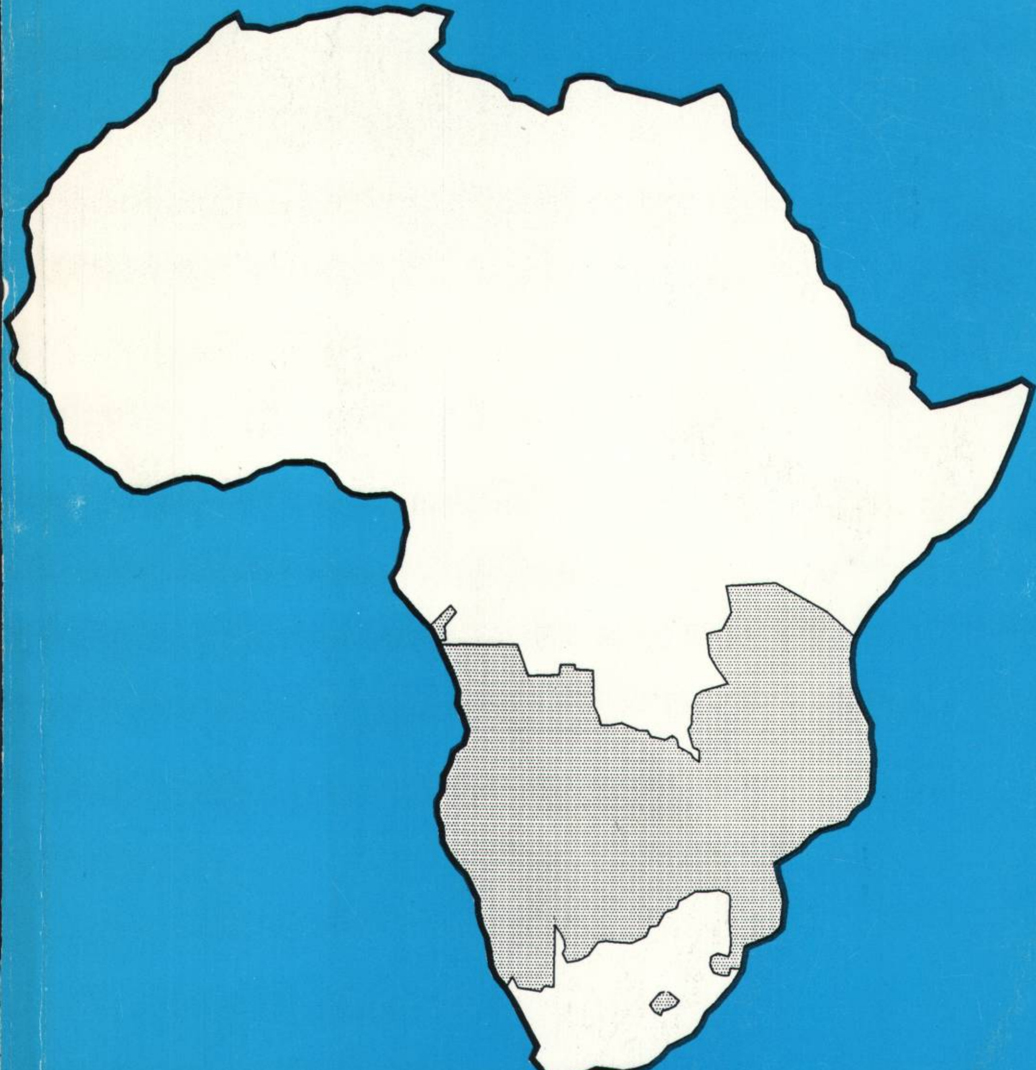
Market Reforms, Research Policies And SADCC Food Security



Edited by

Mandivamba Rukuni & J.B.Wyckoff

University of Zimbabwe UZ/MSU Food Security Research in Southern Africa Project

Market Reforms, Research Policies And SADCC Food Security

Citation:
Mandivamba Rukuni and J.B. Wyckoff, eds. *Market Reforms, Research Policies and SADCC Food Security.* Proceedings of the Sixth Annual Conference of Food Security Research in Southern Africa, November 12-14, 1990. University of Zimbabwe/Michigan State University Food Security Research in Southern Africa Project, Department of Agricultural Economics and Extension, University of Zimbabwe, Harare.

Market Reforms, Research Policies And SADCC Food Security

Edited by
Mandivamba Rukuni
J.B. Wyckoff

Published by:

UZ/MSU Food Security Research in Southern Africa Project
Department of Agricultural Economics and Extension
University of Zimbabwe
May 1991

Published by:

UZ/MSU Food Security Research in Southern Africa Project
Department of Agricultural Economics and Extension
University of Zimbabwe
P.O. Box MP 167
Mount Pleasant, Harare, Zimbabwe
Telex 26580 UNIVZ ZW
Fax 263-4-732828
Telephone 303211 Ext.1516

ISBN Number 0-7974-1000-7

Typesetting and page layout:
Daphne Chanakira and Florence Chitepo

Originated by:
Lucas Photolitho

Produced by:
Print Brokers, Box CH 113, Chisipite,
Tel: 796996

TABLE OF CONTENTS

SECTION III : GRAIN MARKET POLICY REFORM ISSUES -- THE EVOLVING ROLES OF THE PUBLIC AND PRIVATE SECTORS

SECTION IV : ENHANCING HOUSEHOLD FOOD SECURITY -- ISSUES AND PROSPECTS

Preface

The importance of Food Security was recognised at the inception of SADCC more than 10 years ago. The establishment of the Food Security Technical and Administrative Unit (FSTAU) in 1982 followed by the Food Security Research in Southern Africa Project in 1985 is evidence of SADCC's commitment. This Sixth Annual Conference on Food Security Research in Southern Africa provided the forum for reporting the results of ongoing research throughout the region. Participants from 15 nations in Africa, Europe, North America and Asia benefited from the research and policy dialogue the Conference engendered.

The Vice Chancellor of the University of Zimbabwe opened the Conference by alerting the audience to SADCC/SACCAR's "Blueprint for Developing Professional Human Resources for the Agricultural Sector in SADCC". This massive 20 year undertaking is expected to move SADCC's agricultural sector into a competitive position with other regions of the World. The Honourable Witness Mangwende, Minister of Lands, Agriculture and Rural Resettlement and Chairman of the SADCC Programme of Food, Agriculture and Natural Resources, helped place the Conference in perspective with his discussion "Taking Stock of Regional Food Security After Ten Years of SADCC".

An important data base for assessing the status of country and regional food security has been developed for SADCC through FSTAU's region wide Early Warning System. Having just completed its first five years of operation, an appraisal of the system's contribution and an indication of future directions was most appropriate.

It has long been recognized that Food Security within SADCC consists of two elements -- food availability and access to the available food. The Third session concentrated on "Food Access and Nutrition: Policy/Program Linkages". Bringing together those who are responsible for food production, marketing and distribution with those measuring the physical impacts of lack of access to sufficient food, is long overdue. Speakers examined these linkages, informed the participants of new food security and nutrition policies that are being implemented within SADCC and identified issues of continuing concern.

Session IV and V provided the opportunity for food security researchers from five of the SADCC countries to report their most recent findings. Changes in Grain Marketing Policies are occurring throughout the region. Markets are being liberalized and private traders are being permitted to enter markets previously reserved for parastatal monopolies. The implications of these policy changes for household food security were discussed for several countries. Empirical studies of the impact of farm management in communal areas, production instability and increasing crop diversification and productivity on household food security, were reported.

The Conference was "wrapped up" by a well attended session on "Agricultural Research Priority Setting and Household Food Security". Theoretical models and practical applications for setting research priorities were reported by well qualified practitioners from the university system, international agencies, regional research organisations, national research units and private sector research firms. This discussion will significantly influence agricultural and food research within SADCC for many years.

Acknowledgements

These proceedings are a result of the dedicated efforts of many individuals throughout the region. Perhaps most important are the food security researchers who conducted the studies and reported their research findings at the Sixth Annual Food Security Research in Southern Africa Conference. The empirical findings generated through their research are providing a solid basis for food security policy throughout the region.

The administrative support provided by the Food Security Project office via Florence Chitepo, Project Assistant, and the Co-Directors, Godfrey Mudimu and Thomas Jayne, was key to the success of the Conference. Backup from Michigan State by Mike Weber, Jim Shaffer, and Janet Munn was well received. Logistical support was provided by Peter Hopkins, Andrew Barnes, Ronnie Sagwete, Louis Dube, Emma Matimati, Joshua Ndlovu, Elijah Dauka and Maxwell Chiwashira.

This Conference is one of the project activities that supports the Food Security Policy network developed by project activities throughout the SADCC region. The support of John Dhliwayo and his SADCC Food Security Technical and Administrative Unit and Tobias Takavarasha and his Economics and Markets Branch, both in the Ministry of Lands, Agriculture and Rural Resettlement is most appreciated. The project is funded by USAID (Southern Africa Regional Programme). Our special gratitude to Douglas Pickett and Joshua Mushauri.

Daphne Chanakira has again contributed her talent doing the Typesetting and page layout. Florence Chitepo assisted in the process and Lovemore Nyabako provided computer support. Our thanks to all of them.

Mandivamba Rukuni
J.B. Wyckoff

I

Official Opening

1

Blueprint For Developing Professional Human Resources For The Agricultural Sector In SADCC

Professor W.J. Kamba[1]

It gives me great pleasure to welcome you to the **SIXTH ANNUAL FOOD SECURITY RESEARCH IN SOUTHERN AFRICA CONFERENCE.** I particularly want to recognise the presence of our colleagues from other countries in the SADCC region, many of whom will be reporting their food security research findings. Once again, this conference is jointly sponsored by the SADCC Food Security Technical and Administrative Unit and the Department of Agricultural Economics and Extension of the University of Zimbabwe. Its purpose is to assemble researchers, SADCC representatives, interested donors and representatives of international agencies to hear the latest results from ongoing food security research, to identify emerging problems and to plan research agendas. The information generated by these activities provides policy makers with "grist for the mill" in formulating national and regional food security policy.

The ability to attain national and household food security rests with the agricultural sector which employs 70-80 percent of the total labour force of the SADCC region and contributes some 35 percent of the region's Gross National Product. Agriculture also generates 30 percent of the region's foreign exchange. To guarantee food security for the region's rapidly growing population requires that agriculture continue to increase its output by increasing its productivity or expanding the land area under cultivation. This latter option is becoming unavailable in several countries within SADCC as all arable land is already being farmed.

This leaves the agricultural sector facing five major challenges in the next two decades.

---

[1]Vice Chancellor, University of Zimbabwe.

1) To increase production and productivity of both small and large farmers to provide more food and export crops together with increased livestock products;

2) To develop and transfer appropriate and affordable productivity increasing technology;

3) To develop improved transport, processing and marketing infrastructure to better service local and export markets;

4) To arrest and reverse environmental degradation to ensure sustainable agricultural systems; and,

5) To adopt economic policies that will generate the resources required to enable the agricultural sector to meet the above challenges.

The limited supply of trained and experienced professionals in agricultural disciplines within SADCC critically limits the capacity of the agricultural sector to meet these challenges. The current capacity of the training institutions in the SADCC region will be unable to meet the needs for professionals with specialised BSc. or MSc. and Ph.D degrees. Further, virtually all of the Faculties of Agriculture in the region face problems such as:

- inadequately trained and qualified staff;
- poor terms and conditions of service for staff;
- poor and inadequate teaching and research facilities;
- inappropriate curricula and teaching materials; and,
- poor capacity to conduct long term, strategic research.

These conditions lead to difficulties throughout the SADCC region in recruiting, motivating and retaining staff within the University systems. This has led to efforts by faculties to develop regional cooperation in agricultural training and to encourage the exchange of students among countries. Rationalisation of admission requirements, accreditation, foreign student quotas and medium of instruction as well as development of centres of specialisation, have all been undertaken.

PROPOSED SADCC REGIONAL STRATEGY

A regional strategy has been proposed to strengthen the faculties and the teaching and research programmes in agriculture within SADCC. The strategy is long term, requiring at least 20 years of sustained support. The objectives of the strategy include:

- to develop full-fledged BSc. Agriculture programmes in all SADCC countries by the year 2000;

- to increase inter-university and inter-country exchange of students at the BSc., MSc. and Ph.D levels;

- to establish and/or strengthen specialised BSc. programmes across the region at identified regional centres of specialisation;

- to ensure that most MSc. and Ph.D training is undertaken in the region by the year 2010;

- to strengthen teaching and research capacities of faculties in the region;

- to facilitate across border utilisation of staff;

- to provide short-term, on-the-job training courses for academic, research, technical and support staff;

- to increase the relevance of university research to national and regional problems; and,

- to increase across-border cooperation in production, procurement and servicing of teaching and research equipment and facilities.

PROPOSED ADMINISTRATIVE STRUCTURE

This entire programme is proposed to be established under the auspices of the Southern Africa Centre for Cooperation in Agricultural Research (SACCAR), and is to be known as the Regional Programme for Strengthening Agricultural Faculties (REPSAF). Individual projects will fall under the administration, coordination and implementation of REPSAF, facilitating multi-donor funding of one or more projects simultaneously. Once the REPSAF offices are established during 1991-1992 in Swaziland, the country that carries the mandate for manpower development within SADCC, activities will be undertaken to carry out the above mentioned strategy.

Obviously, a human resource training effort of this magnitude can *not* be accomplished without financial as well as other resources. While each separate project element will be justified separately, an indicative figure of some US $150 million is required for the 1991-2000 period. However, the expected output is impressive.

CONCLUSION

Few regions of the world have started so recently or have so far to go in developing their professional human resource base in agriculture as the SADCC region. The task is urgent because of its importance in attaining food security and overall economic development in the region. It is not a task that can be accomplished overnight, but rather, one that requires a long term commitment. Such a continuing commitment must be made by the faculties/Universities themselves, individual governments and the donor community.

Such a commitment is not without precedent.

1) India decided in the 1950's to change her agricultural education and research system. Their first State Agricultural University was established in 1960 -- by 1972, 17 SAU's had been established and 27 by 1986. Today, they are producing 3 500 postgraduate (MSc. and Ph.D) students and 10 000 with BSc. degrees in agriculture and related sciences. The food and agricultural situation in India in the 1950s and '60s was similar to that prevailing in Sub-Saharan Africa at the present time. Yet today, India can boast of strategic grain reserves of 100 million tonnes and other impressive agricultural production statistics.

2) In Latin America, Brazil decided in 1963 to strengthen her agricultural universities by establishing new undergraduate and postgraduate programmes. Today, Brazil is one of the world's largest exporters of agricultural products. It is also interesting to note that almost 60 percent of Brazilian agricultural graduates go to work in the private sector.

3) The success of the agriculture sector in the United States of America, the world's largest exporter of agricultural products, has been unanimously attributed to the establishment of the Land Grant University system in the second half of the last century to train agricultural professionals. This system currently produces 17 000 BSc. graduates per year and 5 500 postgraduates (MSc. and Ph.D) in agriculture and allied sciences.

These three are all countries with land areas about the size of that of the SADCC region. However, their current populations are much higher. Thus, while it may not be possible for individual countries in the region to develop the types of agricultural training systems described above, the SADCC region as a whole *can*. The development of such a system should certainly provide the highly trained agricultural specialists necessary for generating the food supplies needed to feed SADCC's growing human population well into the future.

I, too, welcome you to Zimbabwe and our beautiful capital city of Harare. I trust that this Sixth Annual International Conference on Food Security Research will be successful in transferring the knowledge gained from food security research conducted in the region to appropriate policy makers throughout the developing world. You have my best wishes in this effort.

2

Taking Stock of Regional Food Security After Ten Years of SADCC

Dr W.P.M. Mangwende[1]

The Southern Africa Development Coordination Conference (SADCC) has now reached its tenth year. This is a most suitable occasion to take stock of what has been achieved so far and what still remains to be done. For the purposes of this Conference, my task is to consider these issues in relation to the food security situation in the region.

All ten SADCC countries are heavily dependent on agriculture. This sector provides not only national and household food security but is the major source of employment for the people of the region. It generates foreign exchange in the net agricultural exporting countries and achieves large import savings in the other countries.

It is this dominant role of agriculture in the economy of the region which led the Heads of SADCC states to agree to develop regional action programmes for seven agricultural sub-sectors. It is the action programme dealing with food security, which is the responsibility of Zimbabwe, that is the focus for this Conference. The primary objective of this programme was initially to increase food production in order to improve nutritional levels of rapidly expanding populations.

Cereal production has been increasing but at a slower rate than population growth. This means that, in spite of an increase in cereal imports into the region, there has been a decline in the *per capita* availability of cereals within the region as a whole.

It was agreed in the initial stages that the long term solution to ensuring an adequate supply of food could be achieved only within a broad agricultural development framework involving improved rural infrastructure, more agricultural research and improved training and extension services. The food security programme has expanded to meet these wider goals.

---

[1]Minister of Lands, Agriculture and Rural Resettlement.

The major strategies that have been identified to achieve the SADCC food security objectives are:-

- the development of food production capacity together with the expansion of cash crops and other farm enterprises;

- the improvement of agricultural infrastructure particularly input supplies, storage, transport, processing and financing;

- programmes to control major crop and livestock pests and diseases;

- the expansion of manpower skills;

- the growth of trade within the SADCC region; and,

- the effective exchange of technical and economic information within the region.

These strategies fully recognise that food production would not and could not develop equally among SADCC member states. Some countries simply do not possess the natural resource base to achieve national food self-sufficiency. Others have faced constraints that have prevented them realising their full agricultural potential. At the same time, a few member countries are not only self sufficient but produce a surplus for export. The food security programme must be designed to accommodate these widely differing situations in order to provide maximum benefit for the SADCC region as a whole.

However a policy of food self-sufficiency, either for an individual country or for the SADCC region as a whole, does not automatically lead to food security. Food security should be seen as a situation in which all people have access to enough food in order to live a normal, active and healthy life. This definition focuses on the two distinct aspects of food security -- firstly, the availability of food throughout the region and, secondly, the ability of individual households to acquire the food they need.

In its early years, the SADCC food security programme concentrated on the food availability issue. Food production research, grain storage and the early warning system were the dominant themes. At the level of its regional responsibility, the programme is still concerned mainly with the stabilisation of supply -- to make sure that each member State can get enough basic food. The Regional Early Warning System, now producing regular quarterly bulletins on production prospects, will soon be extended to identify more clearly those who suffer from food insecurity.

On the supply side, the programme will complete its evaluation of the region's agricultural resource base. The programme will carry out a general review among all member States of technical production resources, the application of resources, production incentives, *etc*., to see how production can best be raised to meet the regional demand. This work will be supported by investigation and dissemination of techniques which will help to ensure that needed production is achieved. The programme will be working to improve input supply, evaluate irrigation potential for improved food security and expand seed production.

A review of the regional strategy for agriculture and natural resources will introduce an environmental component intended to ensure that activities to increase production are sustainable. A system to begin to control migrant pests is also being set up.

More recently, however, poverty and the consequent lack of access to food, with the resultant unacceptable levels of hunger and malnutrition, have increasingly become major areas of concern for the programme.

In Zimbabwe, however, we are moving towards solving the problem of food access at the individual household level. A National Consultative Workshop on Food, Nutrition and Agricultual Policy was sponsored recently jointly by my Ministry, the Nutrition Unit of the Ministry of Health and the Food Security Research Project of the University. This workshop brought together senior people from the relevant Ministries and related food and nutrition agencies to examine the problem of household food security and malnutrtion as it exists in this country. The recommendations of this workshop should be of considerable value in designing policies to protect the more vulnerable groups of people in our society. This is an approach which I would commend to other SADCC member states. We still have much to learn ourselves and would be glad to exchange ideas and experiences in order to benefit from the lessons that have been learned in other countries. It is one of the main roles of the Food Security Programme to disseminate conclusions from such activities for even wider discussion and analysis and consideration of the implications.

The Food Security Programme will be working more on the problems of access, initially through a regional food security Training Programme to be put to SADCC in 1991. This programme will concentrate on knowledge-sharing among member States on the many programmes now being tried to support the chronically underfed and the victims of transitory food crises. The Food Security Programme has also been instructed to develop and promote activities that would reduce dependency on aid.

Other SADCC countries facing similar problems of food insecurity at the household level, must design policies with similar objectives using policy instruments which take into account the particular economic, social and physical circumstances of the country in question. Botswana, for example, has developed policies which explicitly recognise the difficulties of national food self sufficiency in that country. They have implemented policies designed to ensure that all people in their country have access to a calorie-adequate diet. This has evolved into pula-for-work-programmes, supplementary feeding programmes, feeding underweight school children, more general school feeding programmes, as well as food production programmes through supplementary irrigation. These programmes have been studied with great interest by other SADCC members to determine their usefulness in their own countries. Mr. Chairman, I would urge other SADCC member States to emulate Botswana and put such programmes into operation in their respective countries.

On the demand-side, the regional food security programme will be working to identify and disseminate means of raising rural incomes through the introduction of cash crops and farm and village-level processing and marketing practices, emphasising those techniques which preserve the shelf-life of home grown foods or enhance its nutritional quality.

So where are we now with regard to regional food security after ten years of SADCC?

Even with two of our member States devastated by war and huge refugee problems, the region has achieved virtual self-sufficiency in the major staple foods -- indeed the most recent estimate is that, in the current year, regional supplies will be about 104 percent of requirements. This does not mean, however, that the problem of food insecurity in the SADCC is solved. The figure of 104 percent self-sufficiency masks the fact that only three of the countries in the region are producing sufficient food for their own needs together with sufficient surplus to cover the deficits of the remaining member states.

This, however does not imply that now is the time to rest on the laurels of what has been accomplished. Our population continues to grow, we are still beset by uncertain rainfall and not all pests and diseases are under control. We still need to strengthen policies designed to increase food availability. We must also take the necessary steps to ensure that our people have access to that food which may be available.

This apparent surplus also disguises extensive chronic under-nutrition in even the surplus grain producing countries. It also disguises the steady decline in the *per capita* availability of cereals at a time when rapid urbanisation demands more.

In spite of our huge and under-utilised production capacity, the region presently is importing about 1,5 million tonnes of cereals in an attempt to stabilise average consumption (now gross 154kg *per capita*). To maintain this level of consumption, we will have to increase our production at an annual rate of four percent, even if we sustain the present level of imports. This new target has to be compared to the average 1,4 percent *per annum* growth in cereal production over the last 14 years.

We have the resources to do this, but, as these figures show, we have not been applying those resources. We cannot afford this any longer and we must, from now on, provide our farmers with supporting infrastructure and appropriate incentives. We must improve our management of surplus production and shift the surplus to the deficit areas. The Food Security Programme will be encouraging even more cooperation than before between member states to coordinate these surpluses and to establish a reserve for the bad years.

This conference should not, however, be an entirely inward looking one. The question of food security in this region is not just a matter for each individual member state, or even for SADCC alone. There is a new mood of international cooperation in relation to the achievement of food security for all countries throughout the world on a scale that has not been seen before. The growing recognition at the global level of the need to achieve equitable and sustained development, and thus eradicate continuing widespread poverty which is at the root of food insecurity at the household level, is a development that needs to be nurtured and encouraged.

We have to bear in mind that traditional surplus suppliers, who have provided the region with large quantities of food aid in the past, are starting to reduce subsidies to their own farmers. We must expect that these traditional sources, which are still providing much of our growing imports, will begin to be reduced. We need a constructive dialogue both within the SADCC region and between SADCC states and the developed countries on effective measures to end food insecurity once and for all in our region. We need to establish what we can do for ourselves and where outside assistance will be necessary to achieve our goals.

I would like to take this opportunity to express the appreciation, not only of the Government of Zimbabwe, but in my capacity as chairman of the SADCC Committee of Ministers of Agriculture and Natural Resources, of all the SADCC member states for the work being done by the Universities of Zimbabwe and Michigan State on food security research in the region. This conference, and all the papers and issues being discussed over the next three days, would not have been possible without the work of these two universities and the financial support provided by USAID.

I must also express the appreciation of the SADCC member states for the support given by a number of other donors to the work of the SADCC Food Security based here in Harare. This work needs to be strengthened and made more effective if universal food security in the SADCC region is to be realised in full. I hope that one of the results of this conference will be a stronger focusing of the efforts and resources of the SADCC Food Security Unit towards the objectives that I have already set before you this morning. There is a great deal still to be done in order to realise these goals.

Let me sum up the ideas that I have set before you today. We in the SADCC region have defined the problem of food security. We have made considerable progress in determining its causes and extent. We have implemented policies designed to alleviate the problem. The fact that food insecurity and malnutrition is still with us intensifies the challenge to ensure its abolition. Our people have the right of access, at all times, to sufficient food in order to live an active and healthy life. It is our duty to work ceaselessly towards ensuring that their right to sufficient food is fulfilled.

I expect your conference to make significant progress on these issues. The problems are not simple. There are no easy solutions. I look forward to the answers you will provide in pursuit of the way forward on this complex issue.

I welcome all of you to our beautiful city of Harare. Thank you for the invitation to address this important international conference. I wish you a most successful meeting.

Finally, it is now my pleasure, honour and indeed humility, to declare the meeting officially open.

Thank you.

II

Early Warning Information, Food Access And Nutrition Policy: Issues and Options

3

Current Status And Future Plans Of The SADCC Early Warning Unit (REWU)

R.T. Masundire[1]

INTRODUCTION

Most of the countries which constitute the Southern African Development Coordination Conference (SADCC) are primarily agrarian. Their agricultural sectors, however, generally have been unable to produce enough food to meet domestic needs or to generate enough revenue to buy food on world markets for several decades.

To resolve these problems, the original nine SADCC countries agreed that a programme of regional cooperation should be mounted to accelerate economic growth, agricultural development and regional food security. The **LUSAKA DECLARATION** of April 1980 created SADCC with the specific objective of accelerating economic growth through regional cooperation. Cooperation in food security, one of the first concepts launched through SADCC, led to the establishment of the SADCC Food Security Programme.

PROJECT BACKGROUND

The SADCC Council of Ministers was given the task of adopting a work programme for SADCC and designating member States to coordinate activities in specific areas of regional cooperation. Zimbabwe was designated to coordinate SADCC's food security activities. The Government of Zimbabwe (GOZ) developed a number of proposals to improve food security in the region. In November 1980, the Council of Ministers adopted the document "Project Proposals for Achieving Regional Food Security", prepared by GOZ, as the initial food security programme of action. One of the proposals was for **An Early Warning System for Regional Food Security** with the objective of establishing "a food data recording system that will monitor food availability in terms of stocks, progress during the production season, and final food output."

---

[1] Agricultural Economist, Regional Early Warning Unit for Food Security.

ESTABLISHMENT OF THE REGIONAL EARLY WARNING SYSTEM (REWS) PROJECT

In September 1981, GOZ on behalf of SADCC, formally requested the assistance of the Food and Agriculture Organization of the United Nations (FAO) to undertake a feasibility study on the establishment of a **Regional Early Warning System (REWS).** The study was conducted in 1982 and FAO's subsequent report supported the proposal and recommended that:

- Regional Early Warning Unit (REWU) be established in Zimbabwe; and,
- National Early Warning Units (NEWUs) be established or strengthened in each SADCC country.

The report was approved by the Council of Ministers in May 1983. DANIDA agreed to provide funds for a three-year operational phase of the project. SADCC then requested that FAO provide technical assistance for the establishment of the REWS. FAO and GOZ jointly decided that thorough preparatory work was needed before the project could be implemented. FAO agreed to finance the preparatory phase of the project which began in June 1985.

FAO prepared documents for the establishment of NEWUs in Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland and Zimbabwe and also for the formation of the REWU. Tanzania and Zambia had started their own early warning systems before the SADCC project commenced but, as members of SADCC, they became part of the SADCC Regional Early Warning System. The units in Tanzania and Zambia are currently funded by the Governments of Norway and the Netherlands respectively.

The project document for Phase I of the project was signed in May 1986 designating FAO as the executing agency but it was not until mid-1987 that the REWU had recruited its full complement of staff. Phase I will be completed in November 1990 and it will be followed by a second five year phase.

Establishment of National Early Warning Units

Tanzania and Zambia were the only SADCC countries with established early warning systems in 1986. Some elements of early warning activities also existed in Botswana and Zimbabwe. The basic elements of an early warning system were not in place in the remaining five countries. There were diverse "methodologies" and approaches to early warning work and significantly different definitions of basic food security concepts existed.

During the latter part of the pre-implementation phase of the project and the early months of Phase 1, visits were made by REWU staff to all SADCC countries to assist in the establishment of NEWUs. The REWU updated the project documents of several countries in preparation for signing. By the end of 1987 all SADCC countries had their NEWUs established and operational. The NEWUs were staffed by FAO staff in agro-meteorology and either agro-statistics or agro-economics. Counterpart staff in the same disciplines were to be provided by national governments. This was not always possible because of a shortage of trained manpower and staff turnover.

Establishment of the Regional Early Warning Unit

While initially there were only two persons in the REWU, by mid-1987 it was fully staffed with a multi-disciplinary team of six professionals. FAO and SADCC each provided an agricultural economist, an agricultural meteorologist and an agricultural statistician.

STRUCTURE OF THE REWS PROJECT AND LINKAGES WITH NEWUs.

The REWS project is composed of 10 interlinked and complementary components:-

- the nine country based National Early Warning Units (NEWUs) which make assessments of the food security situation in each member State; and
- the Harare based Regional Early Warning Unit (REWU), which makes periodic regional assessments of the food security situation, deriving its information mainly from submissions from NEWUs. The REWU also provides technical support to the national units.

Links have been established between these components in the broad areas of:

a) coordination of early warning activities;

b) provision of assistance and advice; and

c) training.

Most of the NEWUs are located in Ministries of Agriculture. Where NEWU staff work under one roof, the staff have been seconded from departments of meteorology, statistics and from other relevant ministries. Other NEWUs operate through inter-ministerial committees set up to oversee early warning activities.

INSTITUTIONAL ARRANGEMENTS

The REWS project is part of the SADCC Food Security Programme which is under the overall responsibility of GOZ through its Ministry of Agriculture. The project is directly responsible to the Food Security Technical and Administrative Unit (FSTAU), the implementing agency for the REWS project on behalf of SADCC. As such, it is responsible for providing the linkage between the project and the Council of Ministers, other regional policy-making authorities, national decision-making authorities of member States and cooperating partners.

OBJECTIVES OF THE REWS PROJECT

SADCC firmly believes that food security is achieved nationally and regionally only when each country and the region can guarantee all its citizens both physical and financial access to adequate food of an appropriate nutritional quality throughout the year. This means that food security is achieved by ensuring both availability of food and its affordability at the household level.

Long-term Objective

The objectives outlined in the project document include immediate and long-term objectives. The long-term objective of the project is to improve regional food security in the SADCC countries through the establishment of an effective early warning system which provides advance information on crop production and food supplies, and alerts all those concerned well in advance of an impending food shortage or surplus so that suitable and timely remedial action can be taken.

Immediate Objectives

Phase I the REWS project had the following immediate objectives:-

- to establish National Early Warning Units (NEWUs) in all SADCC countries;
- to establish a Regional Early Warning Unit (REWU), link the nine NEWUs and coordinate all their activities into a SADCC Regional Early Warning System;
- to advise and assist the NEWUs as and when required;
- to organize training of the professional staff of the NEWUs; and,
- to provide SADCC with regular regional food security information based on data from the NEWUs.

Addressing the Issues of Food Requirements and Access to Food

The project's stated objectives focused on efforts to provide information on food production and supply. No specific objectives addressed the questions of food requirements and access to food. After the inception of Phase I, SADCC reviewed its food security programme and recognised that access to food was an essential additional component of food security. As a result, REWU expanded its early warning activities to include food needs assessments. Phase II includes nutrition surveillance information activities to further address the issue of access to food.

ACTIVITIES UNDERTAKEN IN PHASE I : MID-1987 TO LATE-1990

First Meeting of NEWUs and REWU Staff : October 1987

The REWU organized a three-day meeting in Harare in October 1987, attended by the NEWUs, to discuss operational and technical issues relating to early warning and to chart operations throughout Phase I. The REWU prepared a model national early warning bulletin, together with a set of definitions and guidelines, to be used in the preparation of NEWU bulletins.

Methodological Work

There was little knowledge and experience at the inception of the REWS, in making objective assessments of the food security situation either at the national level or for the region as a whole. The REWU, from the outset, carried out work to improve the methodologies used by the NEWUs to assess country food security.

Methodologies in Agroeconomics.

The REWS project has adopted the commodity base concept by using Maize Equivalent (M.E.) in making food security assessments for all monitored commodities. M.E. is the amount of another crop needed to supply the same amount of calories as a given amount of maize. Maize equivalent accounts for the considerable differences in caloric value per unit of weight of the various crops and makes data comparison and aggregation possible. Most NEWUs are currently using M.E. in part of their assessments.

- *Determining commodities to be monitored:* The REWU used FAO Food Balance Sheets for each SADCC country to determine the "normal" or "*status quo*" caloric contribution of individual commodities to the total diet. This established the relative importance of each food crop. The most important food staples were selected for monitoring by the NEWUs. Appendix I identifies the commodities and their approximate percentage contribution to the total calorie supply in each country.

- *Assessing Food Requirements in Terms of "Nutritional Need" or "Normal Supply":* The caloric contribution of the major staples to the total diet was converted to a *per capita* weight basis and used as a measure of normal supply for human consumption of those commodities.

- *Assessing food balances at the sub-national level:* The REWU also recognized the need for the NEWUs to determine food balances at the sub-national level, especially in those countries where marked differences exist in food consumption patterns in different areas. As a result, a method for preparing balances at the provincial level was developed by the REWU and recommended for use by all NEWUs. Most NEWUs were preparing sub-national food balances by the end of Phase I.

Methodologies in Agrostatistics.

- *Crop forecasting:* Forecasts of crop production provide an important agricultural statistic for food security assessments. But the methodology used in most SADCC countries needs refinement. In Malawi the methodology currently used for crop forecasting is subjective, cumbersome and sometimes arbitrary. The REWU devised an improved methodology, based on crop forecast sample surveys, which has been implemented as a pilot survey in two of the eight Agricultural Development Divisions in that country.

  Mozambique does not have a statistical system for estimating or forecasting crop production. A pilot survey, designed by the REWU, was implemented in Manica Province during the 1988-89 crop season. Due to loss of staff from the NEWU, work on this survey could not be undertaken in the 1989-90 season but will be reinstated during the 1990-91 season.

  In Swaziland, no field surveys were undertaken for crop production forecasting. The Government accepted a proposal by the REWU to undertake suitable sample surveys during the 1990-91 crop season.

Methodologies in Agrometeorology.

- *Crop water balance model:* The FAO methodology for agrometeorological crop monitoring uses such concepts as crop coefficients, water holding capacity and wilting point of the soil, effectiveness of rainfall and rate of evapotranspiration. Effective use of the methodology requires sound knowledge of the regime and balance of soil moisture in fields planted to different crops.

Collection, Scrutiny and Analysis of Data

In compiling SADCC food security bulletins, the NEWUs and REWU use primary data in agroeconomics, agrostatistics and agrometeorology generated by relevant national organizations through their field staff. The NEWUs collect, collate, scrutinize and further analyse data from these sources in making food security assessments.

The objectives of primary data collecting agencies and the NEWUs are not always the same. Thus, data do not always meet early warning needs. They have to be processed and presented in a form which can be easily interpreted and used. Data have often been found to suffer from inaccuracy, incompleteness, lack of timeliness, inconsistency and the lack of comparability. The NEWUs continuously interact with the data collection agencies to overcome these shortcomings.

Issuing of Food Security Bulletins and Other Reports

In 1986, Tanzania was the only country producing an early warning/food security bulletin. However, by the end of Phase I of the project, all countries were producing such bulletins.

The first issue of the REWU quarterly bulletin was published in 50 copies. As interest in this document gradually increased, the number published has increased accordingly. At present 200 copies of the bulletin are published and distributed to an average of 15 addressees in each SADCC country, to SADCC authorities, to 15 major donor countries, to several international organizations, the media, universities, libraries and other interested institutions.

Quarterly Bulletins

These are the main output of the NEWUs and REWU. The REWU began publishing regular quarterly bulletins soon after the October 1987 meeting based on information contained in NEWU bulletins. At present, the REWU bulletin contains a chapter dealing with the SADCC regional food security assessment together with nine other chapters devoted to country assessments. Each chapter is further divided into two sections:

- an assessment of the Food Security Situation; and,
- an assessment of Factors Affecting the Food Security Situation.

The REWU aggregates, analyses and edits the data received from the NEWUs on the above items in assessing the food security situation to obtain a regional picture of food supply, demand and distribution.

"Early warning" does not relate only to the identification of expected physical food surpluses/deficits in any given year. It also includes assessment of natural, economic and social factors and their longer term effects on food security in different countries. The bulletin contains a table summarising the information for the commodities monitored together with their assessed contribution to the diet. A glossary of the terminology used is provided readers and users. (See Appendix II).

Monthly Updates.

The first monthly issue was published in February 1990. Updates report on changes that have occurred since the previous quarterly bulletin.

Special Reports.

The REWU is requested to compile assessments of the latest food security situation in the region on the eve of important SADCC meetings such as Annual Summits, the Council of Ministers meetings, the Standing Committee of Officials, *etc*.

Training

Activities relating to "early warning for food security" are relatively new and, therefore, lack a well established methodological tradition. REWU designed training courses to help NEWU staff carry out early warning activities in their respective units.

EVALUATION OF PHASE I OF THE PROJECT

A Tripartite (SADCC/DANIDA/FAO) Mission reviewed the progress of the REWS project in October/November 1988 and concluded that the results achieved were well in line with the project's objectives. The main constraint was the slow establishment of the NEWUs which limited the quality and flow of information to the REWU and slowed down its activities.

The Mission's overall findings were as follows:

- all components of the REWS project had been established and were fully operational;
- NEWUs had been set up in all SADCC countries and information was flowing to the REWU on a fairly regular basis;
- SADCC was being provided with regular food security information through quarterly bulletins of good quality;
- information supplied by the REWS was an essential input for other projects under the Food Security Programme and was particularly useful for food security planning and policy formulation in member States;
- the activities of the NEWUs were being coordinated within the limits dictated by national priorities;
- assistance to NEWUs should be increased during the remainder of the project; and,
- training for professional staff of the NEWUs had been conducted.

The Mission also concluded that, although progress had been achieved, more work needed to be done to improve the quality of food security reporting. The quality of data available to the NEWUs in some countries was still inadequate and the value of training of national staff had been reduced by heavy staff turnover.

The Mission therefore concluded that further assistance would be required in order to attain the long-term objective of the project and recommended that additional funds be provided to Phase I to enable the project to operate at full capacity until June 1990.

PHASE II: 1990 TO 1995

The major goal of the project during Phase II is to consolidate, further strengthen and expand the activities of the Regional Early Warning System, which has been established at the regional and national levels, so that the overall REWS will be self-sustaining and fully operational by the end of Phase II.

The project proposal has been designed to phase out international staff in the REWU and NEWUs and ensure that long-term early warning activities are wholly taken over by SADCC and national staff by the end of the Phase II.

The main support to the Tanzania and Zambia NEWUs continues to be provided through separate programmes. However, it is envisaged that these Units will participate in training and other umbrella activities under the REWS project. The current support to these NEWUs would be augmented in Phase II to facilitate their full participation in the REWS. In particular, assistance will be provided to enable them to attend regional training courses, seminars, review meetings and for the acquisition of necessary communication equipment.

It was also recommended that the staffing of the REWU and the NEWUs be designed to allow the REWU to provide technical support to the NEWUs for extended periods and to minimize the international staff component in the NEWUs.

The First Two Years of Phase II

The REWU staff for the first two years will focus on the following activities:

Monitoring of Access to Food

The scope of early warning activities will be expanded to generate information on food access *via*:

- the identification of population groups with limited resources;
- monitoring factors which can adversely affect vulnerable groups; and,
- monitoring the outcome of the reduced access to food in terms of nutrition and health status of these population groups.

This information will be useful to governments for the short-term targeting of relief interventions and for the development of longer term policies and programmes to strengthen food security.

Early Warning Manual

REWU will compile a manual of early warning methodologies in the SADCC region.

Information Network

The REWU will assist in establishing and strengthening an information network among relevant government institutions to enable the NEWUs to collect required information for short and long term remedial measures.

Training

The REWU staff will be actively involved in conducting training programmes at regional and national levels.

Namibia

During Phase II, Namibia will become a full-fledged member of the system. The September 1990 issue of the REWU bulletin included a chapter on Namibia.

PROJECT FINDINGS AND CHALLENGES

Usefulness of Food Security Bulletins

Based on feedback, it is obvious that the REWU bulletins are greatly appreciated by recipients such as the SADCC Secretariat, the SADCC authorities in Zimbabwe, FAO and WFP, the donor community and others. The information contained in these publications is considered reasonably accurate and reliable. The bulletins are also considered to be an effective tool in fostering cooperation among the SADCC member States. The SADCC Summit communique of August 1990 on the state of food security in the region was based entirely on information provided in the REWU's SADCC Food Security Bulletin.

Problems in Assessing Food Requirements

The REWU has developed a methodology for assessing specific requirements in terms of "nutritional need" or "normal supply" for the commodities monitored individually and combined as M.E., based of FAO Food Balance Sheets. The method entails assessing the adequacy of anticipated production to meet requirements for human consumption and other non-food uses. The method requires accurate and up-to-date knowledge of annual estimates of:

- population at the sub-national level;
- the "normal" *per capita* requirement of commodities for human and other needs; and,
- anticipated production.

More work is required in this area, especially in determining normal requirements which requires historical data on actual commodity consumption over many years.

Data on consumption patterns for regions/provinces are difficult to come by in most countries.

Substitutability of Commodities

The use of maize equivalent (M.E.) pre-supposes complete substitutability of different commodities. This may not necessarily be true except in a period of serious food shortages.

Gross Versus Net Requirements

The REWU has preferred to use gross estimates in assessing requirements, which assumes incorporation of both non-food use and losses, in calculating consumption needs. Others have advocated that requirements should be net of non-food use and losses. The majority of SADCC countries utilize gross estimates of production and consumption and REWU considers it appropriate to be consistent.

End-of-Year Carry-Over Requirements

Carry-over requirements vary tremendously from one country to another. The logic of an individual country's determinations appears questionable in many instances. Carry-over stocks are important as they influence commodity import targets from year to year, depending on the level of domestic food availability.

APPENDIX I
Background information for the SADCC countries

Country	Marketing Year	Mid 1990-91 Marketing Year Population: Number (000)	Mid 1990-91 Marketing Year Population: Average Annual Growth Rate (%)	Food Commodities being monitored: Commodity	Food Commodities being monitored: Share in Total calorie intake *** (%)
Angola	*January/ December*	*10 002*	*2,7*	*Maize*	*19*
				Cassava	*29*
				Wheat	*9*
				Rice	*3*
				Sorghum/Millet	*2*
				Total	*67*
Botswana	*April/ March*	*1 297*	*3,3**	*Maize*	*31*
				Sorghum	*11*
				Wheat	*11*
				Rice	*2*
				Millet	*1*
				Total	*56*
Lesotho	*July/ June*	*1 623*	*2,6*	*Maize*	*44*
				Wheat	*20*
				Sorghum	*11*
				Total	*75*
Malawi	*April/ March*	*8 522*	*3,7*	*Maize*	*63*
				Rice	*1*
				Cassava	*2*
				Sorghum/Millet	*3*
				Total	*69*
Mozambique	*May/ April*	*15 840*	*3,0**	*Maize*	*28*
				Wheat	*5*
				Rice	*6*
				Sorghum/Millet	*5*
				Cassava	*36*
				Total	*80*
Swaziland	*May/ April*	*774*	*3,2*	*Maize*	*46*
				Wheat	*9*
				Rice	*2*
				Total	*57*
Tanzania	*June/ May*	*24 188*	*2,6***	*Maize*	*24*
				Sorghum/Millet	*6*
				Paddy	*6*
				Cassava	*25*
				Pulses	*5*
				Wheat	*2*
				Banana	*2*
				Sweet Potato	*2*
				Total	*72*
Zambia	*May/ April*	*8 140*	*3,4**	*Maize*	*60*
				Wheat	*8*
				Paddy	*1*
				Total	*69*
Zimbabwe	*April/ March*	*9 789*	*2,9*	*Maize*	*45*
				Sorghum	*3*
				Millet	*5*
				Wheat	*9*
				Total	*62*
SADCC Region		*80 175*	*3,0*		*70*

World Bank estimates* ** *Revised by FAO on basis of 1988 census.* * *Based on recent FAO Food Balance Sheets except in Mozambique.*

APPENDIX II

The Food Security situation for the 1990-91 marketing year
(000 tonnes)

	Maize	Sorghum	Millets	Wheat	Maize Equivalent
1. Opening stocks on 1-4-90	1 158,0	45,0	21,0	195,0	1 404,4
2. Domestic production	1 993,8	90,9	142,7	325,0	2 522,6
3. Domestic availability (1 + 2)	3 151,8	135,9	163,7	520,0	3 927,0
4. Estimated consumption	1 667,1	93,9	147,9	320,0	2 199,1
5. Carryover requirements on 31-3-90	500,0	0,0	0,0	200,0	687,6
6. Total requirements (4 + 5)	2 167,1	93,9	147,9	520,0	2 886,7
7. Surplus (+) or Deficit (-) (3 - 6)	+984,7	+42,0	+15,8	0,0	1 040,3
8. Planned exports for the entire marketing year	350,0	5,0	1,0	0,0	355,8
9. Import requirements	0,0	0,0	0,0	53,9	50,6
10. Planned imports for the entire marketing year	0,0	0,0	0,0	53,9	50,6
11. Forecast closing stocks on 31-3-91	1 134,7	37,0	14,8	253,9	1 422,7

APPENDIX III

Planned Foodgrain imports and exports during the period 1-4-1990 to 31-3-1991 as of 30 June 1990 (000 tonnes)

	Maize	Sorghum	Millets	Wheat	Maize Equivalent
1. Import requirements	0,0	0,0	0,0	0,0	0,0
2. Imports Planned:					
a. Commercial imports received	0,0	0,0	0,0	53,9	50,6
b. Commercial imports to be received	0,0	0,0	0,0	0,0	0,0
c. Food aid received	0,0	0,0	0,0	0,0	0,0
d. Food aid pledged but not received	0,0	0,0	0,0	0,0	0,0
3. Uncovered import gap (1 - 2)	0,0	0,0	0,0	0,0	0,0
4. Available for export	984,7	42,0	15,8	0,0	1 040,3
5. Planned exports:	350,0	5,0	1,0	0,0	355,0
a. Actually implemented	75,0	0,3	0,0	0,0	75,3
b. Not yet implemented	275,0	4,7	1,0	0,0	280,5
6. Unutilised export availability (4 - 5)	634,7	37,0	14,8	0,0	684,3

APPENDIX IV

The Food Security situation by country in the SADCC region for the 1990-91 marketing year (000 tonnes M.E.)

Item	Angola	Botswana	Lesotho	Malawi	Mozambique	Swaziland	Tanzania	Zambia	Zimbabwe	SADCC Region
1. Opening stocks	32,6	132,5	38,7	236,0	56,3	7,9	246,1	768,4	1 404,4	2 922,9
2. Domestic production	740,3	52,7	156,2	1 447,4	2 107,3	1 306,8	7 002,3	1 520,7	2 522,6	15 680,1
3. Domestic availability (1 + 2)	772,9	185,2	194,9	1 683,4	2 163,6	138,5	7 248,4	2 289,1	3 927,0	18 603,0
4. Estimated consumption	1 284,1	218,9	373,9	1 647,8	2 851,9	177,5	5 729,4	1 658,3	2 199,1	16 268,9
5. Carryover requirements	54,1	92,0	16,4	51,6	109,4	2,0	324,6	225,0	687,6	1 562,7
6. Total requirements (4 + 5)	1 338,2	310,9	390,3	1 699,4	2 961,3	179,5	6 054,0	1 883,3	2 886,7	17 831,6
7. Surplus (+) or Deficit (-) (3 - 6)	-565,3	-125,7	-195,4	-16,0	-797,7	-41,0	1 194,4	405,8	1 040,3	771,4
8. Planned exports for the entire marketing year	0,0	41,9	0,0	4,0	0,0	6,0	37,5	5,4	355,8	450,6
9. Import requirements	565,3	176,2	195,4	27,0	799,3	46,9	251,3	65,0	0,0	2 254,4
10. Planned imports for the entire marketing year	279,2	168,6	214,7	158,0	504,9	45,2	31,5	12,4	50,6	1 593,1
11. Stocks on 30-06-90	n.a.	n.a.	n.a.	1,1	36,3	6,7	182,1	596,9	n.a.	823,1
12. Forecast closing stocks	0,0	93,0	35,7	189,6	0,0	0,2	1 513,0	690,4	1 422,7	3 944,6

APPENDIX V

The Food Security situation by commodity in the SADCC region for the 1990-91 marketing year (000 tonnes)

Item	Maize	Wheat	Paddy Rice	Sorghum/ Millets	Fresh Cassava	Other Crops	Maize Equivalent
1. Opening stocks	2 435,5	258,9	146,3	143,8	14,2	5,0	2 922,9
2. Domestic production	8 131,5	501,6	898,1	1 137,7	11 317,9	1 894,1	15 680,1
3. Domestic availability (1 + 2)	10 567,0	760,5	1 044,4	1 281,5	11 332,1	1 899,2	18 603,0
4. Estimated consumption	8 888,9	1 040,4	1 157,2	1 365,3	10 577,6	1 048,7	16 268,9
5. Carryover requirements	1 159,5	284,5	63,2	36,0	14,0	9,5	1 562,7
6. Total requirements (4 + 5)	10 048,4	1 324,9	1 220,4	1 401,3	10 591,6	1 058,2	17 831,6
7. Surplus (+) or Deficit (-) (3 - 6)	518,6	-564,4	-175,9	-119,8	740,5	841,0	771,4
8. Planned exports for the entire marketing year	361,4	13,8	5,0	36,0	121,2	0,0	450,6
9. Import requirements	1 225,1	618,1	267,0	239,8	257,7	0,0	2 254,4
10. Planned imports for the entire marketing year	979,6	474,6	251,6	2,0	0,0	0,0	1 593,1
11. Stocks on 30-6-90	742,4	25,7	79,7	0,0	0,0	0,0	823,1
12. Forecast closing stocks	2 549,6	309,9	192,1	96,2	877,0	850,5	3 944,6

4

The Tanzania Crop Monitoring and Early Warning Systems Project

D.A. Kajumulo[1]

INTRODUCTION

The problem of food security in SADCC has been discussed at length in many seminars and workshops. Tanzania benefitted from recommendations of the World Food Council (WFC) in the early 1970s and from those of the Food and Agriculture Organization of the United Nations (FAO) in the mid-1970s. The recommendations led to the formulation of the country's food strategy, *i.e.*, the establishment of a Crop Monitoring and Early Warning System (CMEWS) and the institution of the Government's Strategic Grain Reserve (SGR) for bad times. Both are of prime importance in planning for food security.

Equally important is the understanding of the parameters which determine the food security of a given population (Gomez *et al.*, 1984). The numerous interrelated factors are national, international, and environmental in origin. National factors that affect food security include:

- the wealth and income distribution within the population;
- the rate of growth of wealth;
- the presence of social and/or political strife;
- population density and growth rates;
- growth in the domestic food supply as influenced by price incentives;
- agriculture investment;
- technological change;

[1]Senior Agricultural Economist, Crop Monitoring and Early Warning Systems Project, Ministry of Agriculture, Livestock Development and Cooperatives, Dar es Salaam.

- inputs availability;
- the effectiveness of early warnings on food shortages;
- the logistical and institutional infrastructure for food distribution;
- food storage policies;
- health and sanitation infrastructure;
- food import policies (particularly the magnitude and timing); and,
- public and private programmes to assist key target groups in augmenting their food consumption.

International factors include:

- world food availability and prices;
- other world prices;
- capital availability and interest rates;
- donor and relief responses of private voluntary organizations;
- international infrastructure for food distribution;
- war; and,
- international food surveillance and early monitoring.

Environmental factors include:

- short term variables (floods, drought, heat, cold);
- longer term climatic changes;
- resource constraints;
- various effects of environmental pollution; and,
- crop pests and diseases.

In 1975, the FAO Food Security Mission to Tanzania recommended a number of action programmes for strengthening the country's food security. One of these was the CMEWS project.

THE PROJECT

The CMEWS project is to provide the Government advance information on the food situation, making assessments of the crop performances (stages and conditions), stocks supplies and rural open market prices of major food staples (*i.e.*, maize, sorghum, millets, paddy/rice, roots and tubers, wheat, beans and bananas) for all the Regions of Mainland Tanzania. Arrangements are underway to extend the services of the project to the Tanzania Islands. The project also has been assisting in planning the operations of the National Milling Corporation (NMC) and is serving as secretariat to the Government's SGR.

The project is based in the Ministry of Agriculture and Livestock Development (KILIMO), and works in close collaboration with other institutions and organizations including the Directorate of Meteorology (DM) of the Ministry of Communication and Works (UJENZI), the Marketing Development Bureau (MDB), the Prime Minister and First Vice-President's Office (PM), the Regional Quelea project, and the Fertilizer and Seeds Programmes. CMEWS utilizes the services of the Plant Protection Commission, Armyworm Forecasting and National Soil Services.

FAO is the executing agency and the project has been financed by the Netherlands, Norway and the Tanzania Governments for Phase I, October 1978 to December 1981. During this phase the technical base and methodologies were developed. Phase II started in mid-May 1982 and developed the institutional arrangements leading to the establishment of an Early Warning Unit (EWU) in KILIMO. This was completed in mid-1986. The unit is now fully operational.

PROJECT ACTIVITIES

Tanzania, with a total area of about 94,027km^2, has a variety of agroclimates and agroeconomic zones ranging from semi-arid soda flats to heavy rainfall areas on deep, fertile, volcanic soils some with temperatures too cold to grow maize. Some areas have a bimodal, equatorial rainfall distribution.

Bimodality of rainfall is present throughout the country and constitutes the key to understanding Tanzania's food production variability (Gomez *et al.*, 1984). A short dry season typically falls in February. It may last only a week and be imperceptible. The season is virtually unimodal in this case and the crop failures, like rainfall, occur in patches and seldom cover more than two continuous regions of the country's 20. Serious food problems normally affect less than one district (about 10,000 km^2) but may occur in several areas concurrently. Problemless years are exceptional. It is in this context that the CMEWS project began its activities in October 1978.

DATA COLLECTION

Food crop growth and yield are largely dependent on available water supply, thus for the rain-fed crops, on rainfall. Most food crops in Tanzania are rain-fed. Daily rainfall data from some 600 well dispersed stations form the basic reporting network. The present network was obtained by trial and error over several years. It:

a) covers all the important agricultural areas; and,

b) provides all the qualitative information needed for the Crop Soil Specific Water Balance (CSSWB) calculations.

The project follows the East African Meteorological Department's traditional Thursday to Wednesday meteorological week. In the early phases, rainfall data were collected by the DM at a regional level, transmitted to Dar es Salaam and later passed on to the project. Because of delays, pre-paid post cards were eventually adopted as a compromise between timeliness and completeness. The layout of the cards is illustrated in Figure 1. They reflect several years of successive adjustments. The requested information can be provided by uneducated observers, yet in sufficient detail to meet the needs of the project. The cards provide information at a village level on rainfall (seven daily amounts) and on six crops, *i.e.*, maize (mahindi), sorghum (mtama), paddy (mpunga), Bulrush millet (uwele), beans (maharage) and cassava (muhogo). A qualitative production estimate relative to the previous year (mavuno) and price (bei) are reported for each crop, crop stage (ngazi) and condition (hail), and adverse effects (madhara). Phenology is very simply coded from "A" (planting) to "E" (harvesting). Crop condition ranks from "1" (failure) to "5" (bumper harvest). The price (in Tsh) is that which the rainfall and crop reporter (RCR) has to pay in his/her locality for one debe -- a traditional measure equivalent to four imperial gallons. Data from these cards form our "Weekly Reports".

Weekly reports are received from RCRs who were trained in rainfall and crop observations by the project in collaboration with the DM, the hydrometeorological section of the Ministry of Water (MAJI) and KILIMO. Most rainfall stations are run by MAJI, national parks, prisons, schools, parishes, the DM and KILIMO. Thus the RCR is, in most cases, a volunteer and the project spends considerable time and energy keeping in touch with the RCRs. In addition to the training seminars, spare equipment for rain gauges and other meteorological instruments, letters of encouragement, incentives such as T-Shirts, *etc.*, are regularly mailed to the reporters.

In addition to rainfall and crop data, information on crop varieties, growth cycles, planting dates, phenological stages, adverse effects, dates of maturity and yield is provided on a monthly basis by District Agricultural Development Offices (DADOs). These monthly reports from DADOs cover a whole district and also provide an estimate of yield. The coding is basically the same as for RCR reports. It is important to realise that hectarages are usually rather rough estimates and some are faked intentionally. Thus, the data undergo a very close scrutiny by the project before being entered into any calculations. The availability, quantity and distribution of key inputs such as fertilizers, seeds, pesticides, fuel, *etc.*, known to be productivity enhancing factors, are also contained in the same report.

KITUO:	*NA:*	*FORM 1*
WILAYA:	*TARAFA:*	

SIKU	*TAREHE*	*MVUA mm*
THURSDAY ALHAMISI		
FRIDAY IJUMAA		
SATURDAY JUMAMOSI		
SUNDAY JUMAPILI		
MONDAY JUMATATU		
TUESDAY JUMA-MANNE		
WEDNESDAY JUMATANO		
TOTAL JUMLA		

	NGAZI HALI	*MADHARA*	*MAVUNO*	*BEI Shs/ debe*
MAHINDI				
MTAMA				
MPUNGA				
UWELE				
MAHA-RAGE				
MUHOGO				

MAELEZO:

MWANGALIZI

POSTAGE WILL BE PAID BY ADDRESSEE

NO POSTAGE STAMP NECESSARY IF POSTED FOR DELIVERY WITHIN TANZANIA

BUSINESS REPLY SERVICE
LICENCE NO. 53

Team Leader
Early Warning & Crop Monitoring Project
FAO/Kilimo/IDM
P.O. Box 5384
Dar es Salaam

Fig 1: Weekly forms used by rainfall and crop reporters.

The DADOs use this data to make a qualitative estimate of expected yields and production. This information is vital in formulating inputs distribution policy.

Finally the project collects the agroeconomic data necessary for establishing trend information for economic factors relating to the production and supply of food commodities important in Tanzania (Gomez *et al.*, 1984). Food supply and consumption data important for making surplus/deficit computations (*i.e.*, procurement, sales and stocks) plus open market consumer price data are collected. These data provide a basis for rational policies regarding reliable food supplies at reasonable costs.

DATA ANALYSIS

Based on the hypothesis that the crop growth and yield under Tanzania conditions are largely dependent on available moisture, a CSSWB is calculated for that particular crop in a weekly time step. However, using conventional Potential Evapotranspiration (PET) and soil water holding capacities (WHC), yields are calculated from the CSSWB calculations for each crop and district. The calculated yields are calibrated with district averages from DADO reports.

Calibration with local data is essential since it compensates for factors not normally taken into account by the version of the CSSWB computed in the project. This refers particularly to the effect of fertilizers, rates of infiltration versus runoff (effective rainfall), pests (armyworm), and diseases (maize streak virus), *etc.* Finally, yields are multiplied by area to get production estimates.

Rural open market prices are collected to explain the supply and demand situation within regions and districts.

Analyses of procurement, sales/issues, stocks, imports (aid and commercial) and exports are processed on a monthly basis and compared with previous years to assess the national food demand and supply trends. Estimates of marketable surplus available to the NMC and the Cooperative Unions are collected weekly during the intake years. Stock positions are monitored to detect any abnormal expansion or shrinkage in marketed demand. Thus the consumption requirements, stocks in warehouse (first day of month), purchases/procurement (forecast and actual) imports (confirmed and commercial) from different sources, *e.g.*, WFP, EEC, Japan, Italy, Australia, France, Canada, *etc.*, operational shortfall including the SGR and actual issues are tabulated to form the "National Food Balance Sheet" or "National Food Supply Situation".

OUTPUTS

The project issues four types of reports. They are the monthly Farming Weather Bulletin (FWB), the monthly Consolidated Assessment of the National Staple Food Situation (which evolved into the current National Food Security Bulletin), interim Production Estimates and the National Food Supply Projections. The FWB contains the synoptic summaries for the month under review compared to the previous year. It also contains rainfall summaries, including maps, over a 12-month period plus an agricultural overview for selected stations in Mainland Tanzania.

The National Food Security Bulletin contains the current food situation, including a weather and crop review, input supply situation, open market rural price developments and the NMC food supply projections. The status of the SGR is also reviewed. The interim Production Estimates report, issued in April, contains the preliminary production forecast. The National Food Supply Projections report, issued in June, contains the final production forecasts by major crop and district. This report compares the magnitude of the expected harvests with consumption requirements based on standards developed by the FAO and the World Health Organization (WHO), to identify problem areas.

LIMITATIONS OF THE PROJECT ACTIVITIES

Since its inception, the project has met with important technical limitations. Area production data from DADOs often are unreliable or exaggerated intentionally. This problem is likely to ease with the Current Agricultural Surveys (CASs).

The second technical problem is the lack of rain-gauge stations to cover important agricultural and borderline areas. This problem is aggravated by the "decaying" of established stations due to breakage of glass measuring cylinders (which requires foreign replacements), the smashing of rain-gauges by reversing trucks (particularly at district headquarters), dismantling of installed rain-gauges by irresponsible people and the transfer of some of RCRs without replacements. The third technical problem is that our forecasts are in absolute quantities. They could be more scientifically presented in Maize Equivalent quantities of the edible portions. This is done deliberately because of a lack of self-sufficiency in rice and wheat. The fourth technical problem is that the project's final production forecasts are not discussed in any interdisciplinary or interministerial committee, thus, the project has full responsibility for its results.

REFERENCES

Gomez, R., P. Dekerck and T.M. Hyera. 1984. Description of Data Files and Operation of Crop Monitoring Programme. *CMEWSP/8/1*. :57

Kessler, D A. March 1984. Food Safety: Revising the Statute.

Kajumulo D.A. November 1988. Data Requirements for Crop Forecasting and Early Warning. The Case of Tanzania.

5

Food Access And Nutrition Policy/Programme Linkages In Mainland Tanzania

Festo P. Kavishe[1]

INTRODUCTION

Food access is an important component of food security. Food security has little meaning unless food is available, accessible, consumed and meets the basic nutritional needs of the individual and community. Nutritional security is a logical component of food security.

Food and nutrition security implies availability of food, access and consumption by the individual. Adequate individual consumption requires that the total food available and accessible to the family consistently cover basic requirements and be equitably distributed within the family according to individual needs. Food and nutrition security means access by all people, at all times to enough food for an active healthy life (World Bank, 1986).

This paper discusses the question of food access and nutrition policy/programme linkages in mainland Tanzania. It assesses the nature and magnitude of the problem the linkages between nutrition and food security, the knowledge gaps that exist and how to fill such gaps.

THE NATURE AND MAGNITUDE OF THE FOOD PROBLEM

Tanzania is predominantly an agricultural country. FAO (1990) estimates that the agricultural sector (including livestock, forestry and fisheries) contributes, on average, 51 percent of the gross domestic product (GDP); accounts for over 72 percent of export earnings; provides employment for over 80 percent of the labour force; and provides raw materials for over 85 percent of the country's industrial production. Apart from being the backbone of the country's economy, the agricultural sector plays a major role in food self-sufficiency.

---

[1]Managing Director, Tanzania Food and Nutrition Centre, Dar es Salaam.

Food Sufficiency in Tanzania

Tanzania, since independence in 1961, has put a lot of emphasis on food self-sufficiency (TANU 1967, 1971; URT 1964, 1969, 1976, 1982a, 1982b and 1984). Food self-sufficiency is defined as "supplying staple food requirements from domestic production". Food self-sufficiency is not a necessary condition for food security if enough money, including foreign exchange, is available to purchase food. However, the economic problems facing Tanzania and the risk inherent in the present international economic (dis)order make national food sufficiency an essential element in Tanzania's food security goal. But the determination of food self-sufficiency in Tanzania is difficult because of inadequate data and definitional problems.

The types of food eaten by different population groups in a particular area constitute the "food basket". The food basket can be determined by looking at consumption patterns. The consumption pattern in Tanzania consists mainly of one staple food, supplemented with beans or peas, green leafy vegetables and occasionally meat. In some areas, fish and milk contribute substantially to the energy and protein content of the diet. Sufficiency of energy requirements from the mixture of the foods consumed usually meets the requirements of the other nutrients (protein, minerals and vitamins). Food sufficiency is usually an expression of energy sufficiency from the major staples.

The major sources of energy in Tanzania are derived from the consumption of:

- maize, contributing on average more than 60 percent of the energy from the staple foods;

- cassava, rice and sorghum/millet contending for second place in energy supply with variations from year to year, with rice of greater importance in urban than rural areas;

- wheat, the least important of the "preferred staples";

- potatoes (sweet and round), yams and bananas are much lower in food energy per kilogram than other staples but consumed in large quantities; and,

- beans, which are becoming increasingly important (Kavishe, 1990b).

This discussion of food sufficiency will focus on the production of these "foods", and will focus on two levels -- National and Household.

National Food Sufficiency

Except during drought years, Tanzania was largely self-sufficient in food production until the mid 1970s.

During the 1961-66 period, food self-sufficiency was taken for granted. Tanzania was the only independent African state achieving a growth trend in food production higher than that of population (Amani *et al.*, 1988 :72).

The situation changed following the two year drought of 1973-74 and 1974-75. Food imports, necessary for relief during the crisis years, continued to provide a substantial part of food requirements, particularly for maize. The average annual rate of growth in food supply was 2,6 percent for the period 1970-71 to 1983-84 lagging behind the increase in national food consumption estimated at 5,9 percent (Mushi, 1989).

Good rains since 1984-85 and price incentives resulting from structural policy reforms have resulted in a significant increase in food production. This has highlighted the critical problem of the geographical distribution of production being remote from the main consumer markets. National food adequacy computations indicates that Tanzania's food production has provided more than enough to meet theoretical overall food and energy requirements. Subtracting 15 percent from production for seeds and post harvest losses, the balance available for food needs is around 120-140 percent of estimated requirements while that for nutritional energy requirements stand very close to 100 percent, Table 1.

Contrary to current thinking that aggregate national food availability in Tanzania, since the advent of good weather and economic recovery, is that of plenty, in reality, it is a flimsy balance between production and needs. The fragility of the situation stems from the post harvest losses. Estimates of post harvest food loss range from five percent to 40 percent (FAO 1990, quoted in Kavishe, 1982).

These computations do not take into account the energy intake originating from animal products (livestock and fisheries). The Livestock Development Programme in the Ministry of Agriculture and Livestock Development estimated the following for 1988: 457 million litres of milk; 184 000 tonnes of beef; 28 000 tonnes of sheep and goat meat; 290 million units of eggs; 15 000 tonnes of poultry and 8 000 tonnes of pig meat. For fisheries, in 1987, it was estimated that 303 000 tonnes of fresh water fish were caught, 53 percent from Lake Victoria.

Table 1
Tanzania : National aggregate food balance for 1984-85 to 1988-89

Years	Total Production		Total Requirements		Available Balance	
	Food (000mt)	Energy (m kcal	Food (000mt)	Energy (m kcal)	Food (%)	Energy (%)
1984-85	7 026	24 261	4 543	21 047	131	98
1985-86	6 972	24 100	4 670	21 637	127	95
1986-87	7 048	24 499	4 801	22 243	125	94
1987-88	6 780	23 598	4 935	22 865	117	88
1988-89	7 919	27 355	5 073	23 506	133	99

Notes:

1. Balance assumes a 15 percent reduction of total production due to seeds and post harvest losses.
2. Requirements relate the production to the population using 1988 census data.
3. Initial production data derived from Food Security Bulletin, June 1989, Ministry of Agriculture and Livestock Development (MALD).
4. Food and energy requirement computations were based on 1985 FAO/WHO recommendations of 600g of food per person per day and FAO/WHO/UNU recommendations of 2780 kcal per person per day respectively.
5. The following figures were used for the mean energy content of the food products per 100g of edible portion: 350 kcal (=0,6 processing coefficient for paddy), 325 kcal for beans, 330 kcal for wheat, 385 kcal for bananas, 320 kcal for cassava and 460 kcal for sweet potatoes and yam.

Regional Food Sufficiency

The year 1988-89 is acknowledged as a bumper harvest year for Tanzania. Although it was a bumper harvest year, it appears that about 40 percent of the Tanzania population lived in food deficit regions. Another 20 percent just reached a tight balance, leaving 40 percent who could be described as self-sufficient in food production.

Dar es Salaam is the main food deficit region followed by Kigoma, Dodoma and Mara with a production of only 50-60 percent of their energy requirements. The main surplus regions are Kager (bananas, beans and cassava), Ruvuma (maize), Shinvanga (maize and paddy) and Rukwa (maize) producing more than 150 percent of the food energy they actually require. The importance of traditional staples is highlighted by the case of Kagera which is often considered a food deficit region.

Household Food Security

Most households in rural Tanzania consume the food they produce. In a particular household, food security is determined by what the household is able to produce, store, process and prepare. In turn, these are determined by the agricultural productive resources available, such as the amount and quality of land, the amount and division of labour, the health and motivation of the household members, the level of available technology, as well as climatic and ecological conditions. Available female labour is a critical factor because more than 80 percent of household food production is done by women.

Table 2
Tanzania: Proportion of households in Miwara and Morogoro regions reporting inadequate harvests to meet food needs, 1987-88 and 1988-89.

Region	District	1987-1988 n	1987-1988 %	1988-1989 n	1988-1989 %
MTWARA					
	Masasi	398	67,7	398	67,7
	Newala	135	76,7	135	76,7
	Newala Rural	137	71,0	137	71,0
MOROGORO					
	Kilosa	1 098	60,5	1 084	62,2
	Killombero	291	64,2	281	63,5
	Ulanga	206	50,0	203	46,8
	Morogoro Rural	282	63,8	282	72,7
	Morogoro Urban	60	63,3	60	61,7

Source: Kingamkono R. 1987 (20), 1989 (43), and Ntebe *et al,* 1989 (44).

The process and extent to which available food reaches household members throughout the whole year defines the access to food, *i.e.*, who eats what, how often and how much, Table 2. A rapid assessment of 400 households from 21 villages in Mtwara Shinvanga and Zanzibar revealed that food grains lasted for six to eight months after harvest in 80 percent of the households (Seenapa and Mlingi, 1988). Marked differences were noticed between cassava growing regions and non-cassava growing areas. Food grains harvested in the cassava growing areas (Mtwara and Zanzibar) lasted two to three months longer than those in non cassava growing areas (Shinyanga). The better household food security situation in Mtwara and Zanzibar was attributed to the cultivation of the drought resistant cassava as both a food and cash crop. The keeping of livestock also seemed to improve the food security situation and may explain the generally low rates of malnutrition observed in livestock keeping areas.

NUTRITIONAL STATUS AND FOOD SECURITY

Tanzania suffers from four major endemic nutritional deficiencies:

- protein energy undernutrition (PEU);
- nutritional anaemia;
- iodine deficiency disorders (IDD); and,
- vitamin A deficiency (VAD).

Other deficiencies occur sporadically causing pellagra, beriberi, scurvy and rachitis.

Extent and General Pattern of Malnutrition

The estimated magnitude of the major nutritional deficiencies is shown in Table 3. These 1987 estimates are crude and based on nutrition information which is not nationally representative. For example, Iringa Region, which has the longest data series on under five nutritional status, indicates an overall decline of total underweight children (<80% weight for age) from 55,9 percent in 1984 to around 36 percent in 1989. For severe underweight (<60% weight for age), the decline was from 6,3 percent to just under two percent for the respective years.

Declines in the rate of malnutrition have occurred in the two districts of Kagera region implementing the UNICEF supported Child Survival and Development (CSD) programmes. Ngara and Biharamulo districts, which had total underweight rates of 60 percent in 1985, were reporting rates of 44 percent and 40 percent respectively in 1989. Incidence of severe underweight has been reduced from 12 percent and ten percent to below four percent and one percent for Ngara and Riharamulo districts, respectively. For Kilimanjaro Region, Hai district, which has been operating a community based information system since 1987, the prevalence of underweight children dropped from 34 percent to 18 percent by the end of 1989. For severe underweight, the drop was from 3,5 percent to 1,5 percent. Table 3 shows that the four major nutritional problems affect children under five years of age and pregnant or lactating women. Malnutrition is not limited only to these 'vulnerable groups'. Older children and adult males are also affected.

Analysis of the pattern of child growth indicates that children grow normally to the age of 6 months presumably due to breastfeeding. Growth retardation appears with an increase in the prevalence of all types of Protein Undernutrition (PEU). The highest rate of growth retardation occurs between 6 and 24 months resulting in high levels of undernutrition between one to three years. The critical period seems to be between 6 and 36 months, an age that coincides with the weaning period and the period of the severest childhood diseases. Poor feeding, weaning foods, and diseases appear to causes of undernutrition.

Table 3
Tanzania: Prevalence of nutritional problems for age/group, 1987.

Age Group	Protein Energy Undernutrition (PEU)	Anaemia	Iodine Deficiency Disorders (IDD)	Vitamin A Deficiency (VIT.DEF)
	% Affected			
Children under 5 years	52,0	45,0	13,0	30,0
Pregnant/lactating women	13,0	80,0	52,0	0,7
School children and other adults	20,0	20,0	40,0	0,1
All age groups	28,0	32,0	25,0	6,1

Source: Kavishe, F.P., 1987. The Food and Nutrition Situation in Tanzania in 1987, TFNC Report No 1215.

Acute forms of malnutrition (wasting) leads to adaptation (stunting). This decreases the physiological nutrition requirements for stunted children helping them meet their nutritional requirements. Wasting generally increases with age and has its peak prevalence during the second year of life together with diseases like diarrhoea. Stunting increases with age as children accumulate height deficits due to repeated episodes of disease accompanied by inadequate feeding. The result is that stunting becomes the commonest form of malnutrition seen in Tanzania. Catch up growth in height seldom takes place and people in Tanzania generally are shorter than their genetic potential (Kavishe *et al.* 1990). The persistence of high levels of chronic undernutrition (stunting) reflects a chronic problem of food insecurity at the household level.

The Paradox of Nutrition and Food Security

Despite considerable regional differences in food production and wealth among various areas of the country, global malnutrition does not vary in the same proportion nor in the same direction. The problem of PEU has been described as constant over time and geographical location with the possibility that nearby villages have greater variation than regions (URT/UNICEF, 1985). This pattern of variation is similar to that described for food sufficiency. In fact, the most striking feature is that per capita global food production and regional wealth do not seem to relate directly to levels of malnutrition, nor to infant and child mortality rates. Inadequate intake of food is not necessarily correlated with low levels of food production.

Table 4 illustrates this paradox, with data from the seven regions implementing UNICEF supported CSD programmes, where there is satisfactory community based data on nutritional status. Kilimanjaro, the region where the available energy from food crops is the lowest (2415 kcal/capita), has the lowest rate of overall prevalence of child undernutrition (29 percent) perhaps because they are animal keepers. An analysis of the geographical pattern of Protein Energy Undernutrition in relation to the various agricultural production and consumption systems, illustrates the paradox between food availability from own production and the rates of PEU.

The simple agricultural production/consumption system developed by USAID/TFNC (Bryceson *et al.*, 1986) assists in differentiating between the causes and the types of malnutrition. Food availability, malnutrition and food insecurity (particularly the reaction capacity in times of acute food crisis) appear as three different concepts. The areas which seem to have the greatest food insecurity have pastoralist and millet/sorghum/livestock production systems with the latter having the most severe problems. The cassava growing areas are also considered to be food deficit. The most severe food deficit, though not food insecure, region is Dar es Salaam.

Table 4
Tanzania: Food availability from production and malnutrition, 1988-89.

Region	Food Balance (Kcal/cap/day)	Prevalence of Malnutrition (1989) (%)	
	1988-89	Severe	Total
Iringa	4 060	2,4	40,3
Kagera	5 530	1,7	38,7
Mtwara	3 920	9,2	56,1
Ruvuma	5 530	3,8	38,9
Kilimanjaro	2 415	1,9	29,0
Morogoro	3 255	5,2	49,4
Shinyanga	5 530	3,0	37,1

Source: Kavishe and Yambi, 1990.

Cereal deficit areas with higher milk consumption have somewhat lower malnutrition rates. This relationship may be due to the higher energy density of fresh milk and ease of consumption. (Bryceson *et al.* 1986).

Food deficit areas contained between 40 to 60 percent of the mainland population in recent years, yet many of these food deficit areas have lower malnutrition rates than the food surplus areas (maize surplus regions). Malnutrition in relation to household income may be a key element in explaining this variation. But practical strategies of farmers do not clearly show whether a food safety margin is providing for more than survival, using reserve crops such as cassava or cash activities to complement food needs. There may also be a real gap between what farmers consider to be sufficient food for proper nutrition and the figures set by nutritional scientists. Some studies done in the food surplus areas suggest, that on average, about one third of the rural population have to rely on working for food and/or cash to buy food despite adequate harvests. For example, the proportion of food insecure households in Rukwa region in 1988-89 was estimated to be 80 percent despite being a bumper harvest year (FAO 1990). It was because of such discrepancies that TFNC developed a Household Food Security Card to enable families to estimate the number of bags of their staple or legumes needed to sustain the households until the next harvest season considering the number of people in the household. The TFNC household food security card is based on two quantitative models. The first is a household food production model, where the amount of food harvested is calculated on the basis of average yield per area cultivated. The second is a household nutrient requirement model where household energy and protein requirements per annum are estimated on the basis of moderate activity and transformed into the whole household agricultural output. It was estimated that the average annual food requirement for a household of six people is three bags of cereal and half a bag of legumes (therefore called the "bag model").

Policies Affecting Food and Nutrition Security

The Party and the Government have made several policy declarations and carried out a number of campaigns with the objective of attaining food security. Some specific policies with regard to food and nutrition have been declared and a series of macrolevel policies which affect food security have been developed. With the possible exception of these macro-economic policies, there has not been any monitoring of progress or evaluation of the implementation of the various policies or campaigns. A way of filling this gap would be the creation of a special unit dedicated to the monitoring of food security policies and measures. Such a unit would not interfere with existing services managing the different food and nutrition security sectors, but would provide support to decision makers by keeping a comprehensive view on the many dimensions of food security. This would facilitate consistency in the policy framework which might otherwise be over sensitive to pressure from international financial organisations, and would eventually lead to appropriate alteration of policy decisions. Generation of information for the proposed unit could come from existing information systems with the gap closed by appropriate research.

Food and Nutrition Programmes

The varied nature of the food and nutrition problem in Tanzania allows different intervention paths to be taken. Actions may be directed towards ensuring production of adequate food supplies; maximizing stability in the flow of supplies; and securing access to available supplies, particularly for the vulnerable groups (children under five, pregnant and lactating women, and the at risk households).

Another intervention measure would be to ensure that accessible food is consumed in adequate and balanced amounts. Many intervention measures comprehensively cover all the elements, necessitating intersectoral coordination and cooperation.

Consistency between the policies and programmes exists, but the linkages between the different programmes is very weak. The formation in 1989 of a national steering committee for Child Survival and Development (NSC/CSD) within the Planning Commission, has greatly facilitated programme linkages. When the Food and Nutrition Policy is declared, a National Food and Nutrition Technical Committee will further strengthen programme linkages.

On the basis of a recent analysis of the Food and Nutrition Security situation in Tanzania (FAO 1990, Kavishe *et al.* 1990) food and nutrition security measures should focus on four priority points, *i.e.*:

- access to food consumption at the household level with particular emphasis on the role and situation of women as key agents for feeding the household;
- monitoring of the process, progress and impact of specific macro-economic policies affecting food flows through the geographical redistribution of food crops and of economic accessibility to food;
- the transport and communication systems; and,
- the operation of the cooperative societies.

An important component of food and nutrition security is the whole question of community participation. Present food security strategies do not take full advantage of this opportunity. There are too many technologically based "magic bullet" approaches recommending solutions which have been successful in other settings without adequate adaptation. Communities should be helped to assess their own food security problems, identify and analyze the causes and take appropriate action based on available resources. This "Triple A" cycle of assessment, analysis and action seems to be a generalisable key component of successful food and nutrition programmes (Yambi *et al.* 1989).

CONCLUSION

Tanzania is faced with an extensive problem of food and nutrition insecurity. Nearly 40 percent of the population is prone to food insecurity. Household food insecurity is reflected in high rates of child malnutrition.

Several policy and programmatic steps have been taken to improve food security. However, because of inadequate linkages between and among the policies and programmes and the lack of monitoring of their implementation, it is difficult to evaluate their impact. Casual observation indicates improvement and the nutrition situation seems to be improving where specific nutrition programmes have operated for at least two years. Research is needed to determine:

- the causes of the discrepancy between food availability and malnutrition;
- the mechanisms by which farmers cope with fluctuations in food supply;
- the relationship between nutritional status and household security;
- community participation and mobilisation in household food security; and,
- the critical factors which are responsible for the success or failure of food and nutrition programmes.

REFERENCES

Amani H.K.R. *et al.* 1988. Impact of Market Liberalisation on Household Food Security in Tanzania. In Mudimu G.D. and R.H. Bernsten eds. *Household and National Food Security in Southern Africa.* University of Zimbabwe/Michigan State University Food Security Research Project. Department of Agricultural Economics. Harare.

Bryceson, J.; N. Metcalf; A. Shriver; J. Strauss; F.P. Kavishe and A. Petit. 1986. A review of the state of food and nutrition in Tanzania and its programming implications. Prepared for USAID/Tanzania. *TFNC Report.* No. 1019.

FAO. 1990. Assessment and issue paper: *The Nature of the Food Security Problem in Mainland Tanzania. Assistance for the Formulation of a Comprehensive National Food Programme.* Revised draft Report No. 2.

Kavishe, F.P. 1982. *The Need for Increased Technical Assistance for Post-harvest Grain Conservation in Tanzania.* Submitted as a Technical Report to London School of Hygiene and Tropical Medicine. University of London.

Kavishe, F.P.; W. Lorri and O. Yambi. 1990a. Malnutrition and Household Food Security in Tanzania. A consultancy report for the World Bank and FAO. *TFNC Report.* No. 1309.

Kavishe, F.P. 1990b. Malnutrition in Tanzania : a Situational Analysis in 1990. A consultancy report for UNICEF. *TFNC Report.* No. 1322.

Mushi, S.S. 1989. The political economy of food and nutrition in Tanzania. A consultant report submitted to TFNC, Department of Political Science and Public Administration. University of Dar es Salaam.

Sen, A. 1982. *Poverty and Famines.* Oxford Clarendon Press.

Seenapa, M; and N. Mlingi. 1988. Household food security and the role of cassava. A case study from Tanzania. In: *Proceedings of the 3rd African Food and Nutrition Congress.* :734-763.

Tanganyika African National Union (TANU). 1967. *The Arusha Declaration and TANU's Policy on Socialism and Self-Reliance.* Government Printer. Dar es Salaam.

TANU. 1971. *'Mwongonzo wa TANU'.* Government Printer Dar es Salaam.

United Republic of Tanzania (URT). 1964. *First Five Year Development Plan*. Dar es Salaam.

URT. 1969. *Second Five Year Plan.* Dar es Salaam.

URT. 1976. *Third Five Year Plan.* Dar es Salaam.

URT. 1982a. *Long Term Perspective Plan 1981-2000.* Government Printer. Dar es Salaam.

URT. 1982b. Ministry of Agriculture. *The Agricultural Policy of Tanzania.* Government Printer. Dar es Salaam.

URT. 1984. *Tanzania National Food Strategy.* Vol. I. Dar es Salaam.

URT/UNICEF. 1985. Situation analysis of the problem of children and women and plans of operation and action, 1987-91. Dar es Salaam.

World Bank. 1986. *Poverty and Hunger: Issues and options for food security in developing countries.* Washington. D.C.

Yambi O; U. Johnson; and B. Ljunggvist. 1989. The role of government in promoting community-based nutrition programmes. Experience from Tanzania and lessons for Africa. PEW/Cornell lecture series on Food and Nutrition Policy. October 24, 1989.

6

Food Access And Nutrition Policy/Programme Linkages In Malawi

Mabel O. Mpoma[1]

INTRODUCTION

The Government of Malawi is committed to improving the food security and nutrition of its population. In 1986, a high level Symposium on Nutrition was held for all Principal Secretaries to discuss the magnitude and nature of the nutrition problems in the country. A key recommendation from this Symposium was that a Food Security and Nutrition Unit (FSNU) be established within the Department of Economic Planning and Development in the Office of the President and Cabinet. This Unit would be responsible for maintaining an overview of food security and nutrition related policies, undertake policy analysis, formulate policy and disseminate relevant information to the appropriate authorities.

This organisational framework for dealing with food and nutrition issues is unique to this region of Africa. In most countries, Food and Nutrition Units are placed either in the Ministry of Health or in the Ministry of Agriculture. Malawi has food and nutrition units strategically placed in all relevant government sectors: the FSNU in the central planning department of Government, a Nutrition Unit in the Ministry of Health, a Food and Nutrition Unit in the Ministry of Agriculture, in addition to several University groups active in undertaking food security and nutrition related research. The different ministries and organisations involved in food security and nutrition activities (including non governmental organisations) form a food security and nutrition advisory committee which helps the FSNU in its coordinating role.

---

[1]Senior Nutritionist in the Department of Economic Planning and Development in the Office of the President and Cabinet.

PRESENT SITUATION AND STRATEGY

National Level Food Security

At the national level, food security is defined as the ability of the country to produce or import adequate food to feed the population. The country is basically self-sufficient in food although production sometimes is affected by disasters like drought, floods and infestation by a pest like meallie-bug.

Household Food Security

Though the country is self-sufficient at the national level, this does not guarantee that all people have access of enough food at all times for a healthy life. The Government therefore recognises the importance of addressing household food insecurity in addition to attaining national food self sufficiency. At the household level, food security is defined as the access of families to adequate amounts of food, either through home production, purchases or exchanges to satisfy minimum human requirements throughout the year. This is affected by:

- employment opportunities;
- productivity among female headed households; and,
- land holding sizes.

Survey results have shown that those farm families with less than 0,5 hectare of land are often never able to produce enough food to feed themselves throughout the year. Female headed households also have been shown to be at risk in producing enough food to feed their families throughout the year. These families have to supplement their food intake either by working for someone in exchange for food or money (*Food Security and Nutrition Bulletin*, Volume No. 2).

Population Dynamics and their Implications on Food Security and Nutrition

The population of Malawi is growing rapidly. The fixed land area will result in more pressure on agricultural land and other scarce resources in the future and strain the ability of many households to feed themselves. The government recognises that large amounts of the scarce resources have to be allocated to increase food production and social services simply to cater to the increasing number of people. Food insecurity at the household level will run a risk of deterioration for many families unless they can be given some land, improve the productivity of their limited land, be provided with employment or create income generating activities.

STRATEGY

National Level Food Security and Nutrition Strategy

The Government of Malawi is now guided by a Food Security and Nutrition Policy statement produced this year. The Government is trying to provide both direct and indirect focuses in efforts to stimulate growth, *i.e.*, helping smallholders raise the productivity of their land,together with investment to generate off-farm employment opportunity; investment in health and sanitation facilities to reduce the burden of sickness; investment in household technology to help break labour bottlenecks at key periods; and investment in education to improve productivity, welfare and nutrition.

With Malawi's relative shortage of land and abundance of labour, the focus of increasing productivity in agriculture is on land augmenting technology rather than on labour saving technology. The Government emphasises the use of high yielding varieties of cereals, the use of fertilizer, small scale irrigation systems, *etc*.

Household Food Security

The strategy for improving household food security is through an expansion of income and employment opportunities as well as an increase in agricultural productivity. To ensure that the population of Malawi is able to benefit and participate in this process, investment is directed into human resource development (including the expansion of child spacing programmes), the expansion and the strengthening of education and primary health care. The elements of the strategy include to:

- expand income producing employment opportunities;
- increase Agricultural productivity;
- increase Human Resources Development; and,
- increase income transfer.

The strategies are geared to improve food security and nutrition in the short, medium and long term. The first three elements are geared toward addressing household food security in the medium and long term and the fourth strategy is geared toward addressing immediate problems.

To adequately address household food security, several functional groups consisting of: small holding size; medium holding size; large holding size; estates; tenants and, urban poor; were identified and strategies planned for each of these functional groups.

For all smallholder land holding categories, the overall strategy is to intensify cultivation by increasing output per area unit of land in terms of food as well as selected high value cash crops. These strategies include:

- increased use of high yielding cereal varieties;
- improved availability of fertilizer; and,
- extended irrigation during the dry periods.

Small Holding Sizes

Because of their low level of land resources and income to provide food security, this group is very fragile and is highly dependent on output from their land and income generation through off-and non-farm employment. Specific strategies for this functional group include:

- expanding credit facilities;
- targeting specific extension advice and inputs to this group;
- improving storage facilities at the household level;
- ensuring a constant supply of food in the market place either through ADMARC or private traders;
- promoting small, rural milk cooperatives; and,
- instituting immediate income transfer programmes in the short term by creating off-season employment opportunities for farming families and year-round employment for families on very small, non-viable holdings, through public works schemes like food for work or cash for work.

Medium Smallholders

In years of good rainfall this group of farmer may be self-sufficient if they use high yielding varieties of seed and fertilizer. They are on the edge of becoming food insecure during periods of drought. They also depend on off and non-farm employment activities to earn additional cash income. The strategy for this group of farmers is to increase their income by increasing their agricultural productivity and improving the opportunity for rural employment activities. Due to their relatively large land holding size, when appropriate inputs are used enough food is produced to meet family requirements with some left over for sale. Most of the strategies for this group of farmers are similar to those with small holdings. In addition, the following strategies are also specifically targeted to this group.

- promotion of diversification into horticultural and cash crops depending upon irrigation potential and soil characteristics;

- promotion of medium term credit facilities to maintain income generating activities such as egg production, poultry and pig farming and other non-farm activities.

- promotion of agro-forestry through extension as a source of additional food and manure; and,

- encouragement of irrigation cooperatives to bring more land under irrigation and to promote cultivation of a second, particularly cash, crop.

Large Smallholders

This group of farmers have adequate land to produce enough to feed themselves and participate in cash cropping. They are an important source of employment for poorer farmers who depend on off-farm income. The specific strategies for this group of farmers include:

- promotion of livestock production for meat in addition to producing adequate marketing and cold storage facilities;

- linking of livestock production with farming practices to produce more food crops as well as to animal fodder (*e.g.*, re-cycling of manure for organic fertilizer); and,

- development of a small scale food processing industry based on crops which are promoted by extension agents.

Estate Workers and Tenant Farmers

The food security and nutrition status of estate workers depends on the wages they receive and on the social and health services provided in the estates. The specific strategy for this sector is to increase production by expanding the area under cultivation, thus increasing the demand for labour. The major strategy for improving the food security and nutrition of this group includes the regulation of wages on estates and involves:

- regular monitoring of the minimum wage level in relation to staple food costs in order to maintain a reasonable ratio of days worked to the ability to buy a family's monthly maize requirement;

- increased productivity and diversification of the estate sector to increase the demand for labour through provision of estate extension services and instituting land taxes to bolster land utilisation; and,

- increase access to off-season employment to provide income during non-peak estate labour periods.

Tenants

The land tenure status of estate tenants is a major determinant of their food security and nutrition situation. The major strategy for this group is to improve the terms of their employment with the estate owners to improve their food security. Specific actions include:

- increasing productivity and diversification within the estate sector to increase the demand for labour through provision of estate extension services as well as instituting land taxes which should bolster land utilisation;

- providing access to health services which meet government standards;

- promoting good health and nutrition practices through education to ensure that the cash income earned will be invested in meeting the family's requirements to ensure optimal nutrition;

- increasing access to off-season employment to provide income during non-peak estate labour periods.

Urban Sector

The urban poor are characterised by a high dependency on wage employment and are highly vulnerable to fluctuations in the availability of staple foods, especially due to changing price levels. A major element of the strategy for the urban poor is the expansion of employment opportunities in the industrial sector. Specific elements of this strategy include:

- developing urban, medium-term credit facilities to support income generating activities;

- encouraging urban employment in both the informal and formal sectors;

- developing vocational training in skills needed to produce innovations such as appropriate technology in addition to basic technical, engineering and mechanical skills to meet the trained manpower market requirement;

- regular monitoring of minimum wage levels in relation to staple costs to maintain a reasonable ratio of days worked to the ability to buy a family's monthly maize requirements;

- developing and promoting labour saving programmes to reduce the time burden on women;

- promoting sustainable and profitable income generating activities, particularly with NGOs; and,

- promoting income transfer programmes by encouraging employment opportunities for poor urban families through public work schemes (*e.g.*, food for work, cash for work) which would strengthen urban infrastructure.

ORGANISATIONAL FRAMEWORK

Food Security and Nutrition Unit (FSNU)

The FSNU was established to provide the leadership, guidance and analysis needed to improve Malawi's food security at both the national and household levels. A central issue, in improving the welfare of the people of Malawi, is improving the quantity and quality of food available as well as assuring that all have access and the ability to obtain their minimum nutritional needs, particularly the most vulnerable groups.

Accomplishing these goals will take continued monitoring, analysis and implementation of effective national policies and programmes. This can be done only if there is an adequate base of information, correct analysis of that information, and effective action by Government to implement appropriate policies and programmes.

Since its establishment, the FSNU has been attempting to achieve this objective and was given the following mandate in order to accomplish its goals.

1. Maintain an overview and continuing analysis of policies and programmes most relevant for food security and nutrition, including those related to production, strategic reserves, exports and imports, food price policies in relation to income, as well as other health related policies.

2. Coordinate government policies and programmes relative to food security and nutrition.

3. Estimate the food security and nutrition effects of selected existing or potential policies and programmes and identify new policies and programmes or changes in existing ones which are likely to have more desirable effects.

4. Develop a National Food and Nutritional Surveillance system by synthesising, on an on-going basis, available and new information related to food security and nutrition and ensure that the information gathered by the system is disseminated in a timely fashion to the proper authorities via the preparation and distribution of regular bulletins and policy papers.

5. Facilitate the use of information generated for policy and planning purposes, in regards to existing and future Government policies and programmes related to food security and nutrition through the organisation of workshops and seminars.

6. Identify areas where additional information is needed and assume leadership among the relevant institutions in jointly establishing priorities for obtaining and analyzing such information.

Food and Nutrition Unit: Ministry of Agriculture

The aim of the food and nutrition unit in the ministry is to ensure a satisfactory nutritional status for the farming population with particular emphasis on the nutritionally vulnerable households. This is to be done by promoting household food security and improved food utilisation.

In this respect, the unit has been very active in:

- helping the smallholder farmer ensure basic food security through increased and diversified production and decreased post-harvest losses;

- promoting improved utilisation of foods, particularly in the feeding of infants, small children, pregnant and lactating women, through appropriate technology and nutrition education programmes;

- encouraging more equitable food distribution within the family through an expansion of nutrition education and the involvement of men in nutrition education;

- providing sound baseline data for food and nutrition planning through large scale surveys and relevant ad hoc surveys;

- establishing a reliable system for assessing household food security and early prediction of possible shortfall areas through the introduction of appropriate methodology to extension services;

- developing long-term strategies for food and Nutrition at the local level based on data obtained from The National Sample Survey of Agriculture (NSSA) and other relevant large scale surveys;

- developing methodology for evaluation of the impact of development programmes on the food and nutrition situation of smallholder families through the evaluation services of the Ministry of Agriculture;

- continuously monitoring the Food and Nutrition situation at EPA, RDP, ADD and National levels for making decisions and formulating programmes for nutritional improvement at each level; and,

- strengthening interministerial and multi-sectoral cooperation in food and nutrition through permanent representation at inter-ministerial committees.

Nutrition Unit in the Ministry of Health

This Unit is responsible for incorporating nutrition activities into all health programmes with emphasis on preventive programmes. It plays a key role in primary health care programmes.

FOOD SECURITY AND NUTRITION RELATED ACTIVITIES

Food Policy Analysis

The focus of the early analytical work by the FSNU was on food security at the national level. This involved responding to requirements for food aid (drought in the lower Shire Valley and Cassava mealy bug on the central lakeshore areas), in addition to "food gap analysis". This demonstrated that, rather than two localised emergencies, a major national food shortage loomed in addition to the food aid requirements of the growing Mozambican refugee population. The unit played a key role in mobilising aid to forestall what could have been an enormous food emergency. The FSNU also prepared a project to rebuild the Strategic Grain Reserve which was successfully implemented with donor support. The FSNU continues to provide frequently updated reports to Government and to donors concerning the national food supply/demand balance, including specially prepared requests for food assistance.

From a policy perspective, the second major analytical focus of the FSNU has been the development of the rationale, magnitude and principles for managing the Strategic Grain Reserve. The Unit prepared, for the National Agricultural Symposium in November 1988, a preliminary analysis including recommendations which have generally guided the Government's rebuilding of the Strategic Reserve. This work was followed by the development of a more sophisticated analytical model that facilitates the exploration of trade-offs between maize price stability objectives, the cost of alternative stocking, and price and trade policies. the Unit also has developed a simple framework for examining alternative supply/demand/storage scenarios to assist in planning the need and timing of maize imports/exports.

More recently, in 1990, the FSNU took the Government's lead in drafting a Food Security and Nutrition Policy Statement. This provides a strategic plan which the Government will pursue to achieve growth through poverty reduction aimed at improving the food security and nutrition of all households in Malawi. The document now serves as a supplement to the existing *Statement of Development Policies 1987 - 1996.* A noteworthy aspect of the Food and Nutrition Policy Statement is that it concentrates on the issue of household food security and nutrition and includes specific strategies to increase the productivity of smaller farmers, increase income levels through expanded employment, improve human resource development as well as institute short-term income transfers to the poorer segments of society.

Specific groups of households, vulnerable to food insecurity and malnutrition in the smallholder and estate sectors as well as in urban areas, have been explicitly identified and detailed strategies have been formulated to meet their differing needs.

Another important activity of the FSNU has been influencing the view and debate on some of the key issues concerning national and household food security. For example, relative to all consumer prices, the costs of maize has become cheaper in recent years. This statistical fact encouraged a false conclusion that low income consumers were not faring too badly. The FSNU has been able to shift attention from the price of maize, relative to all consumer prices, to the cost of maize relative to the minimum wage which governs what many low income people earn. The drastic fall shown in the "entitlement" to food, conveyed a more accurate picture of changes in the welfare of low income consumers. After purchasing their maize, they have little remaining income -- thus the price of other consumer goods is not relevant in judging their welfare.

The FSNU was also instrumental in initiating a dialogue for policy makers and donors on the broad issues of food-for-work, followed by sessions on the design and implementation of both community and household level food-for-work projects. This included identifying methods for establishing the beneficiary criteria for these and other household level food assistance measures.

Nutrition Education

Another noteworthy activity undertaken has been the development of a comprehensive nutrition education strategy. This has resulted in a book entitled *Nutrition Facts for Malawian Families*. Ten thousand copies of Nutrition Facts have been printed with funding from UNICEF and are being distributed to all extension workers and relevant government and university offices in the country. This book is the first of its kind in Malawi. It is also unique in this region of Africa with respect to the wide spectrum of educational messages presented including food production, child feeding, child health, and maternal health amongst others.

Food and Nutritional Surveillance

The broad range of food and nutrition issues found in Malawi has encouraged the Government to place priority on developing a National Food and Nutrition Surveillance System (NFNSS). The FSNU is charged with this responsibility and has developed the following four objectives.

Problem Identification:

- help to develop a better understanding of food security and nutrition problems and accomplishments; and,

- help to sensitise senior government policy-makers and donor agencies.

Provide a Sound Base for Policy Formulation and Planning:

- agricultural development policies and strategies;
- macro-economic policies and strategies; and,
- health policy and strategies.

Monitoring and Evaluation:

- impact of national programmes in a variety of sectors;
- impact of area-specific projects; and,
- impact of macro-economic policies including structural adjustment measures.

Early Warning of Impending Food Shortages:

- drought;
- crop pests; and,
- marketing bottlenecks.

The FSNU has not instituted any new data collection systems for NFNSS since Malawi has an abundance of information collected by agriculture, health and economic planning as well as University research groups, the National Statistics Office and the Agricultural Development and Marketing Corporation. The FSNU regularly obtains data from these groups and undertakes secondary data analysis useful for food and nutritional surveillance. The FSNU also has served in an advisory capacity to several groups on how to improve the usefulness of data collected to the NFNSS. The Food Security and Nutrition Monitoring System will form a central core of the information base of the NFNSS. In addition, the Ministry of Health has instituted their Health Information System, a clinic based nutritional surveillance system, which is an important component of the NFNSS.

Experience has shown that analysis of the data alone is not sufficient. The results have to be conveyed in a format which enables busy policy makers to grasp the essential facts and distributional impact of the in findings. To achieve this, the FSNU has developed a strategy to disseminate the information generated by the

NFNU which is useful for medium and long-term planning, *i.e.*, the *Food Security and Nutrition Bulletin* with graphical presentations of data depicting the key issues related to food security and nutrition. The *Food Security and Nutrition Bulletin* will be produced twice each year. The first issue was released in April 1989. The *Bulletin* is distributed to all Principal Secretaries, relevant Government offices, the Reserve Bank, University groups, as well as the donor community in Malawi. All members of the National Economics Council, comprised of Ministers and senior officials in the Malawi congress Party, the Army, and the Police in addition to other important offices, receive copies of the *Bulletin*.

To institutionalise the National Food and Nutrition Surveillance System and the regular production of the *Bulletin*, a Food Security and Nutrition Advisory Committee has been formed comprised of a small group of experts from agriculture, health, and economic planning as well as the University of Malawi. This Advisory Committee meets on a regular basis to discuss current food security and nutrition policy issues. The content of each *Bulletin* is examined to identify important issues which need to be highlighted in subsequent issues. The advisory Committee also was instrumental in the formulation of the Food Security and Nutrition Policy Statement.

Early warning issues also have been addressed by the FSNU. However, from an operational standpoint, these are the direct responsibility of the National Early Warning Unit (NEWU) in the Ministry of Agriculture. The NEWU is responsible for data collection and analysis for early warning. To link early warning data with central decision making, an Early Warning Technical Sub-Committee has been formed with FSNU serving as the chair. The Early Warning sub-committee meets on a regular basis during the growing season to monitor the nation's food situation in order to detect impending shortfalls. Appropriate authorities can then be alerted and interventions put into place.

The Ministry of Agriculture has instituted a new approach to collection of household food security data. This approach will provide information on the household food situation. This will facilitate the Government in assessing the food security and nutrition situation at any point in time.

Community Based Household Food Security and Nutrition Activities

Government, in collaboration with nongovernmental organisations, has pilot programmes specifically targeted to those at risk. The programmes are multi-sectional with the following objectives:

- to improve the household availability of food for the population identified;
- to increase the immunisation coverage of children in that population; and,
- to improve the health and sanitation situation in the area.

These programmes have proven to be successful in improving both the food security and nutritional status of the target population.

Food and Work

This activity is promoted to assist families chronically affected by food insecurity due to low total production and low income as well as those families that have been affected by national disasters. Several potential food for work schemes have been identified and should be implemented soon.

COORDINATION MECHANISM

The Food Security and Nutrition Advisory Committee exists to ensure effective coordination. This committee meets regularly to discuss issues of food security and nutrition. Technical subcommittees include:

- subcommittee on education -- responsible for the production and dissemination of nutrition information;

- subcommittee on research -- responsible for research; and,

- early warning subcommittee -- responsible for monitoring food supply shortfalls.

These subcommittees feed information to the Advisory Committee.

REFERENCES

Chiligo-Mpoma, M.O., R. Butao Ayoade, U. Chikagwa and G. Cusack. 1990. *Nutrition Facts For Malawian Families.*

Malawi Government. Department of Economic Planning and Development. 1990. *Food Security and Nutrition Policy Statement.* A Supplement of Development Policies.

Malawi Government. Department of Economics Planning and Development. 1990. *Food Security and Nutrition Bulletin.* Vol 2.

Malawi Government. *Statement of Development Policies 1986 - 1996.*

Malawi Government. 1990. *Ministry of Agriculture Position Paper.* Prepared by Ruth Butao Ayoade.

Food Access And Nutrition Linkages: Policy Issues And Programme Options In Zimbabwe

Julia Tagwireyi[1]

SUMMARY

The paper discusses the nature and extent of the nutrition problems facing Zimbabwe. It outlines the major causes of protein energy malnutrition, discusses current strategies to redress the situation, focusses some attention on the agricultural sector and suggests areas for possible policy review. Finally, the paper proposes a food security research agenda to increase further the current knowledge and understanding of the paradox of household food insecurity in spite of national bumper harvests and overflowing grain silos in Zimbabwe.

INTRODUCTION

Zimbabwe has made tremendous efforts to produce enough food for its people and for export. The overflowing grain silos dotted around the country are a testimony of this fact. However, inspite of this effort, many households in both urban and rural areas have limited access to food even during so called "good harvest years". Protein energy malnutrition in children under five is unacceptably high and, generally, the provinces with food deficits, *i.e.*, Matabeleland, tend to have the highest levels of protein energy malnutrition. (See Annexes for provincial distribution of malnutrition). Further disaggregation of data on nutritional status indicates that the following population groups have the highest levels of malnutrition in order of severity: commercial farm workers, resettlement areas, communal areas in natural regions IV and V and low income urban areas.

Whilst Zimbabwe continues to record impressive food production, this production has not necessarily been translated into increased consumption and improved

[1]Director, Nutrition Department, Ministry of Health.

nutrition. Many policy makers have taken high food production levels to be a proxy for nutrition improvement without assessing the extent to which this food is accessible to the majority of the people. Zimbabwe's experience indicates the need to review the food system from production to consumption and to identify the bottlenecks in the system which prevent many households from being food secure. Food security research is beginning to shed some light in this area and should be strengthened and continued.

THE NUTRITION PROBLEM

This paper will focus mainly on protein energy malnutrition but acknowledges the existence of other micro nutrient disorders such as iodine deficiency.

Available data indicates provincial differences in the magnitude of the problem with the most food deficit provinces, Matebeleland North and South, having the highest levels of both acute and chronic malnutrition.

SOME KEY CONTRIBUTING FACTORS TO LIMITED FOOD ACCESS AND PROTEIN ENERGY MALNUTRITION

Poverty is the basic root cause of hunger and malnutrition. Seventy-five percent of the population lives in the rural areas and the majority of this group subsist on land which cannot support them throughout the year because of small plot size, poor quality soils and rainfall. Lack of access to credit for this group of people is very limited if it exists at all. The opportunity to improve the land and crop yields by obtaining loans to purchase fertilizers, *etc.*, is not available to most of these people. In addition, over 50 percent of the rural households are headed by women as the result of male migration. This limits further access to credit and also labour available to fully utilise available land. The pattern of crop production has, therefore, had to change in order to accommodate these constraints. Often these changes have contributed to food insecurity. For example, the more drought resistant small cereal grains tend to be more labour intensive and have lower yields per acre as compared to hybrid maize. Maize however is not suitable for all areas and often the resultant yield, even in a "good" year, cannot support the family throughout the year. It has been estimated that over 40 percent of the rural farmers do not produce enough food to last from one harvest to the next.

For low income Urban families, wages have not kept pace with the cost of living. It is becoming increasingly difficult for these families to meet their nutritional requirements within their budget. Available data indicate that families in the new housing areas, where families have to build their homes, are most at risk nutritionally. Food is often competing with bricks and cement as families sacrifice food in order to get a roof over their heads.

Poor access to health care services, leading to frequent infections and disease, can also contribute to malnutrition. Most illnesses and infections reduce appetite, especially in young children in households with limited access to food, and it may not be easy to "catch up" after an illness. Conversely, malnourished individuals also are more susceptible to infections.

The excessive work load of women can contribute to malnutrition. Not only does the work load compromise the woman's own nutritional status, but it also predisposes the new born to malnutrition. The baby may be born with a low birth weight due to its mother's excessive work load and limited food intake. Time available to the women for child care and feeding may be very limited due to excessive work, and often the important task of child feeding is left to an older sibling who may not have the appropriate feeding skills.

Drought, a permanent characteristic of a number of areas in Zimbabwe, contributes to food insecurity for many households. Some emergency relief activities have been instituted to provide interim food relief through the National Drought Relief Committee under the Chairmanship of the Ministry of Labour and Social Welfare. However there seems to be no long term plan to address the development of drought prone areas in order to minimise the impact of drought on food security and malnutrition.

Current Strategies to Address the Problem of Protein Energy Malnutrition

The Nutrition Department in the Ministry of Health was given the mandate and responsibility to plan and implement a nutrition programme for the nation. The Primary Health Care Strategy has provided the main vehicle for nutrition activities.

The Ministry of Health has realised that the nutrition problem needs the active participation of many sectors if it is to be adequately tackled. Towards this end, the Nutrition Department has initiated intersectoral collaboration for nutrition activities. Intersectoral Food and Nutrition Committees have been established at National, Provincial, District and Ward levels to plan, implement and monitor nutrition activities. This development placed nutrition on the development agenda. Further, it has brought sectors together to plan towards the solution of nutrition problems of their respective areas.

Limitation of Current Approaches to Address The Problem of Malnutrition

The fact that nutrition planning was assigned to the health sector has tended to cause the matter to be viewed primarily as a health issue. This has tended to limit the people and the range of actions which can be undertaken by the Nutrition Department.

Whilst the Nutrition Department has achieved some success in bringing sectors together on nutrition activities, this collaboration is not formalised. There is no concrete institutional framework to facilitate the coordination of intersectoral activities in nutrition. The existing mechanism for intersectoral collaboration is the result of careful negotiations, advocacy backed by a carefully conceived nutrition project which clearly spelt out and defined the role of each sector in the project and, of course, the generous funding from SIDA to allow us to explore and further refine this concept.

The major limitation to greater achievement toward the establishment of a framework to address nutrition is the absence of a clearly defined food and nutrition policy to provide the framework to ensure that food security and nutrition is assured for the majority of people in Zimbabwe and is enshrined within overall development planning.

Implications for Agricultural Policy

Agricultural policies have the potential to influence nutritional status through their impact on levels of incomes realised by the groups at risk, food prices, demands on womens' labour and the nutrient content of food produced. It is with this view in mind that the following issues are proposed for consideration within the framework of Agricultural Policy in Zimbabwe to address malnutrition wholistically.

1. Household Food Security, throughout the entire year, needs to be one of the clearly defined objectives of Zimbabwe Agricultural Policy. This will ensure that strategies are developed to specifically address seasonal food insecurity prevalent in many households.

2. Nutritional well being of the population should also be one of the stated objectives of Zimbabwe's Agricultural policy. The Agricultural sectors concern should go beyond production and supply. There should be concern over consumers nutritional well being, determined by the availability of a safe and nutritional food supply throughout the year.

    - Dialogue began with the workshop held in June of 1990 where Health and Agriculture began integrating nutrition issues into agricultural planning.

    - The ability of households to acquire the appropriate mix and amount of food adequate for their needs has implications for pricing policy for basic food commodities.

    - Food Security at all levels needs to be redefined to include alternative food commodities such as legumes and oils to provide an adequate diet. The emphasis on cereals, whilst good, has somehow assumed that the rest of the nutrients required by the individual for adequate nutrition will take care of themselves. Access to these need to be planned. We cannot really boast of adequate food security even at national level when we only use cereals as the indicator. A food basket which takes into account regional variations in diet and agro-ecological zones needs to be developed.

- The vulnerable, food insecure communities and groups need to be defined. Who they are, where they are and why they are food insecure must be known. Then appropriate intervention can be developed and targeted. The current system tends to mask the at risk groups and glosses over the problem. The available data needs to be further disaggregated, preferably by district as well as agroecological zone.

- The role of women in agriculture needs to receive active attention and clearly defined strategies need to be developed to enable women to perform their appropriate role in caring for children and preventing malnutrition.

Proposed Food Security Research Agenda

This proposed research agenda assumes that there is a mechanism for the findings of Food Security research to be fed into the appropriate agencies and utilised. Otherwise, the entire exercise will remain an academic activity for libraries, journals and Ph.Ds.

A strong mechanism for coordinating Food and nutrition activities, based on a key coordinating sector, would provide a good forum for dissemination and utilisation of relevant data. It would also facilitate coordination of research and encourage food production based on identified needs. This research agenda is based on knowledge gaps the Nutrition Department has identified and which need to be filled to enable it to plan appropriate interventions within the sphere of its operation.

1. Who are the food insecure households? What are the characteristics of these households? Is it chronic or transitory insecurity? Why are there insecure households? This information is required by geographic location, by season and by identifying nutrition vulnerable areas in commercial farming areas, resettlement areas, communal areas and urban areas.

2. What farming system will facilitate adequate food consumption by vulnerable communities throughout the year (remembering that increased food production per se will not necessarily lead to increased consumption?)

3. Define indicators which will identify the food insecure in a timely manner to facilitate remedial action.

4. Identify and promote ways to reduce the work load of women within the food system from production to consumption, thus facilitating the woman's child care and nutrition activities. Why hasn't the wealth of technology available gained universal adoption and use? Could it be that they are not as appropriate as we may think?

The proposed research agenda highlights the multidisciplinary nature of the problem and suggests the need for interdisciplinary research teams. Household food security research should bring together social scientists, agriculturalists, nutritionist, economists, *etc.* This wholistic approach to the research may also serve to improve the resource base for this research, since other sectors may be in a position to contribute funds and experience towards research activities.

CONCLUSION

In conclusion, the University of Zimbabwe needs to be commended for their initiative in Household Food Security Research. Useful and much needed data has been generated as the result of the Food Security Research Project. Much still remains to be done. Yet the institutionalising of this activity, in order to assure its sustainability, is not apparent. This all important area seems to be entirely in the hands of donor funded University research. Appropriate government research centres do not seem to focus much attention in this area. What will happen when Food Security Research is no longer fashionable or a priority area for donors or the University and yet many questions remain unanswered?

Some mechanism has to be identified for operationalising the research funding, methods and techniques developed by Universities at the micro level for programming applied research. In some cases it may be important to obtain National level data for planning purposes thus requiring existing government machinery to undertake the studies. What role does the University have for transferring research skills to agencies such as the C.S.O. or the Agriculture Research Services?

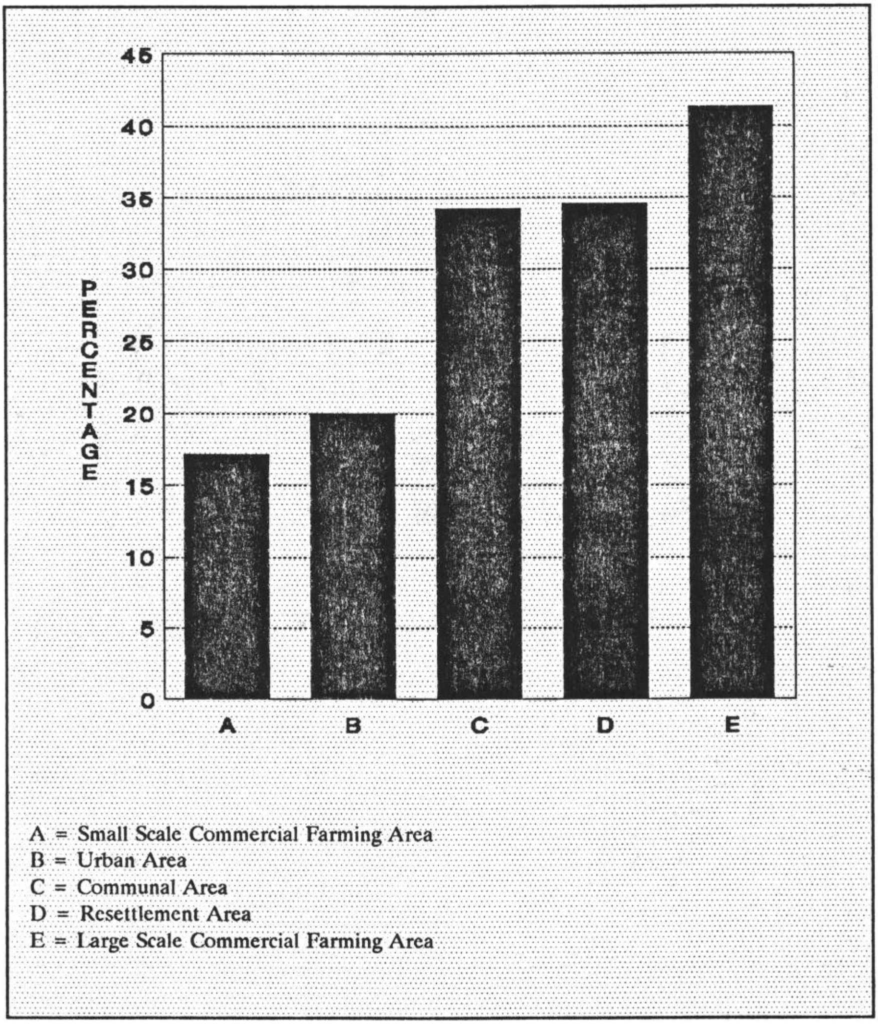
The need to develop a mechanism for the integration of appropriate food security research findings into policy modification and extension activities is apparent. This annual Food Security Research in Southern Africa conference serves a useful purpose in bringing the relevant sectors together. Unfortunately the framework for sustaining that dialogue does not exist. The danger is that the good efforts of this project may not find application in policy development and programme implementation of this issue is not resolved.

REFERENCES

Zimbabwe Government. Nutrition Health Information System Data 1988 and 1989. Harare.

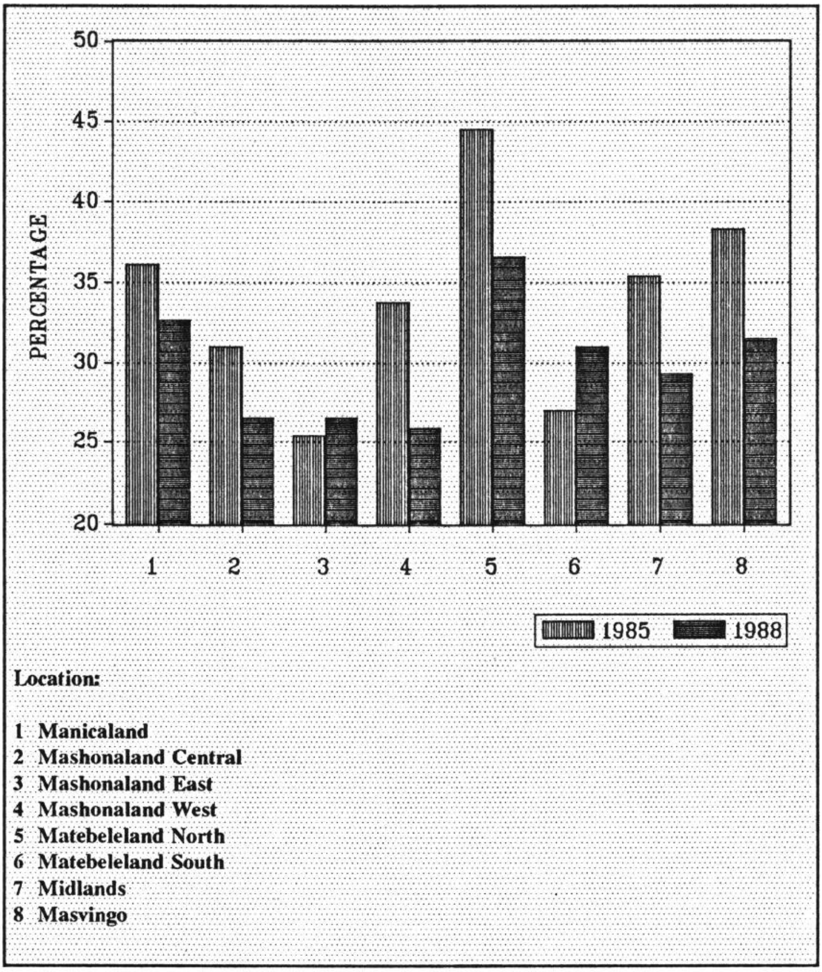
Zimbabwe National Steering Committee for Food and Nutrition. 1988. Issues Paper on Food and Nutrition. In: *Towards the Development of a Food and Nutrition Policy.* Harare.

Zimbabwe National Steering Committee for Food and Nutrition. 1990. The Nutrition Situation: Current Strategies and Plans. In: *Integrating Food, Nutrition and Agricultural Policy in Zimbabwe. Proceedings of the First National Consultative Workshop* Juliasdale, July 1990.



Source: Ministry of Health.

Fig. 1: Zimbabwe : Prevalence of stunting by residential area, 1985.



Source: Ministry of Health

Fig. 2: Zimbabwe : Provincial prevalence of stunting (Low Height-for-Age) 1985 and 1988.

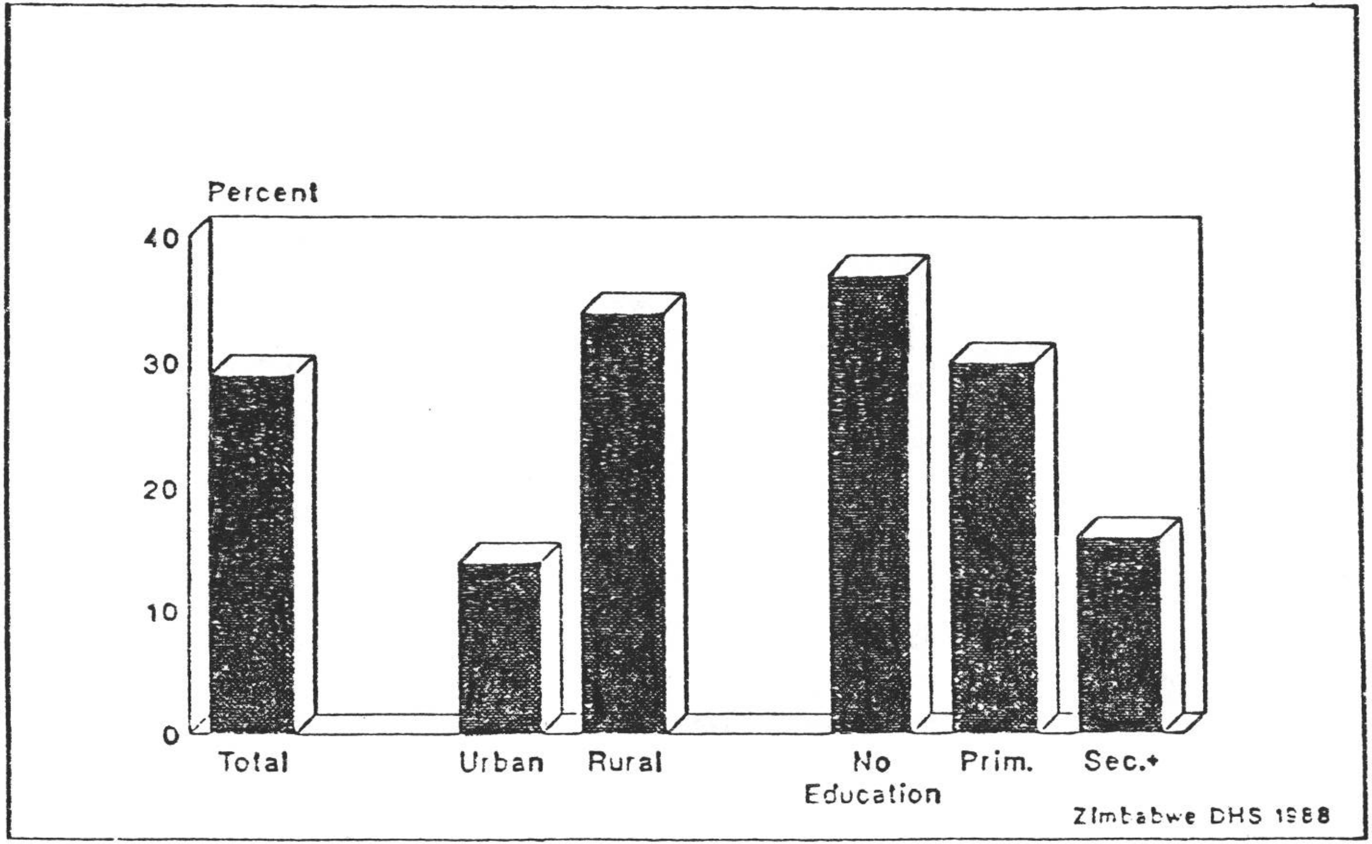
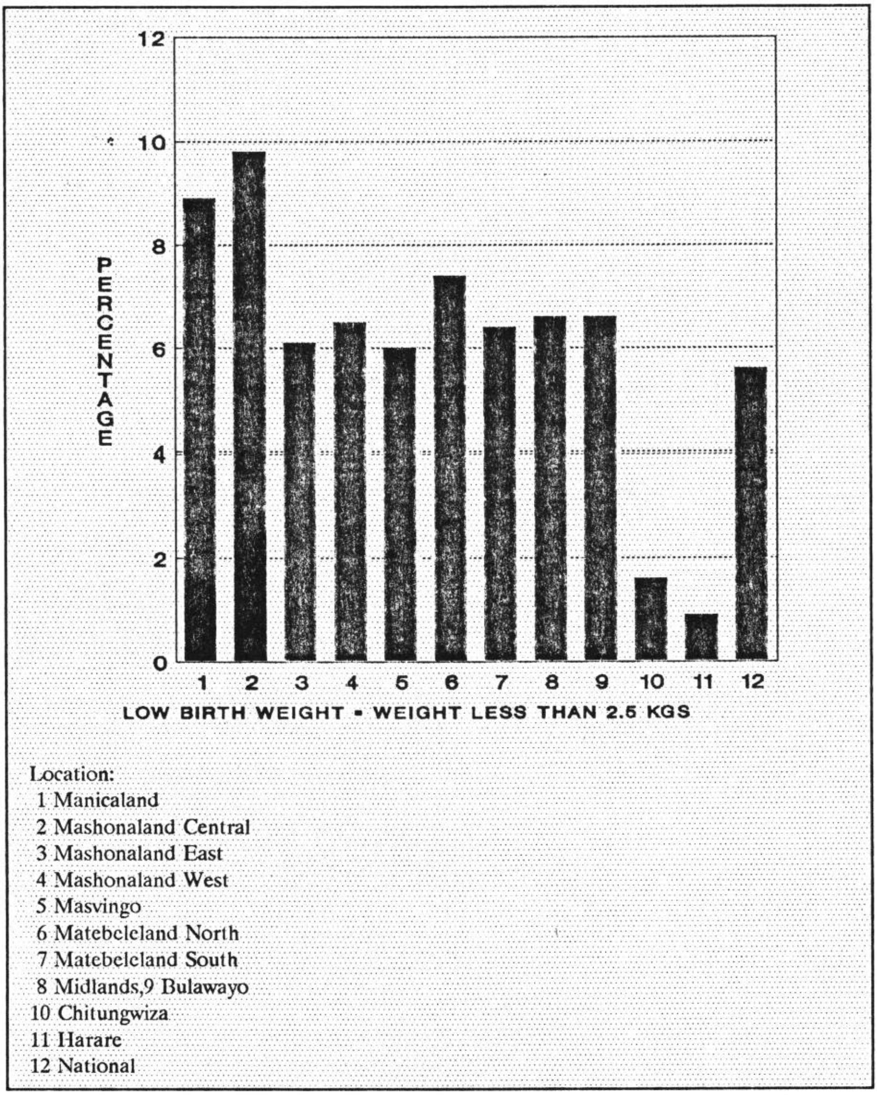


Fig. 3: Percent stunted among children 3 to 60 months



Source: Ministry of Health.

Fig. 4: Zimbabwe : Provincial distribution of low birth weights, 1989.

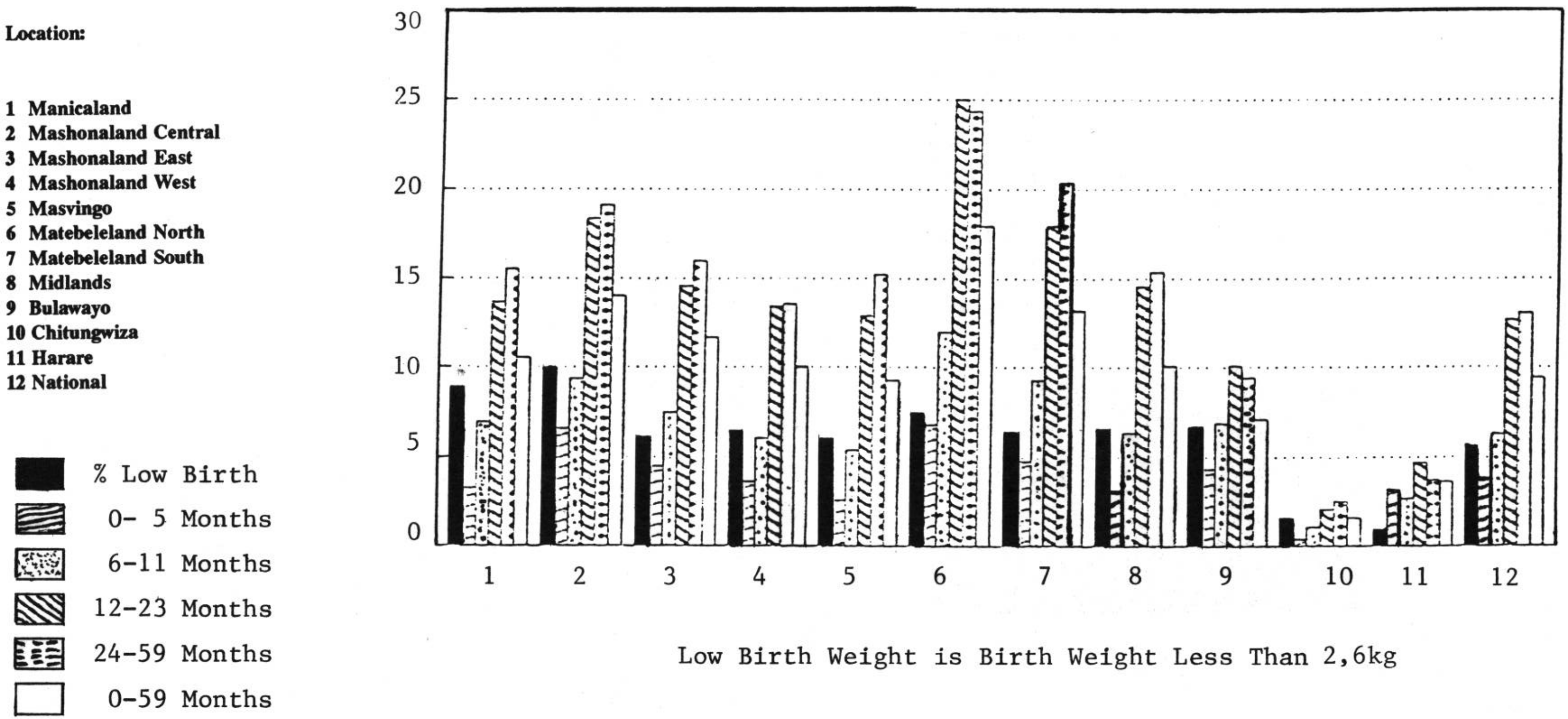


Fig. 5: Zimbabwe : Percentage Malnutrition by age, 1989 % Below the third centile (NCHS)

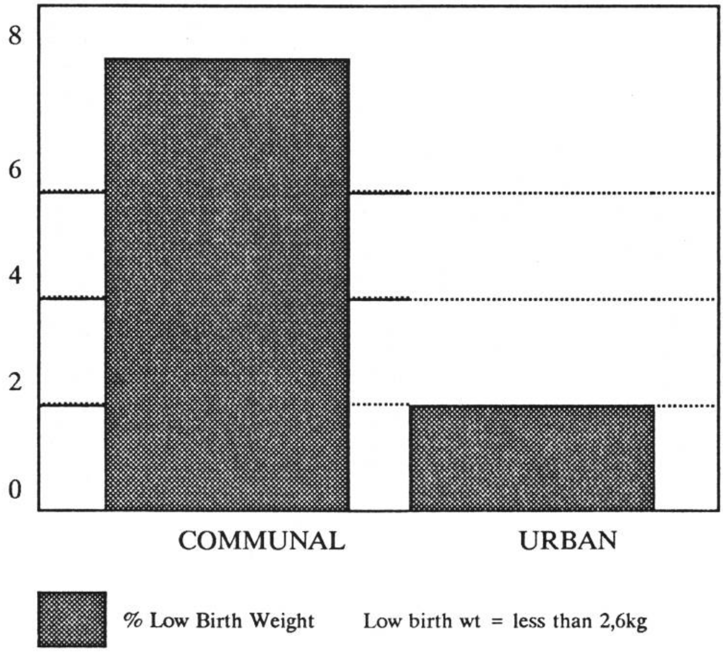


Fig. 6: Zimbabwe : Percentage low birth weight in communal and urban areas, 1989.

III

Grain Market Policy Reform Issues: The Evolving Roles Of The Public And Private Sectors

8

Household Food Security in Tanzania: Preliminary Findings From Four Regions

H.K.R. Amani and W.E. Maro[1]

INTRODUCTION

Six years ago the Government of Tanzania began to take policy measures to improve food availability and accessibility at the national and household levels. The Government realized that to attain food security, policies to increase the productivity and earning power of poor households as well as improve the efficiency of food markets were necessary.

Several policy measures have been taken since 1984 to increase food production in the short-run. First was an increase in real producer prices. This was made possible by the removal of consumer and input subsidies. Second, the Government reduced internal trade barriers on food items by "tolerating" the marketing activities of private traders -- this measure provided farmers (in some parts of the country) with alternative buyers for their food crops and improved food availability in urban areas. Third, a partial import liberalisation measure increased the availability of "incentive goods" in the rural areas. This encouraged the production of agricultural crops.

Policy interventions to increase access to food have included reorganization and rationalisation of the marketing and distribution systems, nutrition programmes and food relief, and, above all, an increase in real producer prices. Amani, *et al.* (1987), showed that there has been an increase in real income among the rural population largely due to increases in agricultural producer prices.

Little is known about the impact of these policies on household food security, food production, consumption, income generation and marketable surplus. Some of the unresolved issues include:

---

[1]Professor and Head, and Research Fellow, respectively, Department of Economics, University of Dar es Salaam.

- How have farming households responded to the new policy environment in terms of changing cropping pattern, consumption and marketing strategies (including where and when to sell)?

- What are the major sources of household income?

- Has the policy of "tolerating" private traders improved farmer's access to markets?

- Has improvement in household food availability (if any) led to access to food by all household members?

This paper provides a descriptive analysis of rural households' food security in Tanzania and sheds some light on these issues. The analysis is based on a first phase, baseline survey undertaken in March 1990. The survey gathered information on households, villages, food prices and marketing activities. Data entry for villages, private traders and food price information has not been completed. Hence, this paper concentrates on analysing household data.

AREAS OF STUDY

Four regions were purposely selected to represent food surplus and food deficit regions (Mtwara, Arusha, Ruvuma, and Singida). In each region, two districts were selected to represent surplus and food deficit areas of the region. The districts included in the study are: Newala (deficit) and Masasi (surplus) in Mtwara; Tunduru (deficit) and Songea Rural (surplus) in Ruvuma; Singida Rural district (self sufficient) in Singida Region and; Babati (surplus) and Monduli (deficit) in Arusha Region. For each district, two wards accessible to researchers were selected. Three villages were randomly selected from each ward and it was planned to select twenty households from each village for a total sample of 960 households. However, Manyoni district[2] was excluded so more than twenty households were drawn from each of the other villages to total 240 for the Region. At the same time, only 188 of 240 households were interviewed in Arusha because some of the respondents could not be reached. Hence, this survey covered a total sample of 907 households.

In contrast to the Singida Region, Arusha, Mtwara and Ruvuma are border regions with some "across the border trade" in food crops.

HOUSEHOLD CHARACTERISTICS

The average sampled household size ranged from 4,8 to 6,9. Most of the households were headed by males, the proportion varying from region to region. It was 90,8 percent in Mtwara; 95,9 percent in Ruvuma; 92,9 percent in Singida; and 96,8

---

[2]Manyoni district in Singida Region was not covered due to impassable roads during the first phase of data collection.

percent in Arusha. The education level of heads of households is generally very low averaging one year of formal education for both sexes. This varies among regions.

An insignificant proportion (0,7 percent) of heads of households have attained levels of education above form four (Junior secondary school level). This appears to have affected the modernization of agriculture in the areas studied and in the country as whole. About 75 percent of the surveyed households indicated that they have no idea of current recommendations on modern farming.

The age-composition of household members reveals high dependency ratios, *i.e.*, members from ages 0 to 14 and over 62. It is 42,2 percent in Masasi, 45,7 percent in Newala, 46,9 percent in Tunduru 41,7 percent in Songea Rural, 48,6 percent in Singida Rural, about 52 percent in Babati and 49,6 percent in Monduli. Given the low level of agricultural technology used, such high dependency ratios appear to increase the burden on the agriculturally active household members and/or leads to less available food for each member.

The main occupation of the sampled households is farming. Because of differences in agroeconomic locations, the four regions show different cropping patterns with some difference within a region. In Mtwara, the major food crops are cassava root, (local) maize, peas and sorghum/millet. Major cash crops include cashewnuts, tobacco and sesame.

In Ruvuma, farmers give priority to (local) maize, cassava root, paddy, beans and sorghum/millet as food crops and cashewnuts, sunflower, sesame and tobacco as cash crops. Cashewnuts are a particularly important cash crop in Tunduru and as is coffee in Mbinga District. Farmers in the drought region of Singida grow (local) maize, sorghum/millet, beans and cassava root mainly for food, and sunflower, cotton and sesame as cash crops. In the studied areas of Arusha, the main food crops include (hybrid) maize, local maize, peas and beans; the main cash crops are coffee and sunflower. Although some of these crops are also grown during the short rains, farming is mainly done during the main (long) rainy season.

YIELDS

Average yields per hectare of each crop for each season are shown in Table 1 and 2. Overall, yields per hectare are higher in Arusha and Ruvuma regions as compared to Mtwara and Singida regions. There are also significant differences in yields between the main and short seasons with yields being substantially higher during the main season except for hybrid maize in Ruvuma and Tobacco in Mtwara. Reliability of rainfall during the main farming season, together with the availability of agricultural inputs, normally explains the difference in yields between the two seasons.

Table 1
Average yield : main season
(kgs/ha)

CROP	MTWARA	RUVUMA	SINGIDA	ARUSHA
Food Crops				
Local Maize	550,0	1 311,7	623,8	1 069,8
Hybrid Maize	664,9	2 268,7	-	1 875,7
Paddy	865,8	1 148,4	-	3 054,5
Wheat	-	222,4	-	556,0
Beans	-	455,4	456,2	733,3
All Peas	406,2	447,3	459,3	472,2
Sorghum/Millet	386,1	901,9	614,8	1 095,7
Cassava Root	1 711,4	4 041,4	1 479,2	444,8
Groundnut	1 221,0	439,4	553,5	-
Vegetable	0	120,8	127,1	-
Cash Crops				
Tobacco	2 223,9	20 161,0	-	-
Coffee	-	-	-	848,4
Cotton	-	-	5 010,4	-
Sunflower	-	839,6	740,2	1 241,7
Sesame	33,6	1 250,5	222,4	-
Cashewnut	441,2	1 073,4	0	-

Source: Survey data.

Table 2
Average yield : short season
(kgs/ha)

CROP	MTWARA	RUVUMA	SINGIDA	ARUSHA
Food Crops				
Local Maize	289,1	3 335,9	-	830,3
Hybrid Maize	481,4	889,6	-	1 067,5
Paddy	444,8	0	-	-
Wheat	0	-	-	-
Beans	-	282,1	0	556,0
All Peas	95,3	-	-	-
Sorghum/Millet	0	0	0	889,6
Cassava Root	247,1	0	-	-
Vegetable	-	996,1	-	-
Cash Crops				
Tobacco	4 781,4	-	-	-
Cotton	-	-	1 779,1	-
Sunflower	-	-	0	0
Cashewnut	1 186,1	-	-	-

Source: Survey data.

CONSUMPTION PATTERNS

The consumption pattern in each region is influenced by what can be produced at minimum risk of crop failure. In Arusha and Ruvuma, maize is the most preferred staple food. In Mtwara and parts of Singida, where maize does not grow very well due to climatic factors, cassava and sorghum/millet are most preferred. In years when maize output is good, small grains (sorghum/millet) are used for beer brewing and/or stored in household storage facilities for future use.

Judging from households' response to each crop (Tables 3 to 6) it is apparent that household consumption dominates their production decisions. There are differences in food crop production objectives between male and female headed households, Table 7.

Table 3
Objectives in planting food and cash crops : proportion of households in Mtwara Region

Crop	Consume Only %	Sell Only %	Sale and Consumption %	Consumption and Gifts %
Local Maize	47,6	-	52,4	-
Hybrid Maize	-	-	100,0	-
Paddy	12,5	75,0	-	12,5
Wheat	-	-	100,0	-
All Peas	41,7	-	58,3	-
Sorghum/Millet	45,0	-	55,0	-
Cassava Root	25,6	-	74,4	-
Groundnuts	14,3	-	85,7	-
Vegetables	14,3	-	85,7	-
Cashewnuts	-	57,1	42,9[a]	-

[a] Mainly for beer brewing.
Source: Survey data.

Table 4
Objectives in planting food and cash crops: proportion of households in Ruvuma Region

Crop	Consume Only %	Sell Only %	Sale and consumption %
	Food Crops		
Local Maize	51,2	2,3	46,5
Hybrid Maize	12,5	12,5	75,0
Paddy	29,2	-	70,8
Beans	81,3	6,3	6,2
All Peas	-	-	100,0
Sorghum/Millet	87,5	6,3	6,2
Cassava Root	80,0	13,3	6,7
Groundnuts	77,8	-	22,2
Vegetables	60,0	-	40,0
	Cash Crops		
Tobacco	-	100,0	-
Sunflower	18,2	72,7	9,1
Cashewnuts	15,4	61,5	23,1
Sesame	25,0	25,0	50,0

Source: Survey data.

Table 5
Objectives in planting food and cash crops: proportion of households in Singida Region

Crop	Consume Only	Sell Only	Sale and Consumption	Consumption and Gifts	Others
		Food Crops			
Local Maize	87,0	2,2	10,8	-	-
Beans	88,9	-	11,1	-	-
All Peas	100,0	-	-	-	-
Sorghum/Millet	72,9	4,2	18,8	-	4,1
Cassava Root	100,0	-	-	-	-
		Cash Crops			
Cotton	-	100,0	-	-	-
Sunflower	10,0	90,0	-	-	-
Sesame	100,0	-	-	-	-

Source: Survey data.

Table 6
Objectives in planting food and cash crops: proportion of households in Arusha Region (%)

Crop	Consume Only	Sell Only	Sale and Consumption	Consumption and Gifts	Others
		Food Crops			
Local Maize	73,1	7,7	19,2	-	-
Hybrid Maize	64,9	2,7	32,4	-	-
Paddy	33,3	-	66,7	-	-
Beans	34,8	4,3	56,5	4,4	-
All Peas	19,2	73,1	7,7	-	-
Sorghum/Millet	55,6	11,1	11,1	-	22,2
		Cash Crops			
Coffee	-	100,0	-	-	-
Sunflower	-	100,0	-	-	-

Source: Survey data.

Table 7
Differences in production objectives for local maize: male and female headed households (%)

Region	Consume Only	Sell Only	Sale and Consumption	Consumption and Gifts	Others
Mtwara:					
Male headed	41,7	-	58,3	-	-
Female headed	83,3	-	16,7	-	-
Ruvuma:					
Male headed	52,6	2,6	44,8	-	-
Female headed	40,0	-	60,0	-	-
Singida:					
Male headed	86,0	2,3	11,7	-	-
Female headed	100,0	-	-	-	-
Arusha:					
Male headed	76,0	8,0	16,0	-	-
Female headed	-	-	100,0	-	-

Source: Computed from survey data.

MARKETING STRATEGIES

A number of factors influence farmers marketing strategy including purchases and sales of food crops. In terms of sales, current producer price is a function not only of supply but of the number of buyers and their ability to buy and pay on time. The number of buyers is, to a large extent, a function of food availability. For purchases, major factors include local availability of food, household income, household food stocks, and food transfers, mainly through food gifts. The transfer of food as gifts is a cultural practice in some areas but often is a function of quantity harvested.

FOOD CROPS MARKETING

The marketing seasons for the studied regions are quite different. For Mtwara, the marketing season is concentrated during the October-December period as compared to July-October in Ruvuma, June-August in Singida and August-October in Arusha. The proportion of households not selling any food crop is 40,4 percent in Mtwara and 51,6 percent in Singida compared to the surplus regions of Ruvuma, (21,7 percent) and Arusha (27,8 percent). Only a small proportion of those households which sold food crops sold to official marketing agents. The role of private traders is very significant in Arusha, Singida and Ruvuma. Singida is generally a food deficit region. Arusha and Ruvuma are food surplus regions and easier to access -- hence, they attract private traders.

The most typical method of payment is cash. However official agents continued to buy on credit, particularly in those areas where private traders did not operate. Farmers continue to sell to NMC and Cooperative Unions when there are no alternative markets.

A few households in Ruvuma (25 percent) and Arusha (32 percent) sold to the Cooperative Unions because it was easier to get agricultural inputs since they are official fertilizer marketing agents.

SOURCES OF FOOD

About 61 percent of the sampled households purchased food during the March 1988-February 1990 period. Most households buy their food from other farmers and private traders. National Milling Corporation and Cooperative Unions Primary Societies play an insignificant role in selling food to rural households. Seasonal sources of food are mostly private traders in the hunger period (March-June) and farmers selling surpluses during the post-harvest period (July-December) Table 8.

REASONS FOR BUYING FROM THIS SOURCE

The main sources of purchased food at the regional level are "other" farmers (43-63,8 percent) and private traders (29,8 to 47,7 percent) although the order of importance is sometimes different among regions. More purchasing households bought food during the July-December 1989 period (40,7 to 55,3 percent in the different regions) than in any other period. This is usually the marketing season when food prices are relatively low. A substantial proportion of households also bought food during the hunger period, *i.e.*, the early part of 1990, when food prices were higher due to a lower supply (23,4 to 34,1 percent).

The most important food crops bought during July-December 1989 were local maize and rice for Mtwara; beans and sembe (maize flour) for Ruvuma; local maize and rice for Singida; and local maize and hybrid maize for Arusha. During the pre-harvest period, the most important food crops purchased by households were: beans, peas, cassava root and vegetables in Mtwara; local maize, paddy, rice and sembe in Ruvuma; local maize in the case of Singida and; rice and to a lesser extent, maize in Arusha.

Sources of seasonal purchases are mainly farmers and private traders although there are slight differences in ranking by each major food crop. Table 8 shows details of sources of purchased food by regions. Overall, very few households purchased food from official agents. Even when primary societies have stocks of food, there are no arrangements to sell it to those who need it. In many cases, farmers who sold crops during the hungry period are those who have overestimated their household food requirements and, as the new harvesting season approached, they had to clear their food reserves.

A large proportion of households which purchased food did so because they had no own-stock. Only a small proportion purchased food because of low prices or increased household size. Looking at food purchases during different periods, the "none in own stock" reason still prevails, particularly during the period preceding harvest, Table 9.

Table 8
Seasonal sources of main food crops by region

Crop	Region	Source	March 1989 to June 1989	July 1989 to December 1989	January 1990 to February 1991
Local Maize	Mtwara:	Private traders	66,7	53,3	100,0
		Other farmers	33,3	46,7	0,0
	Ruvuma:	Private traders	-	0,0	16,7
		Other farmers	-	100,0	83,3
	Singida:	Private traders	40,7	30,0	51,4
		Other farmers	48,1	70,0	40,0
		CU/primary society	11,1	-	-
		NMC	-	-	8,6
	Arusha:	Private traders	28,6	30,4	35,7
		Other farmers	71,4	65,2	64,3
		CU/primary society	-	4,4	-
Rice	Mtwara:	Private traders	100,0	75,0	100,0
		Other farmers	-	25,0	-
	Ruvuma:	Other farmers	-	100,0	50,0
		Black market	-	100,0	50,0
	Singida:	Private traders	66,7	25,0	100,0
	Arusha:	Private traders	33,3	75,0	100,0
		Other farmers			-
Beans	Mtwara:	Private traders	100,0	100,0	100,0
	Ruvuma:	Other farmers	100,0	53,3	50,0
		Private traders	-	-	-
		NMC	-	-	50,0
	Singida:	Private traders	-	100,0	-
Sorghum	Mtwara:	-	-	-	-
	Ruvuma:	Other farmers	100,0	-	-
	Singida:	Other farmers	100,0	-	-
	Arusha:	-	-	-	-
Dona	Mtwara:	Private traders	-	-	100,0
		NMC	-	100,0	-
	Ruvuma:	-	-	-	-
	Singida:	-	-	-	-
	Arusha:	-	-	-	-
Sembe	Mtwara:	Private traders	-	-	100,0
	Ruvuma:	Private traders	-	100,0	-
	Singida:	-	-	-	-
	Arusha:	-	-	-	-
Groundnuts	Mtwara:	Private traders	-	-	100,0
		Other farmers	100,0	-	-
	Ruvuma:	Private traders	50,0	-	-
		Other farmers	50,0	100,0	-

Source: Survey data.

Table 9
Reasons for purchasing food at different periods:
(% of households responding)

Region	Source	March 1989 to June 1989	July 1989 to December 1989	January 1990 to February 1991
Mtwara:	None in own stock	93,8	77,8	80,8
	Prices are lower	6,2	0,0	3,8
	Increase in household size	0,0	8,3	0,0
	Others	0,0	13,9	15,4
Ruvuma:	None in own stock	100,0	82,1	77,8
	Prices are lower	0,0	10,7	11,1
	Increase in household size	0,0	0,0	0,0
	Others	0,0	7,2	11,1
Singida:	None in own stock	80,0	79,7	88,1
	Prices are lower	12,0	13,6	2,4
	Increase in household size	8,0	0,0	0,0
	Others	0,0	6,7	9,5
Arusha:	None in own stock	89,5	90,0	86,4
	Prices are lower	5,25	5,0	0,0
	Increase in household size	0,0	0,0	4,5
	Others	5,25	5,0	9,1
Total		100,0	100,0	100,0

Source: Survey data.

A large proportion of the sampled households did not purchase any food (53,8 percent) in Ruvuma, 66,5 percent in Mtwara, 55,8 percent in Arusha and 46,7 percent in Singida). These households may not be self sufficient but, rather, they have no other source of income to purchase food. Ninety five percent of the households surveyed earned income only from farming. The problem of food access appeared to be more serious during the hunger period when the average number of meals taken by each household member was below the normal three meals for adults and four to five meals for children below age five, Table 10.

There are limited opportunities for off-farm employment in the studied rural areas. The main sources of off-farm income, for the 35 percent of households which received such income, are small business (mainly operating small shops), beer brewing and carpentry. Effort should be directed towards creating off-farm income generating projects, particularly following the farming season, as a strategy for alleviating food insecurity for households without adequate production or without other sources of income to purchase food.

The average number of meals per household member is higher in the food surplus regions of Ruvuma and Arusha. About 94 percent of the sampled households in Arusha and 54,5 percent in Ruvuma had three meals on average. In Singida and Mtwara, on the other hand, less than fifty percent of the households had three meals or more during the hunger period. These households had run out of food stocks and had no income to purchase food.

Table 10
Average number of meals during the hunger period

Region	Household	Children Below Age 5
Mtwara	2,3	2,5
Ruvumba	2,6	2,8
Singida	2,3	2,7
Arusha	2,9	3,4

Inadequate food production and lack of income to purchase food has compelled some of the households to exchange household labour for food. About 5,8 percent of the sample in Mtwara, 2,9 percent in Ruvuma, 10 percent in Singida and 2,5 percent in Arusha exchanged labour for food during the hunger period (January-February 1990). The main food items received in exchange for work completed are: cassava root, sorghum/millet and peas in Mtwara; local maize, rice and beans in Ruvuma; (unrefined maize) flour in Singida and; hybrid maize, local maize, beans and sorghum/millet in Arusha region.

SUMMARY

The focus of the government's food security policy has centered on extracting food from rural areas for urban consumers. This focus implicitly assumes that rural households are food self-sufficient. But this study has shown that a large proportion of households in food deficit areas and, to a much lesser extent, in food surplus regions do not produce enough food for own consumption, leave alone surplus food for the market. Many of the deficit households do not have other sources of income to purchase food. For the few with the ability to buy, food may not be available.

The official marketing agents generally operate a uni-directional distribution system, *viz.*, from rural to urban centers or to the strategic grain reserve. Even when there are stocks of grain in primary society godowns (storage sheds), there are no arrangements to make it available to potential buyers unless there is famine in the area. Even then, the authority to sell food has to come from higher authorities. Although private traders are playing an increasingly significant role in food distribution in some areas, their activities are restricted by poor road infrastructure and/or low production. Even where the roads are good and marketable surplus is high, there are still some barriers to private investment in grain marketing. Apart from private traders, some farmers also sell food to deficit households. Whether this source of purchased food is available every year or whether food from this source is sold at stable prices, is unknown.

Private traders are playing a significant role in terms of buying activities. They could play a much bigger role if their operations were legally recognized. They also need assistance in getting credit for purchasing crops and for erecting storage facilities in rural and urban areas. These actions could reduce food supply fluctuations and possibly reduce price fluctuations, particularly during the hungry season. Government support for investment in private storage facilities and improvement of rural roads infrastructure may encourage more private traders to trade between food deficit and food surplus areas. The market liberalization policy, that began in 1984, has not, unfortunately, led to a competitive market in some areas. Food trade is largely between surplus and deficit households. To be effective, market liberalization must go hand in hand with policies that create an environment for entry and investment in food trade.

To improve food security in the deficit/dry areas like Singida, the production of drought-resistant food grains such as sorghum/millet needs to be encouraged to increase food supplies. This strategy should be combined with a strategy to increase household incomes through expansion of off-farm employment opportunities and/or encouraging the production of high value crops.

Targeted food aid and nutrition programmes should be continued in the short-run. Unfortunately, the sources of food aid are NMC godowns located far away from deficit areas. Given the poor transport infrastructure in the country, it takes a while before food reaches needy areas. There is a need, therefore, to establish food reserves in deficit areas and prepare financially viable targeting mechanisms for alleviating food insecurity during the hungry season.

REFERENCES

Amani, H.K.R. *et al.* 1987. Effects of Market Liberalisation of Food Security in Tanzania. In: Rukuni, M. and R.H. Bernsten eds. *Southern Africa : Food Security Policy Options.* University of Zimbabwe/Michigan State Food Security Research Project. Department of Agricultural Economics and Extension. Harare.

United Republic of Tanzania. 1989. *1988 Population Census : Preliminary Report.* Bureau of Statistics. Tanzania.

9

Household Food Security And Market Liberalisation In Blantyre Agricultural Development Districts

Benson Kandoole[1]

INTRODUCTION

As part of a structural adjustment programme, the Malawi Government introduced the Agriculture (General Purpose) Act of 1987 which provides a legal basis for the operation of private traders in marketing agriculture produce. During the same period, the Agriculture Development and Marketing Corporation (ADMARC) was being restructured by closing down some of its "uneconomic" markets.

To assess the impact of the Act on household income and food security; to assess the response of private traders to the new policy; and to identify the constraints private traders may be facing; the Centre for Social Research, with assistance from UNICEF and UZ/MSU Food Security Project, launched a two year study of smallholder farmers in Malawi. The specific objectives of the study were to:

- examine previous marketing arrangements in each of the study areas and determine what effects these had on household income and food security;
- determine changes that have taken place in marketing arrangements in each of the study areas since the new policy came into force;
- determine the number of registered as well as non-registered traders operating in each study area;
- assess the resources available to private traders for the purchase of produce, transportation and storage;
- assess the impact of the new marketing arrangement on households as producers and consumers of agricultural produce;

[1]University of Malawi, November 1990.

- assess the Government's ability to monitor food supply;
- assess the effectiveness of Government in determining appropriate buying and selling prices in the face of liberalisation;
- assess the extent the private sector can effectively be used for the distribution of agricultural inputs; and,
- make policy recommendations, based on the findings, on overall marketing arrangements, the role of ADMARC and changes needed to strengthen the effectiveness of the private sector.

The 12 month study is being undertaken in three Agricultural Development Divisions (ADDs) in Blantyre, representing a region of food deficit but with a relatively well developed private sector adjacent to the major city in the country; Lilongwe, representing a food surplus area with a growing, but undeveloped, private sector; and Mzuzu, which is generally considered to have a food surplus but with few private sector activities.

For ease of comparison, two Rural Development Programmes (RDPs) were selected from each ADD. Within each of these RDPs, two Extension Planning Areas (EPAs) were selected for focussed interviews throughout the 12 month period. Baseline information was collected from 1800 farm households from which a total of 600 households was selected for collection of monthly data on food consumption, income and expenditure. This paper is based on household baseline data collected from the Blantyre ADD. It examines the characteristics of the households, their income and food security status and how the Act has changed their behaviour in the marketing of agricultural output. The household baseline information for the other ADDs and the study of traders is discussed in another Conference paper.

HOUSEHOLD COMPOSITION

Blantyre ADD is generally a food deficit area but with a relatively well developed private sector. However, there are food deficit and food surplus regions within the ADD. Mwanza RDP was chosen to represent the latter while Shire Highlands was selected to represent the former. The following analysis is a comparison of household behaviour between these two regions. A sample of 300 households was chosen in each RDP. A structured questionnaire on household composition, farm size, crop production and sales, marketing behaviour before and after the Act, survival mechanisms, interventions, extension, food access, storage, and resources was administered.

Mwanza has more families with less than three members (18,7 percent) than the Shire Highlands (10,7 percent), while the opposite is true for larger families. This implies that, in the latter RDP, there should be a tendency for households to use own labour in farming but, at the same time, may have more mouths to feed than in the former, Table 1. However the distribution of the population by age tends to be similar in the two areas. About three percent are under one year of age, 11 percent children under five, 30 percent are of school going age, 39 percent for Mwanza and 32 percent for Shire Highlands are in the economically active age group, and those over 50 years of age comprise 9,5 percent and 13,6 percent respectively in the two RDPs. Females constitute just over 50 percent of the total population in each of the areas. The majority of the household heads are married (71 percent in Mwanza and 67 percent in Shire Highlands) with less than two percent single and the rest either divorced, separated or widowed. In Mwanza, a quarter of the households are female headed while in Shire Highlands, the proportion is a third. The majority of the male household heads (95 percent in Mwanza and 98 percent in Shire Highlands) work within the area.

Table 1
Household members in Mwanza and Shire Highlands

	Mwanza		Shire Highlands	
Household Members	Number	%	Number	%
1	20	6,7	12	4,0
2	36	12,0	20	6,7
3 - 4	139	46,3	144	48,0
6 - 8	73	24,3	94	31,3
Over 8	32	10,7	30	10,0

The literacy rate is about 67 percent indicating that the majority of household members can read and write, hence are able to receive and understand extension service messages provided by the Ministry of Agriculture. The marked difference between the two areas is in the main occupation of household members. Eighty one percent of those in the food surplus area are engaged in their own smallholder farming while the proportion is 64 percent in the food deficit area. The proportions of those either in business or employed are more or less similar in the two areas. However there is a substantial difference in unemployment. Aside from those either in school or under school age, 23 percent of the population in Shire Highlands are unemployed while only 9,5 percent of the respondents in the food surplus area (Mwanza) are without any gainful employment, Table 2. One explanation for this difference may be the availability of land. Mwanza, in relative terms, is sparsely populated with few estates. Shire Highlands has many tea estates in some sections of the RDP with very little land left for smallholder farming. In the other section, population density is the highest in the country. Being an agricultural country, it is not surprising that the land constrained area has a high unemployment rate as compared to the area without the land constraint.

Table 2
Main occupation of household members in Mwanza and Shire Highlands

	Mwanza		Shire Highlands	
Occupation	Number	%	Number	%
Own farming	637	81,1	610	64,1
Employed	56	7,1	89	9,4
Own business	18	2,3	30	3,2
Unemployed	75	9,5	222	23,3
Total	786	100,0	951	100,0

RESOURCES

The major resources in smallholder agriculture are land, labour and capital. The availability of these inputs may contribute to the food security status and income of a household. Fertilizer and chemicals are also important resources.

The majority of households in the food deficit RDP have only one field (58 percent) while about 60 percent of those in Mwanza have two or more fields, Table 3. More pronounced is the number of households who keep at least one field fallow--6 in Shire Highlands and 57 in Mwanza. In addition, as is shown in Table 3, most of the fields in Shire Highlands (55 percent) are less than an acre compared to 29,5 percent in Mwanza. A quarter of the fields in Mwanza are larger than three acres in contrast to 9,7 percent in Shire Highlands. In short, the food surplus RDP has more and larger fields than the food deficit RDP. This difference is also reflected in the cropping patterns in the two areas -- 56 percent of the fields in Mwanza are planted with a single crop while a third are mixed cropped. The situation is different in Shire Highlands where 15 percent is in single cropping but in 83 percent of the fields, farmers use mixed cropping, Table 4. This re-emphasises the significance of land shortage in the food deficit area relative to the food surplus area.

It appears, Table 5, that there is heavy reliance on salary and savings as a source of capital in Shire Highlands (52 percent) compared with 13,5 percent in Mwanza. The reverse is true for the selling of crops and business as a source of capital. This is as expected. In the food surplus area, there is relatively more land and most of the households have larger, multiple fields. Hence, they should be able to grow enough for subsistence with surplus to sell. The proceeds can then be used to buy farm implements, fertilizer, *etc.*, for next growing season. However, farming is not very mechanised in either RDP since the majority of the farmers (over 97 percent) rely on the hoe as the only farming implement.

Table 3
Field Size : Mwanza and Shire Highlands

	Mwanza		Shire Highlands	
Area	Number	%	Number	%
1 Acre	173	29,5	277	55,1
1 - 2 Acres	200	34,0	131	26,0
2 - 3 Acres	68	11,6	46	9,1
Above 3 Acres	146	24,9	49	9,7
	587	100,0	503	100,0

Table 4
Cropping Type (%) : Mwanza and Shire Highlands

Type	Mwanza	Shire Highlands
Single crop	55,9	15,3
Mixed crop	34,4	83,7
Pasture/Fallow	9,8	1,0
	100,0	100,0

Table 5
Source of capital (%) : Mwanza and Shire Highlands

Source	Mwanza	Shire Highlands
Salary	5,8	18,2
Savings	7,7	24,2
Friends	16,0	10,0
Selling crops	31,0	24,7
Business	24,4	11,4
Other	15,0	11,4
	100,0	100,0

Very little hired labour is used in either area -- 4,1 percent in Shire Highlands compared to 10,8 percent in Mwanza. Most of the households (83 percent in the food deficit RDP and 68 percent in the food surplus RDP) use own labour. The balance are households who use a combination of own and hired labour. The relatively higher percentage of own labour in Shire Highlands can be explained by the fact that most of these households, though with many members, have very small plots and hence have no need for hired labour. This is supported by a 22 percent unemployment rate among the household members in the area. If sufficient land were available, this labour could have been utilised.

CROP PRODUCTION AND SALES

The major food crop being grown in Blantyre ADD is maize, either local variety, composite or hybrid. However, 98 percent of the farmers grow the local variety demonstrating the lack of popularity of hybrid maize. The respondents indicated that they do not plant hybrid maize because of its poor storage and poor processing characteristics.

The second major food crop being grown in both areas is pulses (66 percent in Mwanza and 49 percent in Shire Highlands). Pulses are consumed together with maize as relish. Even the leaves of some of their plants are used as such when they are green. Hybrid maize in Mwanza and cassava in Shire Highlands is the third major corp being grown in the areas, Table 6. These are substitutes for the local variety maize. Hence, they may be used during periods of shortage of their staple food.

In Mwanza, the major cash crop competing with maize for land and other resources is cotton. In the other area, they grow pulses both as a cash crop and as a staple, Table 7. Therefore, it can be concluded that in the food deficit area, there is no pure cash crop production due to shortage of land. It is not surprising that the major source of capital in this area does not come from crop sales but from salary and savings.

Most respondents indicated that less than a hectare (59 percent) in Mwanza and 78 percent in Shire Highlands was planted to the major crop (local variety maize). As can be seen, more than three quarters of those in the Shire Highlands had very little land on which to plant hybrids. In fact, 92 percent of the farmers planted less than 2 ha of maize compared to 76 percent in Mwanza. The proportions of smallholdings are high in both areas but, in relative terms, the situation is worse in the food deficit area. On the other hand, 17 percent of the farmers in Mwanza planted over 3 ha of maize compared to four percent in the Shire Highlands.

It was surprising that the food surplus area tends to use less fertilizer (12 percent of respondents) than those in the deficit area (45 percent). One explanation could be that, in Mwanza, with large holdings and many people having more than one field, they can keep one field fallow one year and use it the following year. Hence, the fertility of the land is given a chance to regenerate.

There is no marked difference between the two areas on quantities harvested. The majority harvested less than five 90kg bags and very few got over 10 bags, Table 8. This difference occurred because, during the period of study, the rains were not very good in Mwanza and their output was low.

Table 6
Second major crop grown : Mwanza and Shire Highlands

Crop	Mwanza (%)	Shire Highlands (%)
Pulses	65,5	49,4
Cassava	5,0	25,3
Hybrid	15,8	12,6
Other	13,7	12,6
	100,0	100,0

Table 7
Cash crops : Mwanza and Shire Highlands

Crop	Mwanza	Shire Highlands
Cotton	76,6	-
Pulses	7,6	83,3
Other	15,8	16,7
	100,0	100,0

Table 8
Quantity harvested : Mwanza and Shire Highlands

Quantity (bags)	Mwanza (%)	Shire Highlands (%)
Less than 5	67,9	73,0
5 to 10	22,4	19,3
Over 10	9,6	7,7
	100,0	100,0

A substantial number of farmers sold their produce within a month of harvest. Given the poor harvest, it is likely that they will run out of food during the year. This worsens the food security status of the households. Seventy-two percent of those in Mwanza sold their produce at an ADMARC market while those in Shire Highlands sold theirs at local markets, Table 9. In both areas, the majority of those who had not increased their production mentioned land constraint as the factor though some blamed poor rainfall.

Table 9
Where sold in 1988-89

	Mwanza	Shire Highlands
ADMARC	72,4	10,2
Household	10,1	9,3
Market	12,2	68,9
Traders	15,3	10,7
Other	-	1,0
	100,0	100,0

Table 10
Distance to agent : Mwanza and Shire Highlands

Distance (km)	Mwanza (%)	Shire Highlands (%)
0 - 1	29,6	30,6
1 - 5	70,4	53,2
5 - 10	-	12,9
Over 10	-	3,2
	100,0	100,0

Table 11
Means of transport : Mwanza and Shire Highlands

Means	Mwanza	Shire Highlands
Truck	6,6	10,3
Ox cart	33,6	-
Bicycle	3,8	3,4
Head Portage	53,1	77,9
Sold at Home	2,8	8,3
	100,0	100,0

More households in Shire Highlands use fertilizer than in Mwanza. Sixty two percent of households in Shire Highlands and 42 percent in Mwanza indicated that they have made changes in fertilizer uptake. Of these, 27 percent in Mwanza and 63 percent in Shire Highlands had increased their uptake. The majority increased fertilizer usage because of either increased output prices or better input prices.

A few respondents in both areas indicated that they had changed buyers of their produce between 1986-87 and 1988-89. The reason was the closure of ADMARC Markets. Out of the 300 households in Shire Highlands, only 18 respondents had changed buyers while 10 in Mwanza had changed. Most of the households grew their crops purely for subsistence and did not sell any of their produce (79 percent and 81 percent in Shire Highlands and Mwanza respectively). It is suspected that smallness of holding may have contributed to this state of affairs. Of those who had indicated they sold some produce, 62 percent in Mwanza and 86 percent in Shire Highlands admitted to buying grain later in the year in order to meet their grain needs. The major reasons for selling when they could not meet their subsistence needs included needing cash to satisfy household needs, repay loans and to purchase agricultural inputs. The buying back of grain shows the subsistence nature of farming in this area.

Asked whether they planned to grow crops for sale in the following year (1990-91), over 70 percent in both areas responded in the affirmative. The majority mentioned better output prices as the major reason for their plans to produce for sale. This shows that the supply of agricultural produce is price elastic -- *i.e.*, farmers will respond favourably to a price increase. Those who did not plan to grow crops for sale had varying reasons, depending on the RDP. The majority of those in Mwanza cannot afford the input prices while those in Shire Highlands do not have enough land to grow crops for sale. This shows the difference in the availability of land in the two RDPs. Most of those who plan to grow for sale do not expect any problems in finding a buyer and expect the prices to be higher than at present. This is not surprising since the smallholders know that floor prices will be higher than the current ones and the private traders and local markets will adjust their prices accordingly.

Only thirty eight percent of those in Mwanza plan to apply fertilizer on their crop next season compared to 77 percent in Shire Highlands. This reaffirms the popularity of fertilizer in the food deficit RDP. The majority of those who do not plan to apply fertilizer in their fields indicate that they cannot afford the input prices. This may indicate that the fertilizer subsidy removal program will have a negative impact on fertilizer uptake and output.

Most households in both areas are not going to use chemicals because they are very expensive. Those who plan to apply chemicals in their fields will purchase them from ADMARC indicating the importance of ADMARC markets in the distribution of inputs in the rural areas. This observation is further supported by the majority to those who said that, if there was no ADMARC market, they would not purchase the chemical because they believed it would not be available.

The majority of the households (56 percent in Mwanza and 87 percent in Shire Highlands) would not grow burley tobacco even if it were permitted. Land constraint is the major reason in Shire Highlands while it is input cost in Mwanza, Table 12. This again, emphasises the problem of land availability in the food deficit area.

Table 12
Reasons for not growing barley tobacco : Mwanza and Shire Highlands

Reason	Mwanza	Shire Highlands
Land constraint	12,3	73,0
Expensive inputs	53,8	11,2
Other	33,9	15,8
	100,0	100,0

The majority planned to produce all of their household food requirements in 1990-91. This was more prevalent in Mwanza than in Shire Highlands. Most of those in Mwanza who do not plan to grow all their requirements expect their food supply to last about four to six months while those in the food deficit area expect their supply to run out within three months, Table 13. About half expect to meet their food deficiency through purchase with a quarter though work for food, Table 14.

Table 13
Months of grown food supply : Mwanza and Shire Highlands

Number of months	Mwanza	Shire Highlands
1 - 1	-	44,0
4 - 6	81,8	26,0
7 - 9	9,1	18,0
10 - 12	9,1	12,0
	100,0	100,0

Table 14
How food needs are met in Mwanza and Shire Highlands

	Mwanza	Shire Highlands
Purchase	45,5	51,9
Gifts	18,2	19,2
Work for Food	27,3	28,8
Aid	9,1	-

Most respondents, in case of a serious food shortage, turn to performing casual labour in order to acquire food (52 percent in Mwanza and 69 percent in Shire Highlands). The payment for labour could be either in cash or in kind. Using casual labour as a survival mechanism may worsen the food security situation of the household since serious food shortages normally occur during the rainy season when they need to work in their own fields. Taking time off to work on someone else's land means that they are not going to produce enough for their own subsistence. This implies that they will engage in casual work during the following year. Hence the vulnerable households will be at the mercy of the relatively better off (employing) households. About 20 percent of the households in Mwanza claim that they can get over the difficult times through loans from traders compared to only four percent in the Shire Highlands. This means that private traders are involved in the food surplus areas to the extent of granting households loans. In both areas, over 60 percent of the respondents claim that, during the times of serious food shortages, food supplies are available in the area for those who are able to buy.

More people are nearer ADMARC markets in Mwanza than in the Shire Highlands. Most of them know how long ADMARC stays open to buy and sell produce. The majority of them feel that ADMARC buys for three to four months and sells produce throughout the year. Questioned whether they plan transactions with ADMARC, 73 percent of those who responded positively in the Shire Highlands were planning to sell maize, 13 percent to buy maize and the rest to buy inputs such as fertilizer. In Mwanza about 50 percent plan to go to ADMARC to buy maize and the other half to sell maize. This shows that the food deficit area has few dealings with ADMARC when it comes to the purchase of maize for home consumption. It may be that they prefer to buy from other households and from local markets where they are assured a local variety. Those who do not want to deal with ADMARC may quote the long distance to the market or the low buying and high selling prices as reasons.

At least one market has been closed in each of the areas under study. Ninety five percent of those in Mwanza who transacted with ADMARC were affected by the closure while only 45 percent of those in the Shire Highlands were affected. Their major concern is the difficulty they encounter when they try to buy maize.

Most of the respondents feel that, if they had more land, they would produce enough for their subsistence (82 percent in Mwanza and 97 percent in Shire Highlands). Only two percent of those in Shire Highlands and 41 percent in Mwanza believe that additional land is available within their respective areas. The differences in land availability between the two areas does not exaggerate the land constraint issue in the food deficit area. The people in Mwanza do not use the "surplus" land either because of input constraints or because it is difficult to acquire since it belongs to another household according to the customary laws of the area.

FOOD ACCESS

Practically all the respondents regard local variety maize as their staple. Twenty-four percent of those in Mwanza and 17,5 percent of those in the Shire Highlands never have their stock depleted, while 47 percent of those in Mwanza face this problem in January - March. In the food deficit area, the problem becomes apparent to most households as early as October. This shows the vulnerability of those in the Shire Highlands. ADMARC was mentioned as a source of food after depletion by most of the respondents (74 percent in Mwanza and 53 percent in the other area). Private traders, as a source of food, are only registered in Mwanza (14,4 percent). The second important source in both areas is work for food. Half the people in Shire Highlands and 68 percent of those in Mwanza do not get enough food after depletion because of low incomes and, in some cases, a lack of supply.

In comparison with 1986-87 season, 30 percent of those in Mwanza and 44 percent in the Shire Highlands feel that maize is more available now. In Mwanza, the majority feel the availability is due to good weather, while in Shire Highlands, they attribute this to the introduction of private traders. The majority of those who respond negatively (51 percent in Mwanza and 24 percent in Shire Highlands) attributed it to the bad weather.

SUMMARY AND CONCLUSION

Blantyre ADD represents a region of food deficit but with a relatively well developed private sector since it surrounds the main city in the country. Although the whole ADD is food deficit, within it, there are food deficit and food surplus regions. It was, therefore, purposely decided to choose two Rural Development Programmes with this in mind, *i.e.*, one representing the food deficit areas and the other representing the food surplus areas. In this respect, Mwanza which is, in relative terms, sparsely populated, hence, with little land constraint, was selected to represent food surplus areas and Shire Highlands, which is densely populated, was selected to represent the food deficit areas. A sample of 300 households in each RDP was interviewed.

Household characteristics with respect to family size, age and gender distribution, marital status, and educational level, tend to be similar in the two RDPs. The majority of those in the food surplus area do their own farming and very few are unemployed. Although large proportions are also engaged in own farming in the food deficit area, there are many who are unemployed, presumably due to the land constraint.

The fields in Mwanza tend to be bigger than those in Shire Highlands and there are more fallow fields in the former than the latter. In addition, mixed cropping is extensively applied in the food deficit area as compared to the food surplus area which is single cropped. All show the seriousness of land shortages in Shire Highlands.

More people in the food deficit area than in Mwanza rely on salaries and savings as a source of capital while the latter depends on proceeds from crop sales. This may also be a function of land holding sizes. Farming in both areas is not mechanised with the most important implement being the hoe. There is heavy reliance on own labour.

The major food crop grown in the ADD is maize which is also the staple of the area. The second most important crop is pulses which is consumed together with maize. This is followed by hybrid maize for Mwanza and cassava for Shire Highlands, both substitutes for local maize in consumption. Mwanza grows cotton as a cash crop, while Shire Highlands grow pulses both for consumption and for sale.

Mwanza uses less fertilizer than the food deficit area. This may be due to the fact that with more land they can keep some areas fallow, hence, maintaining the natural fertility of land.

Many households sell their produce at harvest time. Hence, with small holding sizes and low harvest, this worsens the food security status of the household. Over 70 percent of those in Mwanza sell their produce at ADMARC markets compared to 10 percent in Shire Highlands. Shire Highlands has well developed local markets because of the large population of estate workers. Private traders are more prevalent in the food surplus area. The low usage of ADMARC markets when households are selling their produce does not mean these markets are not needed in this area. Being a food deficit area, vulnerable households needs food availability in a reliable market. Hence, ADMARC seems to be the one which can perform this role, therefore should be maintained in the area.

More households in Shire Highlands than in Mwanza travel long distances to markets. The most popular mode of transport in both areas is head portage. Oxcarts are only used in Mwanza. Trucks are relatively popular in Shire Highlands.

Most farmers increased their crop production between 1986-87 and 1988-89 because it is now more profitable. It is difficult to attribute this to market liberalisation alone since ADMARC has also been increasing the producer prices of agricultural output. There has been an increased usage of fertilizer, more so in Shire Highlands. Since the fertilizer subsidy removal programme has not been effective, and the increases in fertilizer prices only reflect transport costs, farmers find prices of fertilizer favourable relative to increased produce prices.

Only a few of the households indicated that they had changed agents due to the closure of ADMARC markets. The majority of the farmers grow for subsistence and do not sell any of their output. However, most of them now plan to grow for sale during the 1990-91 season because of attractive prices. Those in Mwanza who do not plan to grow for sale claim they cannot afford input prices while those in Shire Highlands feel they do not have enough land for expansion. Very few plan to use fertilizer in Mwanza.

A large number of households in both areas, but more so in Mwanza, plan to grow all of their food requirements. Those in Mwanza who do not plan to grow all of their food requirements expect their supply to last four to six months while in Shire Highlands they expect to make up the deficiency through purchase and work for food. A fifth of those in Mwanza expect to get through the difficult times through loans from private traders while in Shire Highlands the figure is four percent. The majority also claim that food is available in the areas for those who can afford it.

But this situation could change if ADMARC closes its markets in the areas. Most respondents indicated that they cared if ADMARC closed the market in their area because they will not have an alternative supply of grain.

ADMARC is still important in both areas, especially when households wants to buy maize, because private traders seldom sell in the rural areas. Therefore, in order to ensure improved food security, private traders should continue to operate side by side with ADMARC. Production in Shire Highlands is hampered mainly by lack of land. The food security situation can be changed if, as indicated in the Statement of Development Policies, off-farm activities such as small scale businesses develop in the area.

10

Malawi : Food Marketing Liberalisation and Household Food Security - Preliminary Results From Baseline Surveys

Ben Kaluwa and Wycliffe Chilowa

INTRODUCTION

The marketing of food crops, typically produced by smallholder farmers, was liberalised in 1987 in response to:

- rising transportation and other costs and falling commodity prices on the world market; and,
- structural problems within the state marketing board -- the Agricultural Development and Marketing Corporation (ADMARC) -- which had over-extended its operations.

These problems, combined with cross-subsidies on an extensive country-wide network of some 1,139 markets together with food crop marketing operations (including the maintenance of strategic grain reserves) led to unprecedented financial difficulties for ADMARC in the 1985-86 trading year. Private traders had always operated in Malawi and their operations had official recognition but no legal basis. Hence, their operations tended to be small-scale except where they operated as agents of ADMARC. The Agricultural General Purpose Act of 1987 established a legal basis for private trader operations defining eligibility criteria and rules of conduct. The market liberalisation programme has been implemented as part of wider reforms under the structural adjustment programmes initiated in 1981.

The two major objectives of the 1987 economic liberalisation programme were to relieve the financial burdens of ADMARC and improve the efficiency of the marketing structure through competition. In order to facilitate the first objective, ADMARC started to withdraw from markets with low throughput and confine their activities to those more directly related to marketing functions. By the end of 1988, 15 percent of ADMARC's markets had been closed.

THE THEORETICAL BASIS OF THE REFORM

The two basic objectives of the market liberalisation -- improving efficiency and food security -- are based on a theoretical model of market integration which can be easily illustrated and provides direction for the investigation reported in this paper.

The model predicts that, under competition, seasonal commodity price differentials will reflect storage costs, regional (spatial) price differentials will reflect transport costs and both will facilitate arbitrage. For simplicity, the model can be split into two components -- one spatial and the other for seasonal integration of the market.

We consider the case with two regions, Y (exporting) and X (importing); and two seasons, k (producing) and s (consuming). P represents price, S storage costs and T transportation costs. The market integration models are then:

$$Py + Tyx = Px \qquad (1)$$
$$Pk + Skj = Pj \qquad (2)$$

In Malawi, official prices are pan-territorial and pan-seasonal. Hence $Py=Px$ and $Pk=Pj$, despite the fact that $Tyx, Skj > 0$. Hence, price intervention suppresses pricing signals that would indicate relative shortages. This means that ADMARC's transportation and storage operations are necessary to move grain from one region to another or to store it from one season to the next.

Under the previous ADMARC system, grain was moved from regions such as Mzuzu Agricultural Development Division in the Northern Region, to the strategic grain silos in Lilongwe, stored and moved back in the hungry season for distribution. This has been one of the root causes of ADMARC's food crop trading deficits. These were cross-subsidised by its trade in non-food crops for which, on average, $Py + Tyx < Px$ where Py is controlled and Px is the auction price. This provided the basis for the belief that liberalisation and competition, in conjunction with a differential spatial pricing policy, would lead to more efficient resource allocation and reduce cross-subsidies and crop trading losses. Multidirectional commodity access to food would also be provided through relative scarcities triggering price signals and, hence, the necessary functions such as storage and distribution.

Unfortunately, the model and its predictions rely on the assumption of perfect competition entailing free entry and exit among traders and among consuming groups. In practice, with free prices, large price differentials can persist implying segmented markets spatially or inter-seasonally which can lead to persistent deficits in some areas or seasonal deficits in areas which are otherwise surplus producers. This will only be the case if inhibiting factors such as an underdeveloped transportation system, storage system and technology; or simply inadequacies in complementary markets (such as the capital market), unequal purchasing power or imperfect information flows exist. Government storage and food distribution policy can also affect private trader entry and participatory response.

Pricing policy, if not completely free, can be another inhibiting factor to free entry and competition as can other regulations. At worst, these factors can influence traders' views about the government's commitment to marketing reforms and can result in uncommitted entry where traders avoid sunk costs to facilitate easy exit. This will result in an unstable marketing structure and unpredictable outcomes making policy analysis difficult.

The foregoing indicates a number of areas for investigation. The spatial and commodity pattern of entry, scale of participation and the direction of trade movements can provide an indication of the extent of spatial market integration. Stocking behavior provides an indication of inter-seasonal integration. Problems in either of these or the pricing structures (spatial and inter-seasonal) exacerbate the vexing issue of what ADMARC's or any other intervention should be for the two objectives to be fulfilled simultaneously.

The reforms, in the wider sense, might not be delivering adequate incentives and the environment to motivate traders capable of entering into the areas from which ADMARC has withdrawn. Specifically, the study aims at assessing the impact of the reform measures, including liberalisation, on household income and food security, assessing the response of private traders to the new policy and investigating the constraints private traders may be facing.

METHODOLOGY

The main study is being undertaken in three Agricultural Development Divisions (ADDS) for a period of at least 12 months (*i.e.*, one crop year). Blantyre ADD (BLADD) in the southern region of the country is a food (grain) deficit ADD, Lilongwe ADD (LADD) in the central region is a food surplus ADD, while Mzuzu ADD (MZADD) in the northern region is marginally above average.

Two Rural Development Projects (RDPs) were selected from each ADD, some purposely food surplus (*e.g.*, Mwanza RDP in BLADD) and some food deficit (*e.g.*, Shire Highlands RDP also in BLADD).

From each RDP, two Extension Planning areas (EPAs) were randomly selected. Lastly, two sections from each EPA were randomly selected giving us a total of 24 for the sample. Seventy-five (75) households were selected randomly from each section for the household baseline survey comprising a total sample of 1,800 households. No known population existed for the trader baseline survey. Thus the census method was adopted to include all grain traders identified on the sections over a period of two months from the beginning of the field work. In addition to the households and traders' surveys, price monitoring is being undertaken in rural markets within the sections.

PRIVATE TRADER BASELINE

The first issue investigated was the extent to which the entry pattern of private traders, over time, had been influenced by liberalisation. The second was the extent to which the spatial pattern of their operations is influenced by remoteness from proximity to urban centres. The third is the extent of concentration in commodity trading.

Characteristics of the Traders

The survey covered 83 private traders -- 33 in BLADD, 50 in LADD and none in the MZADD. This distribution baseline conforms to the pattern of licensed traders for 1988-89. MZADD had the highest number of designated markets and yet accounted for only five percent of the traders. Some areas in MZADD are so remote that some of the private traders operating in the area offer to buy maize only on a transport cost sharing arrangement based on a uniform hire rate. This obviously depresses the margins of the more remote farmers.

Traders are predominantly male (95,2 percent) and polygamous (88,0 percent). All are over 21 years of age with 77,1 percent between the ages of 21 and 50 years. Sixty-one percent of the traders in the BLADD were educated to primary level IV or above, the level assumed to be the minimum for functional literacy. The corresponding proportion for the LADD was 70 percent. All the traders in the BLADD had public positions or were involved in activities such as farmers clubs and business associations, while only 58 percent were similarly involved in the LADD. Business association or farmer's club membership applied to 24,3 percent in BLADD and 14,0 percent in LADD.

In BLADD, 51,5 percent resided within the EPA and 78,8 percent within the RDP. In total, 93,9 percent were rural-based. The remaining 6,1 percent were based in the smaller urban centres rather than the cities. In LADD, things were significantly different. Only 70 percent were rural-based (46 percent within the EPA) with the rest being urban-based, mainly in Blantyre and Lilongwe.

Crop trading is the most important activity for the traders in BLADD and LADD (63,6 percent and 62,0 percent respectively) followed by farming (15,2 percent and 22 percent). Transporting was only mentioned by 12,1 percent of the traders in BLADD and none in LADD. The traders tend to have diversified activities beside crop trading (66,7 percent in BLADD and 58 percent in LADD), with those in BLADD tending to combine trading with retailing and grain milling while those in LADD combine trading with farming, retailing and grain milling in that order.

Liberalisation and Entry

Only 15,2 percent of the traders in BLADD began operating after liberalisation compared to 48 percent in LADD. Entry in BLADD, induced by liberalisation was smaller compared to LADD. Sixty-seven percent of those in BLADD had been trading for six years or more while the proportion for LADD was 78 percent.

Private Trader Activity

The majority of traders (78 percent) in LADD felt that they bought enough crops. This question was not answered by most of those in BLADD. Although buying extends to September (BLADD) or August (LADD) most of the traders concentrate their buying within three months of harvest, *i.e.*; April to June for BLADD (78,8 percent) March to May for LADD (78 percent). Buying stops between August and September for 57,6 percent and 46 percent of the traders in BLADD and LADD respectively with some activity before and after. For the most part, buying is between April and September for BLADD and between March and September in LADD. This suggests quite a significant amount of early buying in the latter (44 percent starting in March).

Although a significant proportion of traders indicated that there was no fixed selling period, most traders sold immediately after purchase (57,6 percent in BLADD and 72,0 percent in LADD). Storage behavior supports these observations although there was more storage in LADD than in BLADD. In BLADD, 72 percent did not store for more than a month while in LADD the proportion was 36 percent. Thus, a majority (64 percent) stored for at least one month. The explanation for these differences stems from the fact that, although a sizeable proportion of the LADD crop trading was town-based, a significant proportion of the traders (23,7 percent) were selling in slow-moving town outlets (markets and directly to households). Twenty-eight percent of the selling in Blantyre was to processors compared to eight percent in LADD.

The responses indicate that rural area crop markets are better served by private traders than previously assumed (24,6 percent of the responses in BLADD and 27,6 in LADD). But the critical issue is whether these operations are sustained throughout the year. Household level results provide an indicator.

With little variation between the ADDs, the most important crops in which traders deal are maize, including hybrids, (38,4 percent in BLADD and 43,5 percent in LADD) and pulses (43,0 percent in BLADD and 38,1 percent in LADD). There is some specialisation in LADD where potatoes are grown in Ntcheu district. Overall, there is a tendency towards crop concentration which is probably a reflection of supply and demand conditions. High throughput crops (buying and selling) are logically favoured.

Generally, the traders in BLADD appear to be comprised of more small-scale traders dealing in less than 100, 90kg bags. Some of these small-scale traders may be specialists in higher value crops like pulses. This increases the value of their limited turnover. Perhaps the most significant and interesting result is that over 15 percent of the responses relate to quite large transactions of over 1 000, 90-kg bags. Thus, private traders are providing competition for ADMARC and fulfilling their expected role in buying. On the other hand, only 15 percent and 10 percent of the traders in BLADD and LADD, respectively, sell inputs (all types). Their terms are cash in BLADD (100 percent) and other than cash in LADD (85 percent). It is not expected that an element of subsidy is involved in such transactions. On the contrary, the traders will expect to make considerable margins in order to undertake such activities, especially considering that some of the areas may be remote.

Market Structure and Profitability

Despite the fact that over 70 percent of the traders in both ADDs said that there was more competition now than before liberalisation, a similar proportion said that they were better off now than before (72,7 percent in BLADD AND 74 percent in LADD). This is despite the fact that a majority of the traders felt that general price regulations resulted in higher buying and lower selling prices than would otherwise be the case. A possible explanation is that, although floor prices exist and are used as a guide for actual buying prices, they are not enforceable. Messages relating to ceiling prices are poorly defined (Scarborough, 1990). In any case, with the current maize scarcity, ceiling prices are difficult to enforce. ADMARC selling prices could be regarded as a guideline by the traders and perceived to be restrictive.

Trading Constraints

The most important trading constraints are credit (36,6 percent in BLADD and 20 percent in LADD), transport availability (19,7 percent in BLADD and 14,9 percent in LADD) and transport costs (11,3 percent in BLADD and 15,8 percent in LADD). The perceived importance of credit is understandable since finance can be channelled into any area. The presence of fairly large-scale traders means that the demand for credit is significant. The transport constraint, both availability and cost, limits the likelihood of urban to rural trade in crops at any time due to relatively depressed conditions in the latter. Food sold in the rural areas is, therefore, likely to originate there. This is supported by results from the household survey.

Investment

Sunk investments in crop-trading operations imply that exit will not be easy. Thus, 'hit-and run' entry and exit by crop trading operaters becomes more difficult. It is an indication of commitment and is "good" in light of the fact that one of the objectives of liberalisation is to foster competition.

Transport and storage are by far the most prevalent types of investment mentioned and are closely related to trading. They were mentioned in 77,8 percent of the responses in BLADD and 83,8 percent in LADD. In BLADD crop trading investments amounted to over K1 000 in value for 54,0 percent of the respondents compared to 57,7 percent in LADD. The investments had been completed for 86,5 percent of the cases in BLADD compared to only 27,9 percent in LADD.

THE HOUSEHOLD SURVEY

The sample size for both (BLADD) and (LADD) is 600 households each, whereas that for (MZADD) is 599.

On average, 47,7 percent of the entire sample of household heads were males and 52,3 percent females with no significant differences between ADDs. There are more female headed households (FHHs) in BLADD than in LADD and MZADD (30 percent, 15,7 percent and 13,4 percent respectively) because of BLADD'S proximity to the city of Blantyre where males migrate in search of employment.

Fifty-eight percent of all members of households in the entire sample were single, 32,3 percent, 36,5 percent and 38,5 percent were married in BLADD, LADD and MZADD, respectively. However, there are differences between ADDs in type of marriage (polygamous *vs* monogamous) and the divorce and separation variables. There are more polygamous marriages in MZADD than the other ADDs. Divorce and separation rates are less in MZADD due to the patrilineal type of marriage practiced there. Household heads comprised 19,4 percent of the sample population in BLADD, 19,1 percent in LADD and 20,4 percent in MZADD.

A large percentage of the sampled households farm their own land (41 percent, 41,5 percent and 44,1 percent in BLADD, LADD and MZADD respectively). An equally high percentage of the population is either at school or under school age (42,9 percent, 40,4 percent and 49,6 percent in BLADD, LADD and MZADD respectively). Only 3,9 percent are employed outside agriculture in BLADD, 1,5 percent in LADD and 0,7 percent in MZADD. There are differences within ADDs with Shire Highlands RDP in BLADD providing most of those employed outside of agriculture.

A large proportion of the sample population is illiterate, *i.e.*, those with no education and those who have reached standard three or less of the primary education (68,4 percent, 79,5 percent and 68,6 percent in BLADD, LADD and MZADD respectively). Christianity is the dominant religion.

Mean household size is 5,12 for BLADD, 5,25 for LADD and 4,90 for MZADD giving a mean for the entire sample of 5,09.

Farm Size, Crop Production and Sales

On average, BLADD has 5,3 acres per household compares to 3,6 acres in LADD and five acres in MZADD. The higher figure in BLADD results because Mwanza RDP was purposely selected as a food surplus RDP with larger fields. Mixed cropping is prevalent in BLADD and LADD but single cropping predominates in MZADD. More land is left fallow in MZADD as compared to the other two ADDs. Likewise, there are more fields per household in MZADD than in the other ADDs.

Local maize was the major food crop grown in the 1988-89 season by 98,7 percent of households in BLADD, 98,3 percent in LADD in 98,6 percent in MZADD. Cotton, beans and pulses were the main cash crops grown in BLADD in the 1988-89 season, beans, wheat and potatoes in LADD and hybrid maize, groundnuts and tobacco in MZADD. Local maize still claims the major share as a percentage of all crops grown in the 1988-89 season.

The following results, aggregated at the ADD level, should be interpreted with caution because some RDPs were selected purposely to include those that are food (grain) deficit and those that are food surplus within the same ADD (*e.g.*, Mwanza RDP in BLADD is food surplus, whereas Shire Highlands RDP is food deficit).

There is a positive correlation between fertilizer use and grain harvested. The results indicate that the mean harvest is greatest in MZADD followed by LADD and BLADD. Maize fertilizer use is highest in MZADD followed by LADD and BLADD (62,8 percent, 44,7 percent and 42,9 percent respectively), and may be related to the relative availability of land.

Mean *per capita* maize harvest is positively correlated with fertilizer use among the ADDs. However, there are no significant differences between those who use fertilizer and those who do not in the Blantyre ADD. Due to land constraints in the Shire Highlands RDP of BLADD, use of fertilizer on already small holdings may not increase harvest significantly.

These preliminary results show that those who use fertilizer harvest more grain. They also show that, for those who do not use fertilizer, the larger the landholding, the larger the harvest. The mean size of harvest ranges between 400,9kg (BLADD) and 698,6kg (MZADD) for those with less than 0,5ha, progressively rising to between 826,6kg (BLADD) and 1 986,3kg (MZADD).

The results reveal that the mean total value of maize sales increases with landholding size. For example, for BLADD, the mean sales are K6.2 for those with less than 0,5ha and rises to K236,0 for those with over 2,0ha. The corresponding range for LADD is K0.0 to K420.7 and for MZADD, K0.0 to K400.7. Only in BLADD do households with 0,5ha or less sell their grain at harvest. These are the "distress selling" deficit households who have to buy back grain after they have depleted their meagre stocks. Analysis of mean total field size by categories of maize sale clearly indicates the positive relationship between landholding size and maize sales.

Diagnostic Analysis

Reform Issues

Analyses of the diagnostic information collected in the baseline survey are discussed in this section. Changes are examined that occurred prior to and after the food marketing liberalisation policy (pre 1986-87 season). Some of these changes may be attributable to the ongoing SAPs while others can be linked specifically to the food marketing liberalisation.

Slightly over half of the respondents in the sample ADDs affirmed that they had crop changes between 1986-87 and 1988-89 crop seasons, (51,9 percent, 50,8 percent and 52,8 percent in BLADD, LADD and MZADD respectively). In Blantyre ADD households increased crops grown more than in the other ADDs (76,1 percent) compared to only 44,7 percent and 43 percent for LADD and MZADD respectively. Reasons for these increases are that crops grown now are more profitable, more money is needed and improved land husbandry is being used. The importance given to each reason differs among ADDs.

Those in BLADD and LADD reporting a reduced area of crops grown, encountered a land constraint while in MZADD, there was a shortage of fertilizer. More households in BLADD increased fertilizer use on maize as compared to the other two ADDs. Three reasons given by households for increased fertilizer use in all ADDs were increased price of output, better prices of inputs and higher yields. Increased input prices and lack of money feature prominently in all ADDs for those decreasing fertilizer use together with land constraints in BLADD and distant selling points in MZADD.

A high percentage of households sold to an ADMARC market in 1988-89 that is now closed (40,3 percent in BLADD, 71,1 percent in LADD and 91,1 percent in MZADD). Other marketing channels were households - direct - local and households - direct-town in BLADD, and ADMARC markets in LADD. The main reason households sell to agents are pressing cash needs, proximity and attractive prices. More households in MZADD sold maize during the 1986-87 season than in BLADD and MZADD (55,1 percent, 19,5 percent and 24,2 percent respectively). Most households have not changed the place where they sell their maize. Those that have changed were affected by the closure of ADMARC markets and accessibility/transport/proximity problems.

Compared to the pre-1986-87 period, most households in LADD and MZADD report they are having increased difficulties in transporting their crops, *i.e.*, 37,7 percent in BLADD, 61,0 percent in LADD and 68,8 percent in MZADD. Asked if, over the past four years, they had sold some of their grain crops at harvest and bought grain later during the year, most respondents answered in the negative in all ADDs (85,5 percent in BLADD, 87 percent in LADD and 74,4 percent in MZADD). When those who sold were asked why they had done so (while being cognisant of the fact they did not have enough to meet their yearly needs) the two main reasons given in all ADDs were to buy household necessities and to repay loans.

In this survey we also tested the hypothesis that people are responsive to price incentives. To operationalise this, we asked respondents whether the price they expected or believed they would receive influenced their crop plantings. Only in Lilongwe Agricultural Development Division did most of the respondents answer in the affirmative. Affirmative responses were BLADD, 46,4 percent; LADD, 61,8 percent; and MZADD, 37,8 percent.

In all the sample ADDs, most households planned to produce crops for sale in the 1990-91 crop season. Current ADMARC markets are where most of them plan to sell the crops. ADMARC market closures could have an impact since private traders are not mentioned as alternative agents except in LADD where potatoes are not bought by ADMARC. However, most households in BLADD and MZADD expect to receive more than the ADMARC buying price. Those in LADD expect less. Most households in MZADD are skeptical about storing crops because of the near absence of private traders and local markets where they can sell their produce. In some of the remote areas reached by private traders, the traders have devised transport-sharing arrangements between farmers and themselves which penalise the remote farmers to the extent that their transport costs are not subsidised.

Households planning to purchase fertilizer next year totaled 57,5 percent in BLADD, 73,3 percent in LADD and 82,8 percent in MZADD. The main reason for not buying was that they could not afford it. For those planning to use fertilizer, most would use it on local maize (65 percent in BLADD, 74,9 percent in LADD and 76,4 percent in MZADD), as compared to 28,9 percent, 19,1 percent and 23 percent in BLADD, LADD and MZADD respectively, who would use it on hybrid maize.

The research team investigated the reception of respondents to the pending relaxation of restrictions on smallholders designed to enable them to produce a high value crop, namely burley tobacco. Most respondents, in all our sample ADDs, said they would not produce burley tobacco if it were permitted, 71,8 percent in BLADD; 70,2 percent in LADD and 51,6 percent in MZADD. Almost all of those who said they would grow it gave profitability as the reason they would do so. However, those who answered in the negative gave several reasons why they would not grow it ranging from inadequacy of landholdings, expensive inputs, unsuitable soils and climate, the need to grow food, to not knowing how to grow it.

The majority of the respondents in all the sample ADDs said they would not put all their land into tobacco and use the earnings to buy food for the household, (95 percent in BLADD, 96,8 percent in LADD and 93,7 percent in MZADD). This reinforces the point that smallholders in our sample area are risk adverse, especially with respect to food crops.

The majority of households in the sample, plan to produce all of their household requirements, ceterus paribus, (80,7 percent in BLADD, 86.2 percent in LADD and 87,6 percent in MZADD). Those who said they did not plan to produce all of their food requirements next year, on average, expected to have 5,31, 5,71 and 5,15 months of own food supply in BLADD, LADD and MZADD respectively.

The majority of the households said their plans for next year are primarily influenced or affected by household food considerations (92 percent in BLADD, 70,5 percent in LADD and 95,3 percent in MZADD). Most respondents said they would deal directly with ADMARC next year, (67,3 percent, 76,5 percent and 82,4 percent in BLADD, LADD and MZADD respectively). The main transactions anticipated with ADMARC were selling and buying maize and buying fertilizer.

The majority of smallholders in MZADD expect to buy inputs from ADMARC next year. Hence, the consequences of ADMARC closures in this ADD could be disastrous. Asked if an ADMARC unit had closed recently in their area, 57,8 percent, 53,3 percent and 48,7 percent in BLADD; LADD and MZADD answered affirmatively. The majority of the respondents either had bought or sold maize to that unit. Asked if it made a difference to them that an ADMARC market had closed, 89,8 percent in BLADD, 86,7 percent in LADD and 77,6 percent in MZADD answered affirmatively saying it is now difficult to buy and sell produce or buy maize inputs.

The household baseline survey sought to capture households' survival mechanisms in times of hardship. Local maize is the main staple food for almost all households in the sample ADDs (99,8 percent in BLADD and LADD and 89,7 percent in MZADD). The majority of households are food insecure for at least 6 months per year. But fertilizer uptake does make a difference because those who use fertilizer have fewer months of food insufficiency. The majority of those that deplete their stocks before the next harvest do so between December to March in all the sample ADDs. Information from other sources indicate that there is a significant level of food depletion before September. This is quite high in some BLADD RDPs (46 percent in Blantyre RDP; 27 percent in Blantyre/Chiradzulu and 52 percent in Thyolo) compared to other ADDs (*e.g.*, 21 percent in Ntcheu RDP and 19 percent in Thiwi-Lifidzi) (Mann *et al.*, 1988).

Households have various sources of food after they have depleted their own stock. These include ADMARC, 'Ganyu' labour, supplementary crops, *etc.* In both LADD and MZADD more households turn to supplementary crops after they have depleted their staple food stock compared to those in BLADD. However, in BLADD private traders and the local market provide alternative sources of food following depletion. These results confirm that farmers in remote areas have a real reason for being risk-averse with respect to food supplies and cropping decisions. They can expect to have little access to private traders as a food source in their areas.

Asked what they would do to get the additional resources needed to acquire food in case of a poor crop year, a majority of the sample indicated that they would resort to 'ganyu' labour. Asked if food availability had changed between the pre and post liberalisation periods, most respondents in LADD and MZADD thought food was less available now. Low availability now was due to bad weather, less labour, closure of ADMARC markets and low incomes, among other reasons.

Respondents were asked about the number of additional days of labour that their households could work off their farms without reducing their farms' production. The mean number of days in BLADD was seven, 22 days in LADD and 26 in MZADD at the wage rate of K2.36, K4.79 and K4.66 per day, respectively.

While the results of the survey show that smallholders in our sample are very willing to work both on food for work or food for cash projects in the hungry season, it is also clear that their expectations with respect to what they should earn are very high relative to the statutory minimum wage -- currently less than K1.50 in all areas including urban centres.

The Acceptability of Hybrid Maize

When respondents were asked if they planned to plant any hybrid maize for household use, 55,7 percent in BLADD said yes, compared to 50,1 percent in LADD and 52,9 percent in MZADD. Households generally would rather plant hybrid maize only for sale because of its poor processing, poor storage and high labour input characteristics. It was only in LADD that poor taste was given as a second most important reason for not planting hybrid maize for household use. The two main reasons given for growing hybrid maize for sale are high yields and profitability.

Crop Storage

The desire for self-sufficiency should be backed by a willingness and ability to store food at the household level. A majority of the respondents in all ADDs think that their storage is adequate although losses do occur.

POLICY IMPLICATIONS AND CONCLUSION

Food marketing liberalisation and the increase of private traders have been largely detrimental to the smallholder sector -- particularly households in remote areas. These areas have experienced closure of uneconomic ADMARC markets and private traders have been reluctant to penetrate such areas for the same reason. Mzuzu ADD, has the largest number of designated markets where private traders can operate yet it had the lowest number of licensed traders in the 1987-8 and 1988-9 marketing years.

Even where such traders operate, they typically purchase for sale in other areas. Some large traders in the Mzuzu ADD have devised transport cost-sharing schemes which reduce the returns to farmers in the most remote areas.

These results have a number of implications. ADMARC's retrenchment has led to a withdrawal of marketing outlets for selling crops and for buying food and inputs. Inputs are in higher demand in remote, relatively land-abundant areas with surplus production where ADMARC outlets are being closed. Thus, withdrawal has the potential of threatening national food security.

Second, remote households have access to fewer alternative sources of food. The government's drive towards greater export crop diversification is undermined in these areas by risk-aversion with respect to food supply. This encourages food crop specialisation. Thirdly, distress selling of food crops soon after harvest is more prevalent in the Mzuzu ADD than in the more land constrained Blantyre ADD. The main reason for selling was to obtain cash for paying off farm credit. Three factors are causing this result; high dependence on fertilizer, rising fertilizer costs, and transport cost sharing arrangements with private buyers which reduces net selling price.

Fourth, the orientation of private traders towards outside grain sales has led to greater reliance on locally available food sources. Apart from alternative food crops, the sources are typically other farmers who are able to buy or grow and store excess maize. They realise high margins by trading maize for *ganyu* labour when the labour supply is high (the hungry season) and maize is in short supply. By neglecting their own farms, short-term food deficit farmers can find themselves in chronic deficit situations. This problem will persist as long as local food supplies are not available on the open market.

These are all examples of marketing problems with implications for household food security as well as national food security and general economic development. This is especially true for a country whose economy is heavily dependent on agricultural production.

If private traders are now permanent actors in the agricultural marketing system, one possible approach would be to interest them in input trade. One possibility is to develop a system of differential input prices (between buying points and selling points) similar to the one devised to encourage them to act as buying agents for ADMARC. For subsidised inputs, the subsidies could be paid directly to the producer/wholesalers so that the traders could buy at appropriate prices for them and get a reasonable return.

The problem of food availability in remote areas can only be resolved through storage facilities located close to the target areas. One possibility would be to foster competition among those that currently provide storage for local supply by providing credit and technical assistance for storage technology. The aim would be to facilitate the storage of even the hybrid maize which is being increasingly accepted for household consumption. ADMARC already has little known facilities for providing services related to storage technology. The alternative would be for ADMARC to take the lead and develop a decentralised grain storage system. The present system is oriented towards regional depots with its associated high costs of moving grain from and back to the rural areas. Incentives need to be devised to encourage private traders to move the grain to specific areas when needed. The longer term solution will likely lie in encouraging locally-based businessmen to provide storage.

REFERENCES

National Statistical Office. 1987. *Malawi Population and Housing Census, 1987.* Government Printer. Zomba.

Kaluwa B.M. and B.F.Kandoole. 1989. The Impact of Market Reforms on Household Food Security in Rural Malawi. In: Mudimu G. and R. Bernsten eds. *Household and National Food Security in Southern Africa.* UZ/MSU Food Security Research Project. Department of Agricultural Economics and Extension. Harare.

Kandoole B.F., B.M. Kaluwa and S. Buccola. 1988. Market Liberalisation and Food Security in Malawi. In: Rukuni, M. and R.H. Bernsten eds. *Southern Africa: Food Security Policy Options.* UZ/MSU Food Security Research Project. Department of Agricultural Economics and Extension. Harare.

Mkwezalamba, M.M. 1989. *The Impact of the Liberalisation of Smallholder Agriculture Produce and Marketing in Malawi.* Ministry of Agriculture. Lilongwe.

Scarborough, V. 1990. *Domestic Food Marketing Liberalisation in Malawi : A Preliminary Assessment.* Department of Agricultural Economics. Wye College. University of London.

Mann, C., H. Mapondo and J. Mhango. 1988. *Food Security Policy, Including the Role of ADMARC in Price Stabilisation.* Presented at the Symposium on Agricultural Policies for Growth and Development. Mangochi, Malawi 31 October - November, 1988.

Sijm J. 1990. *Food Security and Policy Interventions in Malawi.* Tinbergen Institute/Centre for Development Planning. Erasmus University. Rotterdam.

World Bank. 1989. Malawi: Country Memorandum. *Growth Through Poverty Reduction.* Report No. 8140 - MA.

APPENDIX I

Number of private traders registered, by ADD and characteristics

Region/ ADD	Population[a] ADD (000)	Population[a] Urban (000)	Food Balance[b] (000mt)	Registered 1987/88 (No.)	Traders 1988/89 (No.)
Northern		44			
Karonga	261		-6	-	7
Mzuzu	709		-7	22	35
Central		234			
Kasungu	1 085		+142	10	27
Salima	369		+19	20	28
Lilongwe	1 880		+191	113	128
Southern		374			
Liwonde	1 550		-90	109	224
Blantyre	2 130		-259	99	417
Ngabu	558		-79	14	51
Total	7 983	653		387	917

Notes:
[a] Urban population refers to that of the four major urban centres as follows: Northern = Mzuzu; Central = Lilongwe; Southern = Blantyre and Zomba. There is a close relationship between the urban population and remoteness.
[b] This is in maize equivalents of the difference between production and consumption.
Source: Scarborough, 1990; National Statistical Office, 1987.

APPENDIX II
Destination of sales by traders : all crops

	BLADD (%)	LADD (%)
ADMARD	26,1	30,3
Town	16,9	23,7
Estate owner	3,1	6,6
Processor	27,7	7,9
Rural	24,6	27,6
Export	-	3,9
Other	1,6	-
	100,0	100,0

APPENDIX III
Scale of trader operations : crop purchases[a] 1989

90kg bags	BLADD	LADD
Up to 99	43,5	28,6
100 - 499	12,3	30,0
500 - 999	15,2	13,1
1000 +	19,8	15,7
Don't know	9,2	12,6
	100,0	100,0

[a] All crops

APPENDIX IV
Month of food depletion

	BLADD (%)	LADD (%)	MZADD (%)
Never depleted	23,4	23,8	28,7
December to March	49,7	51,8	38,6
April to November	26,9	24,3	32,7

APPENDIX V
Number of months food insufficient

	BLADD (%)	LADD (%)	MZADD (%)
1 to 3 months	49,9	52,0	48,9
4 to 6 months	34,3	33,9	33,1
7 to 9 months	9,5	11,7	12,1
10 to 12 months	6,1	2,4	5,9

APPENDIX VI
Source of food after depletion

	BLADD (%)	LADD (%)	MZADD (%)
ADMARC	63,1	26,7	34,0
Worked for food (Ganyu)	20,1	40,0	31,5
Used supplementary crop	0,9	20,6	18,5
Given by relatives	1,3	0,8	7,8
Bought from other household	2,4	6,7	5,0
Private traders	7,8	0,5	0,2
Local market	4,4	1,9	0,0
Food aid	0,0	2,7	3,1

APPENDIX VII
Source of additional resources during serious food shortages[a]

	BLADD (%)	LADD (%)	MZADD (%)
Ganyu labour	73,2	76,7	78,3
Gifts from relatives	17,7	7,8	30,7
Loans from relatives	15,5	10,2	18,7
Loan from trader	12,4	9,5	10,1

[a] Totals to more than 100 percent as some households accessed more than one source.

Traders' Perceptions Of Constraints On Informal Grain Marketing In Zimbabwe: Implications For Household Food Security And Needed Research

M. Chisvo, T.S. Jayne, J. Tefft, M. Weber and J. Shaffer[1]

INTRODUCTION

Observers of Zimbabwean agriculture often express astonishment at the absence of informal grain markets in the rural areas.[2] Hypotheses abound as to the reasons for this: colonial suppression of local entrepreneurship over many decades, poor rural infrastructure, perceived low effective demand in rural areas and lack of profitability given the pricing and marketing structure of the formal sector.

This paper reports the results of a survey of 124 grain and grain meal traders operating in Zimbabwe's communal areas. The study examines:

- the structure, behavior and performance of the informal grain trade;
- factors constraining investment and entry into grain transport, storage, and processing;
- the potential of improved informal markets to enhance household food security in the rural areas; and

---

[1]Research Scholar, Department of Agricultural Economics and Extension, University of Zimbabwe; Visiting Lecturer, University of Zimbabwe and Assistant Professor, Michigan State University; Research Scholar, Department of Agricultural Economics, Michigan State University; and Professors, Department of Agricultural Economics, Michigan State University, respectively.

[2]We use the term "informal markets" in the typical sense of public rural gathering places where unlicensed buyers and sellers interact. Formal marketing agents, by contrast, are those licensed by the Grain Marketing Board to buy or sell grain or grain meal under stipulated conditions.

- government strategies to promote the development and performance of informal grain trade.

This report is based on preliminary results from surveys of 648 households, 124 grain and/or grain meal traders, 52 informal millers, five Grain Marketing Board (GMB) depot managers and two GMB inspectors operating in seven communal areas situated in Natural Region III, IV and V.[3] The period studied was between the harvest of April 1989, which was relatively poor in terms of rainfall, and April 1990.

THE SCOPE FOR IMPROVED INFORMAL GRAIN TRADE TO ENHANCE HOUSEHOLD FOOD SECURITY

Zimbabwe has ample food. Marketed grain output from the smallholder sector[4] trebled over the past decade. Since 1986, between 700 000 and 1,8 million tonnes of maize have been stored at numerous GMB depots throughout the country.

Yet household food insecurity and malnutrition remain widespread.[5] Thirty percent of Zimbabwean children under five years of age suffer from chronically inadequate food intake (CSO, 1989). The country's major newspaper frequently reports that thousands of poor people in the semi-arid areas face chronic food shortages.

Inadequate farm production and inadequate purchasing power among the rural poor are largely responsible for the persistence of food insecurity amidst food abundance. In the long run, enhanced food security will require increased on-farm productivity and income growth among the poor. However, given the dearth of proven, on-shelf technology suitable to low-rainfall environments and the current state of rural employment opportunities, substantial growth in rural productivity and incomes are, at best, considered long-term possibilities.

Increased purchasing power, among the rural poor in the short and medium run, may be facilitated by reducing the price of goods that form large shares of their expenditure bundles. In a recent survey in Buhera Communal Area, grain and grain meal purchases accounted for up to 40 percent of the total expenditure of households in the lowest income quartile. This was during a good rainfall year

---

[3]Zimbabwe is disaggregated into five agro-ecological natural regions (NRs) ranked I, II, III, IV, and V. NRs I, II, and III receive the highest rainfall and are suitable for intensive crop production. NRs IV and V receive under 650 mm of average annual rainfall and are prone to frequent drought. Sixty percent of Zimbabwe's communal population lives in NRs IV and V.

[4]This sector accounts for 60 percent of the country's population.

[5]Malnutrition has many causes but amongst the most important, particularly in the low potential areas, is inadequate food access. Other causes are related to disease, poor sanitation, dietary composition and weaning practices.

(Chigume, forthcoming). The importance of staple food purchase in total expenditures among the poor has been well established elsewhere (Mellor, 1978).

Estimates from past research have indicated that a reduction in consumer grain prices in rural areas through the development of intra-rural trade may increase real cash incomes among poor grain-deficit households by as much as 20 to 30 percent (Jayne *et al.*, 1990). These gains, however, are based on a scenario of well-functioning informal grain markets that supply grain to deficit areas throughout the year. These markets currently do not exist.

THE STRUCTURE OF INFORMAL GRAIN TRADE

More than 50 percent of farm households in NRs IV and V typically are net purchasers of grain, Table 1. The exact proportion of grain-deficit farm households depends on the particular geographical area and the quality of the harvest. The volume of grain purchased is largely a function of the time between harvests that households have exhausted grain stocks from own production and storage. Among households surveyed in two communal areas in NRs IV and V, 25 percent depleted their own stocks by September (six months before the availability of maize from the next harvest) -- 50 percent ran out of stocks by December, Figure 1. This stockout pattern corresponds closely with the seasonal pattern of commercial maize meal purchases among these households.

Sources of Grain to Buy in Communal Areas

Consumers in rural areas may purchase grain or grain meal from one of four sources:

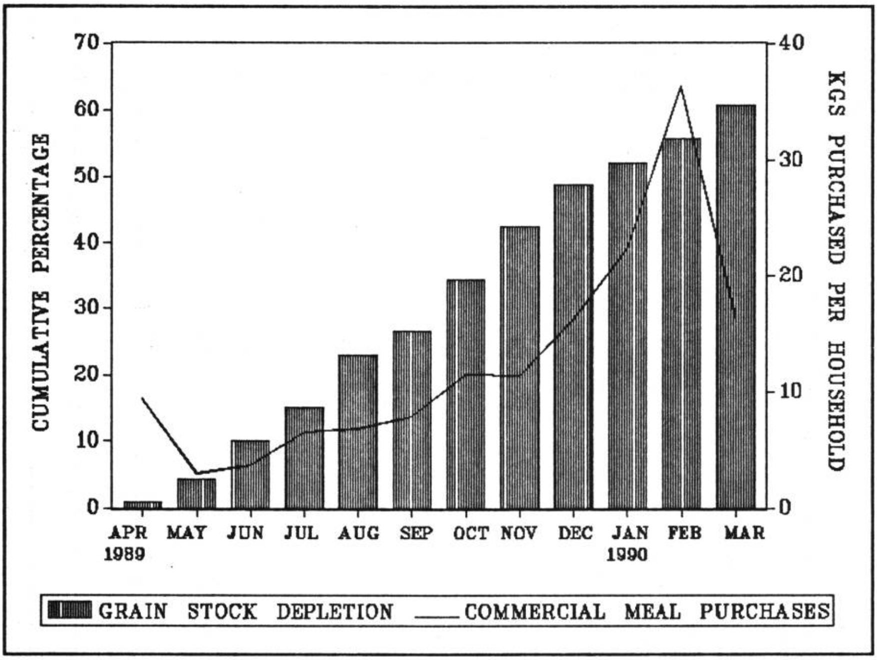
- neighboring households having grain to sell;
- the nearest GMB depot;
- informal traders; or,
- local shops licensed to sell urban-manufactured commercial maize meal.

The relative volumes flowing through these channels is presented in Table 2. Purchases of grain from informal traders were quite low except in northern Gokwe and Runde, two deficit areas contiguous to nearby surplus areas. No household surveyed in several grain-deficit wards was able to identify an informal buyer operating in the area, Table 3. In the surplus areas (southern Gokwe and northern Buhera), consumers purchased most of their grain from neighboring households. The bulk of households' residual grain needs, in the remaining deficit areas, was met with purchases of commercial maize meal from licensed shops. On the national level, over 100 000 tonnes of commercial maize meal is consumed in the rural areas of Zimbabwe each year (Jayne *et al.*, 1990). This figure may be as high as 275 000 tonnes during a drought year.

Table 1
Grain marketing profile of households in selected semi-arid communal areas.

COMMUNAL AREA	NATURAL REGION	QUALITY OF RAINFALL DURING SURVEY PERIOD	AVERAGE NET HOUSEHOLD GRAIN SALES (KGS)	% OF TOTAL GRAIN SALES FROM THE TOP 10% OF GRAIN SELLING HOUSEHOLDS	% OF HOUSEHOLDS THAT ARE NET GRAIN PURCHASERS
Gokwe (south)[a]	III	average	2 592	51	12
Gokwe (north)[a]	IV	average	159	59	59
Buhera (north)[a]	III	average	496	50	26
Buhera (south)[a]	IV, V	average	87	72	57
Runde[a]	III, IV	average	3	74	61
Mberengwa[a]	IV, V	average	-248	60	85
Nata[b]	IV	below average	-275	57	94
Ramakwebana[b]	V	below average	-353	68	96
Semukwe[b]	V	below average	-344	62	98

Source: [a] UZ/MSU/ICRISAT Grain Marketing Surveys, 1990;
[b] Hedden-Dunkhorst, Bettina, *The role of small grains in semi-arid smallholder farming systems in Zimbabwe: preliminary findings*, draft mimeo, SADCC/ICRISAT, Matopos.



Note:
Harvest in Runde (Natural Regions III and IV) and Mberengwa (NRs IV and V) normally occurs in April or May. However, households may begin eating "green maize" from the new harvest as early as February or March.
Source: UZ/MSU/ICRISAT Grain Marketing Surveys, 1990.

Fig. 1: Seasonal pattern of commercial maize meal purchases and the cumulative proportion of households depleting grain stocks: Mberengwa and Runde communal areas, 1989-90 Marketing Year

Table 2
Importance of alternative grain marketing channels used by households in selected semi-arid communal areas.

COMMUNAL AREA	NATURAL REGION	% OF TOTAL HOUSEHOLD GRAIN SALES TO:			% OF TOTAL HOUSEHOLD GRAIN AND MEAL PURCHASES FROM:			
		GMB OR APPROVED BUYERS	NEIGHBOURING HOUSEHOLDS	INFORMAL TRADERS	GMB	NEIGHBOURING HOUSEHOLDS	INFORMAL TRADERS	SHOPKEEPERS
					---- GRAIN ----			- commercial meal -
Gokwe (south)[a]	III	86	8	6	7	80	13	0
Gokwe (north)[a]	IV	5	95	0	10	44	36	10
Buhera (north)[a]	III	69	16	15	16	70	1	13
Buhera (south)[a]	IV, V	68	31	1	0	36	11	53
Runde[a]	III, IV	30	70	0	0	23	37	40
Mberengwa[a]	IV, V	43	57	0	26	15	17	42
Nata[b]	IV	0	100	0	0	7*		92
Ramakwebana[b]	V	0	100	0	0	13*		87
Semukwe[b]	V	0	100	0	0	21*		79

Note: *The distinction between purchases from households and informal traders was not made in this study.

Source: [a]UZ/MSU/ICRISAT Grain Marketing Surveys, 1990.

[b]Hedden-Dunkhorst, Bettina, "The role of small grains in semi arid smallholder farming systems in Zimbabwe: preliminary findings", draft mimeo, SADCC/ICRISAT, Matopos.

Table 3
Number of grain buyers and sellers in operation during some portion of 1989-90 marketing year.

COMMUNAL AREA	WARD	----- GRAIN BUYERS (numbers) -----				---- GRAIN SELLERS (number) ----			
		Approved Buyer	Shopkeeper	Household That Trades	TOTAL	Approved Buyer	Shopkeeper	Household That Trades	TOTAL
Runde	1	-	3	9	12	1	1	-	2
	2	-	-	-	0	-	-	2	2
	3	-	-	-	0	-	3	7	10
	4	-	1	3	4	-	9	25	34
Mberengwa	1	1	4	1	6	1	-	3	4
	2	1	5	-	6	-	2	6	8
	3	-	-	-	0	-	3	2	5
	4	-	-	-	0	-	3	2	5
	5	-	-	-	0	1	3	6	10
Shurugwe	1	-	1	2	3	-	-	2	2
	2	1	1	2	4	-	-	8	8
	3	-	-	4	4	-	-	9	9
Buhera (north)	1	15	6	-	21	3	2	4	9
	2	2	3	-	5	1	-	-	1
	3	1	2	-	3	-	-	-	0
Buhera (south)	1	1	3	-	4	-	3	-	0
	2	-	-	-	0	-	3	6	10
Gokwe (north)	1	4	4	1	9	2	3	3	8
	2	-	4	2	6	1	3	3	6
Gokwe (south)	1	2	7	2	11	-	2	5	7
	2	3	7	4	14	-	3	8	11
Kana	1	13	11	-	24	-	1	-	1

Source: UZ/MSU/SADCC/ICRISAT Grain Marketing Surveys (1990); Central Statistics Office (1989).

GMB depots, in theory, could play an important role in selling maize grain to rural consumers. Yet the volume of grain purchased from the GMB by rural consumers largely depends on the proximity of a particular grain deficit area to the nearest depot. GMB grain sales in Mberengwa were substantial during 1990 because a depot is located in the middle of this drought-affected area. However, direct purchases from the GMB dropped markedly in areas of Mberengwa more than 40 kilometres from the depot. Most households relied on ox-drawn carts for transport. No household surveyed in any communal area located more than 60 kilometres from the nearest depot bought any grain from the GMB. This indicates that the availability of large grain stocks at GMB depots in town centres throughout the country does not necessarily assure access for consumers in distant rural areas.

Consumer Grain Prices

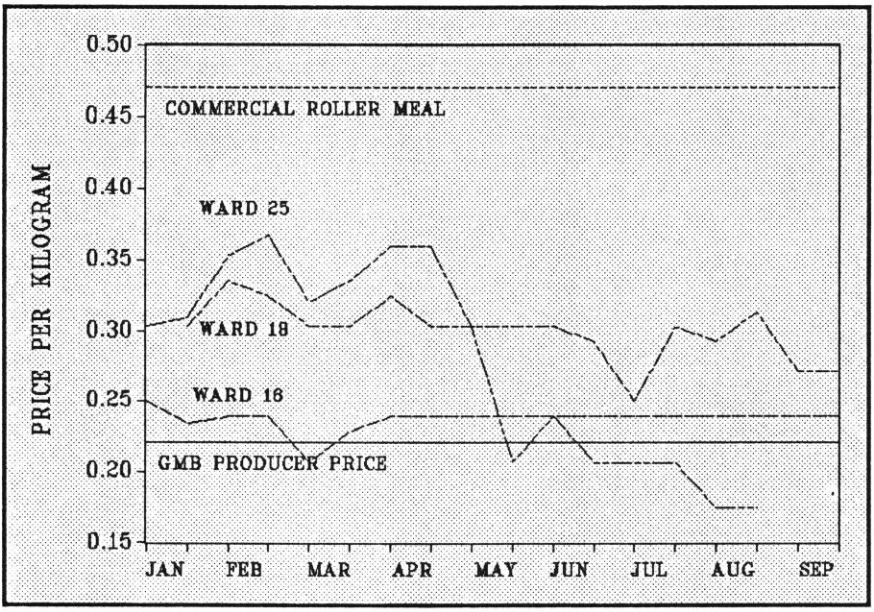
Actual prices paid for maize and maize meal reflects the effective supply and demand situation prevailing in rural areas. Price monitoring surveys conducted bi-weekly in eight communal areas during 1990 showed a wide price difference between commercial maize meal and maize meal obtained through the informal system, Figures 2a and 2b. Even during the pre-harvest months of 1990, the controlled price of commercial maize meal was from 10 to 80 percent higher per kilogram than the price for maize obtained and milled through informal channels.[6] Yet the relative volume through informal channels is often smaller, especially in the severely grain deficit areas.

Ironically, most rural people prefer the attributes of locally-processed meal to those of the more refined commercial meal. In a survey of 648 households in eight communal areas, 71 percent said they would prefer a bag of locally-milled meal over an equal-sized bag of any type of commercial meal. Based on taste alone, 88 percent said they preferred sadza (the staple dish) made with locally-milled meal.

In spite of being higher priced and less desirable, commercial meal constitutes a large percentage of residual staple requirements in semi-arid areas. This is because grain is often not available for sale in these areas later in the season. Seventy-four percent of the respondents from households randomly interviewed in four semi-arid communal areas stated that they bought commercial meal simply because they could not find grain to buy locally.

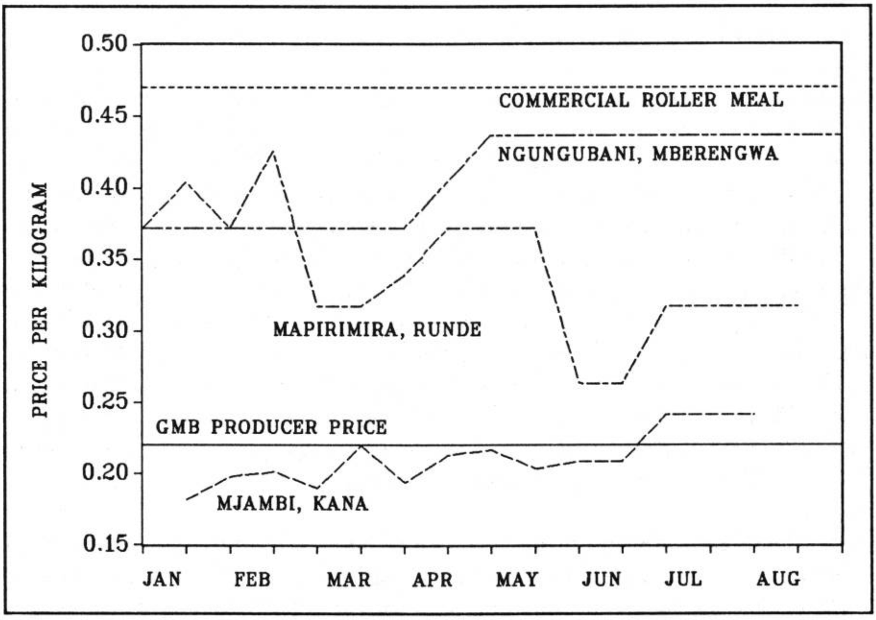
---

[6]A number of shops were observed selling commercial meal above the control price, especially in more remote areas.



Note: Maize meal costs were derived by adding average observed local milling charges and accounting for observed extraction rates of 97 percent.
Source: UZ/MSU/SADCC/ICRISAT Grain Marketing Surveys, 1990.

Fig. 2a: Observed Informal Maize Meal Costs (maize prices plus milling costs) in three wards in Buhera District: January - September 1990.



Note: Maize meal costs were derived by adding average observed local milling charges and accounting for observed extraction rates averaging 97 percent.
Source: UZ/MSU/SADCC/ICRISAT Grain Marketing Surveys, 1990.

Fig. 2b: Observed informal maize meal costs (maize prices plus milling costs) in three wards in Mberengwa, Runde, and Kana Communal areas: January - August 1990.

Only 43 percent of the grain traders surveyed stored grain for more than one month; only seven percent stored for more than three months. All of the grain bought by informal traders was resold before October 1989 -- more than six months before the next harvest. This suggests that, apart from storage by farm households, the important function of reallocating grain across time through storage is performed almost entirely by the formal marketing system.[7]

There appears to be substantial micro-variation in productive potential between various locations within a given communal area, especially the larger ones. Marketable grain surplus is often produced in relatively high-potential locations within communal areas that are grain-deficit in the aggregate. In the case of northern Gokwe, Buhera, and Runde, the grain surpluses generated were sufficient to satisfy the residual grain and maize meal demanded by the remaining households in the communal area. Yet very little of this grain was sold to informal traders -- the GMB and neighbouring households apparently provided more profitable or convenient market outlets, Table 2. Smallholders in the survey who sold grain to the GMB or neighbouring households were asked why they did not sell to informal traders. Their responses were: no informal buyers were operating nearby at time of sale (48 percent), other buyers gave higher prices (42 percent), and informal traders could not provided grain sacks (10 percent).

The failure of informal grain markets to provide viable outlets for surplus grain production causes supplies to be effectively siphoned out of semi-arid rural areas through the formal marketing channels and forwarded to urban mills. This creates localised shortages later in the season as deficit households deplete their own grain stocks. As a result, large volumes of relatively expensive commercial meal flow into these areas to satisfy consumer demand that could have been supplied by the grain siphoned out through the formal channels (Jayne *et al.*, 1990).

Why isn't grain being adequately redistributed through informal trade, either spatially from surplus areas to deficit locations (in the same or another communal area), or temporally from post-harvest periods of abundance to pre-harvest periods of scarcity?

CONSTRAINTS TO INVESTMENT AND ENTRY IN INFORMAL GRAIN TRADING

Traders were asked about various types of trading activities to identify constraints to investment in grain trading. Rural businessmen who were not involved in grain trading were also interviewed to identify factors limiting entry into grain marketing activities.

---

[7]While prices in the communal areas are unregulated and may fluctuate seasonally according to supply and demand conditions, the degree of seasonal price variation may be circumscribed by the pan-seasonal selling prices of grain at GMB depots and of maize meal distributed by the urban millers.

Some analysts have suggested that the underdevelopment of informal grain markets may be due to a general lack of profit (Amin, 1990). This is not supported by the responses of rural traders and shopowners. Grain trading, milling, and transport were identified as the second, third, and fourth most profitable activities in which to invest in Zimbabwe's rural areas (opening a restaurant/bottle store was first).

However, only 32 percent of the respondents identifying grain marketing activities actually intend to undertake them. The major barriers to investment and entry can be grouped into three broad categories: limited resources available for engaging in grain trading, ambiguity of state regulations governing informal grain trade, and restrictive government policy concerning the movement and resale of grain.

Limited Resources

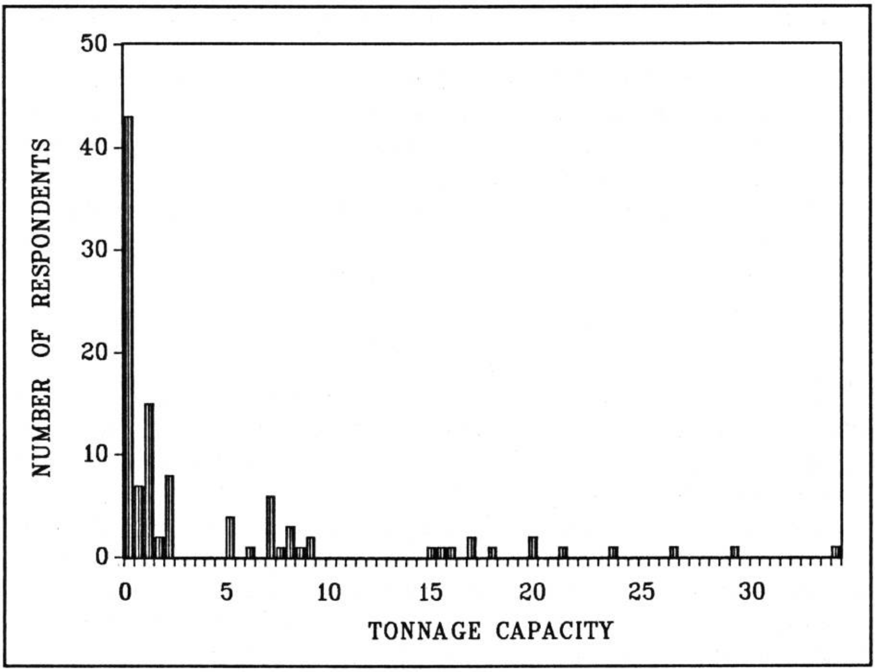
Working Capital

The viability of grain trading depends on exploiting economies of scale in transactions. Buying enough maize from the GMB to fill a 5-tonne truck requires almost twice the annual income of the average Zimbabwean. Not surprisingly, the inability to secure loans through either the formal or informal sector, represents a major barrier to grain trading. Those actually involved in grain trading, with few exceptions, reported that their only source of working capital was their own savings. This creates a barrier to entry by restricting potential entrants from capturing scale economies thus depresses their net returns. Those who can capture scale economies using their own cash are relatively wealthy traders.

Limited Transport Capacity

Only 60 percent of the rural traders surveyed owned a vehicle, Figure 3. Of the owners, less than 50 percent owned a vehicle with the capacity to carry more than 20 bags of grain. Shortage of credit also limits investment in the grain trade. The availability of vehicles to purchase is severely restricted in Zimbabwe due to foreign exchange constraints, a 60 percent import tax on foreign-purchased vehicles and limited domestic production. The general manager of a major truck dealer in Harare revealed that the dealership was allocated only 30 vehicles from domestic production to cover over 3 500 orders for trucks. Only 1 000 heavy trucks are produced domestically each year and these are largely rationed through non-market means. The manager estimated that over 50 000 trucks would be needed to alleviate the critical transport bottlenecks currently plaguing Zimbabwe's economy.

Poor rural roads also limit access to hired transport in the remote areas, particularly during rainy periods. Access during the period just before harvest is critical since many households will have depleted their grain stocks.



Source: UZ/MSU/SADCC/ICRISAT Grain Marketing Surveys

Fig. 3: Distrubution of transport capacity among 106 traders surveyed in seven Communal Areas

It is rational for traders to seek trade in commodities that maximize returns to their limited capital and transport capacity. Top priority has been identified as low-bulk, high-value commodities such as liquor and soft drinks. In an environment of constrained transport supply, shopowners have also found commercial maize meal to be a convenient substitute for grain since: (1) most wholesalers and commercial millers deliver their products to retailers' shops even in rural areas, (2) the demand for commercial meal is guaranteed by the absence of grain locally, and (3) commercial meal is more valuable per unit and easier to handle than maize[8].

Seventy-three percent of the respondents possessing trucks engage in grain trading. Yet it was often a passive form of trading where grain would be bought by the trader only if customers delivered it to his shop. Very little active procurement of grain was detected.

Limited Specialisation in Marketing Functions

The unspecialised nature of the informal grain trade necessitated that buyers in surplus areas find their own means of disposing of the grain, typically to consumers or the GMB. There were no reported cases of resale between traders. Thus the system is less specialised than the informal marketing system commonly found in developing countries in which first handlers, wholesalers, and retailers have developed their own niche in the marketing channel. Lack of specialisation inflates the information and management requirements as well as the transactions costs associated with trading grain. Many respondents stated that an expansion of grain trading would require investing in a new a shop in a deficit area or using a relative's home as a place to sell grain procured in surplus areas. There are no open markets for selling grain to wholesalers or retailers who may have more knowledge of supply and demand characteristics in other locations.

This process of expanding the number of shops to accommodate grain trading exacerbates the working capital constraint. It also increases management capacity problems since only members of the family are trusted to hold responsible positions. Several shopowners stated that a trustworthy employee/salesman or relative with a good knowledge of local market conditions would be needed and that such sales persons are scarce. Lack of trust in employees requires strict supervision and record keeping, increasing transaction costs. Advertising certain trading days would enable the traders themselves to trade, shorten the amount of time it would take to buy and sell grain, and lower the risk and cost associated with employing a salesman. Advertising grain to sell and buy is currently suppressed as informal traders often perceive their activities to be illegal.

---

[8]In most cases grain will be sold in fractions of a bag (*eg*., buckets) whereas traders always sell commercial meal in original packs.

Confusion over Regulations Governing Grain Trading

Informal marketing of grain is circumscribed by the Grain Marketing Act which divides the whole country into two areas, "A" and "B". Area "A" consists mainly of the large-scale-farming areas, most small-scale commercial farming areas, and urban centres. Area "B" is predominantly the communal lands and game reserves. The Act (CAP 113, 1966) states that:

1. Area "A" is controlled; and Area "B" is uncontrolled;

2. The GMB '...won't be concerned with what goes on in Area "B", and main attention will focus on Area "A"';

3. Anyone will be permitted to acquire and sell or resell the controlled...'maize[9] in Area "B"...without reference to the Board, provided that the controlled product does not leave Area "B"; if it does leave Area "B", its destination must be the GMB, and the only people who can deliver it to the Board are approved and registered by the Board. These people include producers, co-operatives and approved buyers in possession of a GMB card.'

Approved buyers, as opposed to non-approved buyers, have a contract with the GMB. An approved buyer can sell grain that he has purchased from farmers only to the GMB. However, approved buyers can sell grain that they buy from the GMB to anyone. Failure to comply with this, and other conditions contained in the contract, may result in cancellation of the contract.

These rules, clearly stated in GMB publications, are nevertheless subject to a wide variety of interpretations both within the GMB and in rural areas. Four of five GMB depot managers interviewed perceived it to be illegal for anyone to purchase grain from the depot in excess of his consumption needs, particularly if the grain was to be resold. Hence, a private trader who wanted to buy truckloads of grain for resale to deficit households in his area, would be questioned. And if that trader should indicate that he was buying in order to resell, he would be denied the opportunity to buy from the GMB. The GMB managers interviewed hinted that private traders were likely to set exploitative retail grain prices in remote deficit

[9] In fact, all controlled products can be traded freely in area "B".

areas[10]. Only a few of the informal traders surveyed bought grain from GMB depots. In fact, this survey found that those traders who bought from the GMB either did so in unsuspicious small quantities, hence failing to achieve economies of scale, or pretended to be transporters who were buying and transporting on behalf of those grain deficit households who had no transport.

The majority of informal traders lack sufficient information on the rules governing grain trade. They perceive grain trading to be illegal, regardless of whether the product is controlled or not, in the area in which they trade. The reluctance of many traders to initially admit to enumerators that they traded grain, despite being identified by surveyed households as the ones with which they traded, illustrates this. In fact, about ten percent of the original sample of informal traders refused to be interviewed. The difficulty faced by enumerators to gain the trust of informal traders portrayed the risk the latter attached to their grain trading activities.

Informal traders were asked if trade in red sorghum, mhunga and rapoko was legal outside communal areas. (The government decontrolled these crops in 1989 making it legal for informal traders to sell to commercial buyers in urban areas). Only 27 percent were aware of the change in the rules. Thirty-one percent were confident that it was illegal to trade these three crops, while 43 percent were not sure.

Approved buyers, through their day-to-day interaction with GMB, have greater access to information sources. They, therefore, would be expected to have updated knowledge of the rules governing grain trading. However, only 33 percent of those interviewed were aware of the changes in the regulations. Fifty percent still perceived it to be illegal to trade mhunga, red sorghum, and rapoko outside of their area and 16 percent were not sure.

Four informal traders reported that approved buyers threatened to report them to the police for trading grain informally -- even within their own communal area -- which is legal. While the ambiguity of trading regulations has not precluded the development of informal trade, trade would be expected to expand if the rules were clear and government actually took steps to actively support such intra-rural trading activity.

---

[10]This seems ironic given that the GMB itself can resell grains, the same day that it buys it, at a price 20-30% higher than its purchase price. Moreover, the informal grain price data collected in eight communal areas rarely contains evidence of exploitative informal grain trading. First, the GMB depots are usually too far from retail areas. Second, informal retail prices are not set by traders themselves but are largely a function of i) the effective demand for grain in consumption areas and ii) the price and reliability of supply of commercially-milled meal in relation to that of grain. Finally, it would likely be better to supply expensive food in deficit areas rather than let households go without food.

Marketing Policy Restrictions

Apart from perceived, albeit erroneous, restrictions, rural grain traders are constrained by two important government restrictions:

1. Maize is prohibited from crossing Zone A areas (commercial farming and urban areas) into Zone B (communal areas). Furthermore, grain may not legally pass from surplus communal areas into deficit communal areas if this requires passing through a Zone A area; and,

2. Grain delivered to rural collection points or Approved Buyers cannot be resold directly to consumers. Instead, the grain must be forwarded to the nearest GMB depot, usually located in town centres. These resale restrictions prevent deficit households from buying from local sources while the grain is still in the rural areas.

While some illicit trade has been detected in the surveys, it is of lower volume and higher cost than if the government were to remove their restrictions. Both of these rules tend to exacerbate the problem of grain shortages in semi-arid areas later in the season. The rules also contribute to the importance of commercial maize meal in rural areas despite its higher cost and lower preference.

POLICIES TO BE IMPLEMENTED AND RESEARCH ON GRAIN MARKETING AND FOOD SECURITY

The foregoing problems encountered by informal grain traders suggest a number of policy and regulatory changes that should be implemented and some that require further research. Those that should be immediately implemented include:

- Publish and widely disseminate information pertaining to regulations governing the grain trade in Zimbabwe;

- Publish and widely distribute information that the GMB sells grain at depots; and,

- Make the maximum amount of grain that a trader can buy from the GMB explicit.

Changes that appear reasonable but require further analysis include:

- Abolish restrictions on the movement of grain produced in Zone B areas. The GMB would still procure grain from Zone A and surplus areas of Zone B to meet urban demand and maintain strategic buffer stocks. The GMB would also maintain its role as a residual buyer in all areas, effectively offering a floor price to guard against adverse price fluctuations.

- Expand the function of rural collection points to include the sale of grain to rural consumers. Any costs to the GMB associated with grading and selling could be reduced by conducting such sales only once or twice a week. Any costs incurred would be less than the cost of transporting the grain to main depots, handling and storing the grain and transporting expensive commercial meal or food aid back into deficit areas. The retention of grain in rural areas would reduce the costs of drought relief food aid borne by the Ministry of Labour, Manpower Planning and Social Welfare.

  Removal of resale restrictions would also expand the scope for intra-rural trade considerably by reducing the search costs of grain procurement by informal traders.

- Allow approved buyers to become "approved sellers". Under such an arrangement, the GMB would set selling prices at which the approved buyer/seller could sell grain to local consumers. This price would have to be high enough to provide incentives to the trader and would have to allow for the trader's cumulative storage costs. Over the long run, the need for controlling the selling price may become obsolete if a sufficient number of such "approved sellers" operate in an area to ensure competition.

- Develop government or private sector financial support for entry and investment in rural grain trading. The Zimbabwe Development Bank, SEDCO, or private banks could play a role by targeting credit for specific private investments such as vehicles, hammer mills, spare parts, storage, and marketplace facilities in rural areas. This could be complemented by investment in rural roads and elimination of import restrictions on vehicles and spare parts. Promotion of new entry into grain trading is necessary to ensure that sufficient numbers of traders are in operation to promote competition.

REFERENCES

Amin, Nick. 1990. Peasant Differentiation And Its Implications For Land Redistribution In Zimbabwe, revised version of paper presented at the conference on Land policy in Zimbabwe after "Lancaster". 13-15 February, Harare, Zimbabwe.

Central Statistics Office. 1989. *Zimbabwe Demographic and Health Survey 1988.* Central Statistics Office. Ministry of Finance, Economic Planning and Development. Harare. Zimbabwe.

Chigume, S. forthcoming. *Grain Marketing Behavior and Household Food Security in Low Potential Areas of Zimbabwe.* M.Phil Thesis. Department of Agricultural Economics and Extension. University of Zimbabwe.

GMB. 1966. The Grain Marketing Act (CAP 113). 1966'. In: *Grain Marketing Board circulars.*

Jayne, T.S., Munhamo Chisvo, B.Hedden-Dunkhorst and Solomon Chigume. 1990. 'Unravelling Zimbabwe's Food Insecurity Paradox: Implications For Grain Marketing Reform. In: *Integrating Food, Nutrition and Agricultural Policy in Zimbabwe. Proceedings of the First National Consultative Workshop.* Montclair Hotel, Juliasdale. Zimbabwe. July 16-17.

Mellor, J.W. 1978. Food Price Policy and Income Distribution in Low-Income Countries. In: *Economic Development and Cultural Change.* Vol. 27 (1) :1-26.

IV

Enhancing Household Food Security: Issues And Prospects

12

Farm Management Characteristics Of Communal Farms In Zimbabwe: Implications For Household Food Security

G. Sithole and E.A. Attwood[1]

INTRODUCTION

Nearly three of every five persons in Zimbabwe live and derive their livelihood on farms in the communal farming areas. In other words, 50 percent more people live in communal farming areas in Zimbabwe than in all the rest of the country. The incomes earned by these people, the source of their incomes and the opportunities for improvement are the very heart of national economic and social debates.

The total value of production from the Communal Farming Lands increased from just under \$146 million in 1980 to \$719 520 million in 1988. A major part of this was due to price changes but the significant growth was in the value of sales rather than in production for own consumption. The latter figure increased by 215 percent while the value of sales rose by 1100 percent from \$28 692 million in 1980 to \$344 413 million in 1988. This, in the cash economy, serves as the engine of development for the communal sector.

Our knowldge of the economic situation of communal farmers has been inadequate. The Farm Management Section of the Ministry of Lands, Agriculture and Rural Resettlement, therefore, initiated a detailed study of the current economic and financial position of these farmers and their resident families. This report is not exhaustive -- it is an initial assessment rather than a comprehensive statement.

The collection and analysis of physical and financial data on communal farming presents special difficulties. More experience will make it possible to refine the data collection techniques and improve the coverage. However, the report that recently has been published gives a valuable picture of the social and economic circumstances

---

[1]Chief Economist and Technical Advisor, respectively, Economics and Markets Branch, Ministry of Lands, Agriculture and Rural Resettlement.

of the communal farm family. It also provides a measure of the wide range of production results from different farming activities across the country.

The primary purpose of the survey was to provide the necessary economic and social information required for policy decisions by the Ministry of Lands, Agriculture and Rural Resettlement on the most effective means of improving living standards of people living and working in communal farming areas. Additional analysis of the data collected will further this objective.

RESOURCES AND SOCIAL CONDITIONS

The average communal farm sampled consisted of three hectares of arable land approximately 1km from the household. Arable land varied between 1,5 hectares in the Mutoko area to 4,5 hectares in Zvishavane. Less than half the households have their own garden for producing vegetables. Garden sizes vary widely from one area to another. In general the farmers have adopted beneficial farming practices; 80 percent practice a crop rotation and buy their crop inputs in advance, 70 percent practice winter ploughing and 60 percent apply manure. The average household owns seven cattle and seven goats. One in five hired draft animals although 36 percent owned a scotch-cart for use in their farming programme.

The average farm household surveyed had ten members but two were not regularly resident. In two survey areas, (Nyajena and Zvishavane), the average household was comprised of 12 people of whom two were non resident. Two thirds of the households had at least one non resident member. One third of the household had at least on non resident sending remittances. The average remittance was $20 per household per month.

The head of the household was a male in 85 percent of cases. Nearly 24 percent of male household heads were non-resident. Thus, the role of women was much greater than might appear to be the case. Half the members of the average household are children under 16; the proportion of elderly people over 60 is very small -- less than three percent. Most of the households are situated a considerable way from basic rural needs, *i.e.*, on average, 1km from water, nearly 3km from a local shop or a grinding mill, over 5km from a health clinic and 20km from a tarred road. Forty-six percent of the main water sources go dry in winter for three to four months. Only 37 percent of the households use pit toilets.

ECONOMIC RETURNS PER HOUSEHOLD

The average gross farm income was $1 288. This varied from less than $600 per household in Chirumanzu and Mutoko to over $2 000 in Chirau and Kandeya. The average within areas varies widely from household to household. Allowing for variable costs, averaging just under $500 per farm, and overhead costs, averaging about $60 per farm, the average net income from farming was $735. In addition, net non-farm income averaged $375. Thus, total net household income was $1 110.

However livestock appreciation accounted for $212 leaving net annual disposable income (in cash and in kind) of $900 per household.

These sample averages vary widely from one area to another. In Kandeya and Chirau, net total household incomes averaged over $2 000 *per annum* with livestock appreciation accounting for only a small proportion. In Buhera, and particularly in Chirumanzu, average household incomes were much lower. Allowing for livestock appreciation, the disposable incomes were very low in both of these areas. In these latter areas, the resident household size averaged just over six people.

There are two fundamental factors affecting the incomes of communal farm households. The most important is the basic soil and climatic characteristics of the area being farmed. Chirau and Kandeya are in Natural Region II (though part of Kandeya stretches into Natural Region III), while Mutoko and Chirumanzu are in Natural region IV (with part of Chirumanzu in Natural Region III). The effect of the physical environment is not, however, a complete explanation of the differences in economic results; Zvishavane which is in Natural Region V has better economic results than Buhera, Chirumanzu, Mutoko or Nyajena which are all situated in Natural Regions IV and III.

The second major factor affecting net household incomes of communal farms is the level of non-farm incomes received. Non farm incomes come from a wide range of sources. For the sample as a whole, they account for over one third of total net household income and over 40 percent of net household disposable income. In areas of low net farm incomes, access to outside income sources tend to be limited. Thus, the problems of low farm incomes are more serious in areas such as Chirumanzu and Buhera. On the other hand, Kandeya, which has the highest gross farm income, also has the highest off farm income resulting in average total household incomes more than double the sample as a whole.

The farm area per household is also important. The crop area per farm tends to be small in all areas, but there are wide variations among the different areas. For the whole sample, the average cropped was 3,28 hectares. In Mutoko and Chirumanzu, it was only two hectares. In Kandeya and Nyajena it was just over four hectares. Zvishavane averaged close to five hectares. The effect of physical production characteristics and other factors had a major effect on the output produced on these hectares. In Chirau, the net crop income per hectare was $480 and Kandeya it was $312. On the other hand, in Zvishavane it was under $15 and in Buhera, $44.

EFFECTS ON LABOUR USE

There is no significant relationship between the hours of labour spent on crop operations and the resultant net crop incomes. The farm families in Chirau spent the least time on crop operations (542 hours) and had the highest net crop income per hectare; the four areas with the lowest crop incomes occupied the second, third, fourth and fifth positions in the ranking of areas by time devoted to crop production.

This meant the net incomes earned per hour from crop production varied by an extraordinarily wide margin. The returns per hour of labour spent on crop production in Chirau was over 40 times that in Zvishavane. Even though it may be necessary to interpret the Chirau results with caution, there are still wide differences.

The average net income to own labour was 31 cents per hour for the whole sample. In Chiweshe the returns were 67 cents per hour and in Buhera only nine cents. These average returns cover even wider differences among individual households.

THE ROLE OF LIVESTOCK PRODUCTION

Comparable levels of variability from one area to another also arise with the livestock enterprises. The average number of livestock units per farm for the whole sample is just over seven, varying from 5,4 in Mutoko to over 9,7 in Kandeya. The income per livestock unit varies from $3,2 in Chiweshe to almost $91 in Zvishavane. Livestock are an important asset for the majority of communal farms, but the returns earned from these assets are affected by a wide range of factors. The average return, in terms of income as a proportion of the opening value of livestock, was 12 percent but this varied from under one percent in Chiweshe to over 35 percent in Zvishavane. Most of the livestock income came from the appreciation in the value of the livestock herd due to increasing stock numbers. This was three times as important as actual trading income from livestock. Livestock appreciation is the result of changes in the capital value of the livestock herd rather than a form of disposable income for the farm household.

CROPPING PATTERN

Virtually all the farmers in the sample grew maize. Even in the poorest areas, over half of the total crop area planted was under this crop. The next most important crop was groundnuts, grown by over 70 percent of farmers in the sample, but accounting for only 11,6 percent of the total land area planted. Millet was also of considerable importance with 45 percent growing finger millet (rapoko) and 30 percent growing pearl millet (mhunga). The combined total area of finger and pearl millet accounted for 19 percent of the total area planted.

The rest of the cropping programme for the farms in the sample involved a wide range of crops, many of them grown in very small quantities. Bambara nuts were grown by 35 percent of farmers but accounted for only 3,5 percent of the total area planted. Sunflowers, grown by 20 percent of farmers, accounted for less than five percent of the total area planted and cotton was of comparable significance.

The pattern of input use by crop is also dominated by maize, which accounted for over 60 percent of total variable costs. The next most important crops, in relation to input costs, were millet and cotton accounting for 11-12 percent each and then groundnuts. In the case of all the other crops, the level of input costs was very low. A similar pattern existed with the assessment of own labour used in crop production.

The variable inputs are dominated by two categories--draft animals and fertilizers. Draft power (including the value of own animals used) accounted for over 40 percent of total variable inputs with fertilizers comprising about a quarter.

The importance of non-farm earnings already has been highlighted. These non-farm earnings consisted primarily of selling vegetables (38 percent of farmers) brewing beer (26 percent) and remittances (19 percent). Eighteen percent of the farmers had no off farm earnings. In terms of the contribution to total off farm earnings, remittances and the selling of vegetables are by far the most important. While brewing beer is a relatively widespread activity, it contributed only 6 percent to total off farm income.

IMPLICATIONS FOR FOOD SECURITY

The main sources of income are from three crops -- maize, groundnuts and millet -- and from three sources of off-farm income -- selling vegetables, remittances and brewing. The location of a communal farm is by far the most important explanatory variable of income, both in terms of the level of returns from cropping and in terms of the levels of off-farm incomes. In general, the better areas for crop production are also the better areas for off-farm incomes. This tends to accentuate the variation in farm household incomes between the better and poorer areas. In the poorer areas, the major input into farming is family labour, but the returns per hour are very low.

The contribution of livestock enterprises to farm incomes is generally small. Most of the income is in the form of livestock appreciation which contributes nothing to the disposable income of the farm family in the year in which it arises.

The survey demonstrated vividly the need to improve crop yields. For crops such as mhunga, sorghum and sunflower, the average yields per hectare are less than 400 kgs. Virtually no purchased fertilizers are used on these crops. In years of poor rainfall, the likelihood of any return would be small. But this low return is also a feature of years of reasonable rainfall due to the failure to use fertilizer. The very low yields are also a result of poor yielding varieties. Data on this were not quantified in the survey.

An extension of the survey is presently being planned to increase the representation of communal farms in Region V. This is expected to improve the quality of the data from that region rather than to provide a new dimension. It is also proposed to produce detailed household budgets, in addition to the farm budgets, to improve knowledge of the financial earnings and expenditure of communal farm households.

CONCLUSION

It may be argued that this survey does not reveal any new truths about the economic and social position of communal farming families. However, the fact that the survey gives precise quantitative data on the major financial and demographic parameters of the lives of communal farming families contributes to a much clearer understanding of the economic realities of life in these areas. It also illustrated the wide variation in financial results from one area to another both at the household income level and in relation to each of the individual cropping enterprises. None of the communal farming areas in the survey could be regarded as prosperous but the families in some areas could live in frugal comfort. In other areas, the standards of living are very poor indeed.

The lack of resources, apart from family labour, is a heavy burden on most -- though not all -- communal farm families. This applies not only to physical resources but also to knowledge as to the best use that can be made of the resources which are available. The growth in the population of these areas only adds to the problem. The extra mouths to be fed are not matched by additional productivity of the farm family labour force.

Improvement in the living standards is not just a matter of agricultural development. Only if additional off-farm employment and off farm income sources can be generated will it be possible to achieve worthwhile progress in improving the economic and social life of the majority of people in these areas. This majority is not just of the people in communal areas -- it is a majority of all the people of Zimbabwe.

13

Regional Crop Production Instability In Zambia And Its Implications For Food Security

Phiri Maleka, John Milimo and Catherine Siandwazi[1]

INTRODUCTION

The occurrence of instability in crop output increases risk and uncertainty in the agricultural sector. This may adversely affect the decision making process of both farmers and policy makers for stabilising output and food security in a country (Murshid, 1987; Singh, 1989). Furthermore, instability in crop production has an adverse effect on prices offered to farmers for their crops (Amhed, 1988). This is because producer prices of crops rise when output falls and *vice versa*. The rise and fall of producer prices due to crop production instability ultimately results in fluctuations in farmers' income and food consumption levels. This in turn affects food security. The definition of food security in this study follows that of Hay and Rukuni (1988) which encompasses all endeavours to stabilise growth of food output and food consumption.

The objective of stabilising crop production has been emphasised in all of Zambia's past and present National Development Plans.[2] However, this objective has not been realised and instability in crop production remains a problem at both the national and regional levels.[3]

Despite this crop production instability and its potential detrimental effects on prices, incomes and food security, no attempt to measure crop production instability in Zambia at the national and regional levels had been undertaken. This paper,

---

[1]Phiri Maleka and John Milimo are with the Rural Development Studies Bureau of the University of Zambia while Catherine Siandwazi is Coordinator, National Food and Nutrition Council.

[2]Zambia has formulated four national development plans since it gained its independence in 1964.

[3]See Annual Plans 1982 to 1988 and Economic Reports 1982 to 1988.

reports an attempt to measure crop production instability in Zambia at the regional or provincial levels.[4] The objectives of this paper are:

- to measure crop production instability in Zambia's nine regions/provinces for maize, cotton, sorghum, sunflower, soyabeans and rice. These crops are chosen because of their national importance and data availability (Fourth National Development Plan, 1989);

- to identify the correlation between the production of maize and other crops. Maize is chosen as a yardstick because it accounts for more than 60 percent of the value of crop output in Zambia (Levi and Mwanza, 1986; Sano, 1988);

- to measure the relationship between instability in yield and hectarage and the instability of production of these crops; and,

- to identify the implications of crop production instability on food security.

SOURCES OF DATA AND METHODOLOGY

Relationships between instability in crop production, yields and hectarage planted were estimated using multiple regression and other analytical techniques. Seven years of time series data (1980-1986) on production, yield and hectarage of the above six crops were used for these estimates. These data were collected from secondary sources for all nine of Zambia's regions/provinces: Central, Eastern, Lusaka, Southern, Northern, Luapula, Copperbelt, North-Western and Western. It is recognised that seven years of data covers too short a time period to make a definitive analysis of crop production instability. However, data availability established the effective constraints. Data sources were official government publications including Annual Plans 1980-1986, Economic Reports 1980-86, Food Strategy Study 1981-1985 and Agricultural Statistics Bulletins 1984 and 1986.

Crop production instability can be measured by various methods. The method used by several researchers (Firch 1977, Sagar 1980, Green and KirkPatrick 1981, Hazell 1982, 1984, 1986, Alauddin and Tisdell 1986, Murshid 1986 and Singh 1989) is the coefficient of variation. This is defined by Murshid (1986) as the standard deviation divided by the mean and multiplied by 100. An equation can be written as:

EQUATION 1

$$CV = \frac{S}{\bar{X}} \times 100$$

---

[4]The words regional and provincial are used interchangeably in this paper.

Where:

CV = Coefficient of Variation;

S = Standard Deviation; and

$\bar{x}$ = Mean.

The coefficient of variation is used in this study because it is both easy to compute and to understand (Murshid, 1986). It is an appropriate instrument to measure instability in situations where data are limited and do not show any trend pattern (Research Notes, 1989).

To measure instability in crop production, coefficients of variations were calculated for production, yield and hectarage for the above mentioned crops in all of Zambia's regions/provinces for the 1980-1986 period. The values for these calculated coefficients of variation are reported in Tables 1, 2 and 3. The correlation between maize production and production of other crops is shown in a correlation matrix table, Table 4.

Since instability in crop production is a function of instabilities in hectarage and yield of crops (Murshid, 1986), and as the coefficient of variation for each crop is computed for the nine regions, it is possible to apply a regression model to measure the contribution of the variations in yield and hectarage to the variation of production. A log transformation regression model was used to measure these relationships for all of the six crops analysed. In this model, the dependent variable is the coefficient of variation of the production for each of the crops, Table 1. The independent variables are the coefficients of variation of yields and hectarages for the respective crops presented in Tables 2 and 3. The specification of this model is as follows:

EQUATION 2

$$\log P_{icv} = \log A_0 + A_1 \log Y_{icv} + A_2 \log H_{icv} + U$$

Where:

P_{icv} is the production coefficient of variation for crop i;

A_0 is a constant;

Y_{icv} is the yield coefficient of variation for crop i;

H_{icv} is the hectarage coefficient of variation for crop i;

U is the error term with constant variance and zero mean.

The estimated coefficients of the variables in equation 2 measure the contribution of yield and hectarage to total crop production instability.

RESULTS AND DISCUSSIONS

The results of crop production instability are classified into three components:

- results pertaining to the measurement of crop production instability;
- results identifying the correlation between the production of maize and the production of other crops; and,
- results measuring the contribution of variation in yield and hectarage to variation in production of the six crops.

The presentation and discussion of results follows this classification.

Measurement of Crop Production Instability

Results of crop production instability are reported in Table 1. This table can be analysed from two perspectives, namely, the perspective of analysing instability in crop production according to crops, and, that of analysing crop production instability on the basis of regions. The analysis of the results of this table takes into consideration both of these perspectives.

Table 1
Coefficient of variation for production of crops by region
(%)

Region/Province	Maize	Cotton	Sorghum	Sunflower	Soyabeans	Rice
Central	12,22	63,23	10,53	39,52	62,30	64,74
Copperbelt	50,82	104,14	37,92	50,70	54,00	73,49
Eastern	18,24	39,38	31,02	37,39	21,41	18,56
Luapula	41,05	103,57	59,97	42,49	106,90	46,62
Lusaka	24,21	39,39	71,09	58,21	88,13	87,21
Northern	40,03	103,93	68,91	54,95	154,35	46,42
North-Western	25,48	59,80	69,52	77,81	95.86	53,73
Southern	33,62	53,58	88,37	50,74	66,64	74,05
Western	32,63	78,19	62,57	34,13	54,67	33,02

The analysis of crop production instability according to crops is done by looking at the rows of Table 1. For example, in the row indicating the Central Region, rice shows the highest crop production instability. This is followed by cotton and soyabeans. Maize and sorghum show the lowest crop production instability. The high production instabilities for rice, cotton and soyabeans were due to government policies designed to increase production of these crops during the 1980s.

Since it is hypothesised that crop production is influenced by yield and hectarage, the computed coefficient of variations for yield and hectarage, Tables 2 and 3, are compared with the computed coefficients of variation for crop production presented in Table 1. This permits us to draw inferences on whether a relationship, in terms of the magnitude of the respective coefficients of variations, (*i.e.*, production *versus* hectarage and yields), exists. Such a comparison, though crude, gives a rough indication as to whether crop production instability can be explained by instabilities in yield and hectarage. On the basis of this comparison, one observes a general pattern that high crop production instabilities, Table 1, are roughly matched by high yield and hectarage instabilities, Tables 2 and 3. Hence, one might deduce that instability in yield and hectarage explains crop production instability. This holds true for most of the crops shown in Tables 1, 2 and 3.

Similarly, in the row indicating the Northern Region, Table 1, soyabeans show the highest production instability. This is followed by cotton and sorghum. The lowest production instability in the Northern Region is observed in the maize and rice crops. The high production instability of soyabeans, cotton and sorghum may have occurred because of 1980 government policies which encouraged farmers in the Northern Region to grow more of these crops as complementary cash crops to maize and rice.

Columns in Table 1 give information on crop production instability according to regions. For instance, in the column indicating maize, Copperbelt has the highest maize production instability. This is followed by Luapula, Northern and Southern Regions. The lowest maize production instability is registered in Central and Eastern Regions. The high maize production instability in the Copperbelt Region seems to be explained by the high hectarage instability for the same crop in the same region, Table 3. This, in turn, might be a result of increased harvested hectarage in the 1980s for maize by large scale commercial farming enterprises.

For cotton, the highest production instability was in the Copperbelt (104.14 percent). This was followed by Northern and Luapula Regions, (103.93 percent) and (103.57 percent), respectively. The lowest production instability for cotton was in Lusaka (39.39 percent). The high production instability for cotton in the Copperbelt appears to be explained by high variation in cotton yield, Table 2. This high cotton yield instability seems to reflect the increasing application of modern technology by commercial farmers in cotton production.

The highest production instability of sorghum was in the Southern Region (88.57 percent), followed by Lusaka (71.09 percent) and North-Western (69.52 percent). The Central Region had the lowest production instability for sorghum. The high sorghum production instability in Southern Region may have resulted from the increased hectarages planted due to the government encouraging farmers to grow sorghum for the stockfeeds and bottled beer industries in Lusaka.

Table 2
Yield coefficient of variation for crops by region
(%)

Region/Province	Maize	Cotton	Sorghum	Sunflower	Soyabeans	Rice
Central	15,00	25,37	20,56	9,19	37,63	27,27
Copperbelt	23,60	114,74	27,96	43,86	17,44	26,81
Eastern	14,73	21,79	45,40	7,21	25,06	13,59
Luapula	8,90	6,47	14,51	16,42	52,67	17,40
Lusaka	48,14	42,56	31,47	38,17	33,57	35,59
Northern	14,86	35,49	33,90	47,00	26,82	27,67
North-Western	18,92	17,27	79,92	5,35	31,61	24,83
Southern	13,18	25,63	54,66	38,55	36,14	44,54
Western	23,31	29,29	34,65	36,65	19,62	14,53

North-Western Region had the highest production instability for sunflower (77.81 percent), followed by Lusaka (58.21 percent), Northern (54.95 percent), and Copperbelt (53.70 percent). The Western Region had the lowest production instability for sunflower, (34.13 percent). Sunflower production instability in the North-Western Region seems to be explained by instability in hectarage allocated to sunflower, Table 3.

Soyabeans registered the highest production variability in the Northern Region (154.35 percent), followed by Luapula (106.90 percent), North-Western (95.86 percent), and Lusaka (88.13 percent). The Eastern Region had the lowest variability (21.41 percent). The high production instability of soyabeans in the Northern Region appears to be explained by the variability of hectarage for this crop, Table 3.

Table 3
Hectarage coefficient of variation for crops by region
(%)

Region/Province	Maize	Cotton	Sorghum	Sunflower	Soyabeans	Rice
Central	16,98	41,60	3,31	12,09	71,08	48,20
Copperbelt	48,72	41,32	30,02	32,27	34,18	67,97
Eastern	14,43	31,89	17,94	18,77	27,43	16,47
Luapula	31,05	85,42	67,79	14,41	97,16	36,20
Lusaka	115,23	37,07	44,48	21,20	69,73	87,65
Northern	35,61	71,48	46,00	45,00	111,00	35,91
North-Western	15,69	101,43	14,92	75,66	101,00	53,05
Southern	20,31	27,51	54,88	40,79	77,64	20,25
Western	39,10	47,75	56,21	40,09	56,00	36,86

Rice showed the greatest production instability in Lusaka (87,21 percent), followed by the Southern (74 percent), and Copperbelt Regions (73,49 percent). The lowest variability occurred in the Eastern Region (18,56 percent). The high production instability for rice in the Lusaka Region seems to be explained by the variability of both yield and hectarage, Tables 2 and 3.

Variation of the Production of Maize in Relation to the Variation of Other Crops

Results showing the variation of maize production in relation to other crops are presented in Table 4. Columns of Table 4 relate to the relationship between maize and other crops by regions. Rows of the same table relate to the relationship between maize and other crops within regions. This relationship (correlation) might be highly/lowly positive or highly/lowly negative, respectively. If the relationship is positive, it indicates that the two crops are complementary. This means that an increase in the production of one crop results in a corresponding increase in the production of the other crop. A negative (correlation) relationship implies substitution between the two crops in question. Thus, an increase in the production of one crop results in the decrease in the production of the other (Murshid, 1986 and Hazell, 1986).

Table 4
Correlation matrix of production of maize in relation to the production of other crops

Region/Province	Maize	Cotton	Sorghum	Sunflower	Soyabeans	Rice
Central	1,00	0,855	0,682	0,846	0,607	0,785
Copperbelt	1,00	0,629	0,046	0,953	-0,049	-0,461
Eastern	1,00	0,276	0,826	-0,209	-0,408	0,356
Luapula	1,00	0,637	0,746	0,102	0,735	0,707
Lusaka	1,00	0,225	0,719	0,657	0,223	-0,708
Northern	1,00	-0,092	-0,806	-0,016	0,022	0,711
North-Western	1,00	0,262	0,481	0,619	0,611	0,099
Southern	1,00	-0,063	-0,103	-0,629	0,847	-0,606
Western	1,00	0,277	0,669	0,508	0,833	0,315

Looking at the column which indicates cotton, one observes that a very high and positive production relationship exists between cotton and maize in the Central, Luapula and Copperbelt Regions. Thus, cotton and maize are highly complementary crops in these three Regions.

Similarly, the production relationship between maize and sorghum is highly significant and positive in the Eastern (0,826), Luapula (0,7457), Lusaka (0,719), Central (0,682) and Western Regions (0,669). The high and positive production relationship between sorghum and maize in these regions is not strange because, whilst maize is grown as both a food and cash crop, sorghum is mainly grown for beer brewing. Moreover, both crops are grown during the same season.

There is a high and positive production relationship between maize and sunflower in the Copperbelt (0,953), Lusaka (0,657) and North-Western Regions (0,619). However, the production relationship between sunflower and maize, though highly significant, is negative in the Southern Region. The negative relationship between maize and sunflower in the Southern Region indicates that these two crops might be substitutes.

The production relationship between maize and soyabeans is highly significant and positive in Southern (0,735), Western (0,833) and Luapula Regions (0,735). Rice and maize showed a very high and positive production relationship in Central (0,785), Northern (0,711) and Luapula Regions (0,707).

The production relationship between maize and other crops within regions is observed across rows. For example, the relationship between maize and other crops in Central Region can be observed in the first row. Very high and positive production relationships exist between maize, on the one hand, and cotton, sorghum, sunflower, soyabeans and rice on the other, Table 4. The positive relationship between maize and other crops in the Central Region is expected because these crops are grown during the same season and by the same farmers using similar agricultural inputs (Annual Plans, 1984-1986).

However, the production relationship between maize and other crops in the Eastern Region is highly positive only for sorghum. The rest of the crops, apart from sunflower and soyabeans, have a low but positive production relationship with maize. Sunflower and soyabeans register low and negative relationships with maize. The negative relationship between sunflower and soyabeans on the one hand and maize on the other seems to confirm Sano's (1988) assertion that sunflower and soyabeans act as substitute crops for maize in the Eastern Region.

Variation of Area and Yield to Variation in Total Crop Output

Results showing the contribution of variation of hectarage and yield to total crop production variation are tabulated in Table 5. The results of this table can be interpreted by reading down the columns. For example, column 2, which represents maize, shows that variation in maize production is significantly influenced by the variation in hectarage at the five percent level of significance. The impact of variation in yield on variation in maize production, though significant, is less than that for hectarage, Table 5. Moreover the negative sign of the estimated yield coefficient is worrying because it is contrary to what one might expect. A positive relationship is normally expected to exist between variation in maize yield and variation in maize production.

Table 5
Contribution of yield and hectarage instabilities to total crop production instability (Dependent Variable (Total Crop Production)

Independent/ Variable	Maize	Cotton	Sorghum	Sunflower	Soyabeans	Rice
Log (Yield)	-0,666	0,089	0,626	-0,039	-0,425	0,876
T - Values	(-1,62)[b]	(0,459)	(3,636)[a]	(-0,399)	(1,340)	(5,914)[a]
Log (Hectarage)	0,611	0,390	0,630	0,268	1,235	0,392
T - Values	(2,091)[a]	(1,300)	(6,908)[a]	(1,911)[a]	(5,486)[a]	(3,550)[a]
F - Ratio	2,205	0,850	30,069	1,829	18,478	34,041
R^2	0,424	0,22	0,909	0,379	0,8603	0,919
Durbin-Watson	2,0	3,513	1,79	1,42	2,52	2,52

Note:
[a] Significant at 0,05 percent level.
[b] Significant at 0,10 percent level.

The R^2 indicates that variations in maize yield and hectarage explain about 42 percent of the total variation in maize production. The remaining 58 percent of the variation in maize production is explained by other factors such as rainfall. The Durbin Watson of 2,00 indicates the absence of autocorrelation in the maize equation.

Similarly, if we look at the last column, rice, it is observed that both the variation in rice yield and hectarage significantly influence variation in rice production at the five percent level of significance. The results of the rice column also indicate that the variability in rice yield and hectarage explains about 92 percent of total rice production variation. Again, a Durbin Watson coefficient of 2,52 is sufficiently high to indicate the absence of autocorrelation in the rice equation. Interpretation for the remaining variables in Table 5 follows a similar pattern.

IMPLICATIONS FOR FOOD SECURITY

Food security is usually defined as ensuring the availability of a sustainable supply of food at affordable prices to all members of society (Hay and Rukuni, 1988; Mellor, 1988; Hlophe, 1989 and Banda, 1989). The causes of food insecurity have been identified as: inadequate storage and poor transport facilities, a general low level of investment in agriculture and high consumer prices relative to peoples' income. (Dhliwayo, 1989; Takavarasha and Rukovo, 1989; and, Amani and Kapunda, 1989) If high crop production instability, Table 1, implies high crop output, then high crop production instability may have adverse implications on food security. This is because high crop output may result in low prices for farmers and excessive government owned food stocks which create storage problems. For example, during the bumper maize harvest years of 1987-88 and 1988-89, much of the maize was not collected and moved to safe maize storage facilities resulting in significant losses in the maize crop. Factors contributing to this problem were poor road networks and inadequate transport facilities (Banda, 1989).

The impact of rural infrastructure on crop production (implicitly on food security) is clearly illustrated in the Bangladesh study by Ahmed and Hossain (1987) when they show that good infrastructure is associated with 92 percent more fertilizer use per hectare, 4 percent more labour per hectare in farming, 30 percent more non-farm employment and a 12 percent higher wage rate.

On the other hand, if low crop production instability reflects a low crop output, then food shortages might occur. This, in turn, will result in high food prices and hunger and malnutrition among the disadvantaged members of society.

Both upward and downward instability in crop production is of major concern to food security policy analysts because both situations involve some degree of risk (Hazell, 1986). However, the degree and seriousness of the risks involved will depend to a great extent on how far crop output is above or below national food requirements.

Implications of Relationships Between Production of Maize and Other Crops

Results of the relationship between production of maize and other crops are presented in Table 4. Other crops are compared to maize because it is assumed that most households in Zambia are concerned not only with maximising food consumption (security) but also with maximising income from growing non food crops (Maleka, 1990). This is the situation in some parts of Zambia. For example, farmers in Gwembe Valley grow cotton to raise money to purchase maize flour and other basic non food items. A similar situation was observed by Mellor (1988) who wrote that, besides spending their acquired income on food, smallholders in Bangladesh and Malaysia spend 35 and 40 percent, respectively, of their increments to income on locally produced non-agricultural goods and services. A similar study in Nigeria noted that small farmers spend as much as 20 percent of their increments to income on locally-produced agricultural goods, such as vegetables and livestock, thus contributing to employment creation in the rural sector.

Implications the Variation of Yield and Area to that of Total Crop Production

The estimated contributions of yield and hectarage to total crop production instability are presented in Table 5. The results show that, with the exception of cotton, there are significant relationships between the instability in hectarage and the instability of crop production. However, there are significant relationships between instabilities in yield and production for only three of the six crops.

Thus, it would appear that policies aimed at stabilising crop hectarages would have a greater impact on production instability than those aimed at stabilising yields. Promoting the expansion of hectarage, for example, when it is estimated that it has a more significant influence than yield on crop production instability, may be a less appropriate strategy than one which stabilizes hectarage. In general, the implications of Table 5 lie in formulating policies which promote food security through manipulating yield and hectarage variables for the crop being analysed.

SUMMARY AND CONCLUSIONS

Crop production instability in Zambia has assumed a greater importance because of its implications for food security. No serious study has been undertaken to analyse crop production instabilities in Zambia in spite of this concern. This study used seven years of data (1980-1986) to generate coefficients of variation and a correlation matrix for total crop production, yield and hectarage by region/province. A log transformation equation was used to test whether yield and hectarage variability significantly influence total crop production instability.

The results reveal that instability in crop production varies by crop and region possibly because of climatic and ecological differences in the nine regions. The overall results indicate that regions with very high rainfall, (that is, regions with rainfall values above the national average), tend to have higher crop production instability than those with average and below average rainfall. Of the six crops covered in this analysis, cotton and soyabeans have higher production instability within these higher rainfall regions than other crops. The regions with high rainfall are: Northern, North-Western, Luapula and Copperbelt (Muchindu, 1986). The relationship between variability in maize production and variability in the production of other crops differs by crop and region.

The relationship between variations of hectarage and yield and variations in crop production, reveals that hectarage has a more significant influence on production instability than yield. This is contrary to the findings of Hazell (1984), Murshid (1986) and Singh (1988) who reported that yield rather than hectarage instability contributed more strongly to crop production instability.

The results of this paper have important implications for some aspects of food security in Zambia. For example, high and/or low instabilities on crop production have implications on farmers' and consumers' prices received/paid, transport, storage facilities required, *etc*. These in turn affect the year to year availability of food to consumers.

Given the limited nature of the time series data available for this study, the findings should be treated as tentative and interpreted with caution. More research in crop production instability and on food security should be undertaken to guide policy makers in Zambia.

REFERENCES

Ahmed, R.U. 1988. Rice Price Stabilisation and Food Security in Bangladesh. *World Development.* Vol. 16 (9): 1035-1050.

Ahmed, R. and M. Hossain. 1987. *Infrastructure and Development of a Rural Economy.* International Food Policy Research Institute. Washington D.C.

Alauddin, M. and C. Tisdell. 1988. Impact of New Agricultural Technology on the Instability of Food Production and Yield. *Journal of Development Economics.* Vol. 29 :199-206.

Amani, H. and S. Kapunda. 1989. Agricultural Marketing Reform in Tanzania: The Restriction of Private Traders and its Impact on Food Security. In: M. Rukuni, G. Mudimu and T.S. Jayne eds. *Food Policies in the SADCC Region.* Proceedings of the Fifth Annual Conference on Food Security Research in Southern Africa, October 16-18, 1989. University of Zimbabwe/Michigan State University. Harare.

Banda, A.K. 1989. Zambia: Food Security Issues and Challenges for the 1990s. In M. Rukuni, G. Mudimu and T.S. Jayne eds. Food Policies in SADCC Region. *Food Security Policies in the SADCC Region.* Proceedings of the Fifth Annual Conference on Food Security Research in Southern Africa, October 16-18, 1989. University of Zimbabwe/Michigan State University. Harare.

Dhliwayo, K.J.M. 1989. National Food Security Policies and Challenges: SADCC Countries' Experiences. In M. Rukuni, G. Mudimu and T.S. Jayne eds. *Food Policies in SADCC Region.* Proceedings of the Fifth Annual Conference on Food Security Research in Southern Africa. October 16-18, 1989. University of Zimbabwe/Michigan State University. Harare.

Firch, R.S. 1977. Sources of Commodity Market Instability in U.S. Agriculture. *American Journal of Agricultural Economics.* Vol. 59 (1) :165-169.

Green, C. and C. KirkPatrick. 1981. A Cross Section Analysis of Food Insecurity in Developing Countries: Its Magnitude and Sources. *The Journal of Development Studies.* Vol. 18 (2) :194-199.

Hazell, P.B.R. 1982. *Instability in Indian Food Grain Production.* Research Report No. 30. International Food Policy Research Institute. Washington D.C.

Hazell, P.B.R. 1984. Sources of Increased Instability in Indian and U.S. Cereal Production. *American Journal of Agricultural Economics.* Vol. 66 (3) :305-309.

Hazell, P.B.R. 1986. *Summary Proceedings of a Workshop on Cereal Yield Variability.* International Food Policy Research Institute. Washington D.C.

Hay, R.W. and M. Rukuni. 1988. SADCC Food Security Strategies: Evolution and Role. *World Development.* Vol. 16 (9) :1013-1024.

Hlophe, S.S. 1989. Swaziland: Food Security Issues and Challenges for the 1990s. In M. Rukuni, G. Mudimu and T.S. Jayne eds. *Food Security Policies in the SADCC Region.* Proceedings of the Fifth Annual Conference on Food Security Research in Southern Africa, October 16-18. University of Zimbabwe/Michigan State University. Harare.

Levi, F.S. and A.M. Mwanza. 1986. *Zambia Case Study Agricultural Policy Issues.* The University of Zambia. Department of Economics, Lusaka.

Maleka, P.T. 1990. *An Approach to Systems Modelling to Drought Management Strategies in the Lake Kariba District of Zambia.* A PhD Thesis: Department of Economics. University of Wollongong. Wollongong.

Mellor, J.W. 1988. Global Food Balances and Food Security. *World Development.* Vol. 16 (9) :997-1011.

Ministry of Agriculture. 1988. *Agricultural Statistics Bulletin 1982-1988.* Planning Division Ministry of Agriculture. Lusaka.

Muchindu, M. 1986. *Estimation of Crop Water Requirements in Zambia.* Department of Meteorology. Lusaka.

Murshid, K.A.S. 1986. Instability in Food Grain Production in Bangladesh: Nature, Levels, Trends. *Bangladesh Development Studies.* :54-57.

National Commission for Development Planning. *Annual Plans, 1982-1988.* Lusaka.

National Commission for Development. *Economic Reports, 1982-1988.* National Commission for Development Planning. Lusaka.

National Commission for Development Planning. 1989. *Fourth National Development Plan, 1989.* Lusaka.

Research Notes. 1989. *Indian Journal of Agricultural Economics.* Vol.44 (1): 67-69.

Rohrbach, D.D. and C. Mwila. 1989. Industrial Utilisation of Sorghum and Millet in Zambia: An Approach to Food Security. In M. Rukuni, G. Mudimu and T.S. Jayne eds. *Food Security Policies in the SADCC Region.* Proceedings of the Fifth Annual Conference on Food Security Research in Southern Africa. October 16-18, 1989. University of Zimbabwe/Michigan State University. Harare.

Sano, H.O. 1988. Agricultural Policy Changes in Zambia During the 1980s. *Working Paper No. 4.* Centre for Development Research, Copenhagen.

Singh, I.J. 1989. Agricultural Instability and Farm Poverty in India. *Indian Journal of Agricultural Economics.* Vol. 44 (1) :2-5.

Takavarasha, T. and R. Rukovo. 1989. Zimbabwe: Food Security Issues and Challenges for the 1990s. In M. Rukuni, G. Mudimu and T.S. Jayne eds. *Food Security Policies in the SADCC Region.* Proceedings of the Fifth Annual Conference on Food Security Research in Southern Africa. October 16-18, 1989. University of Zimbabwe/Michigan State University, Harare.

Prospects For Increasing Household Food Security And Income Through Increased Crop Productivity And Diversification In Low Rainfall Areas Of Zimbabwe.

J. Govereh and G. Mudimu[1]

INTRODUCTION

The achievement of communal area farmers in increasing production and marketed output of food and cash crops in the decade of the 1980's has been studied and documented by several researchers (Stanning, 1985; Rohrbach, 1987). In the 1990-91 marketing year, the communal area farming sector contributed 68 percent of the maize marketed, 62 percent of cotton deliveries and 96-98 percent of sunflower deliveries. Despite these spectacular achievements, communal area farmers are still vulnerable to food insecurity. Crop output per farm household remains very low and highly variable due to low and unreliable rainfall. Income levels are low and unevenly distributed (Chopak, 1988; Jackson and Collier, 1988; Shaffer and Chigume, 1989; Stanning, 1988). The incidence of malnutrition and related health problems are unacceptably high.

The task of increasing agricultural output to improve food security and household income remains formidable. There is potential for increasing output and productivity through increased adoption of improved agricultural technologies. Household food security can also be enhanced through crop diversification. The purpose of this paper is to explore the potential for increasing crop productivity and diversification through adoption of improved technology. The paper also examines the prospects of crop diversification arising from increased crop productivity and access to appropriate technologies.

[1]Research Scholar and Lecturer, respectively, Department of Agricultural Economics and Extension, University of Zimbabwe.

SOURCES OF DATA

The data for this paper were obtained from surveys undertaken in Mutoko/Mudzi and Buhera communal areas in 1987-88 and 1988-89 as part of the research on household food security in low rainfall areas of Zimbabwe. Current levels of crop production are compared with the potential for Natural Regions III, IV and V. Production levels are based on current technologies that are recommended by the extension and the research systems. The adoption of these technologies is assessed to identify constraints and potential for increased adoption.

The performance of farmers is analysed to identify agronomic and socio-economic practices of farmers achieving higher output levels. The objective is to assess whether there is scope for other farmers to achieve such performance so as to increase household output and income. The profitability of current technologies is measured and a comparative economic analysis of alternative crops is undertaken to determine whether there is scope for farmers to improve household income by increasing production of more profitable crops.

RESULTS AND DISCUSSION

Resource Pattern

Household production resources are low in quantity and quality posing a serious challenge to the exploration of avenues that intensify production or increase resource productivity.

Labour Supply

Family labour is, in most areas, inadequate to meet seasonal demands. Operations like planting and weeding require proper timing and inadequate labour at home and for hire cause operational delays that reduce crop yields. Although average family size is about 9,5 members, only 25 percent are engaged full-time in farming. An equal proportion work as part-time farm workers, Table 1. Non-farm workers are mostly preschool children, those of school going age and family members working in urban areas. The seasonal nature of rain-fed agriculture makes it difficult for household members to earn incomes throughout the year. This, together with low and uncertain rainfall and frequent drought makes farming a risky and low return venture in these marginal areas. This has forced about half of the able bodied farm workers to seek employment outside farming where wages are higher and year round.

Table 1
Zimbabwe: Farm family sizes in Mutoko/Mudzi and Buhera, 1987-88.

	Average Number of family Members Per Farm					
	Adult Males	Adult Females	Children < 15 yrs	Total Size	P-Time Workers	F-Time Workers
Mutoko/Mudzi	2,8	3,1	3,3	9,1	2,4	2,1
Buhera	2,7	3,2	4,2	10,1	2,6	3,5
Average	2,74	3,15	3,74	9,6	2,5	2,8

Source: Food Security Surveys, 1987-89

Land Supply and Quality

Also, households, particularly in favourable environments, are facing an acute land shortage. For example, the average farm size in Mutoko/Mudzi, Natural Region IV, is ten acres Table 2. The most frequent tenure system is household ownership with few households, 0.5 percent, borrowing in or borrowing out.

Table 2
Zimbabwe: Total land ownership systems (ha.) in Buhera and Mutoko/Mudzi, 1987-88.[a]

	Household Owned	Rent In	Rent Out	Share In	Borrow In	Borrow Out
Mutoko/Mudzi	685,58 (90%)	0,21 (,5%)	0,0 (0%)	3,39 (,5%)	3,34 (6%)	4,32 (3%)
Buhera	967,59 (81,5%)	0,34 (,6%)	1,0 (,6%)	0,0 (0%)	53,56 (15,6%)	2,34 (1,8%)
Average	826,59	0,28	0,5	1,7	28,45	3,33

[a] Figures in parenthesis represent the proportion to total fields falling in each tenure category.
Source: Food Security Surveys, 1987-89

In Buhera, NR V, farm sizes are relatively larger (17 acres) than in Natural Region (NR) IV. Even if farmers in marginal areas have larger landholdings than their counterparts in favourable areas, the soils are very infertile and fragile, and usually unable to sustain crop production. About 64 percent of the field area in Buhera (NR V) has extremely sandy soils (Ruseya) and about eight percent of the field area is gravelly, Table 3. In contrast, 35 percent of the field area in Mutoko/Mudzi, had vertisols (Gova) and 59 percent of the field area was in light sandy soils (Shapa). Thus, Mutoko/Mudzi farmers have smaller plots but higher quality soils that can sustain intensified crop production. Yet, newly married members of the family expect to get a sub-plot within the parent family's plot because all uncultivated land is grazing area.

Table 3
Zimbabwe: Distribution of arable area by soil type, Mutoko/Mudzi and Buhera, 1987-88.

	Mutoko/Mudzi		Buhera	
Soil Type	Mean Area (ha)	% To Total[a] Area	Mean Area (ha)	% to Total[a] Area
Light sandy	3,19	58,6	4,6	5,4
Vertisols	3,12	35,4	2,02	1,8
Red clays	4,61	1,3	3,6	13,7
Extremely sandy	0,0	0,0	5,58	58,3
Gravel	1,47	2,3	2,76	7,8

[a] Column totals do not add up to 100. The remainder represent other minor soil types.
Source: Food Security Surveys, 1987-89.

Availability of Draft Power

Draft power for both ploughing and transport is essential for timeliness in performing farm operations. In Mutoko/Mudzi, 48 percent of the farmers owned no draft power compared with 18 percent in Buhera Table 4. Fifteen percent and 37 percent of the farmers had at least the recommended four draft animals in Mutoko/Mudzi and Buhera, respectively. The draft power available was of poor quality and some farmers could not winter plough their fields due to poor animal health.

Although draft animals for hire were available, there were few farmers willing to part with their cattle during periods of land preparation and planting operations. Hired animals were mostly available during the slack periods when not needed by non-draft owners. In Buhera, 35 percent of the sampled farmers borrowed draft animals with 52 percent doing the same in Mutoko/Mudzi. Draft ownership was more skewed in Mutoko/Mudzi than in Buhera because grazing area was relatively less plentiful in the former communal area.

Table 4
Zimbabwe: Distribution of draft power ownership in Mutoko/Mudzi and Buhera, 1987-88.

Percent of Household Owning Zero to 73 Draft Animals	Mutoko/Mudzi (n = 146)	Buhera (n = 138)
0	43	18
1	13	3
2	23	29
3	10	13
>4	15	37
Percent borrowing	52	35
Percent loaning	44	16

Source: Food Security Surveys, 1987-89.

Cropping Patterns

Marginal areas are predominantly millet producing areas. Maize is increasingly substituting for millets and sorghum particularly in NR IV where it performs well relatively to millets. More than 80 percent of the farmers in both Mutoko/Mudzi and Buhera are producing both maize and bulrush millet (Mudimu *et al*, 1989). Maize and bulrush millet are allocated the same proportion (33 percent) of cropped area in Mutoko/Mudzi. In Buhera, maize is planted to only half of the area (19 percent) allocated to bulrush millet. Other important crops in Mutoko/Mudzi are sunflower and groundnuts in that order for farmers growing the crop. In Buhera, groundnuts, roundnut and sorghum are also grown in that order of importance.

PRODUCTION TECHNOLOGY EMPLOYED BY FARMERS

Communal farmers in marginal areas obtain lower crop yields than yields obtained by farmers in NR II and III. This section of the paper seeks to highlight:

- the proportion of farmers obtaining higher maize yields;
- factors that determine yield variation across sites; and,
- constraints limiting adoption of yield increasing techniques.

General statistics on the levels of maize yields in Mutoko/Mudzi and Buhera are shown in Table 5. Average maize plot yields in Mutoko/Mudzi (1,282 kg/ha) were double the yields in Buhera. The main reason is low rainfall and poor soils which are more severe in Buhera than in Mutoko/Mudzi. In lower altitude areas of Buhera, annual rainfall was less than 600mm and evaporation rates were high. This makes crop production risky.

Table 5
Zimbabwe: Statistics on maize yields in Mutoko/Mudzi and Buhera, 1988-89.

Statistic	Mutoko/Mudzi kg/ha	Buhera kg/ha
Mean	1 281,48	648,31
Median	1 033,94	516,00
Mode	1 033,94	786,70
Standard deviation	755,16	416,96
Minimum	129,24	98,47
Maximum	4 135,77	1 811,00

Source: Food Security Surveys, 1987-89.

About 38 percent of the farmers in Mutoko/Mudzi were getting yields of less than 1000 kgs/ha, Table 6. In Buhera, 82 percent were getting yields below one tonne. A fifth of the farmers sampled obtained yields in excess of 1,8 tonnes/ha in Mutoko/Mudzi compared with only two percent in Buhera. The yield distributions were more even in Mutoko/Mudzi than in Buhera.

Table 6
Zimbabwe: Distribution of farmers by maize yield levels, Mutoko/Mudzi and Buhera, 1988-89.

Yield	Mutoko/Mudzi		Buhera	
(kg/ha)	Number	Percentage	Number	Percentage
Up to 600	21	17	38	56
601 - 800	19	16	15	21
801 - 1 000	4	3	4	5
1 001 - 1 200	19	16	2	2
1 201 - 1 400	9	8	2	2
1 401 - 1 600	19	16	5	7
1 601 - 1 800	5	4	0	0
Above 1 801	24	21	2	2

Source: Food Security Surveys, 1987-89.

The management factors that influenced maize yields significantly in Mutoko/Mudzi were the seedrate, planting date, weeding intensity and application rates of both basal and top dressing fertilizers. The above factors were highly significant, Table 7, with planting date and top dressing significance levels being 0,0005. Farmers who obtained significantly higher yields weeded twice, winter ploughed, top and basal dressed more than farmers who obtained lower yields. Higher yielding farmers, on average, purchased, from their own savings, seasonal inputs three times the value of those purchased by lower yielders. This implies that higher yielding farmers had more income or at least were willing to spend more for inputs than lower yielding farmers.

Socio-economic factors that were significant and positively related to yields were the farmers' knowledge of recommended maize production techniques, crop income, land and livestock holdings and earnings from livestock sales, Table 7. Use of modern inputs, for example hybrids and fertilizers, required specific management practices to maximise net returns.

Table 7
Zimbabwe: Agronomic practices of low and high yielders in Mutoko/Mudzi, 1988-89.

Practice	Low Yielders	High Yielders	Chi-Sq[a] Sig Level
Yield (Kg/ha)	< 1 033	> 1 033	
Average Group Yield (kg/ha)	727,74	2 025,41	0,0005
Management Factors			
Average Seedrate (kg/ha)	22,96	30,50	0,001
Average AN Rate (kg/ha)	38,50	146,90	0,000
Average Cmpd D Rate (kg/ha)	53,74	152,03	0,010
Average Weeding Hours (hr/ha)	119,66	181,70	0,045
Average Draft Hours (hr/ha)	48,19	48,40	0,982
Average Total Labour (hr/ha)[b]	468,40	635,80	0,001
Planting Week (1= mid Sept)	10,80	7,90	0,000
Percentage Weeding Twice	35,00	68,00	0,0005
Percentage Winter Ploughing	32,00	67,00	0,0003
Percentage Top Dressing	40,00	83,00	0,0000
Percentage Basal Dressing	59,00	75,00	0,0003
Socio-Economic Factors			
Technical Awareness Score (%)[c]	46,00	61,00	0,006
Average Value of Annual Purchased Crop Inputs ($)	48,28	133,19	0,000
Average Land Holding (ha)	9,96	12,29	0,065
Average Livestock Units (LU)	8,00	13,53	0,003
Average Crop Income ($)	1 321,73	4 541,82	0,016
Average Livestock Sales ($)	105,92	233,03	0,084
Average Remittances ($)	200,61	268,56	0,266
Average Off-farm Earnings	176,10	267,07	0,181

[a] For continuous variables, the 2-tail probability value is shown.
[b] Includes both hired + own labour hours.
[c] Scores were obtained from farmers' awareness of a the package of recommendations.
Source: Food Security Surveys, 1987-89.

Farm incomes were very critical in the adoption of techniques that required farmers to disburse some cash. Because of the limited access to credit faced by communal farmers, use of modern techniques was potentially constrained by access to cash.

In Buhera, the management factors that influenced yields were the intensity of weeding and seed rates, Table 8. Maize plot sizes were relatively larger in Buhera than in Mutoko/Mudzi, (Mudimu *et al*, 1989) and this potentially constrained weed management in Buhera. However, high yielding farmers weeded as frequently as low yielding farmers. No farmer used fertilizer in Buhera. The planting week (early December) was, on average, almost the same for both high and low yielders. Ridging (using a plough at weeding) was done significantly more often by high yielders than low yielders. The ridging operation at weeding substituted ox-power for labour and offered a micro-environment that trapped and conserved moisture.

Important socio-economic factors included the knowledge of recommended production practices, crop income and land holding, Table 8. Farmers without a sound awareness of the modern use of inputs were disadvantaged.

PROFITABILITY OF MAIZE PRODUCTION TECHNOLOGIES

Several management and socio-economic factors have been identified as significantly influencing maize yields in both Mutoko/Mudzi and Buhera. This section studies the profitability of maize production by low and high yielding farmers in order to establish whether there are better returns to production resources.

Mutoko/Mudzi farmers were high input users relative to farmers in Buhera. Low yielding farmers were using fertilizers but at low levels. The low production costs and low yields resulted in the gross margins, including own labour, being negative. Even the returns to cash expenditures were negative, Table 9. Although the gross margin, excluding own labour, was positive, the returns to own labour ($0,09) was below the local hiring wage of $0,39. This indicates that low yielding farmers would earn better returns by hiring out than producing their own maize. However, when higher fertilizer and seed rates were used, the gross margin, including own labour was only slightly negative. In addition, higher input rates improved returns to own labour ($0,36), close to the hiring wage.

Table 8
Zimbabwe: Agronomic practices of low and high yielders in Buhera, 1988-89.

Practice	Low Yielders	High Yielders	Chi-Sq[a] Sig Level
Median Yield (Kg/ha)	< 516	> 516	
Average Group Yield (kg/ha)	339,94	936,5	0,000
Management Factors			
Average Seedrate (kg/ha)	42,90	63,00	0,557
Average Weeding Hours (hr/ha)	119,66	181,70	0,095
Average Draft Hours (hr/ha)	43,22	79,76	0,008
Average Total Labour (hr/ha)[b]	261,49	396,17	0,065
Planting Week (1= mid	10,90	10,50	0,580
Percentage Weeding Twice	53,00	71,00	0,2121
Percentage Winter Ploughing	29,00	41,00	0,6082
Percentage Manuring	10,00	14,00	1,0000
Percentage Ridging	42,00	87,50	0,0482
Socio-Economic Factors			
Technical Awareness Score (%)[c]	28,00	49,00	0,007
Average Value of Annual Purchased Crop Inputs ($)	27,55	54,70	0,011
Average Land Holding (acres)	15,16	21,47	0,026
Average Livestock Units (LU)	18,28	22,38	0,361
Average Crop Income ($)	588,53	978,05	0,013
Average Livestock Sales ($)	530,04	283,56	0,215
Average Remittances ($)	104,32	192,25	0,130
Average Off-farm Earnings ($)	228,68	343,15	0,415

[a] For continuous variables, the 2-tail probability value is shown.
[b] Includes both hired + own labour hours.
[c] Scores were obtained from farmers' awareness of a the package of recommendations.
Source: Food Security Surveys, 1987-89.

Table 9
Zimbabwe: Maize budget per hectare for low and high yielders in Mutoko/Mudzi, 1988-89[a]

	Low Yielders ($)	High Yielders ($)
1.Labour[b] (Hired+Own) @ $0.39/hr/ha[c]	182,68	247,96
2.Draft at 30,45/ha[c]	30,45	30,45
3.Seed Cost @ $1,09/kg[c]	25,03	33,25
4.Ammonium Nitrate @ $0,53/kg[c]	20,41	77,86
5.Compound D @ $0,53/kg[c]	25,79	72,97
6.Total Variable Costs (1+2+3+4+5)	284,36	462,49
7.Gross Product @ $0,22/kg[d]	160,10	445,59
8.Gross Margin (7-6)	-124,26	-16,90
9.Gross Margin (% of Gross Income)	-43,70	-9,60
10.Returns per $ of Purchased inputs ((8/(6-2-1))	-1,75	-0,09
11. Gross Margin ($/ha) (exc own labour)	38,12	175,96
12. Own Labour hours (hrs/ha)	416,36	494,50
13. Returns to own labour ($/hr)	0,09	0,36

[a] Average input amounts are obtained from Table 6.
[b] Labour hours do not include transportation from field to homestead and secondary harvesting.
[c] The rate was the average used by the Farm Management Research Section, Ministry of Lands, Agriculture and Rural Resettlement, 1988-89.
[d] This is the local/field price for a kg of maize.
Source: Food Security Surveys, 1987-89.

Maize appears to be unprofitable for surplus production among both low and high yielding farmers in Mutoko/Mudzi. Reasons farmers did not adopt the recommended inputs and management were many but lack of cash was the most limiting (Govereh, Forthcoming).

Variable input expenses indicate that farmers in Buhera bought only hybrid seed. Neither fertilizers nor chemicals were used. Low yielders had negative returns to their cash, Table 10. The returns to own labour ($0,23) were close to the hiring wage of $0,26, but these low yielding farmers could still earn slightly better returns from being hired than producing their own maize. The returns to each dollar spent on inputs were as high as $5,79 for high yielders. In Buhera, improving management of weeds and increasing seed rates increased profitability and returns to own labour tremendously.

Cash returns were relatively higher in Buhera than in Mutoko/Mudzi but Buhera farmers were not buying fertilizers. More than 80 percent were aware of fertilizer use but only ten percent tried fertilizers. Only four percent adopted its use (Govereh, Forthcoming). Farmers in Buhera did not try or adopt fertilizer probably because of its unavailability, unprofitability, riskiness and lack of cash. The return per additional unit of labour was improved when better management practices, such as timely and intensive weeding, were adopted.

Maize production was economic when improved management practices were adopted. In Mutoko/Mudzi, higher levels of fertilizer and seed resulted in improved returns to own labour.

Table 10
Zimbabwe: Maize budget per hectare for low and high yielders in Buhera, 1988-89[a]

	Low Yielders ($)	High Yielders ($)
1.Labour[b] (Hired + Own) @ $0,26/hr/ha[c]	67,99	103,10
2.Draft at 30,45/hac	30,45	30,45
3.Seed Cost @ $1,09/kgc	20,06	25,94
4.Total Variable Costs (1+2+3)	118,50	159,39
5.Gross Product @ $0,33/kg[d]	112,07	309,50
6.Gross Margin (5-4)	-6,43	150,11
7.Gross Margin (% of Gross Income)	-5,70	48,50
8.Returns per $ of Purchased inputs(6/3)	-0,32	5,79
9. Gross Margin ($/ha) (exc own labour)	54,00	230,22
10. Own Labour hours (hrs/ha)	232,44	308,13
11. Returns to Own Labour ($/hr)	0,23	0,75

[a] Average input amounts are obtained from Table 6.
[b] Labour hours do not include transportation from field to homestead.
[c] The rate was the average used by the Farm Management Research Section, Ministry of Lands, Agriculture and Rural Resettlement, 1988-89.
[d] This the local/field price for a kg of maize.

COMPARATIVE ECONOMICS OF MAIZE PRODUCTION VERSUS OTHER CROPS

Work in Mudzi by Mudhara (1990) showed that even if maize was not recommended for production in Natural Regions IV and V, farmers were rational in producing maize. A comparative economic analysis gave the following results:

- pearl millet and sunflower did not show significantly higher returns than maize;
- maize gave higher returns to land and family labour than millets;
- alternative crops gave consistently, through not significantly, higher returns to cash investment as compared to maize; and,
- under the assumption of risk averseness, maize was preferred to sunflower.

The conclusion derived from the above is that maize is a viable crop compared to alternative crops in low rainfall areas. However, the comparative advantage of maize did not exist when rainfall and planting were late.

CONSTRAINTS TO ADOPTION OF TECHNOLOGIES

This paper hypothesizes that farmers in marginal areas, in general, have low incomes, do not qualify for credit, have inadequate information on recommendations, and find most technologies unprofitable due to high input prices and uncertain weather conditions.

Farmer Perception of Maize Recommendations

Farmers were asked to give the advantages and disadvantages of several recommendations. The following results are presented as a frequency distribution of the responses, Table 11 and 12.

Short Season Maize Varieties

The major advantages of using short season maize varieties in Mutoko/Mudzi, as seen by the farmers, were that they were early-maturing, high-yielding and had a high germination percentage. In Buhera, farmers reported these varieties were also high-yielding, had a high germination percentage and produced a healthy crop stand. The main drawbacks of using these varieties in Mutoko/Mudzi were that to plant hybrid seed, farmers needed cash to purchase the seed and fertilizer, and the seed was difficult to find when farmers needed it. The only disadvantage which farmers in Buhera mentioned was that when rainfall was below average, the hybrids yielded poorly.

Plant Spacing

Following recommended plant spacing gave a healthy crop stand in Mutoko/Mudzi and Buhera. In Buhera, farmers reported they also got high yields when they followed this spacing. The major disincentive in both Mutoko/Mudzi and Buhera was that it was difficult to accurately measure and maintain the recommended spacing.

Single Superphosphate

Farmers agreed that applying Single Superphosphate fertilizer gives rise to high yields and a healthy crop stand in both Mutoko/Mudzi and Buhera. The major drawback in Mutoko/Mudzi was cash to buy the input and difficulty sourcing the fertilizer locally. Buhera farmers reported that the input was expensive and, given the uncertain weather patterns, investment in single superphosphate was unprofitable.

Compound D

Advantages farmers gave for following the recommended application levels of Compound D fertilizer in Mutoko/Mudzi were mostly high yields and a good crop stand (in that order). But in Buhera, the order was reversed. The major drawbacks in Mutoko/Mudzi were the need to have cash on hand, the potential loss if rainfall was poor and the difficulty in finding this fertilizer. In Buhera, farmers reported that local input prices were very high and input application risky when seasonal rainfall was below average.

Ammonium Nitrate

The benefits reported for following recommended application levels of ammonium nitrate fertilizer were high yields and a good crop stand (in that order) for Buhera farmers. In Mutoko/Mudzi, the order was reversed. The main disadvantages reported in Mutoko/Mudzi were the riskiness of this practice when the rainfall was below average, the need to have cash and the difficulty in finding this input. In Buhera, the input was very expensive and risky to apply, resulting in negative economic returns.

Crop Rotation

The advantages reported for following the recommended crop rotations in Mutoko/Mudzi were the achievement of a healthy stand, high yields and maintaining soil fertility. In Buhera the benefits were high yields, a healthy crop stand and a reduction in the incidence of diseases and weed parasites. The main disincentive for farmers in both Buhera and Mutoko/Mudzi was that the amount of crop land was too small to make crop rotation feasible.

Timing of Superphosphate and Compound D

The benefits reported for applying compound D at planting in Mutoko/Mudzi were a healthy crop stand and high efficiency of utilising fertilizer (in that order). In Buhera, the benefits were reversed in order. The major drawback in both Mutoko/Mudzi and Buhera was the riskiness when the start of the season was delayed. Riskiness further deterred farmers from applying what they already considered a high priced input.

Table 11
Benefits from Following Maize Management Recommendations in Mutoko/Mudzi (M) and Buhera (B), 1987-88, Zimbabwe[a]

	BENEFITS													
	Higher Yields		Healthy Crop Stand		High Germination Rate		Early Maturing		Less Disease		Soil Remains Fertile		High Fertilizer Efficiency	
Recommendations	*M*	*B*	*M*	*B*	*M*	*B*	*M*	*B*	*M*	*B*	*M*	*B*	*M*	*B*
	PERCENT OF GROWERS													
1	29	39	8	23	29	27	33	8	0	0	0	0	0	0
2	7	22	83	69	0	0	0	0	0	0	0	0	0	0
3	64	15	0	85	0	0	0	0	0	0	0	0	0	0
4	78	31	11	67	0	0	0	0	0	0	0	0	0	0
5	27	15	51	85	0	0	10	0	0	0	0	0	0	0
6	25	48	30	25	7	0	0	0	0	25	0	23	0	0
7	7	14	53	27	0	10	0	0	0	0	0	0	24	41
8	38	30	23	58	0	0	0	0	0	0	0	0	0	0
9	51	28	38	72	0	0	0	0	0	0	0	0	0	0
10	42	13	12	23	0	0	0	0	29	63	0	0	0	0

[a] Sample size in Buhera (B) was 105 and in Mutoko/Mudzi (M) 147. These responses were obtained only from farmers growing maize. The row values for each location (*e.g.*, B) do not necessarily add up to 100 percent because less frequent responses are not shown.
Source: Food Security Surveys, 1987-89

Maize Recommendations:

1. Plant variety R201 mostly, R215 and R200.
2. Space between rows 90cm and 30cm within row.
3. Apply 25kg/acre Single Superphosphate
4. Apply 33kg/acre Compound D
5. Apply 33kg/acre Ammonium Nitrate.
6. Plant legumes before planting maize in the same plot.
7. Apply Compound D in rows or per station before planting.
8. Apply 2/3 of AN at knee height(4-6 weeks) and
9. Apply the remaining 1/3 at tasseling(8-10 weeks).
10. Prevent stalkborer by applying Dipterex or Thiodin(1-2 kg/acre).

Table 12
Disadvantages of following maize management recommendations in Mutoko/Mudzi (M) and Buhera (B), 1987-88, Zimbabwe.[a]

	DISADVANTAGES											
	Risky Due to Poor Rains		Very Low Return		Hard to Find		Requires Cash		Requires More Land		Hard to Measure /Follow	
Recommen-dations	M	B	M	B	M	B	M	B	M	B	M	B
	PERCENTAGE OF GROWERS											
1	7	92	0	0	10	0	42	6	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	69	50
3	8	43	0	11	38	6	48	37	0	0	0	0
4	23	32	0	20	19	12	36	16	0	0	0	0
5	32	19	0	13	20	10	24	37	0	0	0	0
6	0	0	0	0	0	0	0	0	48	76	34	21
7	54	30	0	18	5	8	16	17	0	0	0	13
8	43	26	0	10	0	0	26	39	0	0	0	12
9	35	21	0	8	18	0	29	33	0	0	0	17
10	0	0	11	0	17	0	50	0	0	0	0	0

[a] Sample size in Buhera was 105 and in Mutoko/Mudzi 147. These responses were obtained only from farmers growing maize.
The row values for each location (*e.g.*, B) do not necessarily add up to 100 percent because less frequent responses are not appearing.
Source: Food Security Surveys, 1987-89

Maize Recommendations

1. Plant variety R201 mostly, R215 and R200.
2. Space between rows 90cm and 30cm within row.
3. Apply 25kg/acre Single Superphosphate
4. Apply 33kg/acre Compound D
5. Apply 33kg/acre Ammonium Nitrate.
6. Plant legumes before planting maize in the same plot.
7. Apply Compound D in rows or per station before planting.
8. Apply 2/3 of AN at knee height(4-6 weeks) and
9. Apply the remaining 1/3 at tasseling(8-10 weeks).
10. Prevent stalkborer by applying Dipterex or Thiodin(1-2 kg/acre).

Ammonium Nitrate Timing

Following the recommended timing for ammonium nitrate application gave rise to high yields and a good crop stand in both Mutoko/Mudzi and Buhera. The main drawbacks were the uncertain weather patterns and the need to have cash on hand in both Mutoko/Mudzi and Buhera. This input was expensive in Buhera, lowering its profitability.

Insecticide

The benefits reported for using Dipterex for controlling stalk-borer were higher yields and reduction in the incidence of this pest. In Buhera, the advantages were curtailing the incidence of this pest and giving a healthy crop stand. The major disincentives in both Mutoko/Mudzi and Buhera were the very high input price, the difficulty in finding the input and the need to have cash on hand. Overall, given their resource and crop environment, farmers had rational reasons for not adopting many of the recommended practices.

Adoption of the Recommendations

Mutoko/Mudzi farmers had tried and adopted more of the recommendations than their counterparts in Buhera, Table 13. Recommended seed varieties, plant spacings and crop rotations were widely accepted by farmers in Buhera.

Reasons and Alternatives to not Adopting Recommendations

Fertilizer Levels

Farmers in Mutoko/Mudzi reported they did not try recommended levels of Compound D (83 percent) and Ammonium nitrate (90 percent) because they could not afford this input, Table 14. Some farmers select parcels with a high percentage of clay for maize and apply lower levels of compound D (71 percent), provided they could buy it. Others do not apply the fertilizer, Table 15. Instead of applying recommended levels of top dressing, farmers either applied manure (53 percent) or lowered their application rates (42 percent). In Buhera, after initially adopting fertilizer, some farmers did not continue to use basal (79 percent) and top dressing (85 percent) fertilizers.

Table 13
Pattern of Maize Recommendations Awareness, Trial and Adoption in Mutoko/Mudzi and Buhera, 1987-88, Zimbabwe[a]

	Awareness		Trial		Adoption	
	M/M	B	M/M	B	M/M	B
Recomm-endations	PERCENT OF GROWERS					
1	93	98	85	92	85	91
2	49	34	31	29	26	26
3	b	b	b	b	b	b
4	38	20	22	b	b	b
5	41	20	25	b	23	b
6	50	48	37	45	31	43
7	60	27	47	b	40	b
8	58	25	40	b	29	b
9	46	b	25	b	b	b
10	73	b	36	b	37	b

[a] Farmers who planted maize in Buhera were 105 and in Mutoko/Mudzi 147
[b] < 20%.
Source: Food Security Surveys, 1987-89

Recommended Cropping Practices Maize

1. Plant variety R201 mostly, R215 and R200.
2. Space between rows 90cm and 30cm within row.
3. Apply 25kg/acre Single Superphosphate
4. Apply 33kg/acre Compound D
5. Apply 33kg/acre Ammonium Nitrate.
6. Plant legumes before planting maize in the same plot.
7. Apply Compound D in rows or per station before planting.
8. Apply 2/3 of AN at knee height(4-6 weeks)
9. Apply the remaining 1/3 at tasseling(8-10 weeks).
10. Prevent stalkborer by applying Dipterex or Thiodin(1-2 kg/acre).

Table 14
Farmers' reasons for not following maize recommendations, in Mutoko/Mudzi (M) and Buhera (B), 1987-88, Zimbabwe.

	RECOMMENDATIONS														
Reasons	2		4		5		6		7		8		9		10
	M	B	M	B	M	B	M	B	M	B	M	B	M	B	M
	PERCENT OF NON-USERS														
No Money	0	0	83	79	90	85	0	0	66	64	76	47	60	0	86
Difficult to Obtain	0	0	0	0	0	0	0	0	14	14	20	21	33	0	0
Fields are Small	0	0	18	0	0	0	69	0	0	0	0	0	0	0	0
Difficult to Follow	69	71	0	14	0	0	17	0	10	14	0	21	0	0	0

[a] The percentages are based on the proportion of farmers who had tried but did not continually follow the practice, (*i.e,* % trial - % adoption = % that did not follow, from Table 3)
The column values for each location (*e.g.*, B) do not necessarily add up to 100% because other less frequent responses are not appearing.
Source: Food Security Surveys, 1987-89

Recommended Cropping Practices : Maize

1. Plant variety R201 mostly, R215 and R200.
2. Space between rows 90cm and 30cm within row.
3. Apply 25kg/acre Single Superphosphate
4. Apply 33kg/acre Compound D
5. Apply 33kg/acre Ammonium Nitrate.
6. Plant legumes before planting maize in the same plot.
7. Apply Compound D in rows or per station before planting.
8. Apply 2/3 of AN at knee height(4-6 weeks)
9. Apply the remaining 1/3 at tasseling(8-10 weeks).
10. Prevent stalkborer by applying Dipterex or Thiodin(1-2 kg/acre).

Table 15
Farmers' alternatives to following maize recommendations, in Mutoko/Mudzi (M) and Buhera (B), 1987-88, Zimbabwe.

	RECOMMENDATIONS														
Alternatives	2		4		5		6		7		8		9		10
	M	B	M	B	M	B	M	B	M	B	M	B	M	B	M
	PERCENT OF NON-USERS														
Nothing	0	0	29	61	0	15	100	0	10	39	93	32	0	0	100
Lower levels	20	0	71	0	42	0	0	0	0	0	0	0	0	0	0
Use feet to measure	66	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apply manure	0	0	0	39	53	85	0	0	31	62	0	68	0	0	0
Apply after planting	0	0	0	0	0	0	0	0	59	0	0	0	0	0	0
Apply once	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0
Dribble behind plough	0	34	0	0	0	0	0	0	0	0	0	0	0	0	

Source: Food Security Surveys, 1987-89

Recommended Cropping Practices : Maize

1. Plant variety R201 mostly, R215 and R200.
2. Space between rows 90cm and 30cm within row.
3. Apply 25kg/acre Single Superphosphate
4. Apply 33kg/acre Compound D
5. Apply 33kg/acre Ammonium Nitrate.
6. Plant legumes before planting maize in the same plot.
7. Apply Compound D in rows or per station before planting.
8. Apply 2/3 of AN at knee height(4-6 weeks)
9. Apply the remaining 1/3 at tasseling(8-10 weeks).
10. Prevent stalkborer by applying Dipterex or Thiodin(1-2 kg/acre).

Because of cash constraints, Table 14. Some farmers (85 percent), however, use kraal manure, Table 15. Others (15 percent) did not add any nutrient to their fields for fear of losing the crop. Biological evidence has proved the need for a minimum amount of moisture in the soil to allow survival of organisms responsible for making the nutrients available from kraal manure. In some parts of Buhera, soil moisture levels were very low because of low rainfall and high evaporation rates.

Timing of Top Dressing

In Mutoko/Mudzi, cash constraints (68 percent) limited some farmers ability to apply a split application of ammonium nitrate at knee height and at tasseling stages. Other farmers (25 percent) were limited by the lack of available fertilizer. Farmers who purchased fertilizer applied only at knee height stage (100 percent). Farmers who were unable to purchase fertilizer to apply at the knee height stage (4-6 weeks) also could not apply it at the tasseling stage (8-10 weeks). In Buhera, farmers reported that they did not have cash to purchase the required levels of fertilizer (47 percent). Furthermore, the fertilizer was not available for purchase (41 percent). The strategies available to farmers were to either apply manure before planting (61 percent) or apply no additional nutrient (39 percent).

Timing of Basal Dressing

Application of basal dressing was delayed by farmers in Mutoko/Mudzi because they did not have the cash to purchase fertilizer when planting took place (66 percent). Even if they had the cash, the fertilizer was not available to purchase (24 percent). The alternative strategies available were to apply it after germination (59 percent) or to apply manure before planting (31 percent). In Buhera, farmers did not have money (64 percent) to purchase fertilizer and it was not available for purchase (28 percent). Some farmers' strategy was to apply manure before planting (61 percent). Other farmers did not add any nutrient (39 percent).

Rotation

Farmers in Mutoko/Mudzi found rotations difficult to follow because their landholding was small (69 percent). Also, the ability to rotate was limited by the farmers' lack of knowledge on how to rotate the multiple crops they grew. Farmers had no alternative strategy and planted crops with limited rotation. In Buhera, farmers have adopted crop rotation with ease because of significantly larger landholdings and less land size constraints than farmers in Mutoko/Mudzi.

Plant Spacing

In Mutoko/Mudzi, farmers found it difficult (69 percent) to maintain the recommended spacing precisely but they relied on using their feet to maintain uniform spacing (66 percent). In Buhera, farmers also had difficulty (72 percent) maintaining the required spacing but their strategy was to dribble the seed behind the plough (34 percent).

Stalkborer Prevention

Farmers in Mutoko/Mudzi were not applying dipterex to control stalkborer because of cash constraints (86 percent). They had no alternative preventative measure except to lose part of their yields to the stalkborer. In Buhera, few farmers (<20 percent) were aware of the need to prevent the effects of the stalkborer. To the majority of farmers, use of Dipterex was still a recent technology. Even if farmers tried certain technologies, they only continued some of the techniques because of their resource circumstances. Farmers adopted techniques that suited their resource levels, environmental conditions and the existing institutions. Although there were potentially high returns to adopting some techniques, farmers were unable to exploit these to their advantage.

Because of the resource-poor nature of most farmers, adoption was successful only for selected techniques. This might indicate that farmers were seeking those techniques maximising returns to their inputs -- not necessarily those that maximise output. Farmers could achieve maximum output from adopting all recommendations for a particular crop but they were unlikely to maximise profits by adopting the complete package.

CONCLUDING REMARKS

This paper has highlighted the major constraints to improving crop productivity in marginal areas. Household resources were low and of poor quality. The supply of labour was limited by the high numbers of household members going to school and absent migrant labourers. Few farmers had adequate draft power and equipment, while the majority had none or inadequate draft power. The potential of increasing herd size in the communal areas was limited and alternative forms of draft power need to be sought.

Household income levels were relatively low and dependent on crop production. Resource productivity in cropping was reduced by the low environmental potential. Farmers in marginal areas depended less on crop income than farmers in favourable conditions. In the event of a drought, households relying mostly on cropping were usually unable to manage their normal expenditures. Farmers in marginal areas already were diversifying out of farming into other income generating activities which normally supplement crop income and are affected less by drought conditions.

Access to land was generally a less serious problem in the study areas because the distribution was relatively even. However, access to good crop land was a major problem, particularly for young families because the soil fertility status of most communal soils was deteriorating.

Management skills were generally low among household heads. Skills were potentially limited by the low literacy, years in school, male absenteeism and limited exposure to extension meetings. Given the low resource levels of most communal farmers, few technologies were adopted. Very few techniques were new to farmers but only a few of these were tried and successfully adopted. Farmers draft power, labour, savings and land resource levels were limiting adoption of techniques that required additional resources. Also, inputs were not available when farmers wanted to purchase them and farmers attitude toward risk influenced their production decisions.

The study identified the major factors limiting productivity as levels of input application, rainfall characteristics of the natural regions and the quality of input application. Important inputs were seed, fertilizer and hours of weeding labour. Therefore, there is need to; (i) determine the most economic levels of input application in low rainfall areas to improve the efficiency of input use and (ii) determine ways of improving response to input application in low rainfall areas (NR V).

Important management variables were the planting date and the level of technical knowledge of the manager. Strategies that bring the planting date forward should be supported and farmers awareness of management techniques should be strengthened to improve the quality of input application.

Crop production techniques need to be fine tuned to suit the environmental conditions where adoption is anticipated. Natural region can reliably be used for generating and testing technologies for appropriateness.

Technology generating institutions have had a biased focus towards more favourable areas at the expense of marginal areas. The technologies generated to date are inappropriate for very dry areas which are more livestock than crop based. Farmers technical knowledge about modern crop practices declines with decreases in relative cropping potential. The focus of research institutions in marginal areas needs to be directed toward the existing potential of these areas to generate techniques that extension workers can successfully extend to farmers.

REFERENCES

Chopak, C. 1988. Family income source and food security. In: G. Mudimu and R. Bernsten eds. *Household and National Food Security in Southern Africa.* :193-208. UZ/MSU Food Security Project. Department of Agricultural Economics and Extension, University of Zimbabwe, Harare.

Chigume, S. and J.D. Shaffer. 1988. Farmer marketing strategies to improve food security. In: G. Mudimu and R. Bernsten eds. *Household and National Food Security in Southern Africa.* UZ/MSU Food Security Project. Department of Agricultural Economics and Extension, University of Zimbabwe, Harare.

Govereh, J. 1990. *Constraints to Increasing Crop Productivity in Marginal Rainfall Areas of Zimbabwe: Impact and Extent of Technology Adoption.* Unpublished M.Phil thesis. Department of Agricultural Economics and Extension, University of Zimbabwe, Harare.

Jackson, J. and P. Collier. 1988. Incomes, poverty and food security in the communal lands of Zimbabwe. *RUP Occasional Paper No.11.* Department of Rural and Urban Planning. University of Zimbabwe, Harare.

Mudhara, M. 1990. *The Economic Analysis of Maize Production and Farm Management Strategies in High Risk Conditions of Zimbabwe.* Unpublished M.Phil thesis. Department of Agricultural Economics and Extension, University of Zimbabwe, Harare.

Mudimu, G., C. Mbwanda, S. Chigume and J. Govereh. 1987. Household food security in low rainfall areas of Zimbabwe: Initial findings in Mudzi, Mutoko and Buhera Communal areas. In: M. Rukuni and R. Bernsten eds. *Southern Africa: Food Security Policy Options.* :217-234. UZ/MSU Food Security Project. Department of Agricultural Economics and Extension, University of Zimbabwe, Harare.

Mudimu, G., C. Chopak, S. Chigume, J. Govereh and R. Bernsten. 1989. Household income, food production and marketing in low rainfall areas of Zimbabwe: status, constraints and opportunities. In: M. Rukuni, G. Mudimu and T.S. Jayne eds. *Food Security Policies in the SADCC Region.* :169-190. UZ/MSU Food Security Project. Department of Agricultural Economics and Extension, University of Zimbabwe, Harare.

Rohrbach, D. 1987. The growth of smallholder maize production in Zimbabwe (1979-1985): Implications for food security. In: M. Rukuni and R. Bernsten eds. *Southern Africa: Food Security Policy Options.* :307-328. UZ/MSU Food Security Project. Department of Agricultural Economics and Extension. University of Zimbabwe, Harare.

Stanning, J. 1987. Policy implications of household grain marketing and storage decisions in Zimbabwe. In: M. Rukuni and R. Bernsten eds. *Southern Africa: Food Security Policy Options.* :329-360. UZ/MSU Food Security Project. Department of Agricultural Economics and Extension, University of Zimbabwe, Harare.

15

Informing The Process of Agricultural Market Reform In Mozambique: A Progress Report[1]

Leopoldina Dias,[2] Mathias I. Mugabe,[2] Raul Varela,[3] Timothy Finan[4] David Tschirley[5] and Michael Weber[5]

INTRODUCTION AND OVERVIEW

In early 1987, the Government of Mozambique embarked upon a series of major revisions in economic policy under the Economic Rehabilitation Programme (ERP). This programme, which affects agricultural input and output markets, exchange rates, and fiscal and monetary policy, is similar to those being instituted in other SADCC countries. Policy reform programmes are being adopted throughout the region which attempt to give a greater role to "liberalised" markets. These programmes are predicated on the belief that markets will emerge and will allocate resources in such a way that stagnant economies once again will begin to grow and increase the living standards of the countries' rapidly growing populations.[6]

---

[1]This paper is prepared as part of the scope of work of the Mozambique component of the Food Security in Africa Cooperative Agreement DAN-1190-A-00-4092-00 between the United States Agency for International Development (USAID) and the Department of Agricultural Economics at Michigan State University. The authors wish to thank the Ministry of Agriculture, the Provincial Directorates of Agriculture in Nampula and Zambezia provinces, the Governor of Nampula province, and Julie Born at the USAID mission in Mozambique for their invaluable assistance during the appraisal team's stay. Any errors are strictly the responsibility of the authors.

[2]Ministry of Agriculture, Mozambique.

[3]Chief of Party, MSU/Mozambique.

[4]Professor, Department of Anthropology, University of Arizona.

[5]Professsors, Department of Agricultural Economics, Michigan State University.

[6]In Mozambique, it is generally agreed that economic reforms and massive donor assistance since 1987 have stabilized the economy and allowed a return to economic growth averaging two percent to four percent per annum.

There is little doubt that more efficient markets will help remedy some of the difficult problems affecting SADCC countries' agricultural sectors. But a number of characteristics of most SADCC economies force one to ask the difficult question of how these efficient markets will emerge. First, underdeveloped transportation, communication and marketing infrastructure inhibits market performance. Second, it is generally agreed that governments have under-invested in market support services such as market information systems, marketing research, credit for agricultural marketing, and quality grades and standards. Finally, these economies have long been dominated by command systems where resources have not been allowed to move freely in response to price and other market signals. Partly as a result of this lack of resource mobility, effective mechanisms for the vertical coordination of economic activity, including formal and informal market information systems, have not emerged.

Simply eliminating government controls and allowing resources to be allocated "by the market" may not yield the desired results. Government clearly must play a role in creating the institutional framework within which efficient and effective markets can emerge. One key element of this framework is market research and information. Developing and maintaining an active and accurate market research and information system is vital to the long term goal of a dynamic and decentralised economic system that uses market signals and complementary information to coordinate production and consumption decisions.

Purpose of this Paper

The purpose of this paper is to present the progress, to date, in the design of a pilot agricultural market information system (AMIS) in Mozambique. The authors recently conducted a three week rapid appraisal in the country. The team interviewed GOM and donor officials in Maputo, visited two provincial capitals, four district capitals and selected rural areas surrounding these district capitals. In each location, the team interviewed local officials, *lojistas*, wholesalers, and farmers. The information obtained shed a great deal of light on the structure of the Mozambican food system, on local perceptions of pricing and market regulation policies and on the problems facing traders and farmers in responding positively to the improved policy and security environment in the country. This paper reports selected findings of this field work and discusses their implications for the AMIS design.

This project is a collaborative applied research and policy dialogue activity between the Ministry of Agriculture of Mozambique and the Food Security in Africa Cooperative Agreement being implemented in the SADCC Region by Michigan State University (MSU) in collaboration with the University of Zimbabwe and the SADCC Food Security Technical and Administrative Unit in the Zimbabwe Ministry of Lands, Agriculture and Rural Resettlement. The Agricultural Economics Department of the University of Arizona will also participate in the work in Mozambique through a subcontract with MSU. Funding for this work is provided by the Government of Mozambique and the United States Agency For International Development.

The Importance of Market Information for the Management of Market Reform

As a result of improving security in the countryside and economic reforms initiated under the ERP, market determined prices are playing an increasingly important role in production and consumption decisions of Mozambique's 16,5 million people. Nowhere is this more evident than in the agricultural sector. In various types of informal markets (*dumbanengues* and *candongas*), in more traditional municipal markets and even in many independent retail stores (*lojas*), prices of a large number of liberalised and still officially controlled agricultural products are determined in a market setting. It is increasingly in these markets that the majority of the population (especially urban) obtains its food. The growing importance of market determined resource allocation in its economy has alerted the government of Mozambique (GOM) to the need to collect systematic price and other related market information.

Special Challenges in Mozambique

Given the depressed status of the economy, the heavy dependence on food aid and the widespread destruction of basic infrastructure in Mozambique, there are some special functions that an agricultural market information system will need to fulfill. First is the need for knowledgeable decisions about the relationships between the commercial food market and the food aid needs of those portions of the population that have no entitlements either because they do not produce enough for their own family needs or because they do not have enough cash income to acquire their food needs in the commercial market. Food aid, which arrives too late in too small quantities, can seriously affect their nutritional status.

A second challenge is to give priority focus to obtaining and disseminating information that will help stimulate the expansion of local food production to meet households' own consumption requirements as well as to meet effective commercial market and food aid demands. Too much food aid, or untimely releases onto the domestic market, can easily destroy the market incentive to expand local production. Balancing these short-term human welfare and longer term market development challenges requires that special efforts be made to prioritise the data to be collected and analysed and to provide public and private agents with timely information about the consequences of alternative options that affect both food aid and local production.

Finally, developing the human and institutional capacity in Mozambique to design and implement an ongoing market information system presents a challenge. Given the severe shortage of trained market analysts in the public and private sectors, the project will give special attention to in-service training and to finding new ways to expand the supply of locally trained analysts.

CURRENT AGRICULTURAL MARKET INFORMATION ACTIVITIES IN MOZAMBIQUE

The only systematic historical price information that has been available in Mozambique is the list of official prices set by the government. As a large parallel economy emerges in Mozambique, official price and quantity data measure a diminishing portion of real economic activity. In response to recent market liberalisation measures, various local and donor organisations have undertaken periodic *ad-hoc* price and market information collection activities. Among these is the United States Agency for International Development's (USAID) list of weekly retail market prices of selected goods in Maputo. This information increasingly has been used by both national and donor agencies concerned with the course of agricultural market reform in the country. This system, in the absence of systematic government efforts, has been quite useful.[7]

The Department of Food Security in the Ministry of Commerce (MOC) is planning to implement a monthly retail food price collection system in selected provincial capitals. A major objective of this effort is to provide the data necessary to estimate accurately the relative value of the subsidised food distribution activities being undertaken by the MOC. Should the system prove successful, it will be expanded to other provincial capitals.

Thus, price and other market information is becoming more available in Mozambique. But neither the USAID nor the MOC systems were designed to fill the needs of the country for a national agricultural market information system. If such a system is to be developed, a number of issues must considered. These include:

- the frequency of collection of price and other information;
- handling of non-standard units of measure;
- precise definitions of transaction levels and other concepts within the system;
- developing a workable plan for the processing of the data and dissemination of the results to priority users in both the public and private sectors; and,
- developing an applied market research and extension programme to complement price and quantity information.

---

[7]The Ministries of Finance and Planning each maintain a Consumer Price Index which is likely supported by systematic market price information. But these data are for internal use only and play little role in improving market information outside the two ministries.

Any information system in Mozambique will be constrained by the limitations of staff and recurrent budget support. Thus, the frequency with which data can be obtained and information disseminated is an open question. However, a number of factors make it clear that a national agricultural market information system must take more than one price observation per month. First, the price recorded may differ significantly from the monthly average price since it will be a single observation on a single day. Most monthly average prices are calculated from daily or at least weekly observations. Second, if for some reason the price is not collected for a given month, there will be a data void for that month. Weekly collection would increase the chances of there being at least some price observation during every month of the year. A well designed system will be capable of obtaining and disseminating weekly observations even given personnel and budget limitations.

Non-standard units of measure are common in Mozambican agricultural markets. The MOC and USAID systems have market reporters purchase the product in these units and weigh them to calculate a price per kilogram. This approach is probably appropriate for a system of modest scope. But it will quickly become both financially and administratively unworkable as the number of products, locations, and market levels increases. If a national agricultural market information system is to be developed, a method must be designed to deal with non-standard units.

It is important to develop a detailed plan for processing and analysing market data and disseminating results to outside users. Unless such a plan is developed, and the details of design and implementation are worked out, it is likely that the information will be utilised by a very small proportion of those who should have access to it.

Finally, as the generation and dissemination of basic price and other market information becomes routinised, the AMIS should expand its capacity to provide more in-depth market analyses and outlook information. This type of information is especially useful to market participants in forming reasonable expectations of future market conditions and effectively planning future production and marketing investments.

ISSUES IN THE DESIGN AND IMPLEMENTATION OF AN AGRICULTURAL MARKET INFORMATION SYSTEM

The design of the AMIS must take into account the current set of policies affecting agricultural production and marketing in the country together with planned reforms and the specific needs of the systems's intended beneficiaries.

Current Price and Marketing Policies and Planned Reforms

The information presented in Table 1 shows pricing policy for key agricultural and food products in Mozambique as of November, 1990. Table 2 summarises market regulation policies as of the same date. Agricultural pricing policy in Mozambique is changing from uniformly fixed prices at various market levels to a mixed, two-tier system.

Table 1
Pricing policies and Maputo parallel market prices for selected basic foods in Mozambique (November, 1990)

PRODUCT	FLOOR PRICE	OFFICIAL PRICES (MT/Kg)		PARALLEL MKT CONSUMER PRICES, MAPUTO (August 1990)
		PRODUCER	CONSUMER	
POLICY: OFFICIAL PRICES				
Yellow corn	None	None	190	369
Rice	None	167	Extra: 756 Med: 471 Low: 253	1214 1180 ----
Sugar	None	At Mill white: 450 brown: 351	white: 660 brown: 569	---- 939
Vegetable Oil	None	None	2286/lt	2875
Soap	None	None	1,102/bar	2354
POLICY: PRODUCER FLOOR PRICE, CONSUMER OFFICIAL PRICE				
Sorghum	109	None	170	----
Peanuts	259	None	497	2313
Dry Beans	Qual. 1: 264 Qual. 2: 184	None	Qual. 1: 461 Qual. 2: 333	1073 1318
POLICY: PRODUCER FLOOR PRICE ONLY				
White Maize	126	None	None	526
POLICY: NO OFFICIAL OR FLOOR PRICES				
Cassava	None	None	None	----

Notes:
1. Official prices are legally decreed and obligatory in nature. Floor prices are indicative prices to farmers and prices at which AGRICOM makes its purchases.
2. Maputo prices are from the USAID price collection system.

In this new system, the prices of some selected products will be completely liberalised while others will move to a "floor price" system. As initially conceived, the difference between the fixed price and floor price approaches was that the latter would set only one price -- the minimum producer price -- and leave prices at all other levels to be freely determined in a market setting. But, as can be seen in the table, beans, sorghum and peanuts are under the floor price system but also are subject to an official consumer price. White maize was moved to a true floor price system for the 1989-90 crop year.

Two comments are in order regarding pricing policy in Mozambique. First, as the data in the final column shows, consumer prices in Maputo parallel markets (where most households make their purchases) are significantly above official consumer prices. The GOM has implicitly accepted this situation by allowing *candongas* and municipal markets to charge market clearing prices. Second, reforms in pricing policy are frequently slow to be communicated to and implemented at the local level. Thus, local authorities may continue to operate under the old rules which allowed them to prevent product movement out of their area and required traders to pay official prices.

Table 2 shows that marketing regulations have been substantially relaxed by Maputo, but that local practice continues to be more restrictive than the new policy permits. As a result, large spatial price differentials exist for some commodities. For example, during late October, bean prices in Maputo were between Meticais 2,500 and 3,000 per kilogram, while the same beans were being sold for MT 1 000/kilo in Nampula.[8] It appears unlikely that the lack of security alone would cause this differential since other products were being successfully and regularly shipped from Nampula to Maputo.

This brief review of "theory versus practice" in agricultural pricing and market regulation policies makes it clear that government needs information on parallel market prices and marketing practices (market entry, product movement) at the district and provincial levels if is to be informed on the progress of policy reform in the country.

Agricultural Market Information System Users and Beneficiaries

In conceptual terms, an effective information system offers advantages to all market agents from producers to consumers. Government also derives important benefits from a well-functioning information system. A transparent market informs on areas of critical scarcity as well as on areas of potential surplus. This supports the development of market policies based on the realities of relative supply and demand.

---

[8]These prices were for good quality *feijao manteiga castanha.*

Table 2
Status of agricultural market regulation policies in Mozambique (November, 1990)

POLICY AREA	PAST POLICY	CURRENT POLICY	LOCAL PRACTICE *
Product Movement	Local authorities could prevent product from moving out of district if deemed necessary for local food security	All products are free to move across district and provincial borders	Local authorities in some areas continue to regulate some product movement
District Wholesaling	Government granted geographic and product monopolies to individual traders who were to purchase all product and sell to the state marketing board, and receive food and consumer goods from government for distribution at official prices.	Any trader who can meet minimum capital requirements can receive a wholesalers' license	Some market entry has taken place, but former monopolists continues to enjoy dominant market position
Licensing practices	Licenses explicitly limited a trader to specific goods and a specific geographic area Licensing process has been quite long, to the point of being a potential barrier to entry	Formal licensing policy is unchanged Licensing process appears to have become more streamlined at the provincial level	Product and area restrictions not uniformly enforced

* As observed during the rapid appraisal mission.

Needs and Benefits for Farmers

For farmers, information on alternative markets for outputs can lead to changes in marketing behaviour. First, access to price information at different market levels (such as wholesale centers) and in different market locations (such as neighbouring districts), can improve farmers bargaining position with local traders. Market information also encourages arbitrage, and, as traders appear in surplus localities to move output to deficit localities, the number of alternative buyers for a given producer increases intensifying competition at the farm gate. Similarly, farmers in

Nampula and Zambésia lack information on the availability of necessary inputs, especially small tools (enxadas, catanas, and machados) and seeds. A market information system could communicate local availabilities of inputs to farmers and the level of effective demand to suppliers.

Needs and Benefits for Traders

Traders need knowledge of intra and interprovincial price differences in order to identify opportunities to profit from moving agricultural output from surplus areas to areas of relative scarcity. They also require information regarding the availability of transport, the schedules of food aid and commercial import arrivals, storage capacities, and relevant government regulations. The market information system should be able to provide this information on a regular basis. Many districts in Nampula and Zambésia produce surpluses, but there are deficit areas within and outside the provinces. Price and complementary market information represents the knowledge base on which product movement strategies can be formulated. While large traders will benefit from information on regional price variation and other market factors, small traders can also derive an advantage. A transparent market implies open access to market knowledge. An improved market information system offers small traders the needed knowledge base on alternative markets and lowers the costs of entry. More buyers improve competition.

Traders and farmers require information on intertemporal price changes to plan their annual marketing strategies. For example, in Nampula and Zambésia, a distinct season of reduced supplies occurs from December to May at which time new crops begin to appear. During this *época de fome* (hungry period), prices for food stuffs, especially manioc flour, rise significantly. Temporal arbitrage in a competitive market should benefit manioc producers and traders who store in anticipation of the price changes. An efficient market information system disseminates this knowledge on price variation to all market participants.

Market participants need information on which to base <u>expectations</u> of future price change. Generally, this information is derived from analysis of seasonal price movements in past years. The AMIS will not immediately be able to provide data for this analysis but will be able to provide it in the future. In the short term, it can contribute to informed storage decisions by providing broad access to information on price movements and relative supplies in geographically separate areas as well as anticipated food aid and food import arrivals.

Needs and Benefits for Consumers

Improved market information should benefit consumers in two principal ways. Increased integration will tend to reduce prices in deficit areas, increase them in surplus areas and stabilise them in both areas. While some consumers might pay higher prices at times, due to product movement out of their area, all consumers should enjoy more stable supplies and prices. Second, better market information will tend to increase the competitiveness of markets (*i.e.*, reduce market power) by increasing transparency for all current and potential market participants and by reducing the barriers to entry. To the extent that this occurs, all consumers will benefit from lower prices.

Needs and Benefits for Government Policy Makers

Government's need for improved market information is clear. The gap between policy reform declarations and practice at the provincial and district levels is obvious. Government must be aware of this gap if it is to effectively design and implement complementary policies and programmes to accompany the market information system. Information alone is not enough. Market participants need the ability to act upon this information. This is provided by effective transportation, storage and marketing infrastructure, streamlined licensing practices, readily available credit, and local authorities who do not interfere with decisions of farmers, *lojistas*, wholesalers and retailers. Better information for national and local policy makers will enable them to pinpoint areas where special initiatives are necessary to facilitate positive responses to reforms.

RAPID APPRAISAL FINDINGS: IMPLICATIONS FOR THE AGRICULTURAL MARKET INFORMATION SYSTEM

The rapid appraisal conducted by the GOM/MSU/UA team shed light on the functioning of the agricultural marketing system in Nampula and Zambezia provinces and highlighted a number of problems which have important implications for the design of the AMIS.

There are several key actors in Mozambican food markets. The *lojista*, or local store owner, serves as the first buyer of both food and cash crops for most farmers and sells food and basic consumer goods to farmers and other consumers. The *ambulante* is a new market entrant with no fixed place of business who travels into production areas and purchases product for resale in population centers. The wholesaler, has enjoyed a legal monopoly in his district and continues to have great advantages over all potential competitors. The informal retailer, operating in municipal markets or *candongas*, sells to consumers in small volumes at market prices. The AMIS needs to reflect the prices paid and marketing activity taking place at each of these market levels.

Results of the Appraisal

The principal problems uncovered by the rapid appraisal relate to:

- a pervasive condition of impacted information;
- entrenched market power at the wholesale level; and,
- high costs and unit marketing margins.

Impacted Information

The appraisal team found that local administrators, traders and farmers were unaware that official prices for white maize had been eliminated in May 1990, and that movement restrictions on white maize and other products had been lifted around the same time. In addition, some traders (and especially farmers) were only dimly aware of prices in even nearby markets. Finally, traders in outlying areas had little idea of how to penetrate the market in larger population centers.

This lack of information regarding policy changes, price relationships and marketing opportunities has had serious repercussions on the marketing and production system. For example, traders in one region with a marketable surplus became aware that retail prices for white maize in the provincial capital were double the prices they were receiving from wholesalers. Transporting maize to the capital in anticipation of an attractive price, they had difficulty finding a buyer and were unable even to recover their transport costs. *Lojistas* in another area had quit purchasing surplus grain at the farm level because their established wholesaler had not yet broken out of the official marketing channel, thus, was not being paid by the state marketing firm. Most disturbing of all, some farmers complained of an inability to sell all the grain they wished to sell, while nearby, people pushed off their land by the war subsisted on inadequate emergency shipments of donated grain.

Market Power

The market power of existing wholesalers stems largely from their protected status under the old policies and from the lag with which private agents and local government authorities are adapting to the new policy environment. Other than those belonging to the state marketing firm AGRICOM, wholesalers own the only storage facilities. They also enjoy long-standing relationships with AGRICOM and utilise its storage capacity when necessary. They have an established chain of *lojistas* with whom they work. These store owners may find it difficult to step beyond this long-standing relationship and form broader market connections. Finally, wholesalers are in a position to obtain preferential access to what little formal credit is available for marketing activities.

Ambulantes are beginning to challenge existing marketing structures. But the barriers they face can be daunting. The team discovered incidents in which local authorities, concerned with what they perceived to be disorder caused by the entrance of *ambulantes* into the market, had attempted to assign specific geographical areas to specific *lojistas* and wholesalers and to keep *ambulantes* out of the market. Until local authorities and established private agents begin to rethink government's role in light of the new opportunities opened up by market liberalisation, the pace of real reform at the local level will be slow. Markets will remain uncompetitive and will be unable to provide production incentives to producers and lower retail prices to consumers.

High Unit Costs and Marketing Margins

High unit costs and marketing margins are partly a result of impacted information and wholesaler market power. Contributing factors include poor infrastructure for storage, transportation, processing and marketing, and the low purchasing power of consumers. Impacted information and market power make for poor vertical coordination within the system. As a result, new entrants or existing traders attempting to operate outside the established system face high risk and high transaction costs which they must pass on to consumers. All traders face high storage losses, expensive and scarce transport, high milling costs (for maize meal and rice) and inadequate wholesale and retail market facilities. Finally, low consumer purchasing power means that retailers must sell in small units -- thus are able to move only a small volume of product each day. Trade unit margins, therefore, must be large for the trader to earn a living.

Implications of the Findings for AMIS Output and Staffing

The rapid appraisal findings have important implications for the type of data which should be gathered by the AMIS, the type of information which should be published, the appropriate format the analytical capacity needed and the staffing required to obtain the data, generate the information and distribute the results. The team envisions three components to AMIS:

- weekly radio and written bulletins;
- semestral situation and outlook reports; and,
- periodic research reports.

Weekly reports will rely solely on weekly market data. The semestral reports will complement these with additional data gathered on a monthly or less frequent basis. The periodic analytical reports will be primarily based upon data gathered through farmer and trader level surveys.

Weekly Radio and Written Bulletins

The written bulletins will report market and price supply information. The bulletin will utilise both tables and graphs with short explanations. They will not exceed 10 to 12 pages and their production will be automated. Emphasis will be on efficiently producing a continuous outflow of market price and supply information, saving a maximum of person-hours for producing high quality semestral and periodic analytical reports. Selected price and market supply information drawn directly from the written bulletin will be disseminated *via* radio.

Semestral Situation and Outlook Reports

The fundamental purpose of these reports is to provide a six month review of the status of the principal agricultural markets over the six month period and to provide reasonable forecasts of the next six months. A secondary purpose will be to report in depth on a current issue of importance regarding agricultural marketing, production or policy. Tentative publication dates are July, just after harvest, and February, which is the peak of the hungry season.

The reports will be based primarily on market, price and supply data for the previous six months, complemented by other information and analyses. The *Review of the Market* will summarise levels, variability and trends over the past semester for prices, market supply, selected spatial price relationships (relative to transport costs) and selected marketing margins. It will review trends in market entry and document the timing, volume and distribution of food aid arrivals.

A temporal perspective on marketing margins and market entry is especially important. Mozambique is undertaking an ambitious market liberalisation programme and the security situation is improving. The ease of entry, especially at the wholesale level, will be one of the key indicators of the success of market regulation and pricing policy reforms. The AMIS should be able to systematically inform policy makers regarding progress on this issue. It is also hypothesised that, as the security situation improves, as new participants enter the market, and as new entrants and established actors begin to effectively coordinate their marketing activities, marketing margins will fall.

The *Market Outlook* will present information on the planned timing, volume and distribution of food aid for the next six months. This information, and that regarding production and commercial imports, will be used to forecast prices and supply for selected crops. Each situation and outlook report will contain a final section which analyses a special problem of current interest.

Systematically publishing these reports will place special demands on AMIS staffing and on data processing capacity. The system will require, at the regional level, a market researcher whose principal job is to be the system's "eyes, ears and mouth". This person's role will be to collect and enter monthly data on marketing costs, to detail how the agricultural marketing system functions in the project area and to coordinate the dissemination of the information generated.

<u>Standardised and preprogrammed analysis routines and output formats</u> must be used for price and related data processing if the task of entering and processing market data, and generating and presenting market information is to be manageable. The project will invest resources to develop automated procedures and programmes and to train Mozambican staff.

Periodic Research Reports

Mozambique desires to achieve more open and efficient agricultural markets. To accomplish this, policy makers require a broad range of basic rural sector information as well as analysis of key policy issues during the transition period. Baseline surveys will be conducted to respond to this need among a sample of farmers and traders in at least two districts of Nampula province. Selected areas of Zambezia province may also be included if necessary and feasible. These surveys will generate information on farm, household and market structures; production and marketing practices and plans; and constraints to increased production and marketing of cash and food crops. This information, while not strictly representative of the country or even the province of Nampula, will provide an improved understanding of the rural economy on which to base policy and project initiatives. The research team anticipates that these surveys will help identify important issues requiring more research.

The team has identified two issues currently of special importance:

- the appropriate role of AGRICOM in a liberalised market economy; and,
- the interaction of cash and food cropping in the family farm sector.

Although the GOM is moving towards an open, private market system, there are many constraints to private as well as public sector actions. The research team was able to identify problems such as long-standing market power at the wholesale level, poor storage and transportation infrastructure and poor or non-existent credit markets as serious impediments to the emergence of efficient agricultural markets in Nampula Province. Given these conditions, can AGRICOM, under an appropriate institutional organisation and set of policies, partially alleviate some of these problems while, at the same time, facilitating the emergence of an improved private market. Given that a parastatal operates under financial, analytical and managerial constraints which limit its potential effectiveness, and given the limitations of both the private marketing system and parastatal organisations, what role might AGRICOM play in facilitating the transition to a competitive and dynamic private marketing system?

The interaction of cash cropping and food cropping, as it effects small farmer food security, continues to be a controversial issue. This issue is of interest in Mozambique for two reasons:

- the country has a long history of cash crop production by family farmers; and,
- very large agro-industrial enterprises which produce, process and market cash crops are being established.

In Monapo district of Nampula province, a large cotton enterprise is being developed in which family sector farmers play an important production role. Similar activities with cotton and other crops are being initiated in other areas of the country. Research to identify policy options that maximize the beneficial effects of these activities to family farmers, is essential.

16

Do Underdeveloped Rural Grain Markets Constrain Cash Crop Production In Zimbabwe? Evidence From Zimbabwe

Solomon Chigume and T.S. Jayne[1]

INTRODUCTION

The expansion of oilseed crops -- cotton, sunflower, and groundnuts -- present major opportunities for foreign exchange generation and income growth among Zimbabwe's smallholders. It has been estimated that these crops provide higher returns per acre than grain crops in many smallholder areas, especially those in semi-arid locations (Ministry of Lands, Agriculture and Rural Resettlement (MLARR), 1990). Cotton and groundnut exports also appear to generate foreign exchange more efficiently than maize in Zimbabwe (Masters, 1990). Considering the stockpiles of grain currently burdening the government budget, efforts to promote diversification into higher-valued cash crops could beneficially affect government budgets, hard currency earnings and farmers' income.

Except for a handful of communal areas, oilseeds constitute only a minor share of smallholder cropped area. This is especially ironic for the semi-arid areas, considering the drought-tolerance of oilseeds compared with maize.[2] Several constraints to the expansion of oilseed production are well-known: poor seed delivery systems, disease and pest problems and low adoption rates of AGRITEX-recommended production practices (Govereh, 1990; Mudimu *et al.* 1990).

This paper focuses on how production of high-valued cash crops may be constrained by marketing problems in the grain sub-sector. The analysis finds that the higher

---

[1]Research Scholar and Deputy Co-Director, UZ/MSU Food Security Research in Southern Africa Project and Visiting Lecturer, Department of Agricultural Economics and Extension, UZ.

[2]For example, the combined area cropped to sunflower, groundnut, and cotton constituted less than 17 and 10 percent of total cropped area in two semi-arid communal areas surveyed in 1988-89 (Mudimu *et al.* 1990).

financial returns to oilseeds as compared with marketed maize production may be negated if the grain marketing system cannot deliver low cost grain to rural areas. The price many rural consumers in semi-arid areas pay for maize (*i.e.*, the retail price of roller meal) is 110 percent more than for the price which many smallholders sell maize (*i.e.*, the GMB producer price of maize). This difference between producer and consumer prices means that the household value of maize may be quite different depending on whether the household is a grain seller or grain buyer. If the latter, normalising for labour time, oilseed production rarely provides greater returns per acre than maize for home consumption. The consumer price is often the more relevant value of maize in semi-arid areas, where the majority of smallholders are net purchasers of grain.

This conclusion is derived from The Ministry of Lands, Agriculture and Rural Resettlement's farm budget data (MLARR, 1990). These data are analysed *via* a model that estimates the cost-effectiveness of two alternate strategies: (1) growing oilseeds for cash to buy back maize to eat, or, (2) growing maize for home consumption. The analysis also determines how low the acquisition price of maize meal must be for oilseed production to be viable in six of the communal areas studied by MLARR.

The results also suggest that price incentives to stimulate oilseed production may have concentrated benefits among relatively wealthy smallholders, similar to the grain sub-sector (Stack, 1989). Results from two semi-arid communal land areas indicate that household grain sales, oilseed sales, and *per capita* income are positively and significantly correlated. As with grain, the use of price incentives to stimulate oilseed production also may generate concentrated benefits among well-equipped farmers in high-potential areas.

CONCEPTUAL FRAMEWORK

A detailed analysis of farm production costs and returns was performed for eight communal areas by the Ministry of Lands, Agriculture and Rural Resettlement (MLARR, 1990). Table 1 presents the relative profitability of maize and oilseed crops grown in these areas as measured by gross margins and returns to own labour. These rankings are based on average prices received for various crops in the respective communal areas.

In the high-potential areas, maize appeared to be the most profitable crop, on average, in two of three cases. This is due in part to the suitability of the areas to maize production with yields of 2,9 tonnes, 3,2 tonnes and 3,7 tonnes per hectare in Kandeya, Chirau and Chiweshe, respectively.

Table 1
Ranking of crop profitability as measured by gross margins and returns to own labour in high and low rainfall areas of Zimbabwe (MLARR Farm Management Survey, 1988-89 Crop Season).

COMMUNAL LAND	GROSS MARGIN ($ per hectare)	RETURN TO OWN LABOUR ($ per hour)
High Rainfall:		
Chiweshe	maize	maize
	groundnut	groundnut
	sunflower	sunflower
	cotton	cotton
Kandeya	maize	maize
	cotton	cotton
	sunflower	sunflower
	groundnut	groundnut
Chirau	cotton	cotton
	maize	maize
	groundnut	sunflower
	sunflower	groundnut
Low Rainfall:		
Buhera	groundnut	groundnut
	sunflower	sunflower
	maize	maize
Mutoko	groundnut	groundnut
	sunflower	sunflower
	maize	maize
Nyajena	groundnut	groundnut
	sunflower	maize
	maize	sunflower
	cotton	cotton
Zvishavane	maize	maize
	sunflower	groundnut
	groundnut	sunflower

Source: MLARR, 1990.

In the semi-arid areas, maize was outperformed by groundnuts and sunflower in three of the four communal areas surveyed as measured by returns per hectare. Groundnuts also provided higher returns to labour than maize in three of the four cases. It must be noted that MLARR presents the cost, yield, and revenue data averaged across all households surveyed in each communal land. Variability in management and other practices may cause the relative ranking of crop profitability to differ somewhat among smallholders within a given area.

Relative returns to marketed crop production, however, may not accurately reflect smallholders' allocation decisions, especially in the grain-deficit areas of Natural Regions IV and V where 60 percent of Zimbabwe's communal population resides. Available survey data indicate that most households in these areas sell little or no grain -- most rely on the market for the purchase of residual grain requirements to feed their families, Table 2. For these households, the decision to grow a hectare of oilseeds must be at the expense of a hectare of food grain for home consumption. Thus, the decision facing these smallholders is whether to (1) grow oilseed or other crops for cash to buy back maize for home use, or, (2) to produce the maize directly for home use. Option (1) entails buying maize or maize meal at the acquisition price in rural areas. The amount of oilseed revenue per land unit remaining after buying back the quantity of maize that could have been produced on that land for home consumption may be evaluated by the following equation:

(1) $$NR_i = Y_i - [(Q_{mz})(s)(xr)(PC_{mz}) - (Q_{mz})(mc)] + (L_{mz} - L_i)w$$

where: NR_i = net returns per hectare from growing oilseed crop i for cash to buy maize for consumption;

Y_i = gross margin of oilseed crop i (\$/ha);

Q_{mz} = maize yield per hectare (kgs/ha);

s = 1 - storage loss factor (proportion of maize production that is consumed over one year);

xr = extraction rate from maize to maize meal (%);

PC_{mz} = acquisition price of maize meal in rural area (\$/kg);

mc = milling cost facing the household to convert maize to maize meal (\$/kg);

L_{mz} = labour input into maize production (hours/ha/year);

L_i = labour input into crop i production (hours/ha/year); and,

w = opportunity cost of own labour (\$/hour).

Table 2
Importance of alternative grain marketing channels used by households in selected semi-arid communal areas.

Communal Areas	Natural Region	% of Households That Are Net Grain Purchasers	% of Total Household Grain and Meal Purchases From			
			GMB	Neighbouring Households	Informal Traders	Shops
			Grain			Meal
Gokwe (south)[b]	III	12	7	80	13	0
Gokwe (north)[b]	IV	59	10	44	36	10
Buhera (north)[b]	III	26	16	70	1	13
Buhera (south)[b]	IV, V	57	0	36	11	53
Runde[b]	III, IV	61	0	23	37	40
Mberengwa[b]	IV, V	85	26	15	17	42
Nata[c]	IV	94	0	7[a]		92
Ramakwebana[c]	V	96	0	13[a]		87
Semukwe[c]	V	98	0	21[a]		79

Note: [a]The distinction between purchases from households and informal traders was not made in this study.
Source: [b]UZ/MSU/ICRISAT Grain Marketing Surveys, 1990; the quality of harvests in these areas during the survey period ranged from average to poor. [c]Hedden-Dunkhorst, Bettina, 'The role of small grains in semi-arid smallholder farming systems in Zimbabwe: preliminary findings', draft mimeo, SADCC/ICRISAT, Matopos; the quality of harvest in these areas during the survey period was poor.

This equation is composed of four terms: The first term, (Y_i), is the revenue generated after production costs (excluding own labour) for growing one hectare of oilseed crop i for sale, are subtracted. But cultivation of this crop means that one hectare of maize for home consumption is foregone. The second term, $(Q_{mz})(s)(xr)(PC_{mz})$, subtracts the cost of obtaining the amount of maize meal that could have been produced on that hectare, accounting for storage losses and grain-to-meal milling losses incurred by the household if it produced and processed the maize itself. The third term, $(Q_{mz})(mc)$, accounts for the advantage of oilseed sale/maize meal purchase by avoiding the cost of milling the own-produced maize for home use. The fourth term, $(L_{mz} - L_i)w$, accounts for differences in own-labour time per hectare between maize and crop i. Own labour is valued at the reservation wage used by MLARR in the respective areas (MLARR, 1991 :49).

The viability of producing oilseeds for cash to buy back maize is affected by the acquisition price of maize meal in rural areas. Table 2 shows the relative importance of various channels through which households purchased grain in seven communal lands during the 1989-90 marketing year. Purchases of commerical maize meal were the dominant form of acquiring grain in most areas, particularly the most severely grain deficit areas. The problems associated with acquiring grain through rural informal channels is discussed in more depth in Chisvo *et al.* 1990.

The control price of commerical maize meal is Z$0,47 per kg. This is significantly higher than the range of acquisition prices observed for maize through informal channels during 1990.[3] The commercial meal price is 110 percent higher than the GMB producer price. This indicates that the value of maize production may vary greatly depending on whether the household is a grain seller or buyer.

RESULTS

Equation (1) is calculated using farm production costs, yields, labour input and oilseed prices from MLARR, 1990. Average annual storage losses are set at 20 percent. Milling costs (Z$0,052 per kilogram) and grain-to-meal conversion rates facing the household (0,95) are from Jayne *et al*, 1990.[4]

The net revenue to the household from growing cotton, sunflower and groundnuts for cash to buy maize meal is presented in Table 3. Column 1 presents net revenues assuming the control price of commercial maize meal (Z$0,47).[5] In each of the areas where cotton and sunflower production were analysed by MLARR, the strategy of growing these crops for cash to buy maize meal was, on average, a loss-making endeavor. Groundnut sale/maize meal purchase strategy resulted in a loss, on average, in four of six cases. The productivity of oilseeds in these areas, during the crop year in question appears to be simply too low relative to maize meal acquisition prices to make this strategy viable. The situation facing households deciding how to allocate crop land remaining after devoting sufficient area to meet annual food consumption requirements is different. In this case, the decision may

---

[3]These prices ranged from Z$0.21 to Z$0.42 per kg, depending on location, during the first six months of 1990. The cost of obtaining and milling the maize through informal channels, accounting for milling losses, was $0.37 per kg on average. Price monitoring surveys were conducted bi-weekly within eight semi-arid communal areas during 1990 by AGRITEX officials.

[4]This milling cost is 20 percent higher than the average milling cost found in surveys of 648 households and 52 informal millers operating in seven communal areas in Zimbabwe during 1990. Moreover, the grain-to-meal conversion rate is also 20 percent lower than the average found in these surveys. We have chosen these estimates to show the robustness of the results even when figures more advantageous to the oilseed sale/maize meal purchase strategy are used.

[5]Price monitoring surveys revealed that the actual prices paid by households for commercial meal frequently exceeded the control price in more remote rural areas further from urban mill distribution points.

be influenced by the relative returns to production for sale illustrated in Table 1. The contrasting results presented in Table 1 and Table 3 are due to the difference between the maize producer prices recorded by MLARR and the consumer price of commercial maize meal.

Table 3
Net returns of growing oilseeds for cash to purchase maize meal

COMMUNAL AREA	(1) RECORDED YIELDS (kgs)		(2) NET RETURNS FROM CULTIVATING: AFTER BUYING BACK MAIZE MEAL ($/HA)			(3) MAIZE MEAL PRICE AT WHICH OILSEED AND MAIZE PRODUCTION BREAK EVEN ($/KG)		
			Cotton	Sunflower	Groundnut	Cotton	Sunflower	Groundnut
BUHERA	maize:	785						
	sunflower:	258	na	-163,9	-7,9	na	,22	,45
	groundnut:	802						
CHIRAU	maize:	3,157						
	cotton:	776	-440,7	-932,2	-990,7	,31	,13	,12
	sunflower:	468						
	groundnut:	217						
CHIWESHE	maize:	3,661						
	cotton:	299	-1,118,9	-1,136,4	-972,4	,13	,13	,15
	sunflower:	454						
	groundnut:	578						
KANDEYA	maize:	2,939						
	sunflower:	138	-825,1	-502,5	-1036,6	,15	,21	,06
	groundnut:	367						
MUTOKO	maize:	1,146						
	sunflower:	598	na	-209,0	+263,6	na	,26	,74
	groundnut:	1,296						
NYAJENA	maize:	440						
	cotton:	810	-53,3	-47,7	+132,8	,33	,40	,82
	sunflower:	482						
	groundnut:	402						
ZVISHAVANE	maize:	572						
	sunflower:	131	na	-153,5	-206,6	na	,29	,27
	groundnut	173						

Source: Computed from data from MLARR, 1990.

How much lower must the consumer price of staple meal be to make oilseed production viable in these areas? This issue is relevant because not all rural households in deficit areas fill their residual grain requirements with commercial meal. Those able to buy grain and have it milled locally face a lower consumer price. By setting net revenue in equation (1) equal to zero and solving for PC_{mz}, one may discern the acquisition price of maize meal in a particular area at which it becomes profitable for grain-purchasing households to grow oilseeds for cash. These threshhold prices are presented in Column 3 of Table 3. In several cases, these prices are in the range of informal maize prices plus milling costs observed from price monitoring surveys in 1990. This suggests that a more reliable supply of grain through informal channels for rural consumers may promote diversification away from maize and into various oilseed crops. This must, of course, be complemented by improvements in seed distribution, management practices and other factors that currently constrain oilseed production in Zimbabwe.

Table 4
Correlation coefficient matric for selected household characteristics in Mutoko and Buhera communal areas

	X1	X2	X3	X4	X5	X6	X7	X8
X1								
X2	,04							
X3	,09	,23 **						
X4	,27**	-,00	,24**					
X5	,32**	,10	,22**	,90**				
X6	,18*	,05	,40**	,45**	,43**			
X7	,35**	-,07	,12	,42**	,35**	,27**		
X8	,25**	,11	,14	,31**	,27**	,25**	,72**	
X9	,05	,02	,00	,09	,06	,02	,03	,06

* = significant at ,01 level
** = significant at ,001 level

X1 = Inome per resident member (*per capita*)
X2 = Area planted to grain (ha)
X3 = Area planted to oilseed (ha)
X4 = Net grain transaction (kgs)
X5 = Grain sales ($)
X6 = Oilseed sales ($)
X7 = *Per capita* grain availability (kgs *per capita*)
X8 = Grain production (kgs)
X9 = Fruit and vegetable sales ($)

THE COMPLEMENTARITY BETWEEN OILSEED AND GRAIN SALES: HOUSEHOLD LEVEL

These results indicate that, in the semi-arid areas, the viability of oilseed production for sale may be influenced by whether the household in question in a grain buyer or grain seller. This hypothesis is supported by data on household cropping patterns from two semi-arid communal areas in Natural Regions IV and V. Of those households that were net grain sellers (n=162), 46 percent grew and sold $83 of oilseeds per household. Of those farm households that were net grain purchasers (n=110), only 32 percent sold any oilseeds, valued at $37 per household. In the entire sample, household oilseed sales were highly correlated with grain sales, Table 4. These were both highly correlated with *per capita* income and grain availability (a proxy for consumption). These results suggest that, in general, grain-deficit rural households are not purchasers because they are growing other crops for cash to buy food, but rather because they do not have the land or other resources to grow enough staple food to feed themselves. These households also tend to have lower incomes, especially those which earn more than 50 percent of their total income from agriculture.

THE COMPLEMENTARITY BETWEEN OILSEED AND GRAIN SALES: PROVINCIAL LEVEL

We examined provincial smallholder data from the Grain Marketing Board and Cotton Marketing Board to determine the degree of complementarity between *per capita* grain and oilseed sales (cotton and sunflower only -- groundnut information is not yet available). Figures 1, 2 and 3 indicate a positive relationship between these crops over the past three years. Simple OLS regressions of the form:

$$Y_i = a + b^*(X_i)$$

where Y_i is *per capita* smallholder cotton and sunflower sales in Province i, and X_i is *per capita* smallholder grain sales in Province i, produced the following results (t-statistics in parentheses):

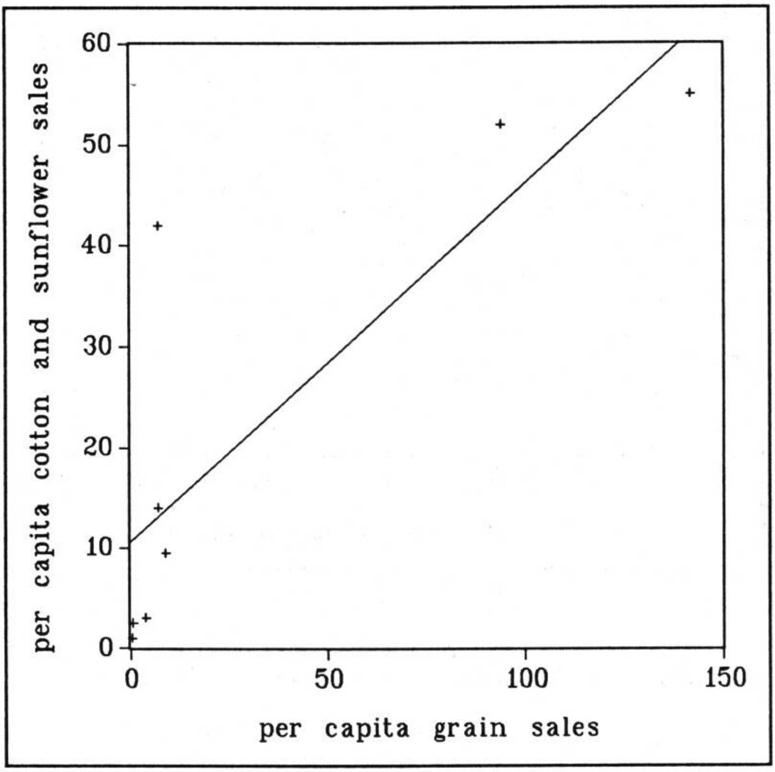
1987-88: Yi = 11,04 + 0,34*(Xi) R2 = ,67 DW = 2,76 F = 12,24
(1,84) (3,50)

1988-89: Yi = 3,35 + 0,19*(Xi) R2 = ,58 DW = 2,14 F = 8,34
(0,22) (2,89)

1989-90: Yi = 9,61 + 0,11*(Xi) R2 = ,44 DW = 2,41 F = 4,67
(1,19) (2,16)

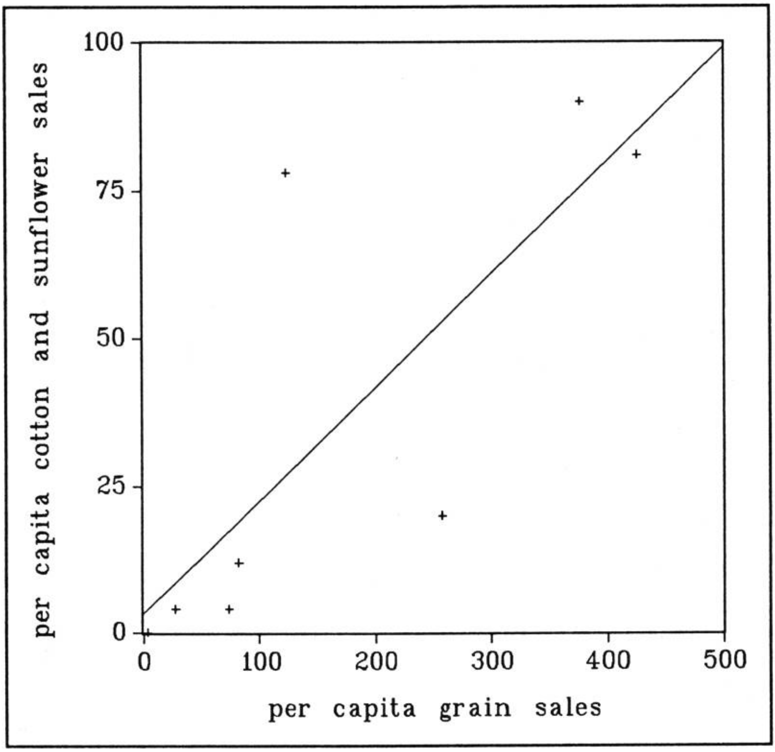
The coefficients on grain sales were statistically significant at the ,05 level in two of three cases.

While causality cannot be inferred in this *ad-hoc* model, the results suggest that *per capita* oilseed production and sales tend to be relatively high in areas of the country where *per capita* grain sales are also high. These areas contain relatively fewer grain deficit smallholders. In addition, it is easier in these areas for those households who are grain deficit to acquire grain from surplus neighbours through informal channels.



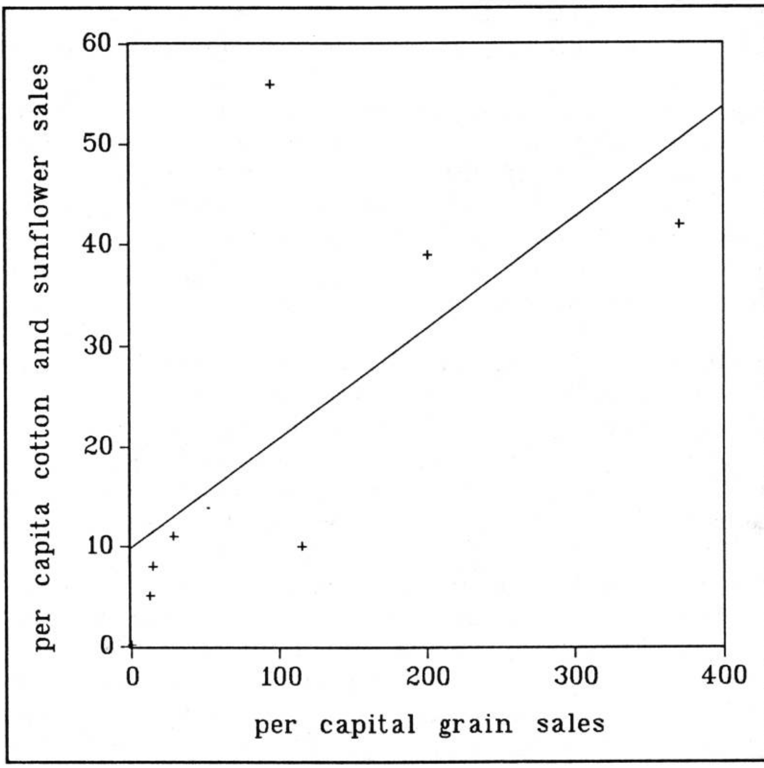
Source: Grain Marketing Board and Cotton Marketing Board data files.

Fig. 1. Relationship between per capita grain and oilseed sales to the GMB from the smallholder sector, by province: 1987-88 marketing year.



Source: Grain Marketing Board and Cotton Marketing Board data files.

Fig. 2: Relationship between per capita grain and oilseed production in the smallholder sector, by province: 1988-89 marketing year.



Source: Grain Marketing Board and Cotton Marketing Board data files.

Fig. 3: Relationship between per capita grain and oilseed production in the smallholder sector, by province: 1989-90 marketing year.

CONCLUSIONS AND AREAS FOR FURTHER RESEARCH

The foregoing provide several preliminary conclusions that should be explored in more depth. The robustness of these conclusions may be examined by carrying out a larger number of surveys in various smallholder production environments.

1. Apart from other oilseed production constraints, high rural grain prices constitute an important limitation to the expansion of higher-valued crops well-suited to semi-arid areas. Poorly developed informal food markets in rural deficit areas constrains income growth directly due to high-priced staple grain through the market and indirectly due to the shifting of production to food crops for household food security rather than potentially higher-valued cash crops.

2. Smallholders cotton and sunflower sales are concentrated in high-potential grain producing areas. Two communal areas, for which data were available, showed oilseed sales to be concentrated among a relatively few well-endowed farmers. Therefore, government attempts to stimulate oilseed production through price incentives or investments in marketing infrastructure may generate highly concentrated benefits.

3. The potential for income growth from oilseed production among smallholders in semi-arid areas might be enhanced if more reliable markets to acquire grain at relatively low cost were available. The results suggest that a 15 to 20 percent decrease in maize meal costs would make groundnut and sunflower production increasingly viable for grain deficit smallholders in several of the areas examined. Efforts to develop a more reliable low-cost informal grain trade may simultaneously stimulate oilseed production and sales in semi-arid areas.

   Due to the apparent entertwined relationship between oilseed production and grain marketing, strategies to promote drought tolerant crop diversification in semi-arid area of Zimbabwe should be conceived and designed in tandem with grain marketing and pricing strategies.

There are several *caveats* to this analysis. First, the analysis examines the effect of a household being grain deficit on its incentives to grow oilseeds for sale. The analysis does not examine incentives to grow oilseeds for own consumption, gifts, or other non-market purposes. Second, we do not examine the effect of risk aversion in semi-arid areas prone to frequent drought on the incentives to grow oilseeds. In such cases, the yield stability of grains *versus* oilseeds becomes important. The risk of drought may induce households to put more of their land into grain to assure adequate supplies even under poor yield conditions. Third, the MLARR results are based on average cost, yield and price data in a particular communal area. Yet there is often substantial micro-variability within a given area such that the relative profitability of oilseeds *versus* maize based on average yield and cost data, may not accurately reflect the situation. Lastly, the MLARR data used to calculate the viability of grain vs. oilseed production pertained only to the 1988-89 crop season which was relatively poor in terms of rainfall over much of the country. The robustness of these results may be examined with crop budgets pertaining to normal and good rainfall years.

REFERENCES

Chisvo, M., T.S. Jayne, J. Tefft, M. Weber and J. Shaffer. 1991. Traders' Perceptions of Constraints on Informal Grain Marketing in Zimbabwe: Implications for Household Food Security and Needed Research. Paper presented at the Sixth Annual Conference on Food Security in Southern Africa. 12 November 1990. Harare, Zimbabwe.

Govereh, J. 1990. *Constraints to Increased Crop Productivity in Two Low Rainfall Areas of Zimbabwe.* Unpublished M.Phil thesis, Department of Agricultural Economics and Extension, University of Zimbabwe.

Masters, William. 1990. *Dynamic Comparative Advantage of Sorghum and Millets in Zimbabwe.* Report prepared for SADCC/ICRISAT Sorghum and Millet Improvement Programme. Bulawayo, Zimbabwe.

Ministry of Lands, Agriculture and Rural Resettlement. 1990. *The First Annual Report of Farm Management Data for Communal Area Farm Units.* Compiled by The Farm Management Research Station. Economics and Markets Branch. Harare, Zimbabwe.

Mudimu, G., C. Chopak, S. Chigume, J. Govereh and R. Bernsten. 1989. Household Income, Food Production and Marketing in Low-Rainfall Areas of Zimbabwe: Status, Constraints and Opportunities. In: Rukuni, M., G. Mudimu, and T.S. Jayne, eds. *Food Security Policies in the SADCC Region.* Proceedings of the Fifth Annual Conference on Food Security Research in Southern Africa. October 16-18, 1989. University of Zimbabwe/Michigan State University Food Security Project. Department of Agricultural Economics and Extension, University of Zimbabwe. Harare.

V

Agricultural Research Priority Setting And Household Food Security

Agricultural Research Priority-Setting In Southern Africa: Nutrition And Household Food Security Issues

Carl K. Eicher[1]

BACKGROUND

Since this is the Sixth Annual University of Zimbabwe/Michigan State University Conference on Food Security Research in Southern Africa, it is timely to step back and analyse what has been achieved through applied research, training, networking and building an information base to guide food policy decisions. Sometimes, the accomplishments of a collective effort are more readily perceived from a distance.

Two months ago, at a SPAAR[2] conference in Washington, D.C. on agricultural research in Africa, special attention was directed to the SADCC region because it is considered to be a beacon for the continent in terms of innovations in agricultural research, training and food security policies. The conference participants noted that SADCC has created a number of new institutions, such as SACCAR, to enhance the performance of national agricultural research systems (NARS) through regional cooperation. SACCAR's Blueprint for Regional Specialisation in Higher Agricultural Education was recently completed by a committee of Deans of Agriculture under the leadership of Dean Mandivamba Rukuni (SACCAR, 1990). After only five years of operation, SACCAR is now helping to coordinate, in cooperation with national institutions, nine regional research and training programmes (Kyomo, 1990). These programmes include the path-breaking SADCC/ICRISAT sorghum and millet programme that has moved progressively from a food production to a food systems research

---

[1]Professor of Agricultural Economics and African Studies, Michigan State University, East Lansing, Michigan 48824-1039.

[2]SPAAR is the Special Program for African Agricultural Research, established by donors in 1985 in recognition that National Agricultural Research Systems (NARS) in Africa were in need of special donor assistance. SPAAR has a secretariat in the World Bank in Washington, D.C.

orientation. Research is underway on production, processing, storage, grain quality, consumer preferences, new end uses for sorghum and millet and market development (Rohrbach, 1990). Finally, the food policy agenda in SADCC countries is moving from national food self-sufficiency to food security. Botswana, for example, recently adopted this position. Howard Sigwele, Chief Economist, Ministry of Agriculture, reports that:

> Botswana's policy decision to shift from food self-sufficiency to food security has been made to ensure long term economic efficiency, sustainability and proper use of the environment . . . After all, food self-sufficiency only tells us about the physical availability/supply of food and not economic access to it . . . Similarly, following the strong drive by the government to diversify the economy, it is hoped this policy initiative will further improve food access through employment creation to increase real income levels (Sigwele, 1990, :15).

The objective of this chapter is to discuss how nutrition and household food security objectives can be incorporated into the research programmes of national agricultural research systems (NARS). Part II presents an overview of food and agriculture in the SADCC region. Part III examines the role of nutrition in agricultural research in historical perspective. We then review the 27-year research programme to increase the protein content of maize through plant breeding because maize is the staple food in at least half the SADCC nations. Part IV discusses studies of the payoff to investment in agricultural research. Part V reviews four quantitative techniques for setting agricultural research priorities in NARS and regional agricultural research systems. We shall then address the key question: Why are these priority-setting procedures rarely used by agricultural research managers in Africa? Because research managers cannot wait until improved techniques are developed to incorporate household food security into research priority-setting in NARS, there is an urgent need to get on with the challenge of promoting rural diversification in less favorable areas in order to expand rural incomes and economic access to food. Part VI addresses rural diversification, a process that can increase rural incomes and economic access to food. Part VII looks to the future and discusses needed research on nutrition and household food security.

FOOD AND AGRICULTURE : OVERVIEW

SADCC, a region of 10 diverse nations and some 82 million people, has the most favorable food outlook of the five sub-regions in sub-Saharan Africa. The aggregate domestic availability of major staples in the SADCC region is 18,60 million tonnes Maize Equivalent (M.E.) for the 1990-91 marketing year, as compared with aggregate regional food requirements of some 17,83 million tonnes M.E. (SADCC, 1990). But at the national level, three countries -- Tanzania, Zambia and Zimbabwe -- have cereal surpluses (mostly maize) while the other seven SADCC countries continue to face serious shortfalls in cereal production.

Moreover, there is considerable diversity of diets in the region. Cassava -- the poor people's crop -- plays a key role in the diets in three SADCC countries: Angola, 29 percent; Mozambique, 36 percent; and Tanzania, 25 percent.

But despite SADCC's relatively favorable macro food outlook *vis-a-vis* other sub-regions in Africa, there are some formidable problems facing the multiplicity of food and agriculture decision makers in the SADCC region. These problems include the following:

1. Food demand will grow at four to five percent per year in the 1990s. While the World Bank's (1989) Long Term Perspective Study calls for African nations to double the annual rate of growth of food production from two to around four percent, there are no high income countries that have achieved and sustained a four percent agricultural growth rate for a period of several decades.[3]

2. Rural employment generation is a crucial problem because the industrial/urban sectors can absorb only a small fraction of the increase in the rural labour force.

3. With the exception of Botswana, which had the fastest growth rate (8.6 percent) of any country in the world over the 1965-88 period (World Bank. 1990b. :178-9), *per capita* incomes are low and stagnant in many SADCC countries. For example, in Zimbabwe "although *per capita* income expressed in 1980 prices, rose from $438 in 1980 to $472 in 1982, it had declined to $470 by 1989. On the average, this means that Zimbabweans in 1989 were worse off then they were in 1982" (Chidzero, 1990).

4. Because of foreign exchange constraints, many countries in the region are scratching for ways to increase traditional and non traditional agricultural export earnings. But as Rusike (1989) has shown, there are formidable barriers to expanding intra-regional and inter-regional trade. UNCTAD (1990) reports that Asian countries gained world market shares in several commodity markets, especially since 1970. In short, Asian nations are proving to be aggressive economic challengers in global commodity markets, including some (cocoa, palm oil), that have long been dominated by Africa. For example, Papua,New Guinea is now producing cocoa and pyrethrum. Kenya's palm oil imports from Malaysia now exceed the value of wheat imports.

5. Sub-Saharan Africa is now importing 75 percent of all wheat consumed. Because wheat is a marginal crop in many African eco-systems, domestic

---

[3]Total agricultural output increased at annual compound rate of 1,6 percent in the U.S. and Japan over the 100 year period, 1880-1980 (Hayami and Ruttan, 1985. :166).

production is not keeping up with demand, and *per capita* wheat consumption is increasing. The macro picture for wheat in Africa is disturbing. Production has failed to keep pace with demand and the share of wheat consumption among all cereals in Africa doubled from five to ten percent since 1960. This dramatic shift has come about chiefly from substitution by other cereals, primarily sorghum, millet and maize and wheat imports. If recent trends in wheat production and consumption continue in Africa, imported wheat will become a pan African staple food for most urban consumers when per capita incomes reach about US$1 000 (Morris and Byerlee, 1990). Such a precedent has already been set in tropical Latin America; in the Andean region of Chile and Peru, where production environments are similar to many highland zones in Africa, annual wheat consumption now averages 42kg *per capita*, 92 percent of which is imported. The government of Tanzania recently requested the FAO to assist in carrying out a study of the wheat sub-sector. Clearly, wheat policy is a burning food policy issue in the SADCC region (Morris, 1989).

6. The 1980s has been a decade of economic liberalisation. Despite the debate between the World Bank (1990c) and the ECA (1989) over the relative success of structural adjustment programmes,[4] there is widespread agreement that major policy reforms are needed in many SADCC countries, including the general need to free agriculture from the state (Lundahl and Ndulu, 1987). There is also widespread agreement that agricultural growth is essential for sustained economic growth and the alleviation of poverty in non-mineral and nonpetroleum-based economies.

7. Despite favourable aggregate food production growth in the SADCC region and maize surpluses in Tanzania, Zambia and Zimbabwe, malnutrition is a problem crying for policy attention by agriculturalists, nutritionists and community health workers in the region. The annual Food Security conferences have helped create an awareness in policy and academic circles that the causes of malnutrition cannot be addressed by a single discipline such as nutrition or agricultural economics. Likewise, malnutrition cannot be effectively combatted through the interventions of a single Ministry such as Health or Agriculture (The National Steering Committee on Food and Nutrition, 1990). Louis Msukwa, Director,

---

[4]Elliot Berg recently assessed the evidence on structural adjustment programmes in the 1980s. He concludes that "The evidence put forward by the World Bank that African countries with reform (liberalisation) programmes have done better than countries without them should not be rejected out of hand, though methodological problems do render those conclusions extremely fragile. Generally, the time is too short and the intensity of liberalising reforms too slight and partial to allow for any general judgment" (Berg, 1990. :7).

Centre for Social Research, University of Malawi, sums up the state of the art of malnutrition in the region:

> Social scientists, agriculturalists, technologists, all have to participate because the problem of malnutrition is multi-faceted. It has to do with technology, economics, as well as people's behaviour. The contribution of every discipline in the research programme is necessary. Not only will the various disciplines have to work together but researchers will have to work closely with the policy makers and implementers. This is the only way we can avoid the past mistakes -- preaching to people to eat more meat when they have no access to meat. Research as far back as 1938 (in Malawi) has shown that the problem was not protein but calorie deficiency (Msukwa, 1990. :261).

Three conclusions flow from this overview of food and agriculture in the SADCC region. Each has implications for agricultural research priorities. First, an agricultural-led industrial growth strategy is essential for the success of structural adjustment programmes, sustained economic growth and the alleviation of poverty. But in the three food surplus countries -- Zambia, Tanzania and Zimbabwe -- where maize is the dominant staple crop, maize cannot fuel widespread growth in the agricultural sector in the 1990s, just as rice did not provide an engine of growth in food surplus Asian economies during the 1980s. Thus, agricultural research has a powerful role to play in generating new technology to create new income streams to increase agricultural growth, speed rural diversification and increase agricultural exports as part of structural transformation.

Second, because of rapid population growth, food supplies from domestic production and/or imports (commercial and food aid) will have to be increased in the region in the 1990s. Thus, agricultural research is essential for accelerating food production, especially in food deficit countries without a mineral base such as Botswana or a petroleum base such as Gabon. Third, increased food production and national food self-sufficiency cannot ensure adequate household food security in the SADCC region. Therefore, the policy question is how to increase household food security through home food production (especially for food deficit households), rural income generation through the selective expansion of traditional exports (*e.g.* cashew and sisal in Tanzania), nontraditional exports and rural small enterprises. Targeted, cost effective food transfers are required for those who cannot secure their food entitlements through their own resources or the market. But, with the exception of diamond-rich Botswana, no SADCC country has the foreign exchange earnings and administrative capacity to finance, mount and sustain a national food for work programme, school feeding programme, *etc.*

Each of these three food and agriculture policy challenges in the SADCC region in the nineties should be matched with forward-looking agricultural research policies. But given the mismatch between available government revenues for agricultural research and research "needs," how does a Director of a national agricultural research system (NARS) decide on research priorities in these three areas? More specifically, how do farmers in less favorable areas, with little political influence, make their research needs known to agricultural research managers? Finally, how can nutrition and household food security needs be incorporated into research priority-setting, especially in marginal areas where rural people generally have little voice in influencing research and extension programme priorities. If food security is incorporated into quantitative research priority-setting exercises, how much weight should be given to food security? For example, in the on-going priority setting exercise in the NARS of Malawi, the priority-setting team has assigned a weight of 15 percent to household security goals and 85 percent to efficiency goals. (Mkamanga, *et al.* 1990). Is 15 percent the optimum weight?

THE ROLE OF NUTRITION IN AGRICULTURAL RESEARCH: HISTORICAL PERSPECTIVES

Four insights emerge from an overview of nutrition research in Africa since the anthropologist Audrey Richards published her landmark study of hunger among the Bemba in Zambia in 1932 (Richards, 1932). The first insight is that, with only a few exceptions, over the past 50 years nutrition research has been dominated by medical practitioners, nutritionists, geographers and anthropologists. Agricultural economists and economists are latecomers to research on nutrition.[5] Several agricultural researchers worked on nutrition and household food insecurity indirectly for decades through research on what were considered "famine" crops such as cassava, and crops for dry areas, *e.g.*, sorghum and millet. Second, some of the current research on household food security can be described as "old wine in new bottles." For example, the pioneering work on seasonal hunger, by Richards, (1932); followed by Hunter (1967), and many others was basically addressing household food insecurity in less favorable areas. Also, current research on the nutritional effect of the commercialisation of agriculture (cash-cropping) was preceded by the massive study of cocoa villages in western Nigeria in the fifties. Collis, Dema and Omololu (1962) found that families producing cocoa were in worse condition from a nutritional point of view than subsistence families not producing cocoa. Third, research on cassava, sorghum and millet has

---

[5]The sparse literature on nutrition studies by agricultural economists from 1950 to 1970 includes Haswell's (1953) study of seasonal hunger in the Gambia, Joy (1967); Smith (1975) and Simmons (1976).

been underfunded for some sixty years.[6] Fourth, some of the early research on seasonal hunger in the 1930s identified inadequate calorie intake, especially just before harvest, as the greatest nutritional problem.[7] But with the post World War II palaver over protein as the overarching global nutrition problem, the centrality of calories only reemerged in the 1970s with the publication of Sukhatme's (1970) pioneering survey of 5 000 families in Calcutta. Sukhatme found that 95 percent of the families consuming adequate calories were also meeting their protein needs.

We shall now examine attempts to improve household food security and combat malnutrition through research on high protein maize, action programmes to expand the use of cassava and the introduction of a new crop, amaranth, that is high in protein. We shall start with maize. In the 1950s and 1960s, international professional opinion held the view that the shortage of protein was the single most important nutrition problem in the Third World. In fact, the discovery of a mutant gene referred to as opaque-2 at Purdue University in 1963 touched off a long term research programme to improve the protein content of maize through plant breeding.[8] Research on high protein cereals was initiated by CIMMYT and ICRISAT researchers[9] in the heyday of the Green Revolution in the late 1960s and early 1970s when many scientists believed that there was "ample proof that technology could solve food problems in developing countries" (Cantrell, 1990. :2). In fact one nutritionist reported at an international conference in 1975 that the discovery of the opaque-2 gene's effect on nutrition "fired the imagination" of maize breeders, biochemists and nutritionists who believed that it might also offer a "means of correcting social ills as well, mainly by lessening competition between increasingly scarce and expensive protein supplies between the haves and have-nots" (Altschul, 1975).

---

[6]Hugh Dogget, the doyen of sorghum researchers in Africa, reports that "In 1946, when I was appointed a government botanist in Tanzania, there were three people working on cotton at my research station . . . But nobody seemed to be paying much attention to sorghum and it was widely grown in the area. So I worked on sorghum from Saturday to Thursday and rice on Fridays." (Quoted in Fisher, 1986). Also, see Norman *et al.* 1988 for a historical review of sorghum research in Nigeria and Botswana.

[7]Msukua reports that Platt's pioneering but unpublished study of nutrition in Nkhotakota district and two urban centers in Nyasaland (now Malawi) revealed that, in all the survey areas, the consumption of protein was enough to meet daily requirements, but there was a shortage of calorie intake over the entire 10 month survey period. In the villages, the largest overall calorie deficit was in January (-28.5%), just before harvest (Platt, 1940. cited in Msukwa (1990, :254).

[8]The opaque-2 gene increases by 50 percent the content of two essential amino acids in maize (lysine and tryptophan) and hence increases the protein content of maize.

[9]ICRISAT dropped its research on high protein sorghum after a few years.

The drive to increase the protein content of maize was popularly known as the Quality Protein Maize (QPM) programme. But formidable technical problems emerged in early trials of maize with opaque-2 genotypes including the basic fact that these varieties yielded less than maize with normal germplasm. Also, the grain characteristics of these high protein maize varieties were unacceptable to many consumers. But through assiduous plant breeding research, many of these technical problems were solved and by the late 1970s, a wide range of tropical QPM (quality protein maize) varieties were available. By 1988 the yield gap had been almost closed and at trials at 69 of 80 locations, QPM varieties yielded as much or more than the normal checks (Cantrell, 1990).

Nevertheless, there are several important economic constraints on farmer adoption of quality protein maize. Ron Cantrell, recent head of CIMMYT's maize programme, offers this cool assessment of QPM in his unpublished paper "Quality Protein Maize: A Better Lunch but not a Free One" (Cantrell, 1990).

> Other countries have experimented with QPM germplasm, but the nine I have mentioned are the only ones that have released QPM varieties, none of which are grown on more than a few thousand hectares, if that much. I suspect that the limited adoption of this germplasm, at least in developing countries, often has little to do with its appearance or performance. The main obstacle in my opinion is the high cost of promoting QPM germplasm among farmers and of ensuring that the grain they produce can move smoothly through market channels to consumers. (Cantrell, 1990. :5).[10]

Meanwhile research continues on QPM at Purdue and CIMMYT. Several scientists believe that it may prove to be an efficient livestock feed in Latin America. Nobel Laureate Norman Borlaug is still a firm believer in QPM. He has recently convinced President Jimmy Carter and the government of Ghana to introduce QPM in the Global 2000 Programme in Ghana.

Cassava represents the second commodity which plant breeders, agronomists and extension workers have given priority in less favourable areas. This is understandable because "cassava research is virtually alone in being able to be targeted on small-scale farmers in marginal agricultural areas" (Lynam *et al.* 1989. :105).[11] Cassava is a new world staple that was introduced into Africa long

---

[10]The economic issues that Cantrell refers to are two fold. First, because hybrid QPM seed has to be replaced every year by farmers, it follows that farmers in marginal environments will hesitate to take on the added cost of purchasing hybrid maize seed every year rather than using open pollinated varieties from the family granary. Second, it is difficult for farmers to gain a premium for QPM over local maize in rural markets where grain is sold in small quantities.

[11]See Sarma (1989); Dorosh (1989) for a review of cassava research.

before colonial research systems were established around 1910 to 1920. Colonial powers promoted cassava in famine-prone areas and today it accounts for about one-quarter of the calories in average diets in Angola, Mozambique and Tanzania. Without question, cassava is ideally suited to mixed cropping but there are many processing, marketing, demand and policy issues that constrain the use of cassava in combating household food insecurity. For example, UNICEF developed a cooperative agreement with IITA (International Institute of Tropical Agriculture (Nigeria) in the mid 1980's to diffuse IITA's high yielding cassava varieties as a means of improving household food security. But UNICEF quickly learned that IITA's high yielding cassava varieties that were performing well in Nigeria's ecosystems had to be adapted through applied research in technology borrowing countries. UNICEF has gradually learned how to deal with the technical and economic issues surrounding the cassava food system (Toole, 1988). In Tanzania, UNICEF no longer uses cassava as the primary intervention in improving household food security. It now focuses on a broad range of interventions (*e.g.*, health, water), including cassava and other crops to improve family food security and welfare.[12]

The third commodity, amaranth, is a plant of potential use in combating household food insecurity because of its high protein quality (Vietmeyer, 1986). But amaranth is not well liked in many third world countries, including Zimbabwe, where it is called pig weed. But amaranth's protein content of 15 to 16 percent (9-10 percent for maize) has aroused the attention of researchers in China, Peru, Thailand and Kenya. Yet Kenyans are reluctant to grow or consume the grain. Several university of Nairobi researchers report that until amaranth is accepted in the United States it will not be accepted in Africa.[13]

In short, the saga of Quality Protein Maize illustrates the point that the improvement of human nutrition through plant breeding has "proven to be an elusive goal" (Tripp, 1990; Pinstrup-Andersen 1990). The promotion of cassava illustrates the need for research on cassava processing, marketing and effective demand, before pushing ahead with cassava action programmes to improve household food security. In the final analysis, the aggressive promotion of "technological bullets" of quality protein maize, cassava or new crops such as amaranth should be replaced by a food systems approach supported by research on marketing, processing and consumer preferences.

---

[12]Latin America's experience with cassava points up the need to keep effective demand, processing and marketing considerations foremost in cassava action programs designed to improve household food security (Lynam *et al.* 1989).

[13]*Economist.* January 27, 1990. :88.

THE PAYOFF TO INVESTMENT IN AGRICULTURAL RESEARCH

Research priority-setting is now a "hot" topic in agricultural research circles. Part of the reason for its sudden popularity is donor uneasiness about past and future payoffs to investments in national agricultural research systems in Africa compared with alternative investments in agricultural extension, roads, and credit for private firms, to speed market liberalisation.

But the SADCC region is unencumbered by evidence on the payoff to agricultural research. In fact, studies of the rate of return (ROR) to investment in agricultural research in the SADCC region and in Africa are as rare as the white rhino. For example, there are only four published rate of return studies in sub-Saharan Africa as compared with 25 in Asia and 66 in Latin America (Daniels, *et al.* 1990). The most recent ROR study (the fifth in Africa) was completed by Daniel Karanja, an agricultural economist from KARI, the NARS of Kenya. Karanja computed the returns on investment in hybrid maize research in Kenya over a 33 year period, 1955 to 1988 (Karanja, 1990). Research on hybrid maize was initiated in Kenya in 1955 and the first hybrid maize variety, H-611, was released in 1964 after a decade of research. Subsequently 20 more hybrid varieties were released over the 1964-88 period. To carry out his ROR study, Karanja dug through the archives in Kenya for five months and computed the total cost of research on hybrid maize over the 33 year period, 1955-88. He then estimated the area planted to hybrid maize by district, and the increase in yield attributed to maize research, in order to figure out the increase in maize output, year after year, over the 33 year period. The costs and benefits data were then used to compute an average ROR (rate of return) on investment in maize research. The average ROR measures the average benefits that accrue from all previous expenditures on maize research over the period studied (1955-88). The average ROR over the 33 year period was found to be 68 percent.

But Karanja's ROR study only reports what happened in the past (*i.e.*, 1955-88). The ROR of 68 percent can be used to inform policy makers that maize researchers have been creative and productive in the past. But the average ROR of 68 percent cannot prescribe how much Kenya should spend on maize research or research on any other commodity, in the future. To answer these questions, extant research is required on the likely future payoff to a particular commodity research programme or research problem such as soil conservation.

Karanja's study shows unequivocally that research is not a luxury -- it can be a profitable investment. For example, the World Bank uses a minimum ROR of 10 percent on projects such as roads, dams and irrigation. One can conclude that the 68 percent ROR on public investment in hybrid maize research has yielded high returns to farmers and consumers in Kenya. But hybrid maize varieties were rapidly adopted because of complementary public investments in agricultural extension, credit, roads, and public and private investments in seed distribution. These activities represent a system of interactive and complementary investments that contributed to the high return on investment in maize research.

INCORPORATING NUTRITION AND HOUSEHOLD FOOD SECURITY ISSUES INTO FOOD SECURITY POLICIES AND AGRICULTURAL RESEARCH PROGRAMMES

We shall examine five approaches to incorporating malnutrition and household food insecurity into research and policy agendas. The first approach focuses on policies and public action to help people gain control over their food entitlements. This approach is spelled out in a recent book *Hunger and Public Action* (1989) by two economists -- Jean Drèze and Amartya Sen. The second approach comes from an economic geographer, Barbara Harriss, who boils research priority setting down to a simple matter of agricultural scientists "getting their politics right" and orienting their research to mass welfare objectives:

> Historical experience in countries as different as Sri Lanka, China and Israel shows that nutritional considerations are not needed to be introduced formally into agricultural research in the way currently being advocated, when agricultural scientists are socially and politically responsible and have furthermore oriented their research to mass welfare objectives and nutritional impact. Moreover, malnutrition can be all but completely eradicated by policies which are sanctioned, endorsed and implemented by the state, unaccompanied by special nutrition-oriented agricultural research as is being proposed (Harriss, 1987. :34).

The third approach to nutrition priorities in agricultural research is to "shoot from the hip" as Michael Lipton and Richard Longhurst do in *New Seeds and Poor People* (1989). To Lipton and Longhurst its all very simple. Research on Green Revolution varieties is for sub-Saharan Africa's poor "the only real hope. It is the only game in the country side" (1989. :359). The authors pinpoint the crops that need research attention -- the poor people's crops' that support, both as producers and consumers, large numbers of nutritionally vulnerable farming households: cassava, yams, cocoyams, sweet potatoes, bananas and plantains, sorghum and millets. Lipton and Longhurst criticise past research efforts because they have:

> greatly emphasised high-cost production of rice on large irrigation schemes, of tropical wheats, of fashionable crops such as soybeans, and of hybrid maize, a crop much eaten by the poor (though more in urban than in rural places), but vulnerable in years of low rainfall, and competitive for land with safer crops that have suffered from relative neglect by researchers (Lipton and Longhurst, 1989. :362).

In a review of the Lipton/Longhurst book, Robert Herdt notes that the authors "seem to believe that just about any desired social change can be produced by changing plants" (Herdt, 1990. :838). Also, Lipton and Longhurst castigate hybrid maize as a "fashionable" crop in Zimbabwe and throughout the SADCC region, even though research progress on hybrid maize has outstripped that of sorghum and millet over the past 40 years. For example, Shumba reports that at the Makoholi Experiment Station in the low rainfall area (Natural Region IV) of Zimbabwe, "maize always out yields the small grain cereals (sorghum and millet). Averaged over a four year period, maize yields were almost double those of pearl millet, the highest yielding small grain cereal" (Shumba, 1990. :8). Moveover, the expansion of hybrid maize in marginal areas is reinforced by the "preference of maize as a starch (source of calories) and cash source, the ease of preparation of maize flour and susceptibility of small grains (sorghum) to bird damage . . . (Shumba, 1990. :7).

The fourth approach to integrating malnutrition into agricultural research priorities was pioneered by the United Nations and the CGIAR in the early 1980s when they joined forces to examine how to incorporate nutrition into the everyday work of the CGIAR centers. The results of these early deliberations are reported in (Pinstrup-Anderson, Berg and Forman, 1984). But to date there are few nutritionists employed in the IARC's.

The fifth approach to addressing nutrition and household food security draws on recently developed quantitative techniques for agricultural research priority setting. There are four common quantitative priority-setting methods available to NARS and regional organisations such as SACCAR in Southern Africa and INSAH in the Sahel:

1. **Weighted Criteria (Scoring) Models.** Several studies have established multiple criteria for ranking commodities (or research areas) and then weighted the individual criteria to arrive at an aggregate priority ranking. The relative weights attached to each criterion to arrive at the final list of research priorities are sometimes left unstated and sometimes made explicit. This procedure is often called a scoring model approach. A few studies also have used a crude scoring model, called congruence analysis, in which all weight is placed on the criterion value of production. For example, if 25 percent of the value of agricultural GDP is derived from tobacco, 30 percent from cotton, 15 percent from tea and the balance of 30 percent to food crops, then the same proportion of the research budget should be assigned according to these percentages.

2. **Benefit-cost Expected Economic Surplus Analysis.** The benefit-cost approach to selecting research priorities has been used in different forms. Most studies have employed consumer-producer surplus analysis and have incorporated "expert" opinion to determine projected research impacts, adoption rates, and probabilities of research success. These studies provide estimates of the economic efficiency and distributional implications of agricultural research resource allocation. They typically calculate benefit-cost ratios, internal rates of return and net present values for alternative types of research or for research on difference commodities. These analyses may or may not include regional and

international research spillovers and the effects of domestic pricing policies on research benefits.

3. **Mathematical Programming.** Mathematical programming is another alternative for research selection. It relies on mathematical optimisation to choose a research portfolio through maximising a multiple goal objective function to the weighted-criteria model but selects an 'optimal' research portfolio rather than simply ranking research areas.

4. **Simulation.** Finally, simulation has been used to identify and select research priorities. For example, Pinstrup-Andersen and Franklin built a mathematical model to project the contributions and costs of alternative research activities. They established goals and then identified changes in supply, demand for inputs and demand for output needed to meet those goals. They identified needed technologies, time and financial costs, and the probability of research success and adoption (Norton and Pardey, 1987).

A research team engaged in priority-setting requires information on the national development goals and the relative weights to attach to these goals. Next, the research needs of the country should be debated by the scientific community and displayed by commodity, research problem (*e.g.*, striga, soil fertility) and location. For example, the Gambia has recently completed a priority setting exercise using the scoring approach (Cessay *et al.* 1989).[14] Similar studies are underway in Malawi (Mkamanga *et al.* 1990)[15] and Tanzania (Teri *et al.* 1990). But, as Emil Javier, former Minister of Science and Technology in the Philippines points out, "priority-setting methodologies have not found much practical use yet in NARS." The reasons for the lack of use of quantitative priority-setting start with some basic questions. First, even if national development goals are clearly stated in a development plan, the assignment of relative weights to favorable versus less favorable areas or to commercial versus communal farmers is a "political act beyond the competence of the research community" (Javier, 1987, :1). It is obviously difficult for political leaders to decide on public investment programmes (*e.g.*, research, roads and production campaigns) in less favorable areas such as the maize belt in Zimbabwe, the central highlands of Kenya or the United States. For example, IRRI agricultural economists found that the expected yield gains from rice research in favourable rainfed areas in Asia were twice those in less favorable rainfed areas (Barker and Duff, 1986).

Randolph Barker recently summarised some of the reasons why priority setting exercises have not been institutionalised by NARS:

---

[14]The scoring approach was developed at ISNAR (Norton and Pardey, 1987).

[15]Editor's note: See chapter 20 in this volume.

- choosing weights for national goals (favorable versus less favorable areas) involves subjective political as well as scientific judgments;[16]

- it is difficult to handle noncommodity priorities such as erosion, integrated pest management, policy analysis (and household food security);

- it is difficult to handle the sequencing of competing research programmes;

- it is hard to "guestimate" the level of expected scientific and financial capacity of a NARS ten to fifteen years down the road;

- it is difficult to guess what type of technology will become available from neighbouring NARS and regional and international systems; and,

- it is difficult to estimate future demand prospects for commodities in regional and international markets (Barker, 1988).

The only published priority setting study in Africa is for the Gambia (Cessay *et al.* 1989). This joint ACIAR/ISNAR study used a simple scoring model to decide how to allocate the 20 person years of scientific talent in the national research system. However, the team found it difficult to rank the 21 major commodities in the Gambia other than listing them in groups of seven under categories of high, medium and low research needs. In Kenya, the National Agricultural Research Project carried out a long-term planning exercise and identified high, medium and low research priorities but these were not matched with likely available human and financial resources. As a result, "this made subsequent short-term planning and programming very difficult" (ISNAR, 1990. :v).

These illustrations point out why very few NARS and regional research organisations such as SACCAR are presently using quantitative priority setting approaches. But the scoring model has great appeal to NARS managers and scientists because it is simple, relatively quick to execute, (three to six months) and it is not data intensive. Moreover, the scoring model approach encourages scientists to discuss their problems and exchange views on research priorities and likely future technical payoffs. One can sense the enthusiasm for the scoring model in the paper describing research priority setting in Malawi (Mkamanga *et al.* 1990).

---

[16]After seven years of farming systems research in Botswana, the FSR team led by David Norman has generated some valuable insights on technical payoffs in less favorable areas. See Heinrich *et al.* 1990a., 1990b.

But a cautionary note is needed at this juncture. Priority setting exercises that are carried out under the direction of agricultural economists may oversell the various models much like economists have done in many FSR projects in Eastern and Southern Africa. And the same phenomenon may come into play with rate of return (ROR) studies of agricultural research. There is a danger that agricultural economists, armed with their micros, will undertake priority setting and ROR studies and fail to tackle more important political economy-type problems such as financing agricultural research. For example, it is well known that a critical problem facing agricultural research in Zimbabwe is funding on-farm research. Shumba (1990) reports that because of funding difficulties and transport problems, Zimbabwe has reduced the number of on-farm trials by "51 percent between 1987-88 and 1990-91" (Shumba, 1990. :9)[17] How will a national priority-setting exercise help address this problem? Critical questions such as financing research and paying scientists a living wage are tough issues that cannot be addressed by quantitative priority-setting exercises.

Nevertheless, the scoring model has great appeal and it should be encouraged in the SADCC region. Veteran researchers in national agricultural research systems can draw on the results of these scoring models as they form judgments about future payoffs to new lines of research, market prospects for traditional and nontraditional exports and the mix of commodities to achieve multiple national objectives such as household and national food security, foreign exchange earnings, employment generation and regional balance.[18]

Turning to research priorities in the SADCC region in the 1990s, because of rapid population growth, research should be pursued on food crops such as maize in favorable areas and maize, sorghum, millet and cassava in unfavorable areas. At the same time, research on economic diversification in marginal areas should be expanded in order to develop/borrow new technology capable of generating new income streams and employment for rural people. Finally, action research on household food security should be pursued through multi-disciplinary research teams consisting of nutritionists, community health specialists, social scientists and technical agricultural scientists such as agronomists.

---

[17]Editor's note -- see Chapter 21 in this volume.

[18]For example, the government of Kenya pragmatically adapted a policy document in 1986 that identified seven "essential" commodities that formed the core of its food and agricultural policy: maize, wheat, milk and meat for food security; horticultural crops for both export and home consumption; and coffee and tea for raising farm income and foreign exchange (Kenya, 1986).

THE ROLE OF RESEARCH IN ACCELERATING AGRICULTURAL EXPORTS AND PROMOTING RURAL DIVERSIFICATION

Rural diversification programmes designed to increase rural incomes, jobs and economic access to food, should not be held up until research findings are available from household food security studies. The simultaneous pursuit of research on rural diversification and household food security research is mutually reinforcing.

We now turn to the role of agricultural research in speeding rural diversification and increasing economic access to food, because at the end of the day, raising rural incomes across the board is a powerful avenue to increasing household food security. Table 1 reveals that Africa's share of world exports declined for 9 of 15 nonpetroleum commodities over the 1970-87 period. This explains why tough-minded decisions are required on how to rebuild Africa's export commodity research capacity, drive down the cost of production, regain home markets from international competitors, develop new commodities for export (ostrich hides and meat, crocodile skins, jojoba, *etc.*) and ferret out windows of opportunity in regional and international markets.[19] Agricultural research should give high priority to rural diversification, the selective expansion of export commodities and the development of nontraditional exports in the 1990s. Public and private sector investments are crucial when going head-to-head with Asian competitors to regain African and European markets (*e.g.*, rice, groundnuts and edible oils).

But Africa lags behind Asia in its capacity to organise, execute and deliver new technology to enable agri-business firms to exploit new markets at home and overseas. For example, Malaysia is currently spending six times more than Nigeria each year on oil palm research. Malaysia has vigorous R&D underway in the development of a) new uses for natural rubber; b) methyl esters of crude palm oil and crude palm stearin as a diesel fuel for vehicles; c) firewood from oil palm and cocoa logs; d) furniture from palm wood; e) mini papayas for the Japanese market; and, f) special cooking and frying oils for the Korean market (PORIM. 1985). Thailand is aggressively promoting pineapple exports (in competition with the Cote d'Ivoire) for European markets. Public sector research and private banks have teamed up to shift Thailand's traditional emphasis on supplying maize to the poultry industries in Taiwan and Japan, to feeding maize to broilers at home and exporting broiler meat to Korea, Taiwan and Japan. Thailand is now the third largest broiler exporter in the world following the United States and Brazil.[20]

---

[19]The discussion in this section draws on Eicher (1990b).

[20]For a recent synthesis of agricultural diversification experiences in East Asia, see World Bank, 1990b. and Barghouti *et al.* (1990a).

Table 1
Africa: Agricultural exports as a percentage of world exports, 1970, 1980, 1987

Commodity	1970	1980	1987
Livestock	6,3	3,2	2,6
Fishery commodities	3,1	2,9	4,1
Coarse grains	1,5	0,7	1,7
Bananas	12,2	12,6	13,0
Sugar	4,5	5,2	5,5
Coffee	33,6	24,1	19,9
Cocoa beans	72,6	61,6	58,7
Tea	9,5	9,9	10,6
Spices	15,0	6,7	5,8
Groundnuts	27,7	24,3	21,1
Palm oil	57,3	27,3	18,4
Tobacco	3,4	5,2	4,8
Natural rubber	7,5	5,2	5,7
Cotton	11,0	8,3	7,9
Sisal	47,7	31,8	25,5

Source: UNCTAD, 1990.

Turning to agricultural diversification, the starting point is to realise that diversification is needed in both food exporting countries, such as Zimbabwe, and in the cocoa-dominated economies of Ghana and the Cote d'Ivoire. But advocates of the expansion of agricultural exports in the 1990s will come under heavy attack. For example, the widely-cited paper *African Alternatives to Structural Adjustment Programmes* by the Economic Commission for Africa (ECA 1989) reports that devaluation fails to stimulate production of exportable goods or import substitutes because of "technological rigidities." But surprisingly this pessimism is not shared in Asia where rice farmers from Thailand, Vietnam, Pakistan, *etc.*, are on the lookout for new markets for rice in Africa and in Thailand where farmers are developing new nontraditional exports such as broilers.

Diversification is not a short term affair. Research on diversification and pilot projects on new products such as jojoba will not pay off until the early part of the 21st Century because, on the average, it takes about ten years to develop, test, and calibrate improved crop technology for micro environments. It takes about 15 years to develop, test and release improved animal technology. Nevertheless, the payoff to a specific investment in basic science, applied research and agricultural extension will be low unless these investments are coordinated and careful attention given to the sequencing of investments in strengthening the institutional base for export production, processing and trade. Such coordination and sound research management are hallmarks of Asia's market penetration in Europe and Africa. For example, Malaysia's national palm oil research system has 60 percent of its scientific staff engaged in research, while Nigeria has 31 percent in research and 69 percent in administration and peripheral tasks (ISNAR, 1988. :94). Nigeria's bloated administrative structure for palm oil research illustrates the basic point that the solution to Nigeria's export malaise is not simply one of spending more money on research. The challenge is to find ways to increase the productivity of agricultural research systems in Africa through improved coordination, management and sequencing of public and private investments in science, R&D, extension and international marketing.

Africa's experience with agricultural diversification also proves that public, private and joint public/private R&D organisational models are all capable of achieving agricultural diversification (Blackie, 1989).[21] For example, Kenya's 150,000 member Kenya Tea Development Authority (KTDA) provides solid evidence that a public sector parastatal can be a highly successful organisation (Lamb and Muller, 1982). Likewise, the 80,000 farm families producing cotton in the Mali-Sud cotton project in Mali illustrates the payoff to a multi-country, vertically linked cotton research and extension system that is supported by public and a private agencies from France (Lele, van de Walle and Gbetibou, 1989). The private investment of Zimbabwe's 45,000 families engaged in smallholder cotton production is supplemented with assistance from a public cotton marketing board.

In short, there is a critical need for food surplus countries such as Zimbabwe to push ahead with agricultural diversification as an important route to increasing rural household food security. The expansion of smallholder cotton production in Zimbabwe is one of the best kept household food security secrets in the SADCC region. Although Zimbabwe has been lionised for its smallholder maize production success, a study of cotton and food security would probably reveal that

---

[21]Even though Thailand is a consistent rice exporter, it has aggressively pursued agriculture diversification to generate new sources of agricultural growth. For example, in 1970, four crops -- rice, rubber, maize and cassava products -- comprised about 85 percent of its agricultural exports. By 1985, this share had fallen to 65 percent because Thai producers branched out to a wide variety of nontraditional products such as orchids, canned pineapple, coffee, canned fish and dried cuttlefish (World Bank, 1990a. :18). Malaysia is now exporting a sweet mini-papaya to Japan and Taiwan, after 12 years of horticultural research and market research about Japanese food preferences.

household food security is higher on farms growing cotton than subsistence farmers producing maize or sorghum.[22]

New Zealand's kiwi fruit industry illustrates the need for the architects of diversification programmes to invest heavily in international marketing to ferret out windows of opportunity in international markets. Sometimes, these windows are "open" for only two to three weeks.[23] The seed of the kiwi fruit (*Actinidia deliciosa*) was introduced into New Zealand from China in 1906 and was promoted under the name 'Chinese gooseberry.' But it stagnated and, by 1953, only 31 hectares were cultivated. New Zealand exported small quantities in the 1950s and exports gradually started to pick up by the 1960s when the name of the fruit was changed to "kiwi fruit" and the Kiwi-fruit Marketing Authority was established. Aggressive international marketing campaigns paved the way for the introduction of Kiwi fruit to European and North American consumers. The United States and other countries have begun production, but New Zealand, with around 24,000 ha under cultivation, still has the lion's share of the world market (Barghouti, *et al.* 1990. :95).

Kenya's success in expanding horticultural exports (fruits, vegetables, and cut flowers) should be closely studied by SADCC states. In 1967, Kenya created the Horticultural Crops Development Authority (HCDA) to develop its horticultural industry. The subsequent growth of local consumption and exports has been extraordinary, especially for flowers. In fact, cut flowers increased from 458 tonnes in 1972, to 8 164 tonnes in 1986. Cut flowers are the leading foreign exchange earner among the air-freighted horticultural exports (Schapiro and Wainaina, 1989). Around 100 large growers and 5 000 to 7 000 smallholders are currently producing horticultural products for some thirty countries. About 60 percent of the volume comes from smallholders, mostly on farms of less than four hectares in total size, with about 0,25 to 1 hectare of land in export crops (Lele, Kinsey, and Obeya, 1989). About 90 percent of Kenya's horticultural products are consumed locally in urban areas and increasingly in rural areas. Yet Kenya's horticultural export success is not attributable to any single factor such as good weather or favourable market opportunities. Two researchers recently concluded that:

> "Government-sponsored research, training, monitoring and other activities facilitated the expansion of the horticultural sector. However, it is what the Government did not do -- create a large bureaucratic structure and interfere to a significant extent with the

---

[22]In Mali, Josue Dione found that families producing sorghum and cotton have generated per capita grain equivalents three to four times higher than families producing millet (Dione, 1989).

[23]For example, Israel is developing high quality melons to slip into European markets during a few weeks during the winter. Israel air freights melons and other fruits to Europe via 747 airplanes and brings home new automobiles on the return flights.

> market mechanism -- that is most impressive. Without this combination of government assistance and government restraint, it is highly unlikely that the expansion in horticultural exports would have been as rapid or as large" (Schapiro and Wainaina, 1989. :93).

AGENDA FOR THE FUTURE

This paper has stressed the need to examine household food security and malnutrition in historical context and to learn from past experience. Increasing the protein content of cereals through plant breeding remains an elusive goal. There is much wisdom in Barbara Harriss' dictum that scientists should "get their politics right" in focusing their research on poor people's crops in less favorable areas. But this simple guideline does not tell us how much research effort in human and financial terms should be spent on research in favourable *versus* less favourable areas or even on crops versus livestock within less favourable areas. To address these tough questions, we turn to economists and analyse whether some of the recent work on priority setting in national agricultural research programmes can be of use to the managers of national research systems. Research priority setting is now a hot topic in agricultural research circles, partially because many donors helped expand the total size of national agricultural research systems in the 1980s beyond the capacity to finance these systems from national sources for the foreseeable future. This explains why priority setting exercises are being used to "slim down" NARS and make them more efficient and sustainable (Eicher, 1989, 1990a., 1990b.).

In the 1980s, donors provided generous project assistance to many NARS of Africa under the general guideline that African countries should spend one to two percent of their agricultural GDP on agricultural research. But over the course of the 1980s, scientific, political, bureaucratic and donor interests interacted to inflate the size of many NARS and enabled some NARS directors to postpone tough decisions on priorities in terms of the number of scientists, number of research stations and number of research projects. Also, during the eighties, the ready availability of foreign aid for NARS served as an "escape valve" for some NARS administrators who were reluctant to make hard scientific and financial decisions on the size of the scientific enterprise and research priorities. Many African countries are making some of the same mistakes that Asian and Latin American countries made in the 1960s and 1970s when the emphasis was placed on expanding the size of NARS to the point where there were many research facilities and researchers "without programmes" (Ruttan, 1987. :78). With this background, it is easy to understand why some donors are raising some tough questions about bloated NARS and the questionable payoff to agricultural research. This, in turn, has sparked a great deal of interest in priority setting and rate of return studies.[24] The priority setting technique that

---

[24]For a global survey of ROR studies see R. G. Echeverria. 1990.

is most appropriate for Africa is the simple scoring model that has been used in the Gambia and is currently being tried on an experimental basis in Malawi and Tanzania. The great advantage of the scoring model is that it promotes communication and dialogue among scientists in a NARS. But conceptual and empirical work needs to be done on priority setting and in figuring out how to incorporate household food security issues into these exercises.

In practical terms, this means that there is a need for joint conceptual and empirical work by nutritionists, agricultural scientists and social scientists on both the development of improved priority setting approaches and village studies of malnutrition.[25] Yet, I am not aware of a single team composed of a nutritionist, social scientist and agriculturalist that is presently carrying out village studies of household food security and malnutrition in the SADCC region. Forming a partnership between nutritionists, social and technical scientists and community health researchers is a challenge for universities in the SADCC region in the 1990s. Until more information is available from these joint studies, policy makers and agricultural research managers must rely on experience and judgment to find the right balance (mix) between support for primary food production such as maize, secondary foods such as cassava and groundnuts, and higher value crops such as soybeans, fruit and vegetables. In closing, the recent World Bank's agricultural diversification study in East Asia has some valuable insights for Africa:

> Allowing the market to be the sole determinant of this mix (of crops) runs the risk of undervaluing foods for the poor and food security in general, whereas high-income consumers and export markets are well served. Concentrating too much on basic foods, however, can lead to rigid production systems that are unable to adjust rapidly to surpluses and discrimination against earning foreign exchange"
> (World Bank, 1990a. :17-18).

REFERENCES

Altschul, A. M. 1975. Worldwide Needs for Quality Protein. In: *High Quality Protein Maize: Proceedings of the CIMMYT-Purdue Symposium on Protein Quality in Maize.* Stroudsburg, PA: Dowden, Hutchinson and Ross. :3-14.

Barghouti, Shawki, Carol Timmer and Paul Siegel. 1990. *Rural Diversification: Lessons from East Asia.* Washington, D.C. World Bank.

Barker, Randolph. 1988. *Methods for Setting Agricultural Research Priorities: Report of a Bellagio Conference.* Working Paper 88-3. Ithaca, New York: Department of Agricultural Economics, Cornell University.

---

[25]See Weber *et al.* 1988 for a discussion of how research results from studies undertaken by the MSU Food Security cooperative agreement have been used to provide an information base for policy makers.

Barker, R. and Duff. 1986. Constraints to Higher Rice Yields in Seven Rice Growing Environments in South and South Asia. Los Banos. IRRI. Unpublished.

Berg, Elliot. 1990. The Rationale for Liberalisation and Some Lessons of Experience. *Conference on Economic Liberalisation in the Agricultural Sector.* Kinshasa, Zaire. May 29-30.

Blackie, Malcolm J. 1989. International Science and the Research Needs of Agriculturally Dependent Communities in Southern Africa. *Agricultural Systems.* 31 :169-183.

Cantrell, R. P. 1990. Quality Protein Maize: A Better Lunch But Not a Free One. Mexico, D.F.: CIMMYT.

Cessay, Sompo *et al.* 1989. *Analysis of Agricultural Research Priorities in The Gambia.* ACIAR/ISNAR Project Papers, No. 16. Canberra and The Hague. ACIAR and ISNAR.

Chidzero, B. T. G. 1990. *Economic Policy Statement: Macro-economic Adjustment and Trade Liberalisation, including the Budget Statement, 1990.* Harare. Government Printer.

Collis, W. R. E., I. Dema, and A. Omololu. 1962. On the Ecology of Child Health and Nutrition in Nigerian Villages: Part 1. Environment, Population and Resources. *Tropical and Geographical Medicine.* 14 :140-163.

Daniels, L., J. Howard, M. Maredia, J. Oehmke and R. Bernsten. 1990. Assessment of Agricultural Research: Ex-Post, Ex-Ante and Needed Methodologies. East Lansing. Department of Agricultural Economics. Michigan State University

Davis, J. S., P. A. Oram and J. G. Ryan. 1987. *Assessment of Agricultural Research Priorities: An International Perspective.* ACIAR Monograph No. 4. Canberra, Australia. Australian Centre for International Agricultural Research.

Dione, Josue. 1989. *Informing Food Security Policy in Mali: Interactions Between Technology, Institutions and Market Reforms.* Unpublished Ph.D. Dissertation. East Lansing. Department of Agricultural Economics, Michigan State University.

Dorosh, Paul. 1989. Economics of Cassava in Africa. In: *Sarma 1989.* :56-72.

Drèze, Jean and Amartya Sen. 1989. *Hunger and Public Action.* Oxford. Clarendon Press.

ECA. 1989. *African Alternatives to Structural Adjustment Programmes: A Framework for Transformation and Recovery.* Addis Ababa. Economic Commission for Africa.

Echeverria, R. G. 1990. Assessing the Impact of Agricultural Research. In: R.G. Echeverria (ed) *Methods for Diagnosing Research System Constraints and Assessing the Impact of Agricultural Research. Vol. II, Assessing the Impact of Agricultural Research.* The Hague: ISNAR, :1-31.

Eicher, Carl K. 1989. *Sustainable Institutions for African Agricultural Development.* Working Paper No. 19. The Hague. ISNAR.

Eicher, Carl K. 1990a. Building African Scientific Capacity for Agricultural Development. *Agricultural Economics.* Vol. 4(2) :117-143.

Eicher, Carl K. 1990b. Leading Issues in Strengthening Agricultural Research Systems in Sub-Saharan Africa. Keynote address presented at the International Conference on Agricultural Research in Sub-Saharan Africa, AAS, SPAAR and MESRES, Douala. Cameroon, November 6-8, 1990.

Eicher, Carl K. and Mandivamba Rukuni. 1990. Zimbabwe's Experience in Restructuring Institutions to Support Communal Farmers: Lessons for Namibia. Paper presented at an IAEA Conference on Agricultural Restructuring In Southern Africa. Swakopmund, Namibia.

Eicher, Carl K. and John M. Staatz. 1986. Food Security Policy in Sub-Saharan Africa, In: A. Maunder and U. Renborg. Eds. *Agriculture in a Turbulent World Economy.* Aldershot, Gower.

Eicher, Carl K. and John M. Staatz. eds. 1990. *Agricultural Development In The Third World.* Second Edition. Baltimore. Johns Hopkins University Press.

Fenner, R. J. and E. M. Shumba. 1989. Linking Research and Extension Through On-Farm Research and Demonstration: The Zimbabwe Experience. Paper presented at an ISNAR International Workshop, November 19-25. The Hague. ISNAR.

Fisher, Anne. 1986. Sorghum: The Struggle for Acceptance. *IDRC Reports.* January: 18-19.

Gittinger, J. Price *et al.* 1990. *Household Food Security and the Role of Women.* Washington, D.C. World Bank.

Harpstead, Dale and M. W. Adams. 1976. "Genetics of Food Crop Improvement," In *Nutrition and Agricultural Development: Significance and Potential for the Tropics.* Edited by N. S. Scrimshaw and M. Behar. New York. Plenium Press. :443-460.

Harriss, Barbara. 1987. Nutrition and Agricultural Research. *Food Policy.* 12(1):29-34.

Haswell, M. R. 1953. *Economics of Agriculture in a Savannah Village: Report on a Three Year Study in a Genieri Village and Its Lands: The Gambia.* London, H.M.S.O.

Hayami, Y. and U. R. Ruttan. 1985. *Agricultural Development: An International Perspective.* Baltimore. Johns Hopkins University Press.

Heinrich, G., J. Siebert, E. Modiakgotla, D. Norman and J. Ware-Snyder, eds. 1990a. *A Technical Summary of ATIP's Activities 1982-90: Research Results.* ATIP-RP-5. Gaborone. Ministry of Agriculture.

Heinrich, G., J. Siebert, E. Modiakgotla, D. Norman and J. Ware-Snyder, eds. 1990b. *Technical Summary of ATIP's Activities 1982-90: Promising Guidelines.* ATIP-RP-6. Gaborone. Ministry of Agriculture.

Herdt, Robert. 1990. Review: New Seeds and Poor People. *American Journal of Agricultural Economics.* 72(3) :837-38.

Hunter, John M. 1967. Seasonal Hunger in a Part of the West Africa Savanna: A Survey of Bodyweights in Nangodi, North East Ghana. *Institute of British Geographers, Transactions.* 41 :167-183.

ISNAR. 1988. *Review of The Nigerian Institute for Oil Palm Research (NIFOR).* The Hague. ISNAR.

ISNAR. 1990. *Kenya: National Agricultural Research Project: Mid-Term Review, 11-22 June 1990.* The Hague. ISNAR.

Jain, H. K. 1990. *Organisation and Management of Agricultural Research in Sub-Saharan Africa: Recent Experience and Future Direction.* WP 33. ISNAR. The Hague.

Javier, Emil. 1987. Priority Setting and Resource Allocation in Agricultural Research at the National System Level. The Hague. ISNAR.

Joy, L. 1967. The Economics of Food Production. *African Affairs.* 65 :317-327.

Karanja, Daniel. 1990. *The Rate of Return to Maize Research in Kenya: 1955-88.* Unpublished M.Sc. Thesis. East Lansing, Michigan. Department of Agricultural Economics.

Kenya, Republic of. 1986. *Economic Management for Renewed Growth.* Sessional Paper No. 1. Nairobi, Government Printer.

Kyomo, M. L. 1990. Priority Setting in Agricultural Research: Examples from SADCC. Paper presented at a meeting organised by SPAAR, September 17-21, 1990. Washington, D.C. SPAAR. World Bank.

Lamb, G. and L. Muller. 1982. *Control, Accountability and Incentives in a Successful Development Institution: The Kenya Tea Development Authority.* Washington D.C. World Bank.

Lele, U., Bill H. Kinsey and Antonia Obeya 1989. *Building Agricultural Research Capacity in Africa: Policy Lessons From the MADIA Countries.* MADIA Working Paper, Washington, World Bank.

Lele, U., Nicolas van de Walle and Mathurin Gbetibouo. 1989. *Cotton in Africa: An Analysis of Differences in Performance.* MADIA Working Paper. Washington DC. World Bank.

Lipton, Michael with Richard Longhurst. 1989. *New Seeds and Poor People.* Baltimore. John Hopkins University Press.

Low, Allan. 1990. Technology Generation and Dissemination for Smallholder Farmers in Southern Africa: Experiences and Lessons. Paper presented at the IAEA Conference in Swakopmund, Namibia. July 23-27.

Lundahl, Mats and Benno J. Ndulu. 1987. Market-Related Incentives and Food Production in Tanzania: Theory and Experience. In: Stefan Hedlund, Ed. *Incentives and Economic Systems.* London. Croom Helm. :191-227.

Lynam, John K., Willem Janssen, and Luis R. Sanint. 1989. Uncertain Marriage of Price Policy and Agricultural Research: Case of Cassava in Latin America. In: B. Greenshields and M. Bellamy Eds. *Government Intervention in Agriculture: Cause and Effect.* Adershot. Gower. :102-109.

Mkamanga, G. Y., L. D. M. Ngwira, and T. J. Cusack, 1990. "Setting National Agricultural Research Priorities for Household Food Security: The Malawi Experience," Paper presented at the Sixth Annual UZ/MSU Food Security Conference. Harare, Zimbabwe. November 11-14.

Morris, Michael. 1989. Wheat Policy Options in Sub-Saharan Africa: The Case of Zimbabwe. *Agricultural Economics* 3 :115-129.

Morris, Michael and Derek Byerlee. 1990. Narrowing the Wheat Gap in Sub-Saharan Africa: Economic Issues for Researchers and Policy Makers. Mexico, D.F.: CIMMYT, April.

Msukwa, L. A. H. 1990. Nutrition Strategies in Malawi. In: M. Rukuni, G. Mudimu, and T.S. Jayne eds. Harare, *Food Security Policies In the SADCC Region.* UZ/MSU Food Security Project, University of Zimbabwe. :253-265.

National Steering Committee on Food and Nutrition 1990. "The Nutrition Situation: Current Strategies and Plans. Paper presented at the National Consultative Workshop on Food and Nutrition Policy. Nyanga, Zimbabwe. July 16-17, 1990.

Norman, D. W., H. Sigwele and D. Baker. 1988. Reflections on Two Decades of Research on Sorghum-Based Farming Systems in Northern Nigeria and Botswana. In: M. Rukuni, and R. Bernsten, eds. *Southern Africa: Food Security Policy Options.* Harare, UZ/MSU Food Security Project. :235-254.

Norton, G. W. and P. G. Pardey. 1987. *Priority-Setting Mechanisms for National Agricultural Research Systems: Present Experience and Future Needs.* Working Paper, No. 7. The Hague. ISNAR.

Ohiorhenuan, Lily. 1989. *Nutritional Considerations in Agricultural Research in Nigeria.* Research Report No. 2. Morrilton, Arkansas. Winrock International.

Pinstrup-Andersen Per. 1990. Agricultural Research and Nutrition. *Food Policy.* 15(6) :475-78.

Pinstrup-Andersen, Per, N. Ruiz de Londono and Edward Hoover, 1976. The Impact of Increasing Food Supply on Human Nutrition: Implications for Commodity Priorities in Agricultural Research and Policy. *American Journal of Agricultural Economics.* Vol. 58 :131-142.

Pinstrup-Andersen Per, Alan Berg and Martin Forman. eds. 1984. *International Agricultural Research and Human Nutrition.* Washington, D.C. and Rome. IFPRI and UN Administrative Committee on Co-ordination/Sub Committee on Nutrition.

Platt, B. S. 1940. Report of a Nutrition Survey in Nyasaland. Unpublished, Zomba. Centre for Social Research. University of Malawi.

PORIM. 1985. *Annual Report 1985.* Selangor, Malaysia: PORIM (Palm Oil Research Institute of Malaysia).

Richards, Audrey. 1932. *Hunger and Work In a Savage Tribe.* London, Routledge.

Rohrbach, David D. 1990. Strengthening Sorghum and Millet Production and Market Systems in the SADCC Region. Paper presented at the IAEA Conference on: Agricultural Restructuring in Southern Africa. Swakopmund, Namibia. July 23-27.

Rukuni, Mandivamba and Carl K. Eicher. 1988. The Food Security Equation in Southern Africa. In: *Coralie Bryant ed. Poverty, Policy and Food Security in Southern Africa.* Boulder CO. Lynne Rienner Publishers. :133-157.

Rusike, Joseph. 1989. *Trader Perceptions of Constraints on Expanding Input Trade Among Selected SADCC Countries.* Harare, UZ/MSU Food Security Project, University of Zimbabwe. July.

Ruttan, Vernon W. 1987. Toward a Global Agricultural Research System. In: Vernon W. Ruttan and Carl E. Pray, eds. *Policy for Agricultural Research.* Boulder, Westview Press. :65-97.

SACCAR. 1990. *A Long Term Strategy for Training of Professional Manpower for the Agriculture and Natural Resources Sector in the SADCC Region: 1991-2010.* Gaborone. SACCAR. June.

SADCC. 1990. *Food Security Update, August, 1990.* SADCC Regional Early Warning Unit for Food Security. Harare. November 3, 1990.

Sahn, David eds. 1989. *Seasonal Variability in the Third World: The Consequences for Food Security.* Baltimore. Johns Hopkins University Press.

Sarma, J. S. 1989. *Summary Proceedings of a Workshop on Trends and Prospects of Cassava in the Third World.* IFPRI. Washington, D.C.

Schapiro, Morton and Stephen Wainaina. 1989. Kenya: A Case Study of the Production and Export of Horticultural Commodities. In: *Successful Development in Africa: Case Studies of Projects, Programme and Policies.* Washington. World Bank, EDI :79-94.

Shumba, E. M. 1990. "Zimbabwe's Experiences in Agricultural Research Priority Setting for Communal Area Households," Paper presented at the UZ/MSU Sixth Annual Conference on Food Security Research in Southern Africa. Harare, November 11-14.

Sigwele, H. K. 1990. The Agricultural Economy of Botswana. Paper presented at the IAEA Conference on Agricultural Restructuring in Southern Africa. Swakopmund, Namibia. July 23-27, 1990.

Simmons, Emmy, 1976. *Calorie and Protein Intakes in Three Villages of Zaria Province, May 1970-July 1971.* Zaria, Nigeria. Ahmadu Bello University.

Smith, V. E. 1975. *Efficient Resource Use for Tropical Nutrition: Nigeria.* East Lansing, Graduate School of Business Administration. Michigan State University.

Staatz, John M. *et al.* 1989. The Scope for Targeted Food Subsidies in Mali. Paper presented at a Workshop on Targeted Consumer Food Subsidy Schemes. Arlington, VA. November 21. USAID.

Sukhatme, P. V. 1970. Incidence of Protein Deficiency in Relation to Different Diets in India. *British Journal of Nutrition.* 24 :477-487.

Ter Horst, K. and E. R. Watts, eds. 1983. *Plant Breeding for Low Input Conditions: Proceedings of a Workshop on Plant Breeding for 'Lousy' Conditions held at Mount Makulu Central Research Station, Chilanga, Zambia on Friday, March 5th, 1982.* Lusaka. Government Printer.

Teri, J., S. E. Mugogo, G. W. Norton. 1990. Analysis of Agricultural Research Priorities in Tanzania. Dar es Salaam. Ministry of Agriculture, Livestock Development and Cooperatives, July, Draft.

Toole, Dan. 1988. Increasing the Contribution of Cassava to Household Food Security. Paper presented at a SADCC Conference on Enhancing the Contribution of Cassava to Food Security in SADCC Member States. Malawi, 28 November-1 December.

Tripp, Robert. 1990. Does Nutrition Have a Place in Agricultural Research? *Food Policy.* 15(6) :467-474.

UNCTAD. 1990. *Africa's Commodity Problems: Towards a Solution.* Geneva. UNCTAD Secretariat.

Vietmeyer, Noel D. 1986. Lesser-known Plants of Potential Use in Agriculture and Forestry. *Science.* Vol. 232, June 3, :1379-1384.

Weber, M., J. Staatz, J. Holtzman, E. Crawford and R. Bernsten. 1988. Informing Food Security Decisions in Africa: Empirical Analysis and Policy Dialogue. *American Journal of Agricultural Economics.* Vol. 70(5) :1045-1054.

World Bank. 1989. *Sub-Saharan Africa: From Crisis to Sustainable Growth.* Washington, D.C. World Bank.

World Bank. 1990a. *Agricultural Diversification: Policies and Issues from East Asian Experience.* Washington, D.C. World Bank.

World Bank. 1990b. *World Development Report, 1990.* Washington, D.C., World Bank.

World Bank. 1990c. *Making Adjustment Work for the Poor: A Framework for Policy Reform in Africa.* Washington, D.C. World Bank.

Regional Level Priority Setting In Agricultural Research And The Evolution Of SACCAR[1] Of SADCC[2]

M.L. Kyomo[3]

SYNOPSIS

In 1980, the majority ruled independent states of Southern Africa, *i.e.*, Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe decided to forge an economic union. This was done through a declaration, "Southern Africa: Toward Economic Liberation". The new entity was named the Southern African Development Coordination Conference (SADCC). The sectors identified for cooperation included the productive sectors of agriculture, mining, industry and trade, and tourism. They included the key service sectors of human resources development, transport and communication. The agricultural sector was subdivided into the subsectors of agricultural research and training; livestock production and animal disease control; forestry; fisheries, wildlife, food security; and soil and water conservation.

The agricultural research and training subsector is coordinated by Botswana using a centre which was established by Charter. It has a Board of Governors comprised of Directors of research, some Deans of Faculties of Agriculture, Forestry and Veterinary Medicine, and some Directors of Agricultural Extension. Agricultural research and training priorities are set by either heads of state and government (top to bottom approach) or through studies on problems affecting farmers

---

[1]Southern African Centre for Cooperation in Agricultural Research and Training.

[2]Southern African Development Coordination Conference.

[3]The author is currently the Director of the Southern African Centre for Cooperation in Agricultural Research and Training (SACCAR) of SADCC, Private Bag 00108, Gaborone, Botswana.

recommending priorities to higher organs of SADCC (a bottom to top approach). Through these approaches, SADCC has identified and is implementing projects and programmes which are bringing benefits to farmers and to the region generally.

Background

The decision to launch the Southern African Development Coordination Conference (SADCC) on April, 1980 was made by Heads of States in Southern Africa. These, at the time included Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe. Namibia, which gained independence on March 21, 1990, joined SADCC on April 1, 1990 -- the day the organisation was celebrating its tenth Anniversary. Before 1980, the SADCC member states had been assisting each other in fighting for political independence. In the declaration, "Southern Africa: Toward Economic Liberation", these states declared their commitment to pursue policies aimed at economic liberation and the integrated development of their national economies. They identified areas in which, working in harmony, they could guide national development toward providing goods and services presently obtained from outside the region and thus weave a fabric of self-sufficiency through regional cooperation. The identified areas were the productive sectors of food, agriculture and natural resources; energy, industry and trade; mining and tourism. They also identified the key service sectors, human resource development and transport and communication. The main objective was to improve the welfare of member state citizens through creation of jobs, services, improved food security and allowing them to participate in intra-regional trade.

The Heads of State and Government also adopted a decentralised structure and small but efficient institutions established to manage the programme of action. In other words, they wanted all member states to participate in the development and management of projects and programmes while avoiding the creation of large bureaucracies.

They allocated the coordination responsibilities as follows:

COUNTRY	SECTOR
Angola:	Energy
Botswana:	(a) Agricultural Research and Training (b) Livestock Production and Animal Disease Control.
Lesotho:	(a) Tourism (b) Soil and water conservation
Malawi:	(a) Forestry (b) Fisheries (c) Wildlife
Mozambique:	Transport and Communication
Namibia:	To be allocated a sector by January 1991.
Swaziland:	Human Resource Development
Tanzania:	Industry and Trade
Zambia:	Mining
Zimbabwe:	(a) Food Security (b) Overall coordination of the large sector of food, agriculture and natural resources.

The coordination mechanisms were to be left to member states to develop using their own personnel and budgetary allocations. However, for transport and communication and agricultural research and training, it was to be the responsibility of all member states to contribute to their establishment and operational costs. The coordinating units established for these sectors were: The Southern African Transport and Communication Commission (SATCC) and the Southern African Centre for Cooperation in Agricultural Research and Training (SACCAR), respectively. Each unit, including the SADCC Secretariat which is located in Botswana, has their own charter defining their objectives, powers and functions.

SETTING RESEARCH PRIORITIES

Priority areas in agricultural research are identified through a participatory approach, and set up through top-down and bottom-up approaches. The summit of SADCC, comprised of the Heads of State and Government, make, from time to time, broad policy directives. The agricultural researchers, through the Ministers of Agriculture and Natural Resources, translate these directives into concrete projects and programmes (see Figure 1 for organizational relationship). When SADCC was established, for example, the Summit directed that agricultural research should give attention to previously neglected rural communities in semi-arid areas. Hence the Sorghum and Millet Improvement Programme and the Land and Water Management Research Programme were developed and now are at various stages of implementation. These projects were followed by the Grain Legume Improvement Programme. This latter programme is developing improved germplasm in beans, groundnuts and cowpeas, the principal sources of protein for the resource poor, rural communities. The summit later directed agricultural research to develop projects and programmes to enhance farmers' food security. They identified horticulture and the related field of irrigation. The agricultural research and training sector has developed a project on vegetable research and will soon develop one on fruit and nuts. Projects on irrigation will be developed later. These are examples of the top-down approach in setting priorities in agricultural research and related training.

The bottom-up approach in setting research priorities also has been used. A consultancy firm, Devres Inc., was commissioned, after consultations between SADCC, through a Committee of Directors of Agricultural Research and CDA[4]. This firm was to conduct an inventory and assessment of country specific agricultural research, training and extension (Agricultural Research Resource Assessments -- ARRA), and do a regional analysis of existing agricultural research, extension and training resources to determine the medium to long-term needs and opportunities for agricultural research to increase agricultural productivity. They used local and international consultants from July 1983 through August 1984 to collect and analyse data and produce reports. The regional analysis and data are stored at SACCAR for reproduction and up-dating. Devres Inc. was commissioned by the same donors to work in the Sahel and produce similar reports for the Institute du Sahel (INSAH). For SADCC, it carried out an analysis of existing resources for each country, Table 1, and for the region, and developed a 20 year strategy to strengthen existing national and regional activities. The constraints identified are show in Table 2.

---

[4]CDA is defined in Appendix II, list of acronyms.

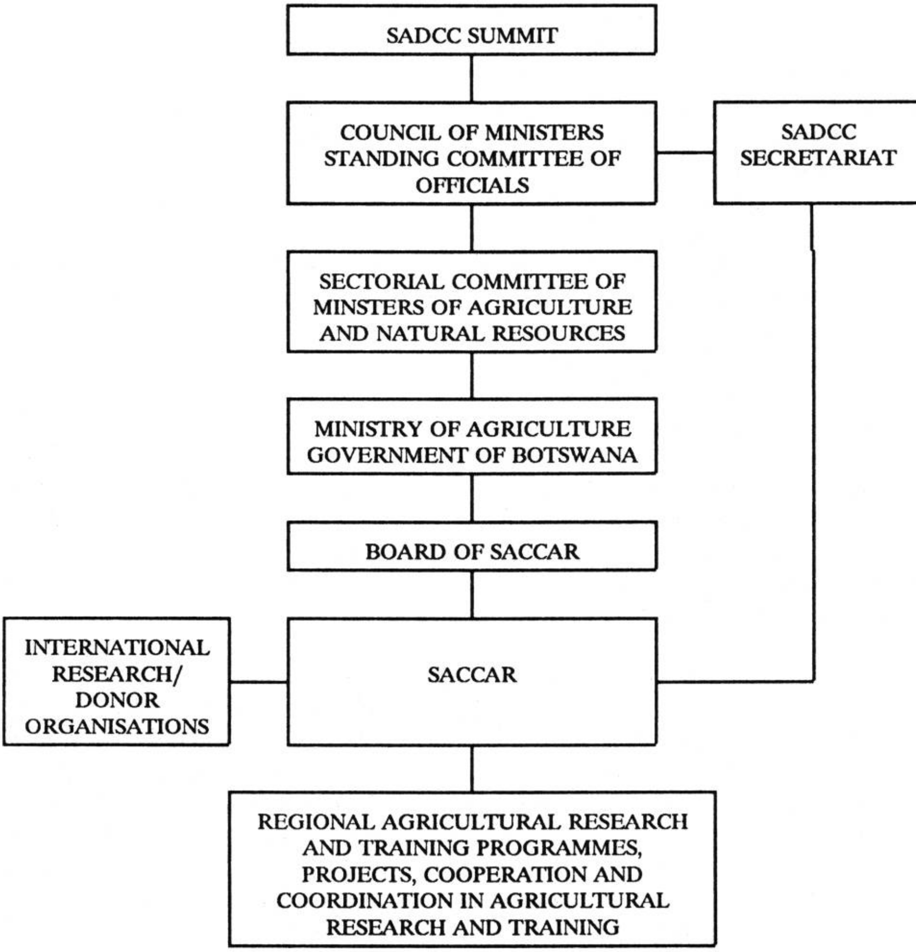


Fig. 1: Organisational relationships of SACCAR and SADCC

Table 1
Some basic resources for agricultural research and production in the SADCC[1]

Country	Population 1 000	Labour force in Agriculture %	Agriculture contribution to GDP %	Total Land Area 1 000 ha	Land in Arable Agriculture %	Number of Graduates in Agric Research[2]	Hectares or Arable land per Grad	Additional hectares of potential	Hectares of total arable + pot. per grad
Angola	7 452	n.a	n.a	124 670	2,0	n.a	n.a	n.a	n.a
Botswana	940	83,0	12	60 037	2,0	46	29 565	n.a	n.a
Lesotho	1 640	87,0	31	3 300	13,0	18	23 889	0	0
Malawi	6 400	84,0	43	9 410	17,6	127	13 070	3 450 000	40 236
Mozambique	11 052	n.a	n.a	80 159	4,0	83	34 337	n.a	n.a
Swaziland	605	75,0	24	1 736	12,4	24	8 333	0	0
Tanzania	21 000	80,4	52	88 360	5,0	321	13 763	48 700 000	165 476
Zambia	5 679	67,0	13	75 000	2,0	197	7 309	9 000 000	52 995
Zimbabwe	7 546	n.a	15	39 024	6,0	222	10 547	15 609 800	80 861

[1] Data compiled from the Devres Agricultural Research Resources Assessment and the FAO document Trained Agricultural Manpower Assessment in Africa, Harare Conference, July 1984.
[2] In some cases this includes professionals in forestry, fisheries and wildlife.
Note: Namibia data not shown.
Source: SADCC Devres, 1984.

Table 2
Constraints being faced by national agricultural research systems in SADCC-DEVRES, 1984.

DIRECT CONSTRAINTS -- PHYSICAL AND BIOLOGICAL

(a) Climate and ecological limitations
(b) Losses due to pests, weeds and diseases and post-harvest losses.
(c) Lack of adapted crop varieties and livestock species
(d) Seasonal shortage of human labour and farm power

INDIRECT CONSTRAINTS

(a) Economic constraints
(b) Constraints related to rural traditions

- Land holding patterns
- Livestock holding patterns
- Low farmer status

(c) Constraints related to the role of women
(d) Constraints related to agricultural research, extension and training institutions and policies.

- Lack of trained and experienced national professionals
- Inadequate capacity and orientation of training
- Lack of institutional collaboration and linkage into smallholders.
- Institutional focus upon the commercial rather than smallholder sector.
- Inadequate national and institutional budget and staffing policies.

The SADCC-Devres (1984) study also developed an agricultural research strategy for the region. The research objectives, strategy objectives and elements to implement the regional research strategy are shown below:

...Quote:

"....A Regional Agricultural Research Strategy

Objective:

The principal objective of the 20 year strategy for agricultural research is to achieve a significant increase in *per capita* agricultural output, thus increasing the well-being of the citizens of the region and promoting national food security in the SADCC countries.

Another important objective of the strategy was to ensure that, in the long-term, the means of attaining *per capita* increase in agricultural production are developed, adapted and implemented by African institutions.

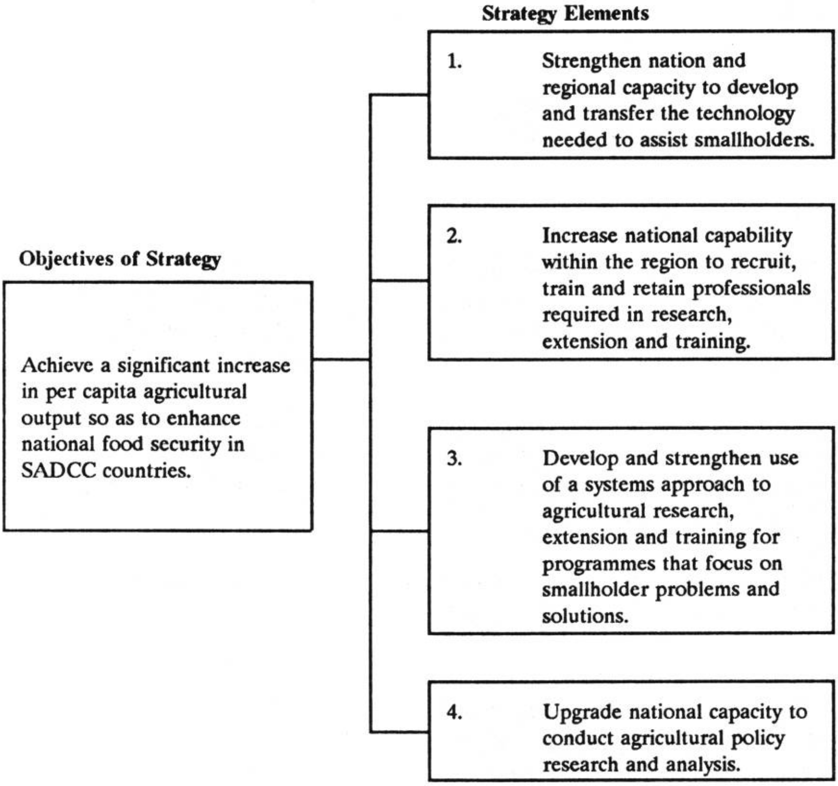
Both objectives are consistent with the proposals of the Lagos Plan of Action of the Organisation of African Unity (OAU) members, the UN and the World Bank.

SADCC and CDA donors have agreed that an essential element in achieving these objectives is agricultural research capability in the region. It has been recognised since 1983-84 that the means must be found to increase agricultural productivity to more than offset the region's rapid population growth while sustaining its fragile natural resource base. Further it has been recognised that these means must be rooted in African Institutions and implemented by SADCC at national and/or regional levels if food security goals are to be reached and sustained in the long term.

The proposed strategy supports national development goals which emphasize increased food production in the rural areas. When this is realised, it will contribute to:

- The welfare of rural population;
- Marketable surpluses of food crops, which can be available for the urban population at lower prices, and export crops;
- Increased *per capita* GNP;
- Increased foreign exchange earnings and savings;
- Lessened imports of food requirements and;
- Increased employment in rural areas.

(SADCC-DEVRES, 1984)



Source: SADCC Agricultural Research Resource Assessment (ARRA), DEVRES, 1984."

... Unquote.

A second example is the SACCAR organised workshops on constraints to agricultural production, extension or training in the majority of SADCC member states. The recommendations emerging therefrom are sent to the higher organs of SADCC for approval before the projects or programmes are formulated. Yet another example is where SACCAR is directed by its Board to commission studies by consultants in specific fields of agriculture. If the recommendations are to establish regional research projects or programmes, and if these meet the SADCC criteria for regional projects or programmes, SACCAR proceeds to develop them. The projects and programmes developed through these mechanisms during the first decade of SADCC are shown in Table 3.

Table 3
Identified regional research and training projects and programmes in SADCC during 1980 to 1990[5]

Project/Programme	Location and Major SADCC Cooperating Partner and Executing Agencies[6]	Status in Implementation
Land & Water Management Research Programme (L&WMRP)	Botswana ODA EEC	First phase got underway in January 1987. The second phase in January 1989.
Sorghum & Millet Improvement Programme	Zimbabwe USAID, CIDA & GTZ (ICRISAT)	It is in its second five year implementation phase.
Utilisation of Sorghum & Millet for food, beverages.	Zimbabwe USAID, CIDA & GTZ (ICRISAT)	It is in the first phase of implementation.
Grain Legume Improvement Programme (GLIP):		
Groundnuts	Malawi GTZ (ICRISAT)	The components are at various stages of implementation.
Cowpeas	Mozambique EEC (IITA)	
Beans (Phaseolus)	Tanzania CIDA (CIAT)	
Agroforestry for the Savannah Woodland Grassland Ecology	Malawi Tanzania Zambia Zimbabwe CIDA (ICRAF)	Under implementation
Establishment of SACCAR	Botswana CIDA Norway ODA SAREC SADCC USAID (SACCAR)	First Phase of five years 1985 to 1990 was extended to 1992
In-service Training in Research Management	CIDA ODA USAID (ISNAR)	Under implementation
Crops & Forest Seeds Gene Bank (SRGB)	NORDIC countries Nordic Gene Bank (NGB) & SIDA	Under implementation

Table 3 continued
Identified regional research and training projects and programmes in SADCC during 1980 to 1990[5]

Project/Programme	Location and Major SADCC Cooperating Partner and Executing Agencies[6]	Status in Implementation
Maize & Wheat Research Network	UNDP funded consultancy work	Consultancy report being analysed
Development for 4 M.Sc Programmes M.Sc in Animal Science M.Sc in Agricultural Economics M.Sc in Agricultural Engineering M.Sc in Agronomy	 Malawi Zimbabwe Tanzania Zambia (GTZ)	Under implementation
Livestock Improvement Small-holder Dairy Small Ruminants Forages		Being developed with International Livestock Centre for Africa (ILCA)
Regional Vegetable Research Programme	(AVRDC)	Feasibility study completed. Project document developed and funding being sought.
Biological control of introduced pests of Maize and Cassava.	(IITA)	Project document finalised. Donor funding being sought.
Wool & Mohair Improvement Project	(Winrock International worked with SACCAR to develop project)	Donor funding being sought.
Management of vertisols (Black cotton soils in SADCC).	Botswana (-)	Donor funding being sought.
Network on draught animal power and mechanisation	(-)	Feasibility study under preparation and UNDP agreed to finance it.

SOME IMPORTANT LESSONS ON COOPERATION IN AGRICULTURAL RESEARCH AND TRAINING

In addition to setting limits on staff numbers at SACCAR to avoid the creation of a top-heavy bureaucracy, SADCC has also encouraged SACCAR to aim for the maximum dispersion of programmes and projects around the region within the limits of ecological suitability. This ensures the maximum spread of benefits to national agricultural research systems.

SADCC itself is a relatively new initiative as a framework for promoting cooperation in different economic sectors of the region and has wider interests, not the least of

[5]For clarification of acronyms see Appendix II.

[6]Names of executing agencies are shown in parentheses.

which is its decentralised mode of operation. SACCAR, in turn, is evidence of the strong political commitment of the member states of SADCC to regional collaboration as a major route to serving both their individual and collective interests in developing strong and efficient agricultural research capabilities. The roles and functions of SACCAR, in this context, have been defined. The Centre, which has moved into its own purpose built accommodation, is now through its formative phase and into its fully functional mode.

It has been accepted by member states and donors alike that, if lasting benefits at regional and national levels are to accrue from regional programmes, the commitment to such initiatives must be long term. The task for SACCAR in discharging its leadership role in promoting cooperation, in ensuring that it remains well informed about both regional and national developments and needs, and in maintaining its service functions, is an arduous one. This activity would have been simpler if all the national agricultural research systems had been well developed. However, there are still some problems confronting National Agricultural Research Systems (See Appendix I).

It is too early to assess the impact of SACCAR in the region. It is anticipated that support for SACCAR at the political level in SADCC and through funding by donors and SADCC member states will continue for the next 15-20 years. This will provide ample time for its impact to become apparent.

There are many issues relating to the development of agricultural research capacity which should be featured in future action agendas. It is certain that the performance of SACCAR as a coordinating and activating centre will be closely observed both from within and outside the region. In common with SADCC, it represents a new and potentially very productive model for collaboration between countries on the world stage.

APPENDIX I

PROBLEMS BEING FACED BY AGRICULTURAL RESEARCH SYSTEMS IN SADCC

For Member States

1. Need to strengthen the education sector so that it produces an adequate number of well qualified students to enter higher education and, eventually, agricultural research, training and extension.
2. The shortage of human capital in scientific fields in Africa continues to be the greatest among developing continents. More investment in higher agricultural training is needed.
3. Scientific equipment is inadequate, needs repair and, in many cases, is obsolete.
4. Library services in Research Systems and Faculties of Agriculture, Forestry and Veterinary Medicine require urgent improvement in terms of text books, periodicals, documentation and reproduction.
5. There is a lack of adequate venues for publication of agricultural research findings. There is a low budgetary allocation to journals and other related literature.
6. Lack of incentives result in a very high turnover of staff in the research, training and extension systems.
7. Lack of adequate resources. Low budgetary allocations exist for agriculture in general and agricultural research training and extension systems in particular. Funds suffice only for salaries and are inadequate for carrying out activities.
8. Too little training for laboratory technicians and research assistants.
9. Shortage of manpower causes Directors of Research not to release staff to go for further training. This leads to frustration and resignations.
10. Universities lack development funds. Money is needed for hostels to house students from the region, visiting professor accommodations and for reading space in libraries.

For Donors

1. Some donors take too long to recognize regional research institutions as channels of addressing regional research issues and continue to prefer bi-lateral approaches. This leads to weakening regional organizations.
2. Executing Agencies have their own Boards of Trustees, as has SACCAR. Which one should prevail when it comes to implementing regional research and training projects and programmes still remains an issue! The region prefers that it be permitted to have its chosen goals respected.
3. Some Executing Agencies under CGIAR systems do not wish to be told that the Regional Body has given priority to some and not all commodities under their mandate. They attempt to add to regionally identified commodities. They claim that they are expected to promote all commodities under their mandate.
4. Some donors do not wish to involve National Research Systems in identifying problems and designing projects for solving them. The region has some experienced manpower who should be working with outside consultants in identifying problems and designing projects.
5. In conclusion, priorities defined by countries and regional institutions alert donors to indigenous requirements.

APPENDIX II

LIST OF ACRONYMS AND ABBREVIATIONS

AVRDC	Asian Vegetable Research Development Centre, Taiwan.
CDA	Cooperation for Development in Africa
CGIAR	Consultative Group on International Agricultural Research
CIAT	International Centre for Tropical Agriculture, Columbia
CIDA	Canadian International Development Agency
CIMMYT	International Maize and Wheat Improvement Centre
CIP	International Potato Centre, Peru
CTC	Consultative Technical Committee of SADCC
EEC	European Economic Commission
IARC	International Agricultural Research Centre
IBPGR	International Board for Plant Genetic Resources
ICRAF	International Council for Research in Agroforestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics, India
IDRC	International Development Research Centre, Canada
IITA	International Institute of Tropical Agriculture, Nigeria
ILCA	International Livestock Centre for Africa, Ethiopia
ISNAR	Institute Service for National Agricultural Research, The Netherlands
NARS	National Agricultural Research Systems
NORAD	Norwegian Agency for International Development
ODA	Overseas Development Administration, United Kingdom Government.
SACCAR	Southern African Centre for Cooperation in Agricultural Research
SADCC	Southern African Development Coordination Conference
SAREC	Swedish Agency for Research Cooperation in Developing Countries
SATCC	Southern African Transport and Communication Commission
SIDA	Swedish International Development Agency
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
USDA	United States Department of Agriculture

19

The Experiences of SADCC/ICRISAT In Setting Priorities For Sorghum And Millet Research For Household Food Security

Leland R. House and David D. Rohrbach[1]

The persistence of food insecurity in the SADCC region, despite regional and some national food surpluses, results from a historical failure to develop improved technologies for smallholder production systems based in semi-arid areas. These low rainfall zones encompass many of the most food insecure households in the region. Frequent droughts cause a persistent need for food relief programmes. But even in years of average rainfall, many of these farm families still cannot produce their annual grain requirements. Such households badly need improved cropping technologies in order to increase the level and stability of their grain production. Improved technologies are also necessary to generate a sustainable income base.

The SADCC/ICRISAT Sorghum and Millet Improvement Programme (SMIP) was established in 1983 to help fill this gap. Decades of research on maize had provided a backbone for the development of the regional maize economy. In contrast, research on sorghum and millet, crops of key, historical importance to the regional agro-economy, was practically non-existent. Technological gains had allowed maize to broadly replace sorghum and millet as the region's principal cereal staple. The lack of technologies for the small grains left these characterised as traditional or subsistence crops.

Periodic droughts have stimulated intermittent interest in the promotion of sorghum and millet. Small farmers have been advised by extension workers to reallocate land from maize to these more drought tolerant crops. Yet improved maize production technologies offer higher returns than unimproved sorghum or millet, even in many drier zones. In Zimbabwe, for example, hybrid maize yields more than traditional sorghum or millet in all but the worst drought years (Hedden-Dunkhorst, 1989).

---

[1]Executive Director and Principal Economist, respectively, of the SADCC/ICRISAT Sorghum and Millet Improvement Programme, Box 776, Bulawayo, Zimbabwe.

Advice to grow unimproved sorghum and millet has threatened the credibility of extension workers.

Several SADCC governments have raised producer prices for sorghum and millet as an additional means to encourage production. But high producer prices have left sorghum and millet uncompetitive on the industrial market. Maize offers a cheaper industrial input because it is more productive. The uncompetitive prices caused the parastatal marketing boards to build unsaleable small grains stocks. Meanwhile, most households residing in low rainfall regions remained food insecure.

The SMIP helps construct the technological base upon which to rebuild the regional sorghum and millet economy. The choice of ICRISAT as the initial implementing agency offered direct access to world germplasm collections and top scientific expertise for sorghum and millet. This decision also facilitated the immediate establishment of an intensive regional research programme. Major complementary investments in the training of national programme staff and the improvement of national programme research facilities offered the basis for developing country-specific research capabilities for these crops. Over time, it is envisioned that these national programmes will take over many of the responsibilities of the regional programme. The development of a strong and sustainable set of national research programmes for sorghum and millet was originally expected to take 20 to 25 years.

This paper reviews the development of the SMIP, highlighting the establishment and evolution of priorities relating to crop productivity and utilisation that ultimately contribute to household food security. Within this context, the paper examines the role of the regional research institute and its response to the varying needs of the ten SADCC countries.

SMIP PROGRAMME ESTABLISHMENT

The primary objective of the SMIP is the strengthening of national capabilities to improve sorghum and millets. To achieve this, the programme was established with three major areas of activity: collaborative research, education and training, and support for the development and management of experimental facilities.

Collaborative Research

The objective of crop improvement was placed at the center of the programme. This decision placed an emphasis on technology generation rather than such broader efforts as the development of new farming systems. In 1983, virtually no breeding for sorghum and millet was being conducted in the SADCC region. Germplasm supplies were limited and national programmes were forced to rely on the testing of improved varieties developed elsewhere. Most national programmes had only limited means to even identify, much less make use of, externally generated technologies.

The initial SMIP priorities also accounted for the dynamic biological circumstances underlying varietal development and dissemination. Changes in cultivar or crop management are often coupled with changes in the disease, insect and weed pest incidence. Environmental changes such as prolonged dry spells and soil degradation also bring these sorts of changes. Correspondingly, the breeding programme needed a complementary input from an agronomist, entomologist and pathologist.

The semi-arid tropics are characterised by high variability in rainfall around the expected mean. The dry extreme is of particular concern. Sorghum and millet are widely known as drought tolerant crops. But plant response to drought is a trait with low heritability limiting gains that can be made by breeding. Large additional gains may be available through improvements in water management techniques. Thus, the development of crop management technologies designed to maximise moisture available to plants is another priority concern.

It was felt important to bring together a critical mass of scientific talent at one location. This would encourage interactions in the crop improvement process and facilitate the analysis of crop development interactions such as the relations between varietal response and moisture availability, soil fertility, moisture utilisation and cultivar, or plant luxuriance and susceptibility to stalk rots. Selection must be seen as a joint effort of breeder, pathologist, entomologist, and agronomist.

An economics input was not originally viewed as necessary until improved technologies had been developed. A production economist would then facilitate identification of technology adoption constraints and impact assessment.

Education and Training

The regional need for manpower development is well known. Correspondingly, a programme for degree education and non-degree training was given high priority. The degree education programme was subcontracted with the United States based Collaborative Research Support Programme in Sorghum and Millet (INTSORMIL). The non-degree training is carried out within the SADCC region and in conjunction with the ICRISAT training programmes in India.

Each national programme holds responsibility for the establishment of its training priorities relating to sorghum and millet and for the identification of candidates for overseas training. During the first ten years of the SMIP (1983-1993) over 100 individuals will have received scholarship support for B.Sc., M.Sc. or Ph.D degrees.

Regional training workshops are being run in crossing and crossing block management, nursery management, pest identification and scoring, economic policy analysis and research station management. The SMIP is supporting the post-graduate research of a small number of students. In addition, the SMIP offers research internships. Annually, 10-12 students from the University of Zimbabwe spend their three month summer vacation period with the SMIP.

Perhaps most importantly, the scientific expertise of the regionally based programme is being extended through collaborative research studies with national programmes and scientists. The strengths of academic training are then broadly complemented by on-going interaction with experienced scientific peers. In practice, such interaction stimulates improvement of the skills of national scientists in setting research priorities, planning investigations, analysing data and reporting research results. Such collaborative research helps educated disciplinarians become experienced scientists.

Station Development and Management

The early contributions of a station development and management officer were viewed as essential for both the establishment of a regional experiment station and the strengthening of several national stations. This position was premised on the assumption that efforts to build national facilities need to be complemented by efforts to run these efficiently. Further, the value of the results of crop experiments is directly linked with the efficient management of the experimental plots and the control of non-experimental sources of variability. Special efforts have been directed toward improving the quality of the management of station facilities and experimental trials.

EARLY SCIENTIFIC PRIORITIES

The establishment of a regional research programme in sorghum and millet was initially requested by the SADCC Heads of State in 1980. A regional needs survey was conducted by the programme Planning Mission in November of that year. This Mission consulted with each of the SADCC countries and outlined the priority each national programme attached to problems of breeding, agronomy, physiology, pest and disease control and food quality for sorghum and pearl millet. This offered the basis for the initial setting of each scientist's research priorities.

Problems of drought stress and the need for varietal and hybrid improvement were identified as particularly critical. Selection, to improve cultivars, depends on variability in the crop for the traits of concern. These encompass yield, disease and pest resistance and crop utilisation characteristics. An early priority was to undertake massive introduction to expand variability. For example, 5 500 accessions of sorghum, were received from 25 stations around the world. Another 2 400 accessions of pearl millet were received from 16 world locations.

Environments were immediately a matter of concern. The programme was centered at Matopos in Zimbabwe -- a representative semi-arid environment in the region. But the SMIP sought a broader series of environments to test cultivar adaptation, to identify racial considerations for diseases, and to screen for pest and disease resistance. Correspondingly, the above collection of sorghums was initially evaluated at five locations in four SADCC countries. The millet collection was initially evaluated in seven locations in five countries.

ENSURING CONTINUING RELEVANCE

Great importance has been attached to the objective of promoting on-going communication about sorghum and millet research in the region. This includes efforts to sponsor frequent reassessments of the value and orientation of SMIP contributions.

A number of steps have been taken to facilitate communication and information flows:

1. *Collaborative Science* - Roughly 30 to 40 percent of the time of SMIP scientists is spent traveling in the SADCC region and working with national scientists. Trials are administered collaboratively, SMIP scientists participate in national research planning workshops and disciplinary conferences, and SMIP scientists provide direct advisory assistance to individual scientists in the national programmes.

2. *Annual Regional Conference* - An annual workshop is held to review the results of sorghum and millet research in each SADCC country and plan the coming year's work. The national programme scientists are offering an increasingly important contribution to these discussions and to the planning of regional trials and nurseries.

3. *Monitoring Tours* - The SMIP organises biennial tours for SADCC scientists working with sorghum or millet to review each other's field research programmes. Every two years the progress of several national programmes is reviewed. Participating scientists not only interact on matters of scientific interest, but request seeds of varieties and hybrids of interest to their own programmes.

4. *Technical Advisory Panel* - A Technical Advisory Panel (TAP) meets annually with the SMIP to review the progress of the regional programme and suggest adjustments in priorities. The TAP is made up of the Director of SACCAR as chairman, three scientists from the region (frequently Directors of Research) and three eminent sorghum or millet scientists from elsewhere in the world.

5. *SACCAR Board* - The SMIP Director provides the Board of SACCAR with an annual update of programme activities. Suggestions are also received from this Board about programme priorities.

6. *Project Evaluations* - The SMIP receives periodic project evaluations from the programme donors. These often seek additional comment from SACCAR and the national programmes.

Few scientific programmes have sought such extensive interaction with other researchers in the region. In effect, the SMIP provides the foundation of a regional scientific programme encouraging both a consistent interchange of ideas and a high quality of disciplinary work. Few programmes also face the extensive scrutiny of programme and scientific priorities experienced by the SMIP. This almost constant communication and evaluation has ensured the relevance of the SMIP to regional needs and expanded support for programme implementation.

THE EVOLUTION OF PROGRAMME PRIORITIES

The SMIP programme began in May 1984 and the first Regional Workshop was held in October of that year. Two important consequences of that meeting were the addition of finger millet to the SMIP crop improvement programme and the identification of stations in the region in different environmental zones that would be appropriate for screening of introductions and early generation materials.

The existence of sorghum and millet surpluses held by the Grain Marketing Board (GMB) in Zimbabwe strengthened an initial concern for crop utilisation. While it was recognised that sorghum and millet could be employed for virtually hundreds of products, considerable thought was required to identify utilisation priorities for research. Several study papers were locally commissioned in 1987. International and regional meetings on sorghum and millet utilisation priorities were held in 1988. With the support of the Technical Advisory Panel and SACCAR, a food technologist was hired in July 1988. The decision was also taken to revise the terms of reference of the economist from production to market economics.

Also at this time, the agenda of the pearl and finger millet breeder was extended to encompass the development of sorghum and millet as forage crops. A regional pearl millet breeder was then employed to take charge of the pearl millet breeding efforts.

The Experiment Station Development and Operations Officer was originally planned for the first three years of the programme. Recognising the need to improve the quality of field research, and as part of the objective of strengthening national programme capabilities, this position was made permanent. Attention to the need for substantial improvement in the strength of experiment station operations in many national programmes brought the employment of a Regional Station Development and Management Officer.

Though some funds have been allocated to the improvement of the facilities of national sorghum and millet research programmes, station management needs remain extensive. Accordingly, the SMIP is in the process of developing a project for SADCC, to be independently funded and managed, that will direct greater resources toward experiment station improvement in the Region.

More recently, concerns have been raised about the lack of availability of improved sorghum and millet seed. As varieties and hybrids reach release, seed is needed for advanced testing, farmer verification trials, extension and preliminary farmer use. One to five tonnes of grain are also needed by food industries to evaluate the processing characteristics of new cultivars. This need for quantities of seeds up to five tonnes is more than a crop improvement programme is organised to manage, but often not enough to interest a country's seed industry.

This problem affects several crop development efforts in the SADCC region. The SMIP has accordingly taken the initiative of working with SACCAR and the SADCC Food Security Project to see if a DENAGRO recommended project can be modified to include this production.

1990 REASSESSMENT OF PRIORITIES

At the latest Annual Conference reviewing the progress of sorghum and millet research in the SADCC region, a survey was conducted asking each of 45 national scientists in attendance to specify the strengths and weakness of their programmes and to reassess their priorities for SMIP assistance. This survey is also being offered to regional scientists unable to attend the Regional Conference including 16 economists participating in a SMIP (and CIMMYT) sponsored training programme in economic policy analysis.

The SMIP seeks ultimately to work its way out of existence. Conceptually, it works to strengthen national programme capabilities to the point that outside assistance is no longer required. Such surveys help us gauge progress toward this goal.

The SMIP assumes that, early on, its own scientific staff takes greater responsibility for conducting regional research. Emphasis is placed on the education and training of national scientists. Over time, the SMIP functions are evolving toward the backstopping of national programmes with advisory assistance, the stimulation of communication flows and facilitation of the introduction and movement of germplasm, and the improvement of breeding stock containing particular traits valuable for incorporation into national research programmes.

SMIP'S REGIONAL ROLE

The maintenance of a strong regional research capability is viewed essential for supporting national programmes at various stages of development. Early on, this regional research effort has emphasised the introduction and distribution of genetic variability. The programme promotes the exploitation of this variability. The SMIP scientists bring new technologies and new ideas into the region. Collaborative research promotes the enhancement of scientific skills as much as the development of technology.

The regional programme is expected to evolve toward a role as generator of variability. The programme will then be less involved in technology development and more involved in the development of breeding material with genetic traits of particular value to national programmes. The scientific thrust of the regional programme would move upstream. The regional research will also concentrate on the analysis of crop improvement problems which have limited priority for any particular national programme but high priority for the region.

The SMIP cannot be viewed as a simple research network. The regional programme promotes scientific interaction among disciplinary peers. But it also strengthens the technology base available to the region. Further, it generates institutional and technological support uniquely geared to the differing needs of each national programme. Clearly, assistance in the development of sorghum and millet improvement programmes must differ for countries as diverse as Tanzania and Lesotho.

The regional programme has not routinely provided support for the regular operational needs of national sorghum and millet programmes. Some national programmes have requested money for capital items and even for operational expenses. But national investments in such costs are viewed as essential signs of national commitment to the development of a capability for sorghum and millet research. The SMIP is increasingly contributing to land surveys and experiment station planning, but the relevant Department of Agriculture must pay for earth moving and other construction costs.

Donors supporting the regional sorghum and millet programme frequently ask whether SMIP generated cultivars are being adopted by farmers. But the SMIP itself does not release new cultivars in the region. This is the responsibility of national programmes. The SMIP offers improved materials to the national programmes for further testing and possible distribution.

This relationship sparks concerns about the capabilities of national programmes to effectively evaluate, multiply and distribute new cultivars. The SMIP is concerned about whether new varieties and hybrids reach the farmer. Correspondingly, the SMIP is increasingly interested in the multiplication of seed for advanced national testing, the introduction and management of farmer verification trials and the strengthening of extension efforts relating to sorghum and millet. SMIP is interacting with seed companies in the region and may increasingly interact with national extension programmes.

SUSTAINABILITY

The SMIP views the objective of sustainability in both environmental and institutional terms. The limited technology base available to farmers situated in low rainfall regions encourages environmental degradation. Indeed, the incentives facing these farmers are to rapidly exploit available resources in order to meet essential family needs while seeking opportunities to move out of agriculture. Improved sorghum and millet technologies should reduce incentives to simply mine soil resources. These also prompt the more efficient utilisation of water. The consideration of the quantity and quality of grain stover offers a feed resource which can contribute to a more sustainable livestock system. The forage research programme directly works toward this objective.

The long term sustainability of the sorghum and millet agro-economy further requires the establishment of a set of price and market policies that facilitate the adoption of improved technologies and trade of a production surplus. The SMIP has correspondingly emphasised shifting the orientation of economics work in national agricultural research programmes from a concern with describing farming systems and technology adoption constraints toward a concern for market efficiency and the competitive position of sorghum and millet in the economy.

The SMIP also seeks the establishment of a set of self-sustaining national capabilities for the improvement of sorghum and millet. This objective is promoted through the reinforcement of disciplinary training with a set of on-going collaborative research ties. Initially these may be viewed as links between a young professional and an experienced scientist. Overtime, these links are evolving into a community of peers.

Such scientific efforts are reinforced by the generation of farm management capabilities designed to provide continuing, cost-effective support for national research efforts. Better programme management and improved economic analysis, including the strengthened assessment of research priorities, offer a means to foster sustained budgetary support from Ministries of Agriculture.

HOUSEHOLD FOOD SECURITY

The objective of household food security marks an important justification for the existence of the SMIP (and for ICRISAT more generally). Sorghum and millet are essentially food security crops. These are grown in regions most subject to production and consumption shortfalls. They are produced by many of the poorest farm households in the SADCC region.

The SMIP recognises that food security can be attained through food purchases (or gifts) as well as food production. Most sorghum and millet producers participate in the national market as grain buyers rather than as grain sellers. But most of these farmers have little money with which to purchase food. The income required to purchase grain comes from cash remittances earned from relatives working off the farm. The cash allocated to purchase grain draws money away from school fees, clothing, housing and agricultural investment. Thus, efforts to improve the capacity of food insecure households to produce their basic grain requirements are essential.

These relations are not changed by programmes of 'structural adjustment' or market liberalisation. Incentives to invest in agriculture will always remain limited without significant improvements in cropping technologies. Currently, the returns to labor allocated to unimproved sorghum and millet enterprises are only ten to twenty percent of the daily wages for casual off-farm labor. As long as this remains true, most households residing in semi-arid areas of the SADCC region are better off migrating out of agriculture.

Improved seed has proven a key low cost means to expand household food production. Hybrid maize seed has been almost universally adopted in Zimbabwe because of its yield advantages. Improved sorghum and millet seed should offer even greater advantages to drought prone areas of the SADCC region. Correspondingly, the principal objective of the sorghum and millet breeding programmes is the attainment of high yields under low rainfall conditions.

The entomology and pathology programmes each have placed emphasis on identifying pest and disease resistance mechanisms either inherent in the seed or in the crop management. These programmes seek to limit the need for expensive pesticides. Concerns for the impact of pesticides on the environment are matched with concerns for their impact on the small farmer's budget.

The agronomy programme has placed great stress on the testing and evaluation of water harvesting technologies. Again, this emphasises the search for opportunities for increasing both yield level and yield stability across different environments with the use of limited amounts of purchased inputs. This programme has also identified an inexpensive means to improve sorghum stand establishment.

The food technology programme places greater priority on resolving constraints to expanding industrial utilisation of sorghum and millet. One major reason for the historical neglect of these crops has been their lack of importance as industrial inputs. In several SADCC countries, parastatal stocks of sorghum and millet have been accumulated and left to rot because of a basic misreading of the competitive position of these crops in industrial markets. This has resulted, in part, from a lack of familiarity with the processing and utilisation characteristics of the small grains.

Expanded industrial demand should provoke expanded support for research and production of sorghum and millet. Though many food insecure households may not produce for the industrial market, the resulting improved technologies should benefit these farmers.

The economics programme examines constraints relating to both the industrial and household utilisation of sorghum and millet. Studies of national market policies suggest the need to revise support prices to more industrially competitive levels. These analyses also highlight the need to support intra-rural markets. Market liberalisation strategies commonly proposed from idealised models of perfect market behavior must be complemented by investments to offset logistical constraints to grain flows from surplus to deficit households. Many of the recent market subsidies applied in the SADCC region have been highest, per unit of grain, in low rainfall and food insecure regions. As these subsidies are withdrawn, the market services offered these farmers are severely limited. Food insecurity may worsen. Improved production technologies may offset part of this loss. Improved rural markets are more broadly necessary to commercialise the semi-arid production system.

Through collaboration, such priorities are reflected in both regional research and national investigations. The regional programme has the capability of comparing the results of varied national efforts and offering input into individual projects reflecting a synthesis of these conclusions. The multidisciplinary strengths of the regional programme also serve to facilitate interdisciplinary ties within the national agricultural research institutes.

CONCLUSION

In order to establish a sustainable foundation of economic growth and household food security, each SADCC country must develop a strong set of institutions for the development and use of agricultural technology. Drought relief programmes and adjustments in market policy may offer temporary and limited gains to impoverished households. But long term solutions can only be found through improving the level and stability of income sources. The productivity of agricultural labor must increase. Improved technologies for sorghum and millet directly carry the farmer toward this goal.

When the SMIP began, initial programme and research priorities were set by an international team of sorghum and millet scientists in consultation with national scientists throughout the SADCC region. These priorities have evolved with regional experience. Better appreciation of national needs has brought the addition of crops (finger millet and forages) to the research mandate, as well as greater emphasis on the improvement of experiment station facilities, the initiation of research on crop utilisation, an expansion in the programme's capability to provide education and training, and most recently, an effort to establish a regional programme in seed multiplication. Strong emphasis has been placed on the promotion of regional consultation and communication as a means to guide the priority setting process. Regional interaction is specifically designed to promote communication across national programmes as well as between national and the regional programmes.

The objective of household food security has been pursued both by means of technology development and through the strengthening of national scientific capabilities. The SMIP is guided by the belief that food security is not simply the improvement of access to food in a dry year. Nor is it simply the generation of technologies (or knowledge) relevant to food insecure households. Household food security requires the development of a sustainable system of agriculture and agricultural institutions for semi-arid farming regions. The evolving priorities and institutional orientation of the SMIP represent a continuing move toward this objective.

REFERENCES

Hedden-Dunkhorst, Bettina. 1989. A Study of the Role of Small Grains in Semi-Arid Smallholder Farming Systems in Zimbabwe: Introduction and Additional Findings. In: *Proceedings of the Sixth Regional Workshop on Sorghum and Millets for Southern Africa.* SADCC/ICRISAT Bulawayo. Zimbabwe.

ICRISAT and INTSORMIL. 1983. A Project Proposal for a Regional Sorghum and Pearl Millet Research and Training Programme for Southern Africa (SADCC Countries). *mimeo.*

SADCC/ICRISAT/SMIP. 1988. The First Five Years: The SADCC/ICRISAT Sorghum and Millets Improvement Programme. *mimeo.*

SADCC/ICRISAT/SMIP. 1990. Overview SADCC/ICRISAT Sorghum and Millets Improvement Programme. *mimeo.*

20

Setting National Agricultural Research Priorities For Household Food Security: The Malawian Experience

G.Y. Mkamanga, L.D.M. Ngwira and T.J. Cusack[1]

SUMMARY

This paper presents the preliminary results of a study of strategic agricultural research priorities for the Malawi Department of Agricultural Research. The analysis used a weighted criteria (scoring) approach to generate a ranking of priorities by commodity and by research area. The study is only partly completed.

Four objectives for the research system were identified and weighted. Based on these objectives, eight criteria were selected and used to generate the following ranking of priorities by commodity: maize, roots/tubers, livestock, vegetables, tropical fruits, other grain legumes, sorghum/millet, groundnuts, rice, cotton, temperate fruits, oilseeds, wheat/barley, tree nuts and coffee. It was concluded from an analysis of current research funding that, although existing funding was in general agreement with the priorities generated by this study, opportunities remain for adjusting resource allocations to agree more closely with these priorities. In fact, these priorities are presently being used to plan resource use in the Department.

The following rank order of research priorities by crop research area were established: agronomy, plant breeding, plant protection, adaptive, irrigation/drainage, farm machinery, socio-economics, food science, soils and agroforestry, and crop storage. Research priorities by livestock research area were ranked as follows: livestock management, animal nutrition, pasture/forages, animal breeding, adaptive, food science, socio-economics and agroforestry, and

---

[1]Director of the SADCC Regional Gene Bank and formerly Chief Agricultural Research Officer in the Malawi Department of Agricultural Research; Deputy Chief Agricultural Research Officer for Research Programmes in the Malawi Department of Agricultural Research; and Agricultural Economist in the Malawi Department of Agricultural Research, respectively.

farm machinery. The highest priority commodity/research area combinations were found to be maize breeding and agronomy.

Heavier weighting of objectives related to food security concerns did not change significantly the commodity rankings. However, food security concerns are being increasingly recognised in research planning and are being increasingly addressed in research programmes.

INTRODUCTION

The Department of Agricultural Research (DAR) must establish priorities and allocate its limited resources among competing programmes to optimise the attainment of national goals and objectives. Research operational funding continues to be very limited while the demand for research services in increasing. Substantial investments in human and fixed resources are expected to continue. The Chief Agricultural Research Officer (CARO) is forced to mediate demands of scientists from various disciplines and commodity areas, scientists outside of DAR, donor agencies, extension and regional administrators, and -- less directly -- of farmers, consumers and agro-industries.

The presence of conflicting demands on the limited available research resources reflects the fact that demanders of new technologies and institutions may place differing weights on national goals and objectives. Although farmers and extensionists are amongst those most aware of problems and constraints, scientists are more knowledgeable about what it is possible to achieve through research. Administrators must also balance national needs and occasionally place demands on the research system in response to short-term "crises". Formal priority-setting procedures, such as the one employed in this study, assembles and analyses information to bring together demands for, and supplies of, new technologies and institutions in light of the relative values (weights) placed on given goals and objectives. The priority-setting process can also be used to explore the implications for research programming of placing alternative weights on objectives, for example, by placing additional weight on food security objectives.

The credibility of DAR's research priorities is enhanced among high-level administrators and aid donors when priorities are carefully and transparently established, making it easier to justify research programmes and associated budgets. The priority-setting process provides internal information for DAR to justify long and short term allocations of resources between individual research teams, increasing the stability of research programmes. Most importantly, annual project planning, long-term human resource development and facilities planning are facilitated.

The DAR has long recognised the need for explicit determination of research priorities (Malawi Government, 1983, and World Bank, 1985). A formal study of research priorities is presently being implemented in the DAR (Ngwira, Mwenda and Cusack, 1990a.), and will be completed in April 1991. Some initial results are presented in this paper.

METHODOLOGY

The relative merits of the various structured methods that have been used for selecting agricultural research priorities are detailed in Norton and Pardey (1987). The method chosen for this study is a scoring approach developed at the International Service for National Agricultural Research (ISNAR), where specific commodities and research areas are ranked by defining and weighting multiple criteria. For an example of this approach, see Cessy *et al.* 1989. This method was chosen over more sophisticated methods because:

- this is the most conceptually defensible procedure given the allocated time frame for the study (six months) and present availability of data, and,

- this method is the most transparent and is readily understood by non-specialists.

The scoring approach involves identifying objectives for the research system, obtaining weights for those objectives, choosing a set of criteria by which to measure the contribution of each commodity or type of research to the objectives, collecting data on the criteria and then applying the weights on objectives to arrive at a ranking by commodity and by research area. The approach incorporates a substantial quantity of subjective information. Fortunately, these subjective judgements are relatively transparent and this facilitates understanding and testing of the sensitivity of results to alternative judgements.

Prior to collection of data for the study, it was necessary to define goals and objectives for the research system and to choose criteria through which to determine commodity priorities. It was also necessary to define the separate commodities and research areas to be prioritised. These decisions were taken by DAR Management prior to and during a visit to ISNAR (Ngwira, Mwenda and Cusack, 1990b.).

DEFINITION OF GOALS, OBJECTIVES AND CRITERIA

Goals and objectives of the research system, Table 1, were selected in accordance with the Malawi Statement of Development Policies (Malawi Government, 1987) and the DAR Research Master plan (Malawi Government, 1988a.). The primary efficiency goal is to improve the average level of well-being through economic growth. Distributional and stability goals are also included.

Table 1
Goals, objectives and criteria for DAR research.

	GOALS		OBJECTIVES		CRITERIA FOR DETERMINING RESEARCH PRIORITIES
1.	Improve the average well-being of all households. (efficiency)	1.	Increase the average level of net benefits to all producers and consumers. (income, productivity, foreign exchange, efficiency).	1.	Value of production.
				2.	Expected yield increase or cost reduction over 5 years.
				3.	Expected probability of research success.
				4.	Expected level of adoption by farmers.
				5.	Expected change in future demand.
2.	Improve the well-being of particular groups. (distribution)	2.	Give additional weight to rural income growth.	6.	Percent of farmers producing the commodity.
		3.	Give additional weight to low income/nutrition households.	7.	Percent of each commodity consumed in same household where it is produced.
3.	Improve the stability of level of well-being (stability)	4.	Reduce year-to-year fluctuations in income/nutrition.	8.	Annual variation in value of production.

The efficiency goal was translated into the objective of increasing the average level of net benefits to all producers and consumers. This implies a desire to increase productivity, efficiency and foreign exchange. Five measures relating the contribution of individual commodity research to the efficiency objective were identified as follows:

- *Value of Production:* Research benefits can be expected to increase in relation to how widely applicable the research results are as research costs are relatively independent of the units over which results are applicable.

- *Expected Yield Increase of Cost Reduction:* An important determinant of increased productivity is the expected per unit increase in yield or cost reduction of successful research over the next five years. This value is independent of expected farmer adoption rates, assumes two man-years of scientist time for each commodity and includes the possibility of transferring/adopting technologies already available in other countries.

- *Probability of Research Success:* This estimates the probability of obtaining the yield increases or cost reductions assumed above.

- *Adoption Rates:* This is the ceiling level (maximum expected percentage) of anticipated adoption of the research results by farmers.

- *Future Demand:* Research benefits will be greater for those commodities with expanding demand than for those with stable or declining demand.

The distributional goal was translated into the objectives of giving additional weight to activities benefiting the largest number of smallholder families, and to giving additional weight to the less commercialised (lower income and lower nutritional status) smallholders. Two measures relating the contribution of research on individual commodities to the distributional objectives were identified as follows:

- *Percentage of Farmers Producing the Commodity:* The greater the proportion of farmers producing the commodity, the greater the level and distribution of benefits to villagers will be. Demand for commodities is assumed to be elastic. Thus the more producers, the more benefit generated by an outward shift in the supply curve.

- *Percentage of Commodity Consumed in the same Household Where Produced:* Low-income producers consume a greater proportion of what they produce than high-income producers. Improvements in food production for lower nutritional status households should carry extra weight.

The stability goal was translated into the objective of reducing year-to-year income fluctuations. The criterion of annual variation in the value of production was chosen to measure the extent of the risks associated with the commodity mix.

The weights assigned to the objectives by DAR Management were 85 percent for the efficiency objectives and five percent each for the distributional and stability objectives. Specific food security related concerns represent approximately 15 percent of the total weighting. As explained later, the implications of using alternative weightings were explored.

DEFINITION OF COMMODITIES AND RESEARCH AREAS

The DAR makes strategic allocations of research resources on the basis of "commodity teams". There are 29 commodity teams, listed in Table 2, consisting of 15 specific commodities or commodity groups and 14 research areas which have independent funding and whose activities usually cut across a number of commodities. The 15 commodities which are listed in Table 3, were prioritised without further sub-division into specific crops or livestock as commodity teams are the principal targets of strategic funding decisions. The chosen research areas, also listed in Table 3, are the principal fields of activity in the DAR, and some represent existing non-commodity research teams. Some existing commodity teams (for example Produce Inspection and Seed Services) are in fact almost entirely service operations and are not included in the prioritisation analysis.

Table 2
List of commodity teams in the Department of Agricultural Research 1990-91

Maize	Rice
Wheat, Barley and Finger Millet	Sorghum and Pearl Millet
Temperate Fruits	Tree nuts
Coffee	Roots and Tubers
Vegetables	Groundnuts
Cotton	Oilseeds
Other Grain Legumes (OGL)	Livestock
Pastures	Soil Physics and Chemistry
Soil Microbiology	Soil Survey
Irrigation and Drainage	Farm Machinery
Agroforestry	Plant Protection and Quarantine
Produce Inspection	Nematology
Entomology	Seed Services
Crop Storage	
Agricultural Economics, Statistics and Data Processing	

Table 3
List of research commodities and research areas used for prioritisation in this study

RESEARCH COMMODITIES OR COMMODITY GROUPS	RESEARCH AREAS
Maize	Plant Breeding
Rice	Agronomy
Wheat Barley And Finger Millet	Plant Protection
Sorghum And Pearl Millet	Farming Systems
Temperate Fruits	Socio-Economics
Tropical Fruits	Food Science
Tree Nuts	Pastures And Forages
Coffee	Soils
Roots And Tubers	Irrigation And Drainage
Vegetables	Farm Machinery
Groundnuts	Agroforestry
Cotton	Crop Storage
Oilseeds	Livestock Management
Other Grain Legumes (OGL)	Animal Nutrition
Livestock	Animal Breeding

RESULTS: COMMODITIES

The results of the prioritisation of commodities are presented in Table 4. The judgements involved in obtaining rankings are preliminary and will be revised following substantial input from researchers and extension staff.

Referring to Table 4, the estimated smallholder production value for each commodity is based on the average annual volume of production during the 1985-90 period and 1990-91 market prices. Data sources were the Final Crop Estimates (Malawi Government, various years) and the FAO Production Yearbook (FAO 1989) for production and ADMARC 1990-91 smallholder price schedules (Malawi Government 1990a.) and the "local Market Price Surveys" conducted by the Planning Division of the Ministry of Agriculture (Malawi Government 1988b.) for market values. Commodities are displayed in Column 3 of Table 4 according to rank order of production value.

Table 4
Use of scoring model to determine agricultural research priorities by commodity

Commodity	Product Value (a)	Rank (1)	Increm. Yield	Prob. Success	Adopt. Level	Future Demand	Effic. Index (b)	Effic. Rank	Percent Farmers	Farmer Rank	Home Consump.	Consump. Rank	Annual Variat	Weighted Total (c)	Rank (2)	Weighted Total (d)	Rank (3)	Weighted Total (e)	Rank (4)
Maize	365 715	1	0.80	0.50	0.20	1.06	31 013	1	90	2	80	2	10	1.55	1	2.65	1	1.30	1
Roots/ Tubers	73 913	2	0.35	0.35	0.60	1.06	5 759	2	20	7	60	5	6	2.60	2	3.80	3	3.20	3
G/nuts	47 066	3	0.20	0.40	0.10	1.06	399	8	30	5	25	8	15	8.20	8	8.60	8	7.55	8
Livestock	41 500	4	0.80	0.50	0.20	1.06	3 519	3	95	1	50	6	1	2.95	3	2.85	2	3.15	2
O.G.L	29 259	5	0.20	0.40	0.25	1.06	620	6	26	6	50	6	9	6.15	6	6.45	6	6.00	6
Cotton	25 201	6	0.20	0.30	0.10	1.04	157	10	5	10	0	14	13	10.35	10	11.05	12	10.60	10
Vegetables	22 325	7	0.25	0.40	0.60	1.06	1 420	4	75	3	70	4	7	4.10	4	4.30	5	3.85	4
Trop. Fruitr	20 047	8	0.25	0.40	0.60	1.06	1 275	5	75	3	80	2	2	4.60	5	3.80	3	4.25	5
Rice	12 874	9	0.20	0.40	0.15	1.03	159	9	7	8	10	9	11	9.05	9	9.15	9	8.85	9
Sorghum/ Millet	4 873	10	0.50	0.40	0.55	1.03	552	7	7	8	90	1	14	7.10	7	7.30	7	6.25	7
Oilseeds	1 004	11	0.25	0.35	0.20	1.06	19	12	1	11	5	10	8	11.65	12	10.95	11	11.55	12
Wheat/ Barley	874	12	0.25	0.45	0.10	1.03	10	13	1	11	5	10	12	12.70	13	18.50	14	12.25	13
Temp. Fruits	405	13	0.25	0.40	0.60	1.03	25	11	1	11	5	10	5	10.65	11	9.95	10	10.85	11
Coffee	240	14	0.20	0.20	0.20	1.00	2	15	1	11	0	14	4	14.20	15	19.90	15	14.25	15
Tree Nuts	63	15	0.25	0.40	0.60	1.04	4	14	1	11	5	10	3	13.10	14	11.30	13	12.95	14

a: value of production is in thousands of September 1990 Kwachas.
b: efficiency index = (value prod.) * (increm. value) * (prob. success) * (adopt. level) * (Future demand)
c: weighted total = ,85(effic. rank) + ,05(farmer rank) + ,05(consump. rank) + ,05(annual variat.)
d: weighted total = ,55(effic. rank) + ,15(farmer rank) + ,15(consump. rank) + ,15(annual var.)
e: weighted total = ,70(effic. rank) + ,15(farmer rank) + ,15(consump. rank)
Rank(1) is based on production value; Efficiency rank is based on the efficiency index;
Rankings (2), (3) and (4) are based on the appropriate weighted totals.

The efficiency criteria 2-4 (Columns 4-6 of Table 4) were measured by senior researchers and extension staff at a DAR/ISNAR workshop held in Mzuzu, Malawi, in May, 1990. Estimates of the fifth efficiency criterion, expected future change in demand for the commodity, were obtained from the Planning Division in October, 1990.

Combining the efficiency criteria results in a new ranking of commodities (Column 9 of table 4). The distribution/stability criteria were measured with the assistance of data and personnel from the Planning Division and the Department of Agriculture. Incorporation of these factors into the analysis results in ranking commodities (Column 16 of Table 4) in accordance with the weights originally assigned to the objectives. The remaining columns of Table 4 explore the effects of alternative weighting systems on commodity ranking.

The results indicate that, whatever the weighting system used, maize remains the highest-ranked commodity and is in a separate highest-ranked category. The final rankings are presented in Table 5

Roots and tubers and livestock remain highly-ranked throughout but groundnuts loses its high-priority ranking, becoming a medium-ranked commodity, when all of the efficiency factors are included. The values attached to the efficiency criteria for groundnuts may need to be revised as they appear out-of-line with those estimated for vegetables, oils and livestock. Sorghum and millet in particular are consistently ranked higher than groundnuts despite having only ten percent of the value of groundnut production.

Other Grain Legumes, vegetables and tropical fruits retain their medium ranking throughout the weighting alternatives except that tropical fruits attain a "high" ranking when emphasis is placed on distribution and stability ("food security") objectives.

Rice retains its low ranking throughout the weighting systems while sorghum and millet attains a medium ranking with all weightings. Cotton is demoted from medium to "low" or "very low" with all weightings.

Oilseeds, wheat/barley, temperature fruits, coffee and tree nuts retain their "very low" rankings throughout the alternative weightings.

The main rankings of commodities according to priority for research appear reasonable with the exception of groundnuts which appear to have been given too low a priority because of some inconsistent estimates of the efficiency criteria 2-4. Further refinement of the data is probably needed to provide a more secure basis for the rankings obtained.

By changing from a "best estimate" to a "food security" weighting, rankings do not change significantly although the values of the indices for livestock and tropical fruits (which are relatively widely grown), show relatively little annual variation in production and are largely consumed within the household, improve somewhat.

Table 5
Ranking of research priorities by commodity

		Best (Rank 2) Estimate	Rank (3)	Rank (4)	Rank (1)
Highest-Ranked:	1.	Maize	1	1	1
High-Ranked:	2.	Roots/Tubers	3	3	2
	3.	Livestock	2	2	4
Medium-Ranked:	4.	Vegetables	5	4	7
	5.	Tropical Fruits	3	5	8
	6.	Other Grain Legumes	6	6	5
	7.	Sorghum/Millet	7	7	10
	8.	Groundnuts	8	8	3
Low-Ranked	9.	Rice	9	9	9
Lowest-ranked	10.	Cotton	12	10	6
	11.	Temperate Fruits	10	11	13
	12	Oilseeds	11	12	11
	13	Wheat/Barley	14	13	12
	14	Tree nuts	13	14	15
	15	Coffee	15	15	14

Notes:
Rank (3) is generated from high "food security" weighting of objectives.
Rank (4) if generated from a moderate "food security" weighting.
Rank (1) is based entirely on estimates of national value of production.
Source: Table 4 - See text and Table 4 for explanation of the bases of rankings.

RELATIONSHIP BETWEEN PRIORITIES AND FUNDING OF COMMODITIES

The procedure used for ranking the research priorities presented in Tables 4 and 5 is intended to maximise the possibility that the most researchable problems of farmers and the most promising opportunities are investigated by the research establishment within the framework of the nation's goals. A framework is presented which facilitates reasoned judgements based on inputs from a wide range of authorities. For this initial stage of the analysis, inputs from senior researchers, senior extension and planning staff and from DAR Management were prominent.

The responsibility for allocation of the limited human, physical and capital resources of the DAR lie with the Chief Agricultural Research Officer. DAR priorities are manifested in the allocations of these resources between the various commodity teams by CARO. Allocations of these strategic resources within commodity teams are largely the responsibility of Commodity Team Leaders.

CARO is assisted in arriving at resource allocation decisions through an annual planning and review exercise involving senior DAR management and researchers, senior extension staff, and senior technical planning and management staff from outside DAR. It is intended that the analysis of priorities presented here would assist with the process. In fact, that has been the case for the 1990 exercise which is almost completed (Ngwira and Cusack, 1990). The present study is being undertaken as an early activity in the updating of a DAR Master Plan for Agricultural Research.

The extent to which research resources may need to be reallocated depends on the disparity between priorities and existing resource allocation. This paper does not attempt to review allocations of all resources between commodity teams as this exercise is not yet completed. However, the recent allocations of Government operating funds to the various commodity teams is a key indicator of overall resource allocation and, therefore of assigned priorities. The disposition of other resources to research follows the pattern of allocation of Government operating funds.

Levels of operating funds allocated to the various commodity teams, and the equivalent rankings, for the years 1989, 1990 and (proposed) 1991 are summarised in Table 6.

Research priorities appear to have shifted significantly over the three year period. In general, expenditures have moved closer to the Rank (2) results. Changes in DAR resource allocations appear to be achieving closer synchronisation with the perceived optimum:

- for the six commodities in the lowest-ranked commodity group, Table 5, out of an "optimal" score of 74 (the sum of the rank numbers) the scores in 1989, 1990 and 1991 were 56, 60 and 68 respectively;

- for the three commodities in the high and highest ranked groups, out of an "optimal" score of 6, the scores in 1989, 1990 and 1991 were 16, 12 and 6 respectively; and,

- for specific commodities -- maize moved from second to the highest-ranked position, roots and tubers moved from eleventh to third, other grain legumes moved from twelfth to seventh, vegetables increased from thirteenth to eighth, while cotton, coffee and tree nuts have fallen significantly in ranking.

Table 6
Comparison of priority rankings of research commodities, based on the scoring model and on the level of Government expenditures

	Scoring Model Results			Level of Government Expenditures				Current Kwacha	
	Product Value	Rank	Rank (2)	1991	1991	1990	1990	'1989	1989
Commodity	(a)	(1)	Best Estimate	Level	Rank	Level	Rank	Level	Rank
Maize	365 715	1	1	367 578	1	116 659	2	115 773	2
Roots/Tubers	73 913	2	2	292 290	3	56 655	7	34 936	11
Groundnuts	47 066	3	8	163 375	5	74 213	5	68 460	4
Livestock	41 500	4	3	324 447	2	107 407	3	91 158	3
O.G.L.	29 259	5	6	109 258	7	60 868	6	33 960	12
Cotton	25 201	6	10	199 089	4	131 084	1	118 518	1
Vegetables	22 325	7	4	97 050	8	39 461	12	30 303	13
Trop. Fruits	20 047	8	5	93 942	9	47 272	10	45 230	6
Rice	12 874	9	9	157 036	6	75 763	4	65 229	5
Sorg/Millet	4 873	10	7	76 427	11	45 537	11	39 903	8
Oilseeds	1 004	11	12	63 967	12	31 524	14	27 149	14
Wheat/Barley	874	12	13	50 886	14	24 586	15	18 307	15
Temp. Fruits	405	13	11	40 000	15	35 756	13	37 530	10
Coffee	240	14	15	91 057	10	50 658	8	39 145	9
Tree Nuts	63	15	14	59 959	13	49 072	9	43 746	7

Notes: The scoring model results are taken from Table 4. Levels of Government expenditures for 1989 and for 1990 are actual allocations. Levels of Government Expenditures for 1991 are levels requested by the Department of Agricultural Research.

Comparing the 1991 Rank and Rank (2) in Table 6 reveals that further adjustment in resource allocation may be needed to approach the "optimum". Existing resource allocation appears to be relatively excessive for cotton, rice, groundnuts, coffee and tree nuts, while existing resource allocations appear to be too limited for vegetables, tropical fruits and sorghum/millet.

Reasons why cotton and rice attract excessive resources are:

- these commodities have relatively limited alternative funding sources so it is expected that their rankings will erode when an "all resources" base is used for comparison; and,

- these commodities provide a strong commercial base in areas of relatively poor agro-ecological conditions where few production alternatives exist. There is little organised international research for cotton or pool of technology on which to draw.

The 1991 ranking of groundnuts is more closely related to Rank (1). The Rank (2) ranking for this commodity will move closer to the 1991 ranking after the revisions discussed earlier.

The trend of reduced allocations to coffee and tree nuts is expected to continue. The DAR is presently completing a programme for transferring much of this research work to independent research entities. This process takes time to ensure adequate continuity to research activities.

The relatively low 1991 allocations to sorghum/millet compared to Rank 2 is offset somewhat by: (a) possible over-ranking of this commodity (indicated above), and (b) sorghum/millet attracts substantial external funding thus would appear as a higher priority in an "all resources" assessment. Vegetables and tropical fruits will continue to attract increasing resources as these programmes further develop towards indigenous needs rather than specialised exotics.

RESULTS : RESEARCH AREAS

The results of the prioritisation of research areas are presented in Tables 7A and 7B. The preliminary work on research area prioritisation has not been completed so these results represent only an initial step. Respondents were assigned the task of completing Tables 7A and 7B identifying high potential research areas for increasing the next five years farm productivity with existing research or somewhat increased resources.

Table 7a shows the results with weights assigned to each research area within a commodity. For crops, the highest priority is plant breeding and agronomy, medium priority to plant protection and adaptive, and low priority to the other research areas. For livestock, the highest ranking is livestock management, followed by animal nutrition, pastures/forages, medium priority to animal breeding and adaptive, and low priority to the other research areas. The ranking of research areas according to research priorities is presented in Table 8.

If weights are assigned to each of the commodities within a research area, the highest priority commodity/research area combinations become apparent. These are maize breeding and agronomy for crops -- poultry, nutrition and management for livestock. Table 7b illustrates a check on the results of the commodity rankings of Table 4. These are reasonably consistent for crops. But other grain legumes and cotton are relatively high while wheat/barley are low. No separate rankings are given for livestock in Table 4 but these are implied in Table 7B showing a rank order of poultry, sheep/goats, dairy, beef and pigs.

CONCLUSIONS

Attention on food security concerns continues to increase at all levels in planning and implementing rural development activities in Malawi. This was recently highlighted in a September 1990 national Food Security and Nutrition Policy Statement published as a supplement to the Malawi Statement of Development Policies (Malawi Government, 1990b). The present paper shows how such concerns are reflected in contemporary decisions by the DAR in allocating research funds to specific commodities. Not only does DAR now explicitly recognise the need to address food security concerns through its commodity research programmes by formally setting research priorities through the scoring approach described in this study, but recent trends in DAR research expenditures indicate that the DAR is orienting its programme to areas more likely to address farmer food security problems. The implications for DAR's strategic funding decisions of placing emphasis on food security concerns are measured in this study. However, heavier weighting of objectives related to food security concerns did not significantly change the commodity rankings.

Although there appears to be further room for strategic reallocation of research resources within the DAR between commodities, this need is relatively minor. It may be further reduced when "all resources" results become available and revisions in the data used for generating the "best estimate" ranking (Rank 2) have been made. This study is to provide a sound basis for the overall allocation of scientists, training opportunities, foreign and domestic funding and facilities within the DAR over the next several years. Also the study is providing a useful vehicle for incorporation of a wide range of research, extension and planning views into the research planning process.

Several of the traditional commodities (maize, root crops, groundnuts, poultry, vegetables, and tropical fruits) could yield high benefits from research because small increase in productivity will be spread over a large number of households.

Table 7A
Summary of scoring results and determination of research priorities based on research areas.

Research Area Commodity	Plant Breeding	Agronomy	Plant Protection	Irrigation Drainage	Farm Machinery	Agro-Forestry	Adaptive	Crop Storage	Soils	Livestock Management	Animal Nutrition	Animal Breeding	Pasture/ Forages	Socio-Economics	Food Science	Total
Maize	30	20	5	5	5	5	5	10	5					5	5	100
Rice	20	25	8	15	5	1	5	5	10					5	1	100
Wheat/barley	35	30	10	1	5	1	6	1	5					5	1	100
Sorg/millet	20	30	10	1	5	10	15	5	1					1	2	100
Temp. fruits	40	40	10	1	1	1	1	1	1					2	2	100
Trop. fruits	24	20	10	5	1	5	20	1	1					3	10	100
Tree nuts	20	40	30	1	2	1	1	0	2					2	1	100
Coffee	30	20	30	2	1	3	7	0	2					5	0	100
Roots/tubers	14	20	10	5	1	5	15	10	5					5	10	100
Vegetables	10	20	5	10	5	5	15	5	5					5	15	100
Groundnuts	30	20	10	5	10	5	10	1	3					5	1	100
Cotton	25	20	20	5	5	1	13	1	5					5	0	100
Oilseeds	20	30	20	5	5	1	10	1	2					5	1	100
O.G.legumes	20	20	10	2	2	5	20	3	8					5	5	100
Crops Only																
Total Weight	338	355	188	63	53	49	143	44	55					58	54	
Rank	2	1	3	5	6	9	4	11	9					7	8	
Livestock																
Poultry					5	5	10			25	20	15		5	5	
Dairy					5	5	10			20	20	10	20	5	5	
Beef					5	5	10			20	10	10	30	5	5	
Sheep/goats					5	5	10			20	15	15	20	5	5	
Pigs						5	10			20	20	20	10	5	10	
Livestock Only																
Total weight					20	25	60			105	85	70	80	25	30	
Rank					8	7	5			1	2	4	3	7	6	

Notes:
For explanation see text. Respondents were asked to take each commodity and then assign weights to each of the research areas.
Higher weights indicate higher research priority.

Table 7B

Summary of scoring results and determination of research priorities based on commodities, by assigning research area weights.

Research Area Commodity	Plant Breeding	Agronomy	Plant Protection	Irrigation Drainage	Farm Machinery	Agro-Forestry	Adaptive	Crop Storage	Soils	Livestock Management	Animal Nutrition	Animal Breeding	Pasture/ Forages	Socio-Economics	Food Science	Total Weight	Rank
Maize	20	10	8	16	20	50	20	50	30					20	10	254	1
Rice	5	6	10	10	10		5	1	20					2	5	63	8
Wheat/barley	4	1	5	5	1		1		3					2		22	13
Sorg/millet	5	6	5	1	10	10	4	5	3					4	5	49	10
Temp. fruits	4	5	5	1	1	1	1		3					1		22	13
Trop. fruits	4	10	6	8	1	5	5	3						3	10	55	9
Tree nuts	4	5	10	1	5	5	1		3					2		36	12
Coffee	5	5	10	5	5	5	1		3					1		40	11
Roots/tubers	5	6	10	10	1	5	10	10	3					8	20	88	3
Vegetables	4	10	6	15	1	1	10	20	2					5	20	94	2
Groundnuts	10	6	5	5	12	1	8	5	10					8	5	75	6
Cotton	10	10	10	10	13	1	8		10					8		80	5
Oilseeds	10	10	5	5	5	1	8	1	10					8	5	68	7
O.G.legumes	10	10	5	5	5	10	8	5	10					8	10	86	4
Crops Only																	
Total Weight	100	100	100	97	90	95	90	100	100					80	90		
Livestock																	
Poultry					3	1	3			40	40	30	5	8	1	131	1
Dairy				1	3		2			20	30	25	30	5	4	120	3
Beef				1	1	1	1			5	5	5	25	1	1	46	4
Sheep/goats				1	2	2	3			30	20	30	30	5	3	126	2
Pigs					1	1	1			5	5	10	10	1	1	35	5
Livestock Only																	
Total Weight				3	10	5	10			100	100	100	100	20	10		
TOTAL	100	100	100	100	100	100	100	100	100						100		

Notes: For explanation see text. Respondents were asked to take each research area and then assign weights to each of the commodities. Higher weights indicate higher research priority.

Table 8
Ranking of research priorities by research area

RANKING	CROPS		LIVESTOCK
High-Ranked	1	Agronomy	1 Livestock Management
	2	Plant Breeding	2 Animal Nutrition
			3 Pasture/Forages
Medium-Ranked	3	Plant Protection	4 Animal Breeding
	4	Adaptive	5 Adaptive
Low-Ranked	5	Irrigation/Drainage	6 Food Science
	6	Farm Machinery	7 Socio-Economics
	7	Socio-economics	8 Agroforestry
	8	Food Science	9 Farm Machinery
	9	Soils	
	10	Agroforestry	
	11	Crop Storage	

Source: Table 7A

This study does not consider priority-setting by researchers within specific commodities. However, this is equally important. (Commodity Team Leaders are required to express and justify their research objectives and priorities through an Action Plan which is sent to CARO for approval and provides the basis for medium-term research activities within the team.)

The analysis presented in this paper is preliminary because data collection is not completed and, even when a consensus is reached on the results, the analysis will represent only one, crucial aid to CARO in making resource allocation decisions. All priority-setting procedures are subjective because of their predictive nature and the fact that values of key factors in the analysis rely upon scientists' opinions. It is expected that refinements will be made from time-to-time as additional data become available.

REFERENCES

Cessay, Sampo, E. Gilbert, B. Mills, J. Rowe and G.W. Norton. 1989. *Analysis of Agricultural Research Priorities in The Gambia.* Australian Centre for International Agricultural Research and International Service for National Agricultural Research.

FAO. 1989. *Food Production Yearbook 1988.* Rome.

Malawi Government. 1983. *Agricultural Research Strategy Plan.* Department of Agricultural Research. Lilongwe.

Malawi Government. 1988a. *Agricultural Research Master Plan.* Department of Agricultural Research. Lilongwe.

Malawi Government. 1988b. *Local Market Price Surveys.* Planning Division. Ministry of Agriculture. Lilongwe.

Malawi Government. 1990a. *Smallholder Producer and Input Prices for the 1990-91 Growing Season.* Planning Division. Ministry of Agriculture. Lilongwe.

Malawi Government. 1990b. *Food Security and Nutrition Statement: Supplement to the Statement of Development Policies.* Department of Economic Planning and Development. Lilongwe.

Malawi Government. 1987. *Statement of Development Policies: 1987-96.* Lilongwe.

Malawi Government. 1990. *Final Crop Estimates 1985-90.* Planning Division. Ministry of Agriculture. Lilongwe.

Ngwira, L.D.M. and T.J. Cusack. 1990. A Preliminary Review of DAR Research Priorities. Paper presented to the November 1990 Agricultural Research Council Meeting. Lilongwe.

Ngwira, L.D.M., A.R.E. Mwenda and T.J. Cusack. 1990a. Workplan for the Analysis of Research Priorities in the Department of Agricultural Research. Department of Agricultural Research. Lilongwe.

Ngwira, L.D.M., A.R.E. Mwenda and T.J. Cusack. 1990b. Institutionalising Improved Research Management Procedures in the Department of Agricultural Research. *Report of a Visit to ISNAR.* July 9-20, 1990. Department of Agricultural Research. Lilongwe.

Norton, George W. and P.G. Pardey. 1987. Priority Setting Mechanisms for National Agricultural Research Systems : Present experience and future needs. *ISNAR Working Paper No. 7.* The Hague.

World Bank. 1985. National Research Project: *Staff Appraisal Report 5295-MAI.*

21

Zimbabwe's Experiences In Agricultural Research Priority Setting For Communal Area Households

E.M. Shumba[1]

INTRODUCTION

Agricultural research priority setting in Zimbabwe has traditionally been based on the need to ensure national food self sufficiency and to promote export crops. To this end, much has been achieved over the years as evidenced by spectacular increases in crop yields and output in both the large scale commercial and communal farming areas, Table 1. These productivity gains can be directly attributed to the practical application of improved technology resulting from research work conducted in this country (Tattersfield, 1982). For example, over 95 percent of communal area farmers purchase and plant hybrid maize seed each year, thus increasing communal maize production and the proportion of the total crop delivered to official marketing outlets. For example, Table 2 reveals that the contribution of communal farmers to the marketed maize output has increased from eight percent in 1976-80 to 48 percent in 1986-88 while the proportion of cotton produced by communal farmers has increased from 22 percent to 56 percent over the same period. Such advances clearly demonstrate that, given the appropriate technical and institutional support, communal farmers have the capacity and willingness to invest in expanding the country's agricultural production.

However, the above scenario is misleading, especially when one considers that about 80 percent of the maize delivered by the communal sector to the Grain Marketing Board in 1985 came from only 20 percent of the 900 000 communal area households who are located in the high rainfall areas (Natural Regions I and II). The rest of the farmers contribute very little because they live in low rainfall environments (Natural Regions III to V). Many of these farmers experience food shortages (both in terms of quality and quantity) because of low and erratic rainfall and low soil fertility coupled with a lack of cash to buy food, particularly during drought years.

---

[1]Head, Agronomy Institute, Department of Research and Specialist Services. Ministry of Lands, Agriculture and Rural Resettlement.

Unfortunately crops like sorghum and millets, which are more adapted to such marginal rainfall conditions, have received little or no research attention in the past because of their limited importance and utility at the national level and in export demand. Table 1 shows that little progress has been made in raising yields of sorghum, pearl millet and finger millet compared to maize since 1951-55.

Table 1
Crop production trends in Zimbabwe by agricultural sector: 1951-55 and 1986-90

		Large Scale Commercial Farms		Communal Areas	
Crop	Year	Area (ha)	Yield (kg/ha)	Area (ha)	Yield (kg/ha
Maize	1951-55	145 000	1 421	628 751	342
	1986-90	141 667	5 063	1 172 250	1 056
Sorghum	1951-55	3 017	568	149 673	307
	1986-90	8 054	2 861	158 264	481
Finger millet	1951-55			91 347	605
	1986-90	93	564	110 352	662
Pearl millet	1951-55			97 853	531
	1986-90	124	599	175 615	542
Cotton	1951-55	5 102	256		
	1986-90	59 233	1 920	178 006	885
Burley Tobacco	1951-55	291	1 202		
	1986-90	62 386	1 928	173 205	901

Source: 1951-55 data extracted from Tattersfield, 1982.; 1986-90 data supplied by the Agricultural Marketing Authority and Central Statistics Office.

Table 2
Proportion (%) of total crop delivered to official marketing outlets by sector: 1976-88.

Crop	Year	Large Scale Commercial Farms	Communal Areas [a]
Maize	1976-80	92	8
	1981-85	69	31
	1986-88	52	48
Cotton	1976-80	78	22
	1981-85	61	39
	1986-88	44	56

[a] Includes deliveries from small scale commercial farms and resettlement areas.
Source: Date supplied by the Agricultural Marketing Authority and Central Statistical Office.

This paper discusses the research priority setting mechanism adopted by the Department of Research and Specialist Services (DR&SS) in its attempt to address the problem of lack of food access of many households in marginal rainfall areas. The problems associated with this approach and suggestions for future work are highlighted.

Agricultural Research Priority Setting for Communal Area Households Since 1980

A major factor that accounted for the agricultural research success story in the large scale commercial sector before 1980 was the close linkage that existed between the research and extension departments. This interactive linkage enabled farmers to influence and direct both the research and extension agendas. However, since a parallel setup did not exist for communal areas, farmers could not directly influence the direction of research. This partly explains why research on traditional drought tolerant crops like sorghum and millets, cowpeas and bambaranut was not emphasised prior to 1980.

Following independence in 1980, the mandate of DR&SS was informally broadened to conduct research that "increases agricultural productivity in the communal areas while maintaining production in the large scale commercial sector". With this wider mandate, there was a need for the department to target research to the needs of communal farmers in marginal rainfall areas. But this required a mechanism to enable researchers to identify important problems of communal farmers for inclusion into the department's research agenda. Since there were no formal linkages between DR&SS and the extension department (Department of Agricultural and Extension Services, (AGRITEX), the Committee for On-Farm Research and Extension (COFRE) was formed to develop on-farm research and demonstration priorities for DR&SS and AGRITEX[2]

The Emerging Research Agenda for Farmers in Low Rainfall Communal Areas

To specifically meet the challenges of improving food access to farmers in low rainfall areas, DR&SS has, since 1980, initiated new on-station research programmes and strengthened its on-farm research thrust. Moreover, on-station research programmes on previously neglected traditional food crops have been created and/or strengthened. Examples include the initiation of cowpea and bambaranut breeding and agronomy programmes and the expansion of small grain cereals research to include crops other than sorghum. Also, agricultural economists have been hired and posted at technical research institutes to influence both the on-station and on-farm research agenda through farm level diagnostic surveys and to broaden the technology evaluation criteria by encompassing socio-economic issues.

---

[2]COFRE has set up a number of national and regional subcommittees to generate on-farm research and extension priorities (Fenner and Shumba. 1989).

The department currently has two economists attached to two technical institutes. In addition, an intedisciplinary Farming Systems Research Unit (FSRU) was formed to conduct research exclusively in communal areas. The major thrust of the FSRU is conducting diagnostic surveys in specific areas followed by adaptive on-farm trials to address the identified constraints. The unit refers all technical constraints with "no ready" technical solutions to disciplinary institutes for on-station work or further on-farm testing.

Perhaps the greatest achievement of the research and extension dialogue initiated through COFRE has been the marked improvement in priority setting for on-farm projects over the last four years. There has been considerable progress in the prioritisation of enterprises and technical areas addressed in on-farm projects. This is in line with recommendations made at the 1987 COFRE workshop on "Setting research and demonstration priorities for natural regions III to V" (DR&SS and AGRITEX. 1987).

In comparison with maize (the major starch staple and cash crop), there was a shift towards trials on small grain cereals, oilseeds, horticulture and production systems between 1987-88 and 1989-90, Table 3. Trials on small grain cereals are aimed at generating technologies that increase household food security in low rainfall areas. Associated with this has been a renewed interest in the utilisation of vlei areas by initiating on-farm research on the production of wheat and rice on residual moisture. Diversification into horticultural crops is aimed at producing technologies that generate cash and a nutritionally balanced "food basket" at the household level. The thrust on production systems research is in recognition of the role played by improved crop husbandry practices in increasing and sustaining crop productivity in communal areas. However, the number of on-farm projects on livestock has been very small despite the importance of livestock as a potential cash source for communal farmers. This has been largely attributed to budgetary and transport problems and the complexity of conducting on-farm research with livestock.

Table 3
The ratio of maize on-farm trials to other crop enterprises: 1987-90

	1987-88 (n = 63)	1988-89 (n = 65)	1989-90 (n = 58)
Small grains : maize	1.11	1.00	1.34
Oilseeds: maize	1.91	1.39	1.55
Horticulture : maize	0.45	0.27	1.11
Production systems[a] : maize	0.64	0.53	1.00

[a] Includes rotations, crop protection, soil fertility, intercropping, tillage techniques and regenerative agriculture.
Source: Shumba, 1990.

In terms of technical areas addressed, there were more projects on moisture conservation techniques and soil fertility management compared to crop variety studies in 1989-90 than in 1987-88, Table 4. The increased emphasis on moisture conservation and soil fertility related work is in recognition of the importance of low rainfall and poor soil fertility as major constraints to high crop yields in communal areas.

Table 4
The ratio of crop variety to other technical areas addressed in DR&SS and AGRITEX on-farm projects

	1987-88 (n = 164)	1989-90 (n = 205)
Planting date: crop variety	0.17	0.17
Population: crop variety	0.12	0.17
Moisture conservation: crop variety	0.14	0.64
Crop protection: crop variety	0.16	0.38
Soil fertility: crop variety	0.91	1.88
Other practices: crop variety	0.33	0.62

[a] Rotations, intercropping, regenerative agriculture, castor, bambaranut, etc.
Source: Shumba, (1990).

Limitations of a Technical Problem Oriented Research Agenda for Zimbabwe's Low Rainfall Areas

Despite the highlighted shifts towards a farmer oriented research agenda for marginal rainfall areas, the following contradictions and challenges have emerged:

Conflicts Between Household Priorities and Agroecological Realities.

Despite marginal rainfall conditions experienced in most communal areas, farmers continue to cultivate maize in preference to small grain cereals which are seemingly more adapted to poor conditions (Agronomy Institute Annual Report. 1981). Table 5 shows that there has been an increase in the area planted to maize compared to small grains since 1951-55. Some of the reasons for this trend include preference of maize as a starch and cash source, the ease of preparation of maize flour, the susceptibility of sorghum and millets to bird damage and the lower yield potential of these crops under average rainfall conditions in Natural Regions (NR) IV and V. A cereals comparison trial conducted at Makoholi Experiment Station (NR IV) showed that maize always outyields the small grain cereals. Averaged over a four year period, maize yields were almost double those of pearl millet, the highest yielding small grain cereal, Table 6. In addition to their lower yield potential, small grain cereals do not respond well to improved inputs like nitrogen fertilizer.

Table 5
Changes in the area planted to maize compared to small grains: 1951-55 to 1986-90

	CROP				
	Maize	Sorghum	Finger millet	Pearl millet	Total
1951-55 Area ('000 ha)	629	150	91	98	968
% of Total	0,65	0,16	0,09	0,10	
1986-90 Area ('000 ha)	1 172	158	110	176	1 616
% of Total	0,73	0,10	0,07	0,10	

Table 6
Grain yield (t/ha) comparisons of four cereal crops planted at Makoholi Experiment Station: 1983-88

	Maize	Sorghum	Pearl millet	Finger millet
1983-84	3,72	1,62	2,24	0,49
1984-85	3,39	1,29	1,96	1,06
1985-86	4,33	2,61	1,33	1,65
1987-88	1,39	0,44	1,38	0,75
Mean	3,21	1,49	1,72	0,99
SE$\pm$	1,27	0,90	0,45	0,50

The foregoing analysis helps explain the following observations:

- why farmers in marginal rainfall areas largely grow sorghum and millets as a buffer crop in the event of a drought and not as a major starch or cash crop;

- why government pricing and marketing incentives to promote small grain cereal production in the mid 1980s largely benefited farmers located in more favourable Natural Regions II and III who could produce the crops cheaper than their counterparts in drier areas; and,

- why there is uncertainty in the minds of seed producers on the extent to which recently released high yielding sorghum and pearl millet varieties will be adopted by farmers in marginal rainfall areas.

Budgetary Limitations

As indicated earlier DR&SS has, since 1980, expanded both its on-station and on-farm research efforts to address agricultural production problems in communal areas. Unfortunately, this expansion has not been matched by corresponding increases in financial resource allocation to the department. For example, Table 7 shows that, in 1988-89, the department was allocated only 75 percent of its 1980-81 budget in real terms.

Table 7
Trends in the government's financial allocation to DR&SS

Year	Total Allocation[a] (Z$'000)	Consumer Price Index (CPI)	1980 $ Value	Index
1980-81	8 074	100,0	8 074	100
1981-82	7 731	111,5	6 933	86
1982-83	8 154	122,7	6 645	83
1983-84	8 978	149,4	6 009	75
1984-85	11 375	180,0	6 319	78
1985-86	12 513	196,2	6 377	79
1986-87	15 040	224,9	6 687	83
1987-88	16 993	257,2	6 589	82
1988-89	16 940	280,3	6 043	75
1989-90	19 554	-	-	-

[a] Excludes government grants and contributions from farmer organisations.
Source: Data extracted from Government of Zimbabwe Blue Book and DR&SS Final Accounts Central Statistical Office - Quarterly Statistics

The proportion of the department's total budget devoted to salaries has increased from 50 percent to just over 70 percent during the same period (Fenner, 1990). This has obviously adversely affected the availability of operating funds and the department's productivity. In 1989-90 government increased its contribution to DR&SS by 15 percent, Table 7, but with inflation averaging 15 percent and vehicle hire charges increasing by 62 percent, the financial situation has been very tight.

These financial realities and transport problems have forced the department to cut some of its programmes. Given that on-farm trials are expensive, these have been the first to go. Table 8 shows that the number of on-farm trials was reduced by 51 percent between 1987-88 and 1990-91. The number of trial sites planted fell by more than 60 percent over the same period.

Table 8
Distribution of on-farm trials and sites by DR&SS Institute or station: 1987-91

	TRIAL (NUMBER)			
	1987-88	1988-89	1989-90	1990-91
Agronomy Institute	12	15	15	8
Crop Breeding Institute	5	4	4	1
Chemistry and Soils	8	7	7	3
Cotton Research Institute	7	6	6	4
Coffee Research Station	1	0	5	0
Farming Systems Research Unit	10	9	0	-
Lowveld Research Stations	5	5	5	2
Plant Protection	12	15	15	10
Livestock and Pastures	3	4	2	2
Total DR&SS	63	65	59	31

Source: Sumba. 1990.

CONCLUSIONS

Zimbabwe's experience with agricultural research priority setting for households in low rainfall areas has revealed several realities. First, financial limitations within national research programmes can constrain well-intentioned efforts to increase on-farm research in communal areas. The budget constraint requires DR&SS to develop a more focused research agenda and strategy.

In the light of the reduction in the number of on-farm trials, DR&SS should consider designing part of its on-station research programme with a communal area farmer problem focus and then invite groups of farmers to visit such trials. This has already been initiated by a few institutes in the department. However, the success of the approach depends heavily on the ability of extension staff to identify problems at the farm level and communicate them to researchers. To this end, diagnostic survey skills are being imparted to extension personnel through COFRE.

Second, the observed conflict between farmer objectives, environmental limitations and financial realities implies that DR&SS should focus on research and extension programmes that reduce the risk associated with the production of maize (the preferred crop). Such work has already begun with emphasis on moisture conservation techniques, fertilizer application rates and breeding earlier maturing and drought tolerant varieties. However in the long term improved technological packages for the efficient production and utilisation of traditional food crops like sorghum and millets and grain legumes will have to be found. Given the annual budget constraints in most national research programmes, this type of research lends itself to joint research projects with international research centres in the SADCC region. Third, the observed cash oriented production of communal households suggest that cash crops such as sunflower (which is comparatively early maturing and drought tolerant) might improve household food security by increasing farm incomes and economic access to food in the market.

Notwithstanding the financial difficulties of national agricultural research programmes, technology development is a more viable long term food security strategy than "fire fighting" approaches such as child supplementary feeding schemes and drought relief programmes.

REFERENCES

Agronomy Institute. 1981. *Annual Report*. Department of Research and Specialist Services. Ministry of Agriculture. Harare.

Fenner, R.J. Forthcoming. Budgetary contraints and their impact on on-farm projects. Do we have any options? In: E.M. Shumba and S.R. Waddington eds. *Proceedings, Workshop to Assess the Performance of the Committee for On-Farm Research and Extension.* 7-9 May, 1990. Kadoma Motel. Zimbabwe.

Fenner, R.J. and E.M. Shumba. 1989. Linking research and extension through on-farm research and demonstrations. The Zimbabwe experience. Proceedings, *ISNAR International Workshop on: Making the Link Between Agricultural Research and Technology Users.* 19-25 November, 1989. The Hague. Netherlands.

Shumba, E.M. 1990. The performance of the Committee for On-Farm Research and Extension (COFRE) in the last four years and suggestions for improvement. In: E.M. Shumba and S.R. Waddington. eds. *Proceedings of Workshop to Assess the Performance of COFRE.* 7-9 May, 1990. Kadoma Motel. Zimbabwe (Forthcoming).

Tattersfield, J.R. 1982. The role of research in increasing food crop potential in Zimbabwe. *Zimbabwe Science News.* Vol 16: 6-10.

PRODUCED BY PRINT BROKERS