaoni in Traditional Authority Chimaliro as research sites. We also met the Village Group Headman, Chaoni, and the Village Headmen of Kambuwa and Kujawo, for discussions about the Project.

On 25 June we visited EPA Headquarters at Chiradzulu North and discussed selection of village sites with the DO, Mr. Munthali. We agreed on village sites bordering the Chitera/Lirangwe dambo. Three sections were visited: Chitera South, Central, and North. We finally selected Chitera North, since this included upland and hillslope fields as well as dambo. After discussion with the FA, Mr. Kadalinga, we selected the villages of Chiwinja and Lidala in Traditional Authority Mpama as research sites. Discussions were held with the Village Group Headman, Mrs. L. Kamwaha, and with the Village Headman of Chiwinja, Mrs. Marita Sapoa, and the Village Headman of Lidala, Mr. Jirani Ahmed.

Diagnostic methods Field-based diagnostic approaches used in Farming Systems Research (FSR) include: (1) questionnaire surveys; (2) rapid rural appraisal (RRA); (3) participatory rural appraisal (PRA); (4) interviews with farmers or farmer groups (Fujisaka, 1991).

Figure 1: Diagnostic survey techniques used by FSIPM Project

Exploration of the farming system

- Transect walks / direct observation
- Seasonal calendars
- Resource mapping / village mapping

Identification of the target group

- Social mapping

Problem identification

- Matrix ranking

Identification of IPM interventions

- Semi-structured interviews
- Identifying innovative farmer PMS

Figure 1 lists the techniques used by the FSIPM Project during preliminary diagnostic surveys. These diagnostic techniques are widely used in Participatory Rural Appriasal (PRA). PRA implies a process of empowerment whereby rural communities prioritise their own problems and identify solutions (Chambers, 1995). Some diagnostic FSR follows this pattern, typically in the initial phase of problem-identification. In the case of the FSIPM Project, however, the scope for empowerment was much more limited because the Project had already a clearly defined research mandate, and because of gaps in indigenous technical knowledge about pests. Consequently, farmer participation was used primarily to: (1) gather indigenous technical knowledge about the farming system; (2) refine the design of IPM interventions for on-farm trials; and (3) build rapport and trust with farmers. Farmer participation of this kind is standard practice in FSR (Ashby, 1989; Farrington and Martin, 1988). Farmer participation in IPM projects has proved valuable in highlighting mistaken assumptions and expectations among scientists about farmers' pest management strategies (Goodell, 1990).

The choice of a participatory approach was also influenced by logistic factors, namely the need to provide timely information before the start of the 1996/97 crop season, and the small size of the research team, which made it more efficient to work with groups rather than individual villagers. The surveys presented in this report required 23 village visits (excluding one meeting cancelled because of a funeral), a team of four researchers, and groups of 10-20 villagers. A schedule of village visits is provided in Appendix 3.

Diagnostic sequence The diagnostic sequence proceeded in four stages:

- The village Chief was asked to call a village meeting, which we attended accompanied by the DO and the FA for the section. Typically, these meetings were also attended by the local UDF Chairmen. After introductions by the DO and FA, we introduced the rationale for the FSIPM Project and clarified its objectives. After questions from villagers, we then asked them to participate in four diagnostic exercises. Village men produced a timeline, and resource map; women produced a seasonality chart; and children drew a village map. The results were then presented to the village meeting by a representative from each of the groups. These participatory exercises generated a vary positive response from villagers.

- We revisited each village to make transect walks. During these walks we traversed the village from one boundary to the other. In each case we requested two or three villagers to guide us and act as informants; in three of five transects, however, the village Chief insisted on accompanying us alone. These transects generated information on a wide range of subjects. After each transect was completed, our notes were written up and circulated among the FSIPM Project team-members to ensure accuracy and completeness.

- We conducted PRA exercises on (1) importance of crops; (2) gender division of labour; (3) farmers' perceptions of pests of maize, beans, and pigeonpea; and (4) weeds. These exercises provided valuable information on farmers' knowledge of pests and pest management strategies, as well as a check on the perceptions of natural scientists.

- Finally we interviewed farmers who used innovative pest management strategies, and held focus-group meetings to discuss the design of IPM interventions.

The results of the diagnostic exercises were retained and copied onto A4 sheets at Bvumbwe. Examples of these exercises are provided in Appendix 1, and a complete listing of diagnostic exercises is given in Appendix 2.

3. BASIC VILLAGE DATA

During village transects some basic statistics were collected to allow comparisons between villages. In Matapwata, Chaoni was found to be split into three sections for administrative purposes; Magomero and Waruna sections had their own sub-chiefs.

Figure 2. Village data, Matapwata and Chiradzulu North

Name of village	Chaoni section	Waruna section	Magomero section	Kambu a	Kujawo	Chiwinja	Lidala
Tribe			Lomwe	Lomwe			Yao
No. households		200	350	330	280		250
School ?	No	No	No	No	Yes	No	No
No. groceries	-	-	8	-	-	1	-
Maize mill ?	No	No	No	No	Yes	Yes	No
No. households with cattle		14	4	6	15	1	4

Source: Village transect walks

4. TIMELINES

Village timelines record important events in the history of the village. They provide a useful "ice-breaker" exercise for introductory village meetings. All the village timelines reported here were recorded by men. Older men with a long residence in the village were obviously most useful in remembering historic events. Younger men, who had recently married into the village, were asked to participate in other exercises.

Matapwata Figures A1-A3 show the village timelines for the three Matapwata villages. The oldest recorded date was 1895 (Kajawo), while the others began in the1930s. Besides information on social history, the timelines also gave useful data on agricultural issues.

Intensification began mainly from the 1940s with the introduction of ridging (Chaoni, 1940; Kajawo, 1949). Fertiliser was first introduced in the 1960s. Villagers associated this with independence in 1964; previously, fertiliser was reported to be restricted to white settlers (Kambua, 1969). Villagers in Kajawo recalled the introduction of sulphate of ammonia (1965). A credit club which issued fertiliser loans started in 1978 (Kajawo). Intensification was also reflected in a growing shortage of wood for fuel and housing. Brick houses become more common in the 1960s (Kajawo, 1965).

Timelines also provided a chronology of important pest outbreaks. These included locusts (Kambua, 1931; Chaoni, 1938; Kajawo, 1945); livestock epidemics (Kajawo, 1948); cassava mealybug (Kajawo, 1989; Chaoni,1991); cob-rot (Kajawo, 1996); weeds called 'Ncheso', identified as *Acanthospermum hispidum* (Kambua, 1994); russet disease on groundnuts (Kambua, 1984); bean wilting (Kambua, 1968).

Chiradzulu North Timelines for the two Chiradzulu villages provide much the same information as for Matapwata (Figures A4-A5). The oldest recorded date was 1908 (Chiwinja).

Again, agricultural intensification begun in the 1950s with the introduction of ridging (Chiwinja, 1950). (Previously, villagers planted on mounds). The imposition of soil conservation measures like marker ridges were deeply unpopular, and villagers destroyed all save those on steep hillslopes (Lidala, 1957). Fertiliser was first used in the 1960s (Lidala, 1964).

The earliest recorded pest problem was striga. Villagers could recall the name of the owner and the location of the garden despite a lapse of nearly 30 years (Lidala, 1928). Other pests included locusts from Mozambique (Lidala, 1935; Chiwinja, 1949). Damage to maize by whitegrubs dates from 1958 (Lidala) or 1959 (Chiwinja) until the present day (Chiwinja, 1996). Fusarium wilt was first reported in 1973 (Lidala). Cassava mosaic virus and sweetpotato pests were also noted (Lidala, 1970).

5. MAPS

Children were asked to draw village maps, showing boundaries, houses, shops, wells, and other features of interest (Figure A6). Maps proved to be a useful way of integrating children into the introductory village meetings, and their presentation by the children aroused a lot of interest among villagers, particularly when individual houses could be identified. Village maps will be used and expanded during later stages of fieldwork.

6. SEASONALITY

Seasonality charts were made by village women at each introductory village meeting. Topics included: (1) rainfall distribution; (2) labour; (3) health; (4) income (*zogulitsa*); (5) business (*geni*); (6) estate labour; and (7) expenses. Figures A5 and A6 give examples of seasonality charts from Lidala and Chaone villages, respectively. Generally, the seasonal pattern of these variables showed little variation between villages and EPAs (Figures A7-A8). Information on the seasonal pattern of four major variables, therefore, has been combined in the chart below.

Monthly **rainfall** distribution (drawn first to act as a point of reference) showed a unimodal pattern, with peak rainfall in the four months between November and February. Rainfall was highest in November and January. An important contrast between the two sites was the longer rainy season in Matapwata EPA, extending into the months of April and May. By contrast, Chiradzulu received no rain in this period and the dry season lasted for seven months. Longer rains in Matapwata permitted cultivation of a second, relay-sown crop of beans. Villagers in Matapwata reported two changes in the rainfall pattern: showers in March now lasted for a shorter period, and there could be two or three weeks in December without rain.

Fig. 3 Composite seasonality chart, Matapwata and Chiradzulu North

Labour	Peak	Peak	Peak		Peak	Peak				Peak	Peak	Peak
Food	Low	Low			High	High	High				Low	Low
Income (*Zogulitsa*)						Peak	Peak					
Health	Worst	Worst	Worst									Worst
Rainfall MAT	X X X X	X X X	X X	X	X						X X X X	X X X
Rainfall CZN	X X X X	X X X	X X								X X X X	X X X
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Source: Seasonality charts for four villages.

Monthly **labour** distribution was bimodal with the highest labour use in the six months October-March and the two months May-June. The first period corresponded to the maize crop and the second to harvest of relay-sown beans, cassava, and sweet potatoes. The two Chiradzulu villages showed a minor peak in August; this may reflect harvest of pigeonpeas.

Monthly **food** distribution revealed that the four months between November-February were months of food shortage. These 'hungry months' cover the period in which maize stocks from the previous season have been exhausted and before the harvest of thenew crop. March and April, when villagers consumed green maize, were not shown as periods of food shortage. Food security was highest in May-July, immediately after the maize harvest.

Food security was mirrored in the **health** pattern. Villagers reported the four months December-March as the worst for disease. Certain infections were highest in specific months: diarrhoea (January); measles (February); conjunctivitis (March); dysentery (December). Diarrhoea and dysentery are chiefly responsible for the high rate of infant mortality in Malawi. Few months were recorded as disease-free. In Chaoni village, for example, malaria was present for eight months of the year.

Income (*zogulitsa,* or cash income) peaked in June and July, presumably reflecting the sale of maize or beans. Other months had no recorded sale of farm produce. Business (*geni*) activities (not shown) followed a different seasonal pattern. The seasonality chart for Chiwinja showed that business activities peaked in the period between September-

January, and were lowest in June and July. More information is needed to understand the nature of business activities in this period.

7. TRANSECTS

Transect diagrams were produced by younger men during the introductory village meetings (Figures A9-A10). As well as providing useful information on village resources and problems, these were used to plan transect walks which we made with villagers during subsequent visits. During these transect walks we collected a variety of information on each village, with particular emphasis on natural resources. Information from each transect walk (three in Matapwata, two in Chiradzulu) has been combined for each EPA, and presented in the form of cross-section showing major natural resource indicators (Figures 3 and 4).

Four major **landtypes** were disinguished: hillslope, upland, dambo, and streambed. Villages varied according to the proportion of area under each landtype.

A dambo is a shallow depression, often adjacent to a watercourse, which can provide opportunities for crops or grazing for all or part of the year. Dambos differ significantly according to soil moisture and soil type. Dambos adjacent to a perennial watercourse have greater agricultural potential than those adjacent to a watercourse which is seasonal. In Matapwata, for example, cabbages are normally grown on perennial dambos. The soil type in the dambo also determines whether or not it is suitable for agriculture in the dry season. The stiff clay soils (*makande*) of the Lirangwe dambo, for example, make it unsuitable for crops in the dry-season but suitable for grazing livestock.

Villagers distinguished four main **soil** groups: (1) red (*katondo*); (2) clay (*lokuda*); (3) sandy (*lamachenga*); and (4) loams (*woyera*). Although distinctions may be made within these four main groups, other soils were generally described as mixtures of these four. Red soils were regarded as the least fertile; they were usually found on hillslopes and upland, and most prone to *striga asiatica.* Clay soils predominated in the dambos. They retained water and were fertile. Sandy soils occupied slopes near the beds of watercourses, while loams were common on upland fields.

Natural **vegetation** was sparse. Thatching grass and natural bamboo were present on hillslopes, while thatching grass was also found in dambos. Villagers did not report a shortage of thatching grass; some had set aside fields specifically for this purpose. Thatching grass sold for 2-3 Kwacha/bundle. Natural bamboo, which is shorter and tougher, is used for weaving baskets or roofing houses while the exotic variety is used for maize-granaries (*nkokwe*). Fuelwood was generally reported to be scarce. Formerly, we were told, Mbawa trees were common along stream banks; now there are virtually none.

Crops were grown on all landtypes. Generally, cropping intensity was highest in dambos and lowest on hillslopes. Maize, pigeonpea, fieldpea, and beans were cultivated most widely. Maize was grown on the summit of both Chingazi and Mitumbo Hills (3,894 and

Figure 3. Transect of Kambuwa, Chaoni, and Kujawo villages, Matapwata EPA

	Chingazi hill 3894 asl.			
LANDTYPE	Hillslope (minda ya mphiri)	Upland (Munda)	Upland and perennial Dambo	Chimvu Dambo and stream
SOILS	Red, black clay on summit	Red, Loams	Red, loams, clay in dambo	Clays, sandy near stream
VEGETATION	bamboo, thatching grass	weeds	elephant grass; bamboo.	reeds; weeds; grasses.
CROPS	maize; p'pea; beans; fieldpeas; sorghum; bananas.	maize;p'pea; beans; s.potatoes; peas;sorghum; cassava;chillies.	maize;p'pea;beans; sweet potatoes;peas; sorghum; cassava; chillies; cabbage; mustard; tomatoes; sugarcane.	maize; p'pea; sugarcane.
PESTS/DISEASES	beanfly;stemborer	termites; stemborer; aphids.	stemborer;maize streak virus; whitegrubs; insects on cabbages.	maize streak virus.
WEEDS	*striga*	*striga; ageratum.*	*kapinga (Cynodon dactylon); ageratum*	*ageratum*
TREES	Bananas	India;bluegum; Gmelina; Cedrela sp; bananas; fruit trees.	India; bananas on stream banks.	Mbawa (few)
PROBLEMS	Soil erosion Hyraxes eat maize Soil fertility	Soil fertility (esp. on red soils).	Tomato diseases; 'chisanu'; theft.	Flooding; stream dries up; steep banks make irrigation difficult.
OPPORTUNITIES	Marker ridges; agro-forestry.	Fertiliser; green manuring	Resistant/cold tolerant varieties;	Water conservation (eg. dam)

Source: Village transect walks

Figure 4.Transect of Chiwinja and Lidala villages, Chiradzulu North EPA

	Mitumbo Hill 4042 asl.			
LANDTYPE	Hillslope (minda ya mphiri)	Upland (Munda)	Lirangwe Dambo	Lirangwe streambed
SOILS	Red	Red, or sandy loams	clays	clays
VEGETATION	Bamboo; thatching grass		Thatching grass	Thatching grass
CROPS	Maize; p'pea; beans;sorghum.	Maize; p'pea;beans; sorghum;fieldpeas; tobacco; sunflower; vegetables in dambos.	Maize; sorghum; rice;sweet potato;soya;p'pea; fieldpeas.	Maize;sorghum; rice;sw. potato;soya;p'pea; fieldpeas.
PESTS/DISEASES	Termites	Aphids;termites; *clavigralla.*	White grubs	White grubs
WEEDS	*Striga*	*Alectra vogelii*	Likakazi (*Leersia hexandra)*	
TREES	Bluegum; Gmelina	Bananas		
PROBLEMS	Soil erosion; thin, infertile soils.	Soil erosion; low soil moisture	Soil too dry for winter cropping; weeds	Flooding in rainy season; no winter cropping; weeds.
OPPORTUNITIES	Marker ridges; agro-forestry	Marker ridges; agro-forestry		Water control

Source: Village transect walks

4,042 m asl, respectively). Vegetable crops were confined largely to dambos. Cabbage, tomatoes, and mustard appeared to be the most common vegetables. Dimba vegetables were limited in Chiradzulu, but were extensively grown in Matapwata. Sugarcane was most commonly grown near the banks of rivers and streams.

Commercial vegetable growing in Matapwata was well developed. There were a large number of perennial dambos, permitting a range of vegetable crops. We met several growers who rented fields from other villagers. Villagers either sell the crop themselves at Bvumbwe market or sell on a wholesale basis to local or visiting traders.

Pests and diseases also varied according to landtype. Termites were worse on the upland, whitegrubs on the lowland. Maize streak virus was particularly associated with dimba maize.

Villagers also reported serious vegetable pests. Cabbages suffered from aphids, caterpillars, and yellowing leaves. Tomatoes suffered from wilting (*chisanu*), which growers attributed to cold temperatures. Spraying for insect pests was common. Growers do not usually spray for diseases since they have difficulty recognising them and do not know what to apply. Chemicals used for spraying cabbages included copper sulphate, Sevin, Ripcord, and actellic. Sevin is also widely used for controlling insects on tomatoes.

IPM pest management strategies for vegetables are the responsibility of the Malawi-German Plant Protection Project (MGPPP) which does not have field sites in the Blantyre Shire Highlands. Given the economic importance of vegetable production in the farming system, however, the FSIPM Project and MGPPP might wish to jointly operate on-farm trials in Matapwata, particularly for cabbage and tomotoes.

Notable **weeds** included *striga, ageratum,* and *alectra vogelii. Striga* was reported to be found primarily on hillslope and upland fields; this weed was not a problem in dambos. *Ageratum* was prevalent on all landtypes. *Alectra vogelii* (a parasitic weed, similar to striga) was found growing in upland fields in Matapwata. The village chief who accompanied us on this particular walk knew this weed resembled *striga* because he had seen how it attached itself to the plant roots. *Cynodon dactylon* was found primarily on dambos. Weeds were particularly abundant in the Lirangwe dambo, which remains uncultivated during the dry season.

Trees were grown for both fruit and fuel. Bananas were the most common fruit tree. Villagers in Matapwata reported that before 1985 bananas were widely grown in the dambo and upland, but that most farmers had abandoned banana cultivation because of a change in the rainfall pattern. Higher prices for vegetables may also have been a contributory factor on dambo land. Bananas are now grown chiefly on the hillslope. Planted in rows on ridges, they are used as a local method of containing soil erosion. Several varieties of banana were grown: Makumbuka and Nkhobowa were better suited to drier soils, while the short Kabutu variety was suited to wet soils and grew well along stream banks.

Fuelwood trees included Bluegum, *Gmelina*, *Cedrela sp*., and 'India', an unidentified exotic. Besides fuel, 'India' was reported to be valuable for cattle fodder, and its resistance to termites made it valuable for poles and roofing. The fruits, which are not poisonous, are eaten by goats. The main sources of fuelwood reported by villagers were: (1) woodlots on neighbouring estates; (2) own woodlots, mostly bluegum; (3) crop residues, particularly maize stover, and stalks of pigeonpea, fieldpeas, and beans; (4) gathering twigs on streambanks and hillslopes.

Among **problems** identified during transects, soil erosion and low soil fertility were uppermost in villagers' minds and featured prominently at both sites. These were associated primarily with hillslope and upland fields.

Opportunities include marker ridging to control soil erosion and agro-forestry or nitrogen-fixing crops to improve soil fertility. According to village timelines, marker ridges were first introduced by the colonial government in the mid-1950s. Ridges were planted with an exotic grass (species seen, but not identified). Farmers maintained these ridges until 1968 after which they were removed or used to plant cassava. Today marker ridges may be seen only in Kajawo and on the top of Chingazi hill in fields belonging to farmers from Magomero section). Villagers reported that marker ridges were abandoned because when Dr. Banda came to power he told them they were free and should return to their traditional customs. Farmers interpreted this as the green light to remove marker ridges.

In general discussion we learned that the approach of the colonial rulers towards soil conservation had been oppressive and harshly enforced. Husbandry practices were codified into "agricultural rules". The penalty for breaking these rules included fines and even imprisonment. Another example given was that "whites" had forced households to site their houses along the roadside, rather than as scattered settlements among fields. In Matapwata in the 1950s, houses were concentrated along the road leading to Kambua, and along the main road running below Chingazi hill. After 1968, however, this settlement pattern was abandoned and people reverted to building houses close to their own fields.

Recent attempts to re-introduce marker ridges have met with apathy if not outright resistance. The FA for Nansadi section, Matapwata EPA, tried to lay out marker ridges about two years ago. This consisted of simply setting out pegs, leaving farmers to provide the labour. Farmers did not understand the rationale for these ridges and simply pulled out the pegs. Although the benefits of marker ridges seem obvious on steep hillslopes, labour and damage to hoes caused by stony soils may pose problems for some farmers. Farmers' own erosion control methods included making stone dykes to direct water flows, and planting rows of banana trees, which formed earth banks. Although these appeared effective they were seen on very few fields.

With the exception of ICP 9145 pigeonpea, we saw no recently-introduced agro-forestry species. Villagers had not heard about Glyricidea or Tiphrosia. Some had heard of Leucena, but only for use as a cattle feed. Villagers were interested to try agro-forestry but had so far not had the opportunity.

8. FARMERS' RANKING OF CROPS

Maize, beans, and pigeonpea were identified as priority crops for the FSIPM Project by the Stakeholder Workshop (Ritchie, 1996). This selection was based on their importance in Blantyre Shire Highlands RDP in terms of area planted, and the existence of IPM interventions suitable for field-testing. This finding was verified in the villages selected for the on-farm trials. In particular, it seemed reasonable to check that these were crops that poorer households and female-headed households normally grew.

Crop ranking exercises with two mainly female groups were made in Kambuwa and Chiwinja villages (Figure A11). These exercises confirmed that maize, pigeonpeas and beans were considered by villagers to be among the five most important crops that they grew (Figure 5).

Figure 5. Farmers ranking of crops grown, Matapwata and Chiradzulu North

Matapwata		Chiradzulu North	
Rank	**Name**	**Rank**	**Name**
1	Maize	1	Maize
2	Pigeonpea	2	Sorghum
3	Sorghum	3	Pigeonpea
4	Field peas	4	Beans
5	Beans	5	Crown pea

Source: Figure A11.

9. GENDER DIVISION OF LABOUR

If appropriate interventions are to be designed with farmers, it is crucial that Project personnel have a clear understanding of how tasks on farm and on the homestead are allocated or ascribed to different members of the household according to age and sex. In general, researchers have found considerable flexibility in the division of labour in southern Malawi. The division of labour, flexibilility and its limits, as well as the decision-making that accompanies agricultural work, will be a principle object of study once on-farm trials have been set up and detailed anthropological and sociological work begins.

As a preliminary exercise, however, and to check that others' findings held roughly true for the Project area, an exercise was carried out with a group of women (with a couple of men present) in Kambuwa village. The farmers were asked to describe the division of labour for the seven crops they had identified as most important (Figure A12).This exercise demonstrated flexibility between men and women regarding the performance of a large number of tasks. Men and women might work together on 30 of the tasks, women alone would carry out 17 of the tasks (seven of which were selling the product if it was to be sold) and men would perform only 2 tasks by themselves (and these were for sweet potatoes which were primarily a cash crop).

In Chiwinja pigeonpea and beans were described as 'women's crops' and in Kambua, we were told that both men and women grew maize and beans but that pigeonpea was primarily women's work. Figure 6 shows that of 22 crop operations for maize, beans, and pigeonpea, the majority (14) were shared by men and women. Field labour for maize, the staple food crop, was a joint responsibility. Pigeonpea was primarily a womens' crop: of seven operations recorded, women had sole responsibility for five. Men had sole responsibility for only one operation, namely purchase of fertiliser. Clearly, women took much of the responsibility for the crops targeted by the Project.

Figure 6. Gender division of labour for maize, beans and pigeonpea, Matapwata

Crop	No. of crop operations	Only men	Only women	Both
Maize	8	1	1	6
Beans	7	0	1	6
Pigeonpea	7	0	5	2
Total	22	1	7	14

Source: Figure A12.

By contrast, cassava was grown by men. Men said this was because women planted the stems upside down, so that the crop flowered but produced no tubers. A more plausible explanation is that the male monopoly is a form of resource control. Cassava can be picked at any time over a long period and is a convenient source of ready cash. Cooked cassava was sold by women, however.

This initial investigation raised several questions, including:

- what is the division of labour in male headed households where men have off-farm employment or are occupied in business;
- does a male cash income substitutes for male labour through the hire of labourers;
- is a cash income translated into inputs for food crops;
- how do female headed households compensate for the absence of male labour; do they;
- how much work is done by children; and how different are the inputs of girls and boys?

10. PESTS

Maize Figure 7 shows farmers' ranking of the five most important pests of maize at each site, giving a total of six pests. "Importance" was explained as "causing most damage to you maize crop". The results of the original PRA exercises, listing 11-14 pests, are provided for reference in Figures A13-A14.

Of the six different pests listed in Figure 11, two (weevils and rodents) were storage pests. Since IPM management strategies for storage pests are complex and require specialist knowledge, the FSIPM Project has focused on field pests. Farmers perceived the most serious field pests of maize to be whitegrubs, termites, cobrot, and *striga asiatica.* Whitegrubs were found chiefly in dambos while termites and striga were found on upland fields. With the exception of cobrot, all maize field pests were perceived as increasing in severity.

Fig. 7 Farmers' ranking of pests of maize, Matapwata and Chiradzulu North EPA, 1996

	CHIRADZULU NORTH			MATAPWATA		
Rank	**Pest**	**Control Method**	**Decrease (-) Increase (+)**	**Pest**	**Control Method**	**Decrease (-) Increase (+)**
1	White grub	Sevin seed dressing	+	White grub	killing (using hoe and hands)	+
2	Termites	killing queen termite in nest (no control in field)	+	*Striga*	weeding and drying	+
3	Weevils (storage)	drying and Actellic dust	+	Termites	killing queen termite in nest (no control in field)	+
4	Rodents (storage)	killing (using traps and cats)	+	Cobrot	no control	+ (a lot of rains) - (with less rains)
5*	Cobrot	burning rotten cobs (fuelwood)	–	Weevils (storage)	using ash and/or actellic dust (no control in *nkhokwe*)	–

Source: Figures A13 and A14.

Note: Striga was ranked No. 6 in Chiradzulu North.

Farmers' perceptions generally matched those of research scientists (Ritchie, 1996). Whitegrubs were an important exception, however. Although farmers at both sites ranked whitegrubs as the most important maize pest, they were not identified as a major pest by scientists. The farmers' perception receives some support from the Soil Pests Project, which ranked whitegrubs as the second most important soil pest after termites in southern Malawi (Nyirenda *et. al.*, 1993).

Villagers in Chiradzulu attributed whitegrub damage to flood-control measures introduced in 1959 by the colonial government. Concrete barriers placed across the path of the Lirangwe stream (not visible in the dry season because of heavy weed growth) have been sited to channel water during the wet season. This was reported to have dried up the soil and encouraged pest build-up.

Although head smut (*Sphacelotheca reiliana*) and cobrot (ear rot fungal complex) are perceived by DAR scientists as among the two most serious pests of maize in Malawi, farmers find it difficult to recognise plant diseases (Orr, 1996). In both the ranking exercises for maize, farmers required prompting to include diseases as pests of maize. Only three diseases of maize were listed: headsmut (*chisikwe*), maize streak virus (*mawawanga*), and cobrot (*naliole*). Symptoms of plant disease were often ascribed to immediate physical causes such as rainfall or bad seed. A single plant disease might be described in several different ways: maize streak virus, for example, was described as "changing colour" (*kusanduka makati*) or "going lame" (*kupanduka*, used referring to polio).

Beans Figure 8 shows farmers' ranking of the five most important pests of beans at each site, giving a total of eight pests. As with maize, "importance" was defined as "causing most damage to the crop". Of these, seven were field pests of beans. The results of the original PRA exercises, listing seven and eight pests, have been provided for reference in Figures A15 -A16).

Wilting (*kunyala*) was ranked as the most important pest of beans in both Matapwata and Chiradzulu. Although wilting in beans is caused by beanfly *(Ophiomyia* spp.), farmers in southern Malawi are not aware of the activities of this particular pest (Riches et. al., 1993). *Sclerotium rolfsii*, ranked as the second most important pest by farmers in Matapwata, is known to be aggravated by beanfly (Riches *et. al.*, 1993). Aphids and *ootheca* were among the other most important field pests. Research scientists at the FSIPM Stakeholder Workshop also ranked beanfly as the most important pest of common beans but angular leaf spot, ranked third by scientists, did not appear in farmers' rankings (Ritchie, 1996). It seems likely that farmers do not recognise these symptoms as a plant disease. For the majority of pests listed, farmers reported no methods of control.

Fig. 8 Farmers' ranking of pests of Phaseolus Beans, Matapwata and Chiradzulu North

MATAPWATA				CHIRADZULU		
Rank	**Pest**	**Control Method**	**Plant growth stage at time of attack**	**Pest**	**Control Method**	**Decrease (-) Increase (+)**
1	Wilting (*kunyala*)	None	Sprouting	Wilting (*kunyala*)	None	+
2	*Sclerotium rolfsii (kuwauka)*	None	Flowering	Aphids *(Nsabwe)*	None	+
3	Aphids (*nsabwe*)	None	Flowering	*Ootheca* (*ukupe*)	killing by hand	+
4	Blister beetle (*asalombe*)	None	Flowering	Termites (*chiswe*)	killing queen termite in nest (no control in field)	+
5	Weevils (*kafutwe-futwe*)	None	Storage	Elegant grasshopper (*nukhadala*)	killing by hand	+

Source: Figures A15 and A16.

Pigeonpea Figure 9 shows farmers' ranking of the five most important pests of pigeonpeas at each site, giving a total of eight pests. As with maize and beans, "importance" was defined as "causing most damage to the crop". All were field pests. The results of the original PRA exercises, listing 10 and 11 pests, are provided for reference in Figures A17 and A18.

Wilting, caused by fusarium, was ranked as the most important pest in Matapwata but only as the fourth most important in Chiradzulu. The lower ranking in Chiradzulu may reflect the effectiveness of the farmers' pest management strategy of planting pigeonpea on the side rather than on the top of the ridge. Farmers in Chiradzulu may also enjoy easier access to supplies of ICP 9145 seed, which is resistant to fusarium wilt. Wilt was ranked as the first and only pest of pigeonpea by research scientists (Ritchie, 1996).

Insect pests included elegant grasshopper, podborer, aphids, *clavigralla*, and weevils. With the exception of weevils, villagers reported no effective methods of control for these pests apart from hand-killing.

Figure 9. Farmers' ranking of pests of pigeonpea, Matapwata and Chiradzulu North

	MATAPWATA			CHIRADZULU		
Rank	**Pest**	**Control Method**	**Plant growth stage at time of attack**	**Pest**	**Control Method**	**Plant growth stage at time of attack**
1	Wilting (*kunyala*)	None	Flowering	Elegant grasshopper (*nunkhadala)*	killing by hand/some eat as relish	Sprouting to vegetative
2	Podborer (*bongololo*)	Removed at shelling (no control in field)	Podding	Termites (*chiswe*)	None	Sprouting to harvesting
3	Weevils (*chiswe*)	drying and applying Actellic dust	Storage	*Clavigralla* (*angogoni*)	None	Podding to maturity
4	Goats (*mbozi*)	Tying	Sprouting to harvesting	Wilting (*kunyala*)	Some plant seed on the side of the ridge	Sprouting to maturity
5	Termites (*chiswe*)	None	Sprouting to harvesting	Aphids (*nsabwe*)	None	Podding to maturity

Source: Figures A17 and A18.

11. WEEDS

Farmers identified a total of 23 weeds, of which 22 species could be identified (Hamilton, 1991), and of which 21 had Chichewa names. In contrast to crops, we did not try to rank weeds in terms of their severity as a pest. Instead, weeds were simply ranked by frequency of occurrence. Consequently, *striga asiatica* was not ranked highly since it was relatively uncommon in relation to other species. The results of the original PRA exercises have been provided for reference in Figures A19 and A20.

Figure 10 shows farmers' ranking of the six most common weeds at each site, giving a total of eight weeds, of which four were common to both sites. The Matapwata ranking closely matched previous rankings by the Soil Pests Project, which found that *Commelina* sp. and *Eleusin indica* were among the three most "troublesome" weeds in Matapwata EPA (SPP, 1993, p. 57 Table 33).

Of the weeds listed, one (*Leernia hexandra*) was found on dambos, four on upland, and three on both dambo and upland gardens. Weeds, therefore, were more common on the upland. The two weed species ranked first in terms of occurrence were also the fastest-growing. In discussions with farmers we learnt that weed species could also have been ranked according to ease of weeding. *Commelina* sp., for example, is easy to weed but does not dry quickly; *Cynodon dactylon* and *Eleusin indica* are both difficult to weed with a hoe; and *Acanththospermum hispidum* is difficult to weed by hand because of thorns.

Figure 10. Farmers' rankings of weed pests, Matapwata and Chiradzulu North

	MATAPWATA			CHIRADZULU		
Rank	**Weed**	**Dambo/ upland**	**Rate of growth (max=1)**	**Weed**	**Dambo /upland**	**Rate of growth (max=1)**
1	*Commelina* sp. (Likhololowani)	both	1	*Leernia hexandra* (likakazi)	dambo	1
2	*Cynodon dactylon* (kapinga)	both	3	*Cynodon dactylon* (kapinga)	both	2
3	*Eleusin indica* (chingombe)	upland	6	*Acanthaspernum hispidum* (nchetso)	upland	4
4	*Ancanthospermum hispidum* (nchetso)	upland	5	*Panicum maximum* (nsonthe)	both	5
5	*Cissampelos mucronata* (chilambe)	upland	2	*Cissampelos muerata* (chilambe)	upland	6
6	*Cyperus* sp. (Anyezi)	both	4	*Bidens pilosa* (chisoso)	upland	3

Source: Figures A19 and A20.

12. FARMERS' PEST MANAGEMENT STRATEGIES

Villagers reported a number of PMS for major pests of maize, beans, and pigeonpea. These included insecticides for seed dressing and storage of maize. The majority, however, involved simple hand-killing of insects or removal of the infected plant. The effectiveness of these PMS is questionable.

Two villagers in Chiwinja, Mrs. Beatrice Chilewani and Mrs. Mandevu, provided information on insecticides prepared from local plant materials. Mrs. Chilewani used *nadinji* roots, the large underground storage organ of an unidentified perennial shrub , which were ground up, seived, and pounded into powder before being dusted onto plants. Mrs. Mandevu ground up green *ntutu* leaves (*Tephrosia* sp.), which were then soaked in water and applied as a drench from a watering can or by splashing with a brush. Both insecticides were used to protect vegetables against caterpillars and other aerial pests.

Two PMS developed by farmers for maize and pigeonpea were identified as potential IPM interventions and both will be tested by on-farm trials during the 1996/97 season.

Sevin seed dressing for maize Farmers in Chiradzulu North reported seed dressing with Sevin insecticide to control damage by whitegrubs to maize. Three farmers were interviewed to learn more about this method and its effectiveness.

Case 1: Mayi Malonda Mayi Malonda was reported to be the first Chiwinja villager to have used Sevin seed dressing to control maize whitegrubs in the Lirangwe Dambo. She got the idea from her brother-in-law (now deceased) who had observed farmers spraying Sevin on cotton. She started using this PMS in 1993/94 and has continued with it ever since. Generally, Mayi Malonda considered the treatment worthwhile but found it difficult to get the necessary cash to buy Sevin.

In 1993/94 she applied one packet to a field of local maize in the Lirangwe dambo. The seed was soaked overnight before treatment. Mixing with Sevin was done in the field, not at home. The packet was burned after use. Application was made by hand, without gloves, but hands were thoroughly washed after the treatment. She used about one winnowing-tray (*lichiru*) of seed. No yield estimate was possible since the cobs were not bagged but stored in the granary. The yield was reported to be good. This was ascribed to poor rains (1993/94 was a drought year). The area of the field was estimated at 0.4 ha.

In 1994/95 she applied one packet (cost 14 MK) to one field of MH18 in the Lirangwe dambo. The yield obtained this season was 10 bags of 90 kg. - less than in 1993/94. The poor yield was ascribed to waterlogging in the field, which washed off the Sevin from the seed.

In 1995/96 she applied one packet (cost 18 MK) to one field of MH18 in the Lirangwe dambo. The seed was planted in late December, since clay soil takes several rains to become moist enough for planting. The yield was very poor - only one 90 kg. bag. Again, she attributed this to waterlogging which reduced the effectiveness of the Sevin.

Case 2: Mayi Poya Mayi Poya (elder sister to Mr. Mombezi, Case 3) reported that she had used Sevin seed dressing for two seasons. In 1994/95 her daughter purchased two packets of Sevin from Lunzu at a cost of approximately 20 MK. The seed was soaked overnight in a container. Mixing with Sevin was done in the field to avoid contamination to children and animals. The maize seed was still wet when Sevin was applied. Sevin was mixed by hand without protective covering. They stopped applying when all the maize seeds were white with the powder. What was left over was used to treat ants round the homestead. She used approximately 1.75 packets of Sevin (150g approx.)and 1.5 pails (*chidebe*) of seed (22.5 Kg). The estimated yield (local variety) in this first season was reported to be very good - the granary was filled, and several bags were stored. In 1995/96 she followed the same methods but the yield (again from a local variety) was less than one 90 kg. bag.

Case 3: Mr. and Mrs. Mombezi Mr. Mobezi and his wife had used Sevin seed dressing for the past two seasons. In both years they had followed the same method, which was to soak the maize seed in water overnight before carrying to the field next morning and dusting it with Sevin. Once the seed had turned milky in colour, it was ready for planting.

In 1994/95 they applied three packets (255g) of Sevin to approximately half an acre (0.2 ha approx.) of their dambo land. The total cost was 54 Kwacha (18 Kwacha/packet). There was no flooding in the dambo and the yield was good. No yield estimate was provided. In 1995/96 they applied only half a packet of Sevin to the same field. There was heavy rainfall and the dambo was flooded. Consequently, the yield was very poor. They believe Sevin seed dressing is effective when there is less rainfall because the chemical stays on the seed long enough for plant establishent.

Conclusions Only five or six households in one village - either relatives or close neighbours - have experimented with Sevin seed dressing. The strategy is relatively expensive (currently K23.60 /100g packet in 1996) and would not be appropriate for all smallholders. Application rates varied and may simply have been determined by the cash which households could spare at the time. All those interviewed had obtained higher maize yields in at least one year using this method. So far, the strategy has only been tested in the floodplain of the Lirangwe River. This is a high-risk environment. Villagers reported that in years of good rainfall, maize fields were usually abandoned if the water level was above knee-height at time of first weeding. Villagers believed that the effectiveness of seed dressing was greatly reduced by high rainfall and water-logging. (It was also reported that Sevin purchased from local traders had been adulterated with maize flour). Farmers were willing to continue the practice, however, since the alternative was severe crop loss from whitegrubs.

Side-planting pigeonpea Farmers in Chiradzulu EPA reported that planting pigeonpea on the side rather than on the top of the ridge reduced damage from wilting. This was believed to reduce infection spread by crop residues and weeds, which are incorporated into the top of the ridge during first and second weeding.

Interviews conducted during transect walks and informal discussions revealed three other reasons for side-planting of pigeonpea, namely: (1) to avoid disturbing the plant if the maize has to be replanted because of whitegrub damage; (2) because other intercrops such as beans or cassava leave insufficient space for planting on top of the ridge; and (3) to avoid damaging the plant during the first weeding of maize, when pigeonpea is still small.

13. DISCUSSION OF IPM INTERVENTIONS

A range of possible PMS were drawn up for on-farm trials during the 1996/97 season (Figure 11). These included innovative farmer practices; interventions which had been tested by researchers; and interventions developed by researchers which had not yet been tested. The pests targeted for IPM on-farm trials were those identified in the diagnostic exercises reported above. These were: whitegrubs, termites, and *Striga* (maize); beanfly (beans); and fusarium wilt (pigeonpea). IPM interventions against two other maize pests (streak virus and cobrot) may be tested as and when the need arises but will not form part of the experimental design of the on-farm trials.

Whitegrubs Although most farmers in Matapwata reported problems with whitegrubs, they had no control method. They were familiar with Sevin, which is mixed with water and applied to cabbages. They warned that Sevin was expensive, but were willing to try seed-dressing maize. Sevin was available from ADMARC in Chaoni village.

Termites

(1) Reactions to the *kaselera* PMS were instructive. Farmers in Matapwata grow a second crop of beans which is relay-sown into the maize crop in March. Before sowing, they strip the leaves from the maize plant (leaving four leaves per plant) to allow air and moisture to reach the beans. After drying for one week, the leaves are incorporated in the soil in a new ridge made in the furrow. After one more week, the relay-beans are planted. Although this resembles *kaselera*, it cannot be effective in controlling termites since the new ridge is made when maize has reached cobbing stage and termites have already damaged the crop. This could be solved by forming the new ridge for planting beans earlier, but farmers objected that late planting was necessary because: (1) the first bean crop, harvested in February, supplied seed for the second crop; (2) if planted too early, the relay-crop risked damage from rains in March. The proposed trials will include a short season bean variety for the first crop.

Villagers in Chiradzulu pointed out that *kaselera* was not appropriate in the Lirangwe dambo because of the high water level and that because of short rains they normally did not grow a second crop of beans. Farmers told us that termites could be controlled by avoiding banking (earthing up maize plants at second weeding), which buried weeds close to the plant roots. This practice will be tested in trials in Chiradzulu.

(2) In Chiradzulu, discussion of *kaselera* led into discussion about choice of bean varieties. The varieties normally grown were: Kaulesi and butter beans (recommended for the first crop if using kaselera since they are high yielding and quick maturing); Chimbamba (quick maturing and good flavour); Kayera (good flavour, but does not do well in the dambo); and Nanyati (high yielding). Villagers identified samples of each variety from the local market in Warera.

Inspection of these sample bean varieties by Mr. T.M. Munthali (Research Assistant, Bunda Bean Project, Matapwata EPA), revealed that most contained more than one variety of seed. The sample of Chimbamba variety, for example, contained three varieties.

Figure 11. Matrix of potential IPM interventions for on-farm trials, 1996/97 season, Matapwata and Chiradzulu North

Rank	Pest	Crop	Pest Management Strategy				
1	Termites	Maize		Varietal resistance (RP)	No weeding (FP)	Cactus (Nkhazi) (FP)	
2	White Grubs	Maize	Seed dressing with Sevin (FP)				
3	Beanfly	Beans	Seed dressing (endosulfan/ Sevin) (RT)	Varietal resistance (but farmers may plant mixtures) (RP)	Mulching (increased tolerance) (RT)	Early planting (RT)	Earthing up/banking (RT); increased planting density RP); botanicals (neem; *Tephrosia*) (RP)
4	Fusarium Wilt	P. Pea	Varietal resistance (ICP 9145) (RT)	Planting on side of ridge (FP)			
5	Striga.	Maize	Weed and remove (RT)	Trap Crops sunhemp soya groundnuts v. beans (?) pigeonpea (?) fieldpeas (?) (RT/RP)	Fertiliser (incorp-orated in seedbed, not dolloped) (FP/RT)	green manure: *Tephrosia* (RP)	
6	Maize streak virus	Maize	Varietal resistance (Pannar 6195 ?) (RT)				
7	Stalkborer	Maize	*Tephrosia* extracts (FP,RT)	Sand/ash inserted in maize funnel (FP)	Varietal resistance (MH18 resists 1 type) (RP)	Grow susceptible sorghum varieties (Thenga-lamanga) (RP)	Put residues on surface to encourage natural enemies (RP)
8	Headsmut/ cob-rot	Maize	Use variety with covered cob (FP)	Break/bend over the cob (FP)	Remove affected plant and burn (RP)		

Notes: FP = Farmer practice; RT = Researcher tested; RP = Researcher proposed

The exception was Kaulesi, which was quite distinctive. He also pointed out that farmers planted climbing varieties, supported by the maize plant, for the first crop. Climbers had longer field durations and were harvested gradually. The relay crop was sown with dwarf varieties, which were faster maturing. Butterbeans (white, with red dot in the middle) and Kaulesi were both climbers and suitable for the first crop; Chimbamba was a dwarf and suitable for relay-cropping.

(3) Planting cactus (*nkhazi*) was reported to discourage termites since the sap is poisonous. Planting cacti in fields did not seem to be common, however, and the practice has no apparent scientific basis. Cacti were commonly planted near houses because villagers believed they protected both humans and animals from evil spirits.

Wilting in beans (beanfly) Farmers in Kambua were not aware that wilting was caused by beanfly and were willing to try seed dressing with Sevin.

Farmers pointed out that mulching might encourage attack by termites, and that grass for mulching was scarce. Similarly, farmers felt that earthing up might encourage termites, but were willing to try this method. Increased planting density posed problems because of a shortage of seed; they are willing to try but would like to be provided with seeds for the trials.

Fusarium wilt Farmers welcomed the idea of growing ICP 9145. Although ICP 9145 was officially released in 1987, farmers continued to plant local pigeonpea varieties. The reasons were not entirely clear. Villagers were already familiar with the pigeonpea variety ICP 9145, which they called "*nandolo wa Chinese*" or "*41*" after the short-duration maize variety NSCM 41. (ICP 9145 matures faster than local cultivars) . Supplies of ICP 9145 seed may be a problem for some. Farmers also acknowledged that yields were higher with ICP 9145 than with local cultivars, which were more susceptible to wilt. Some farmers preferred the taste of local varieties while others could not tell the difference.

Striga asiatica Farmers were aware that uprooting was not an effective control method. They were not aware, however, that striga was a parasitic weed and that seeds remained active for up to 20 years. They were aware that S*triga* was associated with low soil fertility. It was chiefly a problem on upland gardens, and they had seen that fertiliser and nitrogen-fixing crops like beans and pigeonpea reduced S*triga*.

Farmers were willing to try applying fertiliser in the seedbed, incorporated not dolloped, but the problem was cost. They were interested in growing trap crops like soya and green manure plants such as *Tephrosia*, which some had seen demonstrated at EPA headquarters without knowing what it was for. Villagers were confident that *Tephrosia* planted in the furrow would not pose problems during weeding.

REFERENCES

J. A. Ashby, 1989. "Small farmers' perticipation in the design of technologies", Pp. 245-253 in M. A. Altieri and S. B. Hecht, eds., *Agro-Ecology and Small Farm Development* (Boca Racon: CRC Press).

R. Chambers, 1995. "Paradigm shifts and the practice of participatory rural development", Pp. 30-42 in N. Nelson and S. Wright, eds., *Power and Participatory Development*. (London: Intermediate Technology Publications).

J. Farrington and A. Martin, 1988. Farmer participation in agricultural research: a review of concepts and practices. *ODI Agricultural Administration Unit, Occasional Paper*, No. 9.

S. Fujisaka, 1991. "A set of farmer-based diagnostic methods for setting post 'Green Revolution' rice research priorities", *Agricultural Systems*, 36, 191-206.

G. Goodell, 1990. "The contributions of agronomo-anthropologists to on-farm research and extension in integrated pest management", *Agricultural Systems*, 32, 321-340

K. A. Hamilton, 1991. *A Guide to Arable Weeds of Southern Malawi.* Soil Pests Project, University College, University of Malawi.

J. Nabasa, G. Rutwara, F. Walker and C. Were, 1995. *Participatory Rural Appraisal. Practical Experiences.* (Chatham: Natural Resources Institute/Actionaid).

G. K. C. Nyrendra, D. C. Munthali, and J. W. M. Logan, 1993. "Relative importance of various soil insect pests of maize (Zea mays) in southern Malawi", Pp. 253-269 in D. C. Munthali, J. D. T. Kumwenda, and F. Kisyombe, eds., *Proceedings of the Conference on Agricultural Research for Development,* Mangochi, 7-11 June.

A. Orr, 1996. *Significance and management of maize diseases in smallholder farming systems in Malawi.* Natural Resources Institute, U. K. January. Mimeo.

C. R. Riches, L. J. Shaxson, J. W. M. Logan, and D. C. Munthali, 1993. Insect and parasitic weed problems in southern Malawi and the use of farmer knowledge in the design of control measures. *ODI Agricultural Administration (Research and Extension) Network Paper,* No. 42, July, pp. 1-17

J. M. Ritchie, 1996. *Stakeholder Planning Workshop: Summary Report.* FSIPM Project, Bvumbwe Research Station. Mimeo.

Soil Pests Project, 1993. *Relative importance of different insect pests, plant diseases, and weed species affecting farmers' crops in southern Malawi.* Report No. 3. Natural Resources Institute/Chancellor College. October. Mimeo.

TIMELINE FOR KAMBUWA VILLAGE - TA CHIMALIRO - THYOLO 4th JULY 1996

1930	There was a primary school in the village
1931	Outbreak of locust that destroyed maize crop Farmers started growing beans
1932	Outbreak of locust
1934	Death of first headman Kambuwa
1949	Severe drought and famine
1959	Death of the Second headman Kambuwa
1962	There was heavy rainfall
1968	It was very cold and the bean crop was affected in the fields because wilts due to coldness. This resulted into seed scarcity years after.
1969	Dr Hastings Kamuzu Banda authorized that native Malawians should also apply fertilizer in their gardens. At first only White settlers were allowed
1970	There was a good harvest of crops
1980	There was a good harvest of crops
1981	Drought started. Rainfall was very low
1984	Outbreak of Rosset disease on groundnuts
1987 1990	Outbreak of Cassava mealybug. Cassava seeds/cuttings were scarce these years because most plants died of wilts
1991 1992	There was drought
1994	There was a problem of weeds called 'NChesa' Aca

Facilitators: Dr Alastair Orr
Dr Mark Ritchie
Mr Alex Kaloko
Mr Bonex Mkandawire

Participants: Mr I. Chimombo
Mr S. Supedi
Mr P. Kwizombe
Mr G. Mofati
Mr L. Enock
Mr P. Kazembe
Mr N. Sinosi
Mr M. Butao
Mr R. Kawerenga
Mr C. Multhena
Mr D. Sinoya
Mr O. Filipi
Mr D. Tomato
Mr J. Wanyanga
Mr R. Maganga
Mr A. Gusito
Mr L. Makholo
Mr P. Dick

Figure 12.

TIMELINE FOR KAJAWO VILLAGE - T.A. CHIMALIRO - THYOLO 15th JULY 1996

1895	- The village existed and the village headman was a man. - Epidemic of Polio and Small pox diseases - People were building round houses thatched with grass
1918	- Village headman Kajawo was a man - He was the first Kajawo headman
1940	- Death of the first Kajawo headman and appointment of his successor who was also a man - People started building four cornered houses
1945	- There was a force labour (Thangata) system - T.A Chimaliro was being carried on a stretcher - Outbreak of locust - There was famine
1949	- There was severe famine - People started making ridges - People were not applying fertilizer on their crops
1948	- Outbreak of pigs, goats and cattle diseases that killed a lot of animals.
1953	- A white settler by the name of Bwana Lommisi called for soldiers to illtreat those people who refused to do force labour - These soldiers were called or nicknamed Amalaya and seized flour, axes and spears from villagers
1958	- The arrival of Dr Hastings Kamuzu Banda - Dr Banda broke the Thangata (Force labour) system
1965	- People started applying fertilizer on their maize crop - The fertilizer in use was Sulphate of Amonia (wa Suga) - People started building brick houses because of lack of poles
1975	- Village headman Kajawo was relieved of his duties, another one was appointed
1976	- New Village headwoman Kajawo was appointed
1978	- Introduction of farmers clubs in the village - Farmers started getting fertilizer loans. Those who failed to pay back loans had their property confisticated.
1989	- Outbreak of mealybug on Cassava, tomato diseases wilts on pigeonpeas and maize diseases (Cloadsmut and streak)
1994	- President Bakili Muluzi became head of State/Government - Introduction of Democratic government in Malawi: Price of commodities riced such as fertilizer, sugar, matches. Lack of drugs in hospitals, corruption and rise to death of people due to diseases
1995	- Starting of good rainy season - Lack of fertilizer loans to small holder farmers
1996	- Too much rain destroyed a lot of maize due to cob rots - Low yield of maize because farmers didn't apply fertilizer on their maize crops.

Facilitators: Dr A. Orr
Dr M. Ritchie
Mr A. Koloko
Mr CBK Mkandawire

Participants: Mr G. Molande (Mfumu Kajawo)
Mr N. Rojasi
Mr L. Maloya
Mr W. Kuizombe
Mr J. Khumunye
Mr D. Magombo
Mr P. Jamali
[illegible]
Mr P. Yakobe
Mr M. Thulana
Mr P. Gowelo
Mr C. Namakhina

TIMELINE FOR CHAONI VILLAGE - T.A. CHIMALIRO - THYOLO 5th JULY 1996

1930	The village existed, and the first and 2nd headmen was Chikutso, third headman was Chaoni. Construction of a railway line
1938	Outbreak of locust
1939	In order to eliminate witchcraft in the village people were forced to take a concortion of Mchape drug with people died non witch vomited after taking drug.
1940	People started making ridges and planting on ridges
1949	There was severe drought and famine
1950	People started dancing a traditional dance called Chalingana
1956	Rangers came in the village
1953	There was force labour (Thangata) system. There was Malayan war
1960	Villagers started applying fertilizer on crops
1961	Chaoni headmanship taken away from Chaoni to Kumbuwa. This happened because of a dispute Chaoni had with traditional Authority Chimaliro.
1969	It was very cold. Some dimba crops wilted due to coldness.
1970	There was a war called Kachaso (Banda)
1972	Reinstallation of Chaoni as Group Village headman
1979 1980	There was drought and famine
1985	Beans were scarce
1990	Good harvest of beans
1991	Outbreak of Mealybug on Cassava
1992 1993	There was drought
1994	Political Changes in Malawi: New democratic government and multipartyism introduced.
1995	There was good rainfall
1996	Despite good rainfall there was low yields because farmers didn't apply fertilizer

Facilitators: Dr Alastair Orr
Dr Mark Ritchie
Mr Alex Koloko
Mr Bonex Mkandawire

Participants: Mr B. Mpaso
Mr F. Mazinga
Mr M. Zingalume
Mr M. Amoni
G.V.H. Chaoni
V.H. Waruna
Mr M. Harry
Mr Mivenda Njira

Figure A4.

TIMELINE FOR CHIWINJA VILLAGE – TA. MPAMA – CHIRADZULU 31st JULY 1996

Year	Events
1908	- The village existed and the first headman was Bandawe - People were being forced to work in tobacco estates owned by white settlers. Those who resisted had their houses demolished
1916	- Start of mail service (Mtokoma)
1946	- It was a good harvest year - Appointment of 2nd headman Mr D. Chiwinja
1949	- There was severe drought and famine - Outbreak of locust
1950	- People started making ridges and planting on ridges
1959	- The problem of witchweeds started. In the upland people harvested but in the dambo crops were severely damaged. Water lodging was a problem in the dambos.
1960	- People started applying fertilizer - Sell of MCP, party cards started
1964	- Malawi got Independence
1966	- Malawi became a Republic State - There was famine
1967	- Vaccination of Small pox
1978	- Third headman Mr T. Chiwinja was installed
1990	- There was drought
1994	- Start of Multiparty - government
1995	- Free Primary education started
1996	- Outbreak of Matowo that damaged a lot of maize crop, as a result people have harvest low yield. There is food shortage

Facilitators:
Dr A. Orr
Mrs J. Lawson McDowell
Mr A. Kobiko
Mr CBK Mkandawire

Participants:
Mr W. John
Mr I. Chitinkhonde
Mr L.W. Limula
Mr M Mpoya
Mr S.L Saidi
Mr G. Mombezi
Mr R. Chipunga
Mr M. Sapedi
Mr G. Walala

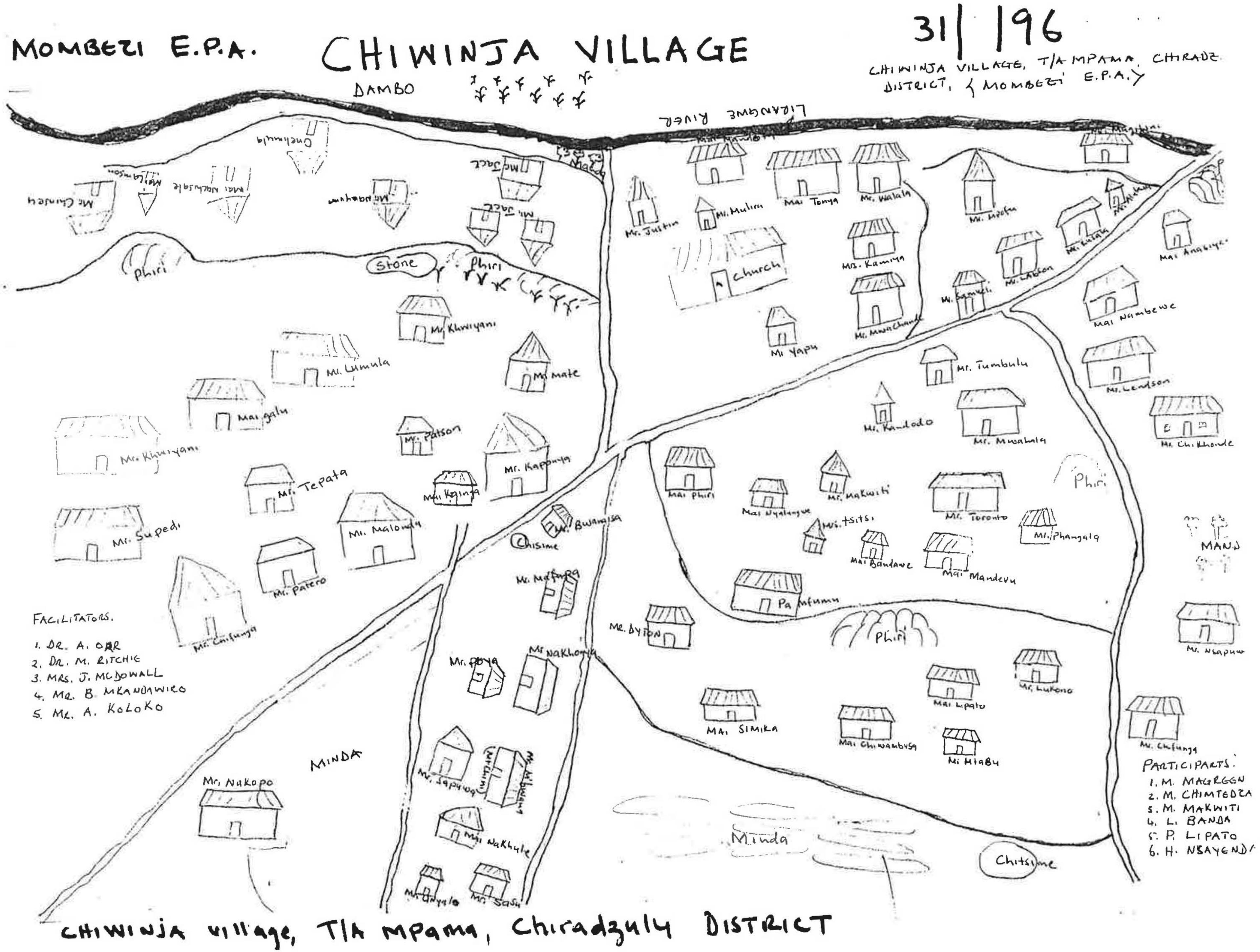
TIMELINE FOR LIDALA VILLAGE - T.A. MPAMA - CHIRADZULU 1st AUGUST 1996

1915	- Village headman Ngwale was installed. His parents emigrated to this village 50 years ago - There was John Chilembwe uprising
1916-1918	- Because of the uprising in 1915 people had low yields as many villagers run away from war
1919-1925	- After the uprising (war) people started concentrating on farming again and there were good crop harvests - Village headman changed his name to Lidala
1928	- This is the year when witchweed started in "the garden of Mr Solomon Nkoma
1931	- Village headman Lidala died
1935	- There was famine because locust from Mozambique West destroyed crops
1936-1939	- After the outbreak of locust food shortage persisted these years
1940 1940-1947	- Village headman died and another one was appointed - There were good crop harvests during this period.
1948 1949	- Severe drought and famine
1950 1956	- There was good rainfall and good harvests
1956 1957	- The colonial Government seized a lot of land from villagers through Marker ridges campaign. - Low yields as a result of whitegrub damage to maize
1957	- Marker ridges were destroyed by villagers and people started harvesting high yields again - Marker ridges remained on the hill slops only
1958-1996	- From 1958 to date there has been a problem of whitegrubs - Nobody has managed to control whitegrubs
1964	- Malawi got independence. People changing farming systems. They started making ridges and applying fertilizer to crops. These pests: termites, weevils, witchweed, stemborer, grasshopper-pollen
1966	- MCP card selling was causing displeasure among villagers - People didn't like paying tax
1970	- Outbreak of Cassava mosaic disease, Sweetpotato pests - New village headman was installed.
1973	- Fusarium wilt on Pigeonpeas started
1990 1995	- Drought - Political changes. In 1994 New President was elected
1995 1996	- Heavy rainfall, good crop harvests but tobacco diseases were causing serious damage to tobacco - New Lidala village headman was installed

Facilitators: Dr A. Orr
Mrs Julie Lawson McDowall
Mr A. Koloko
Mr CBH Mkandawire

Participants: Mr Ngwale (village headman)
Mr Kwiyani
Mr C. Sapanga
Mr K. Sapanga
Mr Chimwala
Mr Wesere
Mr Bauleni
Mr Nchenga
Mr Zuze
Mr Michael Sapanga

Figure A6.



MOMBEZI E.P.A.
CHIWINJA VILLAGE
31/1/96
CHIWINJA VILLAGE, T/A MPAMA, CHIRADZ DISTRICT, (MOMBEZI E.P.A.)
DAMBO
LIKANGWE RIVER
Church
Stone
Phiri
Chisime
MANJ
MINDA
Minda
Chitsime
Mr. Khwiyani
Mr. Lumula
Mai galu
Mr. Khwiyani
Mr. Supedi
Mr. Tepata
Mr. Patson
Mr. Kapanya
Mr. Malonda
Mr. Patero
Mr. Chifunga
Mr. Bwanaisa
Mr. Ayton
Mr. Nakopo
Mr. Sapuwa
Mai Nakhule
Mr. Sasu
Mr. Justin
Mr. Mulira
Mai Tonya
Mr. Walala
Mr. Kamiya
Mr. Yapu
Mr. Samuel
Mr. Labson
Mr. Tumbulu
Mr. Kandodo
Mr. Mwahala
Mai Phiri
Mai Nyalangwe
Mr. Makwiti
Mrs. Tsitsi
Mai Bandawe
Mr. Toronto
Mr. Phangala
Mai Mandevu
Pa Mfumu
Mai Simika
Mai Chiwambvsa
Mai Lipato
Mr. Lukono
Mi Mtabu
Mr. Lendson
Mr. Chikhonde
Mai Nambewe
Mai Anakiye
Mr. Nsapuw
Mr. Chifunga
FACILITATORS.
1. DR. A. ORR
2. DR. M. RITCHIE
3. MRS. J. MCDOWALL
4. MR. B. MKANDAWIRO
5. MR. A. KOLOKO
PARTICIPANTS.
1. M. MAGREEN
2. M. CHIMTEDZA
3. M. MAKWITI
4. L. BANDA
5. P. LIPATO
6. H. NSAYENDA
CHIWINJA village, T/A MPAMA, Chiradzulu DISTRICT

AND EPENSES AT ~~CHI~~ LIDALA VILLAGE ON 1st/8/96.

MOMBEZI EXTENTION PLANNING AREA, T/A MPAMA, CHIRADZULU DISTRICT.

	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUGUST	SEPT	OCT.	NOV.	DEC.
NDALAMA ZOONONGA (EXPENSES)	oooooooooo	oooooooooo	oooooooo	ooooo	oooo	oooo	ooo	ooooo	oooooooo	oooooooo	ooooooooo	oooooooooo
NTCHITO (LABOUR)	oooooooooo	oooooooooo	oooooooo	oooooo	oooooooooo	oooooooooo	ooooooo	oooooo	ooo	oooooo	oooooooooo	oooooooooo
GENI (INCOME)			oo	oooooo	oooooo	oooooooo	ooooooooo	oooooooo	ooo	oo	o	o
MATENDA (HEALTH)	oooooooo	ooooooooo	oooooooooo	ooooo	ooo	oo	oo	ooo	oo	oo	ooo	ooooo
CHAKUDYA (FOOD)			oo	oooo	oooooooooo	oooooooooo	oooooooooo	oooooo	oooo	ooo	oo	o
MVULA (RAINFALL)	oooooooo	oooooooooo	oooooo	oo							oooo	oooooo

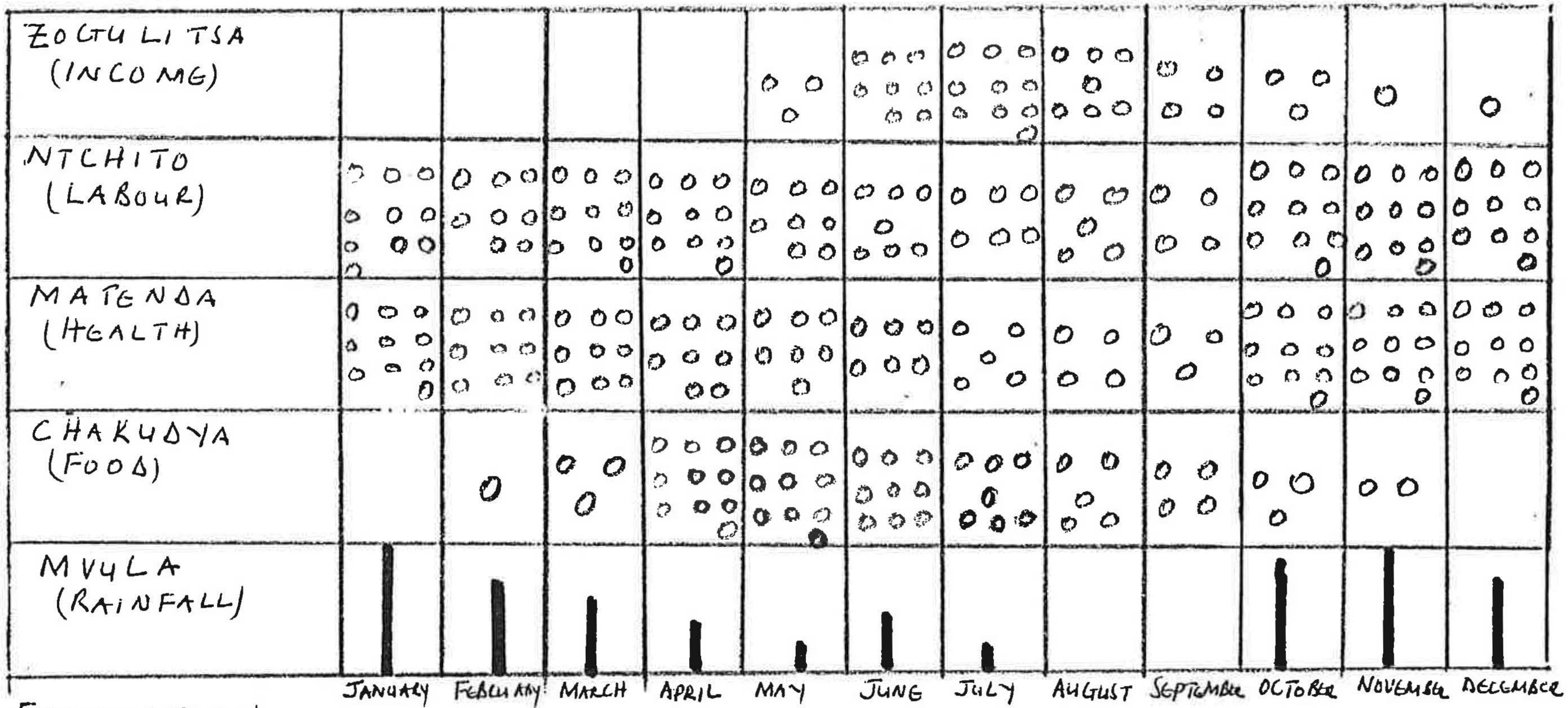
FACILITATORS: DR. A. ORR
DR. M. RITCHIE
MRS. J. MCDOWALL
MR. A. KOLOKO
MR. B. MKANDAWIRE

PARTICIPARTS: 1. MAI E. MULONYA
2. MAI E. LUKA
3. MAI M. HALE
4. MAI J. KASIMU
+ OTHER 36 WOMEN

Figure A8.

MATRIX RANKING OF RAINFALL, FOOD AVAILABILITY, HEALTH, LABOUR AND INCOME AT KAJAWO VILLAGE ON 15th JULY, 1996.

T/A CHIMALIRO – THYOLO MATAPWATA E.P.A.



FACILITATORS:

DR. ALASTAIR ORR
DR. MARK RITCHIE
MR. ALEX KOLOKO
MR. BONEX MKANDAWIRE

PARTICIPANTS:

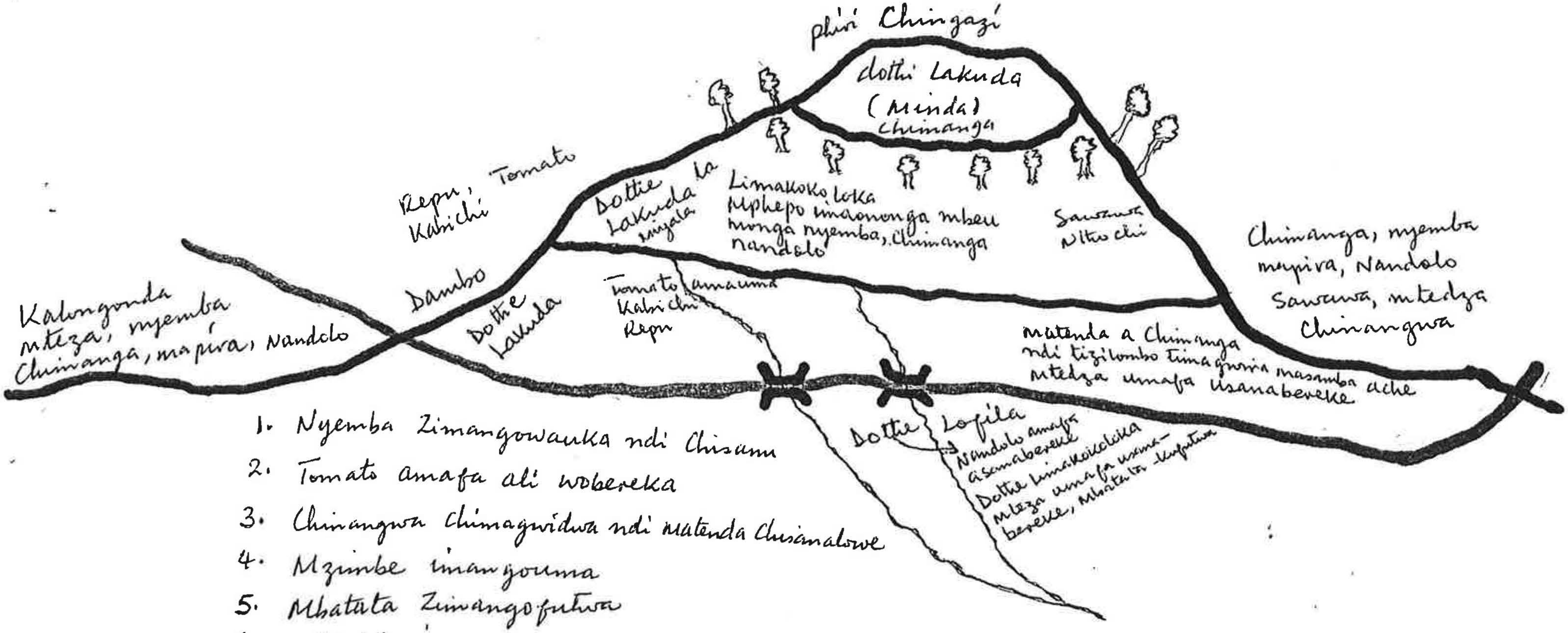
1. MRS. TELEZA NAMUKONDO
2. MRS. TELEZA SANDALAMU
3. MRS. LOVENESS MAGAISA
4. MRS. ESTERY M'CHEMO
+ 21 OTHER WOMEN

FIELD TRANSECT FOR KAMBUWA VILLAGE - TA. CHIMALIRO - THYOLO - 4th July, 1996

Drawn by: F.P.Z. Mmango

Assisted by: J. Chinyama
P. Chinyama Kamoto
R. Kazembe

Facilitators: Dr A. Orr
Dr M. Ritchie
Mr A. Koloko
Mr CBK Mkandawire



1. Nyemba Zimangowauka ndi Chisanu
2. Tomato amafa ali wobereka
3. Chinangwa chimagwidwa ndi matenda Chisanalowe
4. Mzimbe imangouma
5. Mbatata Zimangofutwa
6. Nthochi imauma
7. Tomato amangotuwa
8. Chimanga Chimagwidwa ndi udzu (Kaufiti)

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FIELD TRANSECT FOR LILALA VILLAGE, MUMBOZI E.P.A. T/A MTAMA, CHIRADZULU DISTRICT

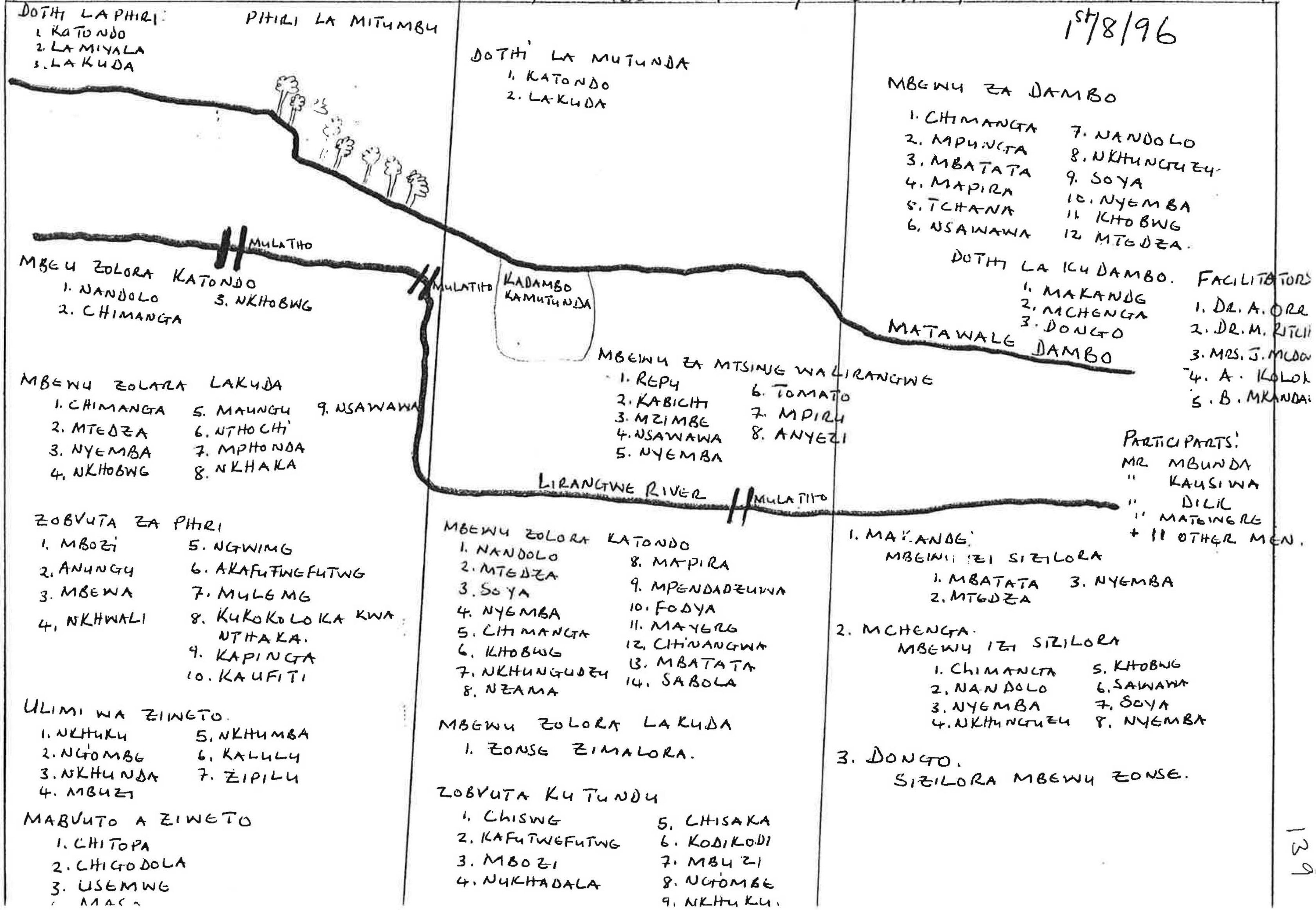

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Figure A11. Farmers' ranking of crops grown, Kambua and Chiwinja villages, Matapwata and Chiradzulu North

No	Crop	Rank	Comments	Crop	Rank
1	Maize	1		Maize	1
2	Pigeonpea	2		Beans	4
3	Sorghum	3		Pigeonpea	3
4	Sawawa	4		Crown pea	5
5	Beans	5		Sorghum	2
6	Velvet beans	6		Field pea	
7	Sweet potato	7	Seed and land shortage	Millet	7
8	Soya		Seed and land shortage	Nkhunguzu	6
9	Pumpkins			Cassava	9
10	Cassava		Seed and land shortage	Sweet potato	11
11	Cabbage			Groundnut	8
12	Tomato			Babara nut	
13	Rape			Pumpkin	12
14	Onion			Rice	13
15	Sugarcane			Tomato	
16	Mango			Sugarcane	15
17	Avocado			Mustard	
18				Rape	
19				Cabbage	
20				Okra + 8 others	14

Figure A12. Gender division of labour, Kambua village, Matapwata EPA

No.	Name	Fertiliser purchase	Seed	Land preparation	Planting	Weeding	Harvesting	Storage	Selling
1	Maize	men	men+ women	men + women	men + women	men + women	men + women	men + women	women
2	Pigeon pea	-	women	men + women	men + women	men + women	women	women	women
3	Sorghum	-	women	men + women	women	men + women	women	women	women
4	Field pea	-	men + women	men + women	men + women	men + women	men + women	men + women	women
5	Beans	-	men + women	men + women	men + women	men + women	men + women	men + women	women
6	Velvet beans	-	women	men + women	women	men + women	women	women	women
7	Sweet potato	-	men	men + women	men	men + women	men + women	men	women sent by their husbands

Participants: Mai Kambuwa, Mai Chikopa, Mai Chelewani, Mai Wilson, +18 other women

Figure A14. Matrix ranking of maize pests, Kambua village, Matapwata

No.	PEST	SCORE	RANK	CONTROL METHOD	STAGE OF ATTACK	CHANGE
1	Nkhwidzi (Whitegrub)	14	5	Hand killing using objects like hoe/sticks	Sprouting stage	+
2	Nunkhadala (Elegant grasshopper)	10		hand killing with hoe/stick	Vegetative stage	–
3	Kaufiti (Striga asiatica)	12	4	Weeding with a hoe and throw the weeds in the same field	Early vegetative and reproductive stages	+
4	Kapinga (Cynodon dactylon)	13		Dig or weed and dry the weeds and finally burn the dried weeds	Throughout the year	–
5	Likakazi (Leersia hexandra)	13		Dig , dry and burn the weeds	Throughout the year	–
6	Nansongole (Imperata cylindrica)	7		Dig , dry and burn the weeds	Throughout the year	–
7	Ntcheso (Acanthospermum hispidum)	7		Weed and bury the residues	Throughout the year	+
8	Kapuchi (Stemborer)	10		Hand killing	Reproductive stage	–
9	Nkhululu (crickets)	8		Hand killing and they eat the crickets	Sprouting stage	+
10	Chiswe (Termites)	9	3	Dig the mound and kill the queen	Reproductive stage	+
11	Nankafumbwe (Grain borer)	14	1	Use ash as pesticide or Actelic dust. In the granaries they just leave it.	Storage pest	–
12	Chinsikwi (Headsmut)	14		No control	Tasseling stage	–
13	Naliole (Cob - rot)	10	2	No control	Maturity stage	–
14	Abongololo (False Wireworm)	9		Hand killing	Sprouting	–

Figure A14. Matrix Ranking of Maize Pests, , Chiwinja village, Chiradzulu North EPA

No.	Pest	Location	Rank	Pest Increase + Decrease -	Control Method
1	Whitegrub (matono)	dambo	1	+	Seed dressing using Sevin
2	Termite (chiswe)	upland	2	+	Getting rid of mounds by killing mounds queen
3	Stem borer (akapuchi)	both	9	+	No control
4	Striga (kaufiti)	upland	6	+	Some apply fertiliser
5	Likakazi	both	10	-	By hoe weeding
6	Cynodon dactylon (kapinga)	both	11	-	Digging out and drying
7	Headsmut (chisikwe)	both	8	+	No control
8	Streak (mawawanga)	both	7	+	No control
9	Cob-rot (naliole)	both	5	-	burning as firewood
10	Weevil (kafutwefutwe)	both	3	+	Drying and applying actellic dust
11	rodents	storage pest	4	+	By physical killing using traps and cats

Participants: Malita Sapuwa, Emile Muchera, Bililesi Chilewani, Lucy Magilin, I. Chilimkhonde

Figure A15. Matrix Ranking of Beans pests, Kambua village, Matapwata EPA

No.	Pest	Rank	Stage of Attack	Control Method
1	Wilting (kunyala)	1	Sprouting	No control
2	Termite (chiswe)	6	Maturity to harvesting	No control
3	Sclerotium (kuwauka)	2	Flowering	No control
4	Aphids (nsabwe 1)	3	Flowering	No control
5	Blister beetle (asololombe)	4	Flowering	No control
6	Ootheca (tizilombo touluka)	7	From vegetative	No control
7	Weevils (kafutwefutwe)	5	Storage pest	Drying and applying Actellic dust

Participants: Mai Palapasa, Mai Chimombo, Mai Basikolo, Mai Misoya, and 18 other women.

Figure A16. Matrix Ranking of Beans Pests, Chiwinja village, Chiradzulu North EPA

No.	Name	Rank	Control Method	Increase Decrease
1	Wilting (kunyala)	1	No control	+
2	Caterpillar (timbozi)	8	No control	+
3	Termite (chiswe)	4	Getting rid of mounds by killing the mound queen	+
4	Nsabwe (aphids)	2	No control	+
5	Ootheca (ukupe)	3	physical killing by hands	+
6	Blister beetle (zokudya maluwa)	6	physical killing by hands	+
7	Elegant grasshopper (nukhadala)	5	physical killing by hands	+
8	Pod suckers (zonyalisa masamba)	7	No control	+

Participants: Malita Muchera, Emile Muchera, Bitilesi Chilewani, Lucy Magilini, Isaac Chilimkhonde.

Figure A17. Matrix Ranking of Pigeonpea pests, Kambua village, Matapwata EPA

No.	Name	Rank	Stage Of Attack	Control Methods
1	Wilting (kunyala)	1	Flowering	No control
2	Termite (chiswe)	3	From sprouting to harvesting	No control
3	Aphids (nsabwe 1)	4	From sprouting to podding	No control
4	Scale insects (nsabwe 2)		From podding to harvesting	No control
5	Caterpillar (choyabwa)		From sprouting to harvesting	No control
6	Blister beetle (asirorombe)		Flowering stage	No control
7	Nezara virdula (zilombo zonukha)		Flowering stage	No control
8	H. Armigera (kaluphira mphuno)		Podding stage	No control
9	Pod borer (bongololo)	1	Podding stage	No control in the field but is thrown when found during peeling fresh peas.
10	Weevil (kafutwefutwe)	2	Storage pest	Drying and applying Actellic dust
11	Mbuzi (goat)	2	From sprouting to harvesting	Kept under control

Participants: Mai Palapasa, Mai Chimombo, Mai Basikolo, Mai Misoya,
+ other 15 other women.

Figure A18. Matrix Ranking of Pigeonpea pests, Chiwinja village, Chiradzulu North EPA

No.	Name	Rank	Stage of Attack	Control Method
1	Aphids (nsabwe1)	5	Podding stage to maturity	No control
2	Scale insects (nsabwe2)	8	Podding stage to maturity	No control
3	Anoplocnemis curvipes	7	Flowering stage	No control
4	Wilting (kunyala)	4	From sprouting to maturity	Some plant seed on the side of the ridge.
5	Elegant grasshopper (nunkhadala)	1	From sprouting to vegetative	Some eat as relish
6	Blister beetle (kazozwe)	9	Flowering sprouting	No control
7	Termite (chiswe)	2	From sprouting to harvesting	No control
8	Whitegrub (mphusi zoyera)	6	From sprouting to vegetative	No control
9	Clavigralla (angogoni)	3	From podding to maturity	No control
10	Black spots (kuda masamba)	10	From podding to maturity	No control

Participants: Malita Sapuwa, Emile Muchera, Bitilesi Chilewani, Lucy Magilini, Isaac Chilimkhonde.

Figure A19. Matrix ranking of weeds, Magomero section, Chaoni village, Matapwata EPA

No.	Name	Locality	Fast-Growing Weed (1-10)	Frequency (1-10)	Edible Weeds
1	Commelina africana	mmunda/ dambo	Commelina africana	Commelina africana	Cleome monophylla
2	Argemone mexicana	mmunda/ dambo	Galinsoga parviflora	Cynodon dactylon	Galinsoga parviflora
3	Imperata cylindrica	mmunda	Panicum maximum	Eleusine indica	Biden pilosa
4	Ocinum basilicum	mmunda	Cissampelos mucronata	Acanthospermu m hispindum	
5	Cleome monophylla	mmunda	Cynodon dactylon	Cissampelos mucronata	
6	Nicandra physalodes	mmunda/ dambo	Cyperus Sp.	Cyperus sp.	
7	Targetes minuta	mmunda/ dambo	Acanthospermu m hispindum	Striaga asiatic	
8	Cissampelos mucronata	mmunda	Biden pilosa	Trichodesma zeylanicum	
9	Cyperus sp.	mmunda/ dambo	Eleusine indica	Argemone mexicana	
10	Trichodesma zeylanicum	mmunda	Striaga asiatic	Biden pilosa	
11	Cynodon dactylon	mmunda/ dambo			
12	Galinsoga parviflora	mmunda/ dambo			
13	Biden pilosa	mmunda/ dambo			
14	Acanthospermu m hispindum	mmunda/ dambo			
15	Ageratum conyzoides	mmunda			
16	Striaga asiatic	mmunda/ dambo			
17	Eleusine indica	mmunda			
18	Panicum maximum	mmunda/ dambo			
19	Vernonia poskeana	mmunda			

Participants: Mr. Speak, Mr. F. Mazinga, Mr. Kandeya, + 5 other men.

Figure A20. Matrix ranking of Weeds, Chiwinja village, Chiradzulu North

No.	Name	Locality	Dambo weed ranking	Upland weed ranking	Stages of attack
1	Leersia hexandra (Likakazi)	dambo and upland	1	10	throughout the season
2	Trichodesma zeylanicum (chilungumwamba)	dambo and upland		4	throughout the season and it's medicine to cure wounds.
3	Cynodon dactylon (kapinga)	upland	5	2	throughout the season
4	Panicum maximum (nsothe)	dambo and upland	4	7	throughout the season
5	Imperata cylindrica (nasongole)	dambo and upland		6	throughout the season
6	Biden pilosa (chisoso)	dambo and upland	6	9	throughout the season
7	Ocinum canum (mpungabwe)	dambo and upland			throughout the season and it's medicine to cure headache.
8	Acanthospermum hispindum (seselesa)	dambo and upland		3	throughout the season
9	Galinsoga parviflora (mamuna aligone)	dambo and upland			throughout the season and it's edible
10	Argemone mexicana (Lilaka la ng'ombe 1 and 2)	dambo and upland			throughout the season
11	Sigesbeckia orientalis	upland			throughout the season
12	Eleusine indica (chingombe)	dambo and upland	7	8	throughout the season
13	Striga asiatic (kamfiti)	upland		1	throughout the season
14	Kochokocho	dambo and upland			throughout the season
15	Ndolora	upland			throughout the season
16	Vernonia poskeana	dambo and upland			throughout the season
17	Chamanga	dambo	3		throughout the season and it's thorny
18	Namacheka	dambo	2		throughout the season and it's thorny
19	Corchorus olitorius (denje)	dambo and upland			throughout the season and it's edible
20	Cissampelos mucronata (chilambe)	dambo and upland		5	throughout the season
21	Cleome monophylla (Nsonyo)	dambo and upland	8	11	throughout the season

Participants: Miss. E. Muchera, Mai Nachuma, Malita Sapuwa, Mai Maduka + 9 other women

APPENDIX 2: LIST OF DIAGNOSTIC EXERCISES

1. Matapwata

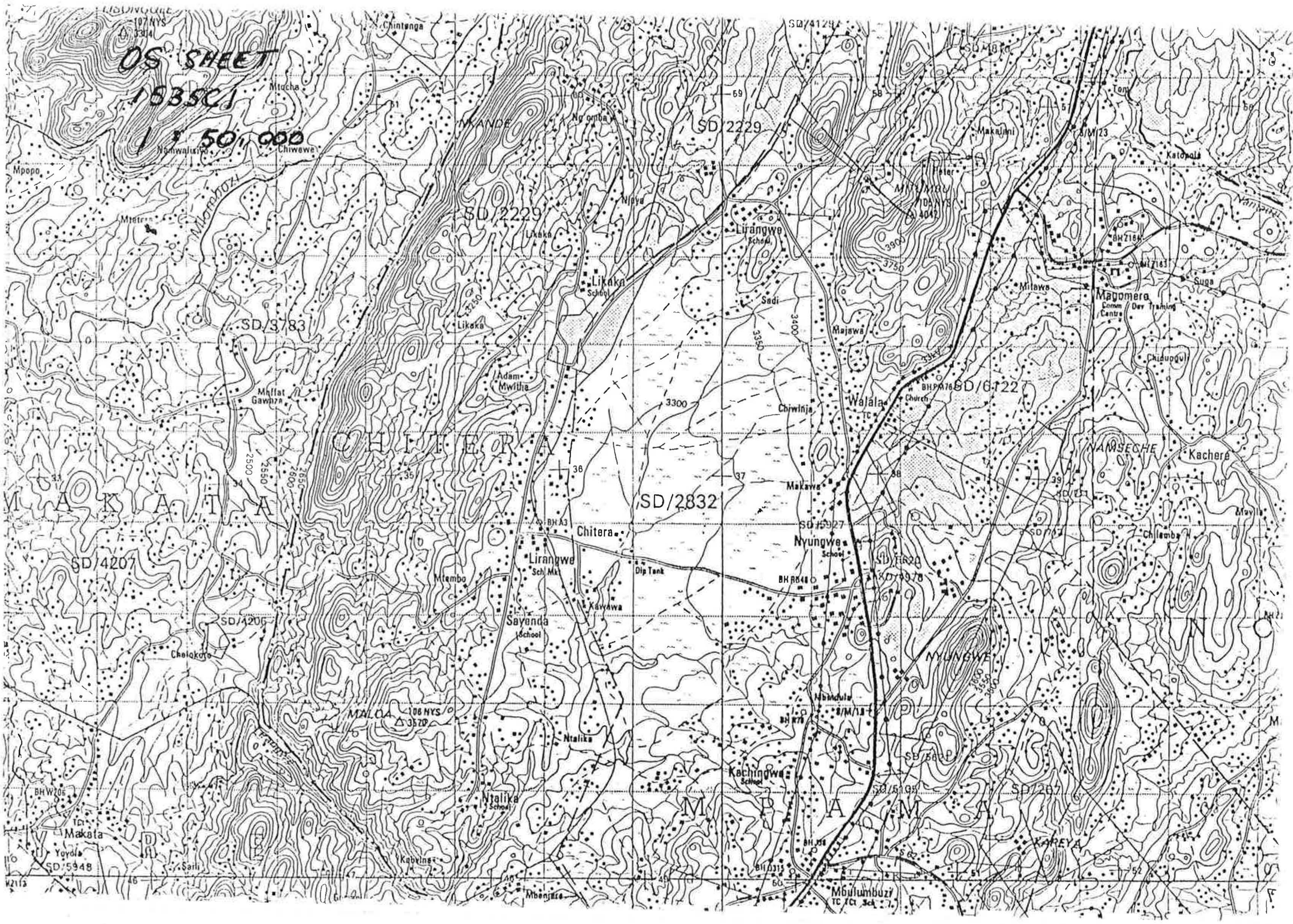
1. Timeline (3)
2. Seasonality chart (3)
3. Transect charts (3)
4. Village maps (3)
5. Maize pests (1)
6. Bean and pigeonpea pests (1)
7. Weeds (1)
8. Gender division of labour (1)
9. Ranking of crops (1)
10. Discussion of IPM interventions

2. Chiradzulu

1. Timeline (2)
2. Seasonality charts (2)
3. Transect charts (2)
4. Resource maps (1)
5. Village maps (2)
6. Maize pests (1)
7. Beans and pigeonpea pests (1)
8. Weeds (1)
9. Ranking of crops (1)
10. Gender division of labour (1)
11. Discussion of IPM interventions

APPENDIX 3: SCHEDULE OF FIELD VISITS FOR DIAGNOSTIC SURVEYS, 17 JUNE- 27 AUGUST, 1996.

Date	Month	Location	Activity
17	June	Matapwata	Village selection
4	July	Kambua	Village meeting
5	July	Chaoni	Village meeting
9	July	Kambua	Transect walk
10	July	Magomero section, Chaoni	Transect walk
15	July	Kajawo	Village meeting
17	July	Chaoni section, Chaoni	Transect walk
18	July	Waruna section, Chaoni	Transect walk
22	July	Kambua	Maize pests
25	July	Magomero	Weeds
29	July	Kambua	Crops ranking
31	July	Chiwinja	Village meeting
1	August	Lidala	Village meeting
6	August	Lidala	Transect walk
7	August	Chiwinja	Transect walk
14	August	Chiwinja	Maize pests
15	August	Chiwinja	Pigeonpea/bean pests
21	August	Chiwinja	Discussion of PMS
23	August	Chiwinja	Pests of beans
27	August	Kambua	Discussion of PMS
27	August	EPA HQ	Interview with T. M. Munthali, Bunda Bean Project



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Lirangwe School
Sadi
Majawa
Makalani
Peter
Katopola
Magomero
Comm Dev Training Centre
Suga
Milawa
SD/3783
Likaka
Adam Mwitha
Moffat Gawnza
3300
Chiwinja
Walala
Church
SD/6122
CHITERA
NAMSECHE
Kachere
M A K A T A
SD/2832
Makawa
Chitera
Nyungwe School
SD/4207
Lirangwe Sch Mkt
Dip Tank
Mtembo
Sayenda School
SD/1206
NYUNGWE
MALOA
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Ntalika
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Yoyola
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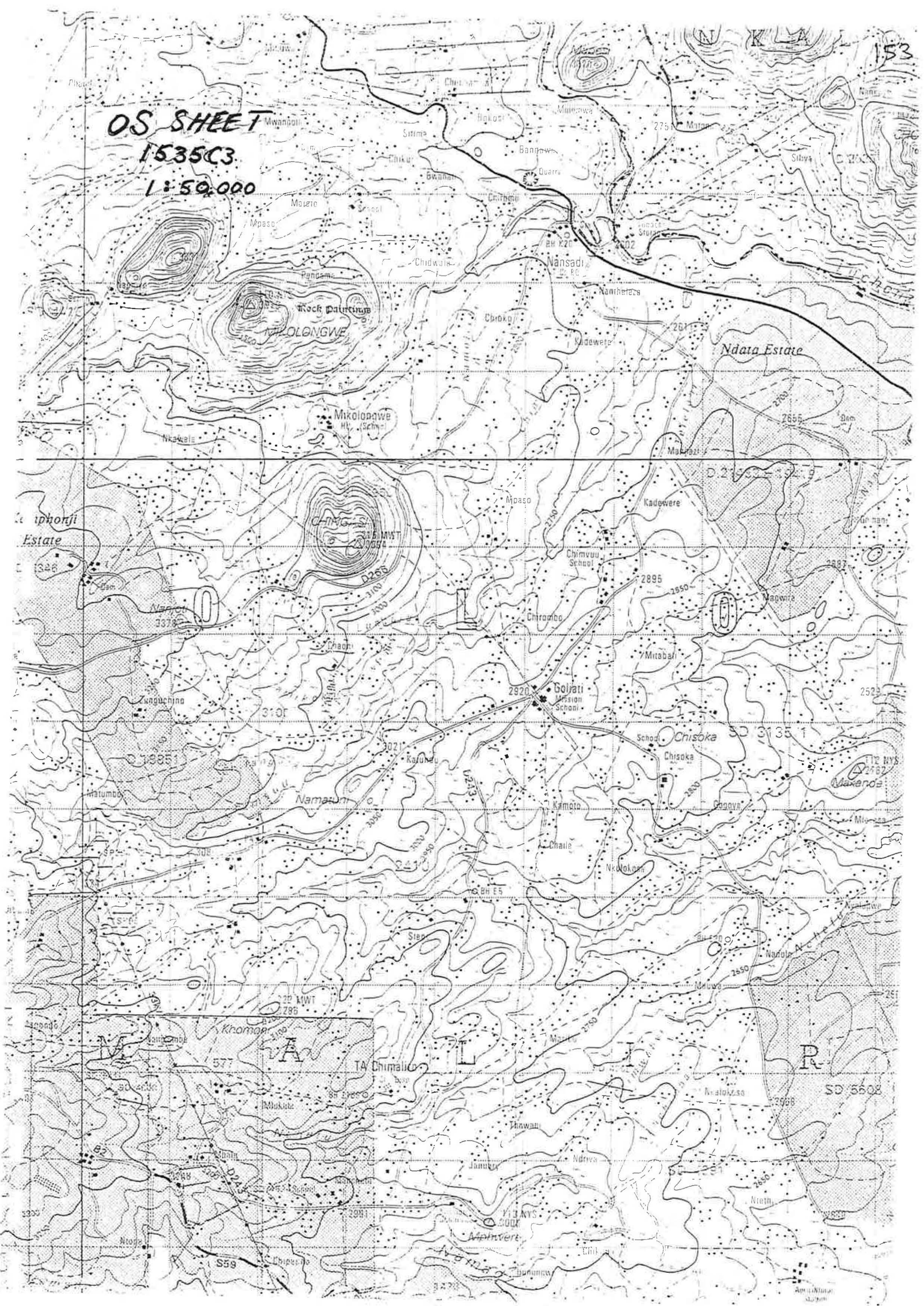
Mbulumbuzi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Kadewere
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CHINGALI
Chirombo
Mitabali
Goliati Mission School
Chisoka
Namatuni
Katundu
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Chaile
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Mduwa
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Bangwe
Chikuli
Chidwala
Pangame
Kadewere
Nankhoma
Mpaso
Chipeta
S59

154

FARMING SYSTEMS INTEGRATED PEST MANAGEMENT PROJECT

BACKGROUND INFORMATION ON BLANTYRE-SHIRE HIGHLANDS RURAL DEVELOPMENT PROJECT

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September 1996

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Abbreviations

AEZ	Agroecological zone
ASA	Annual Survey of Agriculture
DO	Development Officer
EPA	Extension Planning Area
FA	Field Assistant
FSIPM	Farming Systems Integrated Pest Management
FSR	Farming Systems Research
GTZ	German Technical Cooperation
IPM	Integrated Pest Management
NSSA	National Sample Survey of Agriculture

Executive summary

- This report contains background information on Blantyre Shire Highlands RDP, designated as the FSIPM Project area for the first two years of the Project.

- Total population in 1995 was over 1 million, with 0.23 persons/ha of customary arable land. Mean annual income in Blantyre ADD in 1992/93 averaged < 200 MK/adult equivalent/year. In 1992/93 half of smallholder households in Blantyre ADD lay below the poverty line (measured as the poorest 20 % of households in Malawi).

- The RDP had 30 agroclimatic zones characterised by a single rainy season of 4-5 months between November-March. Southern and hilly areas have the longest growing season (195-240 days).The RDP containd 6 major agroecological zones.

- Maize occupied 50-65 % of area planted followed by pulses (20-30 %) and cassava (10 %). Maize and pulses (chiefly pigeonpea and common beans) were the most common intercrop.

- 95 % of smallholder households cultivated holdings of 1 ha or less, with 74 % cultivating holdings of 0.5 ha or less.

- The 1992/93 NSSA showed no difference in average holding size between male- and female-headed households. Labour capacity and the value of off-farm income were lower among households headed by women, however.

- Farming systems are in rapid transition with shrinking farm size, reduced self-sufficiency in maize, and an increased proportion of income earned off farm. Holdings of 0.5 ha or less are self-sufficient in maize for only 5 months/year and earn half their income off-farm.

1. Blantyre-Shire Highlands RDP

The reasons for the choice of Blantyre-Shire Highlands RDP as the project area for Year 1 are stated in the FSIPM Project Document as:

"... (1) Bvumbwe Research Station lies in this RDP, facilitating access; (2) roughly 10% of the Malawian smallholder population live in the RDP; (3) about 75 % of smallholders in this RDP have holdings under 1 ha; (4) the Soil Pests Project has already collected data in this RDP; (5) the FAO/UNDP Land Resources Evaluation Project has collected land resource data... " (FSIPM Document, p. 7).

Overview

Blantyre-Shire Highlands RDP, one of four RDPs in Blantyre ADD, has a land area of 449,400 ha and is located between latitudes 15 degrees 12' and 16 degrees 25' South, and longitudes 34 degrees 21' and 35 degrees 51'. Figure 1.1 shows the location of the RDP within Blantyre ADD.

Smallholder population

Farm families in the RDP numbered 257,800 in 1995/96, and total arable customary land 139,168 ha, giving an average holding size of 0.54 ha. Population in the RDP in 1995 was estimated at 1,115,956 giving a population density of 0.40 ha/person of land area and 0. 23 ha/person of customary arable land. Estates (tea, coffee, and macadamia) occupy approximately 41,286 ha, or 23 percent of the total gross arable area.

Smallholder poverty

Poverty is widespread. Blantyre ADD contains 25 percent of total smallholder households in Malawi. Thirty-one percent of smallholder households in the ADD belong to the poorest 40 percent of Malawian smallholder households. Forty-nine percent belong to the poorest 20 percent. Mean annual household income among smallholders is the lowest among all ADDs, averaging below 200 MK per adult equivalent per year. Thus, the RDP contains one of the highest proportions of poor smallholders in Malawi.

RDP structure

Blantyre Shire Highlands RDP covers the 3 administrative districts of Blantyre, Chiradzulu, and Thyolo, and 41 TAs. It is divided into 7 DAs. Although a total of 22 EPAs have been demarcated, only 7 EPAs are operational. Each DA functions, therefore, as an EPA. Infrastructure in the EPAs was developed by the ADB, which funded the RDP between 1985-89. Figure 1.2 shows the location of the EPAs within the RDP.

Extension coverage

The FSIPM Project has close links with DAET, and collaborates with frontline extension agents in Blantyre Shire Highlands RDP in the design and development of IPM pest management strategies. Extension coverage within the RDP is uneven, however. Of 7 EPAs, only 2 (Blantyre South and Matapwata) currently have their full complement of Field Assistants (Table 1.3). Coverage is thinnest in Thyolo South EPA where there is only 1 FA for each 3,000 farm households.

Socio-economic indicators

Detailed socio-economic indicators for the 7 EPAs in the RDP are presented in Table 1.4. A national comparison is then made by ranking selected indicators for each EPA in terms of the 154 EPAs in Malawi (Table 1.5). All 7 EPAs belong to the most densely populated 20 percent of EPAs in Malawi. In terms of area planted to cash-crops, 6 EPAs are well above the national average, with the exception of Blantyre North. Area planted to drought-resistant crops is also above the national average in 4 of 7 EPAs. Health indicators suggest that, compared to EPAs elsewhere in Malawi, in 5 EPAs children under 5 are more likely to be malnourished; in 3 EPAs they are more likely to have malaria; and in 2 EPAs they are more likely to have diarrhoea.

Snapshots of EPAs

- Blantyre North is situated in the north-west of the RDP. The EPA centre is at Lirangwe. It is relatively dry, with a shorter growing season. All-year cultivation is practised in dimbas on the Shire River bordering the EPA. Groundnuts are more widely grown than elsewhere in the RDP, but beans are not. Population density is lower than average. The EPA is considered drought-prone and given priority in drought-relief programmes, including public distribution of hybrid maize seed.

- Blantyre South is located in the centre of the RDP. The EPA centre is at Ntonda. The EPA includes the peri-urban area around Blantyre City. Rainfall is higher and the growing season longer than in Blantyre North. The EPA includes the Chikwawa Escarpment, and is reguarly exposed to pest incursions from cotton-growing areas in the Lower Shire Valley.

- Chiradzulu North is situated in the north of the RDP. The EPA centre is at Chiradzulu. It has a notably rugged topography, with most of the EPA covered by the Blantyre-Thondwe Highlands. Population density in 1987 averaged 290 persons/sq km of land area, the highest of any EPA in Malawi. The area has traditionally been a source of migrant labour. Chiradzulu North was selected for on-farm trials by the Adaptive Research team at BLADD between 1985-90. Pest problems on maize caused serious yield loss in the Lirangwe Dambo during the 1995/96 season.

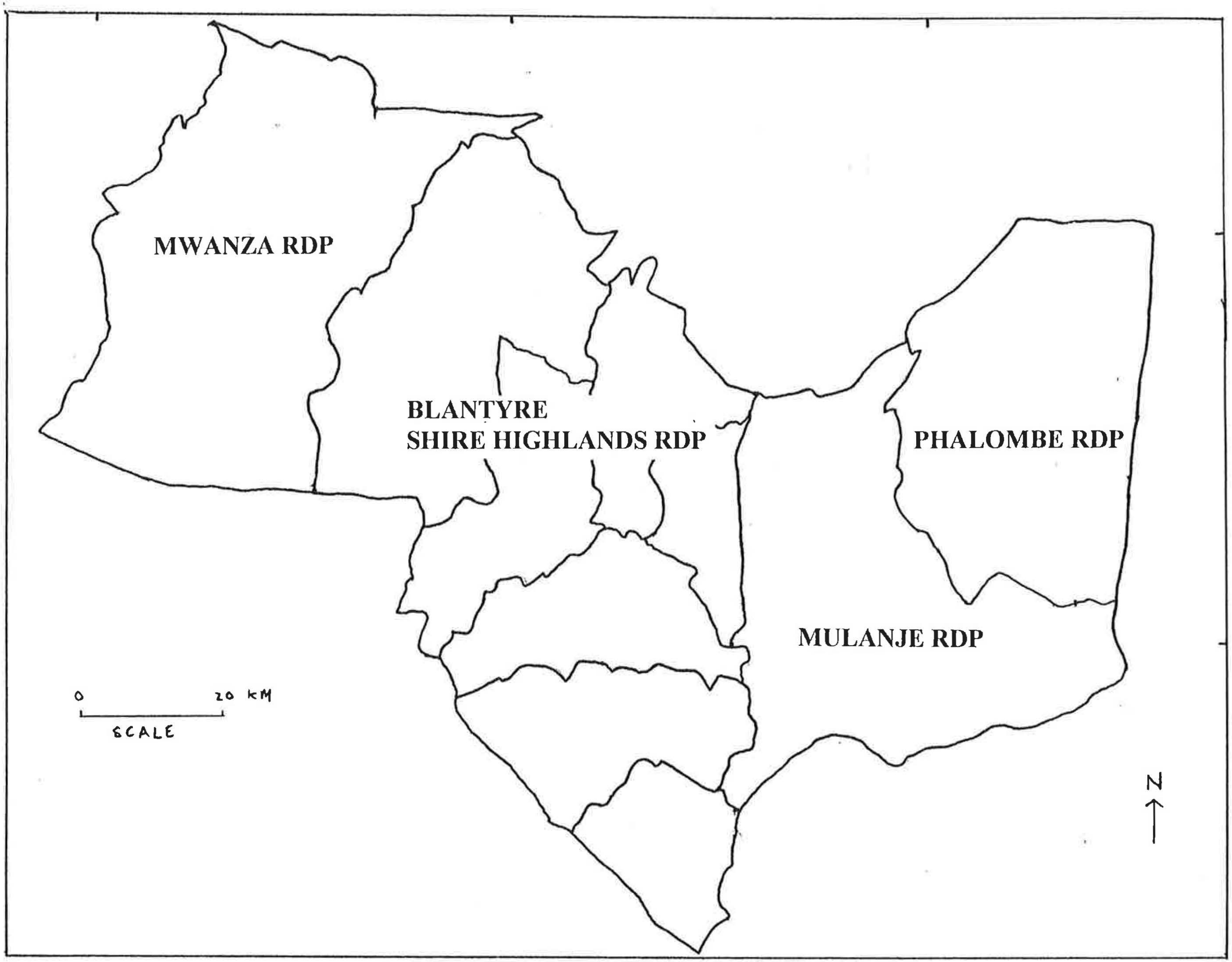
- Chiradzulu South is located in the north-eastern part of the RDP, with the EPA centre at Namitambo. The EPA includes part of the Phalombe Plain Uplands where rainfall is lower and the growing season shorter than average. Sorghum is widely grown, and sunflower is grown as a cash crop. Population density is lower than average. Chiradzulu South was selected as the site of on-farm trials by the Adaptive Research Team at BLADD between 1985-1990.

- Matapwata is situated in the centre of the RDP, with the EPA centre at Matapwata.. Population density in 1987 averaged 285 persons/sq. km of land area, the second highest of any EPA in Malawi. The EPA is notable for a longer rainy season and growing season which allow a large area planted to pulses. Winter beans are widely grown, relay sown before the maize harvest. The presence of several large estates means that the EPA is well served with roads and private traders are active, both in selling seed and purchasing crops. Farmers are commercially aware, evidenced by recent increases in the area planted to velvet beans, chickpeas, and grams, which are purchased by private traders for export markets.

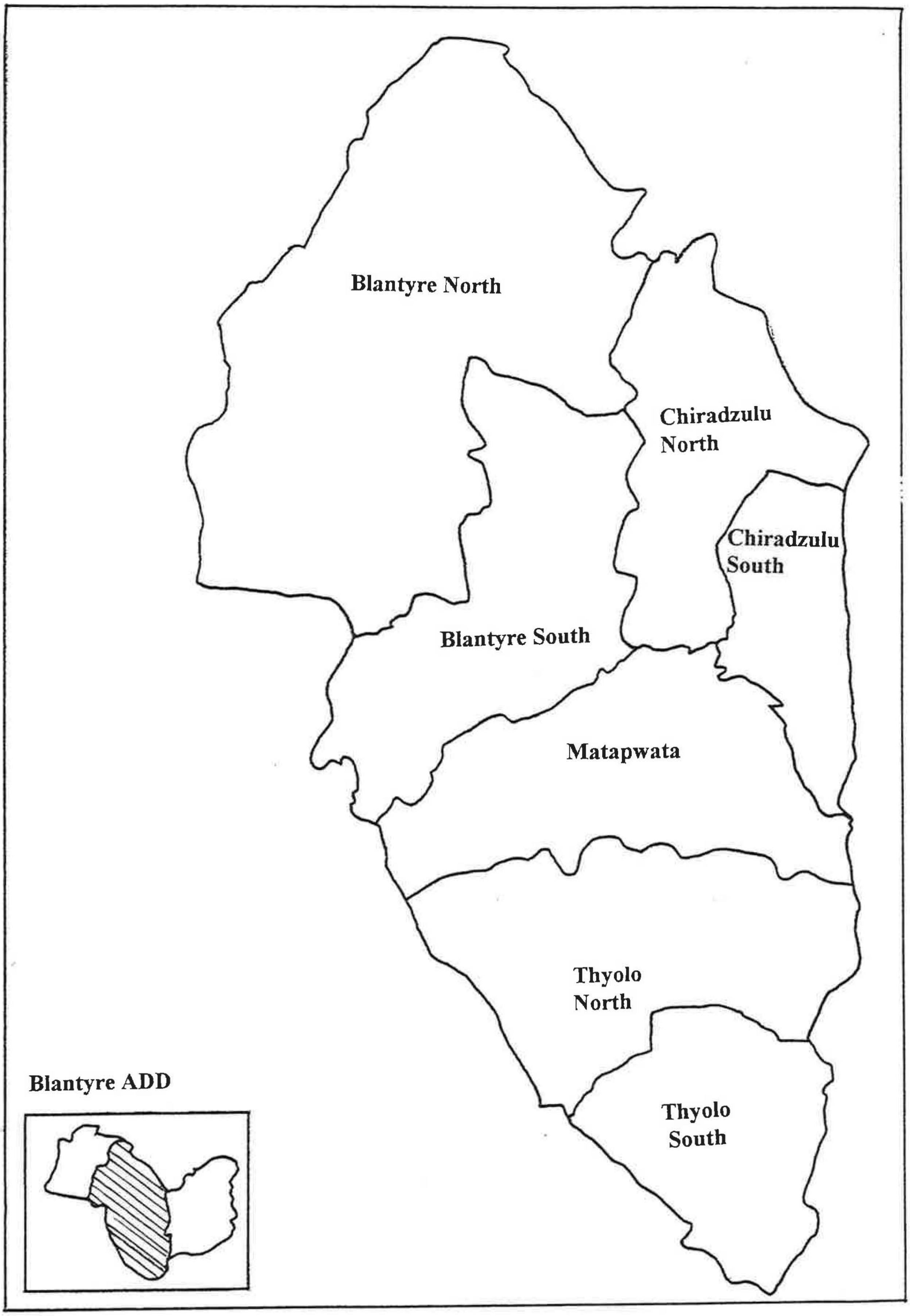
- Thyolo North EPA is situated in the south of the RDP. The EPA centre is at Thyolo Boma. Tea and coffee estates cover about half the land area. Rainfall is higher and the growing season longer than average. Cropping patterns in the west are similar to Matapwata but in the east the climate is drier and sorghum is grown.

- Thyolo South EPA is situated in the south of the RDP. The EPA headquarters is at Masambanjati. The EPA includes the Thyolo Escarpment, with steeply dissected hills and high soil erosion. Land conservation measures (contour ridges, hedgerows, agro-forestry) are promoted in three pilot villages near Thekerani in cooperation with the EU-funded PAPPA Project. Bananas are an important cash crop for smallholders, and cassava is widely grown on steeper slopes. Access to Masambanjati is by dirt road, and extremely difficult in the wet season.

... RDP Boundaries in Blantyre ADD.



1.2 EPA boundaries in Blantyre-Shire Highlands RDP.



1.3 Extension coverage in Blantyre-Shire Highlands RDP, by EPA.

INDICATOR	Blantyre North	Blantyre South	Cz. North	Cz. South	Mata-pwata	Thyolo North	Thyolo South
Farm Households (1995/96)	35,310	39,250	35,320	20,930	34,050	45,470	47,370
Sections	28	25	20	18	14	24	25
Field Assistants (FAs)	21	25	14	17	14	20	14
Farm households /FA	1681	1570	2523	1231	2432	2274	3384
Maize clubs (1995/96	22	na.	39	43	10	46	47

Source: EPA headquarters, Blantyre-Shire Highlands RDP

1.4 Socio-economic indicators for Blantyre Shire Highlands RDP.

INDICATOR	Blantyre North	Blantyre South	Cz. North	Cz. South	Mata-pwata	Thyolo South	Thyolo North
Area (km2)	1200	800	465	292	386	556	714
Population (1987)	157917	115051	134855	74606	109882	133145	178953
Pop. density (persons/km2)	132	144	290	256	285	239	251
Literacy (%)	40.49	38.57	42.18	36.96	39.14	32.32	33.96
Female literacy (%)	32.10	34.80	34.76	29.75	29.97	23.26	24.17
No education (%)	40.79	38.57	39.68	44.96	42.68	48.56	46.26
Secondary education (%)	3.22	3.23	2.68	1.94	2.16	1.41	1.75
Piped water (%)	21.22	7.55	4.98	8.33	8.58	2.88	8.59
Bore hole (%)	13.79	10.09	12.66	16.28	9.47	5.15	11.78
Well (%)	39.69	60.72	59.71	37.35	72.86	79.34	69.96
No water (%)	26.29	21.62	22.62	38.01	9.03	12.45	8.80
Persons per unit	7470	2518	6956	7004	10270	8661	3193
Persons per bed	568	153	2068	2221	3059	535	829
Wasted (%)	17.42	20.16	27.02	13.17	18.65	22.55	17.37
Not growing (%)	17.77	16.48	20.50	17.47	14.13	20.92	17.03
Immunisation (%)	9.67	52.84	7.88	7.30	8.50	27.24	44.32
At risk pregnancies (%)	0.42	4.22	1.14	0.19	0.05	0.60	0.38
Malaria <5s (%)	41.30	42.70	39.60	37.20	44.40	45.50	49.00
Diarrhoea <5s (%)	5.50	8.00	8.50	10.80	9.60	7.00	7.90
Malnutrition <5s (%)	7.20	4.80	1.50	4.10	1.70	4.40	3.60

Source: FEWS.

1.5 National ranking of selected of socio-economic indicators, by EPA, Blantyre Shire Highlands RDP.

INDICATOR	Blantyre North	Blantyre South	Cz. North	Cz. South	Mata-pwata	Thyolo North	Thyolo South
Population (1987)	5 **	8 **	6 **	14 **	10 **	2 **	7 **
Pop. density (1987)	42 *	32 *	1 *	5 *	2 *	6 *	8 *
Total literacy (1987)	124	129	128	111	120	94	78
Female literacy (1987)	126	134	133	116	119	82	78
Drought resistant crops (1994)	71	26 **	78	124	95	99	103
Cash crops (1994)	46 *	132	129	125	121	118	113
Malnutrition <5s (1992)	9 **	28 **	125	38 *	118	50 *	32 *
Malaria < 5s (1992)	84	74	96	57 *	65	33 *	50 *
Diarrhoea <5s (1992)	126	68	117	22 **	35 *	70	96

Note: Rank is the placement of the EPA out of 154 EPAs in Malawi, where '1' ALWAYS represents a maximum, or the 'worst case scenario'.

** bottom 20 th percentile
* bottom 40 th percentile

Source: FEWS.

2. Agro-Ecological Zones in Blantyre-Shire Highlands RDP.

Data

Information on Agro-Ecological Zones (AEZs) in Blantyre-Shire Highlands RDP was obtained from the Land Resources Evaluation conducted by the Government of Malawi and the Food and Agriculture Organisation of the United Nations (1991).

Natural regions, topography

Blantyre ADD covers an area of 10,231 square km, and consists of 7 **natural regions.** Four of these regions are found in the RDP: the Upper Shire Valley, the Middle Shire Valley, the Shire Highlands, and the Thuchila Plain.

Topography in the Shire Highlands RDP consists of undulating and rolling upland plains (600-1200 m asl), rugged dissected escarpment zones (200-1000 m asl), and nearly flat upland plains (650-800m asl) [Figure 2.1]. The Shire Highlands form a narrow ridge-like feature linking the mountains of Chiradzulu, Michiru, Ndirande, Soche, and Bangwe, which rise above what is in fact a fairly wide plateau. The western escarpment of the Shire Highlands falls steeply to the Middle Shire Valley, which forms the floor of the African Rift Valley; the eastern escarpment tilts gently towards the alluvial Thuchila Plain. The Shire River forms the boundary of the RDP in the north, west, and south-west; the Ruo (a tributary of the Shire) forms part of the boundary in the south-east.

Soils

Soils in Blantyre ADD are variable and classed into 60 Soil Units. Soils in the Shire-Highlands are usually very deep, well drained, medium textured and relatively high in nutrients. The Thyolo Highlands have very deep, well drained reddish brown to red fine textured soils which are strongly leached and low in nutrients. Reaction is acid to slightly acid in most soils, but in strongly leached soils in the Thyolo Highlands very strongly acid reaction is common.

Agro-climatic Zones

Blantyre ADD has 60 **agro-climatic zones** (defined in terms of 8 climatic variables), of which 30 are found in the RDP (Figure 2.2). Generally, the RDP has a warm tropical climate with one continuous rainy season of 4-5 months between November-March. Mean annual rainfall largely depends on topography. Annual rainfall increases from north to south, varying from under 700 mm in the Middle Shire Valley to 1200 mm in the Thyolo Highlands. This transition is shown in Figure 2.3, which compares average monthly rainfall in 4 EPAs (Blantyre North, Chiradzulu North, Blantyre South, and Chiradzulu South. In turn, mean annual rainfall largely determines the length of the growing period, which varies from 135-165 days in lower areas, rising to 195-240 days in the Thyolo Highlands.

Agro-Ecological Zones

Blantyre ADD has been divided into 23 **Agro-Ecological Zones**, defined according to **topography, soils,** and **two agro-climatic variables** (length of growing period, and mean temperature in the last month of the growing period).

Blantyre-Shire Highlands RDP contains 11 AEZs. These are listed in Table 2.4, and shown on Figure 2.5. Of these, 3 AEZs (Upper Shire Valley, Thuchila Plain, and Lower Ruo Valley) each occupy under 5 percent of the land area in the RDP, while 2 others (Middle Shire Valley, Chikwawa Escarpment) are considered unsuitable for agriculture. For research purposes, therefore, the RDP has 6 major AEZs. These AEZs and some key characteristics (topography, soils, altitude, rainfall, growing period, major crops) are listed in Table 2.6.

AEZs by Extension Planning Area (EPA)

The area distribution of the 6 major AEZs for each EPA is shown in Figure 2.7.

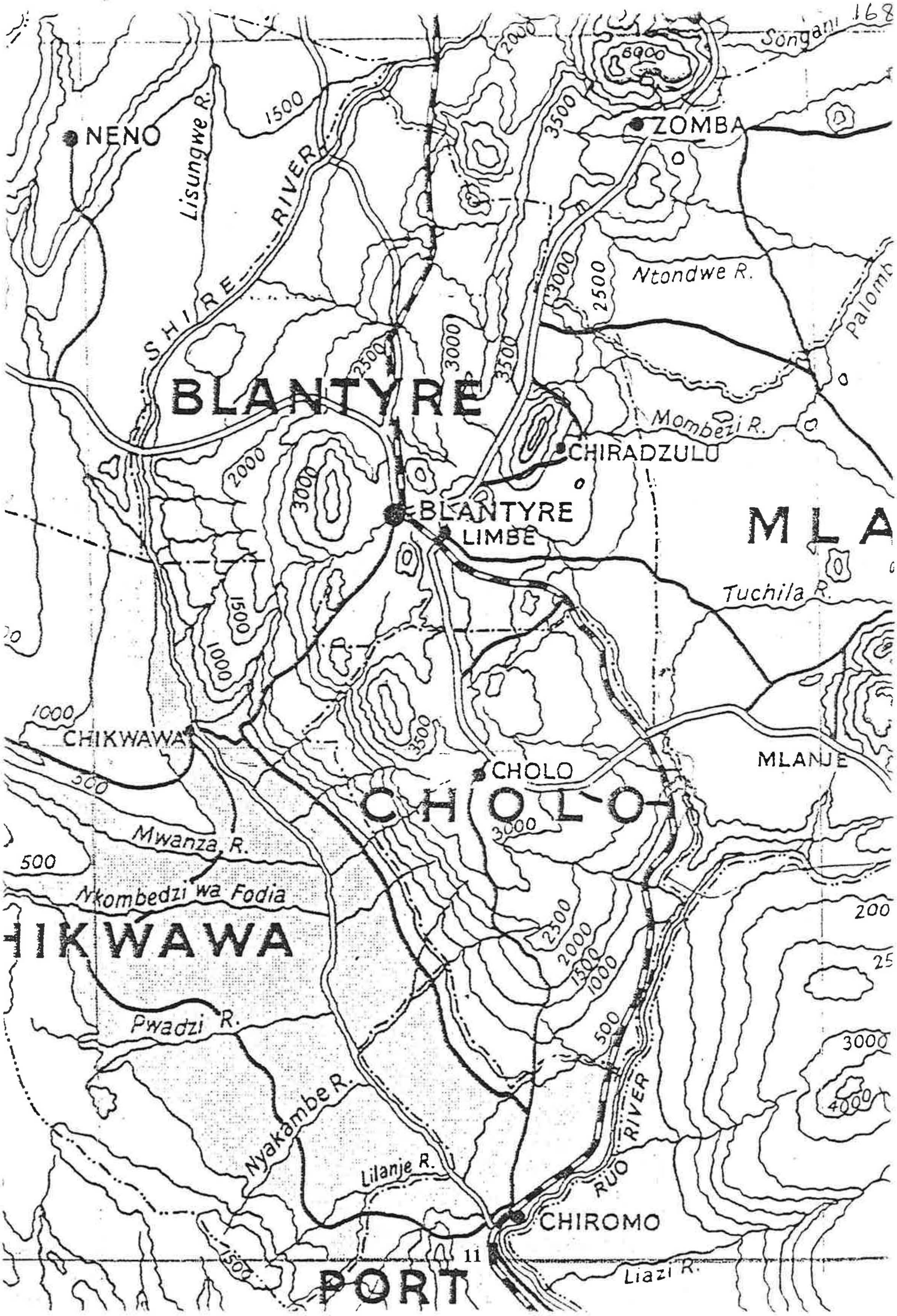
- **Blantyre North** and **Chiradzulu South** both fall largely within AEZs with lower mean annual rainfall (135-165 mm) and a shorter growing season (135-165 days).

- **Chiradzulu North** falls largely within the Blantyre-Thondwe Highlands (annual rainfall 900-1200 mm, 165-195 days' growing season).

- A large portion of **Matapwata** falls in the Limbe-Bvumbwe Highlands, with slightly higher rainfall (1000-1200) and longer growing season (195-225 days).

- **Thyolo North** falls largely within the Thyolo Highlands, with the highest rainfall in the RDP (1200-1500 mm) and the longest growing season (195-240 days).

- **Thyolo South** consists largely of the Thyolo Escarpment, with reasonable rainfall (900-1300 mm) and growing season (165-225 days) but with poor soils and steeply dissected hills.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ZOMBA
Songani
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Lisungwe R.
1500
2000
3500
SHIRE RIVER
Ntondwe R.
3000
2500
Palomba
BLANTYRE
Mombezi R.
CHIRADZULU
BLANTYRE
LIMBE
MLA
Tuchila R.
1500
1000
1000
CHIKWAWA
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3500
CHOLO
MLANJE
CHOLO
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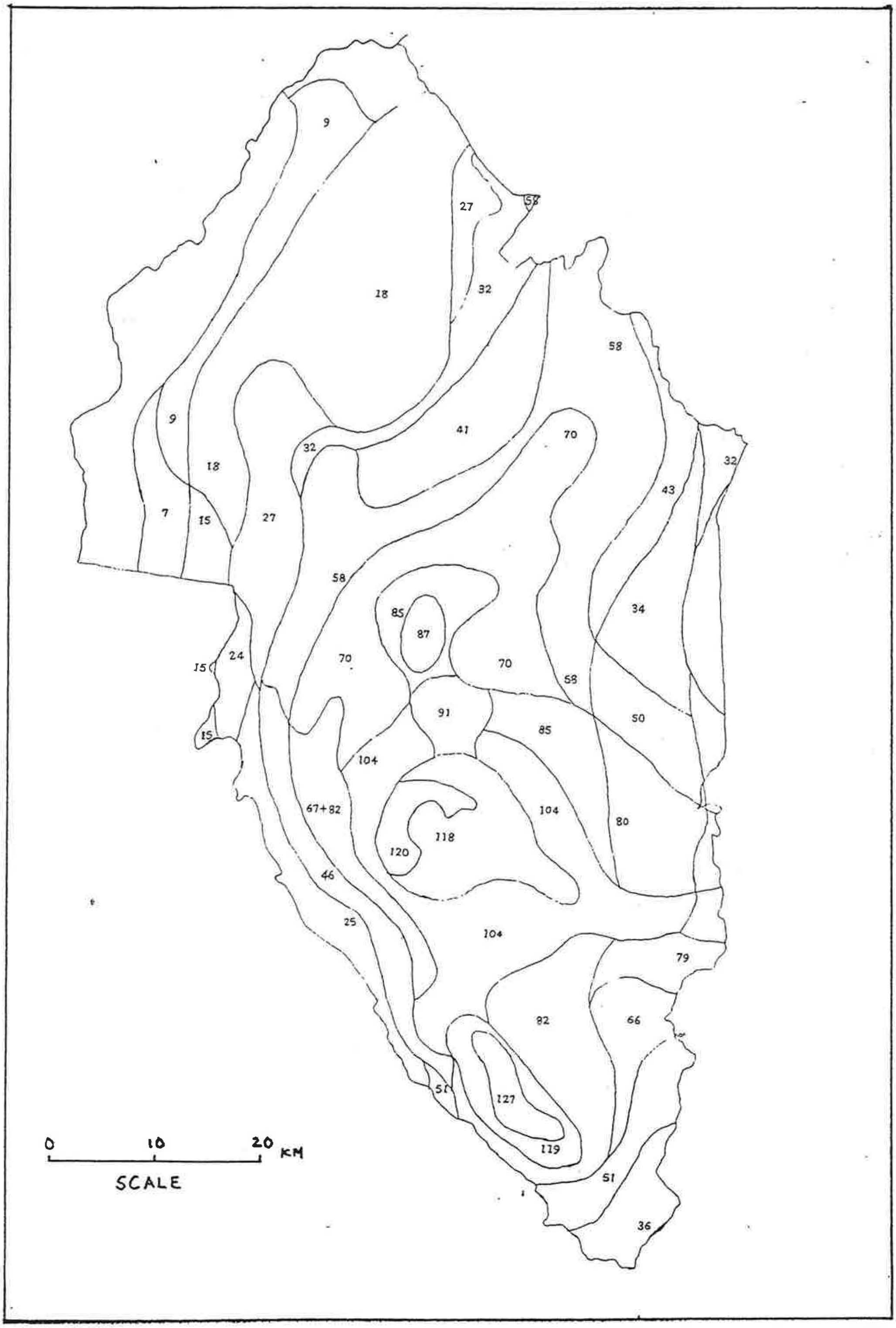
Mwanza R.
500
Nkombedzi wa Fodia
HIKWAWA
2500
2000
1500
1000
200
25
Pwadzi R.
500
3000
4000
RUO RIVER
Nyakambe R.
Lilanje R.
CHIROMO
PORT
Liazi R.

169

2.2 Agro-climatic zones of Blantyre Shire Highlands RDP.



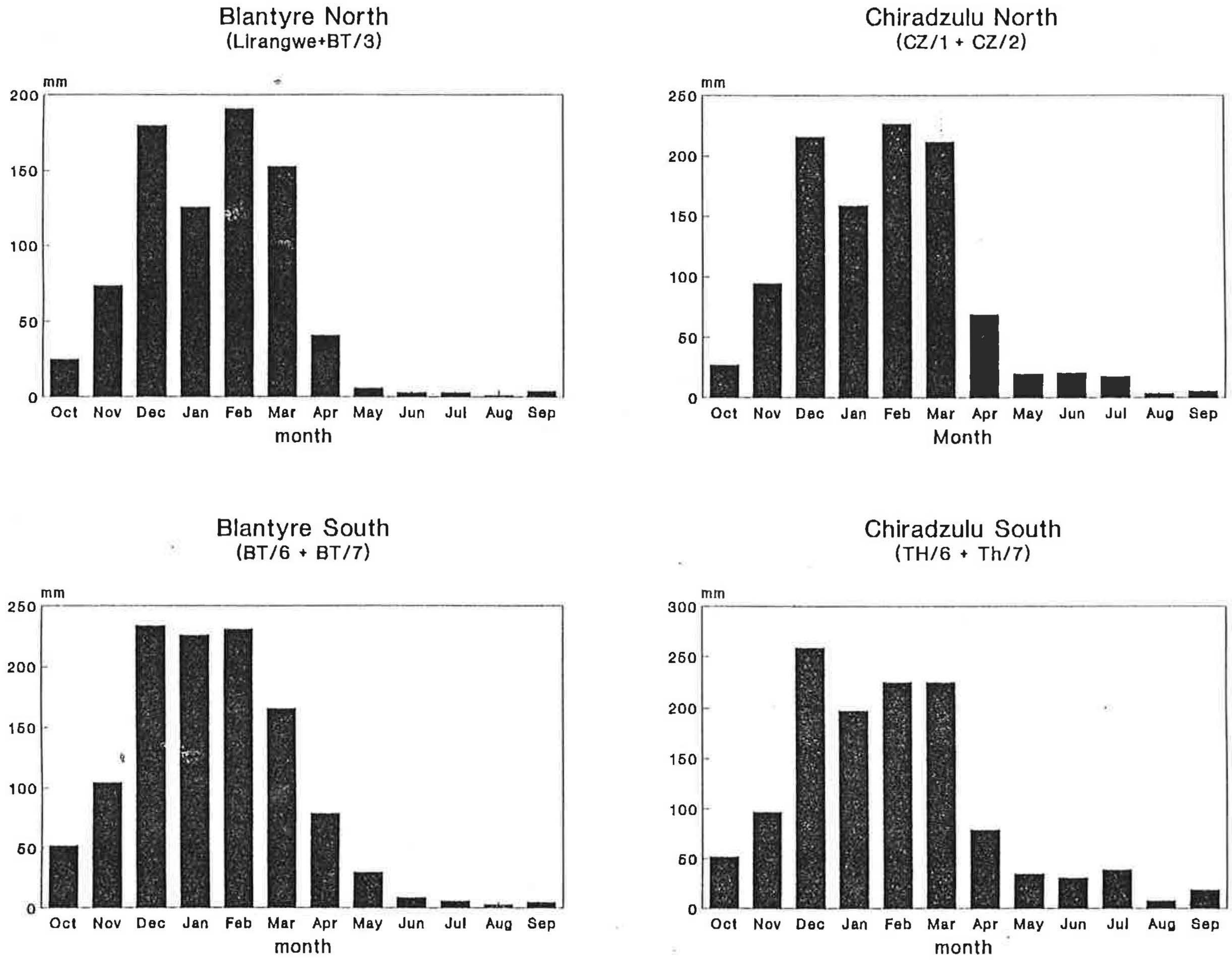
2.2 Agro-climatic zones in Blantyre-Shire Highlands RDP (cont)

Key

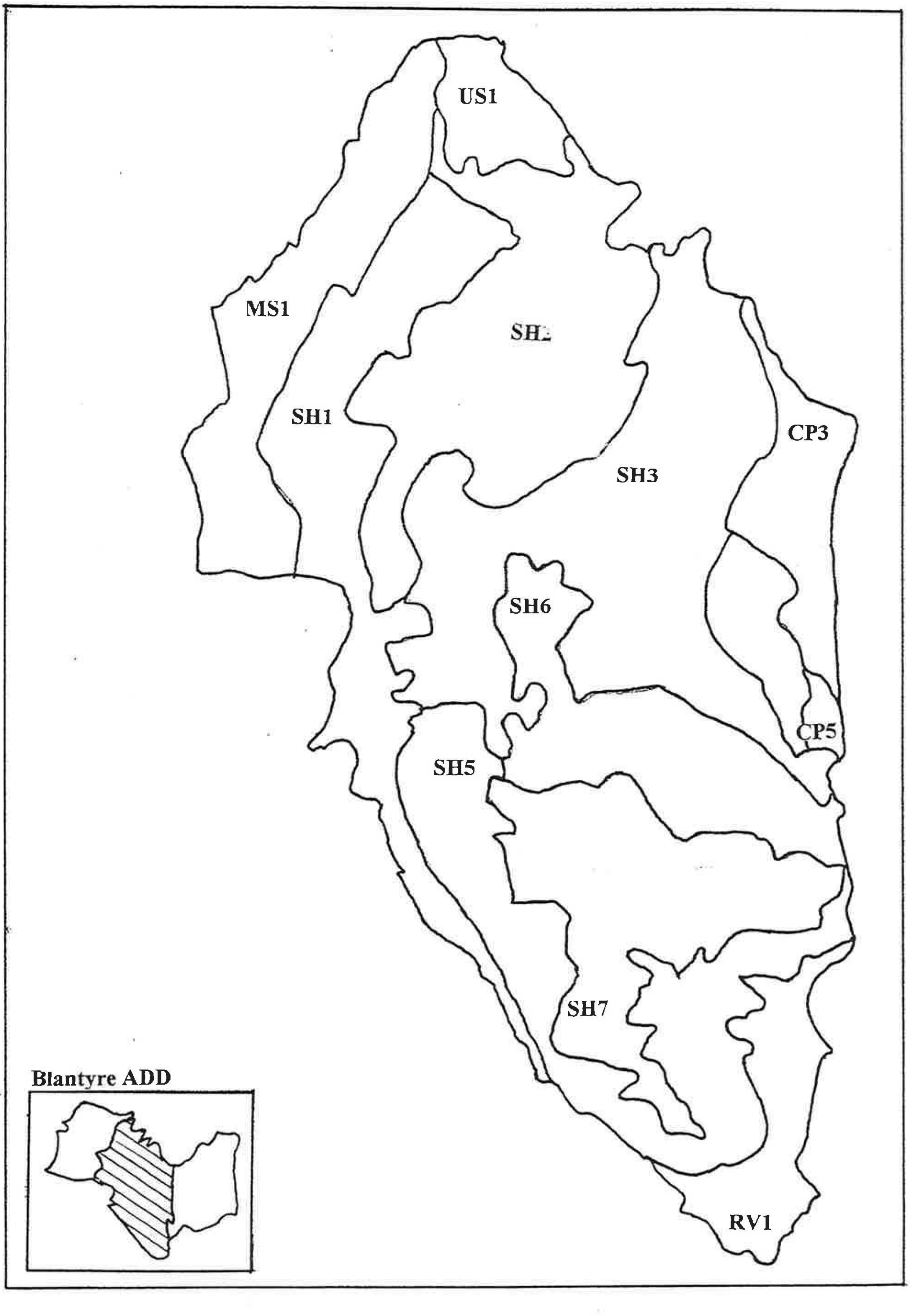
No.	LGP (days)	P/PET	T-GP	P-an (mm)	DM (months)	T-an (C)	T-min (C)
2	105-120	0.8-1.0	25.0-27.5	600-800	7-8	22.5-25.0	12.5-15.0
9	120-135	1.0-1.3	22.5-25.0	600-800	7-8	22.5-25.0	12.5-15.0
15	135-150	“	25.0-27.5	800-1200	7-8	22.5-25.0	12.5-15.0
17	“	“	22.5-25.0	600-800	“	“	“
18	“	“	“	800-1200	“	“	“
19	“	“	“	“	“	20.0-22.5	10.0-12.5
24	150-165	“	25.0-27.5	800-1200	7-8	“	12.5-15.0
25	“	“	“	“	5-6	“	“
27	“	“	22.5-25.0	“	7-8	20-22.5	“
32	“	“	20.0-22.5	“	“	“	“
34	“	“	“	“	5-6	“	10.0-12.5
36	“	>1.3	25.0-27.5	800-1200	“	22.5-25.0	12.5-15.0
41	“	“	20.0-22.5	“	7-8	20-0-22.5	“
43	“	“	“	“	5-6	“	“
46	165-180	1.0-1.3	25.0-27.5	800-1200	5-6	22.5-25.0	12.5-15.0
50	“	“	20.0-22.5	“	“	20.0-22.5	10.0-12.5
51	“	> 1.3	25.9-27.5	“	“	22.5-25.0	12.5-15.0
58	“	“	20.0-22.5	“	“	20.0-22.5	10.0-12.5
66	180-195	1.0-1.3	22.5-25.0	800-1200	5-6	22.5-22.0	12.5-15.0
67	“	“	“	1200-1600	“	20.0-22.5	“
70	“	“	20.0-22.5	800-1200	“	“	10.0-12.5
79	195-210	1.0-1.3	22.5-25.0	800-1200	5-6	20.0-22.5	12.5-15.0
80	“	“	20.0-22.5	“	“	“	10.0-12.5
82	“	>1.3	22.5-25.0	1200-1600	“	“	12.5-15.0
85	“	“	20.0-22.5	800-1200	“	“	10.0-12.5
87	“	“	“	1200-1600	“	“	“
91	“	“	17.5-20.0	800-1200	“	17.5-20.0	“
99	210-225	>1.3	22.5-25.0	1200-1600	5-6	22.5-25.0	12.5-15.0
104	“	“	20.0-22.5	“	“	20.0-22.5	“
118	225-240	> 1.3	20.0-22.5	1200-1600	5-6	20.0-22.5	10.0-12.5
119	“	“	“	“	3-4	“	“
120	“	“	17.5-20.0	“	5-6	17.5-20.0	“
127	240-270	> 1.3	20.0-22.5	1200-1600	1-2	20.0-22.5	10.0-12.5

LGP = Length of growing period (days);
P/PET = Ratio of precipitation and potential evapotranspiration;
T-GP = Mean temperature (in Celsius) during the LGP;
P-an = Mean annual precipitation (mm);
DM = Mean number of dry months per year, ie. months with < 50 mm precipitation;
T-an = Mean annual temperature (in Celsius); and
T-min = Mean minimum temperature (in Celsius) of the coolest month (July).

2.3 Average monthly rainfall in four EPAs, Blantyre Shire Highlands RDP.



2.4 Agro-Ecological Zones in Blantyre Shire Highlands RDP.



2.5 Area of agro-ecological zones in Blantyre Shire Highlands RDP, by EPA.

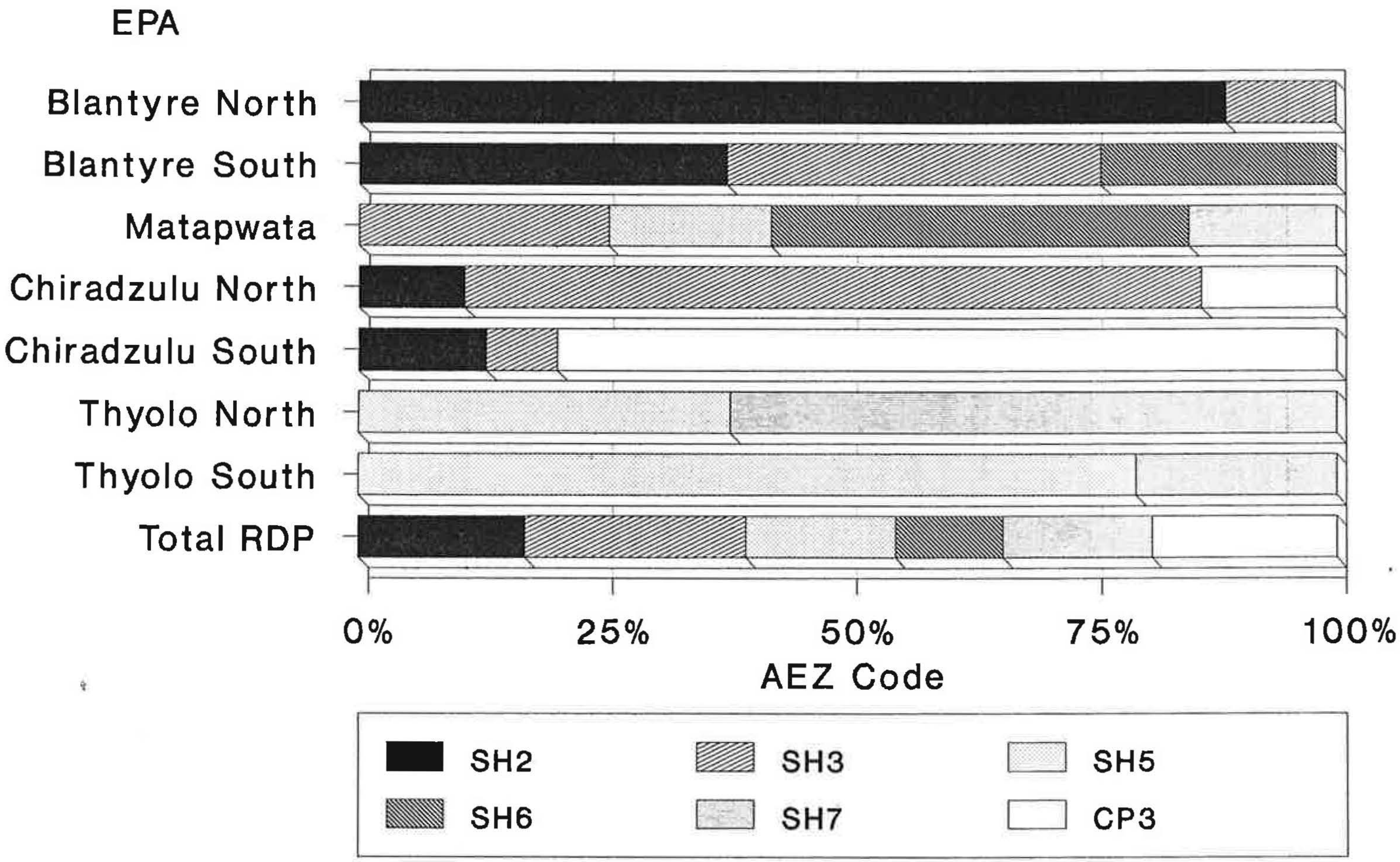
No.	AEZ Code	AEZ Name	Approximate area (000 ha)	Area (percent)
1	MS1	Middle Shire Valley	74.8	15.1
2	US1	Upper Shire Valley	9.0	1.8
3	SH1	Chikwawa Escarpment	51.7	10.4
4	SH2	Chileka & Mikolongwe Uplands	58.0	11.7
5	SH3	Blantyre-Thondwe Highlands	76.6	16.3
6	SH5	Thyolo Escarpment & Nswadzi Valley	52.0	10.5
7	SH6	Limbe-Bvumbwe Highlands	37.3	7.5
8	SH7	Thyolo Highlands	51.5	10.4
9	CP3	Phalombe Plain Uplands	63.5	12.9
10	CP5	Thuchila Plain	2.9	0.6
11	RV1	Lower Ruo Valley	18.5	3.7
Total			495.8	100.0

2.6. Major agro-ecological zones in Blantyre-Shire Highlands RDP.

AEZ Code	AEZ Name	Altitude (m asl)	Topography	Altitude (m asl)	Soils	Mean annual rainfall (mm)	Growing period (days)	Major crops
SH2	Chileka & Mikolongwe Uplands	500-1000	Nearly flat, rolling	500-1000	Deep, well drained, medium textured	800-1100	135-165	Maize, i/c cassava, groundnuts
SH3	Blantyre-Thondwe Highlands	700-1200	Undulating to rolling	700-1200	Deep, well drained, fine & medium textured	900-1200	165-195	Maize, i/c pulses, groundnuts, cassava
SH5	Thyolo Escarpment & Nswadzi Valley	200-1000	Hilly, steeply dissected	200-1000	Deep or shallow, depending on erosion	900-1300	165-225	Maize i/c cassava, groundnuts
SH6	Limbe-Bvumbwe Highlands	700-1100	Undulating to rolling	700-1100	Very deep, well drained, fine textured, strongly leached	1000-1200	195-225	Maize, i/c pulses, vegetables, groundnuts, cassava
SH7	Thyolo Highlands	600-1200	Rolling to hilly	600-1200	Very deep, well drained, fine textured, strongly leached	1200-1500	195-240	North: tea estates South: cassava, banana, maize
CP3	Phalombe Plain Uplands	650-800	Nearly flat, gently undulating	650-800	Deep, well drained on higher ground	800-1000	135-165	Maize, i/c cotton, rice, cassava

Note: Omitting AEZs which each occupy under 5 percent of land area in the RDP (P5: Thuchila Plain; US1: Upper Shire Valley; RV1: Lower Ruo Valley), the Chikwawa Escarpment (SH1), and Middle Shire Valley (MS1).

2.7 Major agro-ecological zones by Extension Planning Area



Source: LREP (1991).

3. Foodcrops in Blantyre Shire Highlands RDP

The FSIPM Project Document states that:

"... the major focus of the IPM research will be on maize-based cropping systems because maize (pure stand and intercropped) is planted on 80 % of the smallholder cropped area in BLADD. Other prime candidates for attention are sorghum and millet, pulses (principally beans, cowpeas and pigeonpeas) and roots and tubers (mainly cassava and sweet potato, which account for 20 % and 7 % of cropped area, respectively" (FSIPM Document, p. 7).

Data

Statistics on area, production, and yield of foodcrops grown in the RDP were obtained from the National Crop Estimates, collated by Famine Early Warning System (FEWS). The FEWS data does not provide a breakdown of the different crops grown under 'pulses'. Statistics on the area under different pulses in each EPA in 1995/96 were collected from EPA headquarters. In addition, statistics on the proportion of crops intercropped were obtained from the National Sample Survey of Agriculture (NSSA), 1980/81 and 1992/93, and the Annual Survey of Agriculture (ASA) for 1982/83, 1983/84, and 1987/88.

Area planted to foodcrops in Blantyre-Shire Highlands RDP

- **Maize**

Figure 3.1 shows relatively little variation in the area planted to **maize,** which varied from 50 % in Blantyre North to 65 % in Thyolo South. The proportion of maize area planted to **hybrid varieties** was highest in Blantyre South, and lower in Matapwata and Chiradzulu North.

- **Millet and sorghum**

Separate statistics on the area planted to **millet** are not available. Field visits suggested that millet was grown primarily for brewing local beer, not as a cereal for nsima. Scattered plantings were common in fields near homesteads. **Sorghum** was grown in all EPAs but was a minor cereal with the exception of Chiradzulu South, where it was grown on the Phalombe Plain (Figure 3.1).

- **Pulses**

In terms of area planted, pulses were the major foodcrop after maize in all EPAs except for Chiradzulu South, where sorghum was more popular Soybean was not common (Figure 3.2). Winter beans (relay sown in February) were grown in Matapwata but were not common elsewhere.

The major pulses crops were **pigeonpeas, beans, and cowpeas** (Figure 3.3). Pigeonpeas was the most important pulse in all EPAs. The relative area planted to summer beans was highest in Chiradzulu North and Matapwata, reflecting higher rainfall and (perhaps) better access to markets for both bean seed (brought by private traders from Dedza) and for sale to private traders from Blantyre and Limbe.

- **Roots and tubers**

Cassava was grown in all EPAs but occupied a higher proportion of the area planted to non-maize foodcrops in Chiradzulu North and Thyolo South (Figure 3.2). Sweet Potatoes (widely grown in 1995/96 because of an extended wet season) occupied a similar proportion of area planted to non-maize food crops across all EPAs (Figure 3.2).

Trends in foodcrop areas

Figure 3.4 shows trends in area planted to 7 foodcrops for a 12-year period for Blantyre-Shire Highlands RDP. The area planted to local maize shows a slow decline, while the area planted to hybrid maize shows has increased, particularly from 1989/90. Among drought-resistant crops, sorghum has become more widely planted but the area planted to cassava shows no discernible trend. Both the area planted to sweet potatoes and to pulses seems to have grown in recent years.

Intercropping in Blantyre ADD

Table 3.5 shows census data on the major intercrops in Blantyre ADD bwetween 1980/81 and 1992/93. Caution is required interpreting the data since definitions of pure and mixed stands may not have been consistent between years. Table 3.5 suggests that the proportion of maize planted in mixed stands has decreased over the period. This is difficult to explain since the proportion of maize planted to hybrid varieties remained below 5 percent between 1980-87. Promotion of intercropping to control pests/diseases of maize may conflict with current DAR recommendations to grow hybrid maize varieties in pure stands.

Classifying intercrops by farmer purpose

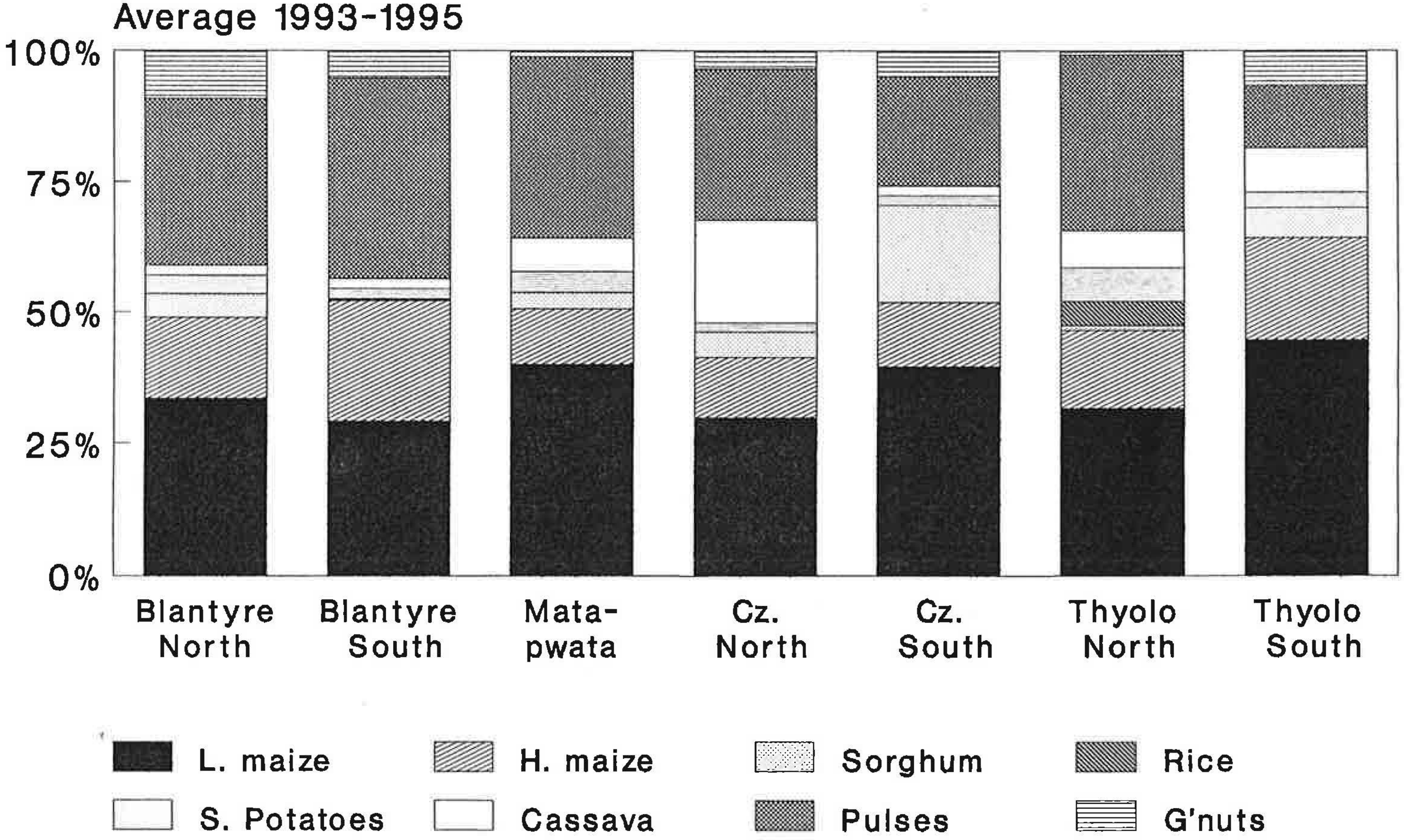
Intercrops in Malawi can be classified by purpose of planting into nsima-nsima mixtures, nsima-ndiwo mixtures, cash-ndiwo mixture etc. (Hansen, 1981). Figure 3.6 shows the crop calendar for the most important crops and intercrops in the RDP.

- Nsima-ndiwo mixtures (maize-pulses) were the most common intercropping pattern, accounting for roughly one-third of the total area planted to crop mixtures. These two elements form the basic diet. Low plant densities for ndiwo crops have encouraged researchers to try denser planting and different varieties. However, denser intercropping may change the ndiwo crop from a consumption to a cash crop. Thus, it is important to determine either that there is sufficient home storage for the extra production, or sufficient market demand if the crop is to be sold.

- Second in importance were nsima-nsima mixtures (maize-cassava, maize-sorghum), occupying 15-20 percent of the total. Nsima-nsima mixtures occur as a response to drought-stress and land pressure. Drought-tolerant crops such as cassava and sorghum are insurance against maize failure.

- Finally, nsima-cash mixtures (maize-groundnuts) occupied roughly 15 percent of the area planted to maize mixtures, although their share has declined since 1987. Other nsima-cash mixtures in the Blantyre-Shire Highlands RDP include maize or sorghum-sunflower, maize-grams, and maize-chickpeas.

3.1 Area under foodcrops
by EPA



Source: FEWS/Crop Estimates.

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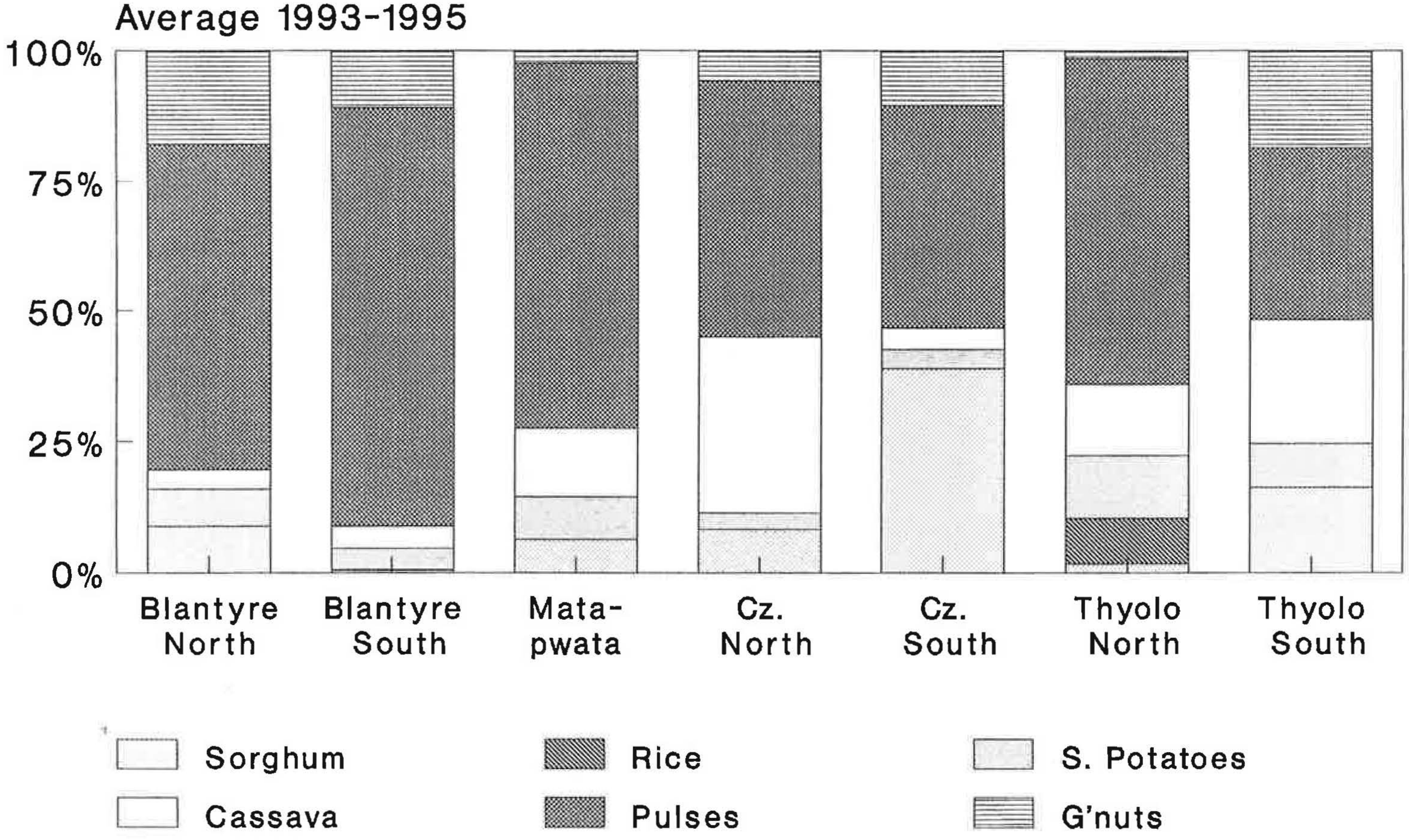
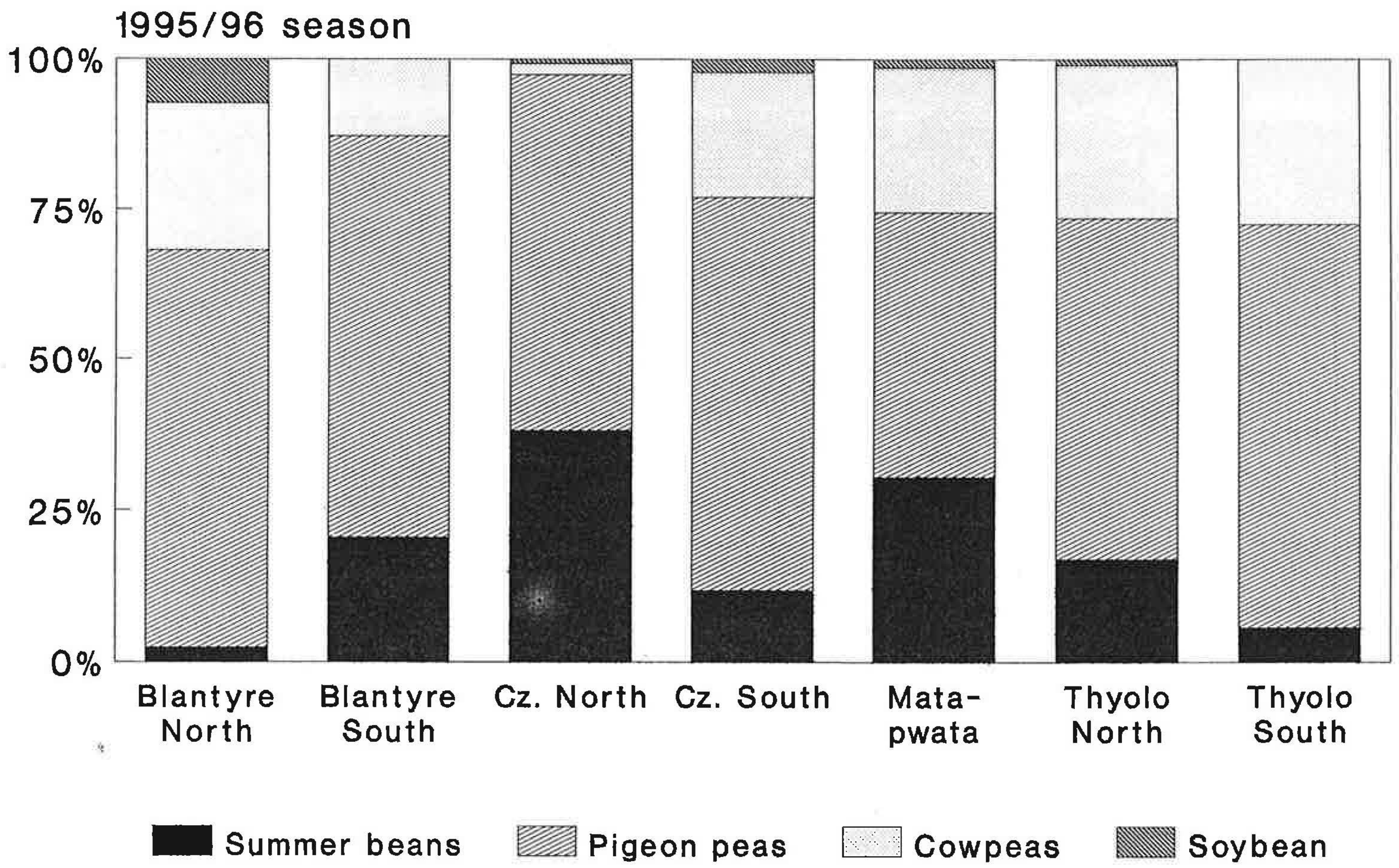
3.2 Area under non-maize foodcrops
by EPA



Source: FEWS/Crop Estimates.

3.3 Pulses in Bt.-Sh. Highlands RDP by EPA



Source: 2nd Crop Estimates (1995/96).

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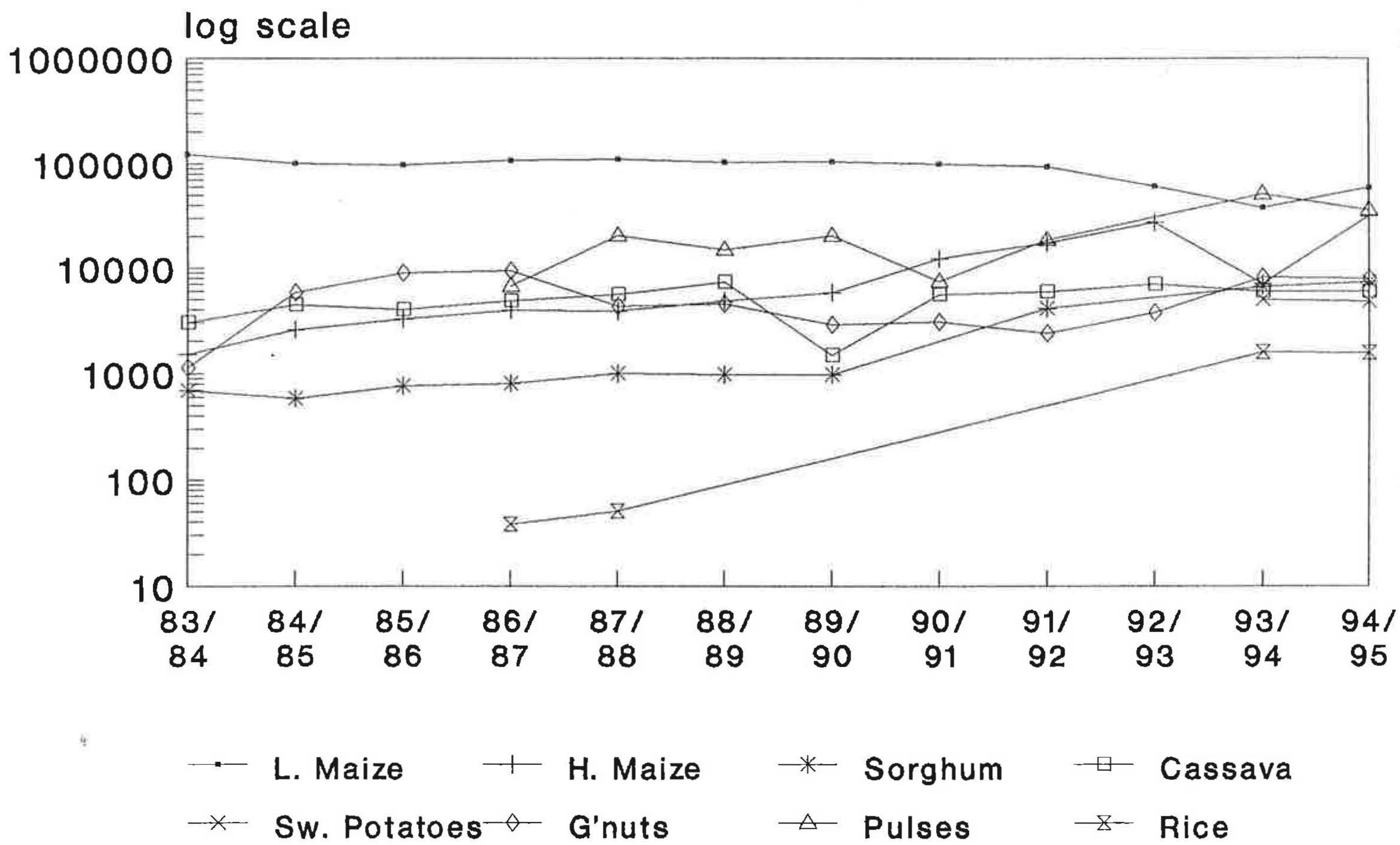
3.4 Trends in Foodcrop area
Blantyre-Shire Highlands RDP



Source: FEWS/Crop Estimates

Table 3.5 Intercropping in Blantyre ADD, 1980-81 - 1992/93

Crop	1980-81	1982/83-1983/84	1987/88	1992/93
Maize: (%)				
- pure-stand	49	49	67	76
- mixed stand	51	51	43	25
Maize mixtures: (%)				
- groundnuts	10	7	18	6
- pulses	27	30	59	34
- cassava	3	{15	10	na.
- millet/sorghum	11		13	9
other				18
Total	100	100	100	100
Other crops: (% mixed stands)				
- groundnuts	48	49	96	87
- pulses	81	81	97	52
- cassava	75	75	62	na.

Sources: NSSA, 1980/81, ASA, 1982/83, 1983/84, 1987/88, NSSA, 1992/93.

3.6 Crop Calendar for Blantyre-Shire Highlands RDP.

Crop	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Maize	<==	===	===	===	===	===	===	===	==>			
Sorghum	<==	===	===	===	===	===	===	===	===	==>		
Cassava		<==	===	===	===	===	===	===	==>			
Beans (relay)					<==	===	===	===	==>			
Beans (intercrop)	<==	===	===	==>								
Chickpeas					<==	===	===	===	===	==>		
Cowpeas	<==	===	===	===	===	===	==>					
Pigeonpeas	<==	===	===	===	===	===	===	===	===	===	==>	
Sw. Potatoes			<==	===	===	===	===	===	==>			
Groundnuts		<==	===	===	===	===	===	===	==>			

Sources: J. D. Ndengu and W. T. Kawonga (1984); Blantyre Shire Highlands RDP.

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Smallholder households in Blantyre Shire Highlands RDP.

The FSIPM Project Memorandum states that the Project will develop:

" ... IPM strategies demonstrated by on-farm research to be attractive to farmers with holdings under 1 ha... Care will be taken to avoid producing a privileged group of participants and, as far as possible, to ensure that more than 50 % are female" (Project Memorandum, Logical Framework, and p. 3).

Data

Information on the distribution of holdings in Blantyre ADD was obtained from the 1980/81 NSSA, the ASAs for 1983/84 and 1984/85, and the NSSA for 1992/93. Comparative data on male and female-headed households was obtained from the 1986/87 ASA, for which a computer print-out is available in the Evaluation Section, Blantyre ADD.

Farm size distribution

The first agricultural census in Malawi in 1968/69 found that 40 percent of holdings in Blantyre ADD were under 0.7 ha. The 1980/81 NSSA found that 74 percent of holdings were under 1 ha. By 1992/93, the proportion of holding under 1 ha had risen to 95 percent. Of these, 74 percent were under 0.5 ha (Figure 4.1). Holding size distribution was very similar for both male- and female-headed households, with slightly more female-headed households operating less than 1 hectare.

Smallholder poverty

Small average holding size is the most important reason for the high incidence of poverty among smallholder households in Blantyre ADD. Although the ADD contains only 25 percent of smallholder households in Malawi, 31 percent of total smallholder households belong to the poorest 40 percent of Malawian smallholder households, and 49 percent belong to the poorest 20 percent.

Smallholder food security

Small average holding size has important implications for household food security. Among households in Blantyre ADD which belong to the poorest 40 percent of the population, the share of household maize requirements which can be met from own production is 44 percent, or roughly 5 months/year. Among households which belong to the poorest 20 percent of the population, the corresponding share is 28 percent, or just 3 months/year.

Gender

Thirty-two percent of smallholder households in the southern region of Malawi in 1992/93 were headed by women. On average, female-headed households have smaller holdings, have less available household labour or access to hybrid seed or fertiliser than male-headed households. Consequently, they are poorer. Of the poorest 40 percent of households in the southern region, 59 percent are headed by women and only 32 percent by men.

Agriculture and gender in Blantyre ADD

Gender-blind IPM pest management strategies ignore important differences between male and female-headed households. Information on farm households disaggregated by sex of household head is available from the 1987/88 ASA and the 1992/93 NSSA.

Examples of such differences which are relevant for the design and development of IPM pest management strategies include:

- According to the 1987/88 ASA, a disproportionate number of small farm households are headed by women. About 4 in 10 households among the target group of smallholders with 1 ha or less were female-headed, whereas households headed by women made up only 3 in 10 of total households (Table 4.3). The 1992/93 NNSA data show no marked difference in holding size distribution by sex of household head, however (Table 4.2).

- Household labour capacity, and household labour available for agriculture, was lower among households headed by women (Table 4.3). This reflected smaller average household size. Moreover, women face more demands on their labour for childcare, cooking, and fetching fuelwood and water. Female-headed households will find it difficult, therefore, to accept IPM strategies which increase labour requirements.

- Total income among female-headed households was one-third lower than for households headed by men (Table 4.3). This suggests that female-headed households may be more risk-averse than their male counterparts.

- Off-farm income among female-headed households was only 40 percent that of households headed by men (Table 4.3). Female-headed households were much less likely to find paid employment in agriculture or non-agriculture activities. This suggests that female-headed households may find attractive IPM pest management strategies which include intercrops that can be sold, and increase cash income.

- Male and female-headed households had similar cropping patterns (table 4.3 and 4.4), but a lower proportion of maize planted to hybrid seed (Table 4.4). But households headed by women had lower average maize yields, particularly for unfertilised plots (Table 4.3). Female-headed households, therefore, may welcome IPM pest management strategies which improve the yield of unfertilised local maize.

The Agrarian Transition in Blantyre Shire Highlands RDP

Farming systems are not static but form a moving target. Changes in smallholder farming systems in Malawi are particularly marked in the Blantyre Shire Highlands, where population density is highest. In socio-economic terms, these changes are reflected in an agrarian transition whereby smallholder households, depending chiefly on income from their own agricultural production, are transformed into functionally landless households earning the bulk of their income off-farm. In 1987/88, holdings with 0.5 hectares or less had a maize provision ability (MPA) of only 5 months/year, and earned 47 percent of their income off-farm (Figure 4.5). In 1992/93, 75 percent of holdings in the RDP were below the 0.5 hectare threshold. This agrarian transition places important limitations on the design of IPM interventions, particularly where they require additional labour or reduce land available for foodcrop production.

4.1 Holding size distribution in Blantyre ADD, 1980/81 -1992/93.

(percent of households)

Holding Size (ha)	1980/81	1987/88	1992/93
< 0.5	34	46	74
0.5-0.99	37	36	21
1.0-2.0	23	16	4
2.0 >	6	2	1
Total	100	100	100

Sources: NSSA, 1980/81; ASA, 1987/88; NSSA, 1992/93.

4.2. Holding size distribution in Blantyre Shire Highlands RDP, 1992/93, by sex of household head.

(percent of households)

Holding Size (ha)	Female-headed	Male-Headed
< 0.5	75	74
0.5-0.99	21	20
1.0-2.0	3	5
2.0 >	1	1
Total	100	100

Source: NSSA, 1992/93.

4.3 Household indicators for holdings below 1 ha, Blantyre ADD, 1987/88, by sex of household head

Indicator	Female-Headed	Male-Headed	Difference (+ MHH)
Total holdings (%)	40.08	59.92	+ 19.84
Holdings under 1 ha (%)	42.47	57.53	+ 15.06
Mean holding size (ha)	0.43	0.48	+ 0.05
Mean household size (consumption units)	3.86	4.85	+ 0.99
Household labour capacity: (mandays/year)			
- male	222.05	439.40	+ 217.35
- female	256.21	240.79	- 15.42
- total	478.26	680.19	+ 201.93
Available labour for household agriculture: (mandays/year)			
- family	436.33	573.40	+ 137.07
- hired	11.57	17.42	+ 5.95
- total	447.90	590.82	+ 142.92
Household income: (Kwacha/year)			
- crops	143.25	180.38	+ 37.13
- livestock	41.46	60.13	+ 18.67
- off-farm	62.78	159.68	+ 96.9
-remittances	12.21	5.00	- 7.21
- total	259.70	405.19	+145.49
Off-farm employment: (mandays/year)			
- self employment	4.77	4.48	+ 0.29
- paid agriculture	22.56	59.65	+ 37.09
- paid other	14.62	43.19	+ 28.57
-total	41.95	106.31	+ 64.36
Off-farm employment: (Kwacha/year)			
- self employment	7.45	6.62	- 0.83
-paid agriculture	33.58	89.02	+ 55.44
-paid other	21.75	64.44	+ 42.69
-total	62.66	159.68	+ 97.02

4.3 Household indicators for holdings below 1 ha, Blantyre ADD, 1987/88, by sex of household head (cont).

Indicator	Female-Headed	Male-Headed	Difference (+ MHH)
Cropping pattern: (% area)			
maize	69.63	69.67	+ 0.04
groundnuts	6.70	5.32	- 1.38
pulses	19.19	21.00	+ 0.88
cassava	3.45	2.57	- 0.41
other crops	1.02	1.43	+ 0.42
total	100.00	100.00	
Input use:			
Maize: (% area)			
- local	98.63	97.62	- 1.01
- hybrid	1.37	2.38	+ 1.01
	100.00	100.00	
Maize area fertilised: (% area)			
- local	19.96	28.94	+ 8.98
- hybrid	80.00	93.02	+ 13.02
- total	20.65	30.47	+ 9.82
Maize yields (kg/ha)			
- fertilised	1882	1902	+ 20
- unfertilised	1040	1222	+ 182
- average	1263	1421	+ 158
Household calorific balance: (kilocalories)			
- requirements	3867.33	5117.41	+ 1250.08
- own production	2123.53	2559.02	+ 435.49
- percent	54.91	50.00	- 4.91

Source: Annual Survey of Agriculture, 1987/88, computer printout in Evaluation Section, BLADD.

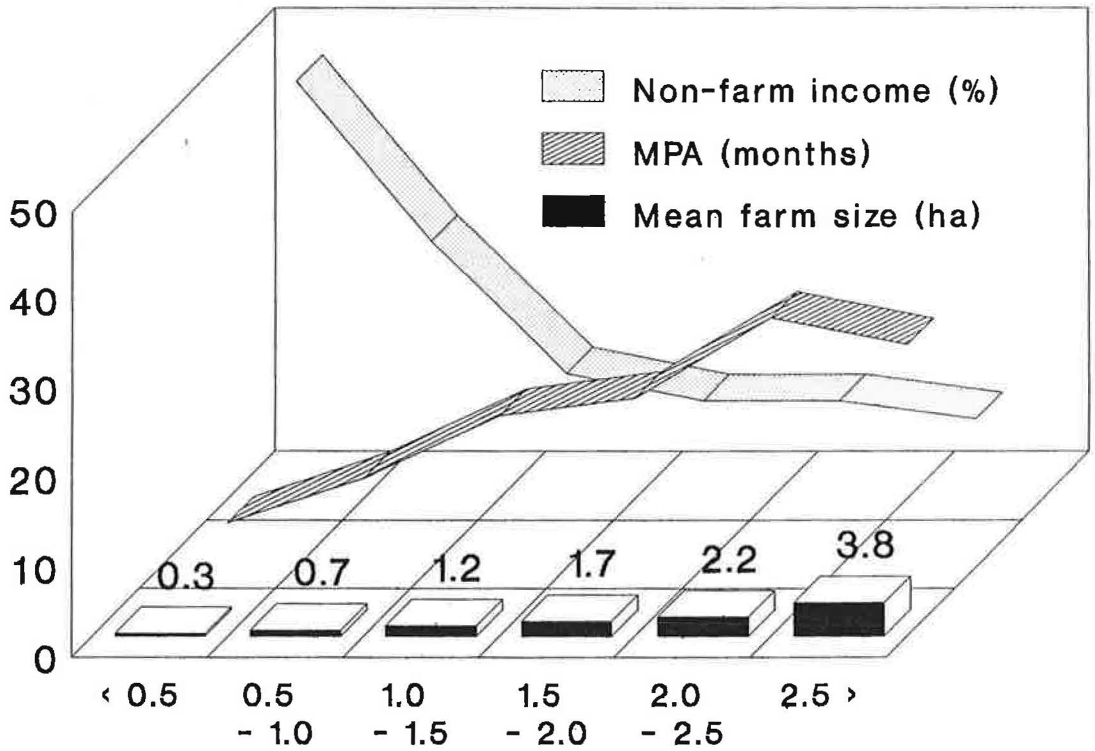
Note: figures are weighted averages for holding size groups 0.5 ha and 0.5-1.0 ha.

4.4. Household indicators for Blantyre Shire Highlands RDP, 1992/93, by sex of household head, 1992/93.

Indicator	Female-Headed	Male-Headed	Difference (+ MHH)
Cropping pattern: (% area)			
maize	72	75	+3
groundnuts	2	3	+1
pulses	19	17	-2
cassava	3	3	-
other crops	4	2	+2
total	100	100	
Input use:			
Maize: (% area)			
- local	85	72	-13
- hybrid	15	28	+13
Maize area fertilised: (% area)			
- local	25	37	-12
- hybrid	60	60	-
- total	34	43	-9
Maize yields (kg/ha)			
- hybrid	1704	1995	-291
- local (pure stand)	1057	1297	-240
- average	1221	1439	-218

Source: NSSA, 1992/93.

4.5 The agrarian transition in Blantyre Shire Highlands



Non-farm income (%)	47	29	14	11	11	9
MPA (months)	5	10	17	19	28	25

Farm size (ha)

Source: ASA, BLADD, 1987/88

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References

Agro-Economic Survey: Chiradzulu. A farm management and socio-economic survey of smallholder farmers in Chiradzulu District, Malawi. Agro-Economic Survey, Report No. 53, Planning Division, Lilongwe.

C. A. Baker, "Blantyre District: A geographical appreciation of thegrowth, distribution, and composition of its population", The Nyasaland Journal, Vol. 12, No. 1 (January, 1957), pp. 7-35.

BLADD, Blantyre Agricultural Development Division. Basic Facts and Figures. BLADD, Evaluation Section July 1987.

W. G. G. Cooper, The Geology and Mineral Resources of Nyasaland. Geological Bulletin No. 6. Revised edn. Government Printer, Zomba, 1957.

Famine Early Warning System (FEWS), Malawi Agricultural Statistics, 1993 Annual Bulletin.

Famine Early Warning System (FEWS), Integrated Overview of Malawi. Lilongwe, 1995.

A. Hansen, "Intercropping and Farming Systems in Three Areas of Malawi", in Proceedings and Materials from the Conference on Intercropping Research In Malawi, Chitedze, 20 October 1981.

W. T. Kawonga and O. A. Jere, Review of Adaptive Research Trial Results for Blantyre ADD 1985-1990. BLADD, Adaptive Research Section, November 1990.

J. D. Ndengu and W. T. Kawonga, Background Information and Informal Survey Results, Blantyre/ Shire Highlands RDP with emphasis on Chiradzulu. BLADD, Adaptive Research Section, November 1984.

J. D. Ndengu and W. T. Kawonga, Chiradzulu RDP Results of the Formal Survey and Proposed Research Trials 1985/86. BLADD Adaptive Research Section, June 1985.

National Statistical Office, National Sample Survey of Agriculture, 1980-81. Vol. 1: Household characteristics, Labour availability and Garden details. Government Printer, Zomba, 1984.

National Statistical Office, National Sample Survey of Agriculture, 1980-81. Vol. 2: Crops and yield. Government Printer, Zomba, 1984.

National Statistical Office, National Sample Survey of Agriculture, 1992/93. Vol. 1: Smallholder Household Composition Survey Report. Government Printer, Zomba, 1996.

National Statistical Office, National Sample Survey of Agriculture, 1992/93. Vol. 2: Smallholder Garden Survey Report. Government Printer, Zomba, 1996.

National Statistical Office, Annual Survey of Agriculture, 1981/82. Government Printer, Zomba, 1992.

National Statistical Office, Annual Survey of Agriculture, 1982/83 - 1984/85. Government Printer, Zomba, 1992.

National Statistical Office, Annual Survey of Agriculture, 1987/88, for Blantyre ADD. Printouts held by Evaluation Section, Blantyre ADD.

UNDP/FAO, Development of Conservation Measures and Messages Trial/Demonstration Sites. Preliminary results, Preliminary results, evaluation and recommendations for continuation under the 5th Cycle Country Programme. MLW/92/008 Field Document No. 1. Lilongwe, 1994.

UNDP/FAO, Land Resources Appraisal of Blantyre Agricultural Development Division. Land Resources Evaluation Project, Malawi. AG: DP/MLW/85/011. Lilongwe, 1991.

World Bank, Malawi: Human Resources and Poverty. Profile and Priorities for Action. World Bank, Southern Africa Department, Mimeo, November 1995.

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FARMING SYSTEMS INTEGRATED PEST MANAGEMENT PROJECT

DIAGNOSTIC SURVEY ON SWEET POTATO WEEVIL *(Cylas puncticollis)* PROBLEM IN MANGUNDA SECTION OF MATAPWATA EPA

REPORT BY

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20 - 21 August, 1997

BACKGROUND INFORMATION

In the 1991/92 season Soil Pest Project of Chancellor College conducted a random survey on sweet potato weevil *Cylas puncticollis* in Mangunda section of the Matapwata EPA. The aim of the survey was to determine the impact of tuber damage and evaluate economic losses due to damage caused by *Cylas puncticollis*. The survey's results indicated that there was heavy infestation of the sweet potato weevil on sweet potato tubers that caused significant losses of yields on the produce of the sweet potatoes. Pheromone traps were set to determine levels of infestation on various fields that were sampled. Results from daily catches of the male weevils trapped in a period of one year also indicated high levels of the population of the pest in the area. The visit to Mangunda section was a follow up to find out more on the problems of sweet potatoes. The technical team was involved in this exercise. The survey was conducted in two days on 20 th and 21st August, 1997.

FARMERS VISITED

We visited six smallholder farmers who had different perceptions of the problem. Some farmers thought the damage was caused by diseases and others by insects. The report is based on the individual discussions with the farmers and diagnostic work done on their sweet potato fields. The survey was conducted in two villages of Chimwanga and Pindani. We were accompanied to these farmers by the section Field assistant Mr Kanyika.

1. Mr Makwiti

He is very prominent farmer in both Chimwanga village and Mangunda section as a whole. He grows quite a range of crops such as maize, pigeonpeas, sweet potatoes, cassava, vegetables and citrus. He is one of the farmers who monitored *Cylas* using pheromone traps during Soil Pests Project surveys. He grows sweet potatoes every year between December and April continuously. He reported that sweet potato weevil damage is a very serious problem on sweet potatoes especially the hybrid variety of Kenya. He grows several sweet potatoes varieties that include both local and hybrid varieties. The most favoured and high yielding variety that Mr Makwiti grows is Kenya, but it has a serious problem of weevil damage. It is very susceptible to *Cylas puncticollis*.

Mr Makwiti is a commercial smallholder farmer who grows up to 5 ha sweet potatoes on his farm. He has 18 workers. Sweet potatoes are sold in bulk to business men who buy straight from the field. He does sell more than 20 tonnes of sweet potatoes every year in a normal season.

When he was asked if he could allow FSIPM project try a research technology of sealing cracks as a way controlling *Cylas* damage on sweet potatoes, he accepted the idea.

On the citrus crops that he is growing, has asked for advisory services on the problems affecting orange fruits. His orange fruits were seriously attacked by fruitflies and sooty mould caused by aphids. The control advice given by Mr Maulana was that he should use Malathion; baited with sugar or molasses or honey starting from the on set of flowers; and every two weeks through to maturity of oranges. For sooty mould, Dimethoet was recommended to be sprayed every two weeks. Apart from growing these crops Mr Makwiti is also keeping bees.

2. Mai Chisanga

Another farmer visited was Mai Chisanga. She is a commercial sweet potato farmer who has grown sweet potatoes for over ten years. She lives in Pindani village. She grows several sweet potato varieties; both local and hybrid. She has employed four women at present who work full time. The number increases to eight during the rainy season when work load increases. All the labourers she has employed are women. When she was asked why she employed women labourers, she said it is easier to supervise women since sweet potato growing is managed by a female head although she has a husband. The monthly wage for each labourer is K120.00. The size of field grown with sweet potatoes is 2 ha. During dry season she grows her sweet potato nurseries in the dambo. This year she has harvested more than 30 bags (90Kg each) of sweet potatoes. Each bag was sold at K130.00.

When she was asked about the sweet potato weevil problem, she said the sweet potato weevil is a big problem. They call the weevil Kafutwefutwe. Hybrid variety (Kenya) is the most susceptible to *Cylas puncticollis* both in the field and storage.

The only control measure she practises to reduce damage is early harvesting. All the tubers harvested are stored in storage shelters. Ash is then spread on the tubers as a pesticide to control *Cylas*. Mrs Chisanga plants sweet potatoes between January and March every year and practises crop rotation. She also perceives that *Cylas* enters the soil through the cracks.

3. Mr Mahinje

Mr Mahinje is from Pindani village. He grows Kenya variety of sweet potatoes. He practises sealing of cracks to control sweet potato weevil. This idea was gained from his friend three years ago. He has ever since sealed his sweet potatoes to control *Cylas*. He acknowledges that this technology does prevent tuber damage by the insects.

Mr Mahinje also practice crop rotation. This year he plans to grow the following crops; sweet potatoes, chillies, maize and cassava. When he was asked to rank these four according to priority, he ranked them in the same order. He is diversifying to commercial crops that are in turn sold and the money gained is used to buy maize for food. We found him drying maize that he bought this year after selling his sweet potatoes. Planting period for sweet potatoes is between January and April. He multiplies seed in the dambo nurseries. Size of field planted with sweet potatoes is 1ha.The farmer acknowledges storage problem with Kenya.

4. Mr Seyidi Mwenyekeni

He is originally from Mtambanyama. He came in Pindani village last year to live with his spouse in the village. He also grows Kenya and has a problem of weevil damage on his sweet potatoes. He plants his sweet potato nurseries in the dambo. Since he is just new in the village the problems he stated were of one year's experience. He sold all his potatoes to primary school teachers. He intends to interplant soya beans within sweet potatoes this season.

5. Mr Phambala

The last farmer we visited was Mr Phambala. He lives in Pindani Village. He started growing sweet potatoes in 1962. Ever since he has had sweet potato weevil problem. He is growing local and hybrid varieties. As a control measure he digs his tubers early to prevent damage. The tubers are then stored in traditional storage pits. Ash is put on tubers as a pesticide.

When we asked him to rank the crops he is growing. Maize was ranked as first, then sweet potatoes, cassava and pigeonpeas. This farmer does practise crop rotation.

OBSERVATIONS

From the preliminary survey we conducte [illegible]ve observed the following:

1. Sweet potato weevil (*Cylas puncticollis*) is a serious problem to sweet potato farmers in the area.

2. Sweet potato crop is a very important cash crop to smallholder farmers in the area. Some farmers have ranked sweet potato as their number one crop replacing maize, the main food crop. Some farmers have diversified their farming systems.

3. Farmers are looking for pest control measures that will help minimise yield losses due to weevil damage.

4. All farmers interviewed showed willingness to work with the project, if the project wants to try sweet potato weevil trials on their fields.

5. We also observed that pigeonpeas are widely grown in the area; more extensively than any other place we are working in.

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FARMING SYSTEMS INTEGRATED PEST MANAGEMENT PROJECT

BASELINE SURVEY, 1996/97

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Executive summary

- A sample survey of 120 smallholder households was conducted in four villages in Matapwata and Mombezi EPAs, Blantyre Shire Highlands RDP, during the 1996/97 season. The general objective of the survey was to provide baseline data on socio-economic and farming systems variables relevant for the design of IPM interventions. Households were stratified by participation in FSIPM on-farm trials and by sex of household head. The survey was administered in two rounds between January - February and March, 1997.

Socio-economic profile

- On average, farm size was 0.7 ha; household size 4.6 persons; the consumer/worker ratio 1.5; self-sufficiency in maize 7 months/year; 9 % of households belonged to burley clubs; and 31 % cultivated *dimba* gardens. No significant differences were found in socio-economic variables between OFT and non-OFT households. Significant differences were found, however, when households were stratified by farm size and maize provision ability (MPA).

- MPA in the survey year was determined by whether households had used fertiliser the previous season, and quality of land cultivated. Farm size was not a significant determinant of the level of self-sufficiency in maize.

- Few significant differences were found in food expenditure *per capita* or non-food expenditure per household, when households were stratified by MPA. Although such differences exist, detecting them would require more frequent visits at different periods of the year.

Farming systems

- On average, 52 % of the area planted to maize was planted to 'hybrid' varieties. Among farms in the highest tercile (1.18 ha), 58 % of the area planted to maize was planted to 'hybrids' compared to 36 % among farms in the lowest tercile (0.29 ha).

- The proportion of households growing 'hybrid' maize had increased over the past two seasons from 53 to 62 %. The largest proportionate increase was among farms in the lowest tercile (0.29 ha), from 39 % in 1994/95 to 49 % in 1995/96. Only 27 % of the sample grew unrecycled hybrid maize in the survey year, however. Thirty-five percent grew 'hybrid' seed retained from previous seasons.

- The proportion of households applying fertiliser had decreased over the past two seasons from 65 % to 53 %. The largest proportionate decrease was among farms in the third tercile (1.18 ha), from 83 % in 1994/95 to 63 % in 1996/97.

- Averaging across *all households*, fertiliser application on the area planted to maize was 28 kg/N/ha. Forty-five percent of the area planted to maize was unfertilised. Fertiliser application on the area planted to maize which received fertiliser averaged 34 kg/N/ha.

- Averaged across *fertiliser users*, fertiliser application on the area planted to maize was 53 kg/N/ha, and 64 kg/N/ha on the area planted to maize which received fertiliser. Average excpenditure on fertiliser among users was 629 MK/household.

- Among fertiliser users, average application rates were significantly higher on smaller farms. Farms in the lowest tercile (0.29 ha) applied 84 kg/N/ha on the area planted to maize which received fertiliser, compared to 45 kg/N/ha for farms in the highest tercile (1.18 ha).

- Adoption of hybrid maize and fertiliser were positively related to household food security. Among households in the highest tercile (10 months/year), 81 % grew 'hybrid' maize and 71 % applied fertiliser, compared to adoption rates of 42 % for hybrid maize and 39 % for fertiliser among households in the lowest tercile (3 months/year). Consequently households with higher MPA fertilised a greater proportion of the area planted to maize: 61 % among the highest tercile (10 months/year) compared to 26 % among the lowest tercile (3 months/year). Expenditure on fertiliser among the highest tercile averaged 870 MK/ha.

- Regression analysis demonstrated that MPA in the previous year (1995/96) was a significant determinant of nitrogen rates/ha in the survey year (1996/97). This implies that households with higher MPA had more spare cash available to purchase fertiliser. Earlier, we noted that fertiliser use in the previous year was an important determinant of household MPA in the current year. Thus, fertiliser use and food security form a virtuous circle.

- Local maize, beans, and pigeonpea - the three foodcrops targeted by the FSIPM Project - were grown by 79 % , 91 %, and 93 % of sample households, respectively. Sweet potato was grown by 76 % of households. Analysis of intercrop mixtures showed that beans and pigeonpea were planted on 58 % of the area planted to maize.

- With the exception of burley, all crops were used both for cash and home consumption. Of 22 crops normally grown by the sample, 15 (68 %) were reported to be normally sold by half or more of the households which grew them. Ranked by order of importance for cash income, the three most important cash crops were field peas, beans, and pigeonpea.

- MH18 was the most popular hybrid variety, grown by 68 % of households growing hybrid maize. Chimbamba and Kaulesi were the most popular bean varieties, grown by 70 % and 31 % of bean growers, respectively. Of households growing pigeonpea, 43 % grew non-local varieties.

- Seed retained from the previous season was the main seed source for maize and pigeonpea (54 % and 69 % of growers, respectively). By contrast, the main source of bean seed was local markets (54 % of households).

Weeds

- *Eleusine indica*, *Bidens pilosa*, and *Panicum maximum* were identified by farmers as the three most common weeds, and *Eleusine indica*, *Panicum maximum*, and *Cynadon dactylon* as the three most 'troublesome' weeds.

- Seventy-one percent of the area planted to maize was fully weeded at first weeding, and 42 % was fully banked at second weeding. Heavy rainfall leading to low average maize yields may have been partly responsible for the low proportion of area planted to maize which was fully banked.

- Significant differences were found in weeding practices between EPAs. Whereas nearly all the area planted to maize in Matapwata received a first weeding, nearly half was not weeded at second weeding and only one quarter was fully banked. Household labour supply was significantly lower in Matapwata EPA (2.42 workers) compared to Mombezi EPA (3.44 workers).

- First weeding had started on 50 % of the area planted to maize within two weeks of planting, rising to 85 % within five weeks. The late start to first weeding may have reduced the area which received a second weeding or banking, since farmers may have felt this was not worthwhile. Second weeding had started on 80 % of the area planted to maize by eight weeks after planting.

- Multivariate analysis showed that thoroughness of first weeding and banking were determined *inter alia* by whether plots had received fertiliser, use of hired labour, and farmers' expectation of termite damage. The complexity of weed management decisions, and specification bias caused by unobserved variables, means that further analysis is required using hierararchical decision-trees.

- Seventy-five percent of the sample hired labour for key field operations such as land preparation, weeding, and banking. The proportion of area planted to maize which was prepared, weeded, or banked using hired labour did not vary significantly by farm size. The market for hired labour was extremely thin, accounting for 13 % of land ridged for maize, 9 % of land weeded at first weeding, and 6 % of land banked.

- *Striga asiatica* was reported present on 36 % of the area cultivated but only 9 % of the area cultivated was reported to contain 'a lot' of *Striga*. Incidence of *Striga* was higher on upland and hillslope fields and on fields which were not weeded or only partly weeded at second weeding.

- Data from the 1995/96 Fertiliser Verification Trials showed that of 98 sections in Blantyre Shire Highlands RDP for which data was available, 48 (55 %) reported the presence of *Striga* on fertiliser trial plots. Of the sections reporting the presence of *Striga*, for 36 (75 %) *Striga* was judged to be a 'potential threat', while for 19 sections (40 %) *Striga* infestation was judged to already be 'very severe'.

Pests

- Farmers perceived whitegrubs, *Striga asiatica* and termites as the three most important pests of maize. For beans, bean foliage beetle (*Ootheca* spp.), caterpillars, and bean stem maggot (*Ophiomyia* spp.) were ranked as the three most important pests. For pigeonpea, the three major pests were *Fusarium* wilt, caterpillars, and termites. Slight variations in these rankings with those obtained from earlier diagnostic surveys probably reflect variation between seasons.

- Very few households used insecticides made from local materials (eg. *Tephrosia* sprays).

- Only 1-10 % of farmers used chemical control for field pests of maize, beans, or pigeonpea. Incentives for adoption of IPM strategies are limited by low expenditure on chemical control, reducing scope for savings in cash-costs, and by low average crop yields, which reduced the economic value of the yield which farmers might save through better pest management.

Female-headed households

- Compared with households headed by men, FHHs had fewer adults (2.50); fewer adult males (0.77); a higher consumer/worker ratio (1.66); smaller average farm size (0.57 ha) and lower MPA (6.8 months/year). Also, fewer belonged to burley clubs (3.3 %). In terms of income, a greater proportion of income among FHHs was earned off-farm (64 %).

- There was no evidence that a lower proportion of FHHs grew 'hybrid' maize or used fertiliser. FHHs used more recycled hybrid seed, however.

- Among FHHs, households in the highest tercile for MPA made greater use of unrecycled hybrid seed (43 % of households), fertilised a higher proportion of the area planted to maize (60 %), and had higher cash expenditure on fertiliser (790 MK/household). Farm size was not a significant determinant of MPA.

- Two factors which may help explain the ability of FHHs to maintain access to hybrid seed and fertiliser are cultivation of *dimba* maize, and cash generated through off-farm employment. More information is required on sources of cash income for fertiliser purchases, both for FHHs and households headed by men.

- FHHs weeded their fields less thoroughly, both at first and second weeding. There was no significant difference in the area planted to maize left unweeded, however. These differences may reflect shortage of labour among FHHs.

Case studies

- Household case studies of four crop and one non-crop enterprise highlighted innovations in the farming system. A striking feature of all case studies was the supporting role played by agricultural research and extension. Dairying required a breeding farm, and continued growth relies on expanded breeding of cross-bred heifers. Smallholder burley required changes in national policy, and a network of credit clubs. Growth in sweet potato production followed extension of the fast-growing, high-yielding variety Kenya. Lastly, cultivation of Irish potato only resumed in the area in 1996/97 following a government seed distribution programme.

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1.0 Introduction

The FSIPM Project operates in Blantyre Shire Highlands RDP, located in Blantyre ADD. The Shire Highlands form a natural region in southern Malawi situated on a plateau of rolling or flat upland plains 600-1200 m above sea level Rainfall ranges from 800-1,300 mm per annum, depending on altitude. The climate is warm tropical with one continuous rainy season between November-March. Showers (*chiperoni*) occur during the cold months of May, June, and July. Soils are mostly deep, well drained and medium textured but low in plant nutrients.

In 1992/93 the total smallholder population in the RDP numbered 549,638, composed of 335,626 farm households of which 38 % were headed by women (NSO, I, 1993). Average farm size was small : 88 % of households cultivated 1 ha or less and 61 % cultivated 0.5 ha or less. The average area planted to maize was 0.24 ha/household. At current levels of productivity, farms of 1.0 and 0.5 ha were self-sufficient in maize for 5 and 10 months/year, respectively (Orr *et. al.*, 1996: 30).

The FSIPM Project operates in two of five EPAs, Matapwata and Mombezi. Average population density in these EPAs in 1995 was 285-290 persons/km^2 of land area, the highest in Malawi. Both EPAs score low on human development indicators (Ibid., 1996: 8). The growing season in Matapwata in the Limbe-Blantyre highlands is slightly longer (195-225 days) than in Mombezi (135-165 days).

The farming system is characterised by intensive cropping of maize with intercrops of pulses and legumes. Relay planting of beans and field peas is also practised. Pigeonpea and beans are the main pulse and legume intercrops. Maize productivity is low due to slow adoption of hybrid maize varieties and limited use of inorganic fertiliser. Burley tobacco and summer vegetables (cabbage, tomato) grown on residual moisture besides streams and streambeds (*dimba*) are important commercial crops. Commercialisation is driven both by international markets (tobacco) and demand from urban consumers in Blantyre-Limbe (pop. c. 500,000 in 1996).

Purpose

The purpose of the baseline survey was to provide information to the FSIPM Project to assist the design of pest management strategies appropriate for smallholder farmers.

Scope

The scope of the baseline survey was restricted to (1) a broad understanding of the farming system, and farmers' economic circumstances, and (2) farmers' perceptions of pests and their pest management practices. The survey was not designed as an in-depth examination of particular aspects of the farming system, nor as a full portrait of the households with which the Project is working. Specific issues identified by the baseline survey will be followed up in focused research activities.

An important limitation of the analysis was the need to process data before the start of the next crop season, which prevented fuller testing of hypotheses and the relation of research findings to relevant secondary literature.

Objectives

The specific objectives were to:

- give a socio-economic profile of households participating in on-farm trials (OFTs);
- characterise smallholder farming systems;
- describe farmers' pest management strategies; and
- describe farmers' perceptions of pests of maize, beans, and pigeonpea.

Methods

Sample survey

The sample frame was provided by a census of households in four villages at FSIPM research sites (Chiwinja and Lidala in Mombezi EPA, and Kambua and Magomero in Matapwata EPA). The size of the sample frame was 605 households.

As far as possible, households participating in OFTs in the 1996/97 crop season were purposively selected to meet the Project's socio-economic objective of targeting poorer smallholders. Social mapping of lineages was used to identify absence of wealth indicators such as salaried employment, ownership of a business, cattle ownership, and cultivation of burley tobacco.

Table 1.1 shows that of 57 OFT households which were identified by social mapping, six did not meet the first poverty criteria used to target resource-poor households. When the poverty criteria were tightened to include households with bicycles, the number of OFT households which failed to meet the criteria rose to 13. Lastly, when the criteria included membership of a burley club, the number rose to 16 households (28 % of the sample). Thus, nearly one-third of OFT households were not selected according to poverty indicators but for pragmatic reasons, such as active participation in diagnostic surveys or high social status.

Table 1.1 OFT households by social mapping poverty indicators, 1996/97.

Households	Matapwata		Mombezi		Total
	Magomero	Kambua	Chiwinja	Lidala	
Total OFT households	15	14	14	14	57
Not meeting poverty criteria 1 [a]	1	2	2	1	6
Not meeting poverty criteria 2 [b]	3	4	4	2	13
Not meeting poverty criteria 3 [c]	3	6	4	3	16

[a] Households with a salary-earner or business or cattle.
[b] Households with a salary-earner or business or cattle or bicycle.
[c] Households with a salary-earner or cattle or bicycle or growing burley tobacco.

Sampling

A random sample of 60 households was selected from the 74 OFT households, stratified according to sex of household head (30 female-headed, 30 male-headed). A simple random sample of 60 non-participating households (30 female-headed, 30 male-headed) was selected as a control, giving a total sample size of 120 households (Table 1.2). The stratification of households by gender was judged necessary in view of the disproportionate share of female-headed households among the poor in southern Malawi (World Bank, 1996).

Female-headed households

This report follows convention by defining FHHs as *de jure* or *de facto*. *De jure* households included those where the head was divorced separated, widowed, or unmarried. *De facto* households were defined as those where the titular head of the household was male, but was absent for six months or more during the 1996/97 growing season. This category also included women married to polygamists. The breakdown of the 60 sample FHHs between these categories was:

De jure	Never married	1
	Separated	7
	Divorced	22
	Widowed	20
	Total *de jure*	50
De facto		10
Grand total		60

The small number of *de facto* households prevented meaningful comparisons with *de jure* households. Unfortunately, while the 1992/93 NSSA disaggregates variables by sex of household head, it does not specify the definition of FHH (GoM, 1996, I: 4-5). Since the NSSA questionnaire contains information on time absent from the household, however, it is possible that the definition includes *de facto* households.

Case studies

Household case studies were made for four crop and one non-crop enterprise in order to highlight dynamic aspects of the farming system. On average, two households were interviewed for each enterprise. The case studies are 'green shoots' of economic activity which illustrate the potential for commercial production in the peri-urban farming system. From the standpoint of the FSIPM Project, these enterprises are important for two reasons. By permitting purchase of fertiliser, the cash they generate can play an important role in increasing average maize yields, thereby increasing the marginal return from crop protection. And relatively high cash expenditure on pesticides for horticulture crops provides farmers with an economic incentive to adopt cost-saving IPM interventions.

Table 1.2 Sample households, FSIPM baseline survey, 1996/97.

Participation in On-farm Trials	Sex of household head	Matapwata EPA	Mombezi EPA	Total
Yes	Male	16	14	30
Yes	Female	15	15	30
No	Male	12	18	30
No	Female	15	15	30
Total		58	62	120

Data collection

Data was obtained using a pre-tested, structured questionnaire administered in two survey rounds between January-February and March 1997, respectively. The first round was administered by FSIPM staff and the second by enumerators from Blantyre ADD. Field measurements were made by Project

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staff, using triangulation and pacing to measure the largest garden cultivated by each household; areas for the remaining gardens were estimated by farmers as a proportion of the largest. The survey questionnaire is reproduced in Appendices 1 and 2 of this report.

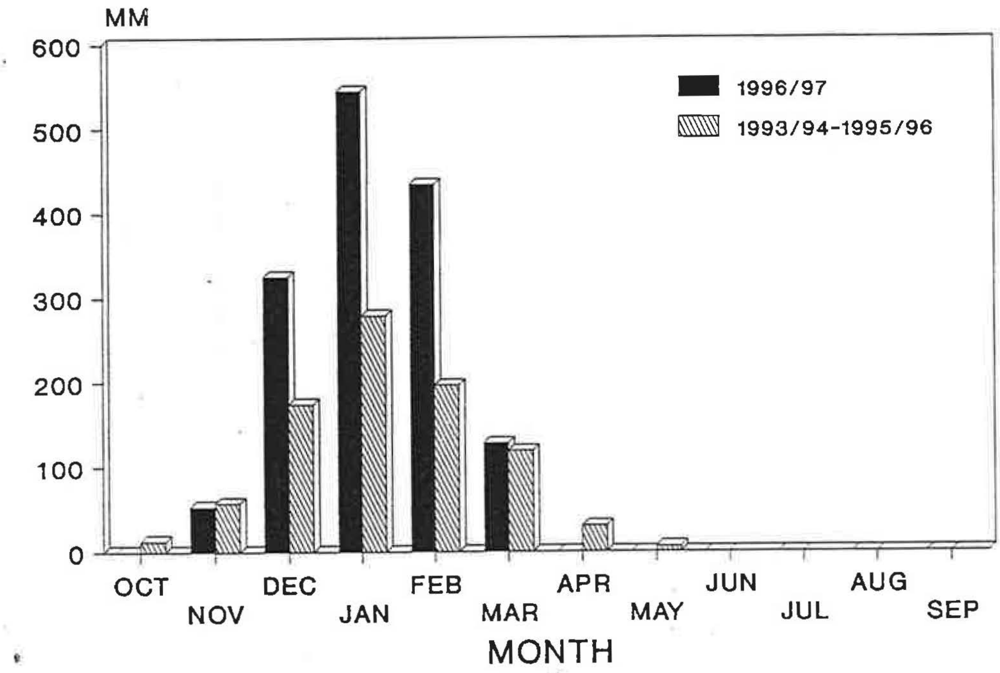
Data processing

Data was entered in nine DBase IV files for cleaning. A master file was then created containing 174 key variables. Statistical analysis was made from the master file using SPSS for Windows V. 6.1.3.

The 1996/97 growing season

The 1996/97 season (31 Sep-1 Oct) was characterised by above-average rainfall, particularly during the early months. Rainfall records from Matambo estate (Mombezi EPA) show that December rainfall totalled 325 mm, compared to an average of 174 mm in the preceding three years. Rainfall in January totalled 544 mm, compared to an average of 279 mm in the preceding three years. Continuous, intensive rains led to delayed weeding and leaching of fertiliser nutrients, contributing to low average maize yields in 1996/97. In Blantyre Shire Highlands RDP, yields during the survey year averaged 454 kg/ha for local and 1534 kg/ha for hybrid maize (BLADD, 1997).

Figure 1. Average monthly rainfall at Matambo estate, Mombezi EPA, 1993/94-96/97.



Source: Matambo Estate records

2.0 Socio-economic profile

The FSIPM Project is tasked with targeting smallholder households cultivating less than 1 ha. The extent of population pressure on land in Blantyre Shire Highlands ensures that nine in 10 smallholder households meets this criterion. In selecting farmers for participation in OFTs, the Project attempted to narrow the definition of poverty by using indicators to identify households which were relatively poorer than others. Indicators included salaried non-farm employment; running a business; and ownership of a bicycle or milking cows. Furthermore, since the Project was also tasked with ensuring that half of OFT participants were FHHs, sex of household head and number of dependents were also used to identify poorer households.

The sample

Table 2.1 shows selected socio-economic variables for the total sample and separately for households participating in FSIPM OFTs.

Mean household size was 4.63 persons/household, close to the average of 4.8 recorded for Blantyre Shire Highlands RDP by the 1992/93 NSSA (GOM, 1996, I: 222). Farm size distribution among the sample differed from that recorded for the RDP by the NSSA, however. Eighty-three percent of sample households cultivated 1.0 ha or less compared to 91 % recorded by the NSSA (GOM, 1996: II: 331). This difference almost certainly reflects the larger sample size and more accurate area measurements made by the NSSA. Maize provision ability (MPA) averaged 7 months/year, within the 5-10 months range previously estimated from the 1988/89 ASA (Orr *et. al.*, 1996: 30). One in 10 households were members of burley clubs, while one in three cultivated *dimba* gardens.

Participating and non-participating households

The socio-economic profile of households participating in OFTs was identical to that of non-participating households (Table 2.1). Of 20 selected socio-economic variables, only one differed significantly between the two groups. There was no significant difference in average farm size, completed years of primary education of household head, MPA, and the proportion of households belonging to a burley club or cultivating a *dimba* garden.

The absence of differences between OFT and non-OFT households was unexpected since farmer selection for OFTs had been based as far as possible on poverty criteria. Several explanations are possible. The indicators used to select poorer households may have been inappropriate. Other work, however, has shown several of these indicators to be significantly correlated with household income (World Bank, 1996). Secondly, non-OFT households were not a representative sample of the smallholder population but included 30 female-headed households, which are generally poorer than average. A comparison between *male-headed* OFT and non-OFT households (not shown here) was made to test this hypothesis, but failed to find significant differences between the two groups (with the exception of maize provision ability, which was significantly *higher* among male-headed OFT households). This suggests that selection of OFT households may have been biased by the inclusion of households which did not meet various poverty criteria (Table 1.1).

Socio-economic profile by farm size

In view of the lack of significant differences between OFT and non-OFT households, the socioeconomic profile was made using cross-tabulations by farm size and MPA.

Households were stratified into terciles by area cultivated (Table 2.2). Numbers in each tercile differed slightly because of tied values. Significant socio-economic differences were observed between the tercile with the largest mean farm size (1.18 ha) and other groups. Households in tercile 3 had a significantly larger mean number of household members (4.98 persons), significantly higher MPA (8 months/year), and a higher proportion had access to *dimba* (40 %). Membership of burley clubs did not vary significantly between farm size groups, perhaps reflecting the success of extension efforts to target poorer smallholders.

Box 2.1 FSIPM vs CIAT farmer selection for OFTs.

The CIAT Bean Research Programme at Chitedze conducted OFTs with 160 farm households in the 1995/96 season. OFT participants were selected by FAs, who were instructed to select 'representative' farm households from their sections. The unprocessed data was obtained from the CIAT economist in order to compare the socio-economic status of OFT households in the CIAT and FSIPM Projects.

Variable	CIAT	FSIPM
Sample size	160	60
FHHs (%)	34.0	50.0
Household size (no)	5.43	4.63
Farm size (ha)	1.12	0.73
Maize area (ha)	0.87	0.72
Maize area (%)	34.0	98.0
Proportion maize sold (%)	9.82 [2]	NA
Growing burley (%)	8.8	9.1
Hiring-in *ganyu* (%)	29.2	75.0
Hiring-out *ganyu* (%)	14.0	36.7
Growing *dimba* crops (%)	28.8	30.8

Among the variables listed, the comparison showed several differences in socio-economic status between the two groups. The proportion growing *dimba* crops and burley tobacco were nearly identical. Mean farm size was smaller among the FSIPM sample, however, with a greater share planted to maize. Participation in the labour market was also higher among FSIPM households, with a greater proportion hiring-in labour. Unfortunately, since the CIAT households were drawn from three regions and included a lower proportion of female-headed households,[1] it is not possible to say to what extent these differences reflect differences in socio-economic status between sample households or simply differences between regions.

Notes:

[1] The CIAT definition of female-headed household was amended to match that used by the FSIPM baseline survey.

[2] Refers to the 1994/95 season

Socio-economic profile by MPA

Households were stratified into terciles by MPA or the number of months the household was self-sufficient in maize (Table 2.3). Self-sufficiency was measured for the 1996/97 season and is therefore based on the 12 months between the maize harvest of April 1996 and the end of March 1997. According to the national Crop Estimates, average maize production in Blantyre ADD was 40 % higher in 1995/96 than in 1996/97 (BLADD, 1997). Thus, household MPA is based on a relatively good crop year.

Mean MPA among the three terciles was 3, 8 and 10 months/year, respectively. Households with 3 months MPA may be regarded as functionally landless households, relying on off-farm income for three-quarters of maize consumption, while households with an MPA of 10 and over may be regarded as relatively food secure. Obviously, this ranking may change over seasons.

Statistically significant differences were found between the three terciles. Households with higher MPA had a lower consumer/worker ratio, perhaps suggesting that food security was related to the relative quantity of labour available for maize production. Education of household head was also higher among more food-secure households, suggesting that dependence on off-farm employment among poorer households may reduce the time available for schooling. Finally, households with higher MPA were more likely to be members of burley clubs, providing access to inputs such as fertiliser both for burley and maize, and also to the international market for Malawi's most lucrative cash crop.

An important result is the non-significance of the farm-size and household size variables in household food security. *Ceteris paribus*, we expected households with higher MPA to have larger areas planted to maize (implying higher total maize production) or smaller than average household size. The lack of relationship between MPA and farm size implies that the absolute area planted to maize is a less important determinant of household food security than land quality or land productivity.

Determinants of MPA

Multivariate regression was used to identify the major determinants of MPA among the sample households. Since the dependent variable (MPA in 1996/97) was the result of household maize production in the 1995/96 season, the specification of independent variables was limited by non-availability of data for several key variables, such as the fertiliser rate applied to maize, or information on coping strategies to prolong household maize supplies (eg. skipping meals, mixing maize flour with bran, or substituting cassava flour). Table 2.4 shows that the specification explained only one-quarter of the observed variation in household MPA ($R^2 = 0.23$). Of the 10 independent variables, only three were statistically significant at the 5 % level or better. Despite the poor fit of the model, however, the results were instructive.

The dummy variable FERT95 was positive and highly significant, indicating that MPA in the *current* season was dependent on fertiliser use during the *previous* season (1995/96). The dummy variable CHITERA was negative and statistically significant, indicating that households with poor quality land in this dambo had significantly lower MPA than others. Finally, the dummy variable SELLMZ was positive and significant, indicating that low MPA did not reflect sale by households with lower maize production ('overselling') but that sale of maize was associated with households with higher household maize production.

The FSIZE variable was positive, but non-significant, while the CWRATIO variable was negative, but also non-significant. This supports the earlier finding (Table 2.3) that area cultivated *per se* was not an important determinant of MPA. Rather, MPA reflected land quality (ie. access to *munda* land) and the ability to purchase fertiliser.

The DMAIZE variable had the expected positive sign, but was non-significant. Of 38 households with *dimba* gardens, only 10 reported cultivating *dimba* maize, presumably because *dimba* cultivation was used primarily as a source of cash income for high-value vegetables. The RGANYU variable had the expected negative sign (the more important the role of *ganyu*, the less labour available for critical field operations such as weeding), but was also non-significant. Finally, the SPOTATO variable was negative, suggesting that sweet potato functioned as a substitute for maize, but the coefficient was not statistically significant.

Female-headed households

Statistically significant differences for 9 of 20 variables were found when households were cross-tabulated by sex of household head (Table 2.5). FHHs had fewer resident adults (2.50), fewer resident adult males (0.77), higher consumer/worker ratios (1.66), fewer mean years of completed primary education for household heads (2.10 years), smaller average farm size (0.57 ha), lower mean MPA (6.8 months), and fewer households belonged to burley-clubs (3.3 %). Thus, FHHs were relatively disadvantaged in terms of land and labour resources, education, and access to credit. These findings are comparable to those from other surveys (Segal, 1987; World Bank, 1994).

It may be noted that the baseline survey collected data on area cultivated, not holding size. Thus, the finding that mean farm size was lower for FHHs does not necessarily imply that FHHs had smaller holdings or had less access to rented land. Land rental accounted for only 2.3 % of area cultivated by the sample. It seems more likely that FHHs cultivate a smaller area than households headed by men because they have less available labour.

Attempts to disaggregate FHHs by MPA failed to produce significant socioeconomic differences (Table 2.6). In particular, there were no significant differences in mean household size, consumer/worker ratio, or mean farm size between terciles. Variations in food security status between FHHs, therefore, was not the product of a larger area under cultivation or greater labour resources. The proportion of households with access to *dimba* rose markedly with increases in household food security, however. Nearly one in four households in the highest tercile cultivated *dimba* gardens compared to just one in 10 in the lowest tercile.

Household expenditure by MPA

Household expenditure on selected food and non-food items was measured within one week in March, 1997. Although the intention was to capture differences in consumption before the 1996/97 maize harvest, most households had in fact started to eat green maize by the time they were interviewed. To reduce recall bias, expenditure on food items was collected for a period of three days preceding the interview. Food items consumed from own production were valued at local market rates. Since non-food items are generally more expensive and purchased less frequently, information on these items was collected for a period of either one month (Table 2.7, rows 1-4) or three months (Table 2.7, rows 5-19).

Both food and non-food expenditure was cross-tabulated by MPA, with households divided into terciles. Of 22 food items, only one (*per capita*/expenditure on sugar, a luxury item) was significantly different between the three groups. Differences in *per capita* expenditure on maize, *nsima*, and green maize were not statistically significant. On this evidence, therefore, the quantity of foods consumed did not vary according to household food security status. This result may reflect poor quality of data based on one three-day period, or an inappropriate measure of household food security (by March, most households in the sample had run out of maize).

Of 19 non-food items, household expenditure on four items differed significantly between the three groups (Table 2.7). Households with higher MPA had higher expenditure on paraffin, coffee/tea, housing, and debt repayment. The first two items may be classed as luxuries, while debt-repayment (from both formal and informal sources) perhaps reflects the higher credit-rating of more food-secure households. The lack of significant differences among most non-food items may be due to the fact that expenditure on such items is highest after the harvest of maize and tobacco when households have surplus cash, and not before the harvest as measured by the baseline survey.

Assets

Goats were the most popular ruminant, owned by 37 households or one-third of the sample (Table 2.7). According to diagnostic surveys pigs were previously more numerous but many had died in a recent epidemic, probably swine fever. Only three households in the sample owned dairy cows. With the exception of goats, ownership of livestock did not vary significantly by MPA. About one-third of the sample reported ownership of fruit orchards (distinguished from fruit used solely for home consumption), and 43 households (36 %) practised horticulture in homestead gardens.

Non-crop enterprises such as dairying and poultry-rearing offer high returns for smallholders with limited opportunities for cash crops. In India, income from one crossbred cow can equal that of five acres of irrigated land planted with MV rice (Singh, 1990: 221-223). With a milk density (production per km^2) 20 times lower than India, scope for commercial milk production in Sub-Saharan Africa is confined largely to peri-urban areas (Walshe *et. al.*, 1991: 19). In the Blantyre Shire Highlands, milk production has risen rapidly over the past few years as farmers exploit new market opportunities (Box 1.2).

Bvumbwe Bulking Group is the largest in the Blantyre Shire Highlands, with production of 7,500 litres/day in July 1997. Milk is stored in two electrified coolers each with a capacity of 3,000 litres. Together, 20 Bulking Groups form the Shire Highlands Milk Producers Association (SHMPA), with 2,735 members. The Association is run entirely by farmers, funded by a levy of six tambala/litre of milk sold. Liquid milk is purchased by MDI, a parastatal which will shortly be privatised. MDI collects and homogenises the milk, which retails at 8 MK/litre. The number of farmers registering with the Bvumbwe Bulking Group has risen sharply, from 300 in January 1996 to stand at about 450 in August 1997. Improved profitability reflects rising producer prices for liquid milk (from 2.75 MK/litre in 1994, to 3.99 MK/litre in 1995, and 4.99 MK/litre in 1996) and lower real exchange rates which have increased the price of imports. With local production meeting only half the domestic demand for liquid milk, there is enormous potential for further expansion, provided that the supply of suitable heifers can be increased through crossbreeding.

Box 2.2 The Milk seller...

Fraser Mazinga, 34, is acting chief of village Magomero, 15 kms from Bvumbwe. Married for 10 years, he lives with his wife and two children aged ten and four. He cultivates three gardens totalling 0.4 ha, growing hybrid maize, beans, pigeonpea, and crownpeas, and rents a *dimba* garden from his mother where he grows cabbage, mustard, and tomato. The household is self-sufficient in maize for all but two months of the year.

Three years ago, his brother-in-law bought an 18-month old heifer for MK 3,000 and gifted it to Fraser's wife. Fraser and his wife reared the calf, helped by a younger brother-in-law, Luka Madeya, who stays with them while studying at the high school in Goliati. When milk production started in December 1996, the animal was inspected by a vetinarian and registered with Bvumbwe Bulking Group for a fee of MK 100. Fraser was satisfied with the services of the Bulking Group. When power failed and milk could not be stored, it was brought home, boiled, and returned in the afternoon; if not sold by the afternoon, it was distributed free to villagers. Spoilage was rare, however. Once a month, Fraser purchased one 50 kg bag of protein-rich dairy mash (produced by Rab Processors) from the Group for MK 135. He also spent a total of MK 135 on medicine, administered by the Group's own vetinarian. The major killer of dairy cattle in Sub-Saharan Africa - East Coast Fever - has been kept out of the Shire Highlands by strict quarantine regulations. Artificial insemination was provided free for cows belonging to Group members.

The task of milk production is shared by the whole household. Fraser and Luka gathered fodder (elephant grass from the dambo, banana stalks from their own homestead, and home-produced *madeya*) to feed the calf morning, noon, and evening. Feed was sometimes difficult to find, particularly in the dry season. Fraser's wife fetched water from the nearby stream. And Luka travelled by bicycle twice a day to Bvumbwe, leaving at 0500 hrs and again at 1400 hrs, to deliver milk to the Bulking Group. (At Bvumbwe the milk is tested for adulteration and acidity. If found satisfactory, the quantity delivered is recorded by the Bulking Group, and in a duplicate farmer's book). Work continued without letup for seven days a week. Fraser found that three people were sufficient to take care of one cow, but one neighbouring household with six animals employs four full-time labourers for this purpose.

Initially, Fraser's cow produced 15 litres/day but by 1997 production had risen to 19-20 20 litres/day. At a price of 4.99 MK/litre, gross income from a single cow averaged MK 1,600-1,700 for the seven months' lactation. The income was split three ways, with Fraser's wife and her two brothers receiving equal shares. Even a one-third share made a big difference to household income. Whereas his other source of cash income from *dimba* vegetables was seasonal, income from milk sales arrived each month, which facilitated regular savings.

Unfortunately, Fraser's brother-in-law was unwilling any longer to share the income from milk sales and reclaimed the calf in April this year. With the money he has saved, Fraser now wants to buy another animal from MDI's nearby farm at Ndata. While a mature animal costs between MK 10-17,000, weaned calves are available for between MK 3-5,000. Thee is a large unsatified demand for dairy cattle, however. The government breeding farm at Thucila produces only about 60-100 heifers/year. Farmers unable to purchase cows locally are forced to import from Zimbabwe, paying 12-13,000 for a heifer in calf. With good management, Fraser believes that one cow could provide him with a regular income of 2,000 MK/month.

Table 2.1 Selected socio-economic variables, by participation in on-farm trials, FSIPM research sites, 1996/97.

No.	Variable	All households (n=120)	OFT households (n = 60)	Non-OFT households (n = 60)	Sig.-level [a]
1	Household size (no)	4.63	4.67	4.58	0.21
2	- adults	2.75	2.85	2.65	0.80
3	- adult males	1.24	1.23	1.22	0.25
4	- adult females	1.51	1.58	1.43	1.01
5	- children	1.88	1.82	1.93	-0.41
6	Consumer/worker ratio	1.47	1.50	1.45	0.51
7	- consumers (no)	3.78	3.83	3.73	0.32
8	- workers (no)	2.71	2.75	2.67	0.32
9	Primary education of household head (yrs completed)	2.73	3.08	2.38	1.33
10	Farm size (ha)	0.67	0.73	0.61	1.34
	(%)				
11	< =0.49 ha	45.0	35.0	55.0	4.07 *
12	0.50-0.99 ha	38.3	45.0	31.7	1.73
13	1.0 ha >	16.7	20.0	13.3	0.54
14	Maize Provision Ability (months)	7.19	7.45	6.93	0.88
	(%)				
15	0-3 months	14.2	11.7	16.7	0.274
16	4-6 months	15.8	13.3	18.3	0.250
17	7-9 months	47.5	51.7	43.3	0.535
18	10-12 months	22.5	23.3	21.7	0.000
19	Burley club member (%)	9.1	6.7	11.7	0.40
20	Cultivating *dimba* garden (%)	30.8	35.0	26.7	0.62

Note:

[a] * indicates significant differences between groups (10% or better), by Chi-square or ANOVA

Table 2.2 Selected socio-economic variables, by farm size, FSIPM research sites, 1996/97.

No.	Variable	Tercile 1 (n=41)	Tercile 2 (n=39)	Tercile 3 (n=40)	Sig-level [a]
1	Farm size (ha)	0.29	0.55	1.18	-74.50 *
2	Household size (no)	4.05	4.87	4.98	2.30 *
3	- adults	2.44	2.79	3.03	1.92
4	- adult males	1.02	1.18	1.53	2.20
5	- adult females	1.42	1.62	1.50	0.61
6	- children	1.61	2.08	1.95	0.96
7	Consumer/worker ratio	1.48	1.54	1.40	0.54
8	- consumers (no)	3.21	4.05	4.10	3.33 *
9	- workers (no)	2.29	2.80	3.06	3.54 *
10	Primary education of household head (yrs completed)	3.02	2.26	2.90	0.81
11	Maize Provision Ability (months)	6.46	7.05	8.08	2.65 *
	(%)				
12	0-3 months	14.6	15.4	12.5	
13	4-6 months	26.8	15.4	5.0	
14	7-9 months	46.3	43.6	52.5	
15	10-12 months	12.2	25.6	30.0	
16	Burley club member (%)	4.9	10.3	12.5	1.50
17	Cultivating *dimba* garden (%)	34.1	17.9	40.0	4.82 *

Note:

[a] * indicates significant differences between groups (10% or better), by Chi-square or ANOVA

Table 2.3 Selected socio-economic variables, by MPA, FSIPM research sites, 1996/97.

No.	Variable	Tercile 1 (n=36)	Tercile 2 (n=42)	Tercile 3 (n=42)	Sig.-level [a]
1	Maize Provision Ability (months)	3.1	7.7	10.2	254.22 *
2	Household size (no)	4.78	4.33	4.79	0.588
3	- adults	2.78	2.83	2.64	0.212
4	- adult males	1.33	1.36	1.05	0.996
5	- adult females	1.44	1.48	1.60	0.383
6	- children	2.00	1.50	2.14	1.970
7	Consumer/worker ratio	1.62	1.33	1.50	2.534 *
8	- consumers (no)	3.89	3.63	3.83	0.231
9	- workers (no)	2.69	2.80	2.64	0.156
10	Primary education of household head (yrs completed)	1.33	3.43	3.24	6.692 *
11	Farm size (ha)	0.53	0.71	0.76	2.112
	(%)				
12	<=0.49 ha	55.6	50.0	31.0	5.394 *
13	0.50-0.99 has	36.1	28.6	50.0	4.187
14	>=1.00 ha	8.3	21.4	19.0	2.657
15	Burley club member (%)	2.8	7.1	16.7	4.80 *
16	Cultivating *dimba* garden (%)	22.2	31.0	38.1	2.291

Note:

[a] * indicates significant differences between groups (10% or better), by Chi-square or ANOVA

Table 2.4 OLS estimates of determinants of MPA at FSIPM research sites, 1996/97.

Variable	Coefficient	S.E.	T-value	Sig. -level
Constant	5.9397	1.6586	3.581	.0005
FHH	0.1075	0.5399	0.199	.8425
FSIZE	0.3929	0.5519	0.712	.4780
FERT95	1.5058	0.6753	2.230	.0278
HYB95	0.7217	0.6575	1.098	.2748
CHITERA	-1.3436	0.6377	-2.107	.0374
DMAIZE	0.78915	0.9808	0.754	.4527
CWRATIO	-0.1589	0.4602	-0.345	.7305
RGANYU	-0.2396	0.3796	-0.631	.5292
SPOTATO	-0.4677	0.6321	-0.740	.4609
SELLMZ	1.4127	0.5961	2.370	.0196
Adjusted R^2: 0.23				
F-ratio: 4.5556 (Sig. 1 % level)				
Durbin-Watson statistic: 1.73				
n = 120 households				

Definitions:

FHH	Dummy for female-headed household (1=Yes, 0 otherwise)
FSIZE	Area cultivated (ha)
FERT95	Dummy for used fertiliser in 95/96 season (1=Yes, 0 otherwise)
HYB95	Dummy for grew hybrid maize in 95/96 season (1=Yes, 0 otherwise)
CHITERA	Dummy for Chitera *dambo* (1=Yes, 0 otherwise)
DMAIZE	Dummy for grew *dimba* maize (1=Yes, 0 otherwise)
CWRATIO	Consumer-worker ratio
RGANYU	Rank of *ganyu* labour in sources of off-farm income (1-4)
SPOTATO	Dummy for normally grows sweet potato (1=Yes, 0 otherwise)
SELLMZ	Dummy for normally sells maize (1=Yes, 0 otherwise)

Table 2.5 Selected socio-economic variables, by sex of household head, FSIPM research sites, 1996/97.

No.	Variable	Female-headed household (n = 60)	Male-headed household (n = 60)	Sig.-level [a]
1	Household size (no)	4.37	4.97	-1.10
2	- adults	2.50	3.20	-1.91 *
3	- adult males	0.77	1.77	-3.92 *
4	- adult females	1.73	1.43	1.32
5	- children	1.87	1.77	0.26
6	Consumer/worker ratio	1.66	1.35	1.87 *
7	- consumers (no)	3.50	4.05	-1.70 *
8	- workers (no)	2.47	2.96	-1.99 *
9	Primary education of household head (yrs completed)	2.10	4.07	-2.97 *
10	Farm size (ha)	0.57	0.77	-2.22 *
	(%)			
11	<=0.49 ha	43.3	46.7	0.03
12	0.50-0.99 ha	45.0	31.7	1.73
13	1.0 > ha	11.7	21.7	1.50
14	Maize Provision Ability (months)	6.80	8.10	-1.74 *
	(%)			
15	0-3 months	13.3	15.0	0.000
16	4-6 months	18.3	13.3	0.250
17	7-9 months	46.7	48.3	0.000
18	10-12 months	21.7	23.3	0.000
19	Burley club member (%)	3.3	15.0	3.60 *
20	Cultivating *dimba* garden (%)	23.3	46.7	2.64

Notes

[a] * indicates significant differences between groups (10% or better), by Chi-square or t-test

Table 2.6 Selected socio-econonomic variables for female-headed households, by MPA, FSIPM research sites, 1996/97.

No.	Variable	Tercile 1 (n=19)	Tercile 2 (n=20)	Tercile 3 (n=21)	Sig.-level [a]
1	Maize Provision Ability (months)	3.0	7.7	10.2	125.786 *
2	Household size (no)	4.37	3.90	4.43	0.4151
3	- adults	2.63	2.50	2.33	0.2898
4	- adult males	1.05	0.90	0.48	2.1468
5	- adult females	1.58	1.60	1.86	0.5860
6	- children	1.74	1.40	2.10	1.1550
7	Consumer/worker ratio	1.67	1.42	1.46	0.6778
	- consumers (no)	3.76	3.26	3.50	0.4839
	- workers (no)	2.59	2.38	2.43	0.1739
10	Primary education of household head (yrs completed)	0.89	2.15	2.29	2.2376
11	Farm size (ha)	0.57	0.51	0.63	0.8904
	(%)				
12	<=0.49 ha	42.1	60.0	28.6	
13	0.50-0.99 has	47.4	30.0	57.1	
14	>=1.00 ha	10.5	10.0	14.3	4.248

Notes:
[a] * indicates significant differences between groups (10% or better), by Chi-square or ANOVA

Table 2.7 Household food expenditure by MPA, FSIPM research sites, 1996/97 (MK/capita).

No.	Food items	Tercile 1 (n=36)	Tercile 2 (n=41)	Tercile 3 (n=42)	Prob.-value
1	Green maize	3.40	4.41	4.24	.6625
2	*Nsima*	9.67	9.04	10.81	.6311
3	Cassava	0.17	0.23	0.34	.6837
4	Sorghum/millet	0.00	0.00	0.02	.4032
5	Rice	0.23	0.71	0.42	.5522
6	Other cereals	0.56	0.24	0.37	.7409
7	Pulses	1.37	2.18	2.37	.3404
8	Other vegetables	2.11	2.70	2.23	.6231
9	Fish	2.10	1.30	2.54	.2729
10	Meat	1.15	0.65	1.14	.6839
11	Chicken	0.56	1.20	0.80	.6051
12	Yellow buns	0.17	0.70	3.81	.2853
13	Milk/dairy products	0.22	0.35	0.52	.8341
14	Bananas	0.04	0.07	0.15	.5002
15	Other fruits	1.21	1.09	2.15	.2613
16	Potatoes	1.73	0.60	0.45	.1819
17	Eggs	0.38	0.42	0.33	.9362
18	Cooking oil	0.84	0.83	1.31	.5127
19	Sugar	1.21	0.95	3.16	.0003
20	Salt	0.56	0.85	1.51	.1592
21	Infant formula milk	0.00	0.30	0.00	.3896
22	Soft drinks	2.55	0.18	0.32	.3254

Table 2.8 Household non-food expenditure by MPA, FSIPM research sites, 1996/97 (MK/household)

No.	Non-food items	Tercile 1 (n=36)	Tercile 2 (n=41)	Tercile 3 (n=42)	Prob.-value
1	Soap	18.24	19.25	21.19	.6959
2	Tobacco/alcohol	9.81	7.20	4.36	.5806
3	Paraffin	5.23	7.04	10.52	.0291
4	Food processing	9.69	10.78	10.95	.7918
5	Clothing	44.89	40.76	62.64	.7656
6	Footwear	11.98	8.93	13.69	.9173
7	Blankets	4.17	6.34	3.33	.8561
8	Household wares	19.25	6.52	5.17	.2449
9	Medicine	15.38	27.64	23.22	.5943
10	Hospital fees	2.97	19.81	18.60	.4228
11	Transport charges	45.89	30.37	40.79	.6942
12	Education	0.00	2.44	58.81	.2737
13	Charcoal	1.67	2.32	9.55	.2840
14	Batteries	6.69	13.07	11.50	.3008
15	Coffee/tea	1.00	1.27	6.17	.0502
16	Housing	0.28	0.00	2.14	.0790
17	House maintenance	6.53	4.39	122.86	.4133
18	Debt repayment	9.27	34.15	93.33	.0248
19	Other non-foods	0.02	2.68	25.52	.3961

Table 2.9 Farm asset ownership by MPA, FSIPM research sites, 1996/97

(households)

No.	Variable	All households (n=120)	Tercile 1 (n=36)	Tercile 2 (n=42)	Tercile 3 (n=42)	Sig.-level
1	Maize Provision Ability (months)	7.2	3.1	7.7	10.2	254.22 *
	Households owning livestock					
2	- cows	3	-	2	1	1.807
3	- calves	3	-	1	2	1.807
4	- goats	37	10	10	17	2.960
5	- kids	17	3	2	12	11.229*
6	- pigs	8	5	1	2	4.502
	Households with					
8	- fruit orchard	36	7	13	16	3.239
9	- woodlot	22	5	7	10	1.394
10	- homestead vegetable garden	43	8	17	18	3.981

Note:

[a] * indicates significant differences between groups (10% or better), by Chi-square

3.0 Farming systems

The baseline survey did not attempt an in-depth exploration of the farming system, which will be made in 1997/98. Rather, the survey collected quantitative data on several key variables. In particular, care was taken to collect and cross-check data on the use of inorganic fertiliser, both at the farm and plot level. As noted, field measurements were obtained through triangulation and pacing, which reduces the accuracy of information on fertiliser rates, though comparisons between households are unaffected.

The sample

Table 3.1 shows selected farming systems variables for the sample and separately for three farm size groups.

Average farm size was 0.67 ha, higher than the 0.39 ha recorded for the RDP by the NSSA in 1992/93 (GoM, 1996: I, 223; II, 347). Only 43 % of total household income came from on-farm sources, with the remainder derived from off-farm employment. The relatively high proportion of household income earned off-farm limits the potential for labour-intensive IPM strategies, particularly during the months when households must earn cash to buy maize. Hybrid varieties covered one-third of the area planted to maize. A growing proportion of sample households reported adoption of hybrid maize varieties over the past three seasons, with 62 % reporting their use in 1996/97. Only 27 % of total households used true hybrid seed, however, while 35 % used seed recycled from previous seasons. Nine of ten households grew pigeonpea, with 38 % planting modern varieties of unspecified origin.

Adoption of inorganic fertiliser had declined since 1994/95, with 53 % of households reporting its use in 1996/97 compared to 65 % in 1994/95. Averaged across users and non-users, fertiliser rates were low at just 28 kg/N/ha for the total area planted to maize, and 34 kg/N/ha for the area planted to maize which received fertiliser. Among users, rates were obviously higher, averaging 53 kg/N/ha on the total area planted to maize and 64 kg/N/ha on the area planted to maize which received fertiliser. User rates appear similar to the revised DAR recommended rates 'for home consumption' for Blantyre Shire Highlands RDP (Benson, 1997). Although less than half the area planted to maize received fertiliser, costs per household were substantial, averaging 629 MK/household among households which used fertiliser in the survey year.

Farming systems variables by size of farm

Tercile grouping by farm size produced several significant differences among farming systems variables (Table 3.1). Tercile 1 (0.29 ha) represented a marginal group with 65 % of household income derived from off-farm sources, while Tercile 3 (1.18 ha) represented active farm households with holdings large enough for agriculture to supply half of household income. Among this marginal group, the crude adoption rate for 'hybrid' maize had risen over the past two seasons from 53 % to 62 % of households. Consequently, there was no significant difference in adoption of 'hybrid' maize between the three farm size groups during the survey year, and no significant difference in the proportion of maize area planted to 'hybrid' varieties. Fertiliser rates among users were higher among the lowest tercile, reaching 84 kg/N/ha on the area planted to maize which received fertiliser. Despite high fertiliser rates and the small area cultivated by households in the lowest farm size tercile, however, they fertilised only half the area planted to maize.

Farming systems variables by MPA

Tercile grouping by MPA gave important insights into the nature of the farming system (Table 3.2). As noted in Table 2.4, levels of MPA were not determined by farm size. MPA varied significantly according to use of inputs such as fertiliser and hybrid maize seed, however. Households with highest MPA (Tercile 3) had significantly higher crude adoption rates of hybrid maize in 1995/96 and 1996/97. They also had significantly higher crude adoption rates of inorganic fertiliser in 1996/97, and in the past two seasons. Finally, they had significantly higher fertiliser rates for maize. On the area planted to maize which received fertiliser, rates averaged 49 kg/N/ha among users and non-users, and 71 kg/N/ha among users.

Thus, household food security among the sample depended not on the area of land households cultivated but on land productivity. In particular, food security depended on access to hybrid maize seed, and sufficient fertiliser to allow fertilisation of 60 % of the area planted to maize at rates of 50 kg/N/ha and above. This finding establishes a clear linkage between low land productivity, the need to improve soil fertility, and the Project's purpose to reduce poverty among smallholders.

Female-headed households

Table 3.3 summarises selected variables for FHHs. As noted, mean farm size was significantly smaller among households headed by women (0.57 ha). This contributed to a lower share of household income originating in agriculture (36 %) and a correspondingly higher share earned off-farm (64 %). The high share of off-farm income among FHHs implies that they may be less willing or able to adopt labour-intensive IPM strategies, which may coincide with peak demand for hired labour.

Average area planted to maize was significantly lower among households headed by women (0.57 ha). The average area planted to hybrid varieties was also lower (0.27 ha), though the difference was not statistically significant. Over the past three seasons, the proportion of FHHs planting 'hybrid' maize had increased significantly, with six in 10 households growing 'hybrid' varieties in 1996/97. By contrast, the proportion of male-headed households growing hybrids actually declined, from 70 % in 1994/95 to 62 % in 1996/97. However, a higher proportion of FHHs planted recycled rather than pure hybrid seed.

About one-third of the sample reported growing modern varieties of pigeonpea; the proportion growing modern varieties did not differ significantly between the two groups.

The proportion of FHHs using fertiliser had declined since 1994/95, from 62 % to 48 %. This appears to have been a general trend, however, since the proportions did not differ significantly by sex of household head. Averaging across users and non-users, fertiliser rates for maize were lower among households headed by women, as was the proportion of maize area fertilised, but these differences were not statistically significant. In terms of access to purchased inputs, therefore, FHHs were not disadvantaged in relation to households headed by men.

Mean expenditure on fertiliser among FHHs which used fertiliser was 658 MK/household, which was not significantly different from male-headed households. Fewer FHHs applied pesticides to *dimba* crops, however, perhaps because *dimba* was used primarily to supplement maize production rather than grow high-value vegetables. This would also free up cash to purchase fertiliser (see below). Cash expenditure on pesticides among FHH *dimba* growers averaged 31 MK/household, compared to 115 MK/household among male-headed households.

Attempts to disaggregate FHHs by MPA once again failed to produce many significant differences (Table 3.4). The exceptions - vital ones - lay in hybrid seed and fertiliser rates. A significantly higher proportion of FHHs in the highest tercile used unrecycled hybrid seed, whereas those in the lowest and middle terciles used hybrid seed retained from past seasons. A higher proportion of FHHs in the highest tercile used fertiliser (six in 10). More importantly, among FHHs which used fertiliser, those in the highest tercile used signficantly higher rates on the total area planted to maize. In other words, they fertilised proportionately more of the area planted to maize (60 %), and incurred significantly higher fertiliser costs (790 MK/household). As before, therefore, the data suggest an important link between fertiliser use and food security.

The analysis suggests, therefore, that despite smaller mean farm size and fewer labour resources, FHHs have managed to retain access to inputs of fertiliser and, to a lesser extent, hybrid maize seed. Two factors seem to have been important in this process. One has been access to *dimba*, which has been used to grow *dimba* maize rather than vegetables, and which is harvested early during a period of high prices. The other factor has been the high proportion of income earned off-farm. It would be interesting to learn more about sources of off-farm income among FHHs. Women in FHHs may be more willing than men to work on estates for low wages, provided they are can secure enough employment to reach a certain target income. They may also be more willing to accept lower margins on petty business and marketing activities. In any event, off-farm employment has generated sufficient cash to allow FHHs to maintain access to fertiliser despite rising prices

Fertiliser rates

Based on the 1995/96 Fertiliser Verification Trials, the recommended fertiliser rates are for 'home consumption' are 69 kg/N/ha for Matapwata EPA and 92 kg/N/ha for Mombezi EPA. Recommended rates for 'market sale' are 35 kg/N/ha for both EPAs (Benson, 1997).

Table 3.5 shows the costs of four different fertiliser rates, using 1997/98 prices, for fertilisers which will be used in FSIPM OFTs (CAN and 23: 21: +4S). The lower cost of CAN (298 MK/bag of 50 kg) compared to 23: 21: 0 + 4S (374 MK/bag) gives a large cost advantage, despite CAN's lower proportion of active nitrogen. Average household expenditure among users in the survey year was 628 Mk/household. The average area planted to maize was 0.67 ha. Hence, expenditure was equivalent to 937 MK/ha/household. The index of farmers' expenditure on fertiliser shows that, given the same level of cash expenditure on fertiliser as in 1996/97, fertiliser *users* can afford to apply the recommended fertiliser rate of 35 kg/N/ha on the total area planted to maize. A fertiliser rate above 35 kg/N/ha would require either greater expenditure or leaving unfertilised some of the area planted to maize.

Determinants of fertiliser use

Multivariate regression was used to identify variables determining farmers' decision to fertilise maize. Previous work has modeled fertiliser adoption in Malawi as a simple either-or decision, using a dichotomous dummy variable (Green and Ng'ong'ola, 1993). However, this specification with FERT96 (1=Yes, 0 otherwise) as the dependent variable did not give meaningful results for FSIPM sample households. An alternative index of adoption - the average nitrogen rate applied to the total area planted to maize, including the area which was not fertilised (MZNRATE) - was therefore used. Rather than measuring the crude adoption rate of fertiliser, this variable measures the intensity of fertiliser use.

Average nitrogen rate was hypothesised to depend on 10 physical and socio-economic variables. Fertiliser use was expected to be low or absent in dambos which experienced heavy flooding (CHITERA). Rates were also expected to be lower on farms with steep hillslopes, increasing the risk of runoff (SLOPE). Nitrogen rates were expected to be vary inversely with the area planted to maize (MZAREA) but to be higher on farms with a high proportion of total maize area planted to hybrid seed (MVMZPER).

Among socio-economic variables, intensity of fertiliser use was expected to depend largely on credit or disposable cash income. In the absence of functioning maize clubs, access to formal credit in 1996/97 depended on membership of a smallholder burley club (BCREDIT). Indices of disposable cash income included dimba maize (DMAIZE); household self sufficiency in maize in 1995/96 (MPA95); and whether the household normally sold maize (SELLMZ). Finally, rates were hypothesised to depend on experience with fertiliser the previous season (FERT95) and to be lower for female-headed households (FHH).

Table 3.6 shows that the specification expained only one-fifth of the observed variation in nitrogen rates/ha. Of 10 independent variables, however, five were significant at the 5 % level or above.

Both the CHITERA and SLOPE variables displayed the expected negative signs, but neither were statistically significant. MZAREA was also negative, indicating that the larger the area planted to maize, the lower the average nitrogen rate (though average rates *on the area fertilised* were higher, Table 3.1). Rates were also positively associated with the proportion of maize planted to hybrids, but not significantly so.

Among socio-economic variables, DMAIZE, SELLMZ, and MPA95 were all statistically significant. The sign for DMAIZE was positive, indicating that this functioned as a source of cash for fertiliser, or because *dimba* maize can be grown without fertiliser, releasing cash to buy fertiliser for maize planted on upland fields. The SELLMZ variable displayed a negative sign, indicating that high nitrogen rates were not a feature of households which normally sold maize. This suggests that the primary function of high nitrogen rates is to secure the household's own maize consumption. Finally, nitrogen rates were higher among households with high MPA in 1995/96, reflecting the availability of cash to purchase inputs rather than food. The FHH and BCREDIT variables displayed the expected signs but the coefficients were statistically significant.

Types of fertiliser

Of the 3.7 mt N applied during the survey year by sample households, 93 % comprised the high analysis fertilisers CAN and Urea, normally applied as topdressing (ie. after planting) [Table 3.7]. Virtually no households applied basal fertilisers (ie. at or before planting) such as 23: 21: 0 +4S. Current knowledge of farmers' fertiliser practices suggests a strong preference for topdressing over basal, with first application at first weeding rather than planting. Thus, OFT fertiliser treatments simulating farmer practice should avoid basal application at planting.

Crop mixtures

Figures shown for the area planted to crop mixtures are highly approximate. Information was derived from a simple listing of crops found growing in the same field. Typically, a specific intercrop might occupy only part of a field, rather than the entire are planted to maize. It was too difficult to measure the precise area planted to each intercrop, however. Consequently, the figures for each intercrop measure the total area of the field. Again, intercrops were frequently grown separately with maize, with one or more portions of the field reserved for beans and another for pigeonpea, for example. Thus, the description maize + beans + pigeonpea does not necessarily mean that these two intercrops were grown on the same ridge wth maize, but only that they were recorded as growing in the same field. Finally, the area under sweet potato and fieldpeas were underestimated because they were planted after the first round of the survey, when most of the crop data had already been collected. The area planted to cassava, which is widely grown on border ridges, was not measured.

Ninety-eight percent of the area planted to maize was intercropped with only 2 % grown in pure stand (Table 3.8). Of the area planted to maize which was intercropped (76.26 ha), only a small area was intercropped with other cereals, chiefly sorghum, often grown on border ridges. The main maize intercrops were beans and/or pigeonpea. Of maize-bean crop mixtures, maize + beans occupied only 8.64 ha (18 %). The most common mixture was maize + bean + pigeonpea (28 %). Among pigeonpea mixtures, maize + pigeonpea was most popular, covering 31 % of the area planted. Thus, pigeonpea appears to be grown more commonly than beans as a single intercrop with maize. Interviews suggest that farmers believe beans perform poorly when intercropped with pigeonpea, some saying the pigeonpea roots produce inhibiting exudates, and shade out the relay-bean crop. Interestingly, the area occupied by the maize + beans + pigeonpea mixture was only 13.75 ha or 18 % of the area planted to intercropped maize, suggesting this mixture is less common than supposed. However, summing the areas planted to maize + beans, maize + pigeonpea, and maize + beans + pigeonpea shows that beans and pigeonpea together accounted for 44.15 ha or 58 % of the area planted to maize which was intercropped. Another popular intercrop was cowpea. Grown with beans or pigeonpea, it occupied 27.52 ha or 36 % of the area planted to maize which was intercropped.

***Dimba* crops**

As we have seen, the proportion of households cultivating *dimba* gardens did not differ significantly by farm-size or by MPA (Tables 2.2 and 2.3). Nor did the proportion of households with *dimbas* which applied pesticides (Tables 3.1 and 3.2) *Dimba* production was concentrated in Matapwata EPA, primarily alongside two streams in Kambua and Magomero (Table 3.9). The minor role of *dimba* in Mombezi EPA reflects shortage of reliable sources of water, and predominance of heavy clay soils in Chitera dambo which dry easily. This underlines the importance for Mombezi households of burley tobacco and sweet potato as sources of cash income. Cabbage - the most profitable vegetable crop - was grown exclusively in Matapwata, generally with tomato. Rape and mustard were also popular but little is known about profitability. Among the 15 households applying pesticides to *dimba* crops in Matapwata, expenditure averaged 92 MK/household. Expenditure on pesticides for *dimba* crops was recorded for only one household in Mombezi.

23D

Box 3.1 The vegetable grower...

Bambo Chimvula, 32, is an alert, resourceful farmer in Magomero known as "Chimvula za *dimba*" because he does not grow maize but relies solely on income from *dimba* vegetables. [1] Married but without children, he is the eldest in a family of five. Two brothers have married and left the village, while his two married sisters cultivate his mother's land. As the eldest son, he chose not to move to his wife's home in Chiradzulu, but to remain in Magomero to care for his elderly parents who live nextdoor but eat with him. His wife has no land and, to avoid quarrelling with his sisters, he has laid no claim to a share of his mother's land, but for the past nine years has rented and cultivated a *dimba* garden.

Chimvula rents *dimba* land for seven months of the year (March through September). Generally he rents from a different owner each year, although he once rented the same plot three years running. This season he is renting an 0.4 ha garden near the Tithelo stream. He pays MK 280 for the first crop (payable after harvest), and a similar sum for the second crop. After October, the owner will reclaim the land and plant *dimba* maize. Although demand for *dimba* has increased - ten years ago, the rent for the same area would have been only MK 85 - Bambo Chimvula reported no problem in finding land to rent.

His main vegetable crops are cabbage and tomato. Both are grown twice each year. Cabbage is planted in a nursery beside his house in February, transplanted in March, and sold in May. A second crop is planted in the nursery in October, transplanted in November, and harvested in February. The hybrid variety Marakanter is preferred for early maturity and large heads. Tomatoes are planted in the nursery in June, transplanted in July, and harvested in September. A second crop is planted in the nursery in September, transplanted in October, and harvested n December. The South African hybrid variety 6-labour force consists of Chimvula, his wife, and a young boy who works full-time throughout the year for 200 MK/month. Casual labour is also hired for land preparation, timely transplanting of cabbage from the nursery, watering later in the season when levels run low, and for head-carrying baskets of tomatoes to Bvumbwe market. During the season, Chimvula generally works from 0600-1100 hrs in the garden every day. Because *dimba* vegetables require careful management, he believes that renting more than one garden would reduce the quality of his vegetable crops.

Cabbage is fertilised at seven days after planting (DAP), dolloping both sides of each planting station at a rate of 20 grammes/planting station, and again at 60 DAP, applying 20 grammes to the surface. Tomato also receives two applications, once at seven DAP with 10 grammes dolloped on one side of the planting station and 20 grammes applied to the surface at flowering. Estimated fromChimvula's expenditure on fertiliser this season, the fertiliser rate was 60 kg/N/ha for cabbage and 80 kg/N/ha for tomato, at a total cost of MK 1,225/ha. Pests posed problems, notably sawfly (*Athalia*) on cabbage and red spider mite (*Tetranychus sp.*) on tomato. Green stink bug (*Nezara viridula*) was reported to be a pest of both cabbage and tomato. Advice on pest management came from other farmers and retailers (who recommended doses for liquid pesticides) rather than from the Field Assistant. Chimvula had never used insecticides made from local plant materials. For cabbage, he sprays twice weekly (Monday and Saturday) for three months with Cypermethrin, at the rate of 6 millilitres/15 litres of water. He buys a one litre bottle each season at a cost of MK 270. For tomato, he sprays three times each season, applying a mixture of one half kilogramme each of Copper Sulphate and Dithane against blight, at a total cost of MK 210. (These are below the recommended rates).[2] Thus, the total cost of chemical control in 1996/97 was 688 MK/ha for cabbage 675 MK/ha for tomato. His knapsack sprayer, bought new for MK 600, was purchased five years ago.

Last season (1995/96) Chimvula's cabbages grossed only MK 900 and MK 700 for the first and second crop, respectively. This season Chimvula's first crop of cabbages did little better. In June, he hired a pickup for MK 250 and transported 400 cabbages to Bvumbwe market, where they sold for MK 2.5/head, earning him a total of MK 1,000. He attributes the low price to oversupply and the need to sell his crop in one day to avoid spoilage. Barring disease problems, he anticipates earning MK 3,000 from his first tomato crop this season. Most of the crop is sold at the farmgate to wholesalers

Box 3.1 cont.

(*pikulitsa*) from town or the village, though sometimes he pays MK 10/load for labour to carry baskets to Bvumbwe market. Bambo Chimvula has no wish to grow maize, since he does not consider it profitable. Instead, he relies on income from vegetables to finance maize purchases. After the tomato harvest in October, he buys maize and sells in the slack months before the harvest when prices are highest. Although he also earns cash from livestock (he owns four goats and a pig), *dimba* vegetables provide the main source of household income.

Notes:

[1] A *dimba* is an area of agricultural land with impermeable soils, adjacent to a stream or lying above an underground water-course, which can be cropped throughout the year using residual moisture or irrigation from streams or wells.

[2] Recommended doses: Cabbage: Cypermethrin, 5 millilitres/10 litres water; Copper, 30-40 grammes/10 litres; Dithane 45 m, 20 grammes/10 litres. Tomato: Cypermethrin, 5-12 millilitres/10 litres water; Copper, 50 grammes/10 litres; Dithane 45m, 20 grammes/10 litres.

'Foodcrops' and 'cash crops'

Table 3.10 shows the major crops grown by the sample households, together with their end-uses. Of 22 crops listed, eight were normally grown by over half the households in the sample. Maize, beans, and pigeonpea - the three foodcrops targeted by the FSIPM Project - were grown by 79 % , 91 %, and 93 % of sample households, respectively. Sweet potato and field peas were grown by 78 % and 76 % of households, respectively.

A feature of the farming system is that there is no clear distinction between food and cash crops. With the exception of burley, all crops were used both for cash and home consumption. Of 22 crops listed, 15 (68 %) were reported to be normally sold by half or more of the households which grew them. Although relatively few households were self-sufficient in maize (8 % in 1996/97, and 32 % in 1995/96), over half the sample regularly sold hybrid maize. Among the 8 crops grown by over half the sample, pigeonpea and fieldpeas were the most popular cash crops, with nearly 7 of 10 growers selling.

Peters (1993: 30) has noted the frequency with which smallholders 'play the market' (selling one foodcrop to purchase another foodcrop which is later sold to take advantage of seasonal price increases) and questions the usefulness of labels such as 'commercial' and 'subsistence' farmers. However, there is a *qualitative* difference between this type of market behaviour (opportunist, low-volume, low-margin) and the market behaviour of farmers producing crops with high market value (high cash-outlay, high-volume, and high margin). Burley tobacco, cabbage, tomato, Irish potato, and to some extent sweet potato fall into this second category. The size and nature of these markets also differs, with producers of the crops listed above being drawn into wider national and international markets with greater price volatility and higher risks.

Asked to rank their three most important cash crops, households ranked field peas, beans, and pigeonpea as first, second, and third, respectively in terms of total score. Burley was ranked seventh, below hybrid and local maize. Of 22 crops listed, households reported that for 16 crops (73 %) half or more production was normally sold. The proportion of crop sold was high even for common foodcrops, with over half the production of beans and pigeonpea normally sold for cash. A high proportion of cassava was also sold. Others have noted the increased market value of this crop, which has displaced bread as a breakfast food among low-income urban households (Peters, 1996: 1-12). Both the high proportion of foodcrops sold for cash, and the high share of production sold, indicate the chronic shortage of cash in the smallholder farming system.

We conclude this discussion of 'cash crops' with three case studies of farmers growing burley, Irish potatoes, and sweet potato. Smallholder burley growing reflects a fundamental policy change, since before 1992 burley production was restricted to the estate sub-sector. Between 1992-1996, smallholders were allocated a quota of total production, marketed through clubs which had access to the international auction floors at Lilongwe and Limbe. In 1996, production was liberalised completely and smallholders were free to market burley through clubs or private traders known as intermediate buyers. Most smallholder production continues to be through clubs, however, which provide credit for fertiliser and other inputs.

Box 3.2 The burley tobacco grower...

Kalimu Sapanga (29) lives with his wife and one-year-old daughter in Lidala village, a short distance from the highway between Limbe and Zomba. His father, Kassimu Sapanga, had 15 children, but Kalimu is the only one of the six brothers still living in Lidala. He cultivates two gardens bordering the Chitera dambo, growing maize and burley tobacco. His household is normally self-sufficient in maize.

Kalimu joined the Chitandizo ("Help") burley club in 1994/95 and has now grown burley for three seasons. Currently the club (of which his father is the chairman) has 16 members. Until last season, production was restricted to a quota of 300 kg/member, but since 1996/97 members have been free to grow as much burley as they wish. Club membership provides access to credit from the Malawi Rural Finance Corporation (MRFC) for inputs (fertiliser for both tobacco and maize; plastic roofing sheets for burley-sheds; hybrid maize seed); advice on burley cultivation from the FA, Mr. Kadalinga. Above all, club membership gives access to the world market through the auction floor at Limbe where a cartel of international tobacco companies buy the cream of Malawi's tobacco crop. Until 1990/91, it was illegal for smallholders to grow burley (the most lucrative variety), and prices for other varieties were artificially depressed by ADMARC, the parastatal development and marketing board. Liberalisation has presented farmers like Kalimu Sapanga with an opportunity to grow Malawi's most lucrative cash crop.

Burley production is almost a year-round activity. After seedbed preparation and mulching in August, the seed is sown in a nursery in mid-September, where it remains for eight weeks. During this period, seedlings require watering two-three times/day. Fortunately for Kalimu, his father has a *dimba* well. After the first heavy rain, the crop is transplanted onto ridges. First fertiliser application is made seven days after planting (DAP), followed by weeding 21-30 DAP. The crop is topdressed and banked when about 60 cm tall, and harvesting begins shortly afterwards in January,extending until June. Bottom leaves are harvested first, transported to open-sided sheds, tied in bunches, and hung until dried. While harvesting continues the first leaves are sorted and graded ready for baling. Once sufficient bales are ready, they are shipped by the club to the auction floors, sold, and the cheque deposited in the club's account with the National Bank in Limbe, after which the money is divided between the growers.

Kalimu's experience over the three seasons has been mixed. In 1996/97, Kalimu bought six bags of fertiliser (D. Compound and CAN) and plastic sheets for his shed. With interest rates at 34 % per annum, the cost of this loan was MK 2,900. He also employs two full-time labourers for MK 150 and MK 200/month, respectively. Hired labour is also needed for land preparation, weeding, and particularly for timely harvesting, required on almost on a daily basis. Hired labour was also required for the skilled task of grading. This season he sold 340 kg of burley but after repaying the loan he received only MK 2,000. He blamed the heavy rain which washed away transplanted seedlings and leached fertiliser, and cold temperatures which blackened the leaves while drying. Consequently, of 340 kg sold in 1996/97 only 13 kg was graded as good quality, and his gross income from tobacco (net of loan and interest payments) was only MK 2,000. In 1995/96, by comparison, he sold 450 kg and received MK 9,000 after loan and interest payments.

Kalimu reported that pests were not a serious problem. Pesticide sprays (Diathin, Sevin) were used against small ants which attacked seedlings in the nursery; these were provided by the FA. Other farmers used Actellic against this pest. Tobacco mosaic virus, which curls the leaves, was treated by uprooting and burning the affected plants. The FA reported termites and caterpillars, which bored into the stem as pests in the 1996/97 season. Kalimu grew his burley on different fields each season to avoid build up of pests, particularly nematodes. The extension recommendation to uproot tobacco stalks before 31 May was widely ignored.

Box 3.2 cont.

Despite incurring a loss in 1996/97, for next season Kalimu planned to increase production to 500 kg. He anticipated a loan for seven bags of fertiliser (three of D. Compound and four of CAN) of which two bags would be used for maize. Given a good crop, the profit would be used to finance a business trip to South Africa selling curios from Machinga. His profits from 1995/96 had also been invested in business and brought a handsome return, buying Irish potato from Ntcheu at 250 MK/bag and selling for 500 MK/bag in Blantyre. Making one trip a week for six months between June-September, his gross income from selling Irish potatoes was higher than that received from burley.

Total smallholder burley production in Blantyre Shire Highlands RDP in 1996/97 was 12.7 mt, worth approximately $ US 19,524 on the Limbe auction floor. On average, growers received a gross return of $ US 591/ha on a yield of 1,237 kg/ha. High potential returns from tobacco explain the explosive growth in burley production in southern Malawi. In 1997, Blantyre Shire Highlands RDP had a total of 323 smallholder burley clubs with a total membership of 6765 households. The highest concentration of clubs was in Mombezi EPA, with 113 clubs (38 %) and 2984 members (44 %). Lirangwe section, where Kalimu Sapangu lives, boasts 13 clubs with a total of 210 members.

Commercial cultivation of Irish potato began in Matapwata in the late 1960s, with support from agricultural research and extension staff. Some years ago, however, heavy rain destroyed the crop and left farmers without seed. Until the mid-1980s, Bvumbwe Research Station had been the major supplier of potato seed, since high losses in storage and economic pressures had forced Irish potato growers to sell most of their crop at harvest. Financial cutbacks at Bvumbwe meant that seed became unavailable. In 1996, however, a fresh initiative made seed available to growers in Matapwata once again. Farmers were supplied with seed (30 kg) and fertiliser, repayable in kind after harvest. The variety promoted - Rosalita - is palatable, and tolerates late blight. It was first released 10 years ago and is the variety of choice in Dedza and Ntcheu, the major production centres. Judging from the response by farmers in Matapwata EPA, Irish potato promises to be highly profitable (Box 3.3).

Box 3.3 The Irish potato grower...

Cliff Chapita, in his early 50s, lives with his wife and six children in Chilemba village, about 6 kms from Magomero. Visible from the roadside, his tin-roofed and brickbuilt house is surrounded by flourishing crops of tomato, onions, and Irish potato. Formerly estate land, he inherited the holding (estimated at 0.6 ha) from his parents in 1983. The household is self-sufficient in maize, grown on two rented upland fields some distance away. A born farmer, Cliff Chapita is found in his fields every morning. His shrewd commercial sense has served him well, with vegetables providing the lion's share of household income for the past 10 years.

His mainstay is the tomato crop, with about 7,000 seedlings. Irrigation means that tomato can be planted in October and harvested from December onwards, when prices are three times higher than at present. Irrigation is provided from a natural spring on his property, dammed to form a miniature pond, which is also used for aquaculture. Onions are his second most profitable crop. Cabbages are not grown. Between 1988-1994, he grew cabbages on 'tender' for Naming'omba Estate, south of Bvumbwe. He contracted to supply 1,200 cabbages weekly for the whole year, most being grown on his own farm, supplemented by purchases in March-May. During this period he grew no other vegetables. In 1994 he discontinued the contract, and returned to growing tomato and onions. He started with Irish potato in 1996. Too many people were growing cabbage, he complained; it was time to find a more profitable crop.

Seed ('Rosalita') was bought from Bvumbwe, and his first crop was planted in an upland field in November last year, harvesting in March and April. A second crop was then planted on *dimba* land in July 1997, and is now ready for harvesting. This coming November the cycle will start again as he plants another upland crop. Cultivation practices vary according to landtype. The field is tilled and flattened in readiness for planting. Straight lines are then marked and holes made for planting stations.

Box 3.3 cont.

Basal fertiliser (23:21:0) is either dolloped in the planting station with the seed or applied just after planting. Earth is then ridged up over the seeds. First weeding normally occurs two weeks after planting, followed by banking at roughly four weeks after planting. A topdressing of CAN is given to the upland crop after banking. After banking, *dimba* potatoes require watering in the morning three times a week, while the upland crop relies on the rains. *Ganyu* labour was used for all operations, with Mr. Chapita working alongside.

Unlike tomato, which suffered badly from wilt, pests were not a serious problem with Irish potato. The dimba crop suffered from cutworms at sprouting stage and was sprayed once with Ripcord (MK 125 for 250 mls). Bacterial wilt (*pseudomonas solanacearum*) was the major pest of Irish potato grown in the upland. It attacked the crop from six weeks after planting onwards; since no control method was known, no curative action was taken. Storage was another headache with the upland crop, which was harvested in the period when farmers relied on rain for relay beans. Once harvested, the crop had to be kept dry at all costs.

Of the two plantings, the *dimba* crop (July-October) had been easily the most profitable. It required less fertiliser (two bags of 23:21:0 and one of CAN, total MK970), and demand was also higher in October when many households had run out of maize. Mr. Chapita had just sold two bags of his *dimba* crop for MK 2,460 gross. He expected to harvest another eight bags or more, earning a potential gross return of over MK 11,000. Yields would have been higher had he managed to plant in June, but seed retained from the upland crop germinated late. Prices were variable, from 6 MK/kg at the farmgate to 9 or 10 MK/kg in Blantyre or Limbe. Allowing for transport costs, and a labour bill estimated at MK 3,000, Irish potato in the *dimba* still brought a handsome return. Irish potato on the upland presented a gloomier picture, however. Higher fertiliser costs (2.5 bags of 23:20:0 and 2.5 bags of CAN, value MK 1,545), plus a labour bill of MK 4,000, but a much poorer crop which fetched only MK 4,000 when sold at the farmgate. Although he planned another upland crop this year, he was hopeful of higher prices since his brother who worked in town had identified a buyer. Without such personal contacts, however, it was difficult to cut out the middleman.

An example of an entrepreneurial women farmer is provided in Box 3.4. Although married, Mai Chisanga has full authority over production of the household's major cash crop, sweet potato while her husband cares for two dairy cows.

Box 3.4 The Sweet Potato seller...

Mai Chisanga (58), lives in Pindani village in Matapwata EPA, 3 kms from the Blantyre-Mulanje highway, close to Luchenza. The household is comfortably off, living in a brick-built house with glass windows, roofed with iron sheets. Of four surviving chidren, the eldest is married and three attend boarding school in Blantyre and Luchenza. Three orphaned grandchildren also live with the household, attending the local primary school. Both she and her husband are active farmers with a reputation as innovators. Bambo Chisanga keeps two pure-bred Friesans, purchased five years ago from a nearby estate for MK 2,000. Today each animal is worth MK 15-18,000. He employs two full-time cattlemen and sells about 70 litre/day to Thondwe Bulking Group, earning 10-15,000 MK/month. In turn, Mai Chisanga manages the field crops, in particular two gardens totalling about 1 ha planted to the household's main cash crop, sweet potato.

Sweet potato vines are planted in a nursery in August to keep and multiply the vines; the nursery is located in a dambo, and vines are watered once a week until the first rains. Since she gives first priority to making ridges for maize, ridges for sweet potato are not prepared until soon after the start of the rains. Sweet potato is planted out in January, then weeded twice, once after establishment and again at maturity. At second weeding the crop is 'earthed up' to cover any cracks which have emerged in the ridge. Harvesting begins in March/April for the hybrid variety Kenya (three-four months' field duration) and in June/July for the local variety (known simply as *cha makolo*, 'of the ancestors'), which

Box 3.4 cont.

has a field duration of six months. The hybrid variety does not store well, so is sold directly from the field. By contrast, local varieties are stored in straw-roofed pits for sale later in the season. The floor of the pit is prepared by burning straw before storage, and the tubers are protected by layers of ash, which are replaced every three months. Mai Chisanga, who learned this technique at the government farm at Thucila, stores some local sweet potato until October to ensure a good price.

Hired labour was required for both the two gardens of sweet potato and three further gardens planted to maize, beans, relay beans, pigeonpea, and soya. Mai Chisanga employed four full-time female labourers (earning 150-200 MK/month), and four additional women at peak periods. Otherwise, cash costs were low. Unlike maize, no fertiliser was applied to sweet potato. Mai Chisanga was aware of crop losses associated with holes bored in the tubers but was unaware that these were caused by the sweet potato weevil (*Cylas pucticollis*). In her view, the problem became serious only when mature plants were harvested late, in June and July. Late harvesting was due chiefly to shortages of labour in March and April, when hybrid maize was harvested, shelled, and bagged, and when relay beans, field peas, and soya were planted to take advantage of the last rains. Even with eight hired workers, it was often difficult to complete these operations and finish harvesting of sweet potato in time.

Last season (1996/97) she harvested 20 bags (90 kg each) of the hybrid variety Kenya which, together with smaller amounts, was sold directly from the field. Buyers came from Blantyre, purchasing sweet potato by the truckload. In addition, she filled two storage pits of local sweet potato, of which the first has already been sold and the second will be sold in October. Mai Chisanga attributed the growth in sweet potato cultivation to the poor late rains in recent seasons, which had discouraged farmers from growing relay beans and field peas, formerly grown as cash crops. A more important factor, perhaps, has been the availability of the hybrid sweet potato variety Kenya: yielding double the local variety, it is also more tolerant of moisture stress and its shorter field duration is useful for farmers who need a quick cash crop. According to the FA, Mr. Kanyika, the growth in sweet potato production in this area dates from 1994/95, when Kenya vines first became widely available. Today, sweet potato has displaced field peas and relay beans as the major cash crop.

Variety groups for maize, beans, and pigeonpea

Table 3.11 shows that MH 18 was the most popular hybrid variety, grown by 50 households or 68 % of those planting hybrid maize. Next in popularity was the variety NSCM41, which has a shorter field duration than MH18 (120-130 days, compared to 130-140 days). Of the five bean varieties shown, Chimbamba was planted by 71 % of growers, followed by Kaulesi (31 %) and Nanyati (20 %). Only half the sample reported growing MV pigeonpea, described variously as '*wa research*' or '*Chinese*'. Among sweet potato growers, '*Research*' or '*Chinese*' was grown by 42 % of households, followed by Kachewere (39 %). The low proportion of growers (11 %) planting the variety Kenya is puzzling in view of its popularity elsewhere. Finally, cassava was dominated by the varity Masangwi, planted by 71 % of growers.

A significantly higher proportion of farmers grew hybrid maize in Matapwata than in Mombezi (72 % and 52 %, respectively). Bean varieties were also more diverse, with more growers planting the varieties Kaulesi and Kayera. By contrast, MV pigeonpea was more widely grown in Mombezi, with 64 % of growers reporting this variety planted. The proportion of households growing sweet potato, centring around the variety Kachewere, was also higher in Mombezi than in Matapwata (58 % and 42 % of growers, respectively). Cassava growing was almost exclusively a feature of Matapwata, however.

Sources of seed for maize, beans, and pigeonpea

Seed recycled from the previous season was the most important source of seed for maize among the sample (Table 3.12). Purchased seed from local markets, retail outlets such as PTC, and ADMARC, was more important among households with higher MPA. By contrast, most bean seed was purchased from local markets rather than retained. The reason for this is not clear. Dependence on purchased seed for beans was greater among households with lower MPA. Finally, most households grew pigeonpea using retained seed, with no significant differences observed between the three groups .

Among growers of these crops, cash expenditure on seed during 1996/97 averaged 33 MK/household for maize, 20 MK/household for beans, and 4 MK/household for pigeonpea.

Table 3.1 Selected farming systems variables by farm size, FSIPM research sites, 1996/97.

No.	Variable	All households (n=120)	Tercile 1 (n=41)	Tercile 2 (n=39)	Tercile 3 (n=40)	Sig.-level [a]
1	Farm size (ha)	0.67	0.29	0.55	1.18	74.50 *
	Sources of income (%)					
2	- own farm	43.3	35.3	44.1	50.8	1.53
3	- off-farm	56.7	64.7	55.9	49.2	1.53
4	Area planted to maize (ha)	0.65	0.28	0.53	1.15	64.35 *
5	- 'hybrid'	0.33	0.10	0.24	0.66	26.98 *
6	- local	0.31	0.18	0.28	0.47	6.47 *
7	% 'hybrid'	54.1	35.7	45.3	57.4	0.55
	Growing 'hybrid' maize (%)					
8	- 1994/95	53.3	39.0	56.4	65.0	5.71 *
9	- 1995/96	65.0	48.8	74.4	72.5	7.23 *
10	- 1996/97	61.7	48.8	69.2	67.5	4.39
11	Growing unrecycled hybrid maize in 1996/97 (%)	26.7	19.5	30.8	30.0	0.11
12	Growing recycled hybrid maize in 1996/97 (%)	35.0	29.3	38.5	37.5	0.11
13	Growing pigeonpea (%)	88.3	92.7	79.5	92.5	4.38
14	- modern variety	38.3	29.3	38.5	47.5	2.85
15	- local variety	60.0	68.3	53.8	57.5	1.89
	Applying fertiliser (%)					
16	- 1994/95	65.0	56.1	56.4	82.5	8.08 *
17	- 1995/96	64.2	56.1	61.5	75.0	3.31
18	-1996/97	53.3	48.8	48.7	62.5	2.03
	Fertiliser rates (users and non-users) (kg/N/ha)					
19	- total maize area	27.8	39.0	23.8	20.4	3.24 *
20	- fertilised maize area	33.8	40.8	32.6	27.8	1.05
	Fertiliser rates (users only) (kg/N/ha)					
21	- total maize area	53.0	79.9	51.5	32.6	17.49 *
22	- fertilised maize area	64.4	83.7	70.7	44.5	9.31 *
23	Maize area fertilised (%)	44.6	48.2	36.1	47.4	0.809
24	Total cost of fertiliser among users (MK/hh)	629	404	695	754	3.087 *
25	Applying pesticides to *dimba* crops (% of *dimba* growers.)	36.8	28.6	57.1	37.5	1.621

Notes:

[a] * indicates significant differences between groups (10% or better), by Chi-square or ANOVA

Table 3.2 Selected farming systems variables by MPA, FSIPM research sites, 1996/97.

No.	Variable	Tercile 1 (n=36)	Tercile 2 (n=42)	Tercile 3 (n=42)	Sig.-level [a]
1	Maize Provision Ability (months/year)	3.1	7.7	10.2	254.22 *
2	Farm size (ha)	0.53	0.71	0.76	2.112
	Sources of income (%)				
3	- own farm	40.8	36.9	51.9	1.603
4	- off-farm	59.2	63.1	48.1	1.603
5	Area planted to maize (ha)	0.52	0.69	0.72	1.709
6	- hybrid	0.22	0.36	0.41	2.150
7	- local	0.30	0.32	0.30	0.013
	Growing 'hybrid' maize (%)				
8	- 1994/95	38.9	57.1	61.9	4.502
9	- 1995/96	44.4	64.3	83.3	12.901 *
10	- 1996/97	41.7	59.5	81.0	12.780 *
11	Growing unrecycled hybrid maize in 1996/97 (%)	19.4	16.7	42.9	8.738 *
12	Growing recycled hybrid maize in 1996/97 (%)	22.2	42.9	38.1	3.900
13	Growing pigeonpea (%)	83.3	85.7	95.2	3.096
14	- modern variety	36.1	38.1	40.5	0.158
15	- local variety	52.8	59.5	66.7	1.564
	Applying fertiliser (%)				
16	- 1994/95	41.7	64.3	85.7	16.546 *
17	- 1995/96	41.7	61.9	85.7	16.501 *
18	-1996/97	38.9	47.6	71.4	9.094 *
	Fertiliser rates (users and non-users) (kg/N/ha)				
19	- total maize area	18.0	22.7	41.4	5.151 *
20	- fertilised maize area	22.7	28.4	48.8	4.768 *
	Fertiliser rates (users only) (kg/N/ha)				
21	- total maize area	46.3	47.7	59.9	1.191
22	- fertilised maize area	58.2	59.7	70.7	0.850
23	Maize area fertilised (%)	25.9	39.7	60.7	6.135 *
24	Total cost of fertiliser among users (MK/hh)	331	429	870	8.4277 *
25	Applying pesticides to *dimba* crops (% of *dimba* growers)	25.0	38.5	43.8	0.800

Notes:

[a] * indicates significant differences between groups (10% or better), by Chi-square or ANOVA

Table 3.3 Selected farming systems variables, by sex of household head, FSIPM research sites, 1996/97.

No.	Variable	Total households (n=120)	Female-headed households (n=60)	Male-headed households (n=60)	Sig.-level [a]
1	Farm size (ha)	0.67	0.57	0.77	-2.22 *
	Sources of income (%)				
2	- own farm	43.3	36.0	51.0	-1.99 *
3	- off-farm	56.7	64.0	49.0	1.99 *
4	Area planted to maize (ha)	0.65	0.57	0.74	-1.84 *
5	- hybrid	0.33	0.27	0.40	-1.59
6	- local	0.31	0.29	0.32	-0.43
	Growing 'hybrid' maize (%)				
7	- 1994/95	53.3	43.3	70.0	3.33 *
8	- 1995/96	65.0	53.3	73.3	1.79
9	- 1996/97	61.7	61.7	61.7	0.00
10	Growing unrecycled hybrid maize in 1996/97 (%)	26.7	21.7	31.7	1.065
11	Growing recycled hybrid maize in 1996/97 (%)	35.0	40.0	30.0	0.916
12	Growing pigeonpea (%)	88.3			
13	- modern variety	38.3	36.7	40.0	0.035
14	- local variety	60.0	56.7	43.3	1.633
	Applying fertiliser (%)				
15	- 1994/95	65.0	61.7	68.3	0.34
16	- 1995/96	64.2	65.0	63.3	0.00
17	-1996/97	53.3	46.7	60.0	1.64
	Fertiliser rates (users and non-users) (kg/N/ha)				
18	- total maize area	27.8	24.0	31.7	-1.19
19	- fertilised maize area	33.8	51.3	54.3	-0.35
	Fertiliser rates (users only) (kg/N/ha)				
20	- total maize area	53.0	51.3	54.3	-0.35
21	- fertilised maize area	64.4	62.3	66.2	-0.44
22	Maize area fertilised (%)	44.6	38.9	48.9	0.42
23	Total cost of fertiliser among users (MK/hh)	628	658	594	0.2211
24	Applying pesticides to *dimba* crops (no.)	14	2	12	6.55 *

Notes: [a] * indicates significant differences between groups (10% or better), by Chi-square or ANOVA

Table 3.4 Selected farming systems variables for female-headed households, by MPA, FSIPM research sites, 1996/97.

No.	Variable	Tercile 1 (n=19)	Tercile 2 (n=20)	Tercile 3 (n=21)	Sig.-level [a]
1	Maize provision ability (months)	3.0	7.7	10.2	125.786 *
2	Farm size (ha)	0.57	0.51	0.63	0.890
	Sources of income (%)				
3	- own farm	34.2	33.0	41.0	
4	- off-farm	65.8	67.0	59.0	0.2575
5	Area planted to maize (ha)	0.57	0.51	0.62	0.6959
6	- hybrid	0.26	0.20	0.36	1.5118
7	- local	0.31	0.32	0.26	0.2442
8	- percent hybrid	45.6	39.2	58.1	4.542
	Growing 'hybrid' maize (%)				
9	- 1994/95	52.6	45.0	57.1	0.615
10	- 1995/96	57.9	55.0	81.0	3.649
11	- 1996/97	47.4	55.0	81.0	5.323 *
12	Growing unrecycled hybrid maize in 1996/97 (%)	10.5	10.0	42.9	8.738 *
13	Growing recycled hybrid maize in 1996/97 (%)	77.8	81.8	47.1	4.410
14	Growing pigeonpea (%)	89.5	90.0	100.0	2.312
15	- modern variety	42.1	40.0	28.6	0.930
16	- local variety	57.9	55.0	71.4	1.337
	Applying fertiliser (%)				
17	- 1994/95	47.4	60.0	76.2	3.540
18	- 1995/96	52.6	55.0	85.7	6.117 *
19	-1996/97	42.1	35.0	61.9	3.211
	Fertiliser rates (users and non-users) (kg/N/ha)				
20	- total maize area	18.15	12.38	40.23	4.4142 *
21	- fertilised maize area	25.76	17.62	42.91	2.2055
	Fertiliser rates (users only) (kg/N/ha)				
22	- total maize area	43.11	35.38	64.99	2.682 *
23	- fertilised maize area	61.17	50.35	69.31	0.642
24	Maize area fertilised (%)	26.3	27.5	59.7	17.884 *
25	Total cost of fertiliser among users (MK/hh)	348	398	790	8.4277 *
26	Applying pesticides to *dimba* crops (% of *dimba* growers)	0.0	0.0	31.0	na.

[a] * indicates significant differences between groups (10% or better), pairwise Chi-square or ANOVA

Table 3.5 Cost of recommended fertiliser rates at FSIPM research sites, 1997/98 (MK/ha).

Fertiliser rate kg/N/ha	CAN	23:21:0 +4S	Index of farmers' expenditure on fertiliser (1996/97)	
35	931	1138	99	121
50	1064	1626	114	174
69	1469	2244	157	239
92	1958	2992	209	319

Table 3.6 OLS estimates of determinants of nitrogen rates (kg/N/ha) applied to area planted to maize, FSIPM research sites, 1996/97.

Variable	Coefficient	S.E.	T-value	Sig. -level
Constant	20.7859	10.6746	1.947	.0541
BCREDIT	14.6936	11.8350	1.242	.2170
CHITERA	-9.2403	7.2169	-1.280	.2031
DMAIZE	27.5995	11.0438	2.499	.0139
FERT95	18.8316	6.9944	2.692	.0082
FHH	-8.8219	6.1566	-1.433	.1547
MZAREA	-21.0927	6.2420	-3.379	.0010
MVMZPER	0.0796	0.0721	1.103	.2723
MPA95	1.7105	1.0036	1.704	.0912
SELLMZ	-16.5798	6.9419	-2.388	.0186
SLOPE	-0.02644	0.1118	-0.236	.8136
Adjusted R^2: 0.20				
F-ratio: 4.038 (Sig. 1 % level)				
Durbin-Watson statistic: 2.08				
n = 120 households				

BCREDIT	Dummy variable for receiving credit from a burley club in 1996/97(1=Yes, 0 otherwise)
CHITERA	Dummy variable for Chitera *dambo* (1=Yes, 0 otherwise)
DMAIZE	Dummy variable for growing *dimba* maize (1=Yes, 0 otherwise)
FERT95	Dummy variable for using fertiliser in 1995/96 (1=Yes, 0 otherwise)
FHH	Dummy variable for female-headed household (1=Yes, 0 otherwise)
MZAREA	Area planted to maize (ha)
MVMZPER	Area planted to hybrid maize as proportion of total area planted to maize (%)
MPA95	Maize provision ability in 1995/96 (months)
SELLMZ	Dummy variable for normally sells maize (1=Yes, 0 otherwise)
SLOPE	Proportion of cultivated area with steep slope (%)

Table 3.7 Types of fertiliser applied, by MPA, FSIPM research sites, 1996/97.

(kg of N)

No.	Fertiliser type	All households (n=120)	Tercile 1 (n=36)	Tercile 2 (n=42)	Tercile 3 (n=42)
1	20: 20: 04	0.0	0	0	0
2	CAN	1675.0	246	392	1036
3	UREA	1773.0	141	505	1127
4	DAP	45.0	9	0	36
5	D. Compound	112.0	8	36	68
6	14: 20: 0	0.0	0	0	0
7	23: 21: 0 + 4S	23.0	0	0	23
8	Sulphate of Ammonia	0.0	0	0	0
9	Mixture of above	0.0	0	0	86
10	Total	3714	405	933	2376

Chi-square value for non-empty rows =129.274, df = 10, prob= 2.000 E-13

Table 3.8 Approximate areas planted, by crop mixtures, FSIPM research sites, 1996/97.

No.	Crop	Area (ha)	Share of area
	Total area planted to:		Share of area planted to main crops (%)
1	- maize	78.11	97.0
2	- burley	2.38	3.0
3	- total	80.49	100.0
	Pure stand:		Share of total area planted to crop (%)
4	- maize	1.85	2.4
5	-burley	1.18	49.6
6	- groundnut	0.19	2.1
	Nsima crop mixtures		Share of *nsima* crop mixtures (%)
7	- maize + sorghum	6.59	69.9
8	- maize + millet	2.15	22.8
9	- maize + millet + sorghum	0.23	2.4
10	- maize + rice	0.46	4.9
	Maize-bean crop mixtures		Share of bean crop mixtures (%)
11	- maize + beans	8.64	17.5
12	- maize + beans + pigeonpea	13.75	27.9
13	- maize + beans + fieldpea	4.95	10.0
14	- maize + beans+ cowpea	12.12	24.5
15	- maize + beans +soya	4.40	8.9
16	- maize+ beans+ groundnut	5.44	11.0
17	total	49.3	100.0
	Maize-pigeonpea crop mixtures		Share of pigeonpea crop mixtures (%)
18	maize + pigeonpea	21.76	31.2
19	- maize + pigeonpea + beans	13.75	19.7
20	- maize + pigeonpea + fieldpea	5.60	8.0
21	- maize + pigeonpea + cowpea	15.40	22.1
22	- maize + pigeonpea + soya	5.28	7.6
23	- maize + pigeonpea + groundnut	7.98	11.5
24	total	69.67	100.0

Table 3.9 Major *dimba* crops by EPA, FSIPM research sites, 1996/97

(no. households)

No.	*Dimba* crop	Matapwata (n = 58)	Mombezi (n=62)	Sig.-level [a]
1	Growers	29	8	17.636 *
2	Sugarcane	9	3	0.000
3	Bananas	5	2	0.000
4	Cabbage	15	0	4.979
5	Tomatoes	15	4	0.000
6	Rape	8	0	1.423
7	Mustard	10	0	2.234

Notes: [a] * indicates significant differences between groups (10% or better) by Chi-square.

Table 3.10 Food and cash crops grown by sample households, FSIPM research sites, 1996/97.

No.	Crop	Farmers growing (n=120)	Farmers growing (%)	Farmers selling (n=120)	Farmers selling (% of growers)	Cash crop score [a]	Share sold (%) [b]
1	Irish Potatoes	3	2.5	2	66.7	0.0	75.0
2	Rice	4	3.3	1	25.0	0.0	25.0
3	Tobacco	11	9.2	11	100.0	10.8	100.0
4	Cabbage	13	10.8	8	61.5	6.7	90.6
5	Chillies	18	15.0	10	55.6	1.8	90.0
6	Mustard	24	20.0	20	83.3	0.8	75.0
7	Sugarcane	24	20.0	14	58.3	2.8	69.6
8	Millet	27	22.5	9	33.3	1.8	50.0
9	Soya beans	28	23.3	20	71.4	0.0	51.7
10	Cowpeas	35	29.2	9	25.7	0.8	35.7
11	Tomato	37	30.8	25	67.6	8.3	83.0
12	Cassava	44	36.7	21	47.7	3.5	65.8
13	Groundnuts	47	39.2	24	51.1	4.3	47.7
14	Velvet beans	51	42.5	33	64.7	3.5	61.7
15	Crownpeas	63	52.5	21	33.3	0.0	41.3
16	Hybrid maize	75	62.5	38	50.7	15.5	45.8
17	Sorghum	82	68.3	15	18.3	0.8	51.7
18	Field peas	91	75.8	62	68.1	42.7	65.4
19	Sweet potatoes	93	77.5	52	55.9	16.0	63.3
20	Local maize	95	79.2	24	25.3	11.7	34.4
21	Pigeonpea	109	90.8	73	67.0	22.8	52.9
22	Beans	112	93.3	64	57.1	32.2	51.2

Notes:

[a]: scores calculated as 1.0 for rank 1, 0.5 for rank 2, 0.3 for rank 3.
[b]: proportions calculated as 25 for 1/4 or less, 50 for 1/4-1/2, 75 for 1/2-3/4, and 100 for all.

Table 3.11 Variety groups for maize, beans, pigeonpea, sweet potato and cassava, by EPA, FSIPM research sites, 1996/97.
(households)

No.	Crop and variety	All households (n=120)	Matapwata (n=58)	Mombezi (n=62)	Sig.-level [a]
1	*Maize*	120	58	62	0.000
2	- LV	82	38	44	0.198
3	- MV	74	42	32	4.640 *
4	- MH18	50	31	19	5.507 *
5	- MH17	10	5	5	0.00
6	- NSCM41	16	9	7	0.169
7	- Bantam	3	2	1	0.003
8	- Other MV	5	1	4	0.702
9	*Beans*	98	46	52	0.167
10	- Chimbamba	69	30	39	1.109
11	- Kaulesi	30	25	5	17.791 *
12	- Nanyati	20	9	11	0.006
13	- Kayera	15	1	14	10.087 *
14	- Zofira	6	1	5	1.377
15	- Other	4	4	0	2.542
16	*Pigeonpea*	106	50	56	0.174
17	- MV	46	10	36	19.434 *
18	- LV	72	43	29	8.244 *
19	*Sweet potato*	83	35	48	3.335 *
20	- 'Research'/ 'Chinese'	35	21	14	2.074
21	- Kenya	9	6	3	0.636
22	-Kanchiputu	13	5	7	0.033
23	-Kachewere	32	1	31	33.287 *
24	- Other	24	12	12	0.000
25	*Cassava*	45	37	8	30.976 *
26	- Masangwi	32	32	0	43.860 *
27	- Choyera	7	6	1	2.721 *
28	- Matapwata	4	4	0	2.542
29	- Other	15	8	7	0.000

Note:
[a] * significant at 10 *% level or better by Chi-square test.

Table 3.12 Source of seed for maize, beans, and pigeonpea, by MPA, FSIPM research sites, 1996/97.

(households)

No.	Crop and seed source	All households (n=120)	Tercile 1 (n=36)	Tercile 2 (n=42)	Tercile 3 (n=42)	Sig.-level [a]
	Maize					
1	- retained seed	89	20	30	39	
2	- local market	31	18	8	5	
3	- credit club	0	0	0	0	
4	- retail outlet	18	2	4	12	
5	- ADMARC	7	2	1	5	
6	- gift	11	3	5	3	
7	- other	8	1	6	1	31.648 *
	Beans					
8	- retained seed	44	14	12	18	
9	- local market	77	22	41	14	
10	- gift	8	1	2	5	
11	- other	9	1	4	4	15.761 *
	Pigeonpea					
12	- retained seed	83	19	29	35	
13	- local market	32	12	11	9	
14	- gift	2	0	0	2	
15	- other	3	1	2	0	8.321

Note:

[a] * significant at 10 *% level or better by Chi-square test.

4.0 Weeds

The FSIPM Project has identified weeds as a pest of its three target foodcrops of maize, beans, and pigeonpea. In particular, the parasitic weed *Striga asiatica* is consideed a major pest of maize at FSIPM research sites.

The most common weeds

Farmers were asked to name the three most common weeds in their gardens, and rank them in order of importance, with the most numerous species ranked first. Results are shown in Table 4.1, with weeds listed according to the number of farmers reporting a particular weed. Weighting the responses by the rank assigned to each slightly altered the order of this listing in some cases. Information on the distribution of weeds relies on farmers' perceptions, not field measurements.

Farmers identified 31 "common" weeds, 26 of which we have identified as separate species. Only 10 weeds were reported as "common" by 10 farmers or more, and only three weeds were identified as "common" by 40 farmers or more (one-third of the sample). Despite the large number of weeds reported, therefore, the number of truly "common" weeds is small.

It is possible to compare this listing with that made by the Soil Pests Project, based on the mean number of each weed species per 1 m^2 quadrat during the 1991/92 crop year (SPP, 1993: 228-230, Table 135). Surveys were conducted in Mombezi and Matapwata EPAs in two rounds, corresponding to the sprouting and vegetative stage of maize. The two surveys identified 23 and 34 weed species in Matapwata and Mombezi EPAs, respectively. Only two weed species (*Eleusine indica* and *Bidens pilosa*) were ranked among the top five most common in both surveys, however.

The most troublesome weeds

Table 4.2 follows the same format, with farmers' ranking weeds in order of difficulty weeding. Of the top five 'troublesome' weeds, *Eleusine indica*, *Panicum maximum*, *Cynodon dactlyon*, the unidentified weed Likakazi and *Bidens pilosa* also featured in the top five common weeds.

Farmers' weeding practices

Weeding practices differed significantly between EPAs (Table 4.3). Average household labour resources (measured as the number of workers in each household, weighted by age and sex) were significantly higher in Mombezi than in Matapwata. Households in Mombezi had more adults than their counterparts in Matapwata. There are a number of possible explanations for this difference (more non-resident adults in Matapwata, a higher birth rate among Muslim households in Mombezi, etc) which we have not had sufficient time to explore. The point is, however, that households in Matapwata have less household labour available for weeding and banking, and have adjusted to this in several ways.

- Participation rates were generally higher in Matapwata, significantly so for first weeding. In other words, a higher proportion of household members participated in field activities. They may also have worked longer and harder, though we have no information about this.

- Households in Matapwata focused their efforts on first weeding rather than on second weeding and banking. Almost all the area planted to maize in Matapwata received a first weeding, but nearly half was not weeded at second weeding and only one quarter was fully banked.

On the demand side, weed management practices may be influenced by the type of weed species or the density of weeds, which in turn may be determined by physical factors (soils, landtype), fertiliser use, and tillage practices. In the Shire Highlands, the local practice of *mbwera* (drawing soil away from the ridge to create a flat bed for planting relay beans) may also discourage farmers from banking maize. Table 4.4 shows, however, that the area planted to maize which was used for *mbwera* did not differ significantly between the two EPAs in either 1995/96 or 1996/97. Similarly, there was no significant difference in the treatment of maize residues on either *mbwera* or non-*mbwera* fields. Most ridges were made in the dry season rather than immediately after harvest, with few farmers preparing land at first rains. Only a small proportion of area planted to maize was re-ridged before planting.

Timeliness of weeding

Timely weeding is particularly important in the Blantyre Shire Highlands because of the high number of weed species (SPP, 1993: 220). DAR's Annual Guide to Agricultural Production does not specify the optimal period for first and second weeding. Research evidence indicates, however, that a critical period of competition is between 10-30 days after emergence.

Figure 4.1 shows that four weeks after planting, weeding had started on only 50 % of the area planted to maize. By five weeks after planting, the proportion had risen to 85 % . It is possible that the late start to first weeding may have reduced the area which which received a second weeding or banking, since farmers may have felt this was not worthwhile. Second weeding had started on 80 % of the area planted to maize by eight weeks after planting. Timing of planting and start of first weeding did not differ noticeably between EPAs, but second weeding started earlier in Mombezi than in Matapwata (Figure 4.2). By seven weeks after planting, second weeding had started on 63 % of the area planted to maize in Mombesi compared to 23 % in Matapwata. The slow start to first weeding was due partly to heavy rains after planting which encouraged weed growth and reduced the benefits from early weeding.

Female-headed households

Weeding practices also differed between households headed by men and those headed by women (Table 4.5). FHHs had significantly fewer workers than those headed by men. The number of persons (weighted by age and sex) who participated in major field operations (land preparation, weeding) was also lower among these households.

- Participation rates for the same operations were higher for land preparation, planting, and first weeding.

- FHHs weeded their fields less thoroughly, both at first and second weeding. Significantly more FHHs banked their gardens, however. There was no significant difference in the area planted to maize left unweeded.

By contrast, time of planting, and timing of first and second weeding did not differ markedly between male- and FHHs, nor were there significant differences in tillage practices (Table 4.6).

Hired labour use

Household labour supply increased with farm size, rising from 2.41 workers on households cultivating 0.29 ha to 3.61 on households cultivating 1.18 ha (Table 4.7). The increase in labour supply was due to increased availability of male and child labour on larger farms. The numbers of household workers participating in major field activities was significantly higher on large farms for land preparation, planting, and first weeding. The lack of observed significant differences for second weeding may reflect the atypical rainfall pattern during the survey year; because first weeding was late, farmers may have considered second weeding less essential. Participation rates did not vary significantly by farm size for major field operations.

A high proportion of households (75 %) hired labour and the proportion hiring did not vary by farm size. Hired labour was used on relatively larger *areas* by farms above 1 ha. However, the proportion of land prepared, planted, and weeded by hired labour did not vary significantly between farm size groups. This finding was unexpected, in the light of previous research which showed that hired labour use was more common on large farms (Bose and Livingstone, 1993: 43 ff). The labour market was extremely thin, however. Hired labour accounted for only 13 % of land preparation, 9 % of first weeding, and 6 % of second weeding. And most households hiring labour also shared the work with them: the proportion of land prepared and weeded using a mixture of hired and household labour was similar to that using hired labour alone. Most households, therefore, hired labour in small amounts for specific tasks, and supervised labourers by working alongside them.

Although the questionnaire did not include questions on wage rates, some data on wages were collected during the course of interviews. The sample size was quite small (16 observations for ridging and weeding, six for banking). These indicate wage rates of 898 MK/ha for ridging, 326 MK/ha for weeding, and 519 MK/ha for banking. The figures were converted to daily rates using the labour requirements for heavy soils in Werner (1987), and assuming a four-hour workday. Wage rates were 13.30 MK/day for ridging, 7.70 MK/day for weeding, and 12.21 MK/day for banking. As a comparison, the daily rate in 1996/97 at Kamphonji estate, Matapwata, for a *gwazu* (a task, 4-5 hours) was 9 MK/day for men and 4.9-5.4 MK/day for women. Although these estate wage-rates are lower than those recorded for ridging, weeding, or banking bby the baseline survey, Kamphonji estate regularly hires 400 villagers during the rainy season. Lower wage-rates on estates may reflect the thinness of the labour market in the smallholder subsector which gives estates a degree of monopsony power. On the supply side, smallholders may be willing to accept lower daily wage rates on estates if it ensures employment for a longer period and allows them to reach a target income.

Farmers' choice of weeding strategy

Farmers' choice of weed management practices is determined by a large number of variables operating simultaneously. Regression analysis was used to identify important variables determining farmers' decisions for first weeding and banking. The estimating equations are underspecified, because of the difficulty of measuring all the likely independent variables (eg. weediness, expected yields, etc). Specification error results in biased estimates of the parameters of the included variables. Two models were specified to identify determinants of thoroughness of first weeding, and thoroughness of banking. Since the dependent variable was dichotomous (0,1), a logistic function was used to obtain maximum likelihood estimates of the specified relationship and asymptotically efficient parameter estimates to which tests of significance could be applied.

Full weeding at first weeding

The dependent variable was the dummy variable MZFWEED1, with 1 = full weeding and 0 otherwise.

The farmer's decision to fully weed at first weeding was specified to depend on eight independent variables (Table 4.8). The Chi-square goodness-of-fit statistic showed that the model fitted the data with significance at Prob. >.0001 and that the specification explained 84 % of the observed variation in full weeding of maize fields. Five of the estimated coefficients were statistically significant at the 10 % level or better.

The FHH variable showed a negative sign, perhaps reflecting lower supply of labour among female-headed households. PRFWEED was negatively associated with full weeding, which was unexpected, but which may be due to the higher participation rates found among female-headed households. The TOTN coefficient was positive, implying that the likelihood of first weeding was higher on fields with higher fertiliser rates. W1HIRE was also positive, with hired labour facilitating fuller weeding. Finally, the dummy variable for the CHITERA dambo was negative because farmers were prevented from weeding by excessive flooding.

The MZAREA, W1WK, and W1TIME variables were not statistically significant, indicating that the total area under maize, the date of first weeding, and the time required for first weeding were not detemining factors after controlling for other variables.

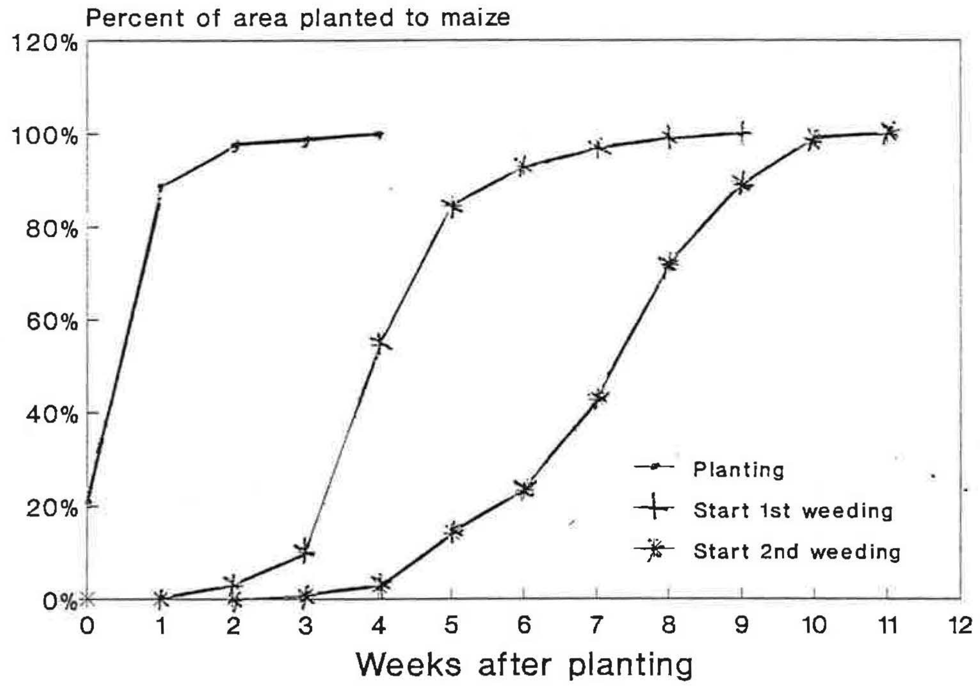
Banking of maize

The dependent variable was the dummy BKDONE, with 1= banking, and 0 otherwise.

The farmer's decision to bank maize was specified to depend on 10 independent variables (Table 4.9). The Chi-square goodness-of-fit statistic showed that the model fitted the data with significance at Prob. >.0028 and that the specification explained 75 % of the observed variation in banking maize. Seven of the estimated coefficients were statistically significant at the 10 % level or better.

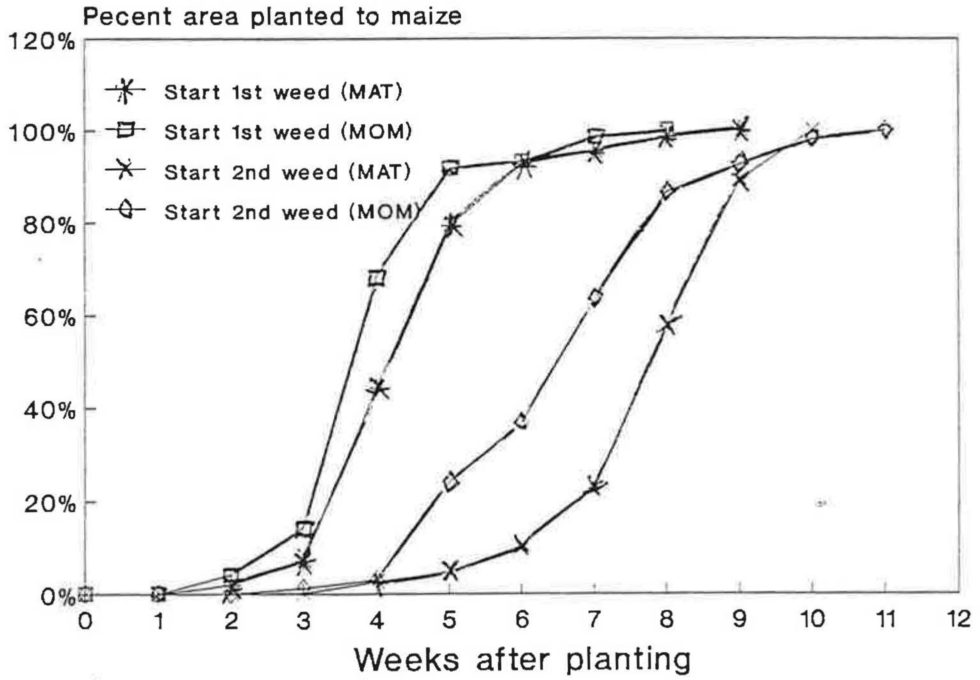
The dummy variable for CHITERA dambo displayed a negative sign, since farmers had abandoned their fields due to flooding. The MZAREA variable was negative. Farmers with larger areas planted to maize

Figure 4.1 Timeliness of first and second weeding, FSIPM research sites, 1996/97



Source: FSIPM Baseline Survey, 1996/97

Figure 4.2 Timeliness of first and second weeding, by EPA, FSIPM research sites, 1996/97



Source: FSIPM Baseline Survey, 1996/97.

may face labour constraints in banking. The TERMITE variable was negative, since farmers believe banking encourages this pest. As expected, the TOTN sign was positive: fields with higher fertiliser rates are more likely to be banked. The sign of the WDWK3 variable was positive, indicating that speed of first weeding influenced farmers' decision to bank. The EPA dummy was positive, even after controlling for the Chitera dambo. Finally, the sign on the TMBWERA variable was positive, suggesting that this cultivation practice was compatible with banking maize.

The FHH, RGANYU, and TOTWORK variables were not statistically significant. The RGANYU variable had the expected negative sign.

Differences in weed management practices warrant further research, particularly in Matapwata where practices appear sub-optimal. The complexity of farmers' weed management decisions limits the scope for multivariate analysis. A more approppriate analytical tool is the hierarchical decision-tree, with a sample of 30-40 households. This quantitative approach could be supplemented by fine-grained anthropological case-studies of selected households with different weeding practices, to monitor allocation of labour. The study would also require physical measurements of weed density and effects of weed competition on maize yields to assist determine the economic costs and benefits of alternative weed management strategies.

Striga asiatica

The baseline survey results show that *Striga* was ranked second as a pest of maize but Table 4.10 shows that the incidence was surprisingly low in the fields of the sample households. There was lower reported incidence of *Striga* in the two EPAs (36.76% of the area cultivated) but there were no significant differences between the two EPAs as well as among the four villages. 'A lot' of *Striga* was reported in only 8.6% of the cultivated area. These low incidences though posing a potential threat for the few infested fields can make it difficult for farmers to experience and appreciate the damaging effects of striga and this can limit their perceptions and practice of control strategies. These results would also cause problems in identifying really infested fields to mark out trial plots so that the effect of various strategies can be clearly assessed.

***Striga* incidence by landtype**

Table 4.11 shows that the *Striga* reported was mostly in upland fields (36.7 % of upland and 35.3% of hillslope fields) as opposed to dambo fields. There was a significant positive correlation between land type and *Striga* incidence, with *Striga* associated with upland fields. These upland fields with some *Striga* had mostly sandy loam soils with very few incidences of *Striga* on clay loam or clay soils. These sandy loam soils are very prone to heavy cultivation and leaching or depletion of nutrients so that they can easily become infertile and associated with *Striga* infestations.

Field management of *Striga*

One of the most important field management techniques for weed management is weeding. In most fields weeding is done twice and this can help reduce *Striga* incidence as a planned strategy or as a coincidence. A lot of people consider first weeding as necessary. As such, most of the fields for the sample households (49.3%) were fully weeded and very few were not weeded. Table 4.12 shows that for the fields where *Striga* was reported there was no significant differences on whether the field was fully, partly or not weeded. Table 4.12 also shows that the correlation between *Striga* incidence and the proportion of maize fully weeded at first weeding (MZFW1PER) was not statistically significant.

For second weeding, it was found that more of the fields with reported *Striga* were either partly or not weeded (Table 4.13). The issue of not weeding or partly weeding during second weeding could be a reflection of the farmers' perceptions of the performance of their maize crop. For the fields with low fertility and no fertiliser application coupled with heavy rains this year, the maize crop performed poorly so that some farmers abandoned their fields. Some of these fields could contain *Striga* either in large or small quantities. Other reasons for not doing second weeding include labour shortage and the impending process of *mbwera* for relay cropping. There was also a significant and positive correlation between second weeding and the incidence of *Striga* (Table 4.14).

Box 4.1 The incidence of *Striga asiatica* in Blantyre ADD...

The 1995/96 Fertiliser Verification Trial evaluated six different fertiliser rates on hybrid maize (MH18) by all section Field Assistants in Malawi. Among the data collected was a *Striga* score, made when the crop was fully grown but still green. The FA noted 1 if there was no *Striga* present, 2 if less than half of planting stations were affected, and 3 if more than half the planting stations were affected.

The raw data for the *Striga* scores for two ADDs (Blantyre and Machinga) was made available to the FSIPM Project by the Maize Commodity Team, Chitedze. The data was analysed to determine: (1) incidence of *Striga* and (2) variation in the severity of *Striga* infestation in Blantyre Shire Highlands RDP.

	Matapwata	**Mombezi**	**Shire Highlands**	**BLADD**
Land area (km^2)	386	465	4413	10239
Total sections	9	17	113	328
Sections reporting	8	13	98	204
Sections with *Striga*	2	4	54	107
Percent with *Striga*	25	31	55	52

The text table shows that slightly over half the sections in Blantyre ADD reporting results from the Fertiliser Trials, scored the presence of *Striga*. This was also true for Blantyre Shire Highlands RDP, which forms the Project working area. Incidence of *Striga* was substantially lower in Matapwata and Mombezi EPAs, however. Only two of eight reporting sections in Matapwata and four of 13 sections in Mombezi scored the presence of *Striga*. These did not include either Nansadi or Mombezi sections, where the Project located Striga trials in 1996/97, and where *Striga* was observed by the FSIPM Project. Although the broad findings are in line with that of the baseline survey - *Striga* was present on roughly one-third of the area cultivated - the incidence of *Striga* in the Shire Highlands is patchy and no firm conclusions can be drawn from single-location trials.

Turning to severity of infestation, 75 % of the sections reporting *Striga* had 'potentially severe' incidence, while 40 % had very severe infestations (see text table below). Thus, *Striga* poses a threat to maize production in the RDP and is already a serious problem in some EPAs. Of eight EPAs, Lirangwe had the highest incidence (89 %), followed by Masambanjati (73 %) and Thyolo North (47 %). The two EPAs targeted by the FSIPM Project had low incidences, however. Only two sections in Matapwata reported *Striga*, of which one (Naphiyo) had very severe infestation, while in Mombezi four sections reported *Striga* but although infestation was potentially severe in three sections, none was severe. In Lirangwe EPA, some of the sections which had very severe cases were Mlombozi, Mchere East, Matope B, Lunzu II, Dziwe, and Kaphikamo. Masambanjati EPA had Milore, Motheriwa and Masambanjati as the most severely infested sections while Thyolo North had Khonjeni and Namileme sections.

EPA	**Sections reporting**	**Sections with *Striga***	**'Potential threat'** [a]	**'Very severe'** [b]
Matapwata	8	2	2	1
Mombezi	13	4	3	0
Thyolo North	17	8	6	2
Lirangwe	18	16	13	10
Mtonda	19	4	3	1
Thumbwe	12	4	3	2
Masambanjati	11	8	6	3
Total RDP	98	48	36	19

[a] two or more plots in a section with score of 2;
[b] two or more plots in a section with score of 3.

Table 4.1 Farmers' ranking of common weeds, FSIPM research sites, 1996/97.

(n=120 households)

No.	Name of weed (Latin, Chichewa)	Farmers reporting	First rank	Second rank	Third rank	Weighted rank[a]
1	*Biden pilosa* (Chisoso)	46	14	21	10	27.5
2	*Eleusine indica* (Chigombe)	45	22	12	11	31.7
3	*Panicum maximum* (Nsothe)	42	14	18	8	25.7
4	*Cynodon dactylon* (Kapinga)	28	9	14	5	17.7
5	*Unidentified* (Likakazi)	21	9	6	5	13.7
6	*Tribulus terrestris* (Ntcheso)	21	14	4	3	17.0
7	*Leersia hexandra* (Nakache)	18	9	5	4	12.8
8	*Galinsonga parviflora* (Mamuna aligone)	16	6	7	3	10.5
9	*Striga asiatica* (Kaufiti)	15	2	3	10	6.8
10	*Commelina bengalensis* (Kholowani)	12	7	5	0	9.5
11	*Ageratum conyzoides* (Ntawetawe)	5	1	2	1	2.3
12	*Imperata cylindrica* (Nasongole)	4	0	1	3	1.5
13	*Trichodesma zeylanicum* (Chilungumwamba)	3	0	1	2	0.8
14	*Unidentified* (Ndeka)	3	1	2	0	1.5
15	*Cyperus rotundus* (Dawe)	3	2	0	1	2.3
16	*Unidentified* (Gonaphili)	3	2	0	1	2.3
17	*Rhychelytrum ropens* (Chirere)	2	0	1	0	0.5
18	*Acanthospermum hispidum* (Masakambwa)	1	1	0	0	1.0
19	*Unidentified* (Njapani)	1	0	0	1	0.3
20	*Unidentified* (Gwadamumvetse)	1	1	1	0	1.0
21	*Unidentified* (Mupoloni)	1	0	0	1	0.3
22	*Unidentified* (Senche lomwe)	1	0	0	1	0.3
23	*Nicandra physalodes* (Chamasala)	1	0	0	1	0.3
24	*Cyperus esculentus* (Mululu)	1	1	0	0	1.0
25	*Alectra vogelii* (kaufiti wakulu)	1	0	1	0	0.5
26	*Unidentified* (Namasakatha)	1	0	1	0	0.5
27	*Unidentified* (Zonde)	1	1	0	0	1.0
28	*Unidentified* (Stamba olimba)	1	0	1	0	0.5
29	*Unidentified* (Moleni)	1	1	0	0	1.0
30	*Unidentified* (Uwe matemba)	1	0	0	1	0.3
31	*Urrachora mocambisensis*	1	1	0	0	1.0

[a] first rank=1.0; second rank=0.5; third rank=0.3.

Table 4.2 Farmers' ranking of troublesome weeds, FSIPM research sites, 1996/97.

(households)

Code	Name of weed (Latin, Chichewa)	Farmers reporting	First rank	Second rank	Third rank	Weighted rank [a]
1	*Eleusine indica* (Chigombe)	32	15	13	6	23.3
2	*Panicum maximum* (Nsothe)	25	6	7	12	13.1
3	*Cynodon dactylon* (Kapinga)	25	17	8	2	21.6
4	*Unidentified* (Likakazi)	19	13	6	0	16.0
5	*Biden pilosa* (Chisoso)	18	1	11	6	8.3
6	*Leersia hexandra* (Nakache)	16	10	4	2	12.6
7	*Tribulus terrestris* (Ntcheso)	15	8	5	2	11.1
8	*Striga asiatica* (Kaufiti)	12	6	3	3	8.4
9	*Commelina bengalensis* (Kholowani)	11	9	2	0	10.0
10	*Galinsonga parviflora* (Mamuna aligone)	9	4	4	1	6.3
11	*Ageratum conyzoides* (Ntawetawe)	4	0	0	1	0.3
12	*Unidentified* (Ndeka)	3	1	2	0	2.0
13	*Cyperus rotundus* (Dawe)	3	1	1	1	1.8
14	*Unidentified* (Gonaphili)	3	2	1	0	2.5
15	*Rhychelytrum ropens* (Chirere)	1	1	0	0	1.0
16	*Acanthospermum hispidum* (Masakambwa)	1	0	1	0	0.5
17	*Unidentified* (Njapani)	1	0	0	1	0.3
18	*Unidentified* (Gwadamumvetse)	1	0	0	0	0.0
19	*Unidentified* (Senche lomwe)	1	0	1	0	0.5
20	*Nicandra physalodes* (Chamasala)	1	0	0	1	0.3
21	*Cyperus esculentus* (Mululu)	1	0	1	0	0.5
22	*Alectra vogelii* (kaufiti wakulu)	1	0	1	0	0.5
23	*Unidentified* (Namasakatha)	1	0	0	1	0.3
24	*Unidentified* (Stamba olimba)	1	0	0	1	0.3
25	*Unidentified* (Moleni)	1	0	0	1	0.3
26	*Unidentified* (Uwe matemba)	1	0	1	0	0.5
27	*Urrachora mocambisensis*	1	1	0	0	1.0

[a] first rank=1.0; second rank=0.5; third rank=0.3.

Table 4.3 Weed management practices, by EPA, FSIPM research sites, 1996/97.

No.	Variable	Matapwata (n = 60)	Mombezi (n = 60)	Sig.-level [a]
1	Total workers (no)	2.62	3.44	-2.83 *
2	- adult male	1.24	1.71	-2.05 *
3	- adult female	1.19	1.52	-2.45 *
4	- child	0.19	0.21	-0.31
	Labour use (no)			
5	- land preparation	2.13	2.39	-1.17
6	-planting	2.14	2.43	-1.33
7	-first weeding	2.19	2.40	-0.98
8	-second weeding/banking	1.74	2.41	-2.31 *
	Participation rates (%)			
9	- land preparation	92.97	82.49	1.53
10	- planting	92.31	85.54	1.00
11	- first weeding	95.19	83.25	1.82 *
12	- second weeding/banking	83.21	81.48	0.29
	First weeding (% area planted to maize)			
13	- fully weeded	79.63	61.00	2.429
14	- partly weeded	17.46	16.49	0.035
15	- no weeding	2.90	22.51	5.252 *
	Second weeding (% area planted to maize)			
16	- fully weeded	16.49	31.46	1.562
17	-partly weeded	34.47	6.80	7.311
18	- no weeding	49.03	61.74	0.700
	Banking (% area planted to maize)			
19	- fully banked	25.65	59.69	7.929 *
20	-partly banked	49.51	15.16	8.901 *
21	-no banking	24.84	25.15	0.053

[a] * indicates significant differences between groups (10% or better), by Chi-square or t-test

Table 4.4 Tillage practices on area planted to maize, by EPA, FSIPM research sites 1996/97.

No.	Variable	Matapwata (n=60)	Mombesi (n=60)	Sig.-level [a]
	Area of *mbwera* in 1996/97 (ha)			
1	- Yes	17.45	13.35	
2	- No	21.07	21.41	0.130 ns
	Area of *mbwera* in 1995/96 (ha)			
3	- Yes	12.14	10.93	
4	- No	28.44	24.51	0.026 ns
	Treatment of maize/weed residues on *mbwera* gardens (ha)			
5	- burned	2.18	1.20	
6	- fuel	0.70	0.00	
7	-laid in furrow	0.00	0.00	
8	- incorporated	9.33	9.73	0.925 ns
	Treatment of maize/weed residues on non-*mbwera* gardens (ha)			
9	- laid in furrow	0.00	0.59	
10	- carried off field	2.80	0.42	
11	- burned	1.36	1.91	
12	- buried after harvest (Jun-Jul)	11.88	14.88	
13	- buried later in season (Aug-Oct)	12.58	6.34	
14	- other	0.00	0.18	4.698 ns
	Time of ridging (ha)			
15	- after harvest (Jun-Jul)	6.41	4.68	
16	- in dry season (Aug-Oct)	27.39	31.18	
17	- at first rains	1.63	3.04	
18	- other	0.55	1.57	1.172 ns
	Ridges rebuilt before planting (ha)			
19	- Yes	0.94	5.18	
20	- No	39.53	30.97	2.290 ns

Notes:
[a] ns = not significant by Chi-square test at 0.05 level

Table 4.5 Weed management practices, by sex of household head, FSIPM research sites, 1996/97.

No.	Variable	Female-headed household (n = 60)	Male-headed household (n = 60)	Sig. -level [a]
1	Total workers (no)	2.47	2.96	-1.99 *
2	- adult male	1.08	1.88	-3.62 *
3	- adult female	1.52	1.20	2.33 *
4	- child	0.23	0.17	1.02
	Labour use (no)			
5	- land preparation	2.18	2.36	-0.82
6	-planting	2.15	2.43	-1.30
7	-first weeding	2.15	2.45	-1.39
8	-second weeding/banking	1.99	2.42	-1.53
	Participation rates (%)			
9	- land preparation	93.56	81.54	1.77 *
10	- planting	92.25	83.57	1.02
11	- first weeding	93.81	84.24	1.45
12	- second weeding/banking	82.11	81.97	0.03
	First weeding (% area planted to maize)			
13	- fully weeded	60.85	76.35	-2.17 *
14	- partly weeded	29.77	9.11	3.37 *
15	- no weeding	9.37	14.53	-1.05
	Second weeding (% area planted to maize)			
16	- fully weeded	18.63	31.47	-1.83 *
17	-partly weeded	21.42	18.36	1.04
18	- no weeding	59.95	56.87	-0.54
	Banking (% area planted to maize)			
19	- fully banked	39.69	44.04	-0.54
20	-partly banked	42.05	25.17	2.23 *
21	-no banking	18.25	30.78	-1.87 *

Notes

[a] * indicates significant differences between groups (10% or better), by Chi-square or t-test

Table 4.6 Tillage practices on area planted to maize, by sex of household head, FSIPM research sites, 1996/97.

No.	Variable	Female-headed households (n=60)	Male-headed households (n=60)	Sig.-level [a]
	Area of *mbwera* in 1996/97 (ha)			
1	- Yes	14.24	16.56	
2	- No	17.53	24.95	0.034 ns
	Area of *mbwera* in 1995/96 (ha)			
3	- Yes	11.55	11.52	
4	- No	21.44	31.51	0.277 ns
	Treatment of maize/weed residues on *mbwera* gardens (ha)			
5	- burned	1.91	1.47	
6	- fuel	0.43	0.27	
7	-laid in furrow	0.00	0.00	
8	- incorporated	9.47	9.59	0.085 ns
	Treatment of maize/weed residues on non-*mbwera* gardens (ha)			
9	- laid in furrow	0.00	0.59	
10	- carried off field	1.78	1.44	
11	- burned	0.88	2.39	
12	- buried after harvest (Jun-Jul)	13.69	13.07	
13	- buried later in season (Aug-Oct)	5.62	13.30	
14	- other	0.18	0.00	3.13 ns
	Time of ridging (ha)			
15	- after harvest (Jun-Jul)	5.56	5.53	
16	- in dry season (Aug-Oct)	25.77	32.80	
17	- at first rains	1.26	3.41	
18	- other	0.40	1.72	1.245 ns
	Ridges rebuilt before planting (ha)			
19	- Yes	2.98	3.14	
20	- No	30.01	40.49	0.017 ns

[a] * indicates significant differences between groups (10% or better), pairwise Chi-square or t-test

Table 4.7 Hired labour use by farm size, FSIPM research sites, 1996/97

No.	Variable	All farms (n=120)	Tercile 1 (n= 41)	Tercile 2 (n=39)	Tercile 3 (n=40)	Sig.-level [a]
1	Farm size (ha)	0.67	0.29	0.55	1.18	74.5013 *
2	Total workers (no)	3.04	2.42	3.12	3.61	5.7709 *
3	- adult male	1.48	1.15	1.41	1.90	3.8345 *
4	- adult female	1.36	1.19	1.44	1.46	1.5520
5	- child	0.20	0.09	0.27	0.25	3.3604 *
	Labour use (no)					
6	- land preparation	2.27	1.83	2.44	2.55	4.4348 *
7	-planting	2.29	1.85	2.43	2.59	4.6289 *
8	-first weeding	2.30	1.90	2.39	2.63	4.4766 *
9	-second weeding/banking	2.19	1.91	2.32	2.33	0.9218
	Participation rates (%)					
10	- land preparation	87.55	81.33	94.75	86.92	1.2840
11	- planting	88.81	83.92	94.10	88.67	0.7590
12	- first weeding	89.03	83.92	92.99	90.39	0.6613
13	- second weeding/banking	82.05	87.15	80.59	78.78	0.8168
14	Households hiring labour (%)	75.0	78.0	74.4	72.5	0.345
	Land preparation (ha planted to maize)					
15	- family	58.32	9.11	16.37	32.84	
16	- hired	10.26	1.56	2.59	6.11	
17	- both	9.47	0.92	1.66	6.89	0.918
	Planting (ha planted to maize)					
18	- family	71.20	11.59	19.81	39.80	
19	- hired	0.12	0.00	0.12	0.00	
20	- both	6.73	0.00	0.00	6.04	4.831
	First weeding (ha planted to maize)					
21	- family	57.09	9.06	14.83	33.20	1.497
22	- hired	6.55	1.02	1.55	3.98	
23	- both	6.20	0.21	2.84	3.15	
	Second weeding (ha planted to maize)					
24	- family	49.20	8.77	14.27	26.16	
25	- hired	3.71	0.25	0.91	2.55	
26	- both	6.96	0.31	1.26	5.39	1.901

[a] * indicates significant differences between groups (10% or better), by Chi-square or one-way ANOVA.

Table 4.8 Logit estimates of determinants of thoroughness of first weeding of maize, FSIPM research sites, 1996/97.

Variable	Coefficient	S.E.	Exp(B)	Sig. -level
Constant	3.9975	1.1795		.0007
FHH	-1.4363	0.4626	0.2378	.0019
MZAREA	0.4321	0.5157	1.5405	.4021
PRFWEED	-0.0175	0.0102	0.9827	.0854
TOTN	0.0462	0.0231	1.0473	.0453
W1WK	-0.2700	0.1811	0.7634	.1361
W1TIME	0.0036	0.0201	1.0036	.8584
W1HIRE	1.2089	0.6752	3.3496	.0734
CHITERA	-1.5102	0.5687	0.2209	.0079
- 2 Log of likelihood function, constant only: 194.366				
- 2 Log of likelihood function: 158.177				
Chi-square goodness-of-fit (d.f.=8) 36.189 (p >=.0001)				
Percent of cases predicted correctly: 85.99				
n = 207 plots				

Definitions:

FHH	Dummy for female-headed household (1=Yes, 0 otherwise)
MZAREA	Total area planted to maize by household (ha)
PRFWEED	Household labour participation rate for first weeding (%)
TOTN	Total nitrogen applied to plot (kg/N/ha)
W1WK	Date of first weeding (weeks after planting)
W1TIME	Duration of first weeding (days)
W1HIRE	Dummy for hired labour used for first weeding (1=Yes, 0 otherwise)
CHITERA	Dummy for Chitera dambo (1=Yes, 0 otherwise)

Table 4.9 Logit estimates of determinants of banking maize, FSIPM research sites, 1996/97.

Variable	Coefficient	S.E.	Exp(B)	Sig. -level
Constant	-0.3613	0.7107		.6112
CHITERA	-1.2854	0.5016	0.2765	.0104
FHH	0.3936	0.3419	1.4824	.2497
MZAREA	-0.8618	0.3756	0.4224	.0218
RGANYU	-0.1037	0.3557	0.9015	.7707
TERMITES	-1.2627	0.5519	0.2829	.0221
TOTN	0.0299	0.0169	1.0304	.0761
WDWK3	1.7925	0.7172	6.0047	.0126
TOTWORK	-0.1159	0.0938	0.8906	.2166
EPA	1.0029	0.4065	2.7260	.0136
TMBWERA	0.6650	0.3555	1.9444	.0614
- 2 Log of likelihood function, constant only: 275.862				
- 2 Log of likelihood function: 249.091				
Chi-square goodness-of-fit (d.f.=8) 26.771 (p >=.0028)				
Percent of cases predicted correctly: 75.11				
n = 221 plots				

Definitions

CHITERA	Dummy for Chitera dambo (1=Yes, 0 otherwise)
FHH	Dummy for female-headed household (1=Yes, 0 otherwise)
MZAREA	Total area planted to maize by household (ha)
RGANYU	Dummy for household participation in ganyu labour (Yes=1, 0 otherwise)
TERMITES	Dummy for farmer perceiving termites as major pest of maize (1=Yes, 0 otherwise)
TOTN	Total nitrogen applied (kg/N/ha)
WDWK3	Proportion of maize area weeded within three weeks of planting (%)
TOTWORK	Household labour, weighted by age and sex (no.)
EPA	Dummy for EPA (1=Matapwata, 2=Mombezi)
TMBWERA	Dummy for *mbwera* done in this plot in 1996/97 season (1=Yes, 0 otherwise)

Table 4.10 Farmers' reporting of the distribution of *Striga asiatica*, FSIPM research sites, 1996/97

No.	Variable	Area (ha)	Proportion of area cultivated (%)	Sig.-level [a]
	Striga reported present			
1	Total	29.66	36.76	
2	- Matapwata EPA	14.31	35.55	0.000 ns
3	- Mombezi EPA	15.35	37.97	
	Villages			
4	- Kambua	7.39	34.13	
5	- Magomero	6.92	37.20	
6	- Chiwinja	6.45	32.80	
7	- Lidala	8.90	42.85	0.529 ns
8	"None"	51.02 (0.33)[b]	63.98	
9	"Very little"	15.35 (0.36)	19.25	
10	"A little"	6.51 (0.43)	8.16	
11	"A lot"	6.86 (0.40)	8.60	0.68 ns
	"A lot" of *Striga* reported		(% of *Striga* area)	
12	- Matapwata EPA	2.02	14.12	
13	- Mombezi EPA	4.84	31.53	0.474 ns
14	- Kambua	1.33	18.00	
15	- Magomero	0.69	9.97	
16	- Chiwinja	2.67	41.40	
17	- Lidala	2.17	24.38	2.002 ns

[a] Chi-square values, significance level at $p > .05$
[b] ( ) mean area in hectares

Table 4.11 *Striga* incidence by landtype, FSIPM research sites, 1996/97

(number of fields)

Land type	No *Striga*	'Very little'	'A little'	' A lot'	Total with *Striga*
Dambo	50	11	2	2	15 (23.1)
Upland	93	29	12	13	54 (36.7)
Hilly	11	3	1	2	6 (35.3)
Total	154	43	15	17	75 (34.5)

Notes: figures in brackets are percentages
Chi-square = 8.4 significant (p> 0.05)

Table 4.12 *Striga* incidence by first weeding, FSIPM research sites, 1996/97.

(number of fields)

First weeding done	No *Striga*	'Very little' *Striga*	'A little' *Striga*	'A lot' of *Striga*	Total with *Striga*
Partly	26	8	1	2	14 (29.7)
Fully	113	30	13	13	56 (33.1)
None	16	5	1	2	8 (33.3)
Total	155	43	15	17	75 (34.5)

Notes: figures in brackets are percentages
Chi-square = 11.52, not significant

Table 4.13 *Striga* incidence by second weeding, FSIPM research sites, 1996/97

(number of fields)

Second weeding	No *Striga*	'Very little' *Striga*	'A little' *Striga*	'A lot' of *Striga*	Total with *Striga*
Partly	29	8	2	4	14 (32..6)
Fully	44	12	4	2	18 (29.0)
No	82	23	9	11	43 (34.4)
Total	155	43	15	17	75 (34.5)

Notes: figures in brackets are percentages
Chi-square = 80.04, significant at p >0.05

Table 4.14 Correlation coefficients for incidence of *Striga asiatica* and selected farm- and plot-level variables, FSIPM research sites, 1996-97.

No.	Variable	Correlation coefficient	Prob.-value (2-tailed) [a]	Prob.-value (1-tailed) [a]
	Farm-level: STSCORE1			
1	FSIZE	-.1432	.119	.059
2	FHH	.-.0461	.617	.309
3	FPCAP	-.1940	.034	**.017**
4	FERT3YR	-.0275	.766	.383
5	EPACODE	.0675	.464	.232
6	MZFPER	.0755	.412	.206
7	MZFW1PER	.1459	.112	**.056**
8	MZFW2PER	-.1542	**.093**	**.046**
9	MZNW1PER	-.0022	.981	.491
10	MZNW2PER	.1368	.136	**.068**
	Plot-level: STRIGA			
11	LANDTYPE	.1282	**.051**	**.026**
12	SLOPE	.0748	.256	.128
13	KATONDO	-.0406	.538	.269
14	LOKUDA	.0074	.910	.455
15	LACHENGA	-.0201	.760	.380
16	MAKANDE	-.0664	.314	.157
17	FERT	-.0214	.746	.373
18	MANURE	.0241	.715	.357
19	TOTN	.0631	.339	.169
20	TOTP	-.1066	.105	**.053**
21	TMBWERA	-.0885	.190	**.095**
22	LMBWERA	.0171	.798	.399
23	COWPEAS	.1071	.158	**.079**

[a] bold type = significant at 10% level or above

Definitions used in Table 4.14.

STSCORE1	Total *Striga* score (ranked 1-3) divided by area planted to maize
FHH	Dummy for female-headed household (1=Yes, 0 otherwise)
FPCAP	Cultivated area *per capita,* for household members
FERT3YR	Dummy variable for household used fertiliser in 1994/95, 1995/96 and 1996/97 (1=Yes, 0 otherwise)
EPACODE	Dummy variable for EPA (1=Matapwata, 2=Mombezi)
MZFPER	Proportion of maize area fertilised (%)
MZFW1PER	Proportion of maize area fully weeded at first weeding (%)
MZFW2PER	Proportion of maize area fully weeded at second weeding (%)
MZNW1PER	Proportion of maize area not weeded at first weeding (%)
MZNW2PER	Proportion of maize not weeded at second weeding (%)
LANDTYPE	Dummy variable for landtype (1=dambo, 2=*munda*, 3=hill)
SLOPE	Dummy variable for slope of plot (1=flat;2=slight;3=steep; 4=very steep)
KATONDO etc	Dummy variables for dominant soil type (1=Yes, 0 otherwise)
FERT	Dummy variable for plot received fertiliser in 1996/97 (1=Yes, 0 otherwise)
MANURE	Dummy variable for plot received manure in 1996/97 (1=Yes, 0 otherwise)
TOTN	Total nitrogen applied to plot in 1996/97 (kg/N/ha)
TOTP	Total phosphorous applied to plot in 1996/97 (kg/P/ha)
TMBWERA	Dummy variable if plot used for *mbwera* in 1996/97 (1=Yes, 0 otherwise)
LMBWERA	Dummy variable if plot used for *mbwera* in 1995/96 (1=Yes, 0 otherwise)
COWPEAS	Dummy variable if plot grew cowpeas in 1996/97 (1=Yes, 0 otherwise)

5.0 Pests

Farmers' perceptions of pests of maize, beans, and pigeonpea were explored using matrix ranking during diagnostic surveys (Orr *et. al.*, 1996: 18-22). The results largely confirmed the previous identification of priority pests made by professional researchers at the FSIPM Stakeholder Workshop (Ritchie, 1996).

It was judged worthwhile to repeat the ranking exercise with a larger sample in the baseline survey, and to supplement this with information on changes over time, and a more detailed exploration of farmers pest management practices. The results of farmers' ranking for pests of maize were almost identical to those obtained during diagnostic work. Results for beans and pigeonpea differed slightly from earlier rankings, reflecting the variation in pest incidence between seasons.

Farmers' perceptions of pests

Maize

Farmers were asked to rank pests of maize, beans, and pigeonpea in terms of the most severely affected crop, and to identify the major pests of each.

Table 5.1 shows that, of 11 pests of maize, farmers considered whitegrubs, *Striga*, and termites to be most severe. The high number of responses for whitegrubs is not surprising since the research site at Mombezi EPA was selected because of the presence of this pest. More surprising is the high number of responses for *Striga* since infestation was reported to be high on only 7 % of the area under cultivation (Table 4.9, this report). Farmers' perception of *Striga* as the second most important pest of maize reflects its potential for damage on infested fields, therefore, rather than the present scale of distribution. Lastly, termites were perceived as the third most important pest, with levels of damage comparable to *Striga* and whitegrubs. The low ranking given to maize diseases has been noted in earlier work in Malawi, and partly reflects the difficulty farmers experience in identifying plant diseases. Damage scores, measured as the number of plants destroyed of 10, were similar for the three major pests. About one-third of farmers interviewed had perceived an increase in damage from these pests since they began farming in the area.

Farmers reported numerous control methods for all three major pests of maize, including two strategies (Sevin seed dressing, and not banking) which were selected for testing in OFTs in 1996/97. Intercropping with velvet beans (*mucuna*) was reported to be effective against *Striga*, though farmers were not necessarily aware of the link between *Striga* and low soil fertility.

Beans

Farmers ranked bean foliage beetle (*Ootheca* spp.), 'caterpillars', and bean stem maggot (*Ophiomyia* spp.) as the three major pests of beans (Table 5.2). A similar survey of farmers' perceptions conducted in four major bean growing areas of Malawi also found bean foliage beetle and bean stem maggot ranked among the top three pests of beans (Ross, 1997). During diagnostic work, bean stem maggot was ranked as the most important pest of beans in both EPAs, with *Ootheca* ranked third in Mombezi EPA (Orr *et. al.*, 1996: 20). The variation in ranking may reflect differences in incidence between seasons. Of all pests of beans, *Ootheca* showed the most year-to-year variation, and damage was associated with the summer and not the winter crop (Ross, 1997: 2).

All three major pests of beans were perceived to be on the increase. The most severe damage was caused by the bean foliage beetle, with eight of 10 plants destroyed, and by bean stem maggot, with seven of 10 plants destroyed. Hand-killing was the most widely used control method for bean foliager beetle. There was no mention of varietal resistance to bean stem maggot by Kaulesi, the variety tested in OFTs in 1996/97.

Pigeonpea

Fusarium wilt, 'caterpillars', and termites were perceived as the three most important pests of pigeonpea (Table 5.3). *Fusarium* and termites were also ranked high by farmers during diagnostic surveys, but no mention was made of caterpillars (Orr *et. al*., 1996: 21). Damage from *Fusarium* was perceived to be increasing, as was damage from termites. Losses from both these pests were estimated at three or four plants from 10. Farmers were aware of varietal resistance to *Fusarium*, but control methods for other pests did not exist or were confined to hand-killing. Interestingly, seed-dressing was reported as a control method against whitegrubs, a method also found with maize in the Chitera dambo, Mombezi EPA.

Farmers' pest management strategies

Table 5.4 shows the proportion of households using selected pest management strategies for maize, beans, and pigeonpea.

- Very few sample households (1-2.5 %) used chemical methods of pest control for maize, beans, and pigeonpea. The most common form of chemical control (seed dressing with Sevin or DDT against whitegrubs) was used by one in 10 households. Thus, the incentive for farmers to adopt IPM strategies does not lie in reducing the cost of chemical control. In the absence of host plant resistance or biological PMS, adoption of IPM strategies will involve additional costs in terms of seed or labour, while reductions in crop losses will be modest because of low average crop yields. This reduces the incentive for the adoption of IPM strategies among smallholders, unless steps can also be taken to raise average yields and thereby increase the economic returns from crop protection.

- Cultural practices were fairly common pest management strategies. Examples include not banking (termites); extra hoeing, intercropping with velvet beans, and removing weeds from field (*Striga*); and planting pigeonpea on the side rather than the top of the ridge (*Fusarium* wilt);

- Very few households used botanical insecticides made from local materials (4.2 %). Farmer-developed PMS included Dema (either *Neorautanenia* sp. or *Dolichos kilimandscharicus*), Nadinji (*Mucuna* sp.), sprayed on vegetable nurseries against leaf-eating insects; sprinkling ash around maize planting stations to control termites and on cowpea leaves to control aphids; and Nkhadze or milk bush (*Euphorbia tirucalli),* planted in corners of the maize field to control termites. Knowledge of these methods seems to be localised and - in the case of Dema - may reflect availability of plant materials. Scope therefore exists for technology transfer and testing of traditional botanical insecticides, based on the indigenous technical knowledge of farmers in other regions of Malawi.

- Three strategies introduced by the Project to control bean stem maggot (mulching, earthing-up, and seed dressing) were completely new to farmers.

Table 5.1 Farmers' ranking of pests of maize, FSIPM research sites, 1996/97.

No.	Pest	Rank[a]	Reporting increase in pest (%)	Most common growth stage of pest attack	Average plants destroyed (no/10)	Control method (s)
1	Whitegrubs	25	11 (44.0)	2 weeks	5.0	Seed dressing (Sevin, DDT)
2	*Striga asiatica*	13	4 (31.0)	4-6 weeks	4.5	Uprooting; fertiliser; intercropping velvet beans
3	Termites	10	4 (40.0)	Late vegetative; tasselling	5.2	not burying stalks; not banking; killing queen
4	'Caterpillars'	5	1 (20.0)	Vegetative and reproductive	2.2	none
5	Stalkborer	3	2 (67.0)	Reproductive	1.3	destroying damaged plants
6	'Worms'	2	1 (50.0)	Tasselling	6.0	none
7	'Insects'	2	2 (100.0)	Vegetative	3.0	hand killing
8	Headsmut	2	2 (100.0)	Tasselling	1.5	none
9	Other weeds	2	0 (0.0)	2-3 weeks	3.5	weeding; banking
10	Wilting	1	0 (0.0)	4 weeks	2.0	none
11	Birds	1	1 (100.0)	Planting	7.0	none

[a] number of farmers reporting pest

Table 5.2 Farmers' ranking of pests of beans, FSIPM research sites, 1996/97.

No.	Pest	Rank[a]	Reporting increase in pest (%)	Most common growth stage of pest attack	Average plants destroyed (no/10)	Control method (s)
1	Bean foliage beetle (*Ootheca* spp.)	39	17 (44.0)	Two leaves stage, or flowering	8.0	Hand killing
2	'Caterpillars'	15	6 (40.0)	Flowering	5.3	Hand killing; spraying by extension officers
3	Bean stem maggot (*Ophiomyia* spp.)	6	4 (67.0)	Flowering	6.7	None
4	Snails	4	2 (50.0)	Soon after germination	4.8	Hand killing
5	'Worms'	2	0 (0.0)	Before flowering	2.5	None
6	Spiders	1	0 (0.0)	Two leaves stage	na	Hand killing
7	Ants	1	1 (100.0)	Soon after germination	5.0	Hand killing
8	Termites	1	1 (100.0)	Maturity	7.0	None
9	*Striga asiatica*	1	0 (0.0)	Soon after germination	1.0	None
10	Unidentified pests	4	1 (25.0)	-	-	-

[a] number of farmers reporting pest

Table 5.3 Farmers' ranking of pests of pigeonpea, FSIPM research sites, 1996/97.

No.	Pest	Rank[a]	Reporting increase in pest (%)	Most common growth stage of pest attack	Average plants destroyed (no/10)	Control method (s)
1	*Fusarium* wilt	9	4 (44.0)	Vegetative (podding)	3.4	'Chinese' variety (ICP9154)
2	Caterpillars	4	1 (25.0)	Early vegetative (knee high)	3.0	None
3	Termites	3	2 (67.0)	Vegetative (before flowering)	6.3	Kill queen
4	Whitegrubs	1	1 (100.0)	Two weeks after germination	3.0	Seed dressing with DDT
5	Worms	1	0 (0.0)	Soon after germination	3.0	Hand killing
6	Bean foliage beetle	1	0 (0.0)	Flowering	5.0	Hand killing
7	Ants	1	1 (100.0)	Knee high	10.0	None
8	Unidentified pests	1	1 (100.0)	Maturity	7.0	None

[a] number of farmers reporting pest

Table 5.4 Pest management strategies used by sample households, FSIPM research sites, 1996/97.

No.	Crop	Pest	Pest management strategy	Households using strategy (%)	Sample size (no.)
1	Maize	Whitegrubs	Seed dressing	10.0	120
2		Termites	Modified *kaselera*	2.5	120
3		Termites	Not banking	27.5	120
4		Unspecified	Pesticide sprays	2.5	120
5		Stemborer	Solutions/powders of local plants/leaves	4.2	120
6		*Striga asiatica*	Adding fertiliser	3.5	57
7		"	Adding manure	3.5	57
8		"	Adding crop residues	5.3	57
9		"	Intercropping with velvet beans	10.5	57
10		"	Other trap crops	3.5	57
11		"	Handpulling	40.4	57
12		"	Extra hoeing	59.6	57
13		"	Removing from field	19.3	57
14		"	Removing and burning	0.0	57
15	Pigeonpea	Fusarium wilt	Planting ICP9145	15.7	108
16		"	Planting on side of ridge	8.3	108
17		"	Pesticide sprays	1.0	108
18	Beans	Beanfly	Mulching	0.0	111
19		"	Earthing-up	0.0	111
20		"	Seed dressing	0.0	111
21		"	Pesticide sprays	1.0	111

References

Agro-Economic Survey (1986). *A Farm Management and Socio-Economic Survey of Smallholder Farmers in Chiradzulu District, Malawi.* Report No. 53. May. Mimeo.

Benson, T (1997). The 1995/96 Fertilizer Verification Trial-Malawi. Area-specific fertilizer recommendations for hybrid maize grown by Malawian smallholders. Reportby Action Group 1. June. Mimeo, 18 pp.

BLADD (1997). Crop Estimates Round 3, 17 July 1997. Mimeo, 13 pp.

Bose, S. R. and I. Livingstone (1993). The Labour Market and Wages Policy in Malawi. Report prepared for the Government of Malawi. October. Mimeo, 123 pp.

GoM (1996). *National Sample Survey of Agriculture 1992/93. Vol I: Smallholder Household Composition Survey Report.* (Zomba: National Statistical Office).

GoM (1996). *National Sample Survey of Agriculture 1992/93. Vol II: Smallholder Garden Survey Report.* (Zomba: National Statistical Office).

Green, D. A. G. and D. H. Ng'ong'ola (1993). "Factors affecting fertiliser adoption in less developed countries: an application of multivariate logistic analysis in Malawi", *Journal of Agricultural Economics,* 44, 1: 99-109.

Hamilton, K. A. (1991). *A Guide to Arable Weeds of Southern Malawi.* Soil Pest Project, Chancellor College, University of Malawi. Mimeo, 23 pp.

Orr, A., A. Koloko, and C.B. K. Mkandawire (1996). *Background Information on Blantyre Shire Highlands RDP.* FSIPM Project. Mimeo, 37 pp.

Orr, A., J. M. Ritchie, J. Lawson-McDowall, A. M. Koloko, and C. B. K. Mkandawire (1996). *Diagnostic surveys in Matapwata and Chiradzulu EPAs.* October. FSIPM Project. Mimeo.

Peters, P (1993). *Maize and burley in the income and food security stratergies of smallholder farmers in the southern region of Malawi, 1993.* Harvard Institute for International Development. Mimeo, 73 pp.

Peters, P. (1996). Conceptual quagmires, old problems and new questions: rethinking policy assumptions about Malawi's rural economy. Harvard Institute for International Development, September. Mimeo, 14 pp.

Ritchie, J. M. (1996). Workshop Summary Report. FSIPM Stakeholder Workshop, 4-6 June,. FSIPM Project. Mimeo, 15 pp.

Ross, S. J. (1997). The status of bean pests in Malawi. Paper presented at Annual Project Meeting for Plant Protection, Mangochi, 24-29 August. Mimeo, 8 pp.

Segal, M. T. (1986). 'Work-family systems of Malawi's smallholder households: an analysis of data from the 1983-84 ASSA', *Journal of Social Science*, 13, 104-124.

Singh, I (1990). *The Great Ascent. The Rural Poor in South Asia.* (Washington, DC: The World Bank).

Soil Pest Project (1993). *Relative importance of different insect pests, plant diseases and weed species affecting farmers' crops in southern Malawi.* Report No. 3. October. Mimeo.

Walsh, M. J., J. Grindle, A. Nell and M. Bachmann (1991). *Dairy Development in Sub-Saharan Africa. A Study of Issues and Options.* World Bank Technical Paper No. 135. Africa Department Technical Series. (World Bank: Washington, DC).

World Bank (1996). *Malawi: Human Resources and Poverty. Profile and Priorities for Action.* Report No. 15437-MAI March 19, 1996. (Washington, DC: World Bank).

ABBREVIATIONS

ADD	Agricultural Development Division
ADMARC	Agricultural Development and Marketing Corporation
ASA	Annual Survey of Agriculture
BLADD	Blantyre Agricultural Development Division
CAN	Calcium Ammonium Nitrate
CIAT	International Centre for Tropical Agriculture
DAET	Department of Agricultural Extension and Training
DAP	Di-Ammonium Phosphate
DAR	Department of Agricultural Research
EPA	Economic Planning Area
FA	Field Assistant
FHH	Female-headed household
FSIPM	Farming Systems Integrated Pest Management
GOM	Government of Malawi
IPM	Integrated Pest Management
MDI	Malawi Dairy Industries
MK	Malawi Kwacha
MOAI	Ministry of Agriculture and Irrigation
MOALD	Ministry of Agriculture and Livestock Development
MPA	Maize Provision Ability
MRFC	Malawi Rural Finance Company
MV	Modern variety
NGO	Non-Government Organisation
NSO	National Statistical Organisation
NSSA	National Sample Survey of Agriculture
OFT	On-farm trial
OLS	Ordinary Least Squares
PMS	Pest management strategy
PRA	Participatory Rural Appraisal
PTC	Press Trading Corporation
RDP	Rural Development Project
SHMPA	Shire Highlands Milk Producers Association

APPENDICES

1: Questionnaire Round 1

2: Questionnaire Round 2

3: Garden Survey

Farming Systems Integrated Pest Management Project
Ministry of Agriculture and Livestock Development,
Department of Agricultural Research,
Bvumbwe Research Station,
PO Box 5748, Limbe

BENCHMARK SURVEY, 1996/97 CROP SEASON

Farmer code number	

	Identification	Code
EPA		
Village		
Lineage		
Name of head of household		
On-Farm Trial plot number		

Name of interviewer (s)	Date of interviews

Describe location of house

2.0 Household listing

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
								Participated 1996/97 season ? Yes/No)				
N	Name of household member	Rel. to HH	Sex	Age	Highest education	Resident status	Primary occupation	Land prep.	Plant -ing	1st weed	2nd weed or bank	Harv est
1												
2												
3												
4												
5												
6												

Codes for household listing

A2	**A3**	**A4**	**A5**	**A6**	**A7**	**A8-A12**
1 head	1 male	1 = 0-6	2 none	1 resident	1 farmer	1 yes
2 spouse	2 female	2 = 7-14		2 res. at school	2 labourer	2 no
3 son/daughter		3 = 15-49		3 polygamist	3 at school	
4 father/mother		4 = 50 +		4 visitor	4 business	
5 son/daughter-in-law				5 = other	5 other (specify)	
6 grandchild					6 none	
7 other relative						
8 labourer						
9 visitor						
10 other non-relative						

2.0 Household listing (cont.)

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
								Participated 1996/97 season ? Yes/No)				
N	Name of household member	Rel. to HH	Sex	Age	Highest education	Resident status	Primary occupation	Land prep.	Plant -ing	1st weed	2nd weed or bank	Harv est
7												
8												
9												
10												
11												
12												

Codes for household listing

A2	**A3**	**A4**	**A5**	**A6**	**A7**	**A8-A12**
1 head	1 male	1 = 0-6	2 none	1 resident	1 farmer	1 yes
2 spouse	2 female	2 = 7-14		2 res. at school	2 labourer	2 no
3 son/daughter		3 = 15-49		3 polygamist	3 at school	
4 father/mother		4 = 50 +		4 visitor	4 business	
5 son/daughter-in-law				5 = other	5 other (specify)	
6 grandchild					6 none	
7 other relative						
8 labourer						
9 visitor						
10 other non-relative						

2.1 Is household head female ?

Yes		1
No		2

2.2 What is the marital status of the household head ?

Never married		1
Married		2
Polygamist		3
Wife of polygamist		4
Separated		5
Divorced		6
Widowed		7

2.3 Is household head male ?

Yes		1
No		2

2.4 If household head is male, is he absent from this household for six months of the year or more ?

Yes		1
No		2

2.5 If absent, specify reasons for absence.

Section 3. Gardens: _____ (total) ______ (munda) _____ (dimba)

3.1	**Garden number**				
3.2	**Plot Number**				
3.3	Area (ha)				
3.4	Is this on On-Farm Trial Plot ? (1= Yes, 2=No)				
3.5	Landtype (dambo=1, munda=2, hill=3)				
3.6	Soiltype				
3.7	Slope (flat=1; slight=2; steep=3; very steep = 4)				
3.8	Land tenure (owned=1, rented=2, other=3)				
3.8	Name of main crop				
3.9	Name of maize variety				
3.10	Was maize replanted ? (1= Yes, 2= No)				
3.11	If yes, specify reason				
 3.12 3.13 3.14 3.15	Names of intercrops 1 2 3 4				
3.16	Name of bean variety (first crop)				
3.17	Name of bean variety (relay crop)				
3.17	Name of pigeonpea variety				
3.18	Was this plot fertilised ? (1=Yes, 2= No)				
3.19	Was this plot manured ? (1=Yes; 2=No)				
3.20 3.21 3.22	First fertiliser application Type No. of Bags Weight/bag				
3.23 3.24 3.25	Second fertiliser application Type No. of bags Weight/bag				
3.26	Was pesticide applied to this plot ? (1=Yes, 2= No)				
3.27	Name of pest				
3.28	Name of pesticide				
3.29	Is there striga on this plot ? (1= none; 2 = very little; 3=little; 4=lot)				

Section 4. Labour

4.1	**Garden number**				
4.2	**Plot Number**				
4.3	Area (ha)				
4.4	Landtype (dambo=1, munda=2, hill=3)				
4.5	Main crop				
4.6	Maize variety				
4.9	Main type of labour used for ridging*				
4.10 4.11	How many weeks after rains did you start planting?				
4.12	Main type of labour used *				
4.13	Did you do first weeding ? 1=Partly 2 = Fully 3 = No				
4.14 4.15	How many weeks after planting did you do first weeding?				
4.16	Main type of labour used *				
4.17	Did you do second weeding ? 1=Partly 2 = Fully 3 = No				
4.18	Banking done ? 1=Partly, 2 = Fully 3 = No				
4.19 4.20	How many weeks after planting did you start second weeding/banking?				
4.21	Main type of labour used *				
4.22	Date started harvesting Week Month				
4.23	Main type of labour used *				

* Codes: 1 = household; 2 = hired; 3 = both household and hired.

Section 5: Pests, diseases, and weeds of crops

	Rank	1.	2.	3.
5.1- 5.3	Which are the three crops most damaged by pests, diseases, and weeds on your gardens, last season and this season ? (1995/6, 1996/7) ?			

CROP 1 (specify)________________________

	Rank	1	2
5.4.- 5.15	Which two pests, diseases, or weeds caused the most damage to this crop ?		
5.17	At which growth stage was there most damage ? 1 = Seedling 2 = Vegetative 3 = Maturity		
5.19	Any change since you started farming ? 1 = Increase 2 = Decrease 3 = No change		
5.20	More damage in wet years (1=Yes, 2=No, 3 = same)		
5.21	More damage in dry years (1=Yes, 2=No, 3 = same)		
5.22	Seedlings damaged in average year (no. plants out of 10)		
5.23	Mature plants destroyed in average year (no. planting stations out of 10)		
5.24	Any difference between varieties ? (1=Yes, 2=No)		
5.25 5.26	Name the varieties most damaged 1. 2.		
5.27 5.28	Name the varieties least damaged 1. 2.		
5.29	On which landtype is damage most severe ? Dambo = 1 Upland = 2 No difference = 3		
5.30	What control methods do you use for this pest ?		

Did you apply any pesticides to crops in your garden this season ?

Yes		1
No		2

If yes, which pesticides did you apply to which crops ?

No.	Crop	Name of pesticide	Quantity	Price/unit	Source of pesticide
1					
2					
3					
4					
5					
6					

Did you apply any pesticides to your dambo crops last season (1995/96) ?

Yes		1
No		2

If yes, which pesticides did you apply to which crops ?

No.	Crop	Name of pesticide	Quantity	Price/unit	Source of pesticide
1					
2					
3					
4					
5					
6					

CODES FOR PESTICIDE	
0 = None used	5 = Diptex
2 = Sevin	6 = Diathin
3 = DDT	7 = Other (specify)
4 = Dimethoate	
5 = Carbaryl	

CODES FOR SOURCE OF PESTICIDE	
1 = ADMARC	4 = Gift
2 = Retail shop (eg. PTC)	5 = Other (specify)
3 = Local market	

Section 6: Pest management strategies

Which of these methods have you used to control pests or diseases on MAIZE ?

(1 = Yes, 2 = No)

6.2	seed dressing for whitegrubs (specify)	
6.3	pulling soil away from ridge to make new furrow (kaselera)	
6.4	no banking for termites	
6.5	pesticide sprays	
6.6	solutions or powders of local plants and leaves (specify)	

6.7 Which of these methods have you used to control pests and diseases on PIGEONPEA ?

(1 = Yes, 2= No)

6.8	ICP 9145 for wilting	
6.9	sideplanting for wilting	
6.10	pesticide sprays	

Which of these methods have you used to control pests and diseases on BEANS ?

6.12	mulching	
6.13	earthing up	
6.14	seed dressing (specify)	
6.15	pesticide sprays;	

Which of these control methods have you used for STRIGA ?

6.16	fertiliser	
6.17	manure	
6.18	crop residues	
6.19	velvet bean (*kalingonda*)	
6.20	other trap crops (specify)	
6.21	pulling weeds by hand	
6.22	extra weeding with hoe	

What did you do with the striga after weeding or hand pulling ?

(1 = yes, 2 = no)

6.23	left in field	
6.24	removed from field	
6.25	removed and burned	
6.26	other (specify)	

7.0 Household assets

7.1 Is the household head a member of:

1 = Yes, 2 = No

7.2	Maize credit club	
7.3	Burley club	
7.4	Milk bulking group	

7.2 If yes, from which clubs did they receive credit this season (1996/97) ?

1 = Yes, 2 = No

7.2	Maize credit club	
7.3	Burley club	
7.4	Milk bulking group	

7.6 Which livestock does the household own ?

	Livestock	Number
7.6	milk cows	
7.7	beef cattle	
7.8	calves	
7.9	goats	
7.10	kids	
7.11	pigs	

7.15 Record what type of house the farmer lives in.

No.	Housetype	Yes=1, No=2
1	Round house	
2	Square house	
3	Ndindo walls	
4	Zidina walls	
5	Burnt brick walls	
6	Glass windows	
7	Wooden door	
8	Straw roof	
9	Iron sheets on roof	
10	Cement floor	

8. SOURCES OF INPUTS

8.1 Where did you get the seed you used this season (1996/97) ?

No.	Name of maize variety	Source of seed	Total paid (cash)	Total paid (kind)
8.1				
8.2				
8.3				
8.4				
8.5				
No.	**Name of bean variety**	**Source of seed**	**Total paid (cash)**	**Total paid (kind)**
8.6				
8.7				
8.8				
8.9				
No.	**Name of pigeonpea variety**	**Source of seed**	**Total paid (cash)**	**Total paid (kind)**
8.10				
8.11				
8.12				
8.13				

Codes for source of seed

1 = Own seed from last season
2 = Local market
3 = Credit club
4 = Retail shop (eg. PTC)
5 = Gift
6 = Other (specify)

8.14 Did you use fertiliser this season ?

Yes		1
No		2

8.15 If yes, what type of fertiliser, and where did you get it ?

No.	Type of fertiliser	Source of fertiliser	Number of bags	Weight/bag (kg)	Price/bag
8.15					
8.16					
8.17					
8.1					

Codes for fertiliser type		Codes for source of fertiliser
1 = 20: 20: 04 2 = CAN 3 = UREA 4 = DAP 5 = D. COMPOUND	6 = 14: 20: 0 7 = 23: 21 8 = S. AMMONIA 9 = MIXTURE 10 = OTHER (SP)	1 = Cash from ADMARC 2 = Credit club 3 = Local market 4 = Retail shop (eg.PTC) 5 = Gift 6 = Other (specify)

9. FOOD SECURITY

9.1 Has your household had to buy maize to eat this season (1996/97) ?

1	Yes	
2	No	

9.2 If yes, which months has your household bought maize to eat ?

(Circle the number opposite each month when maize was bought)

1	OCT 1996	5	FEB 1997	9	JUN 1997
2	NOV 1996	6	MAR 1997	10	JUL 1997
3	DEC 1996	7	APR 1997	11	AUG 1997
4	JAN 1997	8	MAY 1997	12	SEP 1997

9.3 Which month did you run out of maize last season (1995/96) ?

______________________________(month)

10. **INCOME AND EXPENDITURE**

10.1 What are your main sources of off-farm cash income ?

No.	Sources of off-farm income	Rank
10.1	Ganyu	
10.2	Trading/business	
10.3	Salary income	
10.4	Other (specify)	

10.6 How much of your household cash income comes from your own farm ?

(Hold up 10 fingers to get proportions)

No.	Source of income	Score out of 10
10.6	Own agriculture	
10.7	Off-farm	
10.8	Total	10

10.9 What are the main sources of agriculture cash income from your own farm?

No.	Source of income	Rank
10.9	Munda crops	
10.10	Dimba crops	
10.11	Livestock (goats, cattle)	

Farming Systems Integrated Pest Management Project
Ministry of Agriculture and Livestock Development
Department of Agricultural Research
Bvumbwe Research Station
PO Box 5748
Limbe

BENCHMARK SURVEY, 1996/97 CROP SEASON

ROUND TWO.

Farmer code number	

		Code
EPA		
Village		
Name of head of household		
Household member interviewed		

Name of interviewer (s)	Date of interviews

Section 2.0. TREATMENT OF CROP RESIDUES AND TILLAGE PRACTICES

Copy questions 3.1, 3.5, 3.8 a
nd 3.9 over from Round 1 questionnaire

3.1	Garden number	1	2	3	4
3.5	Landtype				
3.8	Maincrop				
3.9	Maize variety				

2.1	Did you do Mbwera in this garden *last season* ? (1 = Yes, 2 = No)				
2.2	If you did Mbwera in this garden *last season,* what did you do with the maize/weed residues ? 1 = burned them 2 = used as fuel 3 = laid in furrow 4 = incorporated in new ridge 5 = other (specify)				
2.3	If you did not do Mbwera in this garden *last season,* what did you do with maize/weed residues ? 1 = laid in furrow 2 = carried off field 3 = burned them 4 = buried just after harvest (June, July) 5 = buried later in the dry season (Aug, Sep, Oct) 6 = other (specify)				
2.4	When did you ridge this garden for *this season's* maize crop ? 1 = just after last harvest (June, July) 2 = in dry season (Aug, Sep, Oct) 3 = at first rains 4 = at planting 5 = other (specify)				
2.5	Did you rebuild ridges before planting *this season* ? (1= Yes, 2, = No)				
2.6	If yes, what sort of rebuilding ? 1 = removing weeds 2 = re-ridging 3 = other (specify)				
2.7	Are you doing Mbwera in this garden *this season ?* (1 = Yes, 2 = No)				

CROP 2 (specify)___________________

	Rank	1	2
5.4.- 5.15	Which two pests, diseases, or weeds caused the most damage to this crop ?		
5.17	At which growth stage was there most damage ? 1 = Seedling 2 = Vegetative 3 = Maturity		
5.19	Any change since you started farming ? 1 = Increase 2 = Decrease 3 = No change		
5.20	More damage in wet years (1=Yes, 2=No, 3 = same)		
5.21	More damage in dry years (1=Yes, 2=No, 3 = same)		
5.22	Seedlings damaged in average year (no. plants out of 10)		
5.23	Mature plants destroyed in average year (no. planting stations out of 10)		
5.24	Any difference between varieties ? (1=Yes, 2=No)		
5.25 5.26	Name the varieties most damaged 1. 2.		
5.27 5.28	Name the varieties least damaged 1. 2.		
5.29	On which landtype is damage most severe ? Dambo = 1 Upland = 2 No difference = 3		
5.30	What control methods do you use for this pest ?		

CROP 3 (specify)________________

	Rank	1	2
5.4.- 5.15	Which two pests, diseases, or weeds caused the most damage to this crop ?		
5.17	At which growth stage was there most damage ? 1 = Seedling 2 = Vegetative 3 = Maturity		
5.19	Any change since you started farming ? 1 = Increase 2 = Decrease 3 = No change		
5.20	More damage in wet years (1=Yes, 2=No, 3 = same)		
5.21	More damage in dry years (1=Yes, 2=No, 3 = same)		
5.22	Seedlings damaged in average year (no. plants out of 10)		
5.23	Mature plants destroyed in average year (no. planting stations out of 10)		
5.24	Any difference between varieties ? (1=Yes, 2=No)		
5.25 5.26	Name the varieties most damaged 1. 2.		
5.27 5.28	Name the varieties least damaged 1. 2.		
5.29	On which landtype is damage most severe ? Dambo = 1 Upland = 2 No difference = 3		
5.30	What control methods do you use for this pest ?		

5.31 How many years have you been farming in this village ?

__________(years)

Section 4.0 Weeds

4.1 Which THREE weeds are the **most common** in your garden ?

No.	Local name or description of weed	Rank (1, 2, or 3)
4.1		
4.2		
4.3		

4. 4. Which THREE weeds in your garden are the **most difficult to control** ?

No.	Local name or description of weed	Rank (1, 2, or 3)
4.4		
4.5		
4.6		

5.0 Fertiliser and hybrid maize in previous seasons

5.1 In which of these seasons did you apply fertiliser in your garden ?

No.	Season	Yes = 1, 2 = No
5.1	Last season (95/96)	
5.2	Season before last (94/95)	

5.2 In which of these seasons did you plant hybrid maize ?

No.	Season	Yes = 1, 2 = No
5.1	Last season (95/96)	
5.2	Season before last (94/95)	

Section 5: Pests, diseases, and weeds of crops

	Rank	1.	2.	3.
5.1- 5.3	Which are the three crops most damaged by pests, diseases, and weeds on your gardens, last season and this season ? (1995/6, 1996/7) ?			

CROP 1 (specify)________________________

	Rank	1	2
5.4.- 5.15	Which two pests, diseases, or weeds caused the most damage to this crop ?		
5.17	At which growth stage was there most damage ? 1 = Seedling 2 = Vegetative 3 = Maturity		
5.19	Any change since you started farming ? 1 = Increase 2 = Decrease 3 = No change		
5.20	More damage in wet years (1=Yes, 2=No, 3 = same)		
5.21	More damage in dry years (1=Yes, 2=No, 3 = same)		
5.22	Seedlings damaged in average year (no. plants out of 10)		
5.23	Mature plants destroyed in average year (no. planting stations out of 10)		
5.24	Any difference between varieties ? (1=Yes, 2=No)		
5.25 5.26	Name the varieties most damaged 1. 2.		
5.27 5.28	Name the varieties least damaged 1. 2.		
5.29	On which landtype is damage most severe ? Dambo = 1 Upland = 2 No difference = 3		
5.30	What control methods do you use for this pest ?		

6.0 Other questions

6.1 Do you have any of the following ?

1 = Yes, 2 = No

6.1	Woodlot (Timber trees)	
6.2	Orchard (fruit trees)	
6.3	Homestead vegetable garden in the dry season	

6.4 Are you growing Cassava this season ?

Yes		1
No		2

6.5 If yes, which varieties are you growing ?

No.	Name of cassava variety *
6.5	
6.6	
6.7	

* Write specific names, not just **wa makolo**

6.8 Are you growing sweet potatoes this season ?

Yes		1
No		2

6.9 If Yes, which varieties are you growing ?

No.	Name of sweet potato variety *
6.9	
6.10	
6.11	

* Write specific names, not just **wa makolo**

7.0 Household expenditure

7.1 Which of these foods did your household eat during the past THREE DAYS ?

Food Items	No.	Items cooked (1 =Yes, 2=No)	Calculations	Total cost (Kwacha)
Green maize	7.1			
Nsima	7.2			
Cassava	7.3			
Sorghum/millet	7.4			
Rice	7.5			
Other cereals	7.6			
Pulses (beans, cowpeas, field peas)	7.7			
Other vegetables (eg pumpkin leaves)	7.8			
Fish	7.9			
Meat	7.10			
Chicken	7.11			

Non-cooked items

Food Items	No.	Items eaten (1 =Yes, 2=No)	Calculations	Total cost (Kwacha)
Yellow buns	7.12			
Milk/dairy products	7.13			
Bananas	7.14			
Other fruits	7.15			
Potatoes	7.16			
Eggs	7.17			
Cooking oil	7.18			
Sugar	7.19			
Salt	7.20			
Infant formula	7.21			
Soft drinks	7.22			

7.23 List expenditures on these non-food items for the household during the PAST MONTH

Non-Food Items	No.	Items bought (1=Yes, 2=No)	Calculations	Total cost (Kwacha)
Soap	7.23			
Tobacco and alcoholic drinks	7.24			
Paraffin	7.25			
Food processing (maize mill)	7.26			

7. 27 List expenditures on these non-food items during the past THREE MONTHS.

Non-Food Items	No.	Items bought (1=Yes, 2=No)	Calculations	Total cost (Kwacha)
Clothing	7.27			
Footwear	7.28			
Blankets	7.29			
Household wares	7.30			
Medicine	7.31			
Hospital fees	7.32			
Transport charges	7.33			
Education fees and charges	7.34			
Charcoal	7.35			
Batteries	7.36			
Coffee/tea	7.37			
Housing	7.38			
House maintenance	7.39			
Debt repayment	7.40			
Other non-foods	7.41			

8.0 Income from crops

8.1 From which of these crops do you normally get some cash income ?

Crop	Code	Normally grown ? (Yes= 1, No=2)	Some sold for cash ? (Yes=1, No=2)	Rank THREE most important for cash income? (1, 2, 3..)	Proportion of each crop sold for cash income ? (Tick ONE box)			
					Less than 1/4	Between 1/4 and 1/2	More than 1/2	All
Local maize	8.2							
Hybrid maize	8.3							
Rice	8.4							
Cassava	8.5							
Sorghum	8.6							
Millet	8.7							
Beans	8.8							
Soya beans	8.9							
Velvet bean	8.10							
Pigeonpea	8.11							
Cowpeas	8.12							
Crownpeas	8.13							
Sweet potatoes	8.14							
Irish potatoes	8.15							
Tomatoes	8.16							
Cabbage	8.17							
Mustard	8.18							
Chillies	8.19							
Groundnut	8.20							
Sugarcane	8.21							
Tobacco	8.19							
	8.20							

GARDEN MEASUREMENT FORM (CONT.)

GARDEN NUMBER				
MAINCROP				

AREA (OUT OF 10)				

INTERCROP AREA	MAX=10	MAX=10	MAX=10	MAX=10
PIGEONPEA				
BEANS				
RELAY BEANS				
CROWN PEAS				
COWPEAS				
SORGHUM				
RICE				
SOYA				

CASSAVA				
SWEET POTATO				

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FARMING SYSTEMS INTEGRATED PEST MANAGEMENT PROJECT
1996/97 SEASON
GARDEN MEASUREMENT FORM

EPA: MAT/ CHZ — PACER: ____________
VILLAGE: KAM/ MAG /CHI /LID — DATE: ____________

FARMER: ______________________________

OFT: YES/NO
FHH: YES/NO

GARDEN NUMBER: ________ (MATCH WITH NUMBER ON QUESTIONNAIRE)

POINTS	PACES	SKETCH GARDEN HERE

MAIN CROP	INTERCROP AREA		INTERCROP AREA
PIGEONPEA	/10	RICE	/10
BEANS	/10	SOYA	/10
RELAY BEANS	/10		/10
CROWN PEAS	/10		/10
COWPEAS	/10	CASSAVA	
SORGHUM	/10	SWEET POTATO	

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FARMING SYSTEMS INTEGRATED PEST MANAGEMENT

SEED SECTOR: POLICY EVOLUTION AND ISSUES

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28th August. 1998

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Introduction

During the Workshop on Participatory Approaches to On-farm Pest Management Trials conducted at Bvumbwe Research Station between the 19th and 27th August 1998. one policy issue that emerged in relation to FSIPM project exit strategy was the question of supply and availability of seed for crops that farmers have tested and are ready for uptake. Members expressed interest to know government's policy on seed and what implication that may have on the Project's exit strategy. This paper is a brief on major recent agricultural policy reforms. and strategies that are in place to make seed available to farmers. Constraints to the seed sector are also looked at and possible future actions to improve the situation are proposed.

General Agricultural Policy Reforms

Since 1994. the Malawi Government has gone through a tremendous policy evolution in the agricultural sector. The origin of these policy reforms *emerged through* Structural Adjustment Programs (SAPs) under the auspices of the World Bank and the International Monetary Fund (IMF) which started in early to mid 1980s.

The economic justification for undertaking the policy reforms was and still remains that of improving resource allocation through operations of market forces that ensures resource utilisation in the highest priority activities. It is believed that efficient resource allocation would increase productivity in all the sectors hence better returns to investments and consumers. In case of the agricultural sector. increased productivity will entail more food and cash incomes to farmers: as well as increased contribution to economic development.

The initial policy reform initiatives focused on changing the pricing policy in order to offer price incentives to farmers. which would in turn stimulate production in the sector. Prior to the adoption of an open market economic system. the Government was at the centre of managing the economic affairs. Under the centrally planned economy. practices included. inter alia. the Ministry Agriculture setting both agricultural inputs and outputs prices: ADMARC being the sole buyer of smallholder farmers' agricultural produce and selling agent for most of the agricultural inputs: smallholders not being permitted to produce some high value cash crops such as burley. Sun air. Northern Dark Fired. and Southern Division Dark Fired tobaccos. etc.

The policy reform program under the Structural Adjustment Programs culminated to the liberalisation of produce marketing in 1987. Associated with this policy reform initiative was the restructuring of ADMARC to improve its management and operation in crop marketing by. among other things. selling of some of its investments in order for the private sector to take over some of activities previously handled by ADMARC.

The Government has also worked further to stretch the policy reforms with support from the World Bank and the United States Agency for International Development (USAID) under the Agricultural Sector Assistance credit (ASAC) and Agricultural Sector Assistance Program (ASAP) respectively. The two programs centred on the following important policy areas:

- Further liberalisation of crops marketing both on export and domestic markets:
- Removal of restrictions on the production and marketing of tobacco and other crops in the smallholder sub-sector under the Special Crops Act: and
- Liberalisation of importation and marketing of inputs (seed and fertiliser) markets.

These policy reforms were aimed at removing barriers and restrictions in the area of production and marketing of agricultural commodities with the view of improving the private sector involvement in the agricultural business activities. To fulfil the policy objectives. it became imperative to change the legislative framework such as:

- Repeal of the Agricultural and Livestock Marketing Act to remove all restrictions to entry into the marketing of all agricultural produce and livestock by the private sector:
- Amendment of the Fertiliser. Farm Feeds and Remedies Act (1970) to allow easier entry of fertiliser and feed supplies on the market:

- Amendment of the Seed Act to streamline the seed certification procedures and liberalise the seed market: and
- Deregulation of the Special Crops Act to allow free entry into the production and marketing of high value crops including. inter alia. burley. flue cured and dark fired tobacco. etc.

Following these policy reforms. the characteristics of production systems. as well as the inputs and output markets have seen tremendous change. For both the inputs and output markets. competition is now flourishing than was previously the case when markets were monopolistic and monopsonistic in nature. Combined with the removal of restrictions on domestic marketing has been the liberalisation of the export market. This move has removed export bans on all crops except for maize where export licensing is required for food security considerations.

But for the agricultural sector to realise substantial growth. one important element that needs to be addressed is **seed.**

Seed Sector Policy changes and strategies

Prior to the amendment of the Seed Act. National Seed Company of Malawi (NSCM) was the sole dealer in the maize seed market for the smallholder sub-sector. exclusively using ADMARC to market the seeds at subsidised prices. Parallel to this arrangement. however. was the direct involvement of NSCM in a free market system using some retail distributors. The liberalisation process has led to Pannar Seed Company joining the seed market.

The Government also liberalised the seed prices to facilitate free entry of private traders in the seed trade be it importing. retailing and production. As a mater of *fact.* anyone can trade in seeds of all types now as is evident from the following examples. The Agricultural Research and Extension Trust (ARET) is currently multiplying tobacco seed. *A process to license public inspectors has* been started. This development will reduce inspection costs to potential investors in the seed industry.

A number of non-governmental organisations (NGOs) have initiated community based seed multiplication programs in rural areas. **Action Aid**. an NGO. has invested substantially in seed multiplication programs. The **European Union** is also supporting a small enterprise seed multiplication program through the Ministry of Agriculture and Irrigation Maize Productivity Task Force. Action Group 2. In 1996/97 season. **72 farmers** participated in this program and the number increased to **123 farmers** in the **1997/98** season. Last year's seed production under the programme is presented in the attached table. The Ministry staff in the Agricultural Development Divisions (ADDs) and research stations supervises this program. Small-scale farmers have produced substantial quantities of basic seed or start-up material for the first time.

Constraints in the Seed Sector

Despite the above efforts, the country continues to face acute seed supply problems for the majority of the food and cash crops such as maize, groundnuts, beans, cotton, cassava, cotton, sorghum, vegetable and citrus fruits. Competition in the seed sector is minimal since no new companies have come into the market. The companies multiply **only hybrid** maize seed. The uptake of improved seed is low in comparison to neighbouring countries and there is net reduction in hybrid seed use partly due to high prices. The **Seed Services** in the Department of Agricultural Research and Technical Services (**DARTS**) does not have the capacity to certify seeds and regulate the industry.

The EU funded small-scale enterprise program has faced marketing problems since farmers expect Government to buy the seeds from them. Some of the NGO seed programs are not sustainable in the long run due to emphasis on relief operations. All in all, inadequate seeds are being produced from current seed production initiatives nationally.

The existing bottlenecks in the seed sector call for a re-focus on the development efforts in the sector in order to 'jump-start' the seed industry. No meaningful increase in crop production will come about **without good quality seeds** even in situations where fertilisers and irrigation facilities exist.

Possible Future Course

The focus for the immediate future should be: -

- Small/medium-scale seed enterprise development promotional campaigns.
- The proliferation of small- seed companies will enhance seed availability. A pre-requisite to this initiative will be the launching of a nation wide publicity campaign aimed at highlighting of the seed sector liberalisation policies (ADDs and Planning Division are key in this activity). Exchange visits with other countries will assist in the development of the seed sector even through joint venture promotion:

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- Establishment of technology information centres in ADDs. Research Stations and private institutions. This will facilitate investment in the seed sector. The data-base should include economics of production:
- Launching a nation-wide technology promotional campaign in order to increase improved seed demand through the use of commercial radio. print media. political forum. posters in both villages. cities and participation of extension staff in general:
- Strengthening of nation-wide variety demonstration programs in order to enhance adoption with increased up supervision. Farmers should be empowered to own the demonstration process:
- Strengthening of extension services through adoption of demand-driven services which will have to be commodity specific and farmer empowerment to seek such information thus doing away with dependency syndrome. This approach should be taken in both the private and public sectors. Re-orientation of extension staff will be required to include courses in business management:
- Provision (by Government) of initial capital infrastructure mainly central seed processing equipment and other capital infrastructure in different parts of the country which should be owned under a co-operative arrangement. Utilisation should be at full cost under hire by small-scale or medium scale entrepreneurs:
- Development of a seed buffer stock (SBS) facility to counter effects of droughts or other calamities which cause total crop failure. All entrepreneurs should have equal access to this facility through developed acceptable principles that do not fail the working of the liberalised seed market: and
- Seed quality control will warrant provision of resources to the Seed Services Unit to facilitate seed certification and regulatory activities under a liberalised environment. Improved operational modalities of seed services will facilitate service delivery.

Although the Ministry continues to strive towards ensuring availability of quality seed to farmers. this will only be possible through concerted efforts from all stakeholders. including smallholder farmers and the private sector.

TABLE: SUMMARY OF QUANTITIES SEED UNDER SEED MULTIPLICATION PROGRAMME 1997/98 SEASON

	SUPPLY SOURCE											
VARIETY	BLADD	LADD	KADD	MZADD	KRADD	SVADD	MADD	SLADD	NSCM MT	BUNDA	PANNAR MT	TOTAL
G/NUTS												
CG7	2,790	21,840	39,340	12,390	3,610	6,180		13,840				99,990
SOYA												
KALEYA	400											400
SANTORASA	300											300
NA		1,890										1,890
OCEPARA-4				100			3,300	765				4,165
BEANS[1]	100	1,29	2,290	1,415	210		55			20		6,019
HYBRID MAIZE												550
MH17									500			500
MH18									1,500			1,500
NSCM21									150			150
NSCM41									1,500			1,500
NSCM51									850			850
C3631									500			500
C3891												
C6222											250	250
PAN6195											275	275
PAN6193											1,375	1,375
PAN6479											600	600
PAN6363												
KAFUMBA			3,050									3,050
MASIKA		450[2]	14,800	1,200				3,220				19,270
SUNDWE			100[3]	5,570			2,065	4,500				12,135
KAKHOMERA				2,500								2,500
MCHOTSANJALA				3,000								3,000

[1] Varieties include Napirira, Nagaga, Kambidzi, Mkhalira, Maluwa
[2] Produced under contract by Impala Farming
[3] produced on contract by Press Agriculture Ltd

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FARMING SYSTEMS INTEGRATED PEST MANAGEMENT PROJECT

The Growth and Potential of Sweet Potato (*Impomea batatas*) in National and Household Food Security

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Abstract

A sample of 60 sweet potato growers in Matapwata and Mombezi EPAs. Blantyre Shire Highlands RDP. was made to determine the socio-economic circumstances responsible for the recent expansion of sweet potato production and the changing status sweet potato has attained in supporting household livelihood. The results of the survey show that sweet potato is no longer a low prestige food. It is an important component of smallholder livelihood. It ensures revenue-generating activity for most rural households and serves as a complementary staple food in times of maize food shortage. The forces that have contributed to the growth of sweet potato and change in status in the role sweet potato plays in household livelihood are mainly socio-economic in nature. The pressing demands for food and cash in the new market oriented economy have forced farmers to look for better alternative food and cash sources. The increasing real cost of fertiliser has also made maize production difficult for most small farmers to rely on for their food security. Thus. the crop deserves the same attention as given to other crops by planners. policy makers. researchers and extension workers. One area researchers need to extend their efforts is the protection of the crop from Cylas weevil, the major production constraint.

1.0 Introduction

Sweet potato (***Impomea batatas***), like other root crops, plays an important dietary role amongst rural and per-urban communities in Malawi. Diagnostic survey of the FSIPM Project in Blantyre Shire Highlands Rural Development Project (RDP), Orr 1996, actually identified sweet potato as one of the important food crops amongst the farmers in both Matapwata and Mombezi Extension Planning Areas (EPAs).

Evidence shows that sweet potato is an efficient producer of biological nutrients for human and animal food in intensive cropping systems. Besides, sweet potato has a relatively short growing season, high yielding potential, low input resource requirements and wide ecological adaptability. Some describe it as an **'Insurance crop'** because of its resistance to very arduous climatic conditions, like drought. Despite all these profound characteristics, sweet potato has still not attained the full recognition it deserves from both planners and policy makers yet. The crop is still treated by many as a low prestige food. Its value has been as a 'survival food' or a food of last resort. It has temporarily attained the status of a staple food, unfortunately, only in time of drought.

Following the collapse of smallholder credit system and increase in real fertiliser cost, competitiveness of sweet potato with unfertilised maize, the staple food, has recently increased. National statistics over the past five years show a nine-fold increase in the production of sweet potato compared to three-fold increase for cassava and less than two-fold increase for both maize and rice (MAI Statistics). Yields quadrupled to an average of over 10 tonnes per hectare during this period.

However, the forces behind this recent increase in sweet potato production are still not known. No detailed studies have been carried out to understand the socio-economic circumstances that have lead to the expansion of sweet potato production in Malawi. Ministry of Agriculture and Irrigation's claim of increased sweet potato yields and changing eating habits of the rural masses has been received with scepticism.

2.0 Objectives and hypotheses

The general objective of this study was to determine the socio-economic factors responsible for the recent expansion in sweet potato production in Blantyre Shire Highlands RDP. The specific objectives were to determine:

- The crop calendar for sweet potato in relation to maize and other major food crops.
- The relative importance of food security and cash needs in sweet potato production
- To compare the economics of main crop sweet potato and maize production; and
- To illustrate the above by case studies of one commercial and one food security grower

Hypotheses

It was hypothesised that:

- Sweet potato is planted earlier in direct competition with maize and other important food and cash crops
- Most small farmers plant improved and high yielding sweet potato varieties and less of traditional varieties
- Expansion in sweet potato production is driven by increased demands on the household economy for cash following market liberalisation; and
- Net returns from main crop sweet potato are higher than for fertilised maize.

3.0 High potential Sweet potato and resistance to consumption as staple food

- *Nutritional balance.* There is wealth of statistics available from many sources indicating the comparative advantages nutritionally of sweet potato over other major food crops. The balance of protein to calories, the balance among the more important amino acids in the protein, and the levels and spread of minerals and vitamins make sweet potato second to eggs in nutritional value as a single source. As someone said, 'increased and sustained sweet potato production is one of the surest ways of ensuring the availability of the much needed calories for the rapidly growing population'. The biological value, which is an index of portion of absorbed nitrogen retained in body for growth and maintenance, or both, is 73, compared to 54 for maize and 53 for wheat flour (Kaldy, 1972).

- *Efficiency.* One of the greatest advantages of root and tuber crops, particularly in areas where land is scarce, is their productivity per unit area and time. Sweet potato – a short season, fast growing crop- tops the list in terms of potential dry matter and edible energy per hectare per day. It produces better-balanced protein and more calories per unit area per unit time than any other plant food.

- *Flexibility.* Sweet potato can be intercropped with a number of other food crops, principally, maize, and soya beans a, with staggered plantings. It is fitted into farming systems to provide a source of food through its flexible harvest period. The crop already has demonstrated its flexibility to fit into farming systems in some parts of the continent where it has become an important complementary staple food..

- *Compatibility*. The other factor contributing to the success of sweet potato is its high compatibility with the low input, intensive farming system that directly affects small, subsistence farmers. Thus farmers unable to hire labour during peak season know that sweet potato can wait. As such, it does not compete for planting and harvest labour. In Rwanda, it is said that ***only those who have nothing to do weed sweet potato fields.***

- *Versatility and adaptability*. The success of sweet potato crop is built on the versatility of the crop in its ability to synchronise its growth cycle and adapt to local climatic changes and soil factors. For example, up to three crops can be grown each year.

Resistance to eating sweet potato as staple food is social, **psychological** and **technical** in nature.

High moisture and sugar content, and Cylas weevil. Sweet potato may not be acceptable as a staple food because of high sugar content (Villareal, 1981). A staple high in free sugar could elevate blood sugar in a short period and reduce appetite. There is also a tendency of sweet foods to dominate the flavour of others. High moisture and sugar content make sweet potato susceptible to rapid deterioration in storage, complicating preservation of large quantities during off-season period. Sweet potato weevil also prohibits effective storage of roots. The pest is not only a problem in production, but also riddles sweet potato roots reducing their value as human food.

Flatulence. Flatulence or 'gas' problems that occur after eating large quantities of sweet potato have been mentioned in a joking manner as a reason for low acceptability of sweet potato.

Traditions and beliefs. Lifelong habits prevent us from seeing broader uses and potentials of the sweet potato, and at the same time discourage changes in traditional consumption patterns. When introduced in Rwanda, sweet potatoes were considered taboo items and not consumed at all. If a person ate them, it was believed that their cows could become sick and die or the milk could go bad.

Seasonal fluctuations. Staple food is included in almost every. To meet that criterion, sweet potato should be available the year round. This is not the case because of production, distribution and post-harvest problems. Limited supply in some months of the year results in high sweet potato prices.

4.0 Data and methods

Blantyre Shire Highlands RDP is one of the most important growing area for sweet potato in Blantyre ADD. Annual sweet potato production in the RDP accounted for over 30% of the total production in the ADD in the past five years. Two EPAs (Matapwata and Mombezi) were chosen for this study. Matapwata EPA is notable for a longer rainy season (900 – 1200 mm) and growing season (195-240 days). Commercial production of sweet potato is high. Mombezi EPA has a notably rugged topography with an annual rainfall of between 900 –1200 mm and slightly a short growing season of 135 – 165 days. Most of the sweet potato in this EPA is grown for food.

Sample survey

A list of about 120 sweet potato growers was made from which 60 were randomly selected for survey, with 30 chosen from each EPA. Data was collected through a structured questionnaire administered in six villages (Pindani, Gumbi, Muhura, and Chimwanga in Matapwata EPA and Chiwinja and Lidala in Mombezi EPA). The survey was administered in May 1999.

Economics of main sweet potato and maize production

Using the current ADMARC maize prices of the 1998/99 season and the prevailing sweet potato prices, enterprise budget analysis was carried out on the adjusted mean yields for maize and main sweet potato. Yield data and labour requirements from sweet potato FSIPM Project 1998/99 Crack Sealing Trial were utilised while for maize, yield data were those obtained by Maize Productivity Task Force fertiliser trials for Blantyre Shire Highlands RDP which were conducted in 1995/96. Wages and sweet potato prices were collected separately. The following modifications or assumptions were made:

- Maize harvest price is the current ADMARC price of K5 per kg, reduced by 10% to incorporate cost of shelling, transport to market and other handing costs. As with fertiliser pricing, the fiction of assuming same real price prevails countrywide has been adopted for this analysis.

- The 1998/99 ADMARC prices of K 873 and K 800 per bag of 50kg of UERA and 23:21:0+4S, respectively, were used. Prices were adjusted upwards by 10% to reflect cost of local transport from deport to field.

- An opportunity cost of capital of 30% was added to the fertiliser cost. This corresponds to the 1998/99 lending rate of Malawi Rural Finance Co. of 36% per year, repaid in 10 months.

5.0 Results

5.1 *General Characteristics of the Farming Households*

Table 1 shows that 30% of the sample farmers were female-headed households (FHHs). Mombezi had a higher proportion of FHHs (40%) than Matapwata (20%). Most of the respondents were married. Only about 30 % of the respondents in Mombezi EPA were not married, either because of separation or divorce or they were widowed. In Matapwata only 12 % of the respondents were not married.

About 37 % of the farmers in Matapwata had on average three gardens while in Mombezi 43 % of farmers had four gardens. Only 13 % of the farmers in Matapwata and 10% in Mombezi did not use all their gardens. The reasons for not using them were mainly due to sickness, labour shortage, renting out and fallow to restore fertility. In terms of land tenure, most farmers (73 %) in Matapwata and 77 % in Mombezi owned the gardens. Only about 27 % of the farmers in Matapwata and 23 % in Mombezi also rented some of the gardens they used this season.

On access to farm inputs, only about 23% of the farmers in Matapwata and 7% in Mombezi had access to farm inputs through credit clubs in 1998/99 crop season. The majority of them (50% in Matapwata and 56% in Mombezi) relied on the government's Starter Pack Programme. Those who could buy inputs with their own cash were only 17% in Matapwata and 26% in Mombezi.

In terms of food security, 50% of the households in Matapwata had run out food by November, compared to 50.2% in Mombezi in 1997/98 calendar year. These statistics rise to 63.3% for Matapwata and 60% for Mombezi by December.

5.2 *Crop calendar and cropping patterns for sweet potato in relation to maize*

Table 1 shows that farmers in Matapwata grow four crops of sweet potatoes a year while in Mombezi farmers grow only up to three crops of sweet potato a year. In Matapwata EPA, farmers start planting first sweet potato crop in December and this crop is harvested by May. The second crop is planted in January while the third and fourth crops are planted in March and April, respectively. The second crop is largely harvested in July and the third and fourth crops are harvested in July and September respectively. In contrast, first crop in Mombezi EPA is largely grown in January and harvested in May. The second and third crops are planted in February and April and are harvested in June and August respectively. There was no fourth crop of sweet potato reported in Mombezi EPA.

The actual percentage of cases representing number of sweet potato grown per year is shown in Table 3.

In relation to Cylas weevil, the major sweet potato production constraint, trap monitoring over ten sampled fields in Mombezi EPA showed that the pest population tends to build up with time and it becomes most serious towards the end of the rainy season. About 250 catches were reported in February compared to over 1000 catches for the month of July. The situation in Mangunda was variable. High catches were recorded at the beginning of the rain season and slightly decreases with time. Overall, weevil population was generally high Mangunda. The lowest weevil catch was 972 in the month March and the highest record catch was 6,328 in the month of October. For the rest of the months, over 1000 weevil catches were reported.

Rainfall pattern is more intensive in Mombezi (coming within a relatively short period- October to March in 1998/99 season) than Matapwata that received rains last season from October to July.

5.3 The relative importance and changing role of sweet potato in household food security

5.3.1 *Sweet potato in the food system*

Most of the farmers interviewed were experienced sweet potato growers. Table 3 shows that 77% of the farmers in Matapwata and 80% of the cases in Mombezi had been growing sweet potato more than ten years ago. In both EPAs, sweet potato is grown along with maize, the main staple food, as an important secondary food and cash crop. Some farmers said they have grown sweet potato with maize as long as they have lived on earth.

5.3.2 *Varieties and why the y plant them*

Although it is an introduced crop, like in many countries in Africa, numerous varieties are grown in farmer's fields throughout the country. Table 3 shows that farmers in both EPAs had a mixture of both local and improved varieties. In Matapwata, most farmers (90%) grow Kenya variety compared to only 60% of the cases in Mombezi. The most popular variety in Mombezi was Kachewere (a type of local variety) grown by 70% of the sampled cases. Other varieties grown by farmers in Matapwata included Kanchiputu (36.7%), local variety (34.5%) and a mixture of other improved varieties such as Semsa, Mugamba and Tainoni. No farmer was growing Kachewere local variety in Matapwata. In Mombezi, 20.7% of the farmers were also growing the white local variety and one third of them were also planting Tainon, Semsa and Mugamba varieties.

The main criteria for selecting particular sweet potato variety to grow were high yield (36%) and early maturity (31%) in Matapwata while in Mombezi high yield was given in 30% of the cases only. Otherwise, about 29% of the farmers in Mombezi said they also grew other varieties like Semsa, Mugamba and Tainon just because FSIPM Project gave them because they did not know them well.

5.3.3 *Socio-economic factors affecting changes in sweet potato production*

There was also a changing trend reported in both EPAs, from growing only one sweet potato crop to growing more than one crop. In Matapwata, 53% of the cases said they used to grow only one crop of sweet potato before but at present, almost 46% said they plant three sweet potato crops per year. Similarly, in Mombezi, 56% of the farmers used to grow only one crop of sweet potato but now 63% of them said they plant at least two crops of sweet potato per year. In terms of area planted to sweet potato over the recent years, 83% of the farmers in Matapwata said they have increased the area. Similarly, 67% of the cases in Mombezi to be planting sweet potato to a larger area than they used to.

Reasons for changes in both areas planted to sweet potato and actual number of sweet potato plantings per year were economic, social and technical in nature. About 46% of the farmers in Matapwata said they plant more sweet potato now than before to get more cash when sold. The same reason was mentioned by about 38% of the cases in Mombezi. A large proportion of farmers in Mombezi said they are growing more sweet potato now as a source of food security. Increases in area planted to sweet potato were mainly justified by the need for more cash (67%) in Matapwata compared to 20% in Mombezi. Another 20% in Mombezi also said they allocate more land for planting sweet potato for both food security and economic reasons.

In Matapwata gains in sweet potato hactarage largely came from *mbwera* (relay) crop, the crop(s) which is planted in the maize field just before the maize is harvested using moisture from the late rains. About 40% of the farmers said instead of growing *mbwera* beans, they now plant *mbwera* sweet potato. About 10% said they replaced *mbwera* field peas for *mbwera* sweet potato and another 27% also said they stopped planting other crops for sweet potato production. In Mombezi, only 13% of the farmers said they have stopped growing mbwera beans for sweet potato production instead. Another 20% said they stopped planting other mbwera crops for sweet potato.

5.3.4 *Sweet potato ranking relative to other food and cash crops*

About 40% of farmers in Matapwata and 23% in Mombezi ranked sweet potato as the number one cash crop. The rest of the farmers (60%) in Matapwata ranked sweet potato as the second most important cash crop compared to only 30% of the farmers in Mombezi. Main uses of cash from sweet potato sales were purchase of household needs, 47% of the cases in Matapwata and 80% in Mombezi. Another 24% of the sampled cases in Matapwata and 8% in Mombezi said income from sweet potato also helps them to purchase maize.

In terms of food security, about 67% of the cases in Matapwata and 77% in Mombezi ranked sweet as the second most important food crop after maize. About 27% of the cases in Matapwata and only 17% in Mombezi said sweet potato is the third most important food crop after maize and cassava.

As food (main or supplementary), farmers in both EPAs reported that they eat own sweet potato from March to December. The peak sweet potato eating months for Matapwata were from May to September and for Mombezi, it was between May and August. During this period, over 66% of the cases in Matapwata and 70% in Mombezi reported to have been eating their own sweet potato.

6.0 The economics of main sweet potato crop and maize production

The economic evaluation of main sweet potato crop (without second weeding) and maize production for Blantyre Shire Highlands RDP is presented in Table 4.

Total average maize yield increases with application of fertiliser. Mean hybrid maize (MH 18) yields of 1.692 and 3,458, for unfertilised and fertilised plots, were obtained during the 1995/96

Fertiliser Verification Trial which was conducted by Action Group I Maize Productivity Task Force for medium texture soils in upland zones of Blantyre Shire highlands RDP. Adjusted maize yields of 1,410 kg and 2,882 kg for the unfertilised and fertilised treatments were used in the economic analysis. Under farmer management, sweet potato yields of 5,417kg were obtained in the FSIPM Project 1998/99 upland Crack Sealing Trial in Mombezi EPA. Adjusted for crop losses from Cylas weevil, the mean yield of 4,240 kg was used for the economic analysis.

The analysis clearly demonstrates that maize production was not beneficial to the farmer compared to sweet potato production. Net benefits from sweet potato production were higher, valued at K 9,970, compared to K 444 and K 2139 with unfertilised and fertilised maize respectively.

7.0 Discussion

Sweet potato in the maize-based food system

The results of the survey show that sweet potato has been part of a maize-based food system for a long time. Some farmers have grown sweet potato as long as they have lived. The only big difference now is that it is more intensively cultivated than before. Most farmers now plant sweet potato, at least, up to three times a year. The difference in crop intensity between Mombezi and Matapwata arises from two explanations:

- Farmers in Matapwata are more commercially oriented than their counterparts in Mombezi EPA.
- Rainfall in Matapwata is more spread than Mombezi; thus Matapwata has a relatively longer period during which farmers can plant a relay crop of sweet potato or even a sole crop after harvesting maize in April.

Sweet potato is also seen superior to maize in utilising marginal soils, like dambo lands. See Mai Malonda case study of Mombezi EPA.

Factors influencing changes in sweet potato production

The reasons for change in the status of sweet potato in the smallholder production system are both technical and socio-economic in nature.

- Technically, the ability of sweet potato to synchronise its growth cycle made itself the most attractive crop because farmers are able to grow more than one crop per year. Particularly, the introduction of improved varieties that are both quick maturing and high yielding have made the greatest appeal to most small farmers. Farmers also like to grow sweet potato because it is compatible with the low input, intensive farming system that directly affects small subsistence farmers. Thus, farmers unable to hire labour during peak season know that sweet potato can wait. As such, it does not compete for planting and harvest labour. In marginal soils, like dambo soils where maize has failed to perform, sweet potato has proved to be superior to maize in utilising these lands.
- Socio-economically, sweet potato production ensures revenue-generating activity for most rural farmers and serves as a complementary staple food for households who are food insecure. Many small farmers sell sweet potato frequently in small quantities in local markets for ready cash. Farmers with well-established contacts, like those from Mangunda Section in Matapwata EPA, tend to specialise in commercial production and grow relatively large plots in monoculture and sell even in distant markets. Both as a cash and food crop, sweet potato is now ranked the second most important crop in most parts of the country.

Comparative advantage of sweet potato production

The economic analysis of main sweet potato crop and maize production system showed that maize production (fertilised or unfertilised) has no comparative advantage over sweet potato production. Without fertiliser, farmers actually get net revenue of MK 444 per ha, equivalent to the value of less than two bags of maize. While with fertiliser application, the farmer gets a net revenue of only MK 2,1284, way below superior net benefits from sweet potato which accounted for MK 9,970 per ha.

8.0 Conclusions

Sweet potato has become an important component in the household food security. With increase in the real cost of fertiliser and pressing food and cash demands in the present market oriented economy, sweet potato is envisaged to remain an important part of the smallholder food production system in the foreseeable future. The surest way of ensuring food security amongst the rural communities in Malawi is diversification of smallholder production system. Food security cannot be fully attained by a maize-dominated food production system alone.

Sweet potato offers a good alternative option to fertilised hybrid maize production. Sweet potato has the advantages of being a low input and low risk crop and is compatible with intensive farming system that directly affects many small subsistence farmers. Very few crops are superior to maize in number of nutritional calories produced per hectare. Sweet potato is the principal exception. Moreover, sweet potato is seen superior to maize in utilising marginal lands arising from continued population pressure.

The growth, expansion and changing status of sweet potato in household food security calls for the same attention that other crops receive from planners, researchers, policymakers and politicians. Particularly, researchers are called upon to extend their efforts in finding solutions for controlling sweet potato weevil, one of the major production constraints. Of concern are the sweet potato crops that are planted late in the season during which the pest infestation is most severe.

The sweet potato subsistence grower case study: Bambo Kennedy Awali

Bambo Awali lives in Lidala Village in Mombezi EPA. Aged at 46 years, he has one wife with eight children. The eldest son dropped out of school while five of the other children are still attending school. The other two children are still young and do not go to school. The household lives in a medium size house, thatched with glass. Both Bambo Awali and his wife are active farmers.

He has two upland fields. One of them is grown mainly to maize and he uses the other one for growing tobacco. The maize he harvests from his own field usually runs out in December. To diversify his food base, he also grows cassava and sweet potato. Sweet potato is the next most important food crop after maize in his household. Bambo Awali said he has been growing sweet potato from the time he was living with his parents. Since then, he has maintained sweet potato as a major part of the food production system. Apart from using some portion of his maize field, he grows more sweet potato by borrowing land from other farmers who fail to utilise all their fields. This year, he managed to harvest six 50kg bags of sweet potato, one of which he has made makaka, peeled and sun-dried sweet potato, for future use.

Varieties grown and crop intensity

Bambo Awali mostly grows one variety of sweet potatoes, which he said originated from Mozambique. He has been growing this variety for more than ten years now. He once grew Kenya variety when he was a member of Christian Service Committee but he lost it because he said it is difficult to keep. He, however, likes his current variety because it is high yielding and not difficult to keep seed. In a year, Bambo Awali normally grows three crops of sweet potato. If rains prolong, he even plants the fourth crop of sweet potato. The first crop is planted in January and harvested in March. The first crop serves as source of planting material for the subsequent crops. The second and third crops are planted in February and March respectively. The second crop is usually harvested in May while the third crop is harvested in June. The fourth crop is planted in April and mainly harvested in September. Bambo Awali only uses family labour in carrying out all sweet potato field operations.

The relative importance of sweet potato

Bambo Awali said his family eats own sweet potato normally for a period of eight months, March to September. During this time, sweet potato serves as the main breakfast food for his school children and the rest of the family. It also serves as main meal when eaten as 'Futali', cooked potato crashed into a thick paste with groundnut flour added to it. When the wife cooks sweet potato around 11.00 o'clock in the morning, Bambo Awali said he never minds eating another main meal for lunch. He would eat nsima in the evening. In this way, the family saves the maize which would have otherwise finished much earlier than if they had no other alternative foods.

Other advantages of sweet potato

Bambo Awali also said he likes sweet potato because it is a low input crop and produces high output per unit of area and time. He only weeds his sweet potato field once and he grows the crop several times a year. He does not apply fertiliser to sweet potato unlike

maize. Besides,
He said that he could get enough sweet potatoes from one planting station, sufficient for a meal, compared to six planting stations if it were beans. Bambo Awali felt he gains more by growing sweet potato from the same unit area than if grown to other crops like beans in terms of food energy.

Production constraint

Bambo Awali, however, reckoned that sweet potato production has also its own problems. He said the major constraints in sweet potato production were crop losses resulting from sweet potato weevil damage and poor storage characteristics of the variety he grows. He had no clear knowledge about the biology of the pest and lacked any conscious control strategy for the pest. He also wondered if there were any varieties that yield high and also store well in the pit.

Is sweet potato a poor man's food?

Certainly not for Bambo Awali. After even realising a gross income of MK 18,000 and a net income of MK 11,000 from his burley sales, Bambo Awali concluded that sweet potato shall remain a permanent part of his food production system. He could not imagine a year passing without growing sweet potato. Bambo Awali said that it is one thing to have money but it is also another to have your own food.

Sweet potato commercial grower:

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References

Kaldy, M.S. 1972. Protein yield of various crops as related to Protein values. Economic Botany 26: 142-144

Livingstone I., 1993. The Labour Market and Wages Policy in Malawi.

Ministry of Agriculture and Irrigation (MAI), 1997. The 1995/96 Fertiliser Verification Trial in Malawi. An Economic Analysis of Results for Policy Discussion.

Orr, A. et al., 1996. Farming Systems Integrated Pest Management Project. Diagnostic Surveys in Matapwata and Chiradzulu EPAs.

Terry E.R., Akoroda M.O., AND Arene O.B., 1986. Tropical Root Crops and African Food Crisis: Proceedings of the International Society for Tropical Root Crops- African Branch Held in Nigeria, 17-23August 1986.

Villareal R.I., and Griggs T.D., 1982. Sweet Potato: Proceedings of the First International Symposium. AVRDC Publication No. 82-172.

Villareal R.I., 1981. Sweet potatoes in the Tropics- progress and problems. In Proc. Inter. Symp. Sweet Potato. Taiwan, Republic of China.

Appendix

Table 1: General Characteristics of the Farming Households

Household head	**Matapwata**		**Mombezi**	
	N	%	N	%
Male	24	80	18	60
Female	6	20	12	40

Marital status	Matapwata		Mombezi	
	N	%	N	%
Married	26	86.7	20	66.7
Wife of polygamist	-	-	1	3.3
Widowed	2	6.7	1	3.3
Divorced	2	6.7	4	13.3
Separated	-	-	4	13.3

No. of gardens held	Matapwata		Mombezi	
	N	%	N	%
One	3	10	1	3.3
Two	8	26.7	5	16.7
Three	11	36.7	11	36.7
More than three	8	26.7	13	43.3

Used all gardens this season	Matapwata		Mombezi	
	N	%	N	%
Yes	26	86.7	27	90
No	4	13.3	3	10

Reasons for not using all gardens	**Matapwata**		**Mombezi**	
	N	%	N	%
Sickness	1	25		
Labour shortage	-	-	2	66.67
Rented out	2	50	1	50
To restore fertility	1	25		

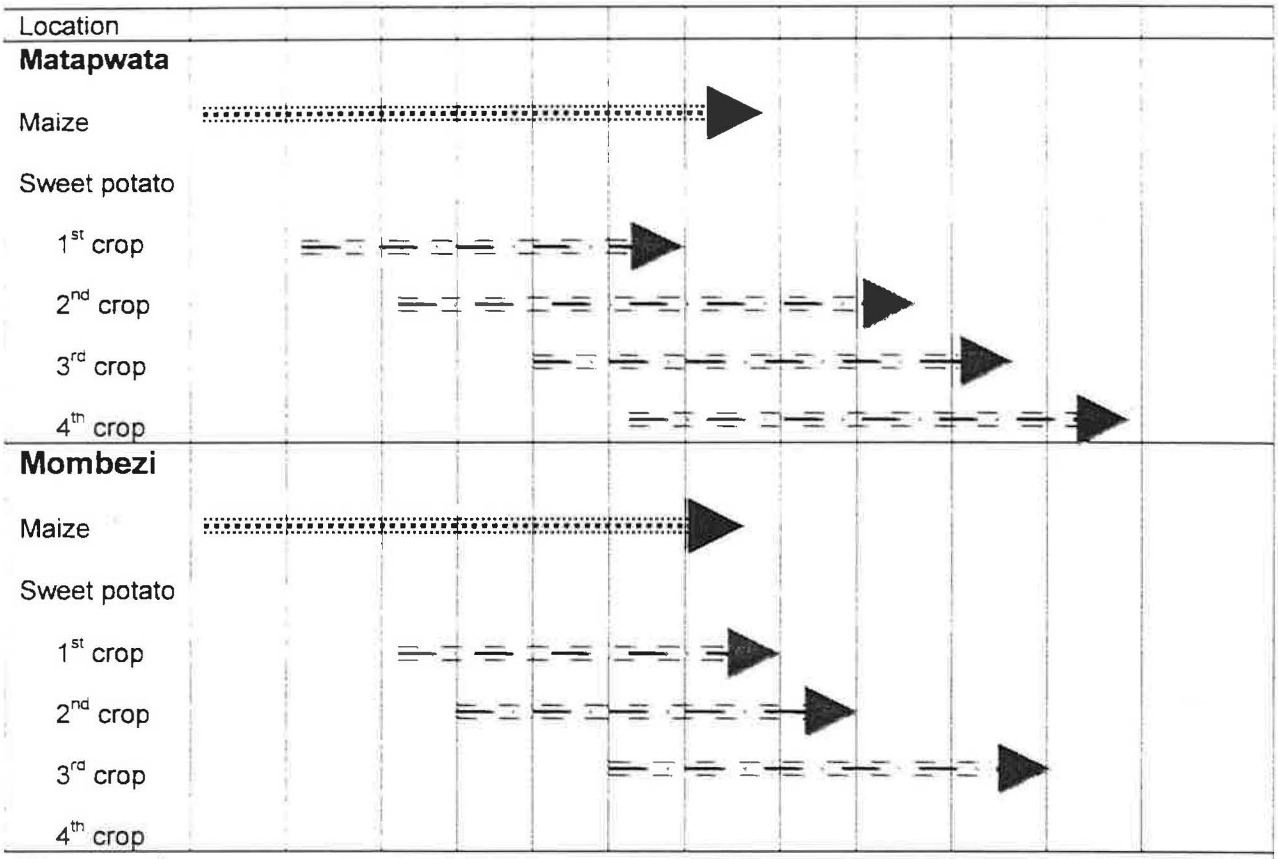
Land tenure	**Matapwata**		**Mombezi**	
	N	%	N	%
Own	22	73.3	23	76.7
Own plus rented	8	26.7	7	23.3

Table 1 Conti.

Source of farm inputs 1998/99 season	**Matapwata**		**Mombezi**	
	N	%	N	%
Credit club	7	23.3	4	10.313.3
Starter pack scheme	15	50	22	56.4
Cash	5	16.7	10	25.6
None	3	10	1	2.6
	30		39	

Household food security				
Months household run out maize in 1997/98 season	Matapwata		Mombezi	
	N	%	N	%
April	2	6.7	2	6.7
May	-	-	1	3.3
June	-	-	1	3.3
July	-	-	-	-
Aug	6	20	2	6.7
Sep	1	3.3	2	6.7
Oct	1	3.3	5	16.7
Nov	5	16.7	2	6.7
Dec	4	13.3	3	10
Jan	5	16.7	3	10
Feb	2	6.7	6	20
Mar	1	3.3		-
Had enough up to next harvest	3	10	3	10

Table 2: Crop calendar and cropping patterns for sweet potato in relation to Maize, Blantyre Shire Highlands



Matapwata												
Weevil population	3417	3222	3728	1808	972	1180	1182	1250	-	-	5526	6328
Rainfall (mm) 1998/99	54	194	626	271	119	145	11	6	5	-	-	10
Months	Nov '98	Dec '98	Jan '99	Feb '99	Mar '99	Apr '99	May '99	Jun '99	Jul '99	Ag '99	Sep '99	Oct '98
Mombezi												
Weevil population	-	-	-	250	309	641	144	371	1103	1252	-	-
Rainfall (mm)	4	264	600	189	207	-	-	-	-	-	-	111
Months	Nov '98	Dec '98	Jan '99	Feb '99	Mar '99	Apr '99	May '99	Jun '99	Jul '99	Ag '99	Sep '99	Oct '98

Table 3: The changing role of sweet potato in the household food security And poverty alleviation

No. of years since farmer has been growing sweet potato	Matapwata		Mombezi	
1- 5 years	3	10	5	16.7
6-10 years	4	13.3	1	3.3
More than ten years	23	76.7	24	80
	30	100	30	100

Sweet potato varieties grown by farmers	Matapwata		Mombezi	
	N	%	N	%
Kenya	27	90	18	60
Kamchiputu	11	36.7	7	23.3
Mugamba	9	30	10	33.3
Tainon	8	26.7	10	33.3
Semsa	5	16.7	10	33.3
Local	10	34.5	6	20.7
Other	1	3.4	5	17.2

Reasons for growing selected varieties	Matapwata		Mombezi	
	N= 103 (responses)	%	N=107 (responses)	%
High yield	37	**35.9**	32	**29.9**
Early maturing	32	**31.1**	15	**14.0**
Marketable	10	9.7	-	-
Good taste	4	3.9	14	13.1
Good storage	12	11.7	2	1.87
Only seed available	1	0.9	10	9.35
Given seed by FSIPM Project	3	2.9	31	**28.97**
Cooks fast	-	-	1	0.9
Establishes well with minimal rainfall	2	1.9	-	-
To experiment	1	0.9	-	-
Other	1	0.9	1	0.9

Table 3: Conti.

Number of sweet potato plantings this season	Matapwata		Matapwata	
	N	%	N	%
One	6	20	6	20
Two	9	30	19	63.3
Three	14	46.7	5	16.7
Four	1	-	-	-

Number of sweet potato plantings in the past	Matapwata		Mombezi	
	N	%	N	%
One	16	53.3	17	56.7
Two	3	10	1	3.3
Three	1	3.3	-	-
The same	10	33.3	12	40

Reasons for changing number of sweet plantings per season	Matapwata		Mombezi	
	N	%	N	%
Need for more food	3	11.5	14	48.3
Need for more cash	12	46.2	11	37.9
Socio-economic(more land available)	-	-	2	6.9
Availability of quick maturing varieties	11	42.3	2	6.9

Changes in the area planted to sweet potato over the recent years	Matapwata		Mombezi	
	N	%	N	%
Increased	25	83.3	20	66.7
Decreased	3	10	4	13.3
Fluctuating	1	3.3	-	
Stayed the same	1	3.3	6	20

Table 3 Conti.

Reasons for increasing area under sweet potato	Matapwata		Mombezi	
	N	%	N	%
Need for more cash	20	66.7	6	20
Need for more food	1	3.3	5	16.7
Need for both more food and cash	3	10	6	20
Other	1	3.3	3	10
Not applicable	5	16.7	10	33.3

Crops replaced by sweet potato	Matapwata		Mombezi	
	N	%	N	%
Mbwera beans	12	40	4	13.3
Mbwera field peas	3	10	1	3.3
None	7	23.3	19	63.3
Other	8	26.7	6	20

Rank of sweet potato as food crop	Matapwata		Mombezi	
	N	%	N	%
1st	-	-	3.3	3.3
2nd	20	66.7	23	76.7
3rd	8	26.7	5	16.7
4th	2	6.7	-	-
Other	-	-	1	3.3

Months farmer eats own sweet potato	Matapwata		Mombezi	
	N	%	N	%
March	7	23.3	3	10
April	13	43.3	10	33.3
May	21	70	25	83.3
June	25	83.3	28	93.3
July	25	83.3	26	86.7
Aug	26	86.7	21	70.0
Sept	20	66.7	12	40
Oct	14	46.7	8	26.7
Nov	7	23.3	3	10
Dec	2	6.9	1	3.3

Table 3 Conti.

Rank of sweet potato as cash crop				
1st	12	40	7	23.3
2nd	18	60	9	30
3rd	-	-	3	10
4th	-	-	2	6.7
Other (grown for food only)	-	-	9	26.7
Main uses of cash from sweet potato sales	Matapwata		Mombezi	
	N	%	N	%
Purchase of maize	11	24.4	2	8
Purchase of household items	21	46.7	20	80
Business	5	12.1	-	
Support school children	4	8.8	3	12
Purchase of farm inputs	4	8.8	-	

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Table 4: Enterprise budgets for main crops sweet potato, fertilised maize, and unfertilised Maize (Sole crop)

Variable	Sweet potato	Maize (unfertilised)	Maize (fertilised)
Benefits			
Total average yield(kg/ha)	5,417	1,692	3,458
Adjusted yield (kg/ha)	4,240	1,410	2,882
Unit price[1] (MK/kg)	3	4.50	4.50
Total Gross Benefits	**12,720**	**6,345**	**12,969**
Labour[2] Inputs - man-hrs/ha			
Land Preparation	210	170	170
Planting	141	150	150
First weeding	145	168	168
Second weeding	-	232	232
Harvesting	220	110	110
Fertiliser application	-	-	30
	567	830	860
Total Labour input (man-hrs/ha			
Wage rate[3] (MK/hr)	4.85	4.85	4.85
Total Labour Cost	**2,750**	**4,026**	**4,171**
Material costs			
Seed	0	1,875	1,875
Fertiliser[4]	0	0	4,784
Total material cost	**0**	**1,875**	**6659**
Total input cost	**3,473**	**5901**	**10,830**
Net benefits (MK/ha	**9,970**	**444**	**2139**

[1] Unit price for sweet potato was the prevailing market price for main crop harvested in May.

[2] Labour requirements were obtained from two secondary sources (FSIPM Project Crack Sealing Trial 1998/99 and Labour Market and Wages Policy in Malawi document (1993) for high crop intensity, pure stand, light textured soils.

[3] Wage rate is calculated based on Government rate of K 33.99/day payment for labourers working from 7.00 a.m. to 2.00 p.m.

[4] Fertiliser cost is based on the recommended application rate of 100kg of 23:21:0+4S per ha plus 100kg of UREA per ha for medium textured upland soils.

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FARMING SYSTEMS INTEGRATED PEST
MANAGEMENT PROJECT

Osauka satopa:
Economic case studies of off-farm enterprises in Blantyre Shire Highlands RDP

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Contents

Abstract

Osauka satopa – *the name of a small village grocery – is Chichewa for 'The Poor Don't Get Tired'. It symbolises the resourceful way in which many rural households in southern Malawi combat poverty. Case studies were made of 22 off-farm enterprises in Mombezi and Matapwata EPAs, Blantyre Shire Highlands RDP. Villagers categorised off-farm enterprises into four types (*geni, okala, ganyu, *and crafts) according to capital requirements, whether producers make directly to order, and location. Of 22 enterprises, 12 were seasonal and 10 were annual. Generally,* geni *enterprises had the highest turnover, profit margins, and returns to labour. Returns to labour were lower for* ganyu *than for* geni, *and lowest of all for crafts. The market radius for inputs for off-farm enterprises was highest for* geni, *but most products of* geni *were sold in the home village. The market radius of labour for permanent and estate* ganyu *was high, indicating a shortage of regular wage employment. Off-farm enterprises were not 'coping mechanisms' but purposeful strategies that involved teamwork, planning, and choice. Spatial, seasonal and professional biases may obscure the full range of off-farm enterprises and their effectiveness in maintaining household food security.*

1.0 Introduction

Off-farm income is a defining feature of the household economy in southern Malawi. Whereas in the northern and central regions rural livelihoods are dominated by maize monoculture or mixed agriculture, in the south they are dominated by off-farm income-generating activities and by urbanisation (Moriniere *et. al*., 1996). Reliance on off-farm income reflects growing population pressure on arable land. Most farms are too small and unproductive to provide households with sufficient maize for a full year. Off-farm income is consequently essential for household food security.

Osauka satopa - the name of a small grocery on the road to our village sites in Matapwata EPA. – is Chichewa for 'The Poor Don't Get Tired'. It captures the importance of off-farm income for rural households. It also symbolises the resourceful way in which many of these selfsame households combat poverty. The poor are sometimes portrayed as helpless victims of their circumstances. We argue that, while villagers are poor, their ability to cope with poverty may be seen in a more positive light. Off-farm enterprises are *strategies*, or purposeful attempts to exploit a market opportunity using a resource, knowledge, or skill in which the household has a comparative economic advantage.

Off-farm income in Malawi is a neglected topic. Previous studies have been concerned with food security and have focused largely on enterprises found during the months of food deficit rather than on off-farm income as a whole (Simler, 1993; Pierce *et. al*., 1996). Similarly, little is known about the relative profitability and returns to labour from different enterprises. A recent review of the literature on micro-enterprise in Malawi concluded that most rural finance institutions know little about their target group or the type of enterprise for which credit was given (Orr *et. al*., 1999). Where such information is available, it is concerned with enterprises that require some capital and are judged to be credit-worthy (Orr and Makawa, 1997). Information is lacking about the economics of *osauka* – off-farm enterprises that require little or no capital.

The general objective of this report is to present economic case-studies of the off-farm enterprises commonly found at the FSIPM research sites in Blantyre Shire Highlands RDP. The specific objectives are to determine:

- The different categories of off-farm enterprise;

- The economics of off-farm enterprises; and
- The market radius associated with each enterprise.

The case studies form part of a larger study that models the farm household economy in the Blantyre Shire Highlands. Given their intrinsic interest and the dearth of information about the economics off-farm enterprise in Malawi, however, we felt that they deserved separate treatment. The case studies do not include all the off-farm enterprises observed during the 1998/99 season. Missing enterprises that we know of include butchering goats; selling firewood: seasonal trading in sugarcane, velvet beans, green maize purchased from estates: and cutting grass for cattle. To the best of our knowledge, however, they represent the major forms of off-farm income found at our village research sites.

2.0 Methods

Blantyre Shire Highlands RDP is located in southern Malawi where poverty is most acute. Matapwata and Mombezi EPAs – from which the sample is drawn - are among the poorest in the country (Moriniere *et. al.*, 1996). Forty percent of households are headed by women, and these form a disproportionate share of the poorest households. The farming system is maize based, with pigeon pea and beans the main intercrops. Six in 10 households cultivate only half a hectare (GOM, 1996) and must buy maize for four-five months each year. Agriculture is therefore market-oriented and a wide range of food crops is sold for cash. On holdings of half a hectare or less, however, almost half of cash income is earned off-farm (Orr *et. al.*, 1996).

Off-farm income

We define off-farm income as *earned cash income* that does not derive from the household's own production of crops, trees, poultry or livestock. 'Off-farm' is preferred to 'non-farm' because it may include income from agricultural sources such as casual labour. Income is specified as 'earned' in order to exclude income transfers (gifts, remittances) from relatives or other villagers.

The sample

All 22 case studies are based on interviews with households drawn from four villages in Mombezi and Matapwata EPAs, Blantyre Shire Highlands RDP. Of these, 7 (32 %) derive from households that we visited every three weeks between November 1998 – October 1999 as part of a larger study of the role of off-farm income in smallholder livelihoods. They were representative of five household groupings at the Project research sites that had earlier been identified by a cluster analysis (Orr and Jere, 1999). Fifteen case studies (68 %) derive from interviews with households that we encountered during the course of these regular visits. These households were identified by a third party or through chance meetings. In most cases, time did not allow more than one case study of the same enterprise. Information was collected using a simple checklist (Appendix 1).

Economic indices

The standard accounting tools for a small business are the balance sheet and the profit-and-loss account (Harper, 1996). The balance sheet, which states the value of a business, is of limited relevance in this context since off-farm enterprises are not for sale. We have valued fixed assets, however, in order to estimate depreciation. Our analysis of the economics of off-farm enterprise is based on the profit-and-loss account. A profit-and-loss account shows what happens to a business over a fixed period. Because of the irregular or seasonal nature of many enterprises, the profit-and-loss account was measured on a monthly basis. Some off-farm enterprises may not involve any operating costs except for the cost of labour. In addition to the profit-and-loss account, therefore, we have attempted to measure returns to labour from each enterprise.

- *Turnover* was defined as the total sales revenue of an enterprise.

- *Fixed assets* were defined as tools, buildings, and any equipment necessary for the enterprise to function.

- *Depreciation* was included as a component of *operating costs*. In periods of rapid inflation, fixed assets may actually increase in value faster than they decrease because they wear out. It is important to recognise that assets wear out, however, and replacement costs should not be included in wages or profits.

- *Operating costs* were defined as the cost of materials plus depreciation on fixed assets.

- *Operating profit* was defined as turnover minus operating costs and the *cost of labour*.

- Defining the *cost of labour* is difficult because rural households do not separate returns from off-farm enterprises into wages and profits. One way to estimate wages from an enterprise is to measure the household's average expenditure. This itself is a difficult task, however. The alternative is to estimate an 'average' wage. The national minimum wage (32 MK/day) is not enforced and has little meaning in rural areas. Instead, we have used the wage rate for casual labour in the 1998/99 crop year that was paid by estates near our two research sites. We have included the value of the midday meal. The wage rate has been calculated for a working day of six hours duration and includes travel time.

The imputed cost of labour for off-farm enterprises

(MK/day)

EPA	Estate	Men	Women
Mombezi	Matembo	23	20
Matapwata	Mindale	22	19

- *Profit margin* was defined as (operating profit/turnover) * 100. In this context, the concept of a 'profit margin' is notional because of the problem of valuing the cost of labour.

- '*Wini*'. Villagers usually defined profit (*wini* or *cholowa*) as the net return from an economic transaction after deducting the cost of the original investment and any associated costs except for depreciation. (Interestingly, villagers did not use standard dictionary equivalents for profit, namely *geni* and *phindu*). An economic transaction was reported as a loss (*anaduka*) if the seller only recovered part of their investment without any *wini*.

Market radius

The distances travelled to the place of trade were measured by vehicle using the kilometre trip in a Project vehicle. Where journeys involved local footpaths across country distances were measured using Department of Surveys map (Sheet 1535C3) for Blantyre City and environs (1:50,000).

3.0 Results and discussion

3.1 Categories of off-farm income

Villagers generally classified off-farm enterprises into four categories:

- ***Geni***

To qualify as *geni,* off-farm enterprises had to meet four criteria. First, *geni* involved buying *and* selling. Simply selling something that the household had produced did not suffice. Second, *geni* required capital, called *mpamba* or *ndalama ya geni.* Without investment of capital there was no *geni.* Third, because geni involved capital it also involved 'profit' (*wini*) or 'loss' (*anaduka*). Fourth, *geni* referred to an autonomous enterprise in which the producer, not the customer, decided when and what to produce. Goods produced to order did not constitute *geni.*

- ***Ganyu***

Ganyu referred to enterprises where the financial transaction was completed in a short period, usually a working day. It also referred to enterprises that might take longer than one day but which involved a cash contract. Work done to order was also considered as *ganyu.* For example, hiring someone to cut thatching grass was categorised as *ganyu.*

- ***Okala***

Okala referred to a business conducted at a fixed location other than a market. A village shop or grocery was classified as *okala.* Another word sometimes used to refer to this type of business was *kantini.*

- ***Crafts***

Some villagers classed crafts as *geni.* Others objected because the activity was seasonal or because the work was done directly to order by the customer. It seems appropriate, therefore, to treat these enterprises as a separate category. Unlike *geni,* they used common property resources and required minimal working capital. If the product was directly to order some villagers classified the enterprise as *ganyu.* If the enterprise was habitual and the producer had acquired a reputation for the product, however, it was referred to by a simple descriptor (eg. *osaka mphasa, wogulitsa udzu,* etc.).

Table 1 applies these categories to the 22 enterprise case studies:

- Eight enterprises (40 %) may be classed as *geni.* Female-headed households (FHHs) were prominent in geni, accounting for five of the eight enterprises. Women were responsible for most market trading in agricultural products. Another notable feature of *geni* was the degree of market specialisation. Customers included distinct markets within the village (cattle-owners, schoolchildren) as well as markets beyond the village boundary (traders. townsfolk, fish-farms).

- One enterprise - the village shop or *bench* - was categorised as *okala*. Like *geni*, this was an annual enterprise. Unlike *geni*, however, it traded in a narrow range of basic goods for a very broad market.

- Eight enterprises were classed as *ganyu or ganyu/thandize* (ie,. involving communal labour). Some forms of *ganyu* such as carpentry or house-building involved a degree of market specialisation. However, markets were narrower than with *geni* and confined to home or neighbouring villages. Specialists in *ganyu* enterprises such as estate labour, house-building, and agricultural labour tended to be younger and fitter than average.

- Four enterprises (20 %) may be categorised as crafts. These did not specialise for particular markets and mostly produced to demand from home or neighbouring villages.

- Finally, we have added the category 'professional' to cater for the enterprise of selling herbal medicine. Knowledge and skill, rather than capital, was the basis for this enterprise. It served a specialised market and attracted customers both from villages and the nearby town.

Figure 1 shows the seasonality of off-farm enterprise for the case study households. Of the 22 enterprises shown, 10 (45 %) were annual. Significantly, most *geni* were annual. The exceptions were brewing *kachasu* and trading in ADMARC maize and maize flour. Trading in maize exploited the differential between the subsidised and free market price of maize during the hungry season. Most specialists in *geni* were able to combine business with agriculture. By contrast, most forms of *ganyu* were seasonal. The exception was estate labour (on estates growing perennial crops) and permanent *ganyu* where workers were employed by one household throughout the year on tasks such as fieldwork or caring for dairy cattle. Crafts were the most seasonal form of off-farm income. Mat-making, basket-making, and making *nkhokwe* were all concentrated in the dry season when raw materials became available.

3.2 The economics of off-farm enterprise

Table 2 shows the financial indices derived from the profit-and-loss accounts for each enterprise.

- ***Geni***

Geni enterprises had the highest average turnover (median, 868 MK/month). Four enterprises (brewing *kachasu*, selling goat hides, selling *kanyenya*, and tailoring) had turnover of 2900 MK/month or more. The *geni* enterprises with the lowest monthly turnover were trading madeya in the wet season at village level and trading ADMARC maize (both 100 MK/month). Both were irregular enterprises because of high competition during the hungry months. Profit margins from *geni* were above 25 % in all but three cases. Interestingly, the highest profit margin was for trading *madeya* to dairy-farmers in the dry season (70 %), a good example of the backward linkages from dairy. Despite the high profit margins of some *geni* enterprises, however, the cash value of *wini* was modest and exceeded MK 1000 in only four cases. Returns to labour were all above 30 MK/day (median, 48 MK/day), higher than from village shop-keeping or *ganyu.*

The economic indices for *geni* illustrate the limited scope of off-farm enterprise for capital accumulation. Of the eight enterprises listed, only tailoring and selling goat hides seem to generate enough profit to offer scope for sustained business growth. Generally, *geni* is not grassroots capitalism but economic niches that provide some measure of livelihood security.

- ***Okala***

Village shop-keeping was a high-volume, low-return enterprise. Turnover was the highest for any enterprise (8000 MK/month) yet the profit margin was only 15 %. Returns to labour were comparable with *ganyu*.

- ***Ganyu***

Turnover from *ganyu* enterprises was generally low, reaching 1000 MK/month in only three cases (carpentry, house-building, and permanent *ganyu*). Obviously, operating costs were low. Only in two cases (land preparation, selling thatching grass) did returns to labour exceed 30 MK/day (median, 28 MK/day). The worst paid form of *ganyu* was selling firewood, averaging just 14 MK/day.

- ***Crafts***

Turnover from crafts was generally low, with only basket-making reaching 1000 MK/month. While raw materials were free, the labour-intensive nature of crafts increased operating costs and eroded profit margins. Three enterprises had either zero or negative profits. Average returns to labour were the lowest for any enterprise (median, 17 MK/day).

- ***Professional***

Despite a low turnover (667 MK/month) selling herbal medicine offered the highest returns to labour of any off-farm enterprise, averaging 208 MK/day. Rural households were evidently willing to pay highly for effective health care.

3.3 The market radius

Figures 2 and 3 show the furthest distance travelled to obtain the materials required for off-farm enterprises, and to sell the products. In the case of enterprises where the sale is made from home, the distance is shown as 'within the village'.

Geni enterprises showed the highest market radius in the location of raw materials (Figure 2). In two cases (trading *madeya* and village shop-keeping) these involved 30 km travel to the town of Limbe. In seven cases, however, the raw materials for *geni* were obtained within 10 km of the home village. Three of the four craft enterprises involved some travel (< 10 km) to locate raw materials.

A different picture emerges in travel to the point of sale (Figure 3). With the exception of selling maize flour, the products of most *geni* enterprises were traded within the home village or nearby (< 10 km). The products of most seasonal crafts were also traded from home. However, both estate *ganyu* and permanent *ganyu* involved long journeys from the village on a daily basis. Both these enterprises involved female-headed households, and the distance travelled indicates the lack of alternative economic opportunities for such women besides *geni*.

3.4 The resourcefulness of the resource-poor

The OED defines the verb 'to cope' as: 'to contend *successfully* with, deal *competently* with a situation or problem' (*our emphases*). Somehow, this perspective is missing from official writing on poverty in Malawi, which portrays poor households as helpless victims of their circumstances. Thus, a recent exercise on poverty monitoring declared that:

"*The villagers suffering from poverty do not have any strategic approach, involving a long-term or even a medium term perspective, to fight this situation. Instead, they rely on isolated, short-term mechanisms to ease an immediate predicament... people go as far as they can on maize and only react to food shortage the moment they encounter it. Thus, coping mechanisms are purely reactive measures and as such seasonal, based on resources available at the time and opportunities given at the time when food shortages hit the people*". (NEC, 1999: 39).

Poverty makes exceptional demands of its victims. It may also provoke a proportionate response. To treat such responses as *mechanisms* – unthinking reactions, devoid of volition or choice - robs them of their human agency. Off-farm enterprises often show initiative, foresight, careful planning, teamwork, and make use of inherited skills. We highlight some salient features from our case studies:

- ***Teamwork***

Several enterprises involved close co-operation between individuals or groups. Trading in *madeya* usually involved two or more women travelling as a group to urban mills. This gave benefits such as security, assistance in transporting heavy bags by vehicle, and economies of scale in sharing food and firewood. Other enterprises (brick-making, selling thatching grass) involved communal labour (*thandize*) where villagers worked in groups of 20 or more in exchange for payment in kind. The purchase and preparation of food, the specialisation of men and women in different tasks, involved considerable skills of organisation.

- ***Planning and forethought***

Careful planning, timing, and saving were features of many enterprises. Villagers regard a business plan (*ndi plan*) and a 'heart for business' (*mtima wa businesi)* as the keys to successful *geni* (Orr *et. al*., 1999: 36). Mai Marichi deliberately timed her foray into trading *madeya* for January in order to maximise her revenue and earn enough cash to buy fertiliser. Bambo Stanley, the village shopkeeper, deliberately invested in trade in order to finance the expensive inputs necessary for successful *dimba* cultivation. Daniel Maliro, the house-builder, was saving his earnings from *ganyu* to finance his secondary schooling. Bambo Mphepo embarked on his career selling fried fish with MK 85 that he had saved from his earnings from *ganyu*. Mai Golia's first capital for selling cooked food (MK 30) came from estate labour. Our case studies thus provide ample evidence for the claim that poverty forces many households to 'take the long view' by conserving their resources and investing for the future (Chambers, 1997: 174 ff).

- ***Barriers to entry***

Barriers to entry made several types of *geni* only feasible as longer-term strategies. This is illustrated by the experience of Mai Mpenda, who accompanied Mai Bitoni, a regular trader in *ufa*, to Limbe market in early June. They found the market crowded with sellers. On the first day Mai Mpenda couldn't even find a place to sit and sell. The following day she found a place, but in three days' trading sold only MK 25 worth of *ufa*. As a newcomer, she could not attract customers. In desperation, she sold the rest of her *ufa* to the 'chairman' of the maize-sellers in Limbe market for MK 320, which was just enough to cover her expenses. By contrast, Mai Bitoni sold to her regular customers and made net returns of MK 350. Similarly, traders in *madeya* make regular gifts to the employees at pounding mills in Limbe in order to ensure preferential treatment during the wet season when competition is most intense.

- ***Use of inherited skills***

Crafts show how traditional skills (often acquired in childhood) may be pressed into service to provide cash income for men who are too frail or elderly for *ganyu*. Bambo Chimwala, who weaves mats, Bambo Nkoma, who makes *nkhokwe*, and Bambo Namvenya, who makes axe and hoe handles, are all in their 70s. Without the capital resources required for trading, they rely on common property resources that are freely available on the riverbanks and hillslopes. Bambo Chimwala and Bambo Nkoma literally work for subsistence wages – they earned 7-9 MK/day at a period the price of ADMARC maize was 7.25 MK/kg. However, there are few other opportunities to earn cash income open to men of their age. The net income from the mats that Bambo Chimwala weaves between June-October will buy sufficient maize to feed him for six months.

- ***Economic choices***

Villagers' choice of off-farm enterprise is often based on a careful analysis of costs and benefits. Mai Nantchengwa works nine hours a day, six days a week, 11 months a year, and all for a wage of 28 MK/day. Her choice of off-farm enterprise might almost be described as 'servitude with security'. However, she prefers this to trading (too risky) or estate labour (because she has a personal relationship with her employer and is paid in maize when her own stocks run out). Her strategy offers security for herself and her young family. Similarly, Mai Golia has opted to sell cooked food rather than work as an estate labourer because it leaves her sufficient time to cultivate her maize field properly, which supplies her household for eight months of the year.

Estate labour seems a common choice of off-farm enterprise among female-headed households or for women in 'fragile' marriages. Mai Tholo (42), who has been separated from her husband for 10 years, took up estate *ganyu* three years ago when she found she could no longer afford the inputs for *dimba* cultivation. Mai Masinoti (26), who separated from her husband in 1998, started estate *ganyu* in 1999. She needs cash not only to buy maize (the household runs out in November) but also to repay an APIP fertiliser loan. Previously she did seasonal *ganyu* (drawing water for moulding bricks) but estate labour offers continuous employment, though at a lower wage.

3.5 Off-farm income unperceived?

Most of us accept that rural poverty is often 'unperceived' (Chambers, 1983). We do not always appreciate that it may be equally difficult to observe villagers' strategies for dealing with poverty. The same biases that affect our perception of poverty may also obscure our vision of off-farm income:

- ***Spatial bias***

Certain enterprises may be overlooked if the villagers who engage in them are physically absent from the village collecting reeds or timber, or trading in local or urban markets. The growing pressure on common property resources in southern Malawi means that poorer households are being forced further afield to obtain materials.

- ***Seasonal bias***

Rural poverty is often unperceived in the wet season, when travel is most difficult. In Malawi, paradoxically, we know *most* about off-farm income in the wet season because this is the period that households run out of maize. Literature on coping strategies has a 'wet-season bias' that obscures the importance of off-farm enterprises such as crafts, or brick-making, or cutting thatching grass, that are only possible during the dry season. Crafts are a particularly important enterprise for the elderly who try to avoid wet-season income strategies such as *ganyu*.

- ***Professional bias***

Several biases interact here:

- Development professionals want to *do something* about rural poverty. They formulate action plans, devise programmes, and make recommendations. This bias for action provides little incentive to discover what rural households actually do to help themselves. It is often easier to see the poor simply as victims and overlook their resilience. Naturally, villagers are willing to accept this view of themselves by outsiders if it serves their interests.

- *Small farmer bias*. A mindset that sees rural households as 'farmers' may view off-farm income as an inferior alternative to income from agriculture whereas the two streams of income are complementary. A strategic objective for most farm households – and not only poor ones – is to achieve a balance between farm and off-farm income. Thus, field research into micro-enterprise in Mulanje, Thyolo district, shows that many rural households strive for a 50: 50 division of income between farm and off-farm income (Orr *et. al*., 1997). Even households that are self-sufficient in maize generally invest in off-farm income strategies in order to provide them with working capital for farming. For example, Bambo Sapanga produces a maize surplus due to the fertiliser and hired labour that he buys with the proceeds from selling goat hides.

- *RRA bias*. The risk of professional bias is increased when investigators are in a hurry. A recent poverty monitoring exercise appears to have spent just two days in each village, the visits coinciding with the start of the rains when villagers were busiest (NEC, 1999). Certain types of off-farm enterprise are not easily discovered by rapid rural appraisal, however, and require close familiarity with one location for an entire year.

4.0 Conclusions

This analysis of off-farm enterprises in Blantyre Shire Highlands RDP contains several broader implications for the study of poverty in Malawi.

First, 'coping strategies' during periods of food shortage need to be seen in the broader context of off-farm income. They are a subset of off-farm enterprises. In areas like the Shire Highlands where the average smallholder household buys maize for four-five months each year, off-farm income is an essential part of household food security. The livelihood strategies that villagers have developed to cope with this extended period of food deficit in response are not restricted to the months of food deficit alone but encompass the entire year. Off-farm enterprises outside the period of food-deficit also make an important contribution to household food security.

Second, the case studies testify to the resourcefulness of the resource-poor. Sources of off-farm income vary widely in nature, in economic returns, and in market radius for inputs and sales. This variety reflects adaptability, skill, and opportunism as well as necessity. 'Coping' needs to be understood in its original, positive meaning. The case studies suggest that off-farm enterprises are not 'mechanisms' but purposeful strategies that frequently involve 'taking the long view', business acumen, and a careful evaluation of alternatives.

Finally, we need to become more aware of various biases. Spatial and seasonal biases may conceal certain types of off-farm enterprise that require travel outside the village or are found only during the dry-season. Professional biases may obscure our perception of the ability of many rural households to cope effectively with maize deficits by achieving a balance between farm and off-farm income.

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References

R. Chambers (1983). *Rural Development: Putting the Last First.* London: Longman.

R. Chambers (1997). *Whose Reality Counts? Putting the First Last.* London: Intermediate Technology Publications.

M. Harper (1996). *Empowerment through Enterprise: A training manual for non-government organisations.* London: IT Publications.

M. Leach (1995). Ganyu *Labour: the Implications of Off-Farm Labour for Alley Cropping in Malawi.* Lilongwe: ADDFOOD. May. Mimeo, 44 pp.

Government of Malawi (1996). *National Sample Survey of Agriculture 1992/93.* Vol 1: *Smallholder Household Composition Survey Report.* Zomba: National Statistical Office.

MOALD (1994). *Guide to Agricultural Production in Malawi.* MOALD: Lilongwe.

L. Moriniere, S. Chimwaza, and E. Weiss (1996). *A Quest for Causality: Malawi Vulnerability Assessment and Baseline 1996.* Lilongwe: Famine Early Warning Systems. December. Mimeo, 121 pp.

B. Morris (1996). *Chewa Medical Botany.A Study of Herbalism in Rural Malawi.* (London: International African Institute).

A. Orr. A. M. Koloko, and C. B. K. Mkandawire (1996). Background Information on Blantyre Shire Highlands RDP. FSIPM Project. September. Mimeo, 37 pp.

A. Orr and P. Jere (1999). 'Identifying smallholder target groups for IPM in southern Malawi'. *International Journal of Pest Management,* 45 (3): 179-187.

S. Orr and J. Makawa (1997). GTZ/IFSP Income Generating Activities Consultancy. Part 1: Main Report. Blantyre: Kadale Consultants. Mimeo, pp.

S. Orr, J. de Gabriele, J. Green and J. Makawa (1999). Improving Support Services to Micro-Enterprise in Malawi: Action Research Report for Oxfam. Blantyre: Kadale Consultants. March. Mimeo.

National Economic Council (1999). *Qualitative Impact Monitoring of Poverty Alleviation Policies and Programmes in Malawi.* Vol 1: *Research Findings.* Lilongwe: National Economic Council. Mimeo. 181 pp.

K. Simler (1993). Coping Strategies for Smallholder Households and Scope for Targeted Interventions to Improve Food Security. Agricultural Sector Memorandum, Working Paper No. 11. Lilongwe: World Bank. Mimeo, 11 pp.

J. Pierce. A. Ngwira, and G. Chimseu (1996). *Living on the Edge: A Study of the Rural Food Economy in the Machinji and Salima Districts of Malawi.* Lilongwe: Save the Children (UK).

J. Werner (1987). *Labour Requirement and Distribution for Smallholder Crops.* Adaptive Research Division. Liwonde ADD. Mimeo, 44 pp.

Table 1. Categories of off-farm enterprise, Blantyre Shire Highlands RDP.

No.	Category	Enterprise	Name	Age (years)	Marital status [a]	Food security (months)	Place of trade	Customers
1	*Geni*	Brewing *kachasu*	Mai Kaminyu	37	FHH	Dec	Residence	Villagers
2	"	Selling goat hides	Charles Sapanga	52	MHH	Self-sufficient	Residence	Tannery companies
3	"	Selling *kanyenya*	Bambo Mpepo	Na.	MHH	Na.	Local villages	Villagers
4	"	Trading maize and flour	Mai Baluti	35	MHH	Nov	Local markets Town	Traders Townsfolk
5	"	Selling *zophikaphika*	Mai Golia	46	FHH	Nov	Primary school	Schoolchildren
6	"	Selling snuff	Mai Chilinkhonde	65	FHH	Nov	Residence	Villagers
7	"	Trading *madeya*	Mai Misoya	49	FHH	Dec	Town, local markets	Villagers, cattle-owners, fish-farm
8	"	Tailoring	Bambo Mangani	45	MHH	Nov	Local markets	Villagers
9	*Okala*	Village shop-keeping	Bambo Stanley	32	MHH	Na.	Home village	Villagers
10	*Ganyu*	Village carpentry	Bambo Muheku	37	MHH	Oct	Nearby village	Villagers
11	"	Building houses	Daniel Maliro	22	MHH	Na.	Local villages	Villagers
12	"	Agricultural *ganyu*	-				Local villages	Villagers
13	"	Permanent *ganyu*	Mai Nantchegwa	52	FHH	Jul	Nearby village	One village household
14		Estate *ganyu*	Mai Speak	23	MHH	Na.	Estate	Mindale Estate
15	"	Selling firewood	Mai Butao	30	MHH	Nov	Residence	Villagers
16	*Ganyu/thandize*	Moulding bricks	-				Home village	Villagers
17	*Ganyu/thandize*	Selling thatching grass	Bambo Baluti	42	MHH	Nov	Residence, local markets	Villagers
18	Seasonal crafts	Making baskets	Bambo Makoto	35	MHH	Nov	Local markets	Villagers, tomato growers
19	"	Making mats	Bambo Chimwala	75	MHH	Oct	Residence	Villagers
20	"	Making *nkhokwe*	Bambo Nkoma	70	MHH	Sep	Local villages	Villagers
21	"	Making hoe and axe handles	Bambo Namvenya	75	MHH	Nov	Residence	Villagers
22	Professional	Herbal medicine	Mai Marichi	44	FHH	Nov	Residence	Villagers, townsfolk

[a] FHH = female-headed (*de facto* or *de jure*); MHH – male-headed.

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Table 2. The economics of off-farm enterprise, Blantyre Shire Highlands RDP. [a]

No.	Category	Enterprise	Turnover (MK/month)	Operating costs (MK/month)	'Profit margin' (%)	'Wini'	Net income (MK/month)	Returns to labour (MK/day) [b]
1	*Geni*	Brewing *kachasu*	2947	2144	27	820	1324	40
2	"	Selling goat hides	2900	2259	26	1250	2435	78
3	"	Selling *kanyenya*	3600	3076	15	1076	1052	44
4	"	Trading maize and flour						
		- ADMARC maize	100	78	22	57	57	31
		- flour	662-805	547-340	31-58	350-530	350-531	48-163
5	"	Selling *zophikaphika*	868	750	14	498	469	50
6	"	Selling snuff	284	241	15	97	97	36
7	"	Trading *madeya*						
		- wet season (town)	480		39	416	416	35
		- wet season (village)	100		47	85	85	28
		- dry season	1400		70	1152	904	52
8	"	Tailoring	3300	2410	27	2203	2203	37
9	*Okala*	Village shop-keeping	8000	6771	15	1600	1625	26
10	*Ganyu*	Village carpentry	675-1180	263-402	-	-	647-1152	61-68
11	"	Building houses	1200	546	-	-	1166	50
12	"	Agricultural *ganyu*				-		
		- land preparation	-	-	-		676	25-40
		- weeding	-	-	-		312	26
13	"	Permanent *ganyu*	-	-	-	-	1024	28
14	"	Estate *ganyu*	-	-	-	-	526	22
15	"	Selling firewood	263	0.75	-	-	262	14
16	*Ganyu/thandize*	Moulding bricks	-	-	-	-	-	29
17	*Ganyu/thandize*	Selling thatching grass	500	31	-	-	469	50
18	Seasonal crafts	Making baskets	1170	841	0	-	1003	25
19		Making mats	144	196	- 218	-	137	7
20		Making *nkhokwe*	195	195	25	-	195	30
21		Making hoe and axe handles	20	48	- 59	-	18	9
22	Professional	Herbal medicine	667	171	74	-	667	208

a See text for definition of accounting terms.

b Assuming one manday @ six hours.

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Fig. 1. The seasonality of off-farm enterprise, Blantyre Shire Highlands RDP.

No.	Category	Enterprise	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	*Geni*	Brewing *kachasu*												
2	"	Selling goat hides												
3	"	Selling *kanyenya*												
4	"	Trading maize												
4	"	Trading maize flour												
5	"	Selling *zophikaphika*												
6	"	Selling snuff												
7	"	Trading *madeya*												
8	"	Tailoring												
9	*Okala*	Village shop keeping												
10	*Ganyu*	Village carpentry												
11	"	Building houses												
12	"	Agricultural *ganyu*												
13	"	Permanent *ganyu*												
14		Estate *ganyu*												
15	"	Selling firewood												
16	*Thandize*	Moulding bricks												
17	"	Selling thatching grass												
18	Crafts	Making baskets												
19	"	Making mats												
20	"	Making *nkhokwe*												
21	"	Making hoe and axe handles												
22	Profession	Herbal medicine												
			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep

(grey box) = Hunger months (*nthawi ya njala*)

Fig. 2: The market radius for materials used in off-farm enterprises, FSIPM Research Sites, Blantyre Shire Highlands RDP

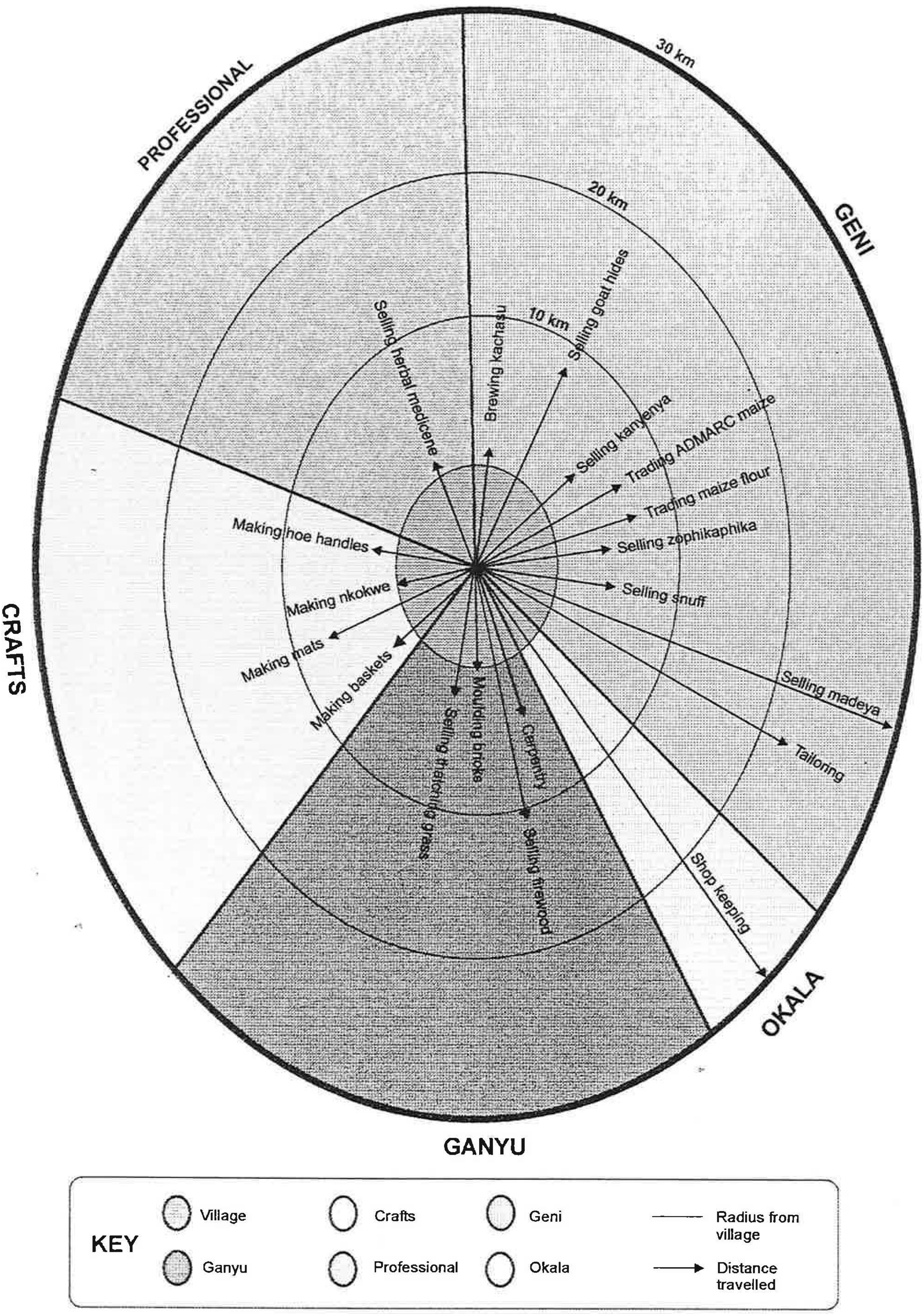
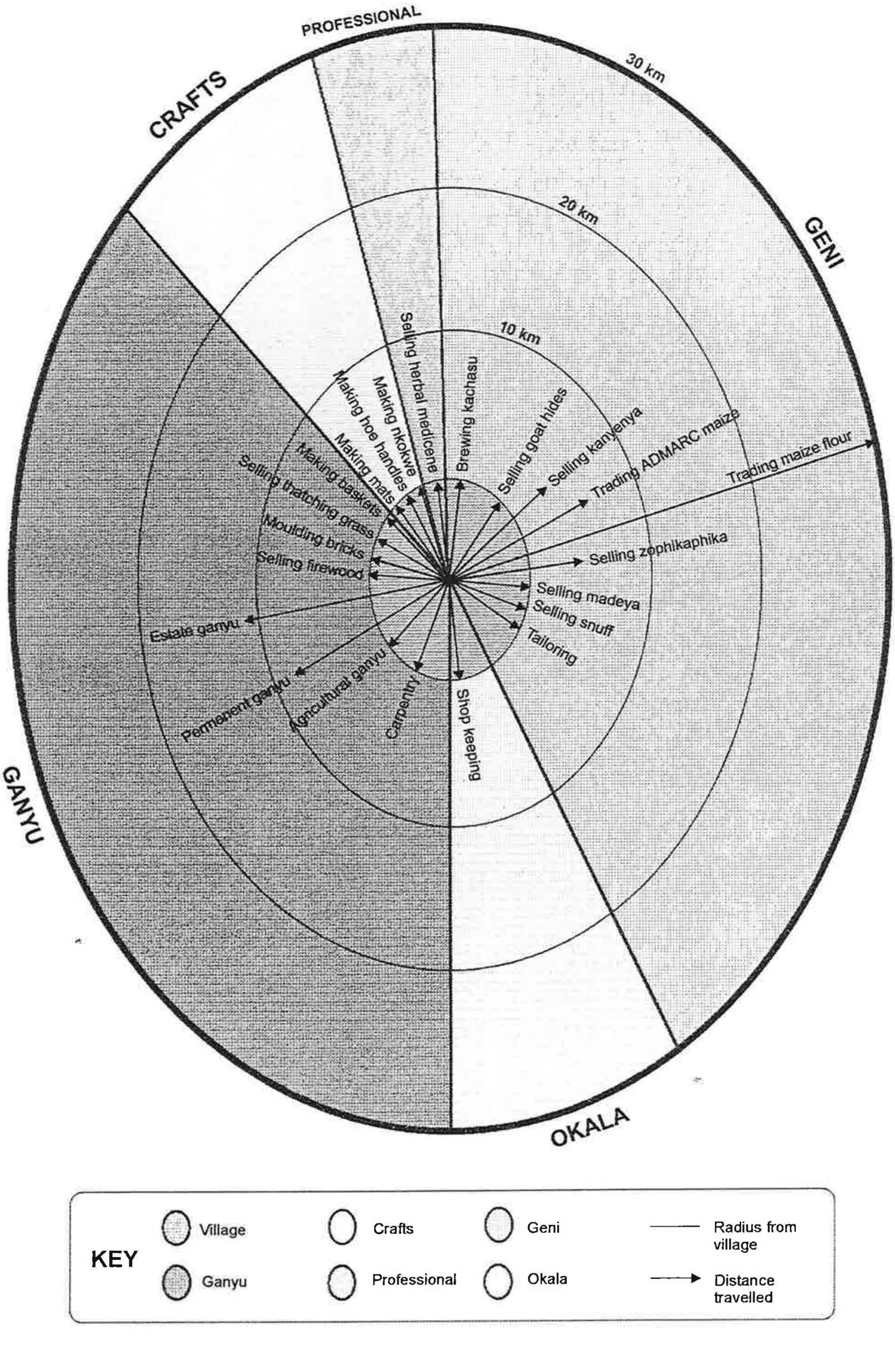


Fig. 3: The market radius for products of off-farm enterprises, FSIPM Research Sites, Blantyre Shire Highlands RDP



APPENDIX 1

CHECKLIST FOR CASE STUDIES

PERSONAL

Name
Village
Description of person
Family details
How long in business
Full time/part time
Household food security

COSTS OF THE BUSINESS

Labour
Materials
Transport to market
Time spent at market

RETURNS FROM THE BUSINESS

How much sold per day/week/month
Number of days sold
Total sales day/week/month

CONSTRAINTS

Source of capital for business
Peak months
Low months

MOBILITY OF SELLER

Markets visited
Frequency of visits
Distance from home

APPENDIX 2

CASE STUDIES OF OFF-FARM INCOME, BLANTYRE SHIRE HIGHLANDS RDP.

Contents

1. THE BREWER OF KACHASU: *MAI KAMINYU...*

Mai Kaminyu lives with her husband and child in Chiwinja village, Mombezi EPA. Her husband, who works for ESCOM, lives in town and returns home only at weekends. In a good year, the household is self-sufficient in maize until December. Mai Kaminyu said that she learnt the brewing of *kachasu* (local gin) from her mother, from whom she obtained all the equipment for brewing some time ago. This is the seventh year of trading. She sells *kachasu* directly from home.

Kachasu is prepared from fermentation of maize bran and sugar. The process has several steps:

- *Madeya* is mixed with 30 litres of water in a big clay pot to which sugar is added. The mixture, known as *matokoso,* must be stirred three times daily (morning, noon, and evening) until it starts to produce bubbles, after which it must be stirred twice daily (morning and evening) until the *madeya* settles at the bottom of the pot. The period required to settle the *madeya* varies: between three or four days when the weather is warm and five days if the weather is cool.

- The *matokoso* is sieved into another clay pot using the *kape* or which is then covered by a small pot with a hole in one side. After sealing the mouth of the pot to prevent vapour escaping when boiling, a pipe is inserted through the hole into a metal basin to which cold water is added. This is done to cool the hot steam passing through the pipe. At the end of the pipe is a small glass (about 20cm) which is bent into a transparent bottle for the condensed vapour to fall into. The apparatus is known as the *injeni* (engine).

- The *kachasu* obtained in the first bottle (appropriately known as *mutu*) is colourless like paraffin, extremely strong, and normally diluted with the rest of the *kachasu* before drinking.

Materials and equipment

Material costs for one brewing include *madeya* (MK 10) and five kilos of sugar (MK 100). Mai Kaminyu estimates that the brewing equipment must be replaced every four years. We estimate the cost of equipment at MK 180. Assuming depreciation @ 25 %, this gives an annual depreciation of MK 45. Assuming 150 brewings/year gives a depreciation of MK 0.3 for each brewing.

Labour requirements

One hour's work is required to purchase *madeya* and sugar from the village or roadside shops in nearby Walala. A few hours (say 3) are needed for stirring the *matokoso*. Time must also be allowed for serving customers. Mai Kaminyu has to be around while customers are present and does not normally venture further than the village well. Usually she does household chores. Customers may arrive anytime between 3 – 10 p.m. One brewing may sell out in one day if sold at the end of the month, or in four days if the brewing is done in the middle of the month. On average, therefore, she sells one brewing in two and a half days, with a total serving time of 17.5 hours/brewing.

Markets and prices

One brewing yields eight litres of *Kachasu.* A 750 m.l. bottle sells at MK 28 (equivalent to 30.7 MK/litre) and gives a total revenue of MK 245.60. Deducting the cost of *madeya*, sugar, and allowing for depreciation, net revenue is MK 135.30. If she manages to find the *madeya*, Mai Kaminyu normally brews three times a week, which gives a monthly total of 12 brewings. Net revenue from brewing is thus 1624 MK/month or 40 MK/day.

The economics of brewing *kachasu*

1. Profit-and-loss account

Costs

Materials (MK/brewing)	
- *Madeya*	10
- Sugar	100
Total	110
Deprecation on equipment (MK/brewing) [a]	0.30
Notional cost of labour (MK/brewing)	68 (3.42 days @ 20 MK/day)
Total operating costs (MK/mo)	
- materials	1320
- depreciation	3.60
- labour	820
Total	2144

Returns

Brewings/month (no.)	12
Revenue/brewing (MK).	246
Turnover (MK/month).	2947
Notional profit (MK)	803
Notional profit margin (%)	27
Wini (MK/month) [b]	820

2. Returns to labour

Labour (hours/brewing)	
- Brewing	3
- Serving	17.5
Total	20.5
Net returns (MK/month).	1624
Returns per day (MK).[c]	40

[a] Assuming depreciation @ 25 % per annum.
[b] Turnover-costs of materials.
[c] Assuming one manday @ six hours (MK 1624)/((246 hours/6)).

D. Saiti, A. Orr, April 1999.

2. *SELLING GOAT HIDES: CHARLES SAPANGA...*

Charles Sapanga (52) lives in Lidala village, Mombezi EPA, with his wife and two children. He formerly worked for a company in Blantyre. The four fields he cultivates keep the household self-sufficient in maize for the whole year. Most of the work is done by hired labour. For a few years he grew burley tobacco but in 1996 he gave this up as unprofitable. Since then his main source of cash income has been selling goat hides. He decided to enter this business after seeing others buying them from local butcheries.

Materials and equipment

At first, Bambo Sapanga bought the hides only from the nearby market of Mbulumbuzi for MK 7 each. Now he obtains hides from Namadzi and Khonjeni markets as well. Hides cost between MK 8-10, depending on the seller. In one week he buys about 50 hides. The average buying price is MK 9. He normally cycles to and from these three markets. He bought his bicycle for MK 1550 in 1995. The hides are washed to remove any blood and flesh that remain after skinning. For this he uses a brush and a knife bought in 1998 for MK 7.95 and MK 5, respectively. The hides are then dried by tying them to a wooden frame, constructed at a cost of MK 60. Drying takes only two days in fine weather. We have assumed depreciation at 10 % p.a. for the bicycle (MK 155), 25 % p.a. for the cleaning equipment (MK 3.24) and 33 % p.a. for the wooden frame (MK 20).

Labour requirements

Bambo Sapanga visits each of his three markets twice a week in order to buy hides. This requires a total of six hours' travel (Mbulumbuzi), five hours (Khonjeni), and three hours (Namadzi), giving a grand total of 14 hours. Ten hours are required to clean 50 hides. Water for cleaning is drawn either by his two children or by his wife when the children are at school. We assume a labour requirement of five hours for carrying water (one hour for 10 hides). Thus, the total labour requirement is 29 hours each week. During drying he works full-time at other activities. Hides are sold directly from his home.

Markets and prices

Bambo Sapanga sells his hides to companies in Blantyre and Mapanga. Prices vary between these companies. The first buys large hides without holes for 12-18 MK/hide and hides with holes for 10-16 MK/hide. The second buys thick hides without holes for MK 16 and thin hides or hides with holes for MK 11-15, depending on size. We will use median figures of MK 16 for hides without holes and MK 13 for hides with holes. Bambo Sapanga estimates that 75 % of the hides he buys are without holes. This gives a weighted average price of MK 15.25.

Income

Average net returns from processing hides were 1145 MK/month, equivalent to 78 MK/day.

The economics of selling goat hides

1. Profit-and-loss account

Costs

Materials (MK/month)	
- Hides	1800
Depreciation on equipment (MK/month) [a]	
- Bicycle	12.92
- cleaning brush and knife	0.27
- wooden frame	1.67
Total	14.86
Notional cost of labour (MK/month)	444 (19.3 days @23 MK/day)
Total operating costs (MK/month)	
- materials	1800
- depreciation on equipment	15
- labour	444
Total	2259
Returns	
Sales (No/month)	200
Price (MK/unit)	15.25
Turnover	3050
Notional profit (MK/month)	791
Notional profit margin (%)	26
Wini [b]	1250

2. Returns to labour

Labour (hours/week)	
- travel to market	14
- cleaning hides	10
- carrying water	5
Total	29
Net returns (MK/month)	1235
Returns per day (MK) [b]	64

[a] Assuming depreciation @ 10 % p.a. (bicycle); 25 % p.a. (cleaning knife and brush); and 33 % p.a. (frame).
[b] Turnover - costs of materials.
[c] Assuming one manday @ six hours (MK 1235)/(116 hours/6)).

D. Saiti, August 1999

3. SELLING KANYENYA*: BAMBO MPHEPO…*

One morning we noticed Bambo Mphepo on the *khonde* of his small house in Chidothi village, Matapwata EPA. He lives with his wife and children. With only one small field, his maize production is only 150 kg/year, not even enough for one adult. Bambo Mphepo used to rely on casual labour (*ganyu*) to earn cash to buy maize, traveling long distances in search of work. In 1997, however, he started selling *kanyenya wa nsomba* (fried fish). He bought his first stock with MK 85 that he had earned from *ganyu*. The business is full-time, all year round. Bambo Mphepo has prospered and he now owns a bicycle and has built himself a new house.

Materials and equipment

Bambo Mphepo prefers to buy two types of fish (*zambo* and *zikukulu*). These sell for MK 5 a heap (*mulu*). He usually buys one *chambo* for MK 1 and sells for MK 3-5. Assuming that he sells for MK 3, then the cost of fish accounts for roughly one-third of his sales. Besides fish, he must buy ingredients for the spicy mixture in which they are fried. His total weekly expenditure on these items was estimated at MK 301 and comprised: curry powder (MK 10); pepper (MK 6); *mgaiwa* (MK 15); flour (MK 60); salt (MK 15); and cooking oil (MK 195). He spends MK 30 every week on firewood.

Cooking equipment consists of a clay pot for frying (MK 7), an aluminium pot used for the mixture (MK 40), and steel spokes to handle the frying fish (MK 1). The fish are transported back from the market in a large basket (MK 28) and laid on two flat winnowing baskets (MK 25 in total) to be carried to customers. The bicycle he uses every day was bought second-hand last year for MK 490. So far he has spent about MK 300 on repairs (new tyres, new handlebars). We estimate annual depreciation @ 25 % for the cooking equipment (MK 12), and @ 50 % p. a. for the baskets (MK 27) and the bicycle (MK 245).

Labour requirements

Bambo Mphepo travels to Goliati and Nansadi markets three times each week to buy fish. Travel time each day is five hours, giving a weekly total of 15 hours. Once home, the fish are sliced open then dipped in a spicy mixture and fried. The time required for preparation and cooking was estimated at three hours, giving a weekly total of nine hours. Bambo Mphepo then sells the freshly-fried fish in nearby villages between 2-6 p.m. in the afternoon. This accounts for a further 12 hours each week.

Prices and markets

Bambo Mphepo estimates that he sells 300 MK of *kanyenya* each day for three days each week, giving total sales of 900 MK/week. Fish supply varies seasonally. In the wet season , the price of a single *zambo* rises from MK 1 to MK 2 or 3. He then sells at MK 5 per fish. Demand is highest after the harvest of pigeonpea in October, when he estimates that his sales rise to as much as 400 MK/day.

Income

Net income was estimated at 1052 MK/month or 44 MK/day.

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The economics of selling *kanyenya wa nsomba*

1. Profit-and-loss account

Costs

Materials and equipment (MK/month)	
- Fish	1200
- Firewood	120
- Spicy mixture	1204
Total	2524
Depreciation on equipment (MK/month) [a]	
- Cooking equipment	1
- Bicycle	20.4
- Baskets	2.25
Total	23.65
Notional cost of labour (MK/month)	528 (24 days @22 MK/day)
Total operating costs (MK/month)	
- Materials	2524
- Depreciation	24
- Labour	528
Total	3076

Returns

Turnover (MK/month).	3600
Notional profit (MK/month)	524
Notional profit margin (%)	15
Wini [b]	1076

2. Returns to labour

Labour (hours/week)	
- Buying	15
- Preparation and cooking	9
- Selling	12
Total	36
Net returns (MK/month).	1052
Returns per day (MK) [b]	44

[a] Assuming depreciation @ 25 % p. a. for cooking equipment; 50 % p. a.for baskets; and 50 % p. a. for the second-hand bicycle.

[b] Turnover-costs of materials

[c] Assuming one manday @ six hours (MK 1052)/(MK (144 hours/6)).

A. Orr, D. Saiti, September 1999.

4. TRADING IN MAIZE AND FLOUR: MAI MARICHI, MAI BITONI ...

Among the households we studied, there were three different forms of trading in maize. The first involved simple on-selling of maize purchased from ADMARC and then resold in the local market. The second was trading in processed flour (*ufa woyera*). The third was trading in maize bran (*madeya*) which we have treated as a separate enterprise (No. 20).

On-selling ADMARC maize (*chimanga*)

Of the 15 households studied, only Mai Marichi was observed to engage in this enterprise.

Materials

On 14 January 1999 she bought MK 43 worth of maize from the ADMARC depot in Goliati. At this period ADMARC only sold maize in bags of 25 kg and it was difficult for one individual to purchase a whole bag. This was her share of the purchase. The ADMARC price at this time was 7.50 MK/kg s Mai Marichi purchased roughly 5.7 kg of maize.

Labour requirements

Walking to and from Goliati to buy the maize took five hours, while walking to and from Nansadi market to sell the maize took six hours. Total: 11 hours.

Markets and prices

Mai Marichi resold the ADMARC maize in Nansadi the next day for MK 100 or 17.5 Mk/kg. The free market price at this time was 1 MK for a #10 plate. She is known as a businesswoman, and sells to other people in business. 'Business is like stealing from people', she commented.

Profit-and-loss account for on-selling ADMARC maize (January, 1999).

Costs	
Materials (MK)	42.9
Notional cost of labour (MK)	35 (1.8 days @19 MK/day)
Total operating costs (MK/month)	78
Returns	
Sale price (MK/kg)	17.5
Turnover (MK)	100
Notional profit (MK/month)	22
Notional profit margin (%)	22
Wini [a]	57

2. Returns to labour

Labour (hours)	
- Buying at ADMARC	5
- Selling at Nansadi market	6
Total	11
Net returns (MK)	57
Returns per day (MK)[b]	31

[a] Turnover - costs of materials
[b] Assuming one manday @ six hours (MK 57)/((11 hours/6)).

2. Trading in maize flour (*ufa woyera*)

Mai Bitoni (unsure of her age, but probably mid-30s) lives in Lidala village, Mombezi EPA. Married to a burley-grower, they have four children living at home. The eldest, Steven, has a separate house but eats with the family. The family is usually self-sufficient in maize until one month before the maize harvest. Mai Bitoni had a regular business trading in maize flour. Mai Bitoni's business was to buy maize in the local market, process it into maize flour (*ufa)* and then sell the flour in the nearby town of Limbe.

Because of variation in buying and selling prices, we have presented examples of this enterprise for four different months.

Costs

Mai Bitoni usually buys one bag of shelled maize at a time. Travel to Mbulumbuzi market by bus to buy maize cost MK 4 each way, plus MK 5 to transport one bag of maize back to the pounding mill at Walala. The pounding charge for one 50 kg bag (four 'tins') is MK 20. The cost of firewood to heat water to soak one bag was estimated at MK 10. Milling the *mphale* to make *ufa woyera* costs only MK 10 for one bag. The bran from one bag, which is saved, is worth roughly MK 25. Transport costs to Limbe cost MK 19 each way for herself and MK 4 one way for one bag of flour. The market licence fee was 5 MK/day. She paid rent of 2 MK/night to sleep on a veranda near the market. She estimated the cost of her food at 20 MK/day.

Labour requirements

Mai Bitoni usually buys maize at Mbulumbuzi market. She travels to market by bus, leaving at 7 a.m. After buying maize she travels by bus to Walala to have the maize de-hulled in a pounding mill (*chigayo chokonola*), arriving back home at 12 noon. After de-hulling, the maize grain (*mphale*) is winnowed to remove the husks (*madeya*). This takes about 30 minutes. The *mphale* is then left overnight soaking in hot water to acidify the grain and remove harmful bacteria. Next morning, the *mphale* is cleaned for one hour then spread on a mat to dry in the sun. The dried *mphale* is then carried to the grinding mill (*chigayo chogayitsa*) at Walala for milling into *ufa woyera,* the preferred fine white flour which is high in carbohydrates but relatively low in fat, minerals, and protein This takes only one hour. Finally, the *ufa* is spread on a mat to dry all day, then sieved (one hour per bag) in preparation for taking to market the next day. Mai Bitoni normally leaves home at 4 a.m. in order to be ready to sell at Limbe market by 6:30 a.m.

Total labour requirements for preparing *ufa woyera* were estimated at 7.5 hours: buying maize and pounding (five hours); winnowing (1/2 hour); cleaning *mphale* after soaking (one hour); and milling into *ufa* (one hour). Other activities (soaking, drying etc.) are usually combined with other household chores. Selling time at the market varied from one – six days.

Markets and prices

Mai Bitoni usually kept account only of her net returns, or her cash in hand after arrival home from Limbe market. By adding other cash costs to this figure (the cost of maize processing, the cost of transport, and the cost of food and accommodation in Limbe) we have estimated the approximate selling price. The sale price of *ufa* fluctuated between visits, ranging from 16.5 MK/kg in April before the harvest of maize to 13.2 MK/kg in early June.

Income

Net returns ranged from 531 MK in May before the harvest to 350 MK in June after the harvest. This was equivalent to 163 MK/day in May and 41 MK/day in June.

Postscript: a cautionary tale

Barriers to entry were notable in the case of trading *ufa*. Mai Mpenda, a neighbour, accompanied Mai Bitoni on her trip to Limbe in early June to sell *ufa* that she had made from a bag of her own maize (estimated value MK 200). The market was crowded with sellers. As a newcomer, Mai Mpenda couldn't attract customers. On the first day she couldn't even find a place to sit and sell. She found a place the next day, but all she sold in three days was MK 25 worth of *ufa*. In desperation, she sold the rest of her *ufa* to the 'chairman' of the maize-sellers in Limbe market for MK 320. Burned by her first venture into trading *ufa*, Mai Mpenda has not been back. On the same trip, Mai Bitoni sold to her regular customers and made net returns of MK 350.

The economics of trading in maize flour (*ufa woyera*)

1. Profit-and-loss account

Costs

Materials and transport (MK/bag)	*March*	*April*	*May*	*June*
- 50 kg bag of shelled maize	360	320	140	150
- pounding charge	20	20	20	20
- transport of maize to pounding mill	5	5	5	5
- fuel for soaking *mphale*	10	10	10	10
- milling charge	10	10	10	10
- transport of flour to Limbe	4	4	4	4
Total	409	369	189	199
Transport costs for trader (MK/trip)				
- bus fare to market and mill	8			
- bus fare to and from Limbe	19			
Total	32			
Other costs in Limbe (MK/day)				
- market fee	5			
- food	20			
- lodging	2			
Total	27			
Notional cost of labour (MK/day)	20			

	March	*April*	*May*	*June*
Bags sold (No./trip)	2	1	1	1
Days spent in Limbe (No.)	6	3	2	3
Total costs (MK/trip)				
- materials	818	369	189	199
- transport	32	32	32	32
- food and accommodation	162	81	54	81
- labour	200	145	65	145
Total	1212	627	340	457

Returns	*March*	*April*	*May*	*June*
Sale price (MK/kg)	14.9	16.5	16.1	13.2
Turnover (MK)	1492	827	805	662
Notional profit (MK)	280	200	465	205
Notional profit margin (%)	19	24	58	31
Wini [a]	480	345	530	350

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2. Returns to labour

Labour (hours/trip)	*March*	*April*	*May*	*June*
- Buying maize and pounding	5	5	5	5
- Winnowing	1	0.5	0.5	0.5
- Cleaning	2	1	1	1
- Milling	2	1	1	1
- Travel to Limbe + selling	60	36	12	36
Total	70	43.5	19.5	43.5
Net returns (MK)	480	350	531	350
Returns per day (MK) [b]	41	48	163	48

[a] Turnover – costs of materials, transport, food and accommodation

[b] Assuming one manday @ six hours (MK 480)/((70 hours)/(6)).

D. Saiti and A. Orr, March-June 1999

5. SELLING ZOPHIKAPHIKA: *MAI GOLIA…*

Mai Golia (46) lives with her six children in Chidothi village, Matapwata EPA. She trades in different types of cooked food (*zophikaphika*) at different times of the year. Formerly she worked at the Henderson estate. When her husband deserted her in 1990, however, she found that maize production in her one small field declined because she could not afford to hire casual labour (*ganyu*) for weeding. The maize from her own field is not sufficient for the household, and she buys maize for four months of the year. Using savings from her work on the estate (MK 30), in 1994 Mai Golia began buying and selling velvet beans (*Mucuna Deeringiana*). This is now her main source of income, providing the cash to pay school fees and buy a school uniform for her eldest son, who attends secondary school. When we interviewed her at Kalimbuka Primary School in late May, she was selling cooked sweet potato.

Materials and equipment

Mai Golia collects firewood from the Henderson estate for MK 2. She buys sweet potato at Goliati market. On the day of our visit she had bought sweet potato for MK 54, enough to last three days. This gives a cost of 18 MK/day or 90 MK for a five-day week.

Labour requirements

Between 2-5 p.m. she manages to collect enough firewood for five days' cooking. Purchasing sweet potato is normally done on Saturdays and Sundays, each visit requiring six hours. Cooking takes only one hour, less if the sweet potatoes are small. The cooked sweet potato is then carried to the school in the cooking pot. She normally sells at the school from 9-11 a.m. every day from Monday through Friday. Thus, the total labour requirement in one week is 27 hours, comprising buying (12 hours), cooking (five hours) and selling (10 hours).

Markets and prices

Mai Golia normally sells at Kalimbuka Primary School, about 2 km from her home. Demand was highest at this time of year when children had money. Unsold food is either taken home to feed her children or sold at the nearby maize mill. Sales ranged between 30-50 MK/day. The sweet potato bought for MK 54 sold for MK 130 over a period of three days. We estimate total sales at 43 MK/day or 217 MK/week.

Income

We estimated net income at 498 Mk/month or 25 MK/day.

Postscript

Mai Golia was still selling sweet potato at the end of August.

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The economics of selling *zophikapkika*

1. Profit-and-loss account

Costs

Materials (MK/month)	
- Firewood	10
- Sweet potato	360
Total	370
Notional cost of labour (MK/month)	380 (20 days @ 19 MK/day)
Total operating costs (MK/month)	
- Materials	370
- Labour	380
Total	750

Returns

Turnover (MK/month).	868
Notional profit (MK/month)	118
Notional profit margin (%)	14
Wini [a]	498

2. Returns to labour

Labour (hours/week)	
- Collecting firewood	3
- Buying	12
- Cooking	5
- Selling	10
Total	30
Net returns (MK/month).	498
Returns per day (MK) [b]	25

a Turnover – costs of materials

b Assuming one manday @ six hours (MK 498)/((120 hours/6)).

D. Saiti, May 1999.

6. SELLING SNUFF: AMAI DAINA AND IDESI CHILINKHONDE…

Mai Daina (65) and Mai Idesi Chilinkhonde (69) are sisters who live in Chiwinja village, Mombezi EPA. They long ago separated from their husbands, probably because they were unable to have children. Although they cook and share food together, they cultivate their fields separately and have separate living quarters. Of their four fields, three are located in the Chitera dambo, an area of productive clay soils (*makande*) but one also liable to flooding which can severely damage their maize crop. The household is self-sufficient in maize until November, five months before the harvest of maize. Snuff is bought jointly, but each sister trades separately. We have treated the household as one trading unit, however.

Materials and equipment

Loose tobacco is bought either from the nearby market at Mbulumbuzi or from Intermediate Buyers (IBs) who are licensed to purchase tobacco from burley-growers. One of the sisters travels to the market on foot. Usually Daina buys MK 60 worth of tobacco while Idesi buys tobacco worth MK 20-30.

Labour requirements

Leaving home at 5 a.m., one sister reaches the market by 6 a.m., in time to be among the first buyers and ensure she obtains good quality tobacco. She arrives back home by 11 a.m. This gives a labour requirement for buying of six hours. The tobacco is then broken into small pieces and leaves, roots, and other debris are removed by hand. This process takes about one hour. After drying, the snuff is ready for sale. Snuff is sold from home when they are present and occupied with household cores, so that no labour is required for marketing. (Sometimes they send a child to sell at the roadside in Walala, in which case they can sell as much as MK 6-8 of snuff in one day).

Markets and prices

Demand for snuff is highest in the wet season because earnings are high from casual labour (*ganyu*) for weeding. During this period (December-January) the two sisters usually spend about MK 80 each week buying tobacco. Demand drops off in the dry season, however. During the rest of the year they only visit the market once every two weeks. They usually buy the same quantity as in the peak period (MK 80) but it takes twice as long to sell. Selling prices vary between the wet and dry season. In the wet season, they charge buyers exactly double their original purchase price. In the dry season, their selling price is only one-third higher.

Income

Income was estimated separately for the two wet months of December-January and for the rest of the year. Gross returns in the wet season averaged 240 MK/month. Net returns were 120 MK/month, equivalent to 51 MK/day. Net returns in the dry season dropped substantially to 60 MK/month or 26 MK/day.

The economics of selling snuff

1. Profit-and-loss account

Costs	*Dec-Jan*	*Feb-Nov*	*Average*
Materials (MK/month)	320	160	187
Notional cost of labour (MK/mo) (@ 20 MK/day)	94	47	54
Total operating costs (MK/mo)	414	207	241

Returns

	Dec-Jan	*Feb-Nov*	*Average*
Turnover (MK/month)	640	213	284
Notional profit (MK/month)	226	6	43
Notional profit margin (%)	35	3	15
Wini [a]	320	53	97

2. Returns to labour

Labour (Hours/month)			
- Buying	24	12	-
- Processing	4	2	-
- Selling	-	-	-
Total	28	14	16.3
Net returns (MK/month)	320	53	97
Returns per day (MK) [b]	69	23	36

[a] Turnover – costs of materials

[b] Assuming one manday @ six hours (MK 320)/((28 hours/6)).

A. Orr, D. Saiti, July 1999.

7. THE MADEYA TRADERS: MAI MISOYA, MAI MARICHI, MAI BALUTI...

The process of making maize flour (*ufa woyera*) produces bran (*madeya*) which is widely eaten as *nsima* during the hungry months before the maize harvest. *Madeya* is fermented then pounded before cooking. During the rest of the year, *madeya* is sold as feed for pigs and dairy cattle. There are two methods of acquiring *madeya* for sale. It can be bought at the mill. Alternatively, it can be obtained free by negotiating with customers to oversee the pounding of the maize at the mill, and winnowing the pounded maize (*mphale*) to separate out the *madeya*. At our research sites in Matapwata, there are only two pounding mills within reasonable walking distance (at Ndata farm and at Bvumbwe) from which it is possible to obtain *madeya*. Consequently, competition for *madeya* is fierce in the hungry months; most households that trade in *madeya* prefer to obtain it from mills in town. We present case studies of four households, two selling *madeya* as dairy feed, and two selling as food during the hunger period.

1. Mai Misowa and Mai Chelewani, Kambuwa village, Matapwata

Mai Misowa (49) started trading in *madeya* (maize bran) in February 1999, after watching the success of her neighbour Mai Chelewani, who has been following this form of *geni* for two seasons. Previously, she cooked and sold doughnuts (*mandazi*) trading in the nearby markets of Nansadi and Goliati. With five young children at home, however, her stock tended to vanish when her back was turned. (A daughter holds the record for consuming 12 doughnuts at one sitting). She depends solely on trading for off-farm income. Her husband is permanently employed on a coffee estate in nearby Chigamula, but rarely assists her. She and her children are responsible for the labour in their two maize fields, which support the family in maize until December, leaving the household dependent on purchased maize for two-three months of the year.

Labour requirements

Mai Misowa obtains *madeya* from mills in Kamba township, in the Mount Soche area of Blantyre. Her normal schedule is to leave the village on Tuesday and return on Saturday. On Tuesday she walks to Bvumbwe market and boards a minibus to town. Wednesday-Friday is spent at the mill searching for customers. She remains at the mill from 6 a.m. – 6 p.m. each day. On Saturday she returns from town with the *madeya* which is transported to the nearby village of Kalimbuka and from thence by bicycle to Kambuwa. This gives a total of 4.5 days of roughly 12 hours each, or a total labour requirement of 54 hours/week.

Materials and equipment

The *madeya* is obtained free from customers in exchange for supervising the processing into flour at the mill. The *madeya* is transported in eight fertiliser bags, each costing MK 10. Mai Misowa estimates that her bags will last only one season, giving an annual depreciation @ 100 % or 7 MK/month. Accommodation in town is free. She sleeps at Zingwangwa, dossing down in company with banana-sellers from Thyolo. She estimates the cost of food at MK 11 per person each day for relish, with a further MK 6 required for firewood. Flour to make *nsima* is obtained from customers after winnowing their *mphale*, and from mill-workers who salvage spilled flour. She gives gifts of tomato, cabbage, and sweet potato worth MK 20 to the mill workers, who give her preferential treatment.

Transport

Transport by minibus from Bvumbwe to Mount Soche costs MK 32. On the return journey she pays 10 MK/bag transport from the mill to Illovo corner in Limbe and a further MK 10 for herself. From Limbe to Bvumbwe she pays another 10 MK/bag, and MK 20 for herself. Finally, from Bvumbwe to Kalimbuka village she pays 10 MK/bag for transport by pickup, with a fare of MK 15 for herself. She normally returns with four bags. Thus, the total cost of transport was MK 240 for the *madeya* and MK 77 in fares.

Prices

Demand for *madeya* is highest in January-March when most households have exhausted their maize stocks. When sold for human consumption *madeya* is sold using a No. 10 plate. In January 1999, a 50 kg bag of *madeya* sold using a No. 10 plate fetched MK 150-200. Demand then declines after maize harvest. In 1999, prices fell to 60 MK/bag in June and July. Subsequently, prices have risen again to 80 MK/bag in August and 100 MK/bag in September. *Madeya* is sold for cattle feed by the bag.

Markets

At this time of year, her customers are households with dairy cows, who pay her monthly after they their income from milk sales. In September it was possible for Mai Chisoya to obtain eight bags in just a few days. She counts on making two trips each month.

Income

Two trips each month, returning with eight bags each trip, gives Mai Chisoya gross earnings of MK 1,600. In addition, she saves the small pieces of flour (*mphale*) that remain with the maize bran after winnowing. She estimated that after her last trip she returned with *mphale* worth 300 MK.

2. Mai Marichi, Magomero village, Matapwata

Materials

To reduce competition from other buyers, Mai Marichi travelled to Limbe with two friends to obtain *madeya* from the pounding mill at Chitawira in Blantyre. The three women slept outside the maize mill. They stayed for two weeks. All the *madeya* was obtained free. Mai Marichi's costs included transport (MK 12 each way) and food for the 14 days she lived at the mill. Maize flour she obtained for free as a gift from her customers. Mai Marichi estimated her share of the cost of the relish at MK 40. Thus, her total costs were MK 64.

Labour requirements

Travel to and from Limbe occupied two days. She worked at the mill six days a week for two weeks. However, two days of this was spent washing clothes for households in Chitawira, for which she earned MK 65. We estimate the total time required for obtaining *madeya* as 10 days. No additional time was added for selling since the buyer was nearby. The total, including travel, was 12 days.

Markets and prices

In her 10 days at the mill Mai Marichi managed to secure three 50 kg bags of *madeya*. These she sold to an Indian businessman who used it as feed for a fish farm in Zomba for a total of MK 480. Had she sold the *madeya* at the market by the plate, she might have realised MK 200 for one bag.

Income

Mai Marichi's net income from selling *madeya* was MK 416, equivalent to a return of 35 MK/day.

3. Mai Baluti, Kambuwa village, Matapwata

Materials

Because of fierce competition for *madeya* at Bvumbwe, Mai Baluti stated that she might easily go there and return empty-handed. Sometimes she was lucky. At other times, she simply bought the madeya for MK 15 for one 'bucket'.

Labour requirements

Leaving for Bvumbwe at 5 a.m. she did not usually return home until 5 p.m, making a total of 12 hours to obtain the *madeya*. Selling at the local market near her home took a further five hours.

Market and prices

At this period, most people bought *madeya* to eat or to pay casual labour. A # 10 plate sold for MK 0.50. A bucket of *madeya* bought for MK 15 would fetch MK 100 on the open market.

Income

Net income was MK 85 per trip or 28 MK/day.

The economics of trading *madeya*

1. Profit-and-loss account

	Mai Misowa (September)	*Mai Marichi (January)*	*Mai Baluti (January)*
Materials			
- *Madeya*	-	-	15
- Food	51	40	-
Total	51	40	15
Depreciation on equipment [a]	0.3	-	-
Transport (MK/trip)			
- *Madeya*	120	-	-
- Village-Mill	32	12	-
- Mill-Village	45	12	-
Total	197	24	-
Notional cost of labour (MK/trip) (@ 19 MK/day)	171	228	38
Total operating costs (MK/trip)			
- Materials	51	40	15
- Depreciation	0.3	-	-
- Transport	197	24	-
- Labour	171	228	38
Total	419.3	292	53
Returns			
Bags of *madeya* (No.)	8	3	0.3
Price (MK/bag)	100	160	na.
Mphale from winnowing	600	na.	na.
Trips/month (No.)	2	1	1
Turnover (MK/month)	1400	480	100
Notional profit (MK/month)	981	188	47
Profit margin (MK/month)	70	39	47
Wini [b]	1152	416	85

2. Returns to labour

	Mai Misowa (September)	*Mai Marichi (January)*	*Mai Baluti (January)*
Labour requirements (hours/trip)			
- Travel	18	12	6
- Milling	36	60	6
Total	54	72	12
Net returns (MK/month)	904	416	85
Returns per day (MK) [c]	52	35	28

[a] Assuming depreciation @ 8.3 % per annum on fertiliser bags.
[b] Turnover – costs of materials and transport.
[c] Assuming one manday @ six hours (MK 904)/((108 hours/6)).

D. Saiti, A. Orr, January-September 1999

8. THE TAILOR: BAMBO MANGANI...

Bambo Mangani lives in Ngumbi village, Mangunda section, Matapwata EPA. He is in his mid-forties. He separated from his first wife in 1982 and remarried the same year. Maize harvested from their three small fields feeds himself, his wife, and three children only until November. In order to buy maize and afford fertiliser, Bambo Mangani makes children's clothes. He learnt tailoring from a friend in 1992. It took him about a year to become proficient with a sewing machine. With a gift of MK 100 he received from a friend, he set up business in 1993 sewing clothes for children aged 10 years and below. His wife now does most of the work in his maize gardens. In rare cases, when there is high demand for clothes from customers, Bambo Mangani hires *ganyu* to help with fieldwork.

Materials and equipment

Bambo Mangani rents a sewing machine for 40 MK/month. Oil to run the machine costs an additional 15 MK/year. A packet of 10 needles costs MK 6, and lasts for a year. Thread of 500 m in length costs MK 45 and is sufficient for 50 girl's dresses or 30 boy's shorts. Both the measuring tape and scissors were borrowed from a friend. The clothes are made from second-hand clothes (*kaunjika*) which he normally buys from Nkando market. He travels there every Saturday to buy clothes, a round trip of five hours.

Girl's dresses

Bambo Mangani buys blouses at MK 15 each from which he is able to make two dresses. Starting at 12 noon, he can sew five dresses by 5 pm. Cutting these dresses from the blouses requires another five hours. Thus, the labour requirement for five dresses is 10 hours, or two hours for each dress.

Boy's shorts

Sometimes Bambo Mangani manages to buy a pair of second-hand trousers for MK 35 from which he can make four pairs of shorts for boys aged three-five. Starting at 12 noon, he can make two shorts by 5 pm. However, it is difficult to find the type of trousers suitable for making shorts, so mostly he makes girl's dresses.

Prices

Each dress is sold for MK 35 and each pair of shorts for MK 25.

Markets

Bambo Mangani sells the clothes either at Lalakani market or at another market. Starting from home at 7 am he normally returns by 1 pm. On average, he sells four dresses each day, five days a week. Over a month, therefore, he sells 50 dresses. He sells fewer shorts. On average, he sells only one each market day. Over a month, therefore, he sells 20 shorts.

The text table summarises costs and returns for tailoring. Costs and returns were worked out assuming average sales of 80 dresses and 20 shorts per month. Labour for buying materials, cutting, sewing, and selling clothes averaged 90 hours/week, or 358 hours/month. Net returns averaged 2202 MK/month, or 37 Mk/day.

The economics of tailoring children's clothes

1. Profit-and-loss account

Costs	Dresses	Shorts	Total
Materials (MK/month)			
- *kaunjika*	600	350	950
Cost of equipment (MK/month)			
- Sewing machine [a]			40
- Oil for machine			4
- Needles			1
- Thread	72	30	102
- Scissors and tape			-
Total			147
Notional cost of labour (MK/mo) (@22 MK/day)			1313

Total operating costs (MK/month)	
- Materials	950
- Equipment	147
- Labour	1313
Total	2410

Returns			
Price (MK/unit)	35	25	
Sales (No./month)	80	20	
Turnover (MK/month)	2800	500	3300
Notional profit (MK/month)	-	-	890
Notional profit margin (%)	-	-	27
Wini [b]			2203

2. Returns to labour

Labour (hours/week)			
- buying materials			7
- cutting and sewing	40	12.5	52.5
- selling clothes			30
Total			89.5
Net returns (MK/month)			2202.5
Returns per day (MK) [c]			36.91

[a] Assuming no depreciation on rented machine.
[b] Turnover – costs of materials and equipment
[c] Assuming one manday @ six hours ((2202.5/(358 hours/6)).

D. Saiti, June 1999

9. THE VILLAGE SHOPKEEPER: BAMBO STANLEY...

Bambo Stanley (32) lives with his wife and two children in Kambuwa village, Matapwata EPA. His main source of cash income is vegetable sales from his *dimba* garden. Dimba cultivation has high cash costs. As a source of cash for his dimba garden, therefore, he decided to start a small shop. Village shops of this type are known as a *bench* to distinguish them from groceries, which sell a fuller range of goods. Bambo Stanley began trading in 1998, financed by MK 1500 from *dimba* sales.

Materials and equipment

The *bench* was constructed from wooden poles, planks, and plastic sheets for a total cost MK 200. He built it himself with help from his brother-in-law Bambo Sitepe. Bambo Stanley buys his goods wholesale in Limbe. He cycles to Limbe once a week to make purchases. The bicycle he uses cost MK 2,450 when new. We estimate depreciation on the *bench* as 33 % p.a. (MK 66.67) and on the bicycle as 10 % p.a. (MK 245).

Labour requirements

Travel to Limbe occupies 10 hours every week. Bambo Stanley employs his younger brother John (15) to mind the store. The bench is usually open between 7 a.m.- 6 p.m., seven days a week. Thus, the labour requirement is 84 hours/week. John receives no pay for this, although Bambo Stanley buys him soap, new clothes, etc. Since we have no information on the costs of these items, we have not included any labour charge for selling goods. The bench is located in front Bambo Stanley's mother's house, which fronts the village road, and John may be occupied with other chores while waiting for customers.

Prices

The text table compares the wholesale and retail prices of the goods in Bambo Stanley's store and the estimated profit margin. Except for sugar, the items are mostly low value. For example, they do not include cooking oil.

Item	Wholesale	Retail	Margin (%)
Sugar	18.75	22.0	17.3
Yellow buns	2.00	2.20	10.0
Maluwa soap	3.06	4.0	30.7
Lifebuoy soap	7.20	9.0	25
Freezes	0.50	0.70	40
Salt (MK/kg)	6	50	na.

Sales and income

On market days (Sunday, Monday, Wednesday, and Thursday) sales average MK 200, while on the remaining three days sales average MK 400. Thus, total sales average 2000 MK/week. Assuming a 20 % profit margin, we estimate the cost of these goods at MK 1,600. Thus, net income may average 1626 MK/month, equivalent to 26 MK/day.

Postcript

When we revisited Bambo Stanley in September 1999 we discovered that he had ceased trading. All the profits from his store had been re-invested in *dimba* cultivation. His brother-in-law Bambo Sitepe now runs the *bench*. Bambo Sitepe's brother-in-law, who lives with him, will mind the store, but again without receiving a regular wage.

The economics of village shop-keeping

1. Profit-and-loss account

Costs

Materials (MK/week)	
- groceries	1,600
Depreciation on equipment (MK/month)[a]	
- Bicycle	20.42
- *Bench*	5.56
Total	25.98
Notional cost of labour (MK/month)	345 (15.7 days @ 22 MK/day)
Total operating costs (MK/month)	
- Materials	6400
- Depreciation	26
- Labour	345
Total	6771

Returns

Turnover (MK/month)	8000
Notional profit (MK/month)	1229
Notional profit margin (%)	15
Wini [b]	1600

2. Returns to labour

Labour (hours/week)	
- Buying goods	10
- Minding the shop	84
Total	94
Net returns (MK/month)	1625
Returns per day (MK) [c]	26

[a] Assuming depreciation @ 10 % p.a. (*bicycle*) and 33 % p. a. (*bench*).
[b] Turnover – costs of materials
[c] Assuming one manday @ six hours (MK 1625)/((376 hours/6)).

D. Saiti, August 1999

10. THE VILLAGE CARPENTER: BAMBO MUHEKU...

Bambo Muheku (37), lives in Kalimbuka village, Matapwata EPA, with his wife and four children. WE met him in Kambuwa, his mother's village, where he conducts his carpentry business. This working arrangement allows him to assist his widowed mother financially. It may also allow him to conceal the real scale of his earnings from his wife. He learnt carpentry from his late father while he was still in his early 20s, but only started it seriously as a business when his father passed away in 1990. The family has three maize gardens in Kalimbuka village which support them until October. For the remainder of the year, they rely on his earnings as a carpenter.

Equipment

Bambo Muheku has no workshop, but a simple bench (MK 40) under a tree. We estimate annual depreciation @ 10 % or 4 MK/year. He inherited his carpentry tools from his father in 1990. The values quoted are current replacement prices:

Item	Price (MK)
Vice ('Cramper')	400
Plane	450
Hammer	85
Set square	25
Guage	15
Chisel	10
Saw	120
Screwdriver	35
Axe (*kasemasema*)	10
Total	1150

Depreciation on this equipment seems to have been minimal, with no item (even the saw blade) replaced since he first started carpentry in 1982, or 17 years ago. We therefore assume depreciation over a 30-year period, which gives an annual figure of MK 38 or 3 MK/month.

Materials

Bambo Muheku claims that there is a greater shortage of timber than of customers. He uses mostly bluegum, sindrea, and mbawa. When he cannot locate timber, he asks customers to supply their own. He estimates that about half his customers supply their own timber. Other material costs include glue every four months (MK 28) and one kilogram of nails every two months (MK 35). This gives monthly material costs of MK 7 and MK 17.5, respectively.

Labour requirements and prices

The labour requirements quoted below include time spent cutting, planing, and construction. Prices varied according to whether the customer supplied the wood or not. One 'timber' is six feet in length, while a '12-board' .

Labour requirements and prices

Item	Labour (hours/item)	Price (MK/item) Excluding wood	Including wood
Window frame	2.5	50	175
Window hasicle	2.5	20	35
Door frame	2.0	45	150
Door	3.0	75	350
Table	6.0	50	150
Chair	4.0	40	80

Markets and sales

Bambo Muheku only makes carpentry items to order and does not sell in local markets. His customers are drawn mainly from four villages surrounding Kambuwa, namely Katunda, Magomero, Chidothi, and Waruna. Two other carpenters also supply these villagers. Demand for most items is highest in the dry season between March-October when new houses are constructed. Table 2 shows production for the months of November 1998-February 1999 and August-September 1999.

Production of carpentry items

Item	Nov-Feb	August	September
Window frame	2	5	6
Window hasicle	-	-	4
Door frame	3	-	5
Door	3	2	4
Table	-	----------3----------	
Chair	-	----------10---------	

Income

Income was estimated separately for August and September by multiplying the monthly production figure and labour requirement for each item. Since we have no data on labour requirements for sourcing wood, we have used prices where customers supply their own timber. Total income from carpentry in August was MK 675, equivalent to 64 MK/day, while total income in September was MK 1180 MK, equivalent to 68 MK/day.

375

The economics of village carpentry

1. Profit-and-loss account

Costs

Materials (MK/month)		
- Glue	7	
- Nails	17.5	
Total	24.5	
Depreciation on equipment [a]		
- Workbench	0.3	
- Tools	3.0	
Total	3.3	
	August	*September*
Notional cost of labour (MK/month) (@22 MK/day)		
Total operating costs (MK/month)		
- Materials	24.5	24.5
- Depreciation	3.3	3.3
- Labour	235	374
Total	262.8	401.8
Returns		
Turnover (MK/month)	675	1180
Notional profit (MK/month)	412	778
Notional profit margin (%)	61	66
Wini [b]	651	1156

2. Returns to labour

Labour requirements (hours/month)	*Aug*	*Sep*
- Travel	16	26
- Carpentry	48	76
Total	64	102
Net income (MK/month)	647	1152
Returns to labour (MK/day) [c]	61	68

[a] Assuming depreciation @ 10 % per annum on workbench and @ 0.03 % per annum on tools.
[b] Turnover – costs of materials
[c] Assuming one manday @ six hours (MK 647)/((64 hours/6)).

D. Saiti, A. Orr, September 1999

11. THE BUILDER: DANIEL MALIRO....

Daniel Maliro (22) of Lidala village, Mombezi EPA, is a student in Form Two at Namadzi Day Secondary School. He lives with his parents and eight brothers who all require the father's support. To provide the money for his education, Daniel builds houses as a part-time job while he attends school. Last year (1998) he was unable to afford the school fees and spent the whole year building houses. He learnt this skill from his brother-in-law four years ago. We interviewed him while he was building a house for Bambo Phiri, who lives in the same village.

Materials and equipment

All the bricks for constructing the house were moulded by the owner, Bambo Phiri. The bricks are cemented together using mud. Builders are contracted only to lay the bricks and fit the door and window frames. The roof and other joinery work for the door and windows form a separate contract. Daniel is really a bricklayer rather than a builder.

A level (*vika*) is required to ensure that the bricks are laid in straight lines and that the corners are at right angles. Daniel bought the level he is using in 1996 for MK 250. A trowel (*mpeni*) is also needed to lay mud between the bricks. Daniel bought this in 1996 for MK 90. Finally, string is used to line-up the bricks. The string that Daniel uses was given to him by his brother-in-law. It costs Mk 1.5 per metre. We estimate depreciation @ 10 % p.a., or 25 MK/year for the level and 9 MK/year for the trowel.

Labour requirements

The dimensions of Mr Phiri's house were 5 x 4 m. Starting at 8 a.m. and finishing at 4 p.m., it took Daniel 10 days to build the house. He works alone without an assistant.

Production

House-building is a seasonal activity which takes place during the dry season usually between July-September. Last year between March-October Daniel managed to build 21 houses. This is equivalent to building 2.5 houses/month. He was not able to attend school, however. Since this year he is attending classes, he has only managed to build two houses.

Prices

This year Daniel has earned MK 800 from the first house that he made (7 x 5 m) and will earn MK 600 from making the house for Bambo Phiri. These houses are relatively big. Costs that we obtained from two other households this year were MK 450 paid by Mai Chipakula and MK 400 paid by Mai Marichi (5 x 4.3 m). However, Mai Marichi also gave the builder lunch for the 10-12 days needed to construct her house. Builders are not usually given food if live in the same village as their employer.

Income

Assuming a building rate of two houses a month @ MK 600 gives a gross income of 1200 MK/month or a net income of 1166 MK/month. This is equivalent to a return of 50 MK/day.

The economics of house-building

1. Profit-and-loss account

Costs

Materials	-
Depreciation on equipment [a]	
- Level	25
- String	-
- *Mpeni*	-
Total	9
Notional cost of labour (MK/month)	537 (23.3 days @23 MK/day).
Total operating costs (MK/month)	
- Depreciation	9
- Labour	537
Total	546

Returns

Houses built (No/month)	2
Turnover (MK/month)	1200
Notional profit (MK/month)	654
Notional profit margin (%)	55

2. Returns to labour

Labour (hours/house)	
- Building	70
Net income (MK/month)	1166
Returns per day (MK) [b]	50

[a] Assuming depreciation @ 10 % p.a.

[b] Assuming one manday @ six hours (MK 1166)/((140 hours/6)).

D. Saiti, July 1999.

12. *AGRICULTURAL* GANYU...

Ganyu (from the Portuguese *ganyao*, or bonus) is the vernacular name for casual labour. Normally, *ganyu* refers to unskilled labour but it is also used to describe skilled labour – such as bricklaying- - that is employed on a cash contract. The three field operations for which *ganyu* is most commonly used are land preparation, weeding, and banking. The examples of *ganyu* below are drawn from a representative sample of village households that we monitored between November 1998 and September 1999.

Land preparation

Land preparation in the Shire Highlands is usually done in two stages. In the first stage, (*kuwojeka*), maize stover and weeds are scraped with a hoe from the ridges, laid in the furrow, and buried under a light covering of soil to aid decomposition. If there are few weeds or crop residues, they are left to decompose without any soil covering (*kusosa*). In the second stage (*kuwunga*), soil is scraped with a hoe from the old ridges, and placed on top of the decomposed crop residues in the furrow to create a new ridge on which the next crop is planted. *Ganyu* for land preparation is paid by a cash contract agreed before the work starts. Contracts are usually negotiated separately for each stage.

Wage rates for *kuwojeka* or *kusosa* depend on the quantity of weed biomass in the field and the soiltype (heavy clays are harder to work). Rates for *kuwunga* vary according to the soiltype, and the proximity to planting time in late November. Contracts for both kinds of land preparation are considerably less for relatives. A key informant quoted us these illustrative rates:

		MK
Kusosa	- weedy field	200
	- normal field	150
Kuwojeka	- normal field	200
Kuwunga	- early	350
	- early, relative	300
	- near the rains	400-450

1. Steven Bitoni, Lidala village, Mombezi

In late May 1999 Bambo Bitoni's son Steven and a cousin contracted to complete *kuwojeka* and *kuwunga* on the field of a non-relative. They worked for seven days between 5-11 am. The cash contract was MK 500 or 36 MK/day. In early June Steven and his cousin contracted for *kuwojeka* on the field of a non-relative. They worked for 18 days between 5-11 am. The cash contract was for MK 1000 or 28 MK/day. In late August, Steven alone did *kusosa* on the field of a non-relative for six days between 6-10 am. The cash contract was MK 200 or 50 MK/day. He later did *kuwunga* on the same field, working for 12 days between 6-10 am. for a cash contract of MK 300 or 38 MK/day.

2. Bambo Basikolo, Kambuwa village, Matapwata

On 17-18 July 1999 Bambo Basikolo contracted for *kuwojeka* on the field of a relative. The cash contract was MK 50 or 25 MK/day. In early August he contracted for *kuwojeka* on the field of a non-relative for four days for a cash contract of MK 130 or 33 MK/day. In early September he again contracted for *kuwojeka* on the field of a non-relative for five days for a cash contract of MK 150 or 30 MK/day.

Based on these figures, we have estimated wages for *kuwojeka* at between 25-30 MK/day. We have no information for our sites on the average number of days' employment as *ganyu*. We have therefore used the average of 15 days per household in the October, from the 1993/94 ADDFOOD survey (Leach, 1995: 20 Table 20). This gives a weighted income from *ganyu* of 676 MK/month.

Weeding and banking

Maize is first weeded soon after planting by scraping weeds from the ridges with a hoe and depositing them in the furrow to wither and die. This operation is known as *kupalira*. Maize is normally weeded for a second time 4-8 weeks after planting by scraping soil from the furrow with a hoe and heaping it around the maize planting station, burying weeds under a covering of soil. This operation is known as 'banking' (*kubandira*).

Ganyu for weeding is normally paid at a fixed rate per planting station, a form of payment known as counting (*kuwerenga*). In 1998/99, the *kuwerenga* rate at our research sites varied between 5-10 *tambala* for three planting stations. Variations reflected differences in the space between maize planting stations (the closer the planting stations, the lower the rate offered by employers) or the weediness of the field (rates for banking maize were higher where no first weeding had been done).

Labourers were usually able to choose whether to be paid in cash or kind. Kind payments were made either in *ufa* (flour) or *madeya* (bran) or pieces of cassava, with the value determined by dividing the figure for cash payment by the current market price of the food. Labourers often preferred the convenience of payment in kind since grain bought for cash had to be milled before it could be eaten, whereas payments in flour or bran could be used to feed the household that same day.

With *kuwerenga*, earnings depend on the rate of payment and the area that one person can weed in a day. We will use the mid-point in the rate of payment (ie. 7.5 *tambala* for three planting stations). The recommended planting density for MH 18 maize is 44,000 plantings stations in one hectare (MOALD, 1994: 45). The total payment for one hectare is therefore MK 733 ((44,000/3)*(7.5)/100). On light soils, the labour requirement for weeding and banking has been estimated at 170 hours/hectare (Werner, 1987: 170). This gives a rate of 4.31 MK/hour or 26 MK/day. From personal observation, farmers usually plant more densely than the recommended rate quoted above. In theory, this would increase labour's potential earnings from weeding. However, employers would also reduce the rate of payment to compensate for easier weeding. Our estimates of daily earnings from weeding and banking are approximate, since the area actually available for one person to weed is limited by competition from other labourers.

Information on the number of days' employment as *ganyu* for weeding and banking is not yet available for our research sites. We have therefore used the figure of an average of 12 days per hosehold from the ADDFOOD 1993/94 survey (Leach, 1995: 20 Table 11). This gives an income of 312 MK/month.

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Returns to labour from agricultural *ganyu*

Land preparation	
Contract rate (MK/day)	
Kuwojeka	25-30
Kuwunga	30-40
Returns/month (MK) [a]	
Kuwojeka	413
Kuwunga	263
Total	676
Weeding and banking	
Rate (*tambala*/3 planting stations)	7.5
Planting density (stations/ha)	44,000
Total cost (MK/ha)	733
Labour requirement (hours/ha)	170
Returns per day (MK)[b]	26
Returns/month (MK) [c]	312

[a] Assuming 15 days *ganyu* in October (Leach, 1995: 20 Table 11).

[b] Assuming one manday @ six hours (MK 733)/((170 hours/6)).

[c] Assuming 12 days *ganyu* in January (Ibid.)

A. Orr, D. Saiti, June-September, 1999

13. PERMANENT *GANYU*: MAI NANTCHENGWA....

Mai Nantchengwa (52) lives in Magomero village, Matapwata EPA, with two of her five children aged six and 10. Two older daughters are married and live in town. A third daughter, who is 15, also lives in town where she works as a housemaid. Seven years ago, Mai Nantchengwa's husband left her. Since then she has worked continuously as a permanent farm worker for her uncle's family, who live in the neighbouring village of Mangawera. This family is comfortably off: it has three maize fields and owns two dairy cows. Mai Nantchengwa's own field is small, and her family runs out of maize in July. Assuming that the family starts to eat green maize in March, this implies that Mai Nantchengwa must buy maize to eat for seven months of the year.

Labour requirements

Mai Nantchengwa usually does field labour or, if there is none, draws water for the cows. She walks straight to her employers' fields, which are located some distance away in a village near the Henderson estate, where her employers used to live. Starting at 6 a.m. she reaches the field by 8 a.m. She works with her employers' family until 1 or 2 p.m., then walks back home, arriving between 4-5 p.m. Her working day, therefore, is approximately nine hours (four hours travel and five hours labour), or 54 hours/week. She works six days a week, with Sunday off, for 11 months of the year. At her own insistence, she rests in June, not even working in her own fields.

Wages

Mai Nantchengwa is employed on a cash contract of 250 MK/month. She also receives lunch of *nsima* and *ndiwo*, with an estimated value of MK 25. This gives a total wage of 850 MK/month. According to the agreement with her employer, however, when she runs out of maize she is paid in maize rather than in cash when her own supply of maize has run out. She then receives 1.5 50 kg bags of maize instead of MK 250. Last season (1998/99) the ADMARC price of maize was MK 365 for one bag of 50 kg. Between August-February, therefore, her wage rate rises to 1148 MK/month (MK 548 in maize, and MK 600 in food for lunch).

Earnings

Mai Nantchengwa's earnings average 850 MK/month between March-July, when her household is self-sufficient in maize. Given a working week of 54 hours/week, or 216 hours/month, this is equivalent to a earnings of 24 MK/day. Between August-February, when her household is not self-sufficient in maize, she earns 1148 MK/month, equivalent to earnings of 32 MK/day. Weighted average annual earnings are 1024 MK/month or 28 MK/day.

Servitude with security

Besides permanent *ganyu*, Mai Nantchengwa has no other sources of off-farm income. She receives no financial assistance from her two married daughters. She is willing to supplement her income with short-term *ganyu* contracts, but her employers object to this. Besides, she has very little free time. After work, she returns home to care for her two children and cultivate her own small field. She does not hire *ganyu* to help her and is proud of the fact that her own field is weeded and banked on time. Asked why she had chosen this form of off-farm income over *geni* or trading, she replied that *geni* as too risky. It would also be possible for her to find permanent work on a nearby estate, but this would require living away from home. Nor would she have the same personal relationship with her employer. Despite the long hours and low pay, therefore, Mai Nantchengwa's strategy of permanent *ganyu* offers security for herself and her young family.

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Returns to labour from permanent agricultural *ganyu*

Labour requirements (hours/week)	
- travel	24
- work	30
Total	54
Wage rate (MK/month)	
March-July	
- cash	250
- food	600
Total	850
August-February	
- maize	548
- food	600
Total	1148
Weighted average	
- cash	424
- food	600
Total	1024
Earnings	
Monthly (MK)	1024
Daily (MK)[a]	28

[a] Assuming one manday @ six hours (MK 1024)/((16 hours/6)).

D. Saiti, A. Orr, September 1999

14. ESTATE *GANYU*: MAI SPEAK...

Mai Speak (23) lives in Kambuwa village, Matapwata EPA with her husband and two young children aged four and seven. Bambo Speak (27) works in a maize mill at Bvumbwe. The household has two maize gardens which provide enough maize to feed their young family until February each year. On average, therefore, they buy maize for only two months. Mai Speak works as a labourer at Mindale estate, a coffee farm situated about 5 km from her home village. She started work at Mindale in 1988, when she was 12 years old and still living with her parents. In 1992, Mai Speak married and gave up estate work. She returned to estate work, however, when she briefly separated from her husband in April 1999, only giving up once more when he returned in September.

Estate labour seems a common choice of off-farm enterprise among female-headed households. Other Mindale estate workers resident in Kambuwa include Mai Tholo (42), with two children aged 13 and 19, who has been separated from her husband for 10 years. She earns 450 MK/month working as a housemaid on the estate. Formerly she earned cash income by selling goats and from a *dimba* garden where she grew maize and tomato. She took up estate work three years ago when she found she could no longer afford the inputs for *dimba* cultivation. Similarly, Mai Masinoti (26) who has three young children and separated from her husband in July 1998, started work at Mindale in June 1999. She needs cash not only to buy maize (the household runs out in November) but also to repay MK 1650 credit for an APIP fertiliser loan. Before her employment at Mindale she earned cash from seasonal *ganyu* (drawing water for moulding bricks) but estate labour offers continuous employment, though at a lower wage.

Materials

The only item of equipment needed is a hoe, which Mai Speak borrows from her mother. The cost of a new hoe and handle was estimated at MK 60. Mai Speak estimates that one hoe lasts three seasons. Monthly depreciation was thus estimated at MK 2.

Labour requirements

Mai Speak wakes early to leave home by 4 a.m. It takes her a full two hours to walk the 10.7 kilometres to Mindale. It is important to be on time. Work starts at 6 a.m. and employees who arrive at 6:30 a.m. are sent home. Work lasts from 6 a.m.- 12 noon, when workers receive a midday meal. Mai Speak usually arrives home by 3 p.m. This schedule continues six days a week, Monday through Saturday. Thus, the total labour requirement is 11 hours/day or 66 hours/week. Overtime is available for those who complete piecework early but few take advantage of this except during coffee harvesting, when the pay is higher. Women will then work until 3 p.m. or 14 hours/day.

Wages

Wages vary according to the type of work:

- Piece-rates (*mgwazu*) are the most common form of payment. The current rate at Mindale is 18.75 MK/day. Examples include weeding coffee (200 planting stations) or filling plastic containers for bluegum seedlings (300 containers). Failure to complete the allotted *mgwazu* results in a 'half—ticket' or half-wages for that day. The *mgwazu* rate for men is higher at 25 MK/day. Men are not employed for weeding or harvesting coffee but for planting coffee seedlings and other trees.

- Fertilising coffee is paid for at a fixed rate of 18.75 MK/day.

- Harvesting coffee is paid for at a rate of 0.65-0.95 MK/kg of coffee harvested. Mai Speak estimates that she can pick 60 kg/day.

In addition to her daily wage (MK 18.70) Mai Speak receives a midday meal of *nsima* and relish made from beans or pigeonpea. She finds the portions too small and estimates the value of the meal at only MK 15.

Earnings

During the 10 weeks of the coffee harvest (July-mid September) Mai Speak managed to earn 42 MK/day (0.7 MK/kg * 60 kg). The value of the daily meal (MK 15) raises this to a total of 57 MK/day. For the remaining 44 weeks of the year, earnings were estimated using the current rate for the *mgwazu* (18.75 MK/day) plus the value of the daily meal, giving total earnings of 33.75 MK/day. Weighted average earnings were 234 MK/week. Weighted average labour requirements were 64 hours/week. This gives a weighted daily wage of MK 22 or net returns to labour of 526 MK/month.

Returns to labour for female estate *ganyu*

Costs

Depreciation on equipment (MK/week) [a]			
- hoe	0.25		
Labour requirements (hours/week)			
	Coffee harvest	*Other*	*Weighted average*
- Travel to and from work	24	24	24
- Work	54	36	40
- Total	78	60	64
Earnings (MK/week)			
- Cash wages	252	112.5	144
- Meals	90	90	90
Total	342	202.5	234
Net returns to labour (MK/day) [b]	26	20	22
Net returns to labour (MK/mo)	622	478	526

[a] Assuming yearly depreciation @ 33 %

[b] Assuming one manday @ six hours (MK 342)/((78 hours/6))

D. Saiti and A. Orr, September 1999

15. THE FIREWOOD SELLER: MAI BUTAO...

Mai Butao (30) lives with her husband and six children in Kambuwa village, Matapwata EPA. The household has only one maize garden and normally run out of maize before planting in November. To supplement their income from agriculture, her husband works as a house-builder, also moulds and fires bricks (*njerwa*), and finds employment as a casual labourer. Mai Butao also does *ganyu*. Starting in 1997, however, she has taken to earning cash income by selling firewood. The availability of free fuel wood from pruned tea bushes at the nearby estate of Mindale was a key factor in her decision.

Mai Butao explained that villagers actually use several types of fuel wood. Wood from pruned tea bushes (*makuli*) is considered the best fuel because it produces charcoal that maintains heat longer than other fuels. One bundle (*mtolo*) will last for six days, cooking three times daily. Fuel wood from natural trees (*nkhuni za chilengedwe*) burns faster than *makuli* and produces less charcoal. She estimated that one *mtolo* will last for four days. Finally, villagers also use the stalks of cereal plants (maize, sorghum) and legumes (pigeonpea) as fuel for cooking. These are known as *mapesi*. One *mtolo* of *mapesi* will lst for only two days. Unlike other fuels, however, *mapesi* is not traded. Finally, it is also possible for villagers to buy fuel wood from villagers with plantations. A stacked heap of wood (*mendulo*) may last for several months.

Mai Butao often travels to Mindale estate with two other women from the same village. Since they are not trading in firewood, however, but simply collecting for their own use, they do not need to visit the estate as frequently as Mai Butao. For company, Mai Butao takes along her 10-year old daughter. Although she also collects fuel wood, this is a small quantity that is used for home consumption. We have therefore omitted her from our estimates of income from fuel wood.

Labour requirements

Mai Butao usually leaves home at 2 a.m. and reaches Mindale estate by 6 a.m. It takes about three hours to collect and tie enough tea bushes for one *mtolo*. She usually arrives back home by 1 p.m, in time to draw water from the well and prepare a meal for her young children. Thus the total labour requirement per trip is 11 hours, of which eight hours is travel.

Costs

The pruned tea bushes are already stacked and awaiting collection. There is no charge for the fuel wood. The only costs involved are ropes made from an old fertiliser bag (MK 8 in the market) and depreciation on an axe for which she paid MK 10 four years ago. We estimate annual depreciation @ 100 % for the rope (MK 8) and @ 10 % for the axe (MK 1).

Markets and prices

When she first started trading, Mai Butao sold her firewood in nearby Goliati market. Nowadays, however, she no longer has to sell from the market because she has acquired a reputation for selling firewood and villagers come to her. Her customers are drawn from her home village of Kambuwa and the neighbouring village of Chidothi. Often customers will place orders with her for firewood. Prices vary slightly according to the season. In 1998/99, she normally sold one *mtolo* of *makuli* for MK 25 in the dry season and for MK 30 in the wet months. Between May-August 1999, one *mtolo* sold for MK 30 and in September the price rose to MK 35. The current price of one *mtolo* of *nkhuni za chilengedwe* is MK 5 less, or MK 25.

Income

Over a fortnight, Mai Butao usually makes a total of five trips to Mindale: three in the first week and only two in the second week because by then she is tired. This gives a total of 10 visits per month. On each trip she collects one *mtolo* of *makuli*. Thus, revenue ranges from 250 MK/month in the dry season to 300 MK/month in the three months of the wet season (Dec-Feb). The weighted average revenue is 263 MK/month. This is equivalent to a return to labour of 14 MK/day.

Returns to labour from selling firewood

Costs

Depreciation on equipment (MK/month) [a]

- Rope for bundle	0.67
- Axe to trim branches	0.08
Total	0.75

Labour requirements (hours/trip)

- Travel to and from estate	8
- Collecting fuel wood	3
Total	11

Returns

Trips per month (No.)	10
Bundles per trip (No.)	1
Price per bundle (MK)	25-30
Turnover (MK/month)	263
Net returns (MK/month)	262
Returns to labour (MK/day) [b]	14

[a] Assuming yearly depreciation @ 100 % on rope and @ 10 % on axe.
[b] Assuming one manday @ six hours (MK 262)/((110)/(6))

D. Saiti and A. Orr, September 1999

16. MOULDING BRICKS…

Brick making is a seasonal activity conducted in the dry season, usually between July-September. Village houses are usually made with sun-dried bricks (*zidina*) rather than kiln-fired bricks (*njerwa*). At our research sites in Matapwata EPA, bricks (*zidina*) were often moulded with the help of communal labour. This system was known as *thandize*. By contrast, *thandize* was not practised at our research sites in Mombezi EPA, where bricks were moulded using hired labour. Our estimates of the returns from this enterprise are based on interviews with three village households.

1. Mai Chipakula, Lidala village, Mombezi EPA

Mai Chipakula contracted her son-in-law to mould bricks to build a new house for her mother.

Materials and equipment

Bricks were made from mud dug up next to the site for the house. A hoe used to dig the soil lasts on average for two seasons, so wear and tear was minimal. The mould was borrowed from a friend. New, it costs MK 45 and lasts for one season or more. Assuming annual depreciation @ 50 %, and two month's use each year, gives an average monthly depreciation of MK 1.88 or 0.04 MK/day. Local bricks are not fired but simply left to harden in the sun.

Labour requirements

Four steps were involved in brick production:

- Soil near the house was dug over to provide earth for the bricks (two hours);
- Water was carried to moisten the soil for moulding. This required fetching 12 pails of water from the well, estimated at 2.5 hours labour by Mai Chipakula;
- Bricks were fashioned using a wooden mould (*chikombole*). The production of 280 bricks took roughly seven hours for one person.

Thus, the total labour requirement was 11.5 hours.

Prices and income

Mai Chipakula's son-in-law contracted to mould 2,400 bricks for MK 270. He contracted to provide labour only for moulding. At the time of our visit, 280 bricks had been produced. Using the labour coefficient of seven hours to mould 280 bricks, we estimate that it will require 60 hours or 10 mandays of six hours to mould 2,400 bricks. This gives Mai Chipakula's son-in-law a return of 27 MK/manday. Mai Chipakula estimated the market price of the bricks at 0.20 MK/brick. Returns from moulding bricks (including digging soil and fetching water) are thus 29 MK/day of six hours duration. This figure is close to the contract rate of 27 MK/day above.

2. Mai Marichi, Magomero village, Matapwata EPA.

Mai Marichi moulded bricks to make a new house to replace one that collapsed in the rains. The bricks were moulded using communal labour (*thandize*). Villagers were recruited by sending children round the neighbouring houses of relatives and non-relatives. In all, more than 50 people were involved. Of these, 27 were men, mostly young men who were the friends of her son Enock. Over 30 were women. Work started at 6 a.m. with women collecting water to wet the soil. The men began moulding bricks at 9 a.m. and finished by 12 noon the same day.

Materials and equipment

Women brought their own buckets to carry water and, in some cases, hoes to dig up soil for bricks. The seven moulds used to make the bricks (*chikombole*) were borrowed. There were no costs involved for these items.

Workers were given sweet beer (*thobwa*) for fetching the water and left before the moulding began. She estimated the cost of the maize used for the beer at MK 100, and one packet of sugar (MK 21.50). Seven women stayed behind to help cook a meal for the men. After they had finished moulding, the men all ate a meal of *nsima* and *ndiwo* made from cabbage and beans. One plate was shared between two people. The total cost of the meal was MK 309, comprising *ufa woyera* (MK 200); beans (MK 40); cabbage (MK 9); and cooking oil (MK 60).

Labour requirements

The only labour requirement from Mai Marichi's side was preparatory work done by her husband, Bambo Milanzi, in digging up the soil with which to make the bricks. This took him four hours.

Production and prices

Mai Marichi estimated that 1,170 bricks were produced, perhaps more. She needed 1,500. Bricks cost between 0.20-0.50 MK/brick, depending on size. Her bricks measured 11 inches x 5.5 inches. Assuming a price of 0.50 MK/brick, the value of the bricks produced was MK 750. Mai Marichi explained that, to produce the same quantity of bricks using hired labour, she would have had to provide lunch for two people (one to fetch water and one to mould) for a number of days. She considered it was both cheaper and much quicker to use *thandize*.

3. Bambo Baluti, Kambuwa village, Matapwata EPA.

Bambo and Mai Baluti used *thandize* to mould bricks for constructing a kitchen. They used *thandize* because they considered it much cheaper than hiring casual labour and, anyway, they did not have the cash to contract labour.

Materials

Mai Baluti prepared *thobwa* (sweet beer) for the women. The total cost was MK 57, and comprised *chimera* made from sorghum (MK 6), sugar (MK 9), and *mgaiwa* flour (MK 40 plus a milling charge of MK 2). The *thobwa* was prepared in one afternoon between 1:30 – 4 p.m. or two-and-a-half hours. The men received a meal. The total cost of this meal was MK 92, and comprised *nsima* made from *mgaiwa* (MK 40 plus a milling charge of MK 2), dried fish (MK 40), and mustard from her own garden (MK 10).

Labour requirements

Bambo Baluti's brother dug the soil to make the bricks. Bambo and Mai Baluti did not know how much time it took. We assume the same labour requirement as with Mai Chipakula, namely 4.5 hours. In total, 14 men and 16 women participated in the *thandize*. Women spent two hours (6 – 8 a.m.) drawing water to wet the soil before moulding. The men spent three hours (8-11 a.m.) moulding bricks. The *thobwa* was prepared in one afternoon between 1:30 – 4 p.m. or two-and-a-half hours.
Mai Baluti also prepared the meal for the men, which took two hours.

Production and prices

The men moulded 909 bricks, each measuring 11 inches x 5.5 inches, the same size as those moulded for Mai Marichi. Bambo Baluti said the price varied between 0.50- 0.70 MK/brick. Assuming a value of MK 0.50, the total value of bricks produced was MK 454.5.

The economics of moulding bricks

	Hired labour (*ganyu*)	*Thandize*	
1. Profit-and-loss account		*Mai Marichi*	*Bambo Baluti*
Costs			
Materials			
- mud for bricks	-	-	-
Food (MK)			
- sweet beer	-	121.50	57
- meal	-	309	97
Total		430.5	154
Depreciation on equipment (MK) [a]			
- Hoes to loosen soil	-	-	-
- Mould	0.40	-	-
Total	0.40	-	-
Labour (hours)			
- Digging soil	2	na.	na.
- Fetching water	2.5	na.	na.
- Moulding bricks	7.0	na.	na.
Total	11.5	na.	na.
Costs to buyer			
Bricks produced (No).	280	1170	909
Market price (MK/brick)	0.20	0.50	0.50
Cash cost (MK)	56	330.5	154
Cost per brick (MK)	0.20	0.28	0.17
Returns to labour			
Gross returns (MK)	56	-	-
Net returns (MK)	55.6	-	-
Returns per manday (MK) [b]	29	-.	-

[a] Assuming depreciation @ 50 % p.a., used for two months/year, used for one day.

[b] Assuming one manday @ six hours ((MK 55.6)/(11.5/6)).

D. Saiti, A. Orr July, September 1999.

17. SELLING THATCHING GRASS: BAMBO BALUTI...

Bambo Baluti (42), a *dimba* farmer, lives with his wife and five children in Kambuwa village, Matapwata EPA. He also has three upland (*munda*) fields that provide the household with maize until November, or five months before the harvest of maize. One of these fields is left fallow each year for the production of thatching grass (*udzu*). The field is 'managed' to produce only *udzu*. Another type of grass (*kamphe*) that is taller and used to make fences is weeded out.

Materials and equipment

Since the grass is produced from Bambo Baluti's own field there is no cash cost for materials. Sickles are used to cut the grass but the cost is minimal and has not been included.

Labour requirements

This year Bambo Baluti and his wife cut the grass together over a period of five days, leaving home each day at 6 a.m. and returning home at 1 p.m. The field is located some distance away at Didima. Thus, the total labour requirement for cutting was 35 hours. After cutting the grass was carried and stored for safekeeping in a house near the field. The carrying and storage was done by Bambo Baluti and his wife, with help from his sister-in-law. This took two days of seven hours each for three people, or a total of 21 hours. Finally, the grass was transported from temporary storage to Bambo Baluti's house. This was achieved using a form of communal labour known as *thandize* (helping). Over 20 villagers participated in this *thandize*. Men carried two bundles and women one bundle. Beginning work at 7 a.m., they made two trips each and had finished by 10:30 a.m. Payment for *thandize* is always in kind, usually a meal. In this case, they were paid in sweet beer (*thobwa*). Bambo Baluti bought one packet of sugar for MK 2150 to add to the beer and paid for milling the *mgaiwa* and sorghum (MK 10).

Markets and prices

Good thatching grass is scarce in Kambuwa. Nearby Kamphonje estate no longer allow villagers to cut grass there. The main source is Chingazi hill, but cultivation there is expanding. Bambo Baluti has no shortage of buyers. The grass is sold direct from his home in bundles (called *chikunje;* in Mombezi EPA the bundles are called *zilipo)*. In 1996, one *chikunje* sold for MK 2-3. Last year the price rose to MK 5. This year, Bambo Baluti is charging MK 10 for one *chikunje*.

Income

Bambo Baluti estimates that they transported 100 *chikunje* of grass home from his field this year. He will reserve 50 for his own use, 30 for thatching a new kitchen and 20 for repairs to the existing thatch on his house. His cash income from sale of thatching grass will thus be MK 500. Net income was MK 469 or 50 MK/day.

Bambo Baluti grows thatching grass as a commercial crop. Most villagers who sell thatching grass, however, rely on grass grown on common property resources such as neighbouring hills. One woman we met in Magomero in late May was just returning from cutting grass on Chingazi hill. In seven hours she had managed to cut nine bundles. She was carrying five bundles to market and had left four on the hill to collect later. She planned to sell each bundle for Mk 10. Thus, her income from one morning's work was MK 50, equivalent to 43 MK/day or 7 MK/day less than that received by Bambo Baluti.

Returns to labour for selling thatching grass

Costs	
Materials	
- Grass	-
- Sweet beer sugar	21.50
- Milling charge	10.0
Total	31.50
Equipment	
- Sickle	-
Labour (hours)	
- Cutting	35
- transporting to store	21
Total	56
Returns	
Turnover (MK)	500
Net returns (MK)	469
Returns per day (MK) [a]	50

[a] Assuming one manday @ six hours (MK 480)/((56 hours/6)).

D. Saiti, B. Mwale, A. Orr, September 1999.

18. THE BASKET-MAKER: BAMBO MAKOTO…

Bambo Makoto (35) lives in Magomero village, Matapwata EPA. He is married with four children. The family has two fields. Generally, maize harvested from these fields last until December; this year, it will last only up to early November. To keep going, Bambo Makoto has started buying maize from other villagers. By June, he had managed to buy three 50kg bags of maize, valued at MK 600. The cash for these purchases came from basket-making, a skill Bambo Makoto learnt from a elderly neighbour, Bambo Nakoma, while he was still a young boy of 12. During my interview with Bambo Makoto I found him teaching basket-weaving to his brother in-law and his two brothers in marriage.

*Baskets (**Madengu**)*

Materials and equipment

To weave a basket one needs bamboo (*Nsungwi*), a knife for stripping the bamboo, a rope (*zilambe*) and a needle. The rope is obtained locally from nearby Chingazi hill, about 2 km from his home. It can also be obtained from the fields since it grows like a weed. Bambo Makoto uses a knife he bought in the early 90s for MK 5. The needle in use was bought for MK 2 in 1997. Assuming depreciation @ 25 % gives a depreciation of 1.75 MK/annum or 0.35 MK/month over the five months (May-September) when baskets are made. The bamboo is cut from along the slopes of Chingazi hill. Between August-March, however, Bambo Makoto has to buy the bamboo from other local villagers. The price ranges from 2-4 MK depending on size. A bamboo of 10 m (MK 4) is enough to make one basket.

Labour requirements

Leaving home at 3 p.m. and returning at 6 p.m., Bambo Makoto can cut enough bamboo for four baskets (*Madengu* or *Mitanga*). The bamboo is then stripped and dried. To strip bamboo for one basket requires not less than four hours (6 -10 a.m). He can weave the frame for four baskets (35-40 cm in diameter and 30 cm high) in one day, starting at 6 a.m and finishing at 3 p.m. Weaving the basket and adding the rim takes an additional eight hours for four baskets (6 a.m - 2 p.m). Thus, the total labour requirement for one basket is approximately nine hours: 45 minutes cutting, four hours stripping, and four hours 15 minutes weaving.

*Winnowing baskets (**Malichero**).*

Materials and equipment

Bambo Makoto also makes winnowing baskets (*Malichero*). The same quantity of bamboo required for one basket makes three winnowing baskets of 45-50 cm diameter. This gives a cutting time of 15 minutes. When bamboo is purchased, a 10 m length of bamboo (MK 4) can make four winnowing baskets.

Labour requirements

The time required to weave three winnowing baskets is equivalent to the time taken for one *Dengu*. This gives a weaving time of three hours. Thus, the total labour requirement for one winnowing basket is three hours, 15 minutes.

Markets and prices

According to Bambo Makoto he sells most baskets between May-September when villagers have money to buy household utensils. Selling from home, a basket of this type fetches MK 30; selling at the local market, the retail price is MK 35. Winnowing baskets fetch MK 15. By contrast, between October-February villagers need all their ready cash to buy food and he will only weave baskets when customers place an order with him. Usually, these are traders who need baskets to transport tomato. During this period baskets are sold at MK 45 each. Winnowing basket are sold at MK 20 each.

Markets and prices

Bambo Makoto normally sells baskets at Goliati and Kanje markets. Every time he takes baskets to the market, not less than 10 – 15 baskets are sold. I have used an average of 12 baskets/market day. On average, he sells four *malichero* each market day. Selling is done every fortnight. Bambo Makoto carries the baskets to market himself. He remains at the market all day for eight hours (4 a.m. – 2 p.m.). Assuming that he sells 12 baskets and four winnowing trays each market day, 30 minutes are required to sell each item. Selling 24 baskets and eight winnowing trays each month gives a gross revenue of 960 MK/month between May-July, equivalent to 22 MK/day. Returns rise slightly between August-September to reach 1240 MK/month or 29 MK/day.

The economics of basket making

1. Profit-and-loss account

Costs

	May-July			August-September		
	Madengu	*Malichero*		*Madengu*	*Malichero*	
Bamboo (MK)	-	-		4	1.30	
Depreciation on equipment (MK/mo) [a]	0.35	0.35		0.35	0.35	
Notional cost of labour (MK/mo)	836	5		836	5	
Total operating costs (MK/mo)	837	5		837	5	
Returns	*Total*				*Total*	
Sales/month (no.)	24	8	30	24	8	30
Price (MK)	35	15	-	45	20	-
Turnover (MK/mo)	840	120	960	1080	160	1240

Weighted averages (May-Sep)
Turnover (MK/mo) 1170
Notional profit (MK/mo) -1
Notional profit margin (%) 0

2. Returns to labour

Labour (hours/basket)						
- Weaving	9	3.25		9.0	3.25	
- Selling	0.5	0.5		0.5	0.5	
Total	9.5	3.75		9.5	3.75	
Net returns (MK/mo)	839	119	958	1079	159	1238
Returns per day (MK) [b]	22	24	22	28	32	29

Weighted averages (May-September)
Net returns (MK/mo) 1167
Returns per day (MK) [b] 25

[a] Assuming depreciation @ 25 % per annum, with five months' production per annum.
[b] Assuming one manday @ six hours (MK 899)/((243 hours/6))

D. Saiti, June 1999

19. THE MAT-MAKER: BAMBO CHIMWALA…

Bambo Chimwala (75) lives with his second wife in Magomero village, Matapwata EPA. The marriage is childless. Although they farm three upland fields the household runs out of maize in October, six months before the next harvest. Their house is a small mud building, thatched and without windows, situated on the slopes of Chingazi hill. When we met him in late May he was recovering from an infected leg, caused by a cut he had received while collecting reeds three weeks earlier. Bambo Chimwala learnt the craft of weaving reed mats (*mphasa*) as a child, by watching his father.

Materials and equipment

Reeds are a common property resource. Bambo Chimwala usually collects them from the banks of the nearby Luchenza river. A long needle (*chisongole*) of 12-15 inches is used for sewing. After drying, the split reeds are sewn together with twine made from sisal (*khonje*). Material costs for sisal twine are only MK 2. Depreciation on the sewing needle, that lasts two full seasons, is 0.13 MK (4 MK/needle, 16 mats/season).

Labour requirements

It normally takes Bambo Chimwala three days to harvest enough reeds to make two mats. When cutting reeds he normally leaves home at 6 am and returns at 2 p.m. the same day. Thus, cutting reeds for two mats requires 24 hours or 12 hours for each mat. After one harvest of reeds, they are split and laid out to dry. Splitting bark from the reed takes about four hours for each mat. Reeds have to split while still fresh to avoid breakage. This can take between six-ten days, depending on the weather. While these reeds are drying, he harvests another batch. In one week, he counts on being able to harvest enough reeds to make four mats. After drying, the split reeds are sewn together with twine made from sisal (*khonje*). Three sizes of mat are produced: 1.5 x 1.5 m, 1 x 1.5 m, and 2 x 2 m. Working from 11 a.m. – 6 p.m. it normally takes three days (21 hours) to make one mat. The total labour requirement is estimated at 39 hours for one mat of 2 x 1.5 m: 14 hours (cutting), 4 hours (stripping), 21 hours (weaving).

Markets and prices

Bambo Chimwala normally starts making mats after the harvest of maize in June and continues until October when the supply of reeds (*mabango*) has become scarce. Mats cannot be made in the wet season because it is difficult to dry the reeds which become rotten when wet. In June when reeds are plentiful he produces an average of four-five mats, declining to two-three mats each month until October. Assuming that he sells four mats each month in June, July, and August and two mats each in September and October, this gives a production of 16 mats. Usually he sells mats directly from home to other villagers, who place orders with him. Only occasionally does he carry mats to the market at nearby Goliati, where there is no shortage of buyers. Last year, the price for a 2 x 1.5 m mat was 45 MK. This gives a weighted average gross revenue of 144 MK/month and a net revenue of 137 MK/month. This is equivalent to 7 MK/day for an average working day of six hours. Were he able to sell his own mats at the market, where the mark-up averages 100 %, he would double the return to labour to 14 MK/day.

The economics of mat-making

1. Profit-and-loss account

Costs

Materials (MK/mat)			
- Reeds (MK)	-		
- Sisal (MK)	2		
Total	2		
Depreciation on equipment [a]			
- Needle (MK)	0.13		
Notional cost of labour (MK/mat)	143 (6.5 days @ 22 MK/day)		
Total operating costs (MK/mat)	147		

Returns

	Jun-Aug	*Sep-Oct*	*Total*
Total sales (No.)	12	4	16
Price (MK/mat)	45	45	45
Turnover (MK/month)	180	90	144
Notional profit (MK/month)	-408	-204	-314
Notional profit margin (MK/month)	-227	-227	-218

2. Returns to labour

Labour (hours/mat)			
- Collecting reeds	14		
- Stripping	4		
- Weaving	21		
Total	39		
Net returns (MK/mo)	172	81	137
Returns per day (MK) [b]	7	7	7

[a] Assuming depreciation @ 50 % per annum and production of 16 mats in six months.

[b] Assuming one manday @ six hours (MK 172)/((156 hours/6)).

D. Saiti, A. Orr, June 1999

20. THE MAKER OF NKHOKWE: *BAMBO NKOMA…*

We met Bambo Nkoma by chance one day while he was hard at work weaving a new *nkhokwe* (granary) for Mai Muhemwe. Aged 70, he lives in Jonasani village, Mombezi EPA. Married and separated three times, he stays with a young son and nephew who both attend primary school. He cultivates one field in Chitera *dambo* that produces less than 180 kg of maize per year. Making *nkhokwe* is one of the activities that he does to earn sufficient income to buy additional maize. He learnt the skill as a boy from his father and began weaving *nkhokwe* as a business in 1946.

Nkhokwe

Nkhokwe are made from local bamboo (*sungwi*) which is found growing wild on hillslopes. Unlike the newer variety of bamboo, which is less pliant, the local variety is easily worked. Bambo Nkoma estimates that he needs two trips (a total of four hours) to collect and strip enough bamboo to make one *nkhokwe*. Once the bamboo is ready, the radius of the *nkhokwe* is drawn on the ground using a central stick, with holes drilled in the ground to indicate where stems are placed to support the walls of the *nkhokwe*. He estimates that making one *nkhokwe* takes three days, working six hours a day. Thus, the total labour requirement is 22 hours: four hours (collecting) and 18 hours (weaving).

Chiphaka

The platform (*chiphaka*) for *nhkokwe* requires wooden poles, string, and stones. These are normally collected from the hillside. String is obtained from the bark of an indigenous tree known as *Chenga* (*Brachystegia appendiculata*). For Mai Muhemwe's *nkhokwe*, it took Bambo Nkoma three hours to collect sufficient poles and string. It took another three hours to construct the platform. Since he does not own a machete (*panga*) for cutting poles, he usually borrows one from the villager who has commissioned the *nkhokwe*.

Denga

A complete *nkokwe* needs a roof (*denga*). Most villagers prefer a conical roof. For Mai Muhemwe's *nkokwe*, Bambo Nkoma took a total of nine hours (five hours collecting poles and string, and four hours making the roof).

Prices

The price of *nkhokwe* varies slightly according to its size. For one *nkokwe with* radius of 0.75 m and height of 1.6 m, Mai Muhemwe and Bambo Nkoma agreed a price of MK 100. The platform and roof cost an additional MK 20 and MK 30, respectively.

Markets

Bambo Nkoma normally starts making *nkhokwe* in May and ends in June. He supplies directly to order and works in only four neighbouring villages (Lidala, Chiwinja, Matola, and Majawa). Last year (1998) he made a total of four *nkhokwe* and so far this year he has made two. In all these cases he has also been asked to construct a platform and a roof for the *nkhokwe*. Over a period of three months therefore, we assume that Bambo Nkoma will make a total of four *nkokwe*, or an average of 1.3 *nkhokwe*/month. This produces a net revenue of 260 MK/month, equivalent to a return of 40 MK/day.

The economics of making *nkokwe*

1. Profit-and-loss account

Costs

Materials (MK/*nkhokwe*)				
- Bamboo	-			
- String	-			
- Machete	-			
Total	-			
Deprecation on equipment [a]	-			
Notional cost of labour MK/*nkokwe*)	150 (6.5 days @ 23 MK/day)			
Total operating costs (MK/mo)	195			

Returns

Production (No/mo)	1.3	1.3	1.3	1.3
Price (MK).	150	20	30	200
Turnover (MK/mo).	195	26	39	260
Notional profit(MK/mo)	-	-	-	65
Notional profit margin (%)	-	-	-	25

2. Returns to labour

Labour (hours)	*Nkhokwe*	*Chiphaka*	*Denga*	*Total*
- Collecting materials	6	3	5	14
- Weaving	18	-	4	22
- Construction	-	3	-	3
Total	24	6	9	39
Net returns (MK/mo).	195	26	39	260
Returns per day (MK).[b]	30	26	26	40

[a] Assuming no depreciation on borrowed equipment.

[b] Assuming one manday @ six hours (MK 195)/((39 hours/6)).

D. Saiti, June 1999.

21. MAKING HANDLES FOR HOES AND AXES: BAMBO NAMVENYA...

Bambo Namvenya (75) lives in Jonasani village, Mombezi EPA, with his wife and two grandchildren. Their two gardens, one of them in the Chitera dambo, provide the household with maize from March through to November. He learnt the art of making hoe-handles from his grandfather while he was still a boy. From that day to this it has been a regular business for him.

Materials and equipment

In the past, hoe handles (*mpini wa khasu*) and axe handles (*mpini wa nkhwangwa*) were made from hardwood such as *Mbawa (Khaya nyasica), Napini (Terminalia sericea), Mchenga (Brachystegia appendiculata), Mposa (Annona chrysophylla),* and *Mlombwa (Pterocarpus angolensis).* Nowadays these trees are hard to find and Bambo Namvenya uses wood from any type of tree, including fruit trees. Hoe handles can be made from any branch provided that it is thick enough to allow one end to be thinned and leave the other end in the form of a bow for the handle to fit through. Wood is obtained from his own garden, where he grows trees for this purpose, or from the nearby hill if the branches on the trees in his own garden are too small.

Tools are simple. Branches are cut using a machete (panga) bought in 1994 for MK 8. A small axe-blade (*kasemasema*) is used to remove the bark and shape the wood. The one that Bambo Namvenya currently uses was bought in 1996 for MK 5. A metal spike (*michiliyo* or *momba*), used to make the hole in the handle, was bought in 1996 for MK 3. Depreciation on the equipment (25 % p.a.) was estimated at MK 0.18 (*panga*), MK 0.11 (*kasemasema*) and MK 0.07 (*michiliyo*).

Labour requirements

Starting at 11 a.m. and ending at 5 p.m. Bambo Namvenya can cut, smooth, and bore one hoe or axe handle. This gives a labour requirement of six hours per handle.

Prices

An axe or hoe handle sells for MK 10.

Production and markets

Between July 1997-January 1998, he made 15 handles. Between July 1998-January 1999, however, he only made nine because he refused orders in order to spend more time working in his maize gardens. This season he has already sold three handles and has received an order for another two. This gives an average production of 2 handles/month. Bambo Namvenya normally sells from home, directly to order. Net returns averaged 17.6 MK/month, equivalent to 9 MK/day.

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The economics of making hoe and axe handles

1. Profit-and-loss account

Costs

Materials	
- Wood	-
Depreciation on equipment [a]	
- *Panga*	1.17
- *Michiliyo*	0.79
- *Kasemasema*	0.44
Total	2.40
Notional cost of labour (MK/month)	46 (2 days @ 23 MK/day)
Total operating costs (MK/month)	48.40

Returns

Sales/month (no.)	2
Price (MK/unit)	10
Turnover (MK/month)	20
Notional profit (MK/month)	-28.4
Notional profit margin (%)	- 59

2. Returns to labour

Labour (hours/unit)	
- Cutting, making handle	6
Net returns (MK/month)	17.6
Returns per day (MK) [b]	8.8

[a] Depreciation at 25 % p.a., with seven months' production per year.

[b] Assuming one manday @ six hours (MK 17.6) / (12 hours/6).

D. Saiti, July 1999

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22. THE HERBALIST: MAI MARICHI...

Mai Marichi (44) lives with her young child in Magomero village, Matapwata EPA. Her husband is a polygamist with a second wife in the same village. The household normally runs out of maize in November, five months before the next harvest. She started practising as a herbalist seven years ago. It began when she had a dream when was sick. A voice in her dream told her to look for a particular herb and she would be cured. When she drank the potion made from that herb, she recovered. Her reputation grew when she successfully cured a violent lunatic. Since then she has had a lot of patients, some of them travelling a considerable distance to meet her. Last year (1998) she decided to give up market trading and concentrate on practising herbal medicine. Her patients call her a herbalist or healer (*sing'anga*). She prefers to call herself a seer (*mlosi*).

Materials and equipment

The most common diseases she treats are headaches, strokes, stomach disorders and mental illness. (Villagers regard madness – *misala* – as a natural, organic disorder distinct from spirit possession, that is curable by natural means). After patients describe their symptoms, Mai Marichi waits for a dream to tell her what herbs she needs for that particular illness. If the spirits (*mizimu*) don't give her guidance, she will not prescribe anything for that patient. Herbs are normally grown around the homestead or grow wild in what remains of the Brachystegia woodland on nearby Chingazi hill. Herbs are most plentiful in August, but become scarce in October. To ensure a good supply, she preserves herbs for use in the dry season. Altogether she uses about 10 different herbs. Her most popular herbs include *bwazi (Ectadiopis oblongifolia, Indigofera panicaulata, Securidala longependunculata)*, *chipembere (Canthium frangula, Catunaregum spinosa)*, and *nsolo (Choristylis shirensis)* and 'lucky herbs' (*mwayi)* which can cause a business to prosper. [a]

Labour requirements

When a patient appears Mai Marichi will spent an hour listening to symptoms and making a diagnosis. She then sends the patient away and waits for a dream to tell her what herbs to prescribe. The herbs are then collected. She estimated that she spent about one day a month (6 a.m. - 3 p.m. or nine hours) looking for herbs. Once the herbs are ready, she visits the patient's house and prepares the medicine there. This usually takes one afternoon (12 noon - 5 p.m.) or five hours. The herbs are cooked and mixed with the blood of a chicken in front of the patient so that they can make the medicine themselves. The patient provides both the chicken and the bottle to store the medicine. If the cure is successful, Mai Marichi returns to the patient's house for a ceremony known as *kusirika* in which another chicken is killed and the heart and entrails are mixed with the medicine, then buried. This prevents the illness recurring.

Markets and prices

Mai Marichi treats men, women, and children. She estimated that she treated two-three patients each week. She prescribes throughout the year except when she is engaged with graveyard ceremonies (*chikumbutso*) when her spirits automatically warn patients to stay away. She estimates that she treats about 40 patients a year. Patients make a down payment (*chipondhatengo*) of MK 50 after describing their symptoms. The second payment is made when the cure has been successful (ie. at *kusirika*). For villagers, the fee is usually MK 150. The price is higher when the treatment is for headache caused by witchcraft: then patients pay a starting fee of MK 150 and a curing fee of MK 150. Patients from town are charged a flat rate of MK 400, payable at first meeting. Mai Marichi explains that this is to prevent them reneging on the second payment. Second payments from villagers are usually irregular and may be spread over one or two months.

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Income

If we use a figure of 40 patients/year, this gives an income of 8,000 MK/year (MK 2000 and MK 6000 from first and second payments, respectively). This understates Mai Marichi's real income from herbal medicine because of the higher fees charged to patients living in town, or to villagers treated for diseases associated with witchcraft. However, we have no information on the frequency of these. Net returns averaged 208 MK/day.

[a] Plant identifications follow B. Morris (1996).

The economics of selling herbal medicine

1. Profit-and-loss account

Costs

Materials	-
Equipment	-
Total	-
Notional cost of labour (MK/month)	171 (9 days @ 19 MK/day)
Total operating costs (MK/month)	171

Returns

Patients (No/year)	40
Patients (No/month)	2.7
Charge (MK/patient)	200
Turnover (MK/month)	667
Notional profit (MK/month)	496
Notional profit margin (MK/month)	74

2. Returns to labour

Labour (hours/patient)

- Diagnosis	0.2
- Collecting herbs	9
- Preparing medicine	5
- *Kuserika*	5
Total	19.2
Net returns (MK/month)	667
Returns per day (MK) [a]	208

[a] Assuming one manday @ six hours (MK 667)/((19.2 hours/6)).

D. Saiti, A. Orr, September 1999

4D2

FARMING SYSTEMS INTEGRATED PEST MANAGEMENT PROJECT

Off-farm income and smallholder livelihoods in Blantyre Shire Highlands RDP

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Abstract

Fifteen households, three from each of the five household types ('clusters') identified by a previous cluster analysis, were monitored at FSIPM research sites at Matapwata and Mombezi EPAs, Blantyre Shire Highlands RDP, between December 1997 – November 1999. Key findings included:

- Households harvested maize continuously for 2 ½ months before the final harvest of dry maize. Many households ate *mgaiwa* throughout the year because it was more filling than *ufa woyera* and allowed their maize stocks to last longer.

- Households planted a wide variety of crops (often in small amounts) to ensure relish at different periods. The most common relish was leaves from pumpkins, an intercrop largely ignored by researchers. Poorer households increased their supply of relish by eating wild plants and planting on termite mounds.

- Except for households with *dimba* gardens, income from the sale of crops was not the main source of cash for maize purchases during the 'hungry months' between November and February.

- The labour market for *ganyu* during the first six weeks after maize planting was highly competitive with no evidence of labour – tying through patron – client relationships. Of 12 households that did *ganyu* during the year, six did *ganyu* for relatives. In three cases, contracts with relatives accounted for more than half of total *ganyu* contracts.

- *Ganyu* was not an important source of income for the poorest households who lacked sufficient stamina for manual labour on fields apart from their own.

- Of the 15 households, 11 participated in some form of off – farm enterprise, including all three vulnerable households. The enterprises used by vulnerable households (brewing *kachasu*, selling snuff, making reed mats) that required little or no capital, were home – based, and had a rapid turnover.

- In nine of the 15 case – study households, agriculture accounted for only half or less of household income. Agricultural income was important primarily for burley and *dimba* households. It was least important for vulnerable households.

- Four households received more than a quarter of their net income from off – farm enterprises. Two of these households were members of the vulnerable cluster.

- Two households in the burley cluster had the highest net incomes. The only other households that approached this level of income were a household with three active adult members and a household that derived income from house rental and salary.

- Vulnerablility in terms of food security was not reflected in net household income. Although vulnerable households had the lowest incomes from agriculture, they also had income from *ganyu*, gifts, and off – farm enterprises. Consequently, all three vulnerable households had higher net incomes than two of the three *dimba* households in the sample.

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1.0 Introduction

"Malawi is a nation of maize-growing smallholders." (Smale *et. al.*, 1991).

The perception that Malawi is simply a country of small farmers refuses to die. Among policy – makers, the archetype of the maize – growing smallholder reflects a preoccupation with food security. The view that food – insecure smallholders might also have off – farm incomes that allow them to buy maize is ignored, or rejected on the grounds that these are merely 'coping strategies' that perpetuate poverty. Among agricultural scientists, the small farmer archetype survives unchallenged, reinforced by a commodity – based research system that lacks a systems perspective and treats off – farm income as a black box with little relevance for crop production.

Among most rural households in Africa, 'non – farm' income accounts for a significant share of total household income (von Braun, 1986). Non – farm income is particularly important for food – deficit households, who form the majority of smallholders in southern Malawi. A 'livelihoods' approach is therefore more appropriate for the smallholder sub-sector in Malawi than one that views smallholders exclusively in terms of income from agriculture. A livelihood has been defined as "the capabilities, assets (including both material and social resources) and activities required for a means of living" (Scoones, 1998). A livelihoods approach sees different income streams as complementary, with households combining streams to meet their needs. From a livelihoods perspective, therefore, an amended definition of smallholders might read:

"Malawi is a nation of maize-growing smallholders who cannot feed themselves and survive because they have access to cash income earned largely outside agriculture".

The micro – economics of off – farm enterprises in Blantyre Shire Highlands RDP is the subject of a separate report (Orr *et. al.*, 1999b). In this study, we analyse the major types of off – farm income, their relative importance, and contribution to aggregate household income. In the course of fieldwork, we also learnt much about seasonal variations in crop production, food supply, and food security. This information provided the necessary background with which to understand the role of off – farm income in the study area.

The objectives of this report are therefore to:

- Analyse the agricultural context in which smallholders operate, with particular attention to food security and the need for off – farm income to buy maize.

- Analyse specific forms of off - farm income and their distribution among different types of household.

- Measure the relative shares of different sources of off – farm income and the contribution of off – farm income to total household income.

The Blantyre Shire Highlands

The FSIPM Project operates in two extension planning areas (EPAs) in the Shire Highlands Rural Development Project (RDP) in Blantyre Agricultural Development Division (ADD). The RDP has a land area of 450,000 ha and is located in southern Malawi. The Shire Highlands form a plateau of rolling or flat upland plains 600 - 1200 m above sea level. Rainfall distribution is unimodal with one continuous wet season between November – April, sporadic showers between May – July and a dry period between July – October. The growing season averages 165-195 days in the north rising to 225 days further south. In terms of altitude, rainfall, and length of growing season the maize ecology is representative of 40 % of the area planted to maize in Malawi (Heisey and Smale, 1995). Soils are mostly deep, well-drained and medium textured but low in soil carbon and organic matter.

Smallholder agriculture is characterised by small farm size, intensive maize cropping, and pervasive poverty:

- Six in ten households in the RDP cultivate 0.5 ha or less and must buy maize for between four – five months each year. Agriculture is strongly market-oriented with a wide range of food crops sold for cash. Burley tobacco and *dimba* vegetables are the most valuable commercial crops. One third of households in Matapwata EPA grow *dimba* vegetables. Marketing infrastructure is favourable with good access to the international tobacco auction floor and the urban markets of Blantyre and Limbe. Despite these markets, most households also rely on off-farm income to cover maize deficits. On holdings of half a hectare or less, up to half household income may be earned off – farm (Orr *et. al.*, 1996).

- The farming system is maize-based with pigeonpea (*Cajanus cajan*) and beans (*Phaseolus* spp.) as the main pulse and legume intercrops. Relay – planting of beans and fieldpeas (*Pisum sativum*) is also practised. Maize yields averaged 836 kg/ha for local varieties and 1765 kg/ha for hybrid semi-flint varieties between 1992-96. Low average yields reflected poor soil fertility and low rates of inorganic fertiliser use.

- Both Mombezi and Matapwata EPAs are classified as among the poorest in Malawi (Moriniere *et. al.*, 1996). This partly reflect the high proportion of households headed by women – 40 % - which form a disproportionate share of the poorest 20 % of the smallholder population (World Bank, 1996).

2.0 Methods

Off – farm income

We define 'off-farm' income as "wage-goods, services, or income transfers that do not derive from the household's own production of crops, trees, poultry, or livestock". We prefer the term 'off-farm' to 'non – farm' because it may include income from agricultural sources such as casual labour.

Sample selection

The case – study method was chosen because staff time was limited and data – collection required frequent visits. Two limitations of the case – study method may be noted. First, small sample size makes it difficult to generalise from case – study findings. However, case – studies may be useful in rejecting *existing generalisations* (Casley and Lury, 1981). Second, bias may arise when the sample differs in unknown ways from the population at large. We have tried to reduce this bias by selecting three households from each of the five household types that had previously been identified through a cluster analysis of households at the FSIPM research sites (Orr and Jere, 1999). These groups were:

- ***Dimba** households* producing high-value vegetables for sale, that were reasonably food secure;
- *Burley households* that did not produce vegetables but enough maize to be reasonably food-secure;
- *Vulnerable households* producing neither vegetables nor burley tobacco, growing maize on marginal land, and without enough maize to be reasonably food-secure;
- *Stable MHHs* producing neither vegetables nor burley tobacco, but enough maize to be reasonably food-secure, and headed by a man; and
- *Stable FHHs* producing neither burley nor vegetables but enough maize to be reasonably food secure, and headed by a woman;

Table 1 compares household assets and fertiliser use among the case – study households and with the average for their cluster group. In terms of the area planted to maize, two households (H 4 and H 9) cultivated significantly more than the average for their clusters. In the case of H 4, 1.7 ha of fallow land was brought back into cultivation because of the availability of fertiliser credit, while H 9 was in fact two sisters with their own fields who formed one household. Vulnerable households were identified as those with low self-sufficiency in maize in 1996/97, a poor crop year. Self – sufficiency was higher in 1997/98, a good crop year. The fertiliser rate for maize remained low for vulnerable households. The low fertiliser rate in H 11 (11 kg N/ha) is explained by the fact that this household does not normally buy fertiliser. The high fertiliser rate in H 12 (105 kg N/ha) was due to the fact that five members of the household received free fertiliser through the Starter Pack Scheme. A fuller description of the 15 case – study households is provided in Appendix 1.

Survey period

Data was collected for the months December 1998 – November 1999. A total of 34 field visits were made to the case – study households. Between December 1998 and January 1999 households were visited every four days as part of a separate study on the timeliness of weeding. The recall period for these visits was four days, including the day of the interview. From mid – February onwards, households were visited every two - three weeks. The reference period for these visits was two weeks, including the day of the interview. Appendix 2 gives a schedule of field visits.

4D9

Data - collection

Data on food consumption. crop sales. *ganyu*. other off-farm enterprises. and gifts was collected using a short questionnaire (Appendix 3). We also collected information on miscellaneous activities that we observed during our household visits (food habits. fuel wood. etc).

Data analysis

Quantitative data were tabulated to show the relative contribution of different income sources. Qualitative data were analysed chiefly using graphics and summary tables. This had two advantages: it allowed a large amount of data to be presented in an accessible form. and freed space in the text to analyse the major points of interest.

A note on the income data

The data were divided into four equal time – periods of three months' each (Appendix 2). For periods II – IV. there were five field visits for each time – period. The recall period of two weeks gave coverage of 10 weeks in every 12. For period I. the months December and January were covered in full. To avoid a biased picture of the scale and sources of household income because of the uneven distribution of household visits. the income data for time – periods II – IV was adjusted upwards by 17 %.

3. Agriculture and food security

3.1 Seasonality

The importance of off-farm income in smallholder livelihoods in the Blantyre Shire Highlands is determined by the low productivity of maize and by seasonality. which determines the flow of income from crop production. Table 2 shows the calendar of agricultural activities for three different land-types.

- Income from *dimba* vegetables was absent in December – January when rain encouraged plant diseases and households were busy with their maize. In March – April. however. growers obtained a stream of income from quick-maturing *dimba* crops (mustard. rape) that allowed them to buy maize instead of harvesting their own unripe maize before the final harvest in May.

- Income from burley came on – stream in March (when intermediate buyers offer low prices) but above all in mid – April with the opening of the auction – floors. Burley – growers also bought luxuries like goat meat on credit against the collateral of their future burley sales. Astute growers like H 2 used some of this income to stock up with maize just after the harvest when prices were lowest.

- Maize producers have extremely limited sources of crop income during the six maize – deficit months between November – April. Indeed. for a period of three months there is no income from dryland crops. This changes only with cash from the sale of intercropped beans in February and from fieldpeas in April. Disease pressures reduce bean yields, however, and make the income from this crop highly variable. Consequently, most households lack purchasing power and begin eating unripened maize in February.

- Income from dryland crops other than burley occurs mainly in the period June – October, with the harvests of fieldpeas and sweet potato (June - July), groundnuts sorghum and finger millet (June), and local, long-duration pigeonpea (September).

3.2 Food security: maize

A striking consequence of the lack of purchasing power between February – April is the consumption of unripened maize. Although they tried to delay harvesting for as long as possible, by mid – March all but seven households had started harvesting unripened maize while by 28 March the number had risen to 13. Only one household that was self – sufficient in maize throughout the year avoided the need to harvest maize before it was fully mature.

Table 3 illustrates the different stages of maize consumption.

- Green maize stalks (*msinde*) were sometimes eaten as a sweet snack in early February, especially by children.

- Green maize – *chimanga cha chiwisi* – was harvested as early as the 17 th of February. By the third week of February, all save H13 were eating green maize from their own garden, generally as a main meal at midday instead of *nsima*. The exceptions to this rule were H13, which was still eating *ufa woyera* made from last year's harvest, and H5, whose young child who could not eat maize in this form.

- Between late February – early March households began harvesting maize to make *matindili*. At this growth stage, maize kernels are still soft and must be scraped off with a knife rather than removed by hand. After shelling, the maize is dried. Typically, the dried maize is then pounded for immediate consumption as *mgaiwa wa matindili*. Flour from *matindili* maize has a distinctive sweet taste which some villagers disliked. To remove it, they preferred to soak the maize before pounding and consume as *ufa wa matindili*. Only one case – study household was found eating *matindili*, however.

- Between mid – March and early May, unripened maize is harvested to make *masalanga*. By this growth stage, the maize kernels have started drying. After shelling, the grain is dried and then pounded immediately to make *mgaiwa wa masalanga*. By the end of March all households except one had harvested maize for *masalanga*.

- Harvest of fully dried maize began in mid – May (the earliest date was 9 th May). After harvest, the maize was sorted to separate small cobs (*zikonyo*) and cobs damaged by cobrot (*naliole*). These cobs were not stored with others in the *nkhokwe* but eaten first. For example, the maize variety Katswiri, distributed by the Starter Pack Scheme, suffered badly from rotting because the sheath did not fully cover the tip of the cob: this variety was shelled and eaten immediately after harvest. Otherwise, shelled maize was stored, or pounded at the mill and eaten immediately as *mgaiwa*, or pounded to remove the bran, soaked to remove lactic acid, and finally pounded again to make *ufa woyera*. Only flour made from fully dried maize was classified by households as *ufa woyera*.

The widespread consumption of unripened maize has important implications for the measurement of household food security. If smallholders in the Blantyre Shire Highlands rely mostly on home – produced maize from March onwards, two months before the final harvest, then the number of months that households eat their own maize may be greater than previously thought.

After pounding, the maize bran (*madeya*) is sifted to remove the larger flakes of bran (*masapi*) which are then fed to chickens or livestock or sold to households owning pigs or a dairy cow. The *madeya* itself is commonly used to make *nsima* during the hungry months before the harvest of green maize in February. Households that do not eat *madeya* themselves will store it to sell to others at this period or to pay *ganyu* labour. The price of *madeya* peaks in January – March, declines sharply after the harvest of maize then slowly rises again in August.

After harvest, a high proportion of households continued to eat m*gaiwa* rather than *ufa woyera*. In some cases, this was sometimes because they could not afford the charge for pounding at the local mill and were unwilling or unable to pound themselves. In most cases, however, it was because they preferred to eat *nsima* made from *mgaiwa* at midday because it was more filling, and to reserve *nsima* made from *ufa woyera* for the evening meal. "If you eat *ufa woyera* for lunch, you'll be hungry again before dark", was the way one household expressed it.

Fuel for cooking *nsima* during the wet season was collected and stored in October. Research has shown that methods of collecting fuel vary greatly within the same village (Brouwer *et. al*., 1997). Of the 15 case – study households, only four relied on their own trees for fuel. Other sources included shrubs, buying from the local market, or buying heaps (*mendulo*) from neighbours. In Matapwata, households also obtained tea prunings (*makuli*) free from local estates while in Mombezi wood was available from the forest reserve for a fee of 5 MK/visit. In most households crop residues (pigeonpea and maize stalks) lasted only one or two months. The cobs of shelled maize - another useful source of fuel – could be obtained from neighbours after the harvest in May, in exchange for shelling them.

3.3 The food calendar

Maize is eaten accompanied by a relish (*ndiwo*), usually vegetables, sometimes fish, rarely meat. Table 4 presents a general picture of food availability among our case – study households. Scientific plant names were obtained from Binns and Logah (1972).

- A striking feature of the calendar is the lack of direct substitutes for maize. Sorghum is only available in June, cassava between October – December, and sweet potato between June – July. Sorghum – not the variety grown for sweet beer (*thobwa*) – may be pounded then boiled in water like rice (*misere ya mapira*) but was usually eaten mixed with maize flour (*mgaiwa* or *ufa ndi mapira*). Cassava was usually eaten as a snack. Only sweet potato eaten boiled with pigeonpea as *makata* was regarded as a substitute for *nsima* at the main midday meal.

- Households planted small quantities of different edible plants that produced relish at different times of the year. Of those listed in Table 4 only pumpkins (*Cucurbita* spp.), pigeonpea and *nkhungudzu* (*Lablab pruriens*) were reported as available for a period of over two months. Beans were available only in February, although households in Matapwata also planted a second (*mbwera*) crop that was harvested in June. *Kabaifa* (*Pisum sativum*) and *kamupanda* (*Phaseolus lunatus*) were eaten only in June, and *tanaposi* (*Brassica chinensis*) in May.

- The leaves from pumpkins (*maungu*), an intercrop little valued by researchers, were the single most important relish with most households eating them for five months (February – June). Leaves from pumpkins planted on termite mounds were still being eaten in July. Households that grow burley may also plant pumpkins in the tobacco nursery in October in order to provide them with relish in November.

- Relish became scarce in the dry season (*Chilimwe*) between August – November. One strategy used to overcome this shortage was to prepare *mfuso*. Villagers make *mfuso* by first boiling the relish for a few minutes, then drying it in the sun and rubbing or squeezing the leaves to make them soft before they are fully dry. *Mfuso* is stored in a fertiliser bag until needed. We witnessed *mfuso* being made with pigeonpea leaves in mid – March. Households also made *mfuso* with cowpea leaves, okra, blackjack, pumpkin leaves, and mustard. Households that made *mfuso* consumed it mostly between September – October.

- Another strategy to obtain relish in October was to make use of wild plants. *Chisoso* (*Bidens pilosa*) was plentiful soon after the early rains but became scarce after fields had been weeded. It was mainly found in dambo fields. We found households eating *chisoso* in October, but also in the middle of March. It was either eaten separately or mixed with groundnut flour. *Bonongwe* (*Amaranthus spinosus*) was plentiful before weeding and two households planted it on a termite mound to prolong availability. *Denje* (wild okra or *Corchorus tricocularis*) and the leaves from the *mpira* tree (*Euphorbia geniculata*) were also eaten. Field mice (*mbewa* or *alololo*) were fried and eaten with salt by non – Muslims after the maize harvest in May. In Kambuwa, a stick of seven mice sold for MK 15.

3.4 Types of food eaten by vulnerable households

What do these variations in food supply mean for the poor? Table 5 shows the types of food eaten by the three case – study households that were classed as 'vulnerable' because of low food security. All three households ran out of maize before November 1998, the earliest in August 1998. Although the livelihood strategies they used to overcome this maize deficit varied greatly, they shared some common features in terms of food consumption:

- Poorer households harvested maize early, in one case eating green maize as early as 22 February. All of them ate *mgaiwa wa masalanga* for a period of two months before the final harvest of dry maize. *Madeya* was a prominent feature of the household diet during the hungry months. In November, for example, the midday meal for H 7 consisted of *madeya* and relish made from blackjack weeds.

- Although very limited use was made of cereals other than maize, all three grew sweet potato and one re-planted sweet potato when the first crop failed. Sweet potato is not a substitute for maize during the hungry months because most households only plant sweet potato in January after they have completed the weeding of maize. Sweet potato is chiefly used to reduce maize consumption between May – August and thereby extend the household's stock of maize as far as possible throughout the year (Mwale *et. al.*, 1999).

- All three households used several strategies to reduce expenditure on relish. These included: eating weeds (*chisoso*) and other wild plants (*denje, mpira* leaves), crop diversification by cultivating a wide assortment of intercrops (okra, *kabaifa, katchembere*), preparing *mfuso*, and planting on sites which allowed late harvesting (termite mounds, old house mounds).

- Fish (*matemba*) was the only form of protein and eaten rarely. Meat was not a feature of their diet.

3.5 Sources of cash for maize purchases

A combination of small farm size and low maize yields mean that the majority of households must buy maize for at least four months of the year. Table 6 shows the 'coping strategies' used by the 15 case – study households for the purchase of maize between November 1998 – February 1999. Of the 15 households, one (H13) had no need to buy maize, while three (H 5, H 6, and H 11) bought maize for just one of these months. The remaining 10 households had to buy maize for the entire period.

- There was no dominant coping strategy and no instance of a household relying on a single strategy. The same household might obtain cash from *ganyu*, gifts, crop or livestock sales, and off – farm enterprise (eg. H 15).

- The strategy of financing maize purchases from crop sales was limited to households with *dimba* gardens. Income from cabbage, tomato, and green beans was critical for these households. Only when the income from *dimba* dried up in February did they turn to alternative strategies.

- Six households reported obtaining maize through *ganyu*, often requesting payment in the form of *ufa* or *madeya* . *Ganyu* was not a popular strategy with the majority of households, however, because it delayed weeding on their own fields and sapped their strength, while competition for employment reduced potential earnings. Consequently, it tended to be a strategy of last resort.

- The sale of chickens or goats was a common strategy. Among the 15 case – study households, 10 owned goats and two owned pigs. Income from this source was found in all five clusters. Some households were reluctant to use livestock sales as a coping strategy, however. For example, H 3 preferred to buy maize by selling fertiliser rather than part with a she – goat that they wanted to keep for breeding as part of a longer – term strategy for income generation.

- Seven households bought maize with income from enterprises other than *ganyu*. These included estate labour, trading (*ufa*, *madeya*, CD discs, snuff, cooked food), brewing *kachasu*, and selling herbal medicine. (The husband in H 7 made reed mats but kept the income for himself rather than use it to buy maize). Most of these enterprises required skills and some (such as trading *ufa* in town) also required working capital and absences from home that took time way from urgent tasks like weeding.

3.6 The resourcefulness of the resource - poor

The Oxford Dictionary defines the verb 'to cope' as 'to contend *successfully* with, deal *competently* with a situation or problem' (our emphases). Each household visit was an opportunity for learning about how households coped with poverty. Often at the end of an interview we wondered how some households would manage to survive until our next visit. Yet survive they did, in ways that always surprised us. We learnt never to under - estimate the resourcefulness of the resource – poor. The case – study of the Mpenda household (Box 1) provides an object – lesson in this respect.

4.1 *Generalised livelihood strategies*

Table 7 provides a calendar of livelihood strategies for the 15 case – study households. Sources of income have been divided into five categories: income from crops (shown separately for dryland and *dimba*), *ganyu*, gifts, and off – farm enterprises.

- *Ganyu* has a strong season pattern, since it depends chiefly on employment in agriculture. Except for February, *ganyu* employment was available throughout the year. The most common *ganyu* activities were weeding between December – January, land preparation (*kuwojeka*, *kuwunga*) between July – November, and moulding bricks between June – September. Apart from maize, the only crops that offered opportunities for *ganyu* were sweet potato (ridging, weeding), fieldpeas (ridging, weeding and harvesting), and *dimba* vegetables (watering, carrying to market).

- Gifts received by the case – study households also revealed a seasonal pattern. Throughout the year, the most common gifts were food crops from village fields. After the harvest of maize in May, however, gifts of packaged foods and non-food items (soap, cooking pots) were common, usually from more distant relatives. Cash was almost always given by relatives in town, not fellow – villagers.

- Off – farm enterprises were seasonal with some (cutting thatching grass, making reed mats) confined to the dry season. There were relatively few examples of off – farm enterprises between November – January. This may be because households reflect the scarcity of working capital for conducting small businesses (*geni*) during the hungry months, and the availability of income from *ganyu*.

Box 1: How to cope with a maize deficit: lessons for researchers.

The Mpenda household is relatively privileged. As a member of a burley club, it is entitled to fertiliser credit for maize. Consequently, the household is reasonably food secure and maize stocks usually last until January. Unlike households in the vulnerable cluster, it lacks a well – developed support network of relatives or older children. Linny's mother, Ellina Harisoni, lives with her, and Linny has only one sister, married and living elsewhere. Her four children - Lynod (15), Sautso (10), Sofina (7) and Nedson (4) – are still dependent on her. Thus, the household was unprepared for the calamity that struck in May last year. While Linny lay sick at home, most of the maize in their two dambo fields was stolen, leaving them with enough to last only until October.

How did the Mpenda household manage to obtain maize for seven months before the harvest of mature maize in May? We visited them on a regular basis from December onwards. At the end of each visit we asked about the source of cash for maize for the following weeks. Invariably, Linny Mpenda replied 'I don't know'. In time, we came to expect this reply, just as we expected to find on our next visit that the family had somehow managed to buy maize. These extracts from our field notes illustrate the various strategies that the family used to cope successfully with this unexpected maize deficit.

1 January
Cash for maize came primarily from *ganyu*. This has been difficult since the household had two maize fields and one burley field to weed at this time. To free labour for *ganyu*, however, the household allocated responsibilities for weeding. Linny weeds her own maize field and the burley field. Her mother works on her own maize field. The three children are assigned a small field of their own to weed, and assist their grandmother. While Linny does not work on her mother's field, her mother will assist her on her burley field but not on her maize field Normally Linny and her mother do *ganyu* together but if one is too busy the other goes alone.

8 January
Ganyu continues to be the main source of income. Lynod (15) did *ganyu* for MK 10 worth of *ufa* when the household had been without *nsima* for two days.

12 January
Linny bought maize with Starter Pack fertiliser that she sold for MK 95. Both Linny and her mother received one Pack each. Linny had not used the fertiliser from the Starter Pack (though she used the seeds) because she had already received MK 3,000 of fertiliser on credit from the burley club.

15 January
Ganyu is now very scarce. Linny knows two households that might offer her *ganyu* but one has no cash and the other will finish weeding on their own. As a result of doing so much *ganyu*, Linny and her mother are late weeding their own fields and estimate that, six weeks after planting, half the area they had planted to maize has not received a second weeding. Linny reports that some days they go to sleep without eating an evening meal. Mai Ellina sold eggs to buy cassava.

15 February
Linny bought MK 70 of maize from ADMARC with cash from the sale of beans. This was immediately pounded and eaten as *mgaiwa*. Lynod is not available for *ganyu* since he is now back at school and works in the burley field in the afternoon. The only *ganyu* available was making sweet potato ridges (*kupiza*) in the dambo, a back – breaking task that the household prefers to avoid.

1 March
Linny bought Mk 40 of maize from the local market using cash from the beans she sold on our last visit. She also sold un – graded burley to a private buyer for MK 70. Her youngest child has had malaria for a week now, preventing her from doing *ganyu* even if it was available. Her mother harvested beans for a sick relative; she was paid in beans and used the cash to buy maize. They began eating green maize on 22 February but since eating this continuously gives stomach pains they still need cash to buy maize for their evening meal.

16 March
Linny has been sick for two weeks since our last visit and was treated with herbs by a village *sing ' anga*. The household bought maize with MK 80 earned from the sale of *mphonda*.
On Sunday 7 March, the maize was sufficiently dry to harvest for *masalanga*. For lunch, they are eating green maize with *mphonda* while in the evening they eat *magaiwa wa masalanga* with pumpkin leaves.

31 March
The household is eating *mgwaiwa wa masalanga* from their own fields. She sold more burley to a private buyer for MK 215.

20 April
The household is now eating *ufa* as a change from *mgaiwa*, made from *masalanga* or partly-dried maize. They are too busy grading burley to look for *ganyu*.

11 May
The household finished harvesting their maize last week, without any loss to theft.

In conclusion, the Mpenda household coped with an unexpected maize deficit largely through market strategies: carefully allocating household labour to allow participation in the labour market for *ganyu*, and selling *mphonda*, beans, and burley tobacco when the demand for *ganyu* dried up towards the end of January. The household was also fortunate in having some fertiliser they could sell. The costs of these coping strategies included: late weeding on their own fields; selling beans that were needed for planting next season; a low price for burley sold to private buyers; and (possibly) a reduced period of self-sufficiency after May because of the need for early harvesting. At the end of this saga of hardship, however, Linny still owned a she – goat that she had been reluctant to sell because she wanted to keep it for breeding.

4.2 The 'economy of affection'

The economy of affection is defined as the "network of support, communications, and interaction among structurally defined groups connected by blood, kin, community or other affinities" (Hyden, 1983: 8). Its importance in Malawi is suggested by the modern Chichewa word for poverty – *umphawi* – which one dictionary translates as "the state of being without relations" (Illiffe, 1985).

Among our case – study households, gifts were an important component of off – farm income. With the exception of H13, which was self – sufficient in maize, all the case – study households exchanged gifts with other households (Table 9). The most common sources of gifts were friends (11 households), children (10) households, and in – laws (9 households). Only one of the four women heads of household that was divorced received anything from her former spouse. Gifts from sisters were more common in the stable female-headed cluster (H 10 – 12). The pattern of gift – giving by the case – study households was reciprocal with the exception of brothers, who received more gifts than they made.

Many gifts went unrecorded. Households regularly shared *nsima*, relish, and other cooked foods with their mothers, married daughters, and sisters. One household (H1) provided meals for elderly parents. Other types of food such as *makata* (pigeonpea or cowpea cooked in the pod and taken as a main meal) were often shared with neighbours. During the hungry season, children were sometimes sent to eat with their grandparents.

4.3 Ganyu

Ganyu (the word derives from the Portuguese *ganyao*, or bonus) is the vernacular name used to describe various forms of casual labour, from agricultural fieldwork to skilled tasks that are considered as piecework, such as carpentry or house-building.

- Of the 15 case – study households, 13 participated in *ganyu* (Table 9). In only nine households, however, did the number of days spent in *ganyu* exceed more than one working week.

- *Ganyu* was concentrated between December – January when 11 households participated. The next highest rate of participation was in October (six households). This confirms the view that demand for *ganyu* is highest during weeding and land preparation.

- Burley tobacco generated little *ganyu* directly, despite being a more labour – intensive crop than maize. Among the three households that grew burley, H1 hired no labour for burley yet both the household head and eldest son worked extensively as *ganyu* throughout the year. H2 hired labour for grading and for repairing the drying shed (building is traditionally a man's job). H3 hired labour only for grading. This lack of demand for *ganyu* is significant, since the village contained two burley clubs, and the section of the EPA in which the village was situated contained no fewer than 14 clubs.

- Only two households (H 1 and H 14) used *ganyu* as a regular strategy to earn off – farm income. These households did *ganyu* for 11 months of the year. One of these households (H 1) was slightly unusual in having a son who was saving to build his own house. This *ganyu* was done chiefly for a sister and a friend who was a bus driver and could not care for his own fields. In the other case (H 14), a young daughter did estate labour during the school holidays and both the husband and wife regularly looked for *ganyu* contracts.

- *Ganyu* was not a commonly – used income strategy among vulnerable households. The heads of these households were elderly and spoke openly of the need to conserve their strength for work on their own fields. In the vulnerable household where *ganyu* was recorded (H 7) the work was done by two sons and a grandson who returned home temporarily from jobs in town. Generally, households avoided the more fatiguing forms of *ganyu* (banking on heavy clay soils, *kupiza* or making sweet potato ridges) whenever possible.

- Only six households recorded working as *ganyu* for their relations. In H 11, this involved a brother who participated in *chipere ganyu* in the morning but was paid for any fieldwork done in the afternoon. In H12, a married daughter and her husband did *ganyu* for her mother and an aunt who lived in town. In H15, the husband was employed by his mother and sister during weeding, leaving his wife to weed their own fields alone.

- Two households – both in the vulnerable cluster – did *ganyu* in exchange for firewood. The third vulnerable household (H7) relied chiefly on cutting its own trees and gathering shrubs and leaves.

Households hiring **ganyu** *labour*

Of the 15 case – study households, 12 hired – in labour. The three households that did not hire labour included two households in the vulnerable cluster (H8 and H9) and H14. Two households hired labour for a short period: H7 (vulnerable) hired *ganyu* to weed for two days and paid in mangoes, while H15 employed a brother for one afternoon as repayment for a debt. In sum, 10 households hired *ganyu* for extended periods.

- Two households (H10 and H13) hired permanent labourers paid by the month. Both these households had salary income from husbands who worked as watchmen, one for ADMARC and the other for an estate. Neither permanent worker was a relation.

- Two burley households (H1 and H2) hired *ganyu* for land preparation and two households (H2 and H3) hired for grading burley

- Three households (H4, H6, and H10) used *thandize ganyu* to mould bricks, and one (H4) used *thandize ganyu* to cut thatching grass. *Thandize ganyu* is paid in kind (usually a meal, or sweet beer) rather than in cash. *Thandize* had fallen into disuse at our village sites in Mombezi EPA, where household H12 had to pay cash to obtain bricks.

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Box 2: How competitive is the market for *ganyu*?

A recent study has suggested that the market for agricultural *ganyu* in Malawi may be better understood in terms of patron – client relationships rather than in terms of the neo-classical model of competitive factor markets (Whiteside, 1999). In theory, a competitive factor market has to meet four conditions: homogeneity; divisibility; pure competition; and perfect markets. We argue that the market for *ganyu* at our study sites meets most of these conditions between January and February, the peak period for weeding:

A sellers' market?

- There is homogeneity in wage rates because, under a system known as *kuwerenga* (counting) *ganyu*, workers are paid according to the number of planting stations that they have weeded. There is also divisibility of labour since workers choose the length of time worked. This system maximised labour supply and ensured that weeding was finished quickly.

- There is pure competition because of the large number of employers bidding for labour. Rates for *kuwerenga ganyu* had increased sharply over the past season. In Kambuwa village in 1997/98, for example, *kuwerenga ganyu* rates were 10 *tambala* for four maize planting stations; in 1998/99, the rate had doubled to 5-10 *tambala* for three planting stations. Within a season, rates varied according to the distance between planting stations and the weediness of the field.

- Workers could usually choose whether to be paid in cash or kind. Payment in kind was made in *ufa* (flour), *madeya* (maize bran) or pieces of cassava. Households often preferred the convenience of payment in kind since these could be used to feed the household that very same day and avoided the need for milling charges. As we have seen (Section 3.2) better – off households usually conserved *madeya* to pay *ganyu* labour hired during this period. Small children can't eat *madeya*, however.

- None of the eight case study households that did *ganyu* reported problems finding *ganyu* during this period. Indeed, several households reported refusing offers of *ganyu* in order to minimise delays in weeding their own fields. Even households that had run out of maize might choose not to eat *nsima* for several days rather than delay weeding their own fields. For example, the 15 –year old son in H 3 did *kuwerenga ganyu* to earn MK 10 after the household had not eaten *nsima* for two days. His mother and grandmother were too busy with the household's own fields. Labour – rationing of this kind does not violate the neo-classical assumption of labour supply, however, since the choice is not between work and *leisure* but between *ganyu* and labour on the household's own fields. Where individuals choose to work is a rational economic decision based on the relative weights attached to food now and in the future.

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A buyers' market?

Although we found no 'patrons' in a South Asian sense, dispensing *ufa* or *ganyu* to needy neighbours, a patron – client model of the labour market may be relevant in the slack season when *ganyu* becomes harder to find. Subtle changes in the market for *ganyu* became evident about six weeks after planting. By this time second weeding had been completed on 53 % of the area planted to maize and most of the households that could afford to hire labour for banking had already completed second weeding on their fields (Orr *et. al.*, 1999c).

- Only on 12 January – seven weeks after planting – did households begin to complain of a shortage (*kusowa*) of *ganyu* employment. For example, the Mpenda household knew of two households that were large employers of *ganyu,* but one had run out of cash and the other was completing banking with family labour. Panel survey data showed that, when households were asked how many weeks after planting it became difficult to find employment as *ganyu* for weeding, only four (8 %) answered 'six weeks', while 65 % answered 'seven weeks'. By eight weeks after planting, when 77 % of the area planted to maize had already been banked, the proportion that reported difficulty finding *ganyu* had risen to 96 %.

- Often, members of case – study households who worked as *ganyu* in this period were employed by relatives. Thus, the wife in H 15 employed her brother, the wife in H14 found employment with her daughters and the head of H 12 hired her son-in-law for banking.

- Although households preferred payment in *ufa* or *madeya* to save costs on the purchase and milling of maize, the mode of payment changed from kind to cash. By this time, employers had either run out of *madeya* or *ufa* themselves or wanted to conserve what was left of maize stocks for household consumption. Thus, on 19 January H11 reported difficulty hiring *ganyu* because it could only pay in cash, not *ufa*.

In sum, the evidence suggests that "the" market for agricultural *ganyu* cannot be understood in terms of a single model, whether neo – classical, patron – client or otherwise. In the case of weeding, there are clearly two markets rather than one, distinguished by differences in supply, demand, and the mode of wage payment. Similarly, the labour market for land preparation, an activity spread over five months during a period when most households are still self – sufficient in maize, is likely to be different in nature from the labour market for weeding, when activity must be compressed into two months or less. We suggest that the seasonal nature of agricultural *ganyu* means that different markets may coexist, though at different times of the year.

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4.4 Off-farm enterprises

The calendar of livelihood strategies (Table 7) shows a total of 16 off – farm enterprises. Households that did not have any off-farm enterprise either grew cash crops (*dimba* vegetables, burley) or had alternative sources of cash income.

Of the 16 off – farm enterprises, two (selling firewood from a collapsed house, renting – out a field) were simply one – off opportunities to earn income while the others represented more regular income-generating strategies. Of the 15 case – study households, 11 participated in some form of off – farm enterprise (Table 10).

- All three vulnerable households had some off – farm enterprise. These were home – based activities using materials found close to home and with the homestead as the place of trade. (The elderly mother of the head of H11 also brewed *Kachasu*). Brewing *kachasu* and selling snuff were year – round activities. The capital required for these two enterprises was low, with one – week turnover. The returns from making reed mats were low but there were few other options available for an 80 year – old man.

- Some enterprises required significant working capital, a head for business (*mtima wa bisinesi*), knowledge and contacts for them to be profitable. H1 successfully traded *ufa* in town for several months of the year. H3 tried just once, but lost money because there was a glut on the market and she lacked regular customers. Similarly, H 11 lost money selling *kanyenya* while H15 lost trading in groundnuts. It took months for these household members to rebuild their working capital.

- Income from most off – farm enterprises was irregular not just because of the risk of losing capital. For example, social disapproval (orchestrated by the village chief) forced H8 to stop selling *kachasu* for three months when a daughter fell ill and died. Similarly, H1 discontinued trading *ufa* in town when the capital was consumed by the expenses of the initiation ceremony (*chinamwali*) for their son. Ceremonies like *chinamwali* and *chikumbutso* (held a year after the death of a family member) are usually held in the dry season.

- Selling cooked food (*zophikaphika*) was popular with women wanting to earn off – farm income in local markets. The start – up capital for this enterprise (MK 100 or so) was less than required for trading *ufa* and could usually be obtained by *ganyu* or crop sales. Selling cooked velvet beans was a useful source of income in the hungry months.

4.5 Aggregate off - farm income

Table 11 shows sources of income from various sources for the period December 1998 – November 1999. Incomes from agriculture and off – farm enterprises are net of cash costs. The costs of *dimba* crops were obtained from previous research in Matapwata EPA (Orr *et. al.*, 1999a). Figure 1 presents the share of household income from the four major components.

- In nine of the 15 case – study households, agriculture accounted for less than half of net household income. Agricultural income was important primarily for burley and *dimba* households. It was least important for vulnerable households.

- In three households, earnings from *ganyu* accounted for more than one – quarter of net income. Of these, only one (H7) was a vulnerable household. In this case the income was earned. The others were a burley household (H1) where the male head and his son both participated in *ganyu*, partly to compensate for the loss of maize to theft the previous year, and a stable male – headed household (H14) where both the head and his wife actively sought *ganyu* contracts.

- Gifts accounted for more than one – quarter of net income in four households. One of these was a vulnerable household (H8) with a son who sent regular remittances from town. The others were drawn from the set of stable male – and female – headed households. Two households in the stable male – headed cluster received a significant share of net income from gifts.

- Four households received more than one – quarter of net income from off – farm enterprises. Two of these households (H8 and H9) were members of the vulnerable cluster. In the case of H9, off – farm enterprises (selling snuff) accounted for three – quarters of net income. The remaining two households received income from herbal medicine (H1) and from a combination of rents and salary (H13).

- In absolute terms, the highest net incomes were found among two households belonging to the burley cluster (H1 and H2). Other households with relatively high incomes included a stable FHH (H11) that had three active adult members and H13, where the household earned income from house rental and a regular salary.

- Although vulnerable households had the lowest incomes from agriculture, income from other sources meant that they did not have the lowest total household incomes. All three vulnerable households had higher net incomes than two households in the *dimba* cluster ((H5 and H6) and one household in the Stable MHH cluster (H15).

- Low net incomes among two households in the *dimba* cluster (HH5 and H6) reflected low income from off – farm sources, particularly off – farm enterprise. Women's involvement in the marketing of dimba crops may not allow them sufficient time for other income – generating activities. At the same time, the fact that *dimba* households have regular cash income, particularly during the hungry months, may reduce the amount of income that they receive as gifts.

Cash income during the hungry months

Table 12 shows sources of income during the hungry period when 14 of the case – study households had run out of maize, and before green maize became available. Income from agriculture in this period was measured as the gross income from crop sales. Figure 2 presents the share of total household income from the four major components.

- Income from crop agriculture was important only for households with *dimba* gardens. Other households obtained only small amounts of cash from the sale of *dimba* maize (H14), mangoes (H7, H10, H12), or stored maize (H11).

- Income from *ganyu* was widely distributed but was absent for two of three *dimba* households, which obtained income from crop sales. With the exception of H7, *ganyu* was also not an important source of cash for vulnerable households in this period.

- Income from off – farm enterprises was particularly important for vulnerable households, where it exceeded the value of income from gifts. Income from off – farm enterprises was marginal for *dimba* and burley households, perhaps because of the high labour requirements for burley and *dimba* crops. The burley household that did devote time to off – farm enterprises (H1) was headed by a man, and the enterprise (trading *ufa* in town) was done by his wife.

- Income from gifts was important during this period, and not only for vulnerable households. Gifts provided the most important source of income for one burley household (H2) and a stable male – headed household (H14). Of three *dimba* households, two did not receive any gifts.

- Most households had a shortage of cash income during this period. This helps explain why *ganyu* labour for weeding and banking is usually paid in kind.

- In absolute terms, the lowest income during this period was found in H7, a vulnerable household. Unlike the other two households in this cluster, it had no income from off – farm enterprise. (Making reed mats was possible only during the dry season).

5.0 *Conclusion*

The findings confirm the importance of off – farm income for households that are often perceived simply as small farmers. Of 15 case – study households, in nine cases agriculture accounted for half or less of net household income. Naturally, in a poor season the share of income from agriculture would have been even lower.

The findings illustrate the importance of off - farm income for households with large maize – deficits. Households were classified as 'vulnerable' because of low food security in 1996/97, when heavy rainfall flooded the maize crop on low – lying dambo fields. In 1998/99, the three vulnerable households sampled in this study continued to have low income from agriculture. However, they were also well – provided with sources of off – farm income. The most important of these were *ganyu* done by sons who were temporary residents, making reed mats, brewing *kachasu*, and selling snuff. In consequence, total household income among food – insecure households was higher than in two *dimba* households that depended almost exclusively on agriculture. One could hardly wish for a better illustration of the importance of off – farm income.

These findings suggest that while food security is clearly related to vulnerability, the link between food security and poverty is less clear – cut. Households with low income from agriculture have developed livelihood strategies that provide a measure of income security, allowing them to buy the maize that they cannot produce for themselves. This is rational. It reflects the low economic returns to maize production where households lack labour and fertiliser. In these circumstances, off –farm income cannot be seen just as a 'coping mechanism' but as a calculated attempt to diversify household income and create the economic basis for a sustainable livelihood. Thus, poverty is a product not just of food insecurity but of income insecurity.

The low incomes of two of the three households in the *dimba* cluster raises interesting questions about the benefits of commercialisation. We expected that households that specialised in production for the market would have had high incomes. Although *dimba* households had high income from agriculture, however, income from off – farm sources was low, perhaps because the labour - intensive nature of vegetable production gave them fewer opportunities for *ganyu* or trading. For vegetable production to have a greater impact on household income, the cost of cultivation must be reduced through the introduction of manual irrigation and IPM techniques.

References

I. G. Brouwer, J. C. Hoorweg, and M. J. Van Liere (1997). 'When households run out of fuel: responses of rural households to decreasing fuelwood availability, Ntcheu District, Malawi'. *World Development*, **25** (2): 255 – 266.

B. Binns and J. P. Logah (1972). *Dictionary of Plant Names in Malawi*. (Zomba: Government Printers).

D. J. Casley and D. A. Lury (1981). *Data Collection in Developing Countries*. (Oxford: Clarendon Press).

G. Hyden (1983). *No Shortcuts to Progress: African Development Management in Perspective*. (Heinemann: London).

P. W. Heisey and M. Smale (1995). *Maize Technology in Malawi: A Green Revolution in the Making?* Research Report No. 4. (Mexico: International Maize and Wheat Improvement Centre (CYMMT)).

J. Illiffe (1985). 'The Poor in the Modern History of Malawi''. Pp. 245 – 292 in Centre for African Studies, *Malawi: An Alternative Pattern of Development. Proceedings of a Seminar at the Centre for African Studies, University of Edinburgh, 24 – 25 May, 1984*. (Edinburgh: Centre for African Studies).

S. Maxwell (1986). 'The role of case-studies in farming systems research'. *Agricultural Administration*, **21**: 147 – 180.

A. Orr, P. Jere, and A. M. Koloko (1997). Baseline Survey, 1996/97, FSIPM Project. October, Mimeo.

A. Orr and P. Jere (1999). Identifying smallholder target groups for IPM in southern Malawi'. *International Journal of Pest Management*. **45** (3): 179-187.

A. Orr. B. Mwale and D. Saiti (1999a). The Economic Potential of IPM for *Dimba* Crops. FSIPM Project. 26 March. Mimeo. 42 pp.

A. Orr. D. Saiti. and B. Mwale (1999b). *Osauka satopa*: case-studies of off-farm income in Blantyre Shire Highlands RDP. FSIPM Project. 28 October. Mimeo. 71 pp.

A. Orr. B. Mwale. and D. Saiti (1999c). 'The six – week window: farmers' decision – making for weeding'. Paper presented at the Workshop on Integrated Crop Management research in Malawi: Developing Technologies with Farmers. Club Makakola. Mangochi. 29 Nov – 3 Dec. Mimeo. 13 pp.

J. von Braun (1989). *The Importance of Non – Agricultural Income Sources for the Rural Poor in Africa and Implications for Food and Nutrition Policy*. Reprint No. 189. (Washington DC: International Food Policy Research Institute).

L. Moriniere. S. Chimwaza. and E. Weiss (1996). *A Quest for Causality: Vulnerability Assessment Mapping (VAM) Baseline 1996.* Lilongwe. World Food Prpgramme/Government of Malawi/Famine Early Warning System.

B. Mwale. A. Orr. and D. Saiti (1999). Sweet potato and smallholder food security in Blantyre Shire Highlands RDP. FSIPM Project. 16 November. Mimeo. 23 pp.

I. Scoones (1998). Sustainable rural livelihoods: a framework for analysis. Working Paper No. 72. Institute of Development Studies. University of Sussex.

M. Smale. with Z. H. W. Kaunda. H. L. Makina. M. M. M. K. Mkanadwire. M. N. S. Misoya. D. J. E. K. Mwale. and P. W. Heisey (1991). *Chimanga Cha Makolo.* Hybrids and Composites: An Analysis of Farmers' Adoption of Maize Technology in Malawi. 1989-91. CIMMYT Economics Working Paper 91/04.

M. Whiteside (1999). *Ganyu* labour in Malawi and its implications for Livelihood Security Interventions. OXFAM. May. Mimeo.

World Bank (1996). *Malawi: Human Resources and Poverty. Profile and Priorities for Action.* Report No. 15437 – MAI. March. (Washington. DC: World Bank).

Table 1. Comparison of resources and fertiliser use between case – study households and cluster groups.

Cluster	Household No.	Maize area, 1998/99 (ha)	Working adults (no).	Maize self-sufficiency (months) 1997/98	Maize self-sufficiency (months) 1996/97	Maize fertiliser rate, 1998/99 (kg N/ha)
Burley	H1	0.59	2	10	10	39
	H2	0.55	2	10	11	34
	H3	0.94	2	10	7	45
Average (n=11)		**0.75**	**3**	**10**	**9**	**70**
Dimba	H4	2.32	3	10	7	17
	H5	0.51	3	10	10	59
	H6	0.46	3	8	10	83
Average (n=22)		**0.89**	**3**	**7**	**8**	**56**
Vulnerable	H7	1.10	3	4	8	5
	H8	0.58	6	7	4	32
	H9	1.85	2	10	4	5
Average (n=24)		**0.71**	**3**	**7**	**2**	**27**
Stable FHH	H10	0.94	5	5	4	29
	H11	1.22	4	10	8	11
	H12	0.70	5	6	8	105
Average (n=34)		**0.73**	**3**	**8**	**9**	**49**
Stable MHH	H13	1.35	3	0	8	57
	H14	0.81	3	4	7	34
	H15	0.34	2	5	8	56
Average (n=29)		**0.82**		**8**	**8**	**36**

Table 2. Agricultural activities of case-study households, by month and landtype.

Month	Landtype: *Dimba*	Dryland: Maize	Dryland: Burley	*Dambo*
Nov	Water tomato, green beans, rape Harvest tomato planted in Jul. Plant tomato	Harvest pigeonpea stems *Kuwojeka* *Kuwunga* *Kukhwaza* Plant maize, beans, and pigeonpea Plant sorghum, finger millet, groundnuts	Water nursery Harvest pumpkin leaves Transplant seedlings	*Kuwojeka* *Kuwunga* *Kukhwaza* Plant maize and pigeonpea Plant rice
Dec		First weeding	First weeding	First weeding
Jan		Second weeding	Second weeding	Second weeding
Feb	Harvest *dimba* maize planted in Oct.	Harvest green maize and beans	Harvest	Harvest green maize Prepare land for sweet potato and field peas Plant 1 st crop sweet potato and field peas
Mar	Plant mustard and rape Harvest tomato planted in Nov.	Harvest maize for *matindili* and *masalanga* Ridge for *mbwera* crops and sweet potato	Harvest and dry leaves Sell to Intermediate Buyers	Harvest maize for *matindili* and *masalanga* Weed 1 st crop sweet potato and field peas Ridge for 2 nd crop sweet potato and field peas
Apr	Transplant cabbage Plant tomato Water cabbage, tomato, mustard and rape Harvest mustard and rape planted in Mar.	Harvest maize for *matindili* and *masalanga* Plant *mbwera* crops and sweet potato	Grading Baling Sell on auction floor	Plant 2 nd crop sweet potato and field peas Harvest 1 st crop field peas

		Landtype		
Month	***Dimba***	**Dryland**		***Dambo***
		Maize	**Burley**	
May	Water tomato. cabbage Prepare land for mustard and rape	Weed *mbwera* crops and sweet potato Harvest and shell maize for *uta* Harvest groundnuts. finger millet. green sorghum Harvest early pigeonpea Harvest sweet potato	Grade Bale Sell on auction floor	Harvest and shell maize for *uta* Harvest rice Ridge for 3 rd crop field peas Plant 3 rd crop field peas Weed 2 nd crop sweet potato and field peas
Jun	Prepare land for maize Plant mustard and rape Water tomato. cabbage. mustard and rape Harvest cabbage planted in Apr.	Finish shelling maize Start *kuwojeka* Harvest groundnuts. velvet beans. early pigeonpea Harvest green sorghum. finger millet Harvest sweet potato *Kukhwaza* on groundnut fields	Complete grading. baling. and sale on auction floor Remove stalks from field	Harvest 2 nd crop field peas Harvest 1 st crop sweet potato
Jul	Prepare land for tomato Plant tomato. green beans Water tomato. green beans	*Kuwojeka* Harvest early pigeonpea Harvest sweet potato. velvet beans. sorghum	Remove stalks from field	Harvest 2^{nd} crop field peas Harvest sweet potato
Aug	Harvest tomato planted in Apr. Harvest mustard and rape planted in Jun. Water tomato. mustard. rape. maize	*Kuwojeka* *Kuwunga* Harvest pigeonpea	Prepare nursery Repair thatch on drying barn	*Kuwojeka* *Kuwunga* Harvest 3 rd crop field peas
Sep	Prepare land for green beans Water tomato. maize. green beans	*Kuwojeka* *Kuwunga* Harvest pigeonpea. *Nkungudzu*. velvet bean	Prepare nursery Sow nursery with tobacco and pumpkins	*Kuwojeka* *Kuwunga*
Oct	Water tomato. maize. green beans Prepare land for tomato	*Kuwojeka* *Kuwunga* Finish harvesting pigeonpea	Water nursery	*Kuwojeka* *Kuwunga*

Table 3. Stages in maize consumption among case-study households

No.	Description	Plant growth stage	Month
1	*Msinde*	Reproductive stage	Early February
2	*Chimanga cha chiwisi*	Cobs full size, kernels in soft dough stage	Mid-February
3	*Matindili*	Kernels in soft dough stage	Early March
4	*Masalanga*	Kernels almost fully dry	Late March – late April
5	*Ufa woyera*	Kernels mature and fully dried	Early May
	Stem eaten raw as a sweet snack		
	Roasted or boiled in water		
	Shelled and dried, then either (1) soaked, dried and pounded to make *ufa* or (2) pounded to make *mgaiwa*		
	Shelled and dried, then pounded to make *mgaiwa*		
	Sorted and shelled, followed by first pounding (*kukonola*)		
	Mphale	*Masapi* *Madeya*	
	Soaked and washed	Cooked with sugar or groundnut flour to make *mangungu*	
	Second pounding		
	Ufa woyera		

Table 4. Food calendar for case-study households, FSIPM research sites, Nov 1998 – Oct 1999.

Category	Type of food	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Cereals	Sorghum												
	Finger millet												
Roots	Cassava												
	Sweet potato												
Cucurbits	Pumpkins												
	Mphonda												
	Pumpkin leaves												
Pulses	Groundnuts												
	Beans												
	Cowpeas												
	Okra												
	Kabaifa												
	Velvet beans												
	Pigeonpea												
	Nkhungudzu												
	Tanaposi												
	Kamupanda												
	Mfuso												
Wild plants	*Chisoso*												
	Denje												
	Mpira												
	Bonongwe												
Season			*Dzinje*							*Chilimwe*			

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Table 5. Types of food eaten by three vulnerable households, February - November 1999.

Type of food	Household 7	Household 8	Household 9
Maize	Started eating green maize on 3 March, two months before harvest on 1-3 May. Did not harvest to make *matindili* because dislikes sweet taste but harvested to make *mgaiwa wa masalanga*. Most harvested maize eaten as *mgaiwa*, not *ufa woyera*, usually because she lacked cash for milling and because maize lasts longer this way. Husband sold 1.5 bags of maize without wife'knowledge. Ran out of maize in August, four months after harvest of dry maize. In September started buying *madeya* to eat, bought from her married daughter using earnings from son's *ganyu*.	Started eating green maize on 22 February. Stopped buying maize in March, and ate own maize as *mgaiwa wa matindili*. Also ate *mgaiwa* made from maize damaged by termites. Final harvest on 19 May, after which household ate both *ufa woyera* and mgaiwa.. Ran out of maize in October, roughly five months after harvest of dry maize. Thereafter maize bought with earnings from *kachasu* brewing and remittance from son in town. *Madeya* not eaten but used for brewing *kachasu*.	Started eating green maize on 17 March. Between March – April ate *mgaiwa wa matindili* and *masalanga*. Final harvest of dry maize on 7 May. Ate *mgaiwa* at lunch and *ufa woyera* in evening because the harvest was so small. Ran out of maize in October, roughly six months after harvest of dry maize. Thereafter relied on maize bought with earnings from selling snuff. *Madeya* not eaten but mostly fed to their pig, for which they also buy *madeya*.
Other cereals	Mixed sorghum and maize to eat as *nsima*. Also pounded sorghum into flour for eating separately as *nsima*.	None.	Rice planted in the dambo, eaten as porridge for breakfast.
Sweet potato	Planted with maize but crop failed. Second planting	Planted late and harvested in late June. Ate as breakfast and snack.	Ate for breakfast or lunch between late April – early June.
Relish	Between February – July ate mostly pumpkin leaves. Availability of pumpkin leaves extended by planting on site of old house. Beans not eaten because needed to keep for seed. Other relishes included wild okra, *kabaifa*, *kamchembere*, amaranthus planted on a termite mound, blackjack, and leaves of the *mpira* tree. Pigeonpea and velvet beans usually eaten as a main meal in the form of *makata*. Also ate cassava and sweet potato leaves. No record of buying relish.	Chiefly pumpkin leaves between February – May. Bean crop failed due to water logging. Other relishes grown were okra, *nkhungudzu*, and *tanaposi*. From July-October ate pigeonpea and some field peas. Bought mustard and beans with earnings from brewing.	Availability of pumpkin leaves extended into July by planting on termite mound. Bean crop and pumpkins badly damaged by water - logging. Eating *mfuso* from green pigeonpea leaves in Aug and Sep. Pigeonpea eaten mostly as *makata*. Other relishes included *nkhungudzu* (eaten green), okra (wild and planted) and *tanaposi*. Bought mustard and bean leaves.
Meat/fish	Fish recorded twice, both times received as a gift. No meat recorded.	Fish recorded seven times. No meat recorded.	Fish recorded four times. No meat recorded.

Table 6. Sources of cash for maize purchases between November 1998 – February 1999, by household.

Category	Household	November	December	January	February
Burley	H1	*Ganyu*	*Ganyu*; trading *ufa* in town	*Ganyu*; trading *ufa* in town	Sold a goat.
	H2		Cash from daughter in town		Cash gift from daughter in town.
	H3	Sold chickens	*Ganyu*	Sold fertiliser, eggs	Sold beans.
Dimba	H4	Sold cabbage and tomato.	Sold tomato	Savings from tomato sales; trading *madeya*	Trading *madeya* and cooked velvet beans; *ganyu*; cash gift from brother.
	H5			Sold green beans, tomato.	
	H6				Sold green beans; sold goat.
Vulnerable	H7	Not known	Sold mango; *ganyu*; cash from son in town; gift from sister.	Cash from son in town; gift from friend.	Sold goat; cash from elder sister and son in town
	H8	Sold goat; cash from son in town	Savings from goat sale; brewing *kachasu*; cash from son in town	Brewing *kachasu*; cash from son in town	Brewing *kachasu* and cash from son in town.
	H9	Sold groundnuts and chickens	Sold cassava, thatching grass, and snuff.	Selling snuff; *ganyu*; cash from relative in town	Selling snuff; cash from uncle and brother.
Stable FHH	H10	Husband's salary	Husband's salary; selling herbal medicine	Sold chilli and mango; trading *madeya* in town	Husband's salary; selling herbal medicine.
	H11				Savings from sale of goat; sold beans.
	H12	Sold mango; *ganyu*; cash from sister and brother-in-law	Sold mango and cassava; *ganyu*; cash from son in town and brother	Sold goat; *ganyu*; cash from son in town	Gifts from sister in town and brother-in law; *ganyu*.
Stable MHH	H13				
	H14	Estate labour by daughter	*Ganyu*; estate labour by daughter; allowance from training course	Estate labour by daughter; *ganyu*	Gift from government clinic; *ganyu*; sold *dimba* maize
	H15	*Ganyu*; savings from tomato sales; trading CD discs in town	Trading CD discs in town; trading cooked velvet beans; *ganyu*	*Ganyu*; sold *dimba* maize	*Ganyu*; loan from friend; sold chickens.

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Table 7. Generalised livelihood strategies among case – study households, FSIPM research sites, November 1998 – October 1999.

Month	Income from crops: *Munda*	Income from crops: *Dimba*	*Ganyu*	Gifts received	Off – farm enterprises
Nov	Maize Pigeonpea	Rape Tomato	*Kuwunga*	[SPS fertiliser] Maize seed *Madeya* Groundnuts Bread Sugar Rice Soap Cash	Brewing *kachasu* Selling snuff
Dec		Tomato Cabbage	First weeding Second weeding Estate labour		Brewing *kachasu* Trading *madeya* Selling snuff
Jan		Tomato Green beans	Second weeding Estate labour	Maize	Brewing *kachasu* Trading *madeya* Selling snuff
Feb	Beans *Mphonda* Mangoes	*Dimba* maize No *dimba* vegetables sold		Maize *Ufa* Green maize Cash	Brewing *kachasu* Trading *madeya* Selling snuff Trading cooked velvet beans Selling firewood Butchering goats Herbal medicine
Mar	Burley (private buyers) Sugarcane Beans Avocado	Mustard Mustard seed	Ridging for sweet potato and *mbwera* crops	[WFP maize] Maize *Mgaiwa* Pumpkins Mustard Beans Firewood Cash	Brewing *kachasu* Selling snuff Herbal medicine Making reed mats Trading *ufa* in town
Apr	Burley (auction) Sweet potato Avocado Guava Orange	Mustard Mustard seed Rape Chilli	Weeding sweet potato Grading burley Ridging fieldpeas	Mustard seed Beans Cowpeas Sweet potato Maize *Ufa* Pumpkins Soap Cash	Brewing *kachasu* discontinued after death of daughter Selling snuff Trading *ufa* in town Making reed mats Herbal medicine Trading groundnuts

Month	Income from crops		Ganyu	Gifts received	Off –farm enterprises
	Munda	Dimba			
May	Maize Burley (auction) Fieldpeas Soya Avocado	Mustard Rape Chilli	Ridging fieldpeas. Weeding fieldpeas Harvesting maize Carrying sugarcane. cabbage Moulding bricks Cutting thatching grass	Cash Soap Rice Sugar Sweet potato Cooking oil Groceries Meat Fish Wristwatch	Trading *ufa* in town Selling cooked sweet potato
Jun	Maize Sorghum Sweet potato Fieldpeas Velvet beans	Mustard Rape Cabbage Pumpkin leaves Green beans Chilli	Carrying cabbage to market Moulding bricks Cutting bamboo Estate labour *Kuwojeka*	Maize. beans Cowpeas. fieldpeas papaya. finger millet. soap. medicine. groceries. meat. chicken. cooking pots cash	Re-started brewing *kachasu* Trading *ufa* in town Trading fried fish Selling fermented sorghum Selling cooked sweet potato
Jul	Maize Pigeonpea Sweet potato Fieldpeas *Nghungudzu*	Cabbage Rape	*Kuwojeka* Moulding bricks Carrying sugarcane	Bread. sorghum Rice. beans Soap. sugarcane Groundnuts. Pigeonpea. cooking oil. chicken. cash	Making reed mats Brewing *kachasu* Cutting thatching grass Selling *madeya* Herbal medicine
Aug	Maize Beans Pigeonpea Fieldpeas *Nkhungudzu*	Pumpkin leaves Tomato	*Kuwojeka* Moulding bricks Harvesting field peas	Rice. Pumpkin leaves *Nkhungudzu* Eggs. Chicken. Soap. toiletries. cash	Brewing *kachasu* Selling snuff Making reed mats Herbal medicine
Sep	Maize Green maize Pigeonpea (dry) Cassava leaves	Rape	*Kuwojeka* *Kuwunga* Moulding bricks Harvesting fieldpeas	Rice Pumpkin leaves Cabbage *Mtuso* Eggs Cash	Brewing *kachasu* Selling snuff Making reed mats No customers for herbal medicine
Oct	Maize Pigeonpea (dry) Fieldpeas *Nkhungudzu*	Pumpkin leaves Rape Tomato	*Kuwunga* Watering *dimba* vegetables Cutting firewood	Maize Millet Sugar Cash	Brewing *kachasu* Selling snuff Renting – out field Herbal medicine Selling *madeya* Trading velvet beans Selling cooked sweet potato

Table 8. *Ganyu* employment among case – study households, December 1998 - November 1999.

Category	Household													Total days (No.)	Total Income (MK)	Contract with relatives (%)
Burley	H1	21	24	13	3	8		55	18	24	25	19	24	222	9633	0
	H2			4										4	29	0
	H3	2	25	9									3	39	562	0
Dimba	H4		2	3	5	1	5							16	354	0
	H6						3	8	2				6	19	503	40
Vulnerable	H7		5	7							30	46	21	109	2837	20
	H8		1											1	9	0
	H9			2										2	30	0
Stable FHH	H10		7	4										11	113	0
	H11		6											6	152	100
	H12	2	27	26	8		5		9	4	8			89	2,047	80
Stable MHH	H14	7	22	17	2		3	17	15	3	13	17	24	140	2984	23
	H15		23	14							12		2	51	966	50 - (?)
	Month	N	D	J	F	M	A	M	J	J	A	S	O			

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Table 9. Source of gifts received by case – study households, December 1998 - November 1999.

Household	Gifts received from								Gifts given to							
	Spouse	Children	Sister	Brother	Mother	Father	In-laws	Friend	Spouse	Children	Sister	Brother	Mother	Father	In-laws	Friends
Burley																
H1		■						■		■					■	■
H2		■	■							■	■		■			■
H3	■				■			■	■		■		■			■
Dimba																
H4				■			■	■					■		■	■
H5			■	■			■								■	
H6		■				■	■	■		■				■	■	■
Vulnerable																
H7		■						■		■						■
H8		■						■			■					
H9				■			■	■							■	
Stable FHH																
H 19	■	■	■		■		■	■		■	■				■	■
H11		■		■			■	■		■	■	■				■
H12	■	■	■	■			■	■		■	■	■			■	■
Stable MHH																
H13		■								■	■					■
H14		■	■			■	■	■			■	■		■		■
H15				■	■		■				■		■		■	

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Table 10. Off – farm enterprises among case – study households, November 1998 – October 1999.

Cluster	Household	Enterprise	Net income (MK/month)	N	D	J	F	M	A	M	J	J	A	S	O
Burley	H1	Trading *ufa* in town	350 – 531	✓	✓	✓		✓	✓	✓	✓	✓			
	H3	Trading *ufa* in town	Loss								✓				
Dimba	H4	Trading *madeya* in village	85			✓									
		Selling thatching grass	469				✓								
		Selling cooked velvet beans	n.a.				✓				✓				
Vulnerable	H7	Making reed mats	137							✓	✓	✓	✓	✓	
	H8	Brewing *kachasu*	480	✓	✓	✓	✓				✓	✓	✓	✓	✓
	H9	Selling snuff	469	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stable FHH	H10	Selling herbal medicine	667	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Trading *madeya* in town	416		✓	✓									
		Trading ADMARC maize	57			✓									
	H11	Brewing *kachasu*	120										✓	✓	✓
		Selling *kanyenya*	Loss									✓			
Stable MHH	H13	House rental	350	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Husband's salary	300	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	H14	Selling cooked velvet beans	140	✓											
	H15	Trading CDs in town	250								✓			✓	
		Selling cooked food	50	✓							✓			✓	
		Trading groundnuts	8						✓						

Table 11. Sources of income among case – study households, December 1998 – November 1999.

Cluster	Household	Gross farm income	Agricultural cash costs			Net farm income	*Ganyu*	Gifts	IGAs	Total
			Ganyu	Fertiliser	*Dimba*					
Burley	H1	18,300	450	3,900	-	13,950	9,633	412	3,529	27,524
	H2	25,645	1,203	3,000		21,442	29	4,752	85	26,308
	H3	13,335	-	2,685		10,650	562	378	110	11,700
Dimba	H4	14,964	133	1,650	635	12,546	354	238	1,154	14,292
	H5	5,951	134	755	854	4,208	-	-	-	4,208
	H6	6,132	-	1720	714	3,698	503	606	-	4,886
Vulnerable	H7	2,360	-	38	-	2,322	2,837	685	322	6,166
	H8	2,490	-	-	-	2,490	9	3,348	4,320	10,167
	H9	2,977	-	-	-	2,977	30	865	5628	9,500
Stable FHH	H10	7,363	1,357	245	-	5,761	113	3,729	7,337	16,940
	H11	21,775	700	-	-	21,075	152	1,152	360	22,739
	H12	6,300	310	1,000	-	4,990	2,047	3,845	70	10,952
Stable MHH	H13	11,663	3,700	1,700	-	6,263	-	6,243	7,200	19,706
	H14	3,135	75	1,052	-	2,008	2,984	3,187	140	8,319
	H15	3,000	40	155	-	2,805	966	786	1,158	5,715

Table 12. Sources of income among case – study households, December 1998 – February 1999.

Cluster	Household	Agriculture	*Ganyu*	Gifts	IGAs	Total
Burley	H1	-	2.330	10	1.322	3.662
	H2	-	29	1.853	-	1.882
	H3	-	515	115	110	740
Dimba	H4	2.113	222	135	85	2.555
	H5	1.308	-	-	-	1.308
	H6	890	-	-	-	890
Vulnerable	H7	14	219	356	-	589
	H8	-	9	1096	1920	3.025
	H9	-	30	150	1.876	2.056
Stable FHH	H10	60	113	371	2.668	3.212
	H11	480	152	-	-	632
	H12	68	775	539	70	1.452
Stable MHH	H13	-	-	3.090	2.400	5.490
	H14	195	1.032	827	20	2.074
	H15	55	425	20	650	1.150

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Fig. 1. Sources of household income
Dec 1998 - Nov 1999

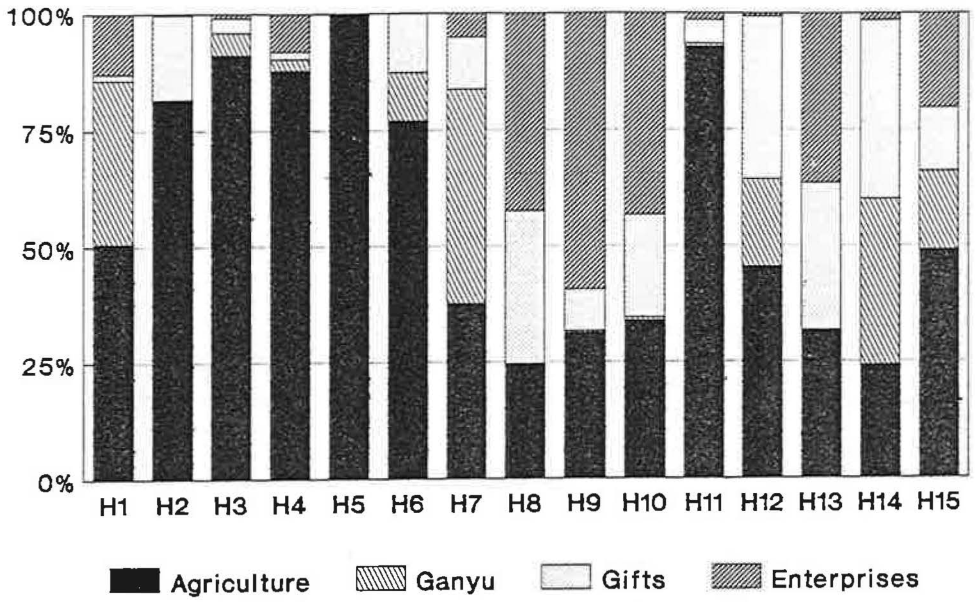
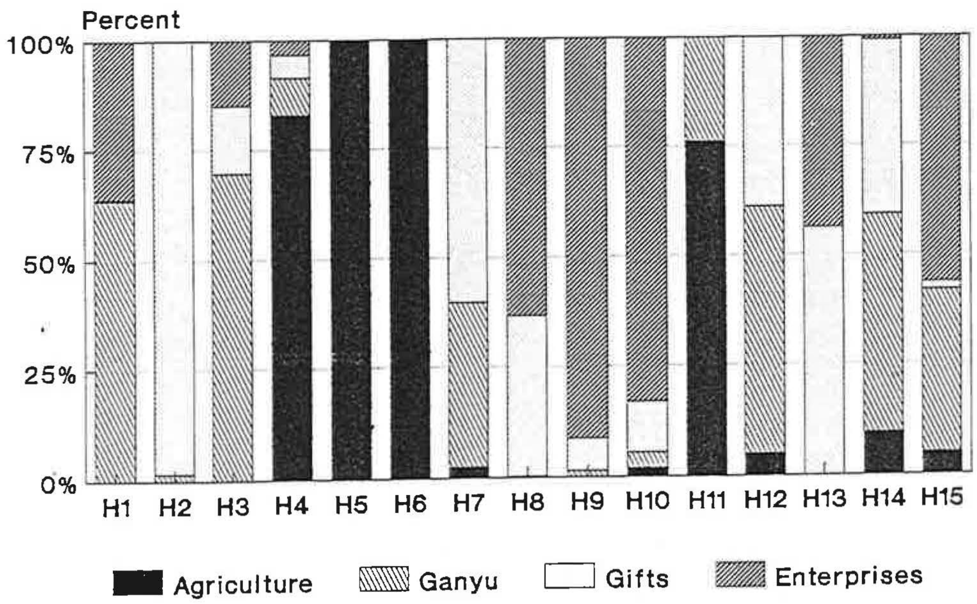


Fig. 2. Sources of household income
Dec 1988 - Feb 1999



Appendix 1. Profiles of case study households

Burley cluster

H1. Bambo and Mai Bitoni

Bambo Bitoni (42) lives in Lidala village, Mombezi EPA. He has been a burley grower since 1992 with the 'Chithandizo' club. Being a club member also enables the household to acquire fertiliser for their maize garden. Mai Bitoni regularly trades *uta* in Limbe. Their eldest son Stephen ( ) has recently built his own house but still eats with the family. There are six other children. Both Bambo Bitoni and Stephen find regular employment as *ganyu* labourer. The household supports Mai Bitoni's elderly parents.

H2. Mai Dorothy Ayimu

Mai Ayimu (46) lives in Lidala , Mombezi EPA. She separated from her husband …years ago. She has been a member of the Chithandizo burley club since 1992. Her household consists of two daughters Alice and Mwandida. Two married daughters and one son live in town. Her widowed mother lives next door. Alice and Mwandida do *ganyu* infrequently and use the money for their own needs. Mai Ayimu normally hires *ganyu* for all the field activities. She regularly receives cash from her two married daughters in town.

H3. Mai Linny Mpenda

Mai Mpenda (36) lives in Lidala Village, Mombezi EPA. She separated from her husband two years ago after six years of marriage. She lives with her widowed mother Elleni Harisoni (aged 50) and three young children, the eldest aged 15. She has been the only female member of the Tiyambe burley club since 1992. She and her mother cultivate their own fields but pool their maize harvest. The household rents an upland field every year for growing maize. In 1999 they ran out of maize early because maize was stolen from their dambo field. Mai Mpenda and her mother do *ganyu* during the period for weeding and banking on their own. In June Mai Mpenda accompanied Mai Bitoni to Limbe to sell *uta* but could not get customers. The household has no other form of off-farm income.

Dimba cluster

H4. Bambo and Mai Baluti

Bambo Baluti (42) lives in Kambuwa village, Matapwata EPA. The family cultivates about 0.7 ha and rents out or fallows almost 0.1 ha. It also cultivates his mother's *dimba* garden in the neighbouring village of Didimo. Bambo Baluti takes primary responsibility for the *dimba* garden while his wife looks after the dryland fields. The household has five small children. The eldest works with his father in the *dimba*. Bambo Baluti's young brother, who stays with the family, also helps with cultivation. The household used to belong to a credit club that collapsed in 1994. During that period the household used to be self-sufficient in maize but today runs out of maize five months before the next harvest. The household has received credit through the APIP scheme for the past two seasons. Mai Baluti sometimes trades *madeya* and sells cooked food. Bambo Baluti also does *ganyu*, butchers goats, and sells thatching grass.

H5. Bambo and Mai Tomato

Bambo Tomato (33) lives in Kambuwa village, Matapwata EPA. He is married with two young children. The household has three upland fields and one *dimba* garden. He does all the fieldwork in the dimba garden and most of the work in the upland. His wife assists in marketing *dimba* vegetables. Bambo Tomato never does *ganyu*. In 1999 the household was self-sufficient in maize until March (ie. 10 months of the year). They own four goats. A careful farmer, Bambo Tomato keeps a set of accounts for his *dimba* garden. She is a sister to Mai Mafaiti (H6).

H6. Bambo and Mai Mafaiti

Bambo Mafaiti (43) lives in Kambuwa village, Matapwata EPA, with his wife, son Thomas (14) and young daughter aged four. They cultivate 0.47 ha, consisting of two upland fields and one *dimba* garden. In 1999, the household ran out of maize in early February. The family own three goats. Both Bambo Mafaiti and Thomas participate in *ganyu*. They regularly exchange food with a daughter, separated from her husband, who lives next door.

Vulnerable cluster

H7. Mai Muthowa

Mai Muthowa, who is in her sixties, lives in Magomero village, Matapwata EPA. Mai Muthowa has four fields totalling 1.14 ha but in 1999 half remained fallow due to shortage of seed. She does not do *ganyu*. The household ran out of maize in July. Of Mai Muthowa's 14 children, eight are living. A married daughter who lives next door and three sons working in town provide her with support. Bambo Muthowa (an octogenarian) visits periodically but usually disappears when there is fieldwork to be done. He makes reed mats, but keeps the income for himself. After a quarrel in October, she threw his belongings out of the house. He left for town and did not return.

H8. Mai Maganga

Mai Maganga, who does not know her real age, lives in Chiwinja village, Mombezi EPA, with her daughter Katalina and three grand-children. Agnes passed away in April 1999. The family cultivate 0.57 ha of which 0.41 ha lies in the Chitera dambo where maize is frequently damaged by floods. In 1999 the household ran out of maize in October. Mai Maganga earns cash by brewing *kachasu*. Public disapproval forced her to stop brewing for two months after Agnes' death. Gerard, a son who works in Limbe, provides regular financial support.

H9. Mai Daina and Idesi Chilinkhonde

Mai Diana and Mai Idesi Chilinkhonde, two elderly sisters, live in Chiwinja village, Mombezi EPA. They cultivate 0.85 ha, of which 0.84 ha lies in the Chitera dambo, where maize is frequently lost to floods. In 1999, the household ran out of maize in December. Although the two women cultivate separate fields and have their own *nkokwe*, they eat together, along with their elderly brother Isaac who lives next door. They rarely do *ganyu* except to earn firewood. Their main source of cash is selling snuff, which they do from home. They own a sow and four piglets.

Stable female-headed cluster

H10. Mai Marichi

Mai Marichi (44) lives with a daughter and grandchild in Magomero village, Matapwata EPA. Her husband, Mr Milanzi, is a polygamist who lives chiefly with his first wife. He is a watchman for ADMARC. Levison, a nephew, works as a street trader in town. Enock, a son, left home during the year and found employment with Blantyre City Council. Mai Marichi cultivates three upland fields with the help of a permanent labourer. In 1999, the household ran out of maize in August. Mai Marichi spent a few weeks in town trading *madeya* to earn money for fertiliser. Her main source of off - farm income is selling herbal medicine. She also receives regular financial help from her son – in – law.

H11. Mai Muhemwe

Mai Muhemwe (50) lives with her elderly mother Mai Wesele and two daughters (Eliza and Grace) in Lidala village, Mombezi EPA. Willard, her brother, eats with them when not with his wife in Zomba. The household cultivates three fields (0.54 ha) and Mai Muhemwe, Mai Wesele and Eliza have separate *nkhokwe*. The household practice *chipere ganyu*, working in rotation in each other's fields. They eat together as one household. In 1999 they ran out of maize in February. Most household income derives from the sale of beans, fieldpeas, and pigeonpea. Grace briefly traded in *kanyenya* (fried fish) in June and in August Mai Wesele started brewing *kachasu*, something she had not done for six years. She explained that formerly she had earned cash from selling eggs but that her chickens had died from Newcastle disease.

H12. Mai Chipakula

Mai Chipakula (46) lives with her elderly mother Enelsei Magomero and children in Lidala village. Mombezi EPA. Her married daughter Kesta and husband Yusuf were members of the household during weeding but ate separately after February. The household cultivates 0.7 ha. Mai Chipakula, her mother Enelesi, and her married daughter Enesi cultivate separate fields. They eat together as one household and rotate labour on each other's fields. In 1999 the household ran out of maize in September. Isaac, her eldest son, is an idler who stole pumpkins, maize and fertiliser from the household to finance his leisure pursuits. The two younger children herd goats. The household's only source of off-farm income is *ganyu*. They are supported financially by the Chilinkhonde family (her elder sister is married to the brother of the Chilinkhonde household, H9), by a married daughter living in town, and also by Mai Chipakula's son working at nearby Njuli quarry.

Stable male-headed cluster

H13. Bambo and Mai Magreen

Mai Magreen ( ) lives in Chiwinja village, Mombezi EPA, with her husband and one son. Her husband works as a night watchman at a nearby estate. They cultivate 1.25 ha of land divided into four fields, of which three are in the Chitera dambo. The household employs one permanent labourer (a non-relative) to help with fieldwork. The family is self-sufficient in maize. Sources of off-farm income include her husband's salary, rental income from a house in Zomba, and financial support from a married daughter who lives in town. The household is comfortably off. Mai Magreen complains that jealous neighbours regard her as a witch.

H14. Bambo and Mai Basikolo

Bambo Basikolo ( ) and his wife live in Kambuwa village, Matapwata EPA. The household has four children. A married daughter lives a few metres away. The harvest from the household's *dimba* and dryland fields rarely lasts up to September. To buy maize the household does a lot of *ganyu*. The eldest daughter Eliza (21) is regularly employed as an estate worker during school holidays. Bambo and Mai Basikolo have no other form of off – farm income except for *ganyu*. (Sometimes, Mai Basikolo sells cooked velvet beans). In 1999 the household was assisted by a 50 kg bag of maize as part of a programme for malnourished children. The household managed to get fertiliser from APIP for the past

H15. Bambo and Mai Chikoti

This young couple, both in their twenties, live in Kambuwa village, Matapwata EPA. They have two daughters, Grace aged 3 and Bertha, born July 1999. The household cultivates two upland fields totalling 0.33 ha and in 1999 they ran out of maize in August. Mai Chikoti sometimes trades cooked food (sweet potato, velvet beans) to earn cash. Bambo Chikoti, who used to travel to Mozambique to trade before he married, now trades CD discs in town. The family own a pig and piglets. Bambo Chikoti is a member of a club run by the Adventist Development Relief Agency (ADRA) teaching AIDS awareness, through which he sometimes obtains cash and medicine. Bambo Chikoti did *ganyu* for his relations between December – February 1999, leaving his wife to cope with weeding and banking their own fields. His earnings from *ganyu* were kept secret from his wife. Relations between the couple deteriorated and the relatives had to intervene to prevent separation.

Appendix 2

Schedule of visits to case – study households

No.	Day	Month	Reference period	Period
1 - 17	Visits at three – day intervals between 28 Nov - 21 Jan	Dec Jan	Dec Jan	I
18	14 – 15	Feb	Feb	I
19	1 – 2	Mar	Feb	I
20	16 – 17	Mar	Mar	II
21	30 – 31	Mar	Mar	II
22	20 – 21	Apr	Apr	II
23	11 – 12	May	May	II
24	1 – 2	Jun	May	II
25	28 – 29	Jun	Jun	III
26	12 – 13	Jul	Jul	III
27	29 – 30	Jul	Jul	III
28	9 – 10	Aug	Aug	III
29	30 – 31	Aug	Aug	III
30	13 – 14	Sep	Sep	IV
31	1 – 2	Oct	Sep	IV
32	18 – 19	Oct	Oct	IV
33	1 – 2	Nov	Oct	IV
34	24 – 25	Nov	Nov	IV

Appendix 3

Off – farm income strategies checklist

*Date of interview:*___________________

*Reference period*___________________*(previous two weeks)*

*Persons interviewed:*____

1. Food security

Is the household buying maize?

If not, what type of maize is the household eating?

What type of relish is being eaten?

What is the household eating today?

Breakfast

Lunch

Dinner

Ganyu

What ganyu has been done by members of the household in this period?

Activity	*Who did the ganyu?*	*Was it for a relative ?*	*No. of days worked*	*Payment*

Was the household looking for ganyu in this period but unable to find it ?

What crop sales have been made?

Crop sold	*Price/unit*	*Total cash income*	*Remarks*

What non-farm activities have been done ?

Activity			
Material cost			
Transport cost			
Other costs			
Days labour			
Source of capital			
Gross Income			
Net income			

Gifts/remittances

Has the household received any gifts?

Type of gift	*Who from?*	*Value (MK)*

Has the household made any gifts?

Type of gift	*Who to?*	*Value (MK)*

What agricultural activities has the household done in the past two weeks?