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AGRICULTURAL RESEARCH RESOURCE ASSESSMENT IN THE SADCC COUNTRIES

VOLUME II
COUNTRY REPORT: MALAWI

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PREFACE

AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

IN THE SADCC COUNTRIES

This document has been prepared by DEVRES, Inc. in cooperation with the Consultative Technical Committee for Agricultural Research (CTCAR) of the Southern African Development Coordination Conference (SADCC) in accordance with the terms of a contract with the US Agency for International Development.

The national agricultural research resource assessments which provide the necessary background information for this document were conducted by national agricultural research scientists from SADCC countries[1] under the guidance of DEVRES in consultation with the CTCAR. Financial support was provided by the US Agency for International Development (under Contract No. AFR-0435-C-00-2084-00 and Project No. 698-0435 entitled Strengthening African Agricultural Research) on behalf of the member countries of the Cooperation for Development in Africa (CDA).

Discussions concerning this country report were held with the country report authors, responsible officials in the ministries of agriculture, rural development and plan, as well as specialists from international organisations, bilateral donors, and universities. On two occasions, drafts of this final report were examined by SADCC's Consultative Technical Committee for Agricultural Research (CTCAR). Suggestions by its members were incorporated into the report.

The results of the assessment are contained in the following reports:

Volume I - Regional Analysis, Strategy, Programmes and Summaries of Country Reports

Volume II - Country Reports:[2]

Botswana
Lesotho
Malawi
Mozambique[3]
Swaziland
Tanzania[3]
Zambia
Zimbabwe

These reports are available in English and in microfiche or printed form at a cost determined by document size at the address below. The Regional Analysis and Strategy and the Mozambique country report are also available in Portuguese in the same forms.

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[1]SADCC member countries are Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe. Angola, however, did not participate in this study.

[2]Each country is printed separately.

[3]Italy provided technical advisors for the preparation of the Tanzania national report and France provided an advisor to help in the preparation of the Mozambique country report.

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The last but not least thanks are directed to Devres, Inc. for coordinating the ARRA so well, and to Dr. Ephriam Whingwiri of the Agronomy Institute, Zimbabwe, for undertaking the pilot study on which the current update for Malawi was based.

LIST OF ACRONYMS AND ABBREVIATIONS

ADB	African Development Bank
ADD	Agricultural Development Division
ADMARC	Agricultural Development and Marketing Corporation
ARRA	Agricultural Research Resource Assessment
ASF	African Swine Fever
BSc	Bachelor of Science degree
BVM	Bachelor of Veterinary Medicine
C	Celsius
CAO	Chief Agricultural Officer
CARO	Chief Agricultural Research Officer
CIAT	International Centre for Tropical Agriculture
CIDA	Canadian International Development Agency
CIMMYT	International Centre of Maize and Wheat Improvement
CRSP	Collaboration Research Support Programme
CSC	Cold Storage Company
CTCAR	Consultative Technical Committee for Agricultural Research
DAHI	Department of Animal Health and Industry
DANIDA	Danish International Development Agency
DAR	Development of Agricultural Research
DOA	Department of Agriculture
DVS	Department of Veterinary Services
EDB	Ethylene Dibromide
EDF	European Development Fund
EEC	European Economic Community
EPA	Extension Planning Area
FAO	Food and Agricultural Organization
FRG	Federal Republic of Germany
FTE	Full Time Equivalent
GDP	Gross Domestic Product
GNP	Gross National Product
GOM	Government of Malawi
GRAMIL	Grain and Milling Company
IBRD	International Bank for Reconstruction and Development (The World Bank)
ICIPE	International Centre for Insect Physiology and Ecology
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics

IDA	International Development Association
IDRC	International Development Research Council (Canada)
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IFS	Internation Fund for Science (Sweden)
IITA	International Institute of Tropical Agriculture
ILCA	International Livestock Centre for Africa
ILRAD	International Laboratory for Research on Animal Diseases
IRRI	International Rice Research Institute
ISTA	International Seed Testing Authority
K	Kwacha (Malawi)
MOA	Ministry of Agriculture
MSc	Master of Science degree
NRC	Natural Resources College
NRDP	National Rural Development Programme
ODA	Overseas Development Agency
PhD	Doctor of Philosophy degree
PO	Professional Officer
PQLI	Physical Quality of Life Index
RDP	Rural Development Project
SACCAR	Southern African Centre for Cooperation in Agricultural Research
SADCC	Southern African Development Coordination Conference
SUCOMA	Sugar Corporation of Malawi
TA	Technical Assistant
TO	Technical Officer
TDRI	Tropical Development and Research Institute
TRA	Tobacco Research Authority
TRF	Tea Research Foundation
UK	United Kingdom
UNDP	United Nations Development Programme
US	United States
USAID	United Staes Agency for International Development

CURRENCY EQUIVALENTS
(December 31, 1983)

Currency unit	=	Malawi Kwacha (MK)
US$ 1.00	=	M 1.30
MK 1	=	US$ 0.769
MK 1	=	100 tambala

WEIGHTS AND MEASURES

1 hectare (ha)	=	10,000 m^2
	=	2.471 acres
100 hectares (ha)	=	1 km^2
1 acre	=	0.405 ha
1 kilogram (kg)	=	2.204 pounds
1 metric ton (MT)	=	1,000 kg
	=	2,204 pounds
1 kilometer (km)	=	0.621 miles
1 kilometer square (km^2)	=	100 ha
1 mile	=	1.609 km
1 liter	=	1.066 quarts
1 quart	=	0.9464 liters

GOVERNMENT OF MALAWI FISCAL YEAR

April 1 to March 31

TABLE OF CONTENTS

	Page
PREFACE	i
ACKNOWLEDGEMENTS	iii
LIST OF ACRONYMS AND ABBREVIATIONS	v
CURRENCY EQUIVALENTS AND WEIGHTS AND MEASURES	vii
TABLE OF CONTENTS	ix
LIST OF TABLES	xvii
LIST OF FIGURES	xix
EXECUTIVE SUMMARY	xxi
A. Background	xxi
1. Country description and economic overview	xxi
2. Agriculture in Malawi	xxi
B. Agricultural Institutions	xxii
1. Research	xxii
a. Department of Agricultural Research	xxiii
b. Department of Veterinary Services (DVS)	xxiii
c. Tea, tobacco and sugar research	xxiv
2. Training	xxv
3. Extension	xxvi
C. Constraints to Agricultural Production and Production Potential	xxvii
1. Food crops	xxvii
2. Commercial crops	xxviii
3. Livestock and animal products	xxviii
D. Staff Assessment of Institutions	xxix

Page

E. Conclusions and Recommendations xxix

1. Agricultural institutions xxix

2. Agricultural productivity xxix

I. INTRODUCTION 1

A. Background 1

B. Methodology 2

II. GENERAL INFORMATION ON MALAWI 5

A. Description of the Country 5

1. Geography 5

2. Agro-ecological zones 5

3. Natural environment 7

4. Climate 7

B. The People 7

1. Population 7

2. Occupational patterns 11

3. Language and ethnic groups 11

4. Religion 12

5. Educational system 12

C. Government and Political Framework 12

1. Structure of government and political parties 12

2. National budget 12

3. Membership in international organisations . . 13

Page

4. Government policies regarding agriculture . . 13

D. Economic Overview 13

1. General indicators 13

2. International trade 14

3. National Development Plan 14

4. External aid 16

E. Agriculture 16

1. Land use 16

2. Land tenure 16

3. Principal agricultural production systems . . 18

a. Smallholder production 18

b. Estate production 20

4. Principal agricultural products 20

5. Forestry 23

6. Agricultural marketing and credit 23

a. Marketing 23

b. Credit 23

7. Food security 23

III. AGRICULTURAL RESEARCH INSTITUTIONS 25

A. Overview of Agricultural Research in Malawi . . . 25

B. Agricultural Research Institutions 25

1. Department of Agricultural Research 25

a. Organisational structure and purpose . . 25

b. Research programmes 31

c. Human resources 31

Page

d. Research facilities 32

e. Financial resources 40

2. Department of Veterinary Services 40

a. Organisational structure and purpose . . 40

b. Research programmes 42

c. Human resources 42

d. Research facilities 43

e. Financial resources 43

3. Bunda College of Agriculture. 44

a. Organisational structure and purpose . . 44

b. Research programmes 44

c. Human resources 44

d. Financial resources 44

4. Tea Research Foundation 44

a. Organisational structure and purpose . . 44

b. Research programmes 46

c. Human resources 46

d. Research facilities 46

e. Financial resources 48

5. Tobacco Research Authority 48

a. Organisation and purpose 48

b. Research programmes 48

c. Human resources 49

d. Research facilities 50

e. Financial resources 50

Page

6. Sugar Corporation of Malawi 50

C. Total Human Resources Available for Research in Malawi 51

1. Staffing patterns 51

2. Staff training 60

D. Total Financial Resources Available for Research in Malawi 60

1. Government research institutions 60

2. Private research institutions 60

IV. AGRICULTURAL TRAINING INSTITUTIONS 67

A. Overview of Agricultural Training in Malawi . . . 67

B. Agricultural Training Institutions 67

1. Bunda College of Agriculture 67

a. Organisational structure and purpose . . 67

b. Training programmes. 67

c. Human resources 69

d. Training facilities 69

e. Financial resources 72

2. Natural Resources College 72

a. Organisational structure and purpose . . 72

b. Training programmes 73

c. Human resources 73

d. Training facilities 73

e. Financial resources 73

Page

C. Total Human Resources Available for Training in Malawi 74

1. Staffing patterns 74

2. Staff training 74

D. Total Financial Resources Available for Training in Malawi 74

V. AGRICULTURAL EXTENSION INSTITUTIONS 81

A. Overview of Agricultural Extension in Malawi . . . 81

B. Department of Agriculture 81

1. Organisational structure and purpose 81

2. Extension programmes 85

3. Human resources 86

a. Staffing patterns 86

b. Staff training 86

4. Extension facilities 91

5. Financial resources 91

VI. CONSTRAINTS TO AND THE POTENTIAL FOR INCREASED PRODUCTIVITY 93

A. Food Crops 93

1. Maize 93

2. Rice 94

3. Wheat 94

4. Beans 96

5. Sorghum/millet 96

B. Commercial Crops 96

1. Groundnuts 96

2. Cotton 96

Page

3. Tobacco 97

4. Tea, coffee and sugar 97

C. Livestock 97

D. Summary of Major Constraints to Achieving Increased Productivity of Crops and Livestock . . 100

VII. STAFF ASSESSMENT OF INSTITUTIONS 103

A. Agricultural Research 103

B. Agricultural Training 103

C. Agricultural Extension 104

VIII. CONCLUSIONS AND RECOMMENDATIONS 105

A. Strengthening Malawi's Agricultural Institutions . 105

1. Research institutions 105

2. Training institutions 105

3. Extension institutions 106

B. Dealing With Constraints Affecting Crop Production 106

1. Food Crops. 106

2. Commercial crops 107

C. Dealing With Constraints Affecting Livestock Production 108

1. Beef and dairy cattle 108

2. Small stock and poultry 108

LIST OF TABLES

Table Number		Page
1	Social and Economic Indicators of Development . .	9
2	Land Use	17
3	Indicators of Agricultural Productivity	19
4	Livestock Production Indicators	21
5	Agricultural Research Institutions: Funding, Location, Activities and Staff, 1984	27
6	Linkages of Malawi's Agricultural Research System with International Research Centres	29
7	Location, Major Activities, Staff and Funding of Agricultural Research Branch Stations, 1984 . .	33
8	Ecological Description and Land Use of the Department of Agricultural Research Stations . . .	38
9	Research Projects at Bunda College of Agriculture, by Department	45
10	Tea Research Foundation Professional Staff by Discipline and by Qualification	47
11	Total Agricultural Research Staff, 1984	52
12	Summary of Professional Staff Effort and Source of Funds by Programme Area of Agricultural Research, 1984	53
13	Disciplines of Professional Staff Related to Agricultural Research Programme Area, 1984	55
14	Summary of Technical Skills of Agricultural Research Professionals by Degree Held, 1984 . . .	61
15	Training Plans for Staff of Research Institutions, 1984	63
16	Donor-funded Agricultural Research Activities, 1984	64
17	Agricultural Training Institutions: Degrees Offered, Number of Staff and Students, 1984 . . .	68

Table Number		Page
18	Qualifications of Teaching Staff of Bunda College Departments, 1984	70
19	Total Agricultural Training Staff, 1984	75
20	Disciplines of Teaching Professionals, 1984 . . .	76
21	Training Plans for Staff of the Training Institutions, 1984	78
22	Agricultural Extension Institutions: Locations and Staff, 1984	83
23	The Subdivision of Agricultural Development Divisions into Rural Development Project Areas, Source and Amount of Funds	84
24	Total Agricultural Extension Staff, 1984	87
25	Summary of Professional Extension Staff Effort and Source of Funds Related to Programme Area, 1984	88
26	Training Plans for Staff of Extension Institutions, 1984	90
27	Budget of the Department of Agriculture 1980/81 to 1984/85.	92
28	Perceptions of Severity of Constraints to Achieving Higher Crop Yields	95
29	Perceptions of Severity of Constraints to Achieving Higher Livestock Productivity	99

LIST OF FIGURES

Figure Number		Page
1	Agro-Ecological Zones	6
2	Climatological Information: Mean Annual Rainfall and Temperature	8
3	GDP by Source, 1960 and 1980	15
4	Agricultural Research Stations	26
5	Organisation Chart of the Department of Agricultural Research	30
6	Organisation Chart of the Department of Veterinary Services	41
7	Organisation Chart of the Department of Agriculture	82

EXECUTIVE SUMMARY

A. Background

1. Country description and economic overview

Malawi is a landlocked country with four agroecological zones: the lower Shire Valley, which is a low-rainfall, semiarid savannah area; the lakeshore and upper Shire Valley, which have both high- and low-rainfall sections; the medium plateau area, which covers three-fourths of the land area and is composed of savannah and woodlands; and the high-rainfall highland areas, consisting of grasslands and evergreen forests. Soils are among the most fertile in south central Africa. Annual rainfall varies greatly, with a number of wet years being followed by a number of drier years. Rainfall distribution also varies from less than 750 mm of rain per year in the Shire valley to 1600 mm annually in the highlands.

Malawi's population was 6.4 million in 1982 and has been growing at the rate of 3 percent annually. Ninety percent of the people live in rural areas and 84 percent of the labour force in 1980 was engaged in agriculture. The population is unevenly distributed, with only 12 percent of people in the northern region, 30 percent in the central region and over half in the south.

Since Independence in 1964, Malawi has made impressive economic progress, due in large part to sound government policies and good weather. Between 1960 and 1981, GDP grew at an average annual rate of 5.7 percent, with agriculture contributing 43 percent at factor cost. Four-fifths of agricultural production was from the smallholder sector. In 1980, agricultural products accounted for 90 percent of Malawi's exports with tobacco (48 percent), sugar (26 percent) and tea (12 percent) being the leading commodities. In 1981, Malawi's current account deficit was 24 percent and debt service was the equivalent of 30 percent of exports.

2. Agriculture in Malawi

The traditional pattern of land use among smallholders is through the assignment of cultivation rights by village headmen. Despite relatively intensive cultivation in the central and southern regions, annual smallholder cultivation of 1.7 million ha is generally much less than the available arable land. Average smallholder farm size is 1.7 ha.

The primary staple crop is maize which is grown on approximately two-thirds to three-fourths of smallholder land. Other major crops are tobacco, grown by 10 percent of smallholders, tea grown by 4,000 smallholders, cotton by 60,000, and groundnuts. Cattle, too, are raised mostly by smallholders, although some estates have dairy cattle.

Land in Malawi is publicly and privately owned. There are 1,100 large private agricultural estates, controlling 470,000 ha of land. Tobacco is produced on 98 percent of the estates, tea is grown on 2 percent and sugarcane on two estates. Combined estate production has increased four-fold since 1968 at the annual rate of 17 percent. The increase is attributed to expansion of areas under cultivation, better management and greater input use. Estate production of tea, tobacco, sugar, tung oil, coffee and macadamia nuts are the main foreign exchange earners, providing 80 percent of agricultural exports.

Forests occupy about 9 percent of Malawi's land area, and 6,000 ha of new forests are planted every year. The lumber produced is for poles and crates and is not usually suitable for general carpentry. Fuelwood is an important source of energy for smallholders and for tobacco curing.

Crop marketing is done by the Agricultural Development and Marketing Corporation (ADMARC), which purchases and sells smallholder crops and sells and delivers agricultural inputs at prices determined by the Price Review Committee of the Government. Estate produce is marketed by the private sector, while tobacco is sold at the Limbe and Lilongwe auctions, and tea and coffee are exported through international trading companies. Livestock markets consist of the Cold Storage Company and several auction markets. There is no central agricultural credit institution in Malawi, but smallholders have access to seasonal and medium-term credit through some MOA projects, the extension service and the Ministry of Trade and Industry's Loan Board.

In 1981 smallholders accounted for 81 percent of agricultural production, meeting the country's food needs and producing some exportable surplus (20 percent of all agricultural exports) and certain raw materials. Currently, the commercial livestock sector (which includes smallholders) provides the entire meat and egg demand for urban consumption. The cattle population is growing at the rate of 4.8 percent and annual offtake averages 9-10 percent. Smallholders own goats and chicken for meat, and pigs are raised by both smallholders and commercial farmers.

B. Agricultural Institutions

1. Research

Agricultural research in Malawi is performed by both government and private institutions. The government's research work is funded by a mixture of national budget allocations and external donor support. The total spent on agricultural research amounted to US$ 8.5 million in 1983-84. Prominent among the external donors are USAID, the UK, DANIDA, and UNDP/FAO. Private research is funded by the respective organisations of growers although tea and tobacco

have received some technical support from the UNDP/FAO and the UK. The professional staff engaged in research numbered 177 in 1984, of whom 30, or 17 percent, were expatriates.

a. Department of Agricultural Research

The Department of Agricultural Research (DAR) of the Ministry of Agriculture (MOA) is the main research institution. It also provides services such as seed multiplication, information and diagnostic services. The organisational structure consists of research stations, substations and district sites. The research emphasis is on maize, cotton, groundnuts, rice, horticultural crops, farm machinery development, crop storage and livestock improvement.

The staff consists of 520 people including support staff, technical assistants and senior technical and administrative staff. The recurrent operating budget in 1984-85 was US$ 2.6 million, half of which was spent on wages and salaries and 29 percent on maintenance and operating expenses. Facilities in each of the 11 research stations include office space. In addition, there are five laboratories, 17 greenhouses and maintenance workshops. The main library is at the Chitedze Research Station. It has 3,000 books and acquires 30-50 books per annum. It receives 250 periodicals and journals and has access to library resources at the University of Florida and the Tropical Development Research Institute in the UK. Except for vehicles and tractors, there is no major equipment. Six micro-computers are available.

Linkages between researchers and extension officers are maintained through joint participation on committees with the Agricultural Development Division (ADD) and the Department of Veterinary Services (DVS). The DAR has relatively weak institutional linkages with the Bunda College of Agriculture (which conducts seven research projects), the Tobacco Research Authority, the Sugar Corporation of Malawi, the Tea Research Foundation and the Smallholder Coffee Authority. It also has bilateral relationships with many international research centres.

b. Department of Veterinary Services (DVS)

The DVS which is attached to the MOA has responsibility for research, extension and provision of services under the direction of the Chief Veterinary Officer. Research is done at the central laboratory at Lilongwe and field services are based in each of the eight ADD's and provided through 17 production centres distributed throughout the country.

The DVS' Livestock Development programme is aimed at improving herd quality through better disease control, nutrition and management and through three research projects: the East Coast Fever Project, the African Swine Fever Project and the Newcastle Disease Vaccine V4 Project.

There are 78 staff members including 22 professional staff, three administrative officers, seven technical officers doing research and 46 support staff. The total DVS budget is US$ 3.08 million. Of this figure, about 15 percent comes from the GOM and the rest from international agencies and only $140,000 is dedicated to research programmes of the DVS.

Facilities include three laboratories at Lilongwe and one each at Blantyre and Mzuzu, five offices in excellent condition at Lilongwe, three offices in poor condition at Blantyre and one in good condition at Mzuzu. There is a library at the Central Veterinary Laboratory which has 5,000 books and 20 scientific journals. There are also three livestock compounds at Lilongwe. Major equipment holdings include a stereoscope microscope, a gas chromatograph, an autoclave, a centrifuge, liquid nitrogen apparatus, 60 vehicles, 15 tractors and 100 motorcycles.

c. Tea, tobacco and sugar research

The private Tea Research Foundation (TRF) conducts research on tea production and provides advisory and extension services. Since much of the research is financed by the industry, it is aimed at estate production, although there is currently a plant improvement project for the Smallholder Tea Authority. The research staff consists of a Director and his Deputy, 21 Professional Officers and five Technical Officers and 28 Assistants for a total of 56 persons. The budget in 1984 is US$ 577,000, the main sources of funding being the tea industry, revenue from TRF's experimental tea crop and the United Nations Development Programme. The main research station has 175 ha of land, of which 70 percent is used for experiments, 28 percent for crop production and 2 percent for seed/plant material multiplication. There are three laboratories, a greenhouse, a maintenance workshop and a library with 3,000 books and 500 periodicals. Extension services and training courses are provided for local research personnel and farmers. It maintains linkages with other organisations outside the country that contribute to its operation.

The Tobacco Research Authority is a private organisation that does research on improved tobacco varieties, methods of disease and pest control, marketing and machinery for planting, reaping and curing in both estate and smallholder cultivation. It employs four administrators, 11 professional Research Officers, seven Technical Officers and 48 Technical Assistants and support staff, or a total of 70. The 1984 budget of US$ 506,000 is financed entirely by a growers' levy and programme income. There are two research stations, one without either a laboratory or electricity. Currently, there are no greenhouses though three are being constructed. The library contains only ten books and six scientific journals but the research staff has access to the Bunda College Library. Linkages also exist with the Chitedze and Bvumbwe Research Stations. The Authority conducts courses for the MOA's extension field staff and publishes a

newsletter. External linkages exist with similar institutions in Zimbabwe, the Republic of South Africa and with North Carolina State University.

The Sugar Corporation of Malawi conducts research on introduction and testing of new varieties of sugarcane, with a staff of 11 that includes one professional researcher. It is entirely funded by Lonrho Ltd. and has a budget of US$ 114,000.

Of the 1229 authorised positions in research only 978 are currently occupied, of which 943 are held by nationals and 38 by expatriates. A BSc degree is required for 177 professional positions, a diploma for 120 technical positions and the rest are for certificate-holders and support staff. At present there are ten people in PhD training, 27 in training for the MSc and five studying for the BSc.

2. Training

The Malawi public school system includes basic agricultural training in its general curriculum. Students with the appropriate level of work can enter the higher educational institutions for agriculture, natural resources and veterinary sciences.

The Bunda College of Agriculture trains students for diplomas (three years) and general BSc degrees in agriculture (an additional two years). The College offers no postgraduate courses although the curriculum is being revised to accommodate some specialisation. Of the total staff of 89 people, 28 have PhDs and the college has a policy of providing training opportunities to upgrade the qualifications of the younger staff. The recurrent budget is US$ 936,200 and capital development funds are sought from donor agencies when needed. The GOM pays student fees and allowances. The College has 42 offices, two lecture halls, four classrooms, six laboratories and two greenhouses. It has a multi-purpose farm of 1800 ha which is used for both teaching and research and for commercial purposes. It has a library with 25,000 books, 350 journals and an acquisition rate of 600 books per year. Audio-visual training equipment is also available. The College cooperates with the MOA to ensure that projects are related to Malawi's development needs. It has also conducted short courses for extension and research personnel of the MOA. All students who obtain bachelor's degrees are offered employment by the MOA and the private sector.

The Natural Resources College of the MOA is a new institution responsible for training Technical Assistance (TA) personnel to the certificate level in agriculture and home economics, veterinary and fisheries, wildlife and game. There are also plans to offer in-service training courses for teaching staff and TAs trained years ago. The College has 40 teaching staff and a Principal and Deputy. Ninety-five percent of the students come from rural areas, their travel and fees paid by the government. The recurrent budget is US$

819,000. The capital account of over US$ 5 million is funded by the Canadian International Development Agency. The College has two conference rooms and 14 classrooms, and a library containing 4,000 books and seven journals. The total land area is 292 ha, of which 68 acres are reserved for pastures and demonstration plots.

Of the 155 authorised positions for agricultural training officers, 112 are filled by Malawians. Seventy-six of them hold at least the BSc degree and the rest have diplomas. There are 18 expatriates representing 19 percent of the total of professional officers. Continued training at the PhD level is being provided for six people in varying fields related to agriculture. Eleven people are in training for the MSc and three for the BSc.

3. Extension

Malawi's extension service is conducted through the Department of Agriculture (DOA) of the MOA. The MOA's Chief Agricultural Officer, with the assistance of a Deputy, has overall responsibility for extension. The national headquarters in Lilongwe administers nine technical sections corresponding to various subject matter specialties. The country is divided into eight Agricultural Development Divisions (ADD), each of which have several specialists depending upon the area's specific needs. The next organisational level is the rural development area, under which are the 180 Extension Planning Areas (EPAs).

There are between 25,000 and 30,000 families in each ADD which is administered by a manager, two assistants and several technical specialists. Forty Rural Development Projects (RDP) are planned for phased implementation over the next 15-20 years. Seventeen of them are already in operation. A Project Officer heads each RDP and is assisted by a Senior Field Officer. They are responsible for a number of EPAs. Each EPA has a headquarters with an office for the Field Supervisor and day training facilities for both farmers and field staff. A oman extension worker with a certificate in agriculture is based at the centre. The EPAs are further divided into sections containing 500 to 700 families and headed by a Field Assistant having a certificate in agriculture.

Extension services are primarily directed towards smallholders and emphasis is given to food crops such as maize, beans, cassava and millet, with some attention to cash crops such as groundnuts, cotton and rice. Among livestock, cattle production is emphasised, followed by poultry and pigs. The objective of the extension effort is to improve productivity per unit area of land.

Of the total number of 4,520 extension workers, there are 124 professionals with at least a BSc, 514 technical officers with a diploma, 2,519 technical assistants with a certificate and 1,337 support staff. Excluding support staff, women comprise only seven percent of the staff. Eleven staff members are in training, including two

women. There are no PhDs, but three men at headquarters hold MScs and three have BScs. The ADDs have eight economists with degrees, a man studying for the MSc in land survey and a woman working towards the BSc in home economics. The majority of field staff are either diplomates or certificate-holders who receive annual in-service training to acquaint them with new practices. Some people are sent abroad for post-graduate training or short courses every year.

The DOA has 147 day training centres, 121 residential training centres and three farm institutes. A day training centre and a demonstration facility are located at each EPA centre. Capacity at the day centres is for 20-30 participants and between 30-100 at the residential centres, where teaching facilities include demonstration. Agricultural courses last a week and home economics courses take two weeks. Each ADD has its own fleet of vehicle, tractors and motorcycles.

The extension service is linked with research services and with the Department of Veterinary Services, with which it carries out animal health programmes. In each Field Assistant's section there are Village Planning Committees designed to function as action groups disseminating information to farmers. The DOA also has an Extension Aids Branch with two mobile film units in each of four ADDs. The Branch produces an average of seven circulars per year, publishes newsletters and farmers' magazines, extension workers' guides and six radio programmes. Current year funding for the DOA is US$ 43.1 million, of which 42 percent is from government revenues and 58 percent from donor agencies.

C. Constraints to Agricultural Production and Production Potential

1. Food crops

Ninety percent of the maize crop in Malawi is produced by smallholders whose yields are low (1,000 kg/ha) compared with those on research stations. The major constraints to increased productivity are the low rate of adoption of improved varieties, the high cost and untimely availability of inputs for growing hybrid varieties, and the reluctance of farmers to use fertiliser in low moisture areas. Malawi produces upland (Faya) and irrigated (Blue Bonnet) rice, the former for domestic consumption and the latter for export. Average smallholder rice yields are low (1,100 to 2,900 kg/ha) due to diseases, limited availability of different varieties and Blue Bonnet vulnerability to slow growth at low temperatures, which extends the growing period into the unfavourable dry season. Less than 5 percent of Malawi's wheat requirements are produced domestically and smallholder yields are very low (500 to 900 kg/ha) because of the lack of adaptable wet season varieties, and lack of supplemental irrigation to sustain cool season production. Sorghum and millet planting have declined along with their importance as food crops.

2. Commercial crops

Groundnut production has declined since the 1960s because of low farmer prices and diseases such as cercospora, leafspot and rosette. Yields are low (260-1,200 kg/ha) due to delayed planting since the main crops such as maize and tobacco have taken precedence. Premium cotton varieties are grown in Malawi but yields are low compared to research station yields (260 to 480 kg/ha) and production has not increased in the past two decades. The government's policy is to standardise production by encouraging growth of one variety at a time with a change every five years. Major constraints are high production costs (especially for insecticides), low farmer prices, lack of capital and unavailability of inputs. Ten percent of the tobacco crop is produced under a quota system designed to ensure product quality and market stability. Yields are fairly static and farmers have not adopted the full package of recommended technology because of uncertainty about potential returns on their investment. Until recently tea, coffee and sugar were produced on large commercial farms. Now the Smallholder Tea Authority and a similiar organisation for coffee have been working on developing smallholder coffee and tea production, and smallholder sugar production has been initiated as well. Comparisons between small and large farm production cannot be made because the data are not yet available.

3. Livestock and animal products

Malawi's cattle herd is growing at the rate of 5 percent per annum while sheep and goat herds have declined. Only 11 percent of rural families own cattle and 9 to 10 percent of offtake is marketed. Of this, only 25 percent pass through formal markets. Overgrazing on communal lands is a serious problem although adequate grazing potential exists to support expanded cattle production into the 1990s. The main constraints to increased cattle production are insufficient availability of quality forage in the dry months and lack of incentives, due to the land tenure system, for adoption of improved pasture and management technology.

Milk production in 1981 declined 26 percent over 1980 mainly because of poor management of herds and forage resources. Currently rural sector meat supplies are provided by goats, pigs, sheep and poultry but insignificant amounts are marketed. Commercial pig and poultry industries exist but productivity is hampered by cost/price conditions and feed quality and availability.

In general, increased smallholder livestock and crop productivity is inhibited because of lack of improved adapted technology and an unfavourable economic environment. Technological solutions are lacking for maize, for draughtpower to ensure early planting and for semi-arid cereal crops. Moreover, farmer technology adoption is restricted by marketing and pricing structures and by high risk. Livestock productivity is constrained by: inadequate funding for veterinary and marketing services; the low throughput (24 percent) capacity of the

main commercial wholesaler, the Cold Storage Company; and by the inappropriateness of existing price policies. This is because of divergent price review mechanisms for producers, wholesale and retail prices, and for the lack of a firm database. Poor pricing policies have had the most serious impact on the pig and poultry industries, which are currently near collapse.

D. Staff Assessment of Institutions

According to the staff of each of the research, training and extension institutions, the limited recurrent costs budget is a severely constraining factor. In addition, Bunda College is hampered by inadequate numbers of trained staff and insufficient classrooms. Extension work is particularly impeded by the shortage of vehicles, and by need for further training of staff.

E. Conclusions and Recommendations

1. Agricultural institutions

Current strategies being implemented at research institutions include: the strengthening of links between research programmes, staff and the ADDs; increased involvement with farmers, particularly to test and evaluate technological packages; and improved coordination between research, extension and implementation of programme goals at the local level. Recommendations for the future include provision of adequate and timely recurrent budget support, and increased investment in agricultural research--up to 1 or 2 percent of agricultural GDP--as recommended by international agencies.

The amalgamation of training institutions offering certificate-level training is now complete and should be followed up by upgrading Bunda College's ability to award the MSc degree in such disciplines as crop and animal production.

Current strategic emphasis in extension is to improve linkages with research at the local level and to achieve a more balanced programme between food and commercial crop extension efforts.

2. Agricultural productivity

The strategies recommended to overcome the constraints to increased food crop production include: a shift in the emphasis in research and extension from commercial crops to food crop production, accomplished by increased investment in technologies adapted to smallholder needs, and the addition of socioeconomic research and analysis to agronomic research to develop policies and programmes that include dimensions such as price, alternate marketing strategies, and smallholder motivation.

Recommendations for overcoming constraints in the commercial crop sector include: increased focus on developing adapted technology for

improving smallholder yields; research and analysis on marketing and price policy options and credit availability for smallholders; and improved on-farm demonstrations to induce farmers to adopt recommended packages.

Recommended strategies for improved production in the livestock sector include: improved coordination between the DAR crop research units and the DVR pasture and range research units; and research, analysis and evaluation of the potential impact of alternate marketing and pricing policies on smallholder production of beef and dairy cattle, including the creation of an economic service for this purpose.

More research should be devoted to small stock (goats, sheep, pigs and poultry) including a breeding and selection programme adapted to the smallholders' resource base and management capability, research in nutrition, and field testing of management practices such as housing and sanitation.

I. INTRODUCTION

A. Background

This Agricultural Research Resource Assessment (ARRA) was conducted from July 1983 through August 1984 in the following countries of the Southern African Development Coordination Conference (SADCC): Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe. The ARRA was initiated as a result of discussions between the SADCC Consultative Technical Committee for Agricultural Research (CTCAR) and representatives of the Cooperation for Development in Africa (CDA). The CDA is an informal association of donors including Belgium, Canada, France, Italy, West Germany, the United Kingdom and the United States.

The inventory and assessment were carried out within the framework of the high priority accorded by the CDA to developing and strengthening agricultural research capability in Africa. The United States, assisted by other CDA donors, was assigned the specific responsibility for coordinating the development of CDA-supported agricultural research programmes in the Southern African and Sahelian regions. The ARRA inventory reports were financed by the United States Agency for International Development (AID) for CDA, and were carried out with the full collaboration and support of SADCC through the CTCAR. DEVRES, Inc., a U.S. private consulting firm based in Washington, DC, was engaged by AID to implement the ARRA together with senior agricultural research personnel from the SADCC countries and to prepare a SADCC regional report. Two other CDA donor countries, Italy and France, also provided technical experts and other assistance for some of the SADCC countries' reports.

The CDA members recognise that the African nations have established Africa-wide and regional institutions, such as SADCC, and that the heads of African states have given unanimous support to the Organization of African Unity's Lagos Plan of Action which emphasises the development of a strong capability to increase agricultural productivity. The donors have, therefore, joined with the African countries and their regional organisations--SADCC in Southern Africa and the Institute du Sahel in the Sahel--to develop country-specific and regional analyses of existing resources and of the medium- to long-term needs and opportunities in agricultural research that will lead to increased agricultural productivity.

The World Bank, in its 1983 report entitled Sub-Saharan Africa: Progress Report on Development Prospects and Programs, reiterated its emphasis on the high priority which governments and donors should give to agricultural research. More specifically the report noted:

> Even within the present state of technical knowledge, improved incentives and marketing arrangements would permit very large increases in agricultural output. However, for the longer term, increased output will depend on the development of effective technical packages, pest and disease control and developments in animal husbandry. . .In a situation of budgetary stringency and of immediate crisis, expenditure on research having a possible, but uncertain, payoff ten years or more in the future is frequently seen as dispensable. This danger is increased when research programmes are manifestly weak and unfocussed. It is, therefore, essential that these programmes be formulated and implemented in ways which will enable them to contribute more effectively to the process of development. . .[1]

The ARRA reports, and the recommended research priorities, programmes, and projects within them, are set in a 20 to 25 year time-frame. This long-term perspective permitted the flexibility to make recommendations which are more carefully adapted to the needs of agricultural research. Individual country research staff in charge of country reports, assisted by technical experts provided through the CDA have endeavoured to be sensitive and responsive to the severe budgetary constraints in SADCC countries. The reports confirm that, even when a high priority is given to research, the SADCC country governments initially will not be able to meet all of the recurrent costs of certain research projects. Donors, therefore, will need to provide for some of these costs.

B. Methodology

This study was carried out with the full participation of African professional agricultural researchers and agriculturalists. It was agreed that such participation was of central importance for all phases of the activity--the design of the questionnaires, the data collection process, the analysis, the assessments of research programmes and direction, the actual preparation of the country reports, and the development and review of a regional agricultural research strategy. DEVRES provided a group of technical experts who had wide African and other international experience to assist the country researchers, to contribute to the analysis of the country reports, and to prepare a SADCC regional report. Italy and France also provided technical experts to assist country researchers in Mozambique and Tanzania, respectively.

The ARRA was initiated with a pilot study performed collaboratively with the SADCC member states of Botswana, Malawi and Swaziland. Following review of this pilot report by both SADCC and CDA members, the ARRA was expanded to include additional SADCC countries: Lesotho, Mozambique, Tanzania, Zambia and Zimbabwe. At the time these countries were added, the pilot country reports were updated and a regional analysis was prepared.

Senior researchers from the SADCC countries were designated as National Coordinators. Each Coordinator provided overall direction and support for the ARRA in her/his country. In turn, each Coordinator nominated researchers to be in charge of completing the questionnaires and preparing the national reports for their respective countries. The Country Researchers also used other experienced researchers for short periods to help complete questionnaires on specific subjects. The scope of the questionnaires included not only the research institutions, but also training institutions and extension institutions which provide links between research professionals and the farmers who are intended to utilise research results.

The expanded ARRA was prepared from July to September 1984 by the Country Researchers in cooperation with the DEVRES staff. A regional report, including summaries of the national reports, was prepared by DEVRES in consultation with the CTCAR members and the Country Researchers. The regional report was based on a regionally-oriented analysis of programmes and national reports, on the answers to the questionnaires, on contacts with international research organisations and national and international donors, and on other available information.

During the course of the ARRA, DEVRES provided assistance in the development of a computerised data bank to process ARRA data and to assist the SADCC countries in meeting their future needs for research which, when combined with other available information, can provide a foundation of practical, useful data that can be continuously updated. The data bank can be a valuable tool for use by those designing programmes and projects in agricultural research. It will remain with the Southern African Centre for Cooperation in Agricultural Research (SACCAR) which will update the data bank, as well as ARRA, in the future.

In preparing recommendations for programmes and projects, the National Coordinators, Country Researchers and DEVRES staff took into account research work already proposed or underway. New ideas were also included in this country report and in the regional report as well. One of the principal objectives of the analysis was to build on existing national research, analyses, conclusions and recommendations in a manner which will strengthen these research activities. A concerted effort was made to place recommendations in a wider context, involving not only the research institutions, but also the training of researchers, the use of research results by the farmers, and the linkages with other SADCC member institutions or other international research institutions.

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[1]The World Bank, Sub-Saharan Africa: Progress Report on Development Prospects and Programmes (Washington, D.C.: The World Bank, 1983).

II. GENERAL INFORMATION ON MALAWI

A. Description of the Country

1. Geography

Malawi, which lies between latitudes 9° and 17° South and longitudes 33° and 36° East, is a landlocked country with a total area of 118,484 km^2. Malawi's portion of Lake Malawi, the third largest lake in Africa, and other inland waters cover 24,208 km^2 or 20 percent of this total area. Malawi is about 900 km from north to south and less than 200 km from east to west. The country is bordered on the north and northeast by Tanzania, on the east, south and southwest by Mozambique, and on the west by Zambia.

For administrative purposes, the country is divided into three regions--the northern, central and southern regions. Malawi can also be divided into four topographic regions:

- The Great Rift Valley, which is the dominant feature of the country, cutting across the country from north to south and containing Lake Malawi and the Shire River Valley. The Shire River flows from the southern end of Lake Malawi into the Zambezi River;

- The Central Region Plateaus, which rise to an altitude of 800 to 1,600 m east and west of the Rift Valley, and cover about 75 percent of the total land area of Malawi;

- The highland areas, which are mainly isolated tracts, some rising to an elevation of 2300 m. They consist of the Nyika, Vipya and Dowa Highlands, and the Dedza-Kirk Mountain range in the north and west and the Shire Highlands in the southeast; and

- The isolated mountains and plateaus of Mulanje (3000 m) and Zomba (2400 m) in the east.

2. Agro-ecological zones

The location of the four major agro-ecological zones, and subzones, are shown in Figure 1. These zones are:

- The lower Shire Valley. With an average elevation of less than 250 m, the lower Valley is a low-rainfall zone of semiarid savannah and thickets;

- The Lakeshore and Upper Shire Valley. These lie in the 300 to 600 m elevation range, and have both high- and low-rainfall areas. Vegetation consists of lakeshore savannah and thickets;

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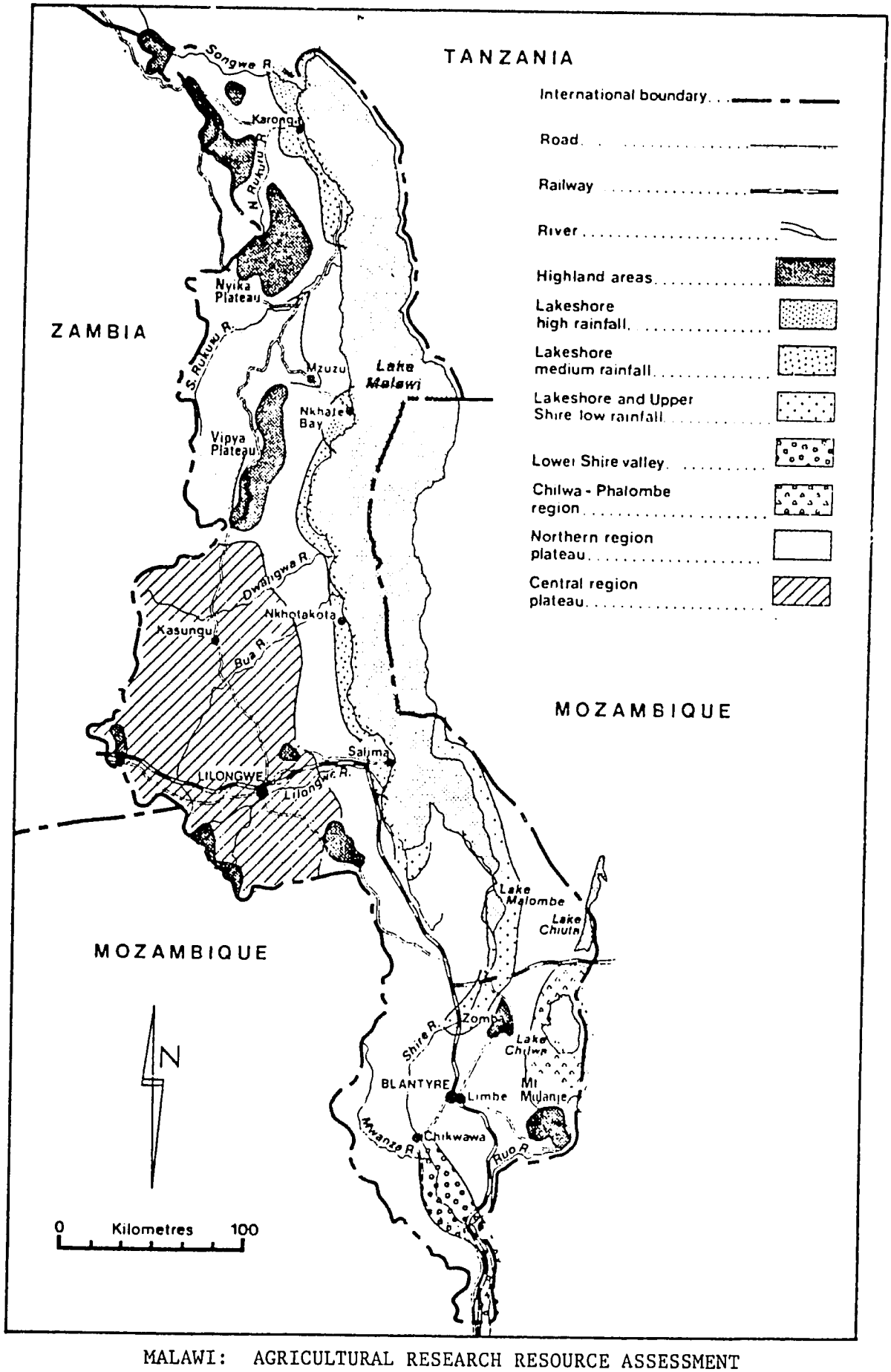


MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Figure 1: Agro-Ecological Zones

Source: Ministry of Agriculture, Malawi.

- The medium plateau areas of the central and northern regions. These cover some three-fourths of the total land area and lie within the 800 to 1600 m range. The predominant vegetation is savannah Brachystegia - Julbernadia woodlands; and

- The highland areas, with elevations ranging from 1800 to 3000 m. These areas comprise approximately 8 percent of the total land area. Vegetation consists of montane grasslands and evergreen forests. This zone generally is a high-rainfall area.

Malawi has considerable agro-climatic variability as well as topographical contrasts.

3. Natural environment

Malawi is fortunate in possessing some of the most fertile soils in south-central Africa. The soils found in the Lakeshore Plains and the Upper and Lower Shire Valley are especially favourable for agricultural production. While the plateau regions are also areas of high fertility, mountainous terrain in some areas prohibits land from being used for farming.

4. Climate

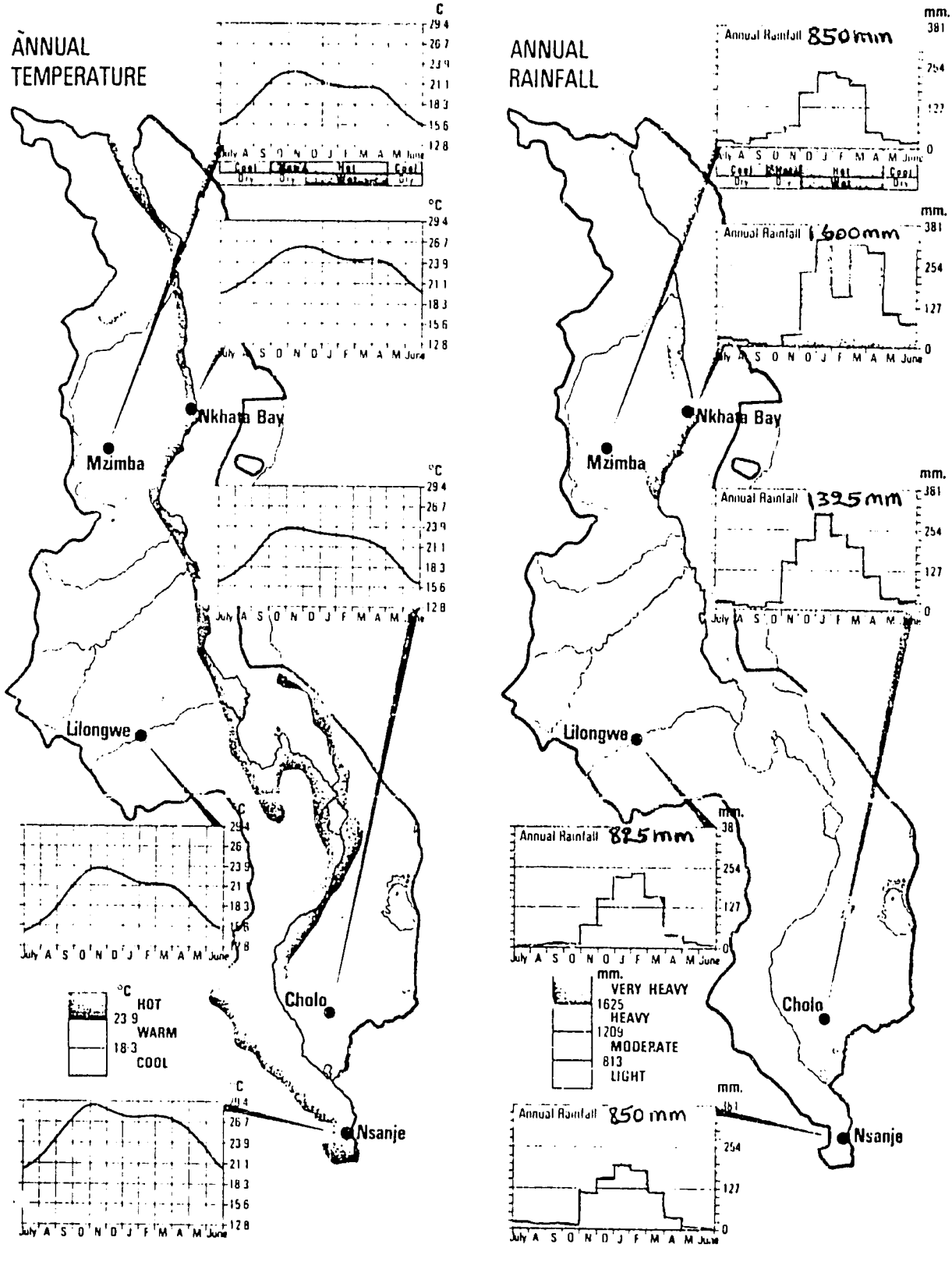
According to Thorntwaite's classification, Malawi's climate is semiarid in the upper and lower Shire River Valley, and semiarid to sub-humid in the plateau and highland areas. Annual rainfall varies greatly from year to year. While there is a tendency for a number of wet years to be followed by a number of years with poor rainfall, there is no regular cycle. Between 80 and 90 percent of the annual rainfall occurs in the four-month period from December to March, and there is a dry period from May to October over most of the country. (See Figure 2.) In the Shire valley and Lake Malawi littoral regions, annual rainfall is often less than 750 mm. In the highland areas, however, annual rainfall may be as high as 1600 mm and may fall throughout the year.

Mean annual temperatures vary considerably with altitude, from 25° C in the Shire River valley to 13° C in the Nyika Highland area. Frost occurs occasionally on the high plateaus.

B. The People

1. Population

Malawi's population was estimated to be 6.4 million in 1982. (See Table 1.) The annual growth rate of the population is 3.0 percent; the average population density is 65 persons per km^2 (170



MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Figure 2: Climatological Information: Mean Annual Rainfall and Temperature

Source: Ministry of Agriculture, Malawi

Table 1: Social and Economic Indicators of Development

Indicator		Average Annual Growth Rate (percent)	Comment
Total Population		3.0	If this rate of growth remains unchanged, Malawi's population will surpass ten million by the year 2000. IBRD projections estimate that the population will approach twelve million by 2000, based on an average annual growth rate of 3.4 percent between 1981 and 2000.[c]
1982[a]	6,400,000		
1975[b]	5,250,000		
Percent of Total Population Living in Rural Areas[a]			Rural growth rate is not currently available. Urban population growth rate is approximately 7.3 percent per annum.
1983	90%		
Percent of Labour Force Involved in Agriculture[b]			The actual number of persons involved in agriculture has increased by 22 percent over the decade, whereas the total population has increased by about 30 percent.
1980	84%		
1970	89%		
Percent of Population Under 15 Years of Age[a]			
1981	48%		
Percent of GDP Attributable to Agriculture[d]			
1980	43%		
1970	51%		
Per Capita GDP[c]		2.7	This average annual growth rate is calculated for the years between 1960 and 1981.
1980 (US$)	$200		
Physical Quality of Life Index (PQLI)[e]	31		This figure is significantly lower than that of neighboring African countries. PQLI is based on an average of life expectancy at age one, infant mortality, and literacy.

Table 1: Social and Economic Indicators of Development (cont.)

Indicator		Average Annual Growth Rate (percent)	Comment
Literacy[c]			Literacy rate is measured among adults 15 years and older.
1980	25%		
Life Expectancy at Birth[c]			
1981	44 yrs.		
Volume of Agricultural Production, 1969-71 to 1977-79[d]			
Food		3.1	
Non-Food		8.6	
Total Agricultural Production Per Capita, 1969-71 to 1977-79[d]			On a per capita basis, food production has just kept pace with the population.
Food		0.3	
Non-Food		5.8	
Food Self-Sufficiency Ratios[d,f]			
1978-80	97		
1964-66	101		

[a]National Statistical Office and Economic Planning Division, Government of Malawi.

[b]FAO, Statistical Yearbook 1983.

[c]IBRD/The World Bank, World Development Report 1983 (New York: Oxford University Press, 1983), p. 204.

[d]Singh, Sub-Saharan Agriculture-Synthesis and Trade Prospects, World Bank Working Paper Number 608 (World Bank, 1983).

[e]John P. Lewis and Valeriana Kallab, eds., U.S. Foreign Policy and the Third World-Agenda 1983, Overseas Development Council (Praeger Publishers, 1983)

[f]$\text{Ratio} = \frac{\text{Production of cereals}}{\text{Production} = \text{imports} - \text{exports of cereals}} \times 100$. Formula and statistics from Singh, Sub-Saharan Agriculture-Synthesis and Trade Prospects, World Bank Working Paper Number 608 (World Bank, 1983).

inhabitants per km^2 of arable land). Only 10 percent of the population live in urban areas. However, as a result of internal migration, the urban population is increasing at a rate of 7.3 percent per year.

Malawi's population is unevenly distributed, with approximately 12 percent of the population in the northern region, 30 percent in the central region and more than half of the entire population in the southern region. New investment (particularly in agriculture and transport) in the northern and central regions, the movement of the capital in the early 1970s from Zomba in the south to Lilongwe in the central region, and the construction of a new international airport at Lilongwe are helping to redress the imbalance in Malawi's population distribution.

About 48 percent of the population were under 15 years of age in 1982. The average family size in the rural areas is about five persons. An estimated 25 percent of the population are literate. Life expectancy at birth in Malawi is only 44 years; infant mortality is high at 137 (under age one) per 1,000 live births. The number of people per physician in 1977 was 40,950. The Physical Quality of Life Index (PQLI)--which is based on an average of life expectancy at age one, infant mortality and literacy--is recorded at 31 for Malawi. This is lower than many African countries (e.g., the SADCC countries' average PQLI is 44) and much lower than most industrialised countries (the United Kingdom's is 95, the United States' is 96).

2. Occupational patterns

The great majority of Malawians live in rural areas and are dependent on agriculture for their livelihood. Eighty-four percent of the labour force were involved in agriculture in 1980, representing a 5 percent decline from 1970. However, due to the high rate of population growth, the actual number of persons involved in agriculture increased by over 20 percent in the decade.

3. Language and ethnic groups

Nine main groups historically are associated with what is now Malawi. These are: the Ngonde, Tumbuka, Tonga and Ngoni of the northern region; the Chewa, Yao and Senga of the central region; and the Lomwe and Nyanja of the southern region. The Chewa and Yao spread from the centre into the south. The Chewa constitute 90 percent of the population of the central region. The Yao, who are mostly Muslim, live along the border with Mozambique, while the Nyanja tribe predominates in the south and the Tumbuka in the north. Each has its own language and customs, although many aspects of traditional ways of life are common to all. Despite the fact that Chichewa and English are the official languages, English was understood by less than 20 percent of the population in 1966, while Chichewa was spoken by more than 50 percent and understood by about 77 percent.

4. Religion

Freedom of worship and religious associations are practiced in Malawi. Approximately 75 percent of the people are Christian : 55 percent of these are Protestant, 20 percent Catholic. About 20 percent of the population are Muslim; there are some Hindus. African traditional religions are also practiced by some members of these groups.

5. Educational system

Primary school enrollment in 1980-1981 was about 810,000, or 58 percent of children of primary school age. The primary school pupil/teacher ratio was 64:1. However, secondary school enrollment amounted to 18,000, or only about 4 percent of the secondary age group.

The GOM is seeking to make secondary schools more relevant to Malawi's needs. For example, it is establishing technical programmes in about half of the secondary schools to provide students with pre-vocational training. A variety of vocational schools are available for both post-primary and post-secondary school students. Among the vocational training programmes for post-primary students is the Malawi Young Pioneer Movement, which teaches youth basic skills in farming and other trades. There are also technical schools and teacher training schools at Blantyre, Lilongwe and Mzuzu. For post-secondary school students, the University of Malawi offers the opportunity for higher education.

C. Government and Political Framework

1. Structure of government and political parties

Malawi is a democratic republic with a one-party system of government, in which the President has executive powers as both Head of the ruling Malawi Congress Party and Head of Government. A Council of Ministers forms the Cabinet under the President's directive. The legislative powers are vested in an elected, unicameral National Assembly; judicial powers rest in both magisterial and traditional courts.

2. National budget

The central government budget for 1982-1983 was US$ 386 million. A series of events in the late 1970s resulted in increased costs for inputs and decreased income from exports, leading to heavy borrowing and government deficits. Malawi's current account deficit increased from an annual average of 9 percent prior to 1978 to 24 percent in 1981. Debt service in 1981 was the equivalent of 30 percent of exports. The donors agreed to reschedule Malawi's debts in 1982 and again in 1983.

3. Membership in international organisations

Since attaining Independence in 1964 and Republic status in 1966, Malawi has been a member of the United Nations and its specialised agencies and the British Commonwealth of Nations. The country has strong diplomatic ties with the West. It is a member of the various international financial institutions, including the World Bank, the International Monetary Fund and the African Development Bank. It is also a member of various Third World and regional associations, including the Nonaligned Movement, the Organization of African Unity, the Lome Convention, and SADCC.

4. Government policies regarding agriculture

The government policy is to support an open-market, export-oriented economy. Economic growth is encouraged by stressing agricultural production for export, while maintaining food self-sufficiency. Malawi is one of the few countries in Africa to have consistently achieved self-sufficiency in food production in the twenty years since Independence; 1981 was the only year that imports of maize were required, due to drought. Since its major exports are tobacco, sugar and tea, the declining world prices for these commodities, combined with other problems, have led to an economic slowdown since 1979, following a five-year period of impressive economic growth.

Agriculture is the centerpiece of the economy of Malawi. Nearly 85 percent of Malawi's 6.4 million people are directly involved in agricultural production. Agriculture contributes 43 percent of the Gross Domestic Product (GDP). Malawi has adopted policies that have encouraged production by both estates and smallholder farmers. Estate production has increased markedly, and Malawi's foreign exchange earnings have also increased. Unlike other developing countries, the GOM has not undermined the economic viability of smallholder farmers by placing low limits on producer prices to subsidise urban consumption.

Government policy for agricultural research stipulates that research planning and implementation should produce results which can be directly applied by farmers and users of agricultural products.

D. Economic Overview

1. General indicators

Since Malawi's independence in 1964, the country has made impressive progress in economic development. Considering its lack of natural mineral resources, the difficult environment and neglected infrastructure, progress has been remarkable and has been due mainly

to the government's strong commitment to development and careful planning. Between 1960 and 1981, GDP grew at an average annual rate of almost 5.7 percent. GDP in 1980 was US$ 1,420 million, compared to US$ 170 million in 1960. Per capita GDP in 1980 was US$ 200.

Agriculture provided about 43 percent of the GDP at factor costs in 1980; over four-fifths (87 percent) of this came from the smallholder sub-sector. Industry accounted for 20 percent of the GDP, and manufacturing and wholesale/retail each contributed 13 percent.[1] (See Figure 3.)

2. International trade

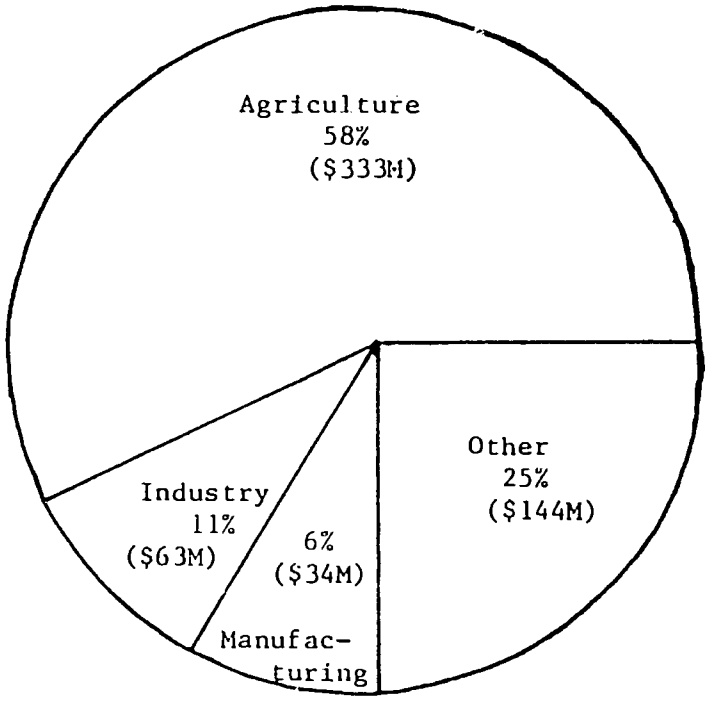
The economy of Malawi is heavily dependent on three agricultural commodity exports--tobacco, sugar and tea. In 1980, agricultural exports accounted for 90 percent of Malawi's merchandise exports. In 1981, tobacco provided the largest share of agricultural exports (48 percent), followed by sugar (26 percent), tea (12 percent), and groundnuts (4 percent). Only about 20 percent of this export production came from the smallholder sector.

3. National Development Plan

The overall goals of the National Development Plan for 1981-1985 are to improve the productivity and income of the rural population and upgrade the social quality of life of the smallholders.[2]

The government's agricultural objectives are to maintain self-sufficiency in food production, expand export crop production, and improve rural incomes. Since land for new cultivation is limited, the emphasis is on a sustained increase in productivity. The government has followed a dual agricultural development strategy: one approach for the estate sector and another for the smallholder sector. The GOM supports development of the estate sector without directly subsidizing either inputs or outputs. To achieve a real annual growth rate of 4-8 percent, a target growth rate of 2-9 percent per year was set for the estate sector and 5 percent per year for smallholders.

The primary means of implementing the development objectives for the over one million smallholders is the National Rural Development Programme (NRDP), which was established in 1977 and was designed to be carried out over a 20-year period. The NRDP aims are: to increase the level of smallholder production, with emphasis on the production of cash crops for export and food crops for domestic consumption; to provide the inputs and services needed to increase yields; and to preserve natural resources by encouraging soil conservation, conserving key watershed areas, and developing forestry resources. At the farm level, while more effort than before will be given to livestock, the greatest emphasis will be given to extension services and credit to promote use of new seeds, fertilisers and increased farm power (by financing purchase of oxen and ox-drawn equipment).



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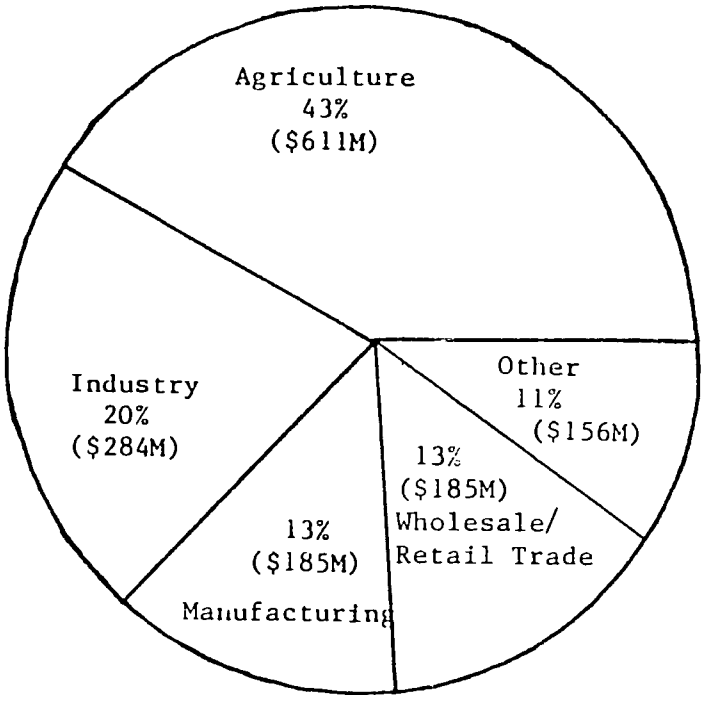

1980

TOTAL (1980 US$) $574 Million[a]

(1980 US$) $1,420 Million[a]

[a]Based on 170 Million U.S. Dollars converted to 1980 Dollars on basis of average annual inflation rate of 2.4 percent from 1960-70 and 10.3 from 1970-81.

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Figure 3: GDP by Source, 1960 and 1980

Source: World Development Report 1983, IBRD/World Bank, 1983.

4. External aid

Donor assistance has been concentrated in the areas of education, agriculture, and rural development. Since its establishment in 1977, the National Rural Development Programme has received US$ 155 million in outside assistance.[3] The Government of Malawi has solicited outside support for this integrated approach to assisting smallholders, which has also facilitated collaborative donor assistance.

Major bilateral donors, and total funds disbursed from 1978-1982, include: the UK (US$ 143 million), West Germany (US$ 134 million), Canada (US$ 85 million), Japan (US$ 37 million), and the US (US$ 19 million). Total bilateral aid in 1982 was US$ 68.4 million.[4] Major multilateral donors include the World Bank (IBRD, IDA, IFC), the African Development Bank, the UNDP and the EEC.

Bilateral aid, totalling US$ 139 million in 1979, was 66 percent of the total official development assistance received by Malawi. It also accounted for 12 percent of GNP and 39 percent of gross domestic investment in that year.[5]

E. Agriculture

1. Land use

The land available for agriculture in Malawi has been categorised according to use in Table 2. Smallholder farmers till about 1.7 million ha each year. The estates hold about .5 million ha of land. The intensity of land use varies among regions; there is great diversity of opinion regarding the degree of land pressure among government agriculturalists. In parts of the central and southern regions, some steep land is being cultivated, and there appears to be relatively little additional land that should be cultivated under optimal land use in these areas. However, the total area cropped in any one year in Malawi is much less than the cultivatable area: 2.2 million ha of arable land available to smallholders are unused; another 1.2 million ha are fallow, but have been cropped within the past five years.

2. Land tenure

Most of Malawi's arable land is under traditional landholder tenure systems. Smallholders live under the control of family heads, village headmen and traditional chiefs. Cultivation rights, rather than ownership, are granted by the village headman. Matrilineage, where the husband leaves his home to live with his wife who inherits cultivation rights, is common in the central and southern regions, while patrilineage is common in the northern region. The remainder of Malawi's arable land is held by large agricultural estates, owned by the public and private sectors.

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 2: Land Use

Land Use Category	Area ('000 hectares)	Percent of Total
Land available to smallholder:		
Cropland:	2,860	30.4
cropped	1,660	17.6
fallow[a]	1,200	12.8
Arable but unused	2,250	23.9
Non-arable grazing and unused	1,550	16.5
Subtotal, smallholder land	6,660	70.8
Agricultural estates	490	5.2
Forestry and forest reserves	870	9.2
Game parks	1,040	11.1
Infrastructure and urban	350	3.7
TOTAL[b]	9,410	100.0

[a]Cropped within past five years.

[b]The total refers to the total area of Malawi less that portion which falls in Lake Malawi.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1983.

3. Principal agricultural production systems

a. Smallholder production

Roughly 70 percent (6.7 million ha) of Malawi's total land area of 9.41 million ha is available to smallholders. Three-fourths of this is considered to be arable, although less than one-half has been cropped recently. (See Table 2.) The average farm size for smallholders is 1.7 ha. Most smallholders produce maize for their staple food on two-thirds to three-fourths of their cultivated land. Most grow flint maize for food and save some for seed. However, until recently Malawi's maize research has concentrated on dent maize, even though flint maize stores better than hybrids. Other crops grown by smallholders are beans, groundnuts, cotton, sorghum, millet, and tobacco. Beans are intercropped with maize. (See Table 3.) Thus, smallholders plant 1.0 million ha in maize, 850,000 ha in beans (pulses), 400,000 ha in groundnuts, 37,000 ha in seed cotton, 35,000 ha in sorghum and millet, 9,000 ha in rice, 4,000 ha in sweet potatoes, 3,000 ha in tobacco, and 2,000 ha in tea. Pulses (cowpeas, beans and pigeon peas) are generally intercropped with maize by smallholders. Yields are low.

Tobacco is grown by about 10 percent of the smallholders. The production of fire-cured, air-cured, sun-cured and oriental tobacco by smallholders is controlled to assure product quality and market stability. Flue-cured tobacco is usually restricted to estates, though some smallholders in Kasungu District are licensed to grow it on leasehold land, on the condition that they sell their tobacco through the Kasungu Flue-cured Tobacco Authority.

Some 4,000 smallholders grow about 2,000 ha of tea under the auspices of the Smallholder Tea Authority.

Cotton is grown by about 60,000 smallholders. Although the average national yield for cotton is 500 kg/ha, higher yields are realisable if available technology, which includes timely planting and pest control, is used.

Groundnuts are produced entirely by smallholders. Yields are in the range of 400-500 kg/ha (shelled). The low yields are attributed to disease, unfilled pods, and inadequate prices. The crop is labour-intensive and vulnerable to fungal and viral diseases, and prices have not been sufficiently high to make pest control profitable.

Cattle are raised mostly by smallholders, although the estate sub-sector has a large number of dairy cattle. Their population is greatest in the central and northern regions, although some also are raised in the Shire Valley. About 1.5 million ha of Malawi's land area is non-arable grazing or unused land; some cropped and fallowed land also is used to graze cattle and other livestock.

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 3: Indicators of Agricultural Productivity

Crops	Yields (kg/ha) Average Range, Traditional Sector[a]	Average Range, Estate Sector	Average Range, Research Station[a]
Food Crops			
Maize	325 - 5,200	6,000 (CCA)	3,500 - 9,000
Pulses	160 - 330	4,000 (MH12)	--
Sorghum	250 - 2,200	--	3,500
Millet	260 - 1,100	--	--
Rice	1,100 - 2,950	--	2,300 - 4,000
Cash Crops			
Groundnuts	260 - 1,200	--	1,500 - 3,000
Cotton	325 - 1,000	--	2,000
Tobacco	--	1,800 (flue-cured) 2,000 (burley)	2,600 (flue-cured) 3,000 (burley)
Tea	--	2,659	3,000
Livestock			
Cattle Indicators			
Offtake	10	10	10
Mortality	12	15 (0-1) 5 (over 1 yr.)	4
Calving Rate	40 - 60	40 - 60	70

[a]The great variability in average yields is due mainly to ecological differences, rather than differences in cultural practices.

Source: National Sample Survey of Agriculture; ADD 1982/83 crop estimates; Sorghum and pearl millet breeding programmes report, 1980/81; Groundnut breeding annual report, 1981/82, (released variety); The Smallholder Tea Authority Annual Report, 1980/81; Tobacco Research Authority.

b. Estate production

Estates control 470,000 ha of which 28,000 ha are planted in tobacco, 16,000 in tea, and 15,000 in sugarcane. There were over 1,100 estates registered with the GOM in 1979, of which 98 percent produced tobacco. Twenty-six others grew tea and two others raised sugarcane. Combined estate production has increased more than four-fold since 1968; some of this increase has been the result of expansion of the area under cultivation.

4. Principal agricultural products

In 1981, the smallholder sub-sector accounted for 81 percent of all agricultural production, meeting the country's demand for food staples (maize, rice, beans, cassava, sweet potatoes, groundnuts, sorghum and millet), and providing some export surplus (tobacco, groundnuts, tea, coffee, and guar beans) and certain raw materials for domestic industry (cotton and fire-cured tobacco). However, the export surplus from the sub-sector comprises only about 20 percent of all agricultural exports.

Most livestock in Malawi are raised by smallholder cultivators who are also livestock owners. (See Table 4.) The commercial livestock sector, including many smallholders, provides virtually all the meat and eggs demanded by urban consumers. Smallholders in the subsistence sector provide meat and eggs to the rural population and produce feeder cattle to be used by commercial livestock producers.

The cattle population in Malawi has been increasing over the past 30 years, and now has a national growth rate of 4.87 percent. The offtake has averaged 9-10 percent per annum. The calving percentage is currently reported to be 55-60 percent for both estate and traditional herds. However, calving rates of 80-90 percent have been achieved by some estates, principally due to adequate nutrition. Growth rates and final slaughter weight are significantly better on estates than among traditional herds, with slaughter weights of 230-240 kg reached at three years.

Nearly all of the goats in Malawi are owned by smallholder farmers. Goat meat is preferred to sheep. Generally, goats are not milked. The national herd is growing at an annual rate of 1.52 percent; the kidding rate is 120 percent. The off-take rate runs about 40 percent, and the average slaughter weight is 11 kg.

Most sheep also are owned by traditional farmers, although several estates run small flocks. The off-take rate is estimated to be 50 percent, and the reproduction rate ranges from 80 to 120 percent.

Two types of pigs are kept by farmers: the traditional village pigs which scavenge around homesteads, and exotic breed pigs which are raised commercially. Pigs tend to provide farmers with low margins

Table 4: Livestock Production Indicators

Livestock	Total Population ('000 head)	Smallholder Population (percent of total pop'n)	Offtake (percent)	Mortality (percent)	Growth Rate	Reproduction rate (percent)
Cattle						
Dairy	200	60	-	-	4.87	-
Beef	700	95	-	-	-	-
Traditional Sector		-	<10	12	-	40 - 60
Estate Sector		-	10	15 (0-1yr.) 5 (over 1 yr.)	-	40 - 60
Research Station		-	10	4	-	70
Goats	718	>99	40	30 (0-1 yr.) 5 (over 1 yr.)	1.52.	120
Sheep	85	88	50	15 (0-1 yr.) 5 (over 1 yr.)	NA[a]	80 - 120
Pigs	206	98	NA	NA	1.75	NA
Poultry	8,468	94	10	NA	1.96	NA

[a]NA = Not available.

Source: Report of the Livestock Task Force, 1983; Department of Livestock Production, Bunda College; Department of Veterinary Services, Livestock and Meat Study, 1982.

over feed costs. Periodic outbreaks of African Swine Fever (ASF) have reduced the pig population; the Department of Veterinary Services has a research project aimed at controlling ASF.

Under average management, producers raise 16 piglets per sow per year. No adequate record on feed conversions was available due to poor record-keeping. However, Mikolongwe production records indicated conversions of 3.5 pounds of feed per pound of gain for porkers and 3.7 to 1 for baconers, given proper feed formulations.

Traditional village poultry production is based on small-scale flocks scavenging on insects, seeds and household waste. Most poultry is reared by smallholders, but some commercial production occurs on estates. Banks and others have been actively seeking to enhance the productivity of the smallholder poultry sector for several years. However, to date no consistent or major yield improvements have resulted from such efforts.

The estate sub-sector functions as the principal earner of foreign exchange, with exports of tobacco, sugar, tea, tung oil, coffee and macadamia nuts. The major estate crops are tea, flue-cured and burley tobacco, and sugar. Estates contribute 15 percent of total agricultural production, while producing about 80 percent of agricultural exports. A certain proportion of the livestock population is raised by government and private estates, under better management practices than those of the traditional smallholder farms.

Estate output has increased substantially since 1968, growing on an annual basis at a rate of about 17 percent. Between 1970 and 1977, for example, production of burley and flue-cured tobacco increased by about 80 percent and 400 percent, respectively. During the same period, tea production increased by about 70 percent. In general, the estates' production increases are attributed to their expansion of areas under cultivation, better management of some of the estates, and greater use of inputs.

The rate of growth in real output by the smallholder sub-sector is not known with certainty, but has been about 3 percent per year in recent years. This is a slow increase, given the importance of the sub-sector to Malawi's overall economy and Malawi's population growth rate of 3 percent. As a result, the GOM, the World Bank, USAID and others have concentrated their attention on ways to improve the productivity of Malawi's smallholders. Table 3 provides yield data of the major food and cash crops for smallholders, estates and research stations. As might be expected, research and estate yields are generally higher than those achieved by smallholder farmers. This suggests that there is potential for increases in productivity by smallholders, even if their yields cannot reasonably be expected to be as high as those in the estate sub-sector.

5. Forestry

Forests and reserves occupy about 870,000 ha, or 9 percent of Malawi's land area. In addition, about 6,000 ha of new forest area is planted each year. While there is little natural forest lumber suitable for general carpentry, softwood plantations begun in the 1950s are now producing lumber for poles and crates. Fuelwood is an important source of energy for smallholders and for tobacco curing.

6. Agricultural marketing and credit

a. Marketing

The Agricultural Development and Marketing Corporation (ADMARC) is a statutory company established to purchase smallholder crops (food and non-food crops), to sell food crops, and to sell and deliver crop production inputs (seeds, fertilisers, chemicals and, sometimes, farm implements). ADMARC operates a national network of marketing sheds and storage facilities for these purposes. It invests in agricultural and agro-industrial enterprises, and pays or charges prices as agreed-upon and authorised by the Price Review Committee of the Malawian Government.

Estate produce is marketed almost entirely through the private sector. The Grain and Milling Company (GRAMIL) is the major maize purchaser; the Tobacco Auctions at Limbe and Lilongwe provide the vehicles for tobacco sales. Tea and coffee are exported through international trading companies.

Two separate livestock markets are in operation. The Cold Storage Company (CSC) buys animals at a fixed price per kg, depending upon the grade. In addition, several auction markets exist where animals are purchased by the CSC, local butchers, other farmers and rural development programmes for stallfeeders.

b. Credit

No central agricultural credit institution exists in Malawi. Smallholders have access to seasonal and medium-term agricultural credit through three major avenues: The Ministry of Agriculture's rural development projects (which have their own credit funds and staff); settlement schemes under the Ministry of Agriculture; and the Loan Board under the Ministry of Trade and Industry.

7. Food security

Malawi is unique among most other African countries because it is self-sufficient in basic food crops. Furthermore, with the exception of 1981, when it was affected by drought, Malawi has been a net exporter of basic food crops, the most important of which is maize. This is true notwithstanding the drought presently affecting

large areas of southern and eastern Africa. The 1983 maize crop was even higher than the 1982 crop of 1.4 million MT. Together with the large maize surplus stock accumulated from the 1982 crop, the 1983 surplus made it possible to export about 100,000 MT to neighbouring countries which were affected by the drought. In addition, Malawi donated foodstuffs to Mozambique.

The goal of Malawi's agricultural policy is to increase production of food crops in order to meet the rising domestic demand and to continue to export these commodities.

In spite of the current surplus of maize, there is no room for complacency, given the country's population growth rate of nearly 3 percent and the relatively low average maize yield of 1,200 kg/ha. In 25 years the population will have doubled and, in the absence of increased yields, the country's maize surplus will have disappeared.

Under the circumstances, appropriate research leading to increased yields by smallholders assumes an element of urgency if the national objectives of self-sufficiency and export are to be met in the future.

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[1]The World Bank, World Development Report 1983 (New York: Oxford University Press, 1983).

[2]Information in this section, unless otherwise noted, is from Drs. L.B. Fletcher and J.R. Moore, in cooperation with USAID/Malawi, "CDSS Agricultural Strategy Supplement", July 1981.

[3]U.S. Agency for International Development, Congressional Presentation, Fiscal Year 1984, Annex I: Africa, (Washington,D.C.: U.S. Agency for International Development, 1983), p. 431.

[4]U.S. Agency for International Development, Congressional Presentation, Fiscal Year 1985, Annex I: Africa (Washington, D.C.: U.S. Agency for International Development, 1984), p. 505.

[5]The World Bank, Accelerated Development in Sub-Saharan Africa: An Agenda for Action (Washington, D.C.: The World Bank, 1981), pp. 164-5.

III. AGRICULTURAL RESEARCH INSTITUTIONS

A. Overview of Agricultural Research in Malawi

Agricultural research is carried out by the Departments of Agricultural Research (DAR) and Veterinary Services (DVS) of the Ministry of Agriculture (MOA), the Bunda College of Agriculture of the University of Malawi, the Tea Research Foundation (TRF), the Tobacco Research Authority (TRA), and the Sugar Corporation of Malawi (SUCOMA).

Figure 4 shows the geographical distribution of the institutions that carry out agricultural research and their branch stations. Table 5 lists the institutions and the major research activities, the number of staff and the financial resources of each.

Since the Department of Agricultural Research has the primary responsibility for research in Malawi, linkages have been established between it and the Bunda College of Agriculture, the TRA, the SUCOMA, the TRF, and the Smallholder Coffee Authority. However, these links do not appear to be well-developed.

The Crop Variety Research Committee is based at the DAR Headquarters. The Committee is made up of the Chief Agricultural Research Officer, the Chief Agricultural Extension Officer, ADMARC, other private agricultural groups, the National Seed Company, and seed technologists. The Marketing Inputs and Crops Officer may also be invited by the Chief Agricultural Officer.

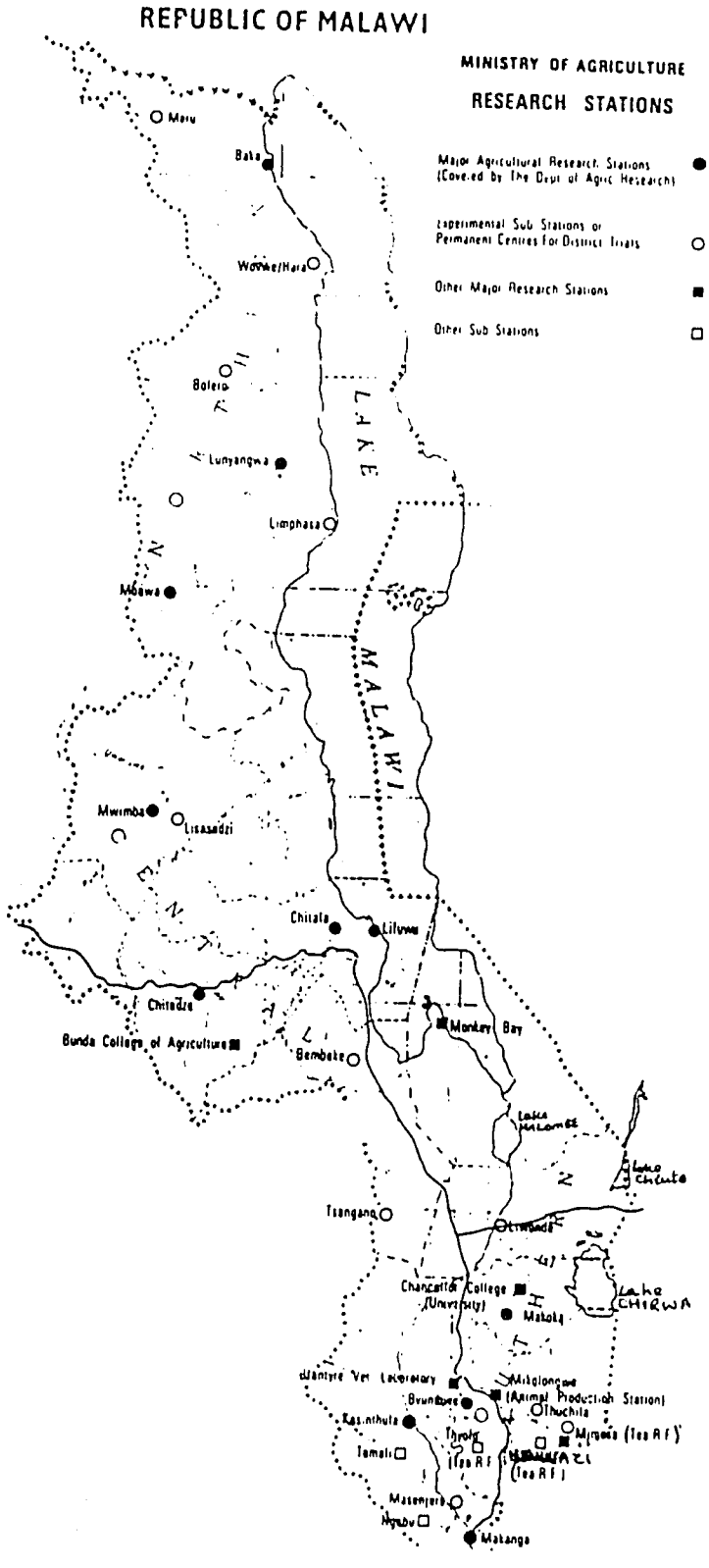
The DAR has bilateral relationships with many international research centres and organisations. (See Table 6.)

B. Agricultural Research Institutions

1. Department of Agricultural Research

a. Organisational structure and purpose

The Department of Agricultural Research of the MOA is headed by the Chief Agricultural Research Officer who is assisted by two Deputy Chief Agricultural Research Officers: one for Research Coordination and the other for Technical Services. As indicated on the DAR organisation chart (Figure 5), research programmes emphasise the needs of smallholder farmers in food and cash crops (with the exception of tea, tobacco, and sugar), horticulture, livestock and farming systems (adaptive research). The DAR also provides services such as: seed multiplication and certification; information about soil and water conservation, and disease and pest control; and diagnostic expertise. Administratively, the DAR is organised on the basis of research stations, which in turn have substations and district sites. Each of the research stations has its own budget and is controlled by an officer-in-charge.



MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Figure 4: Agricultural Research Stations

Source: Ministry of Agriculture, Malawi.

Table 5: Agricultural Research Institutions: Funding, Location, Activities and Staff, 1984

Institution	Funding[a]		Location of Headquarters	Principal Research Activities	Number of Staff				
	Source	Amount (US$)			Professional	Administrative	Technical[b]	Support Services	Total
Dept. of Agricultural Research	GOM	2,562,838	Lilongwe	Administration; research on crops, soils, livestock, and pastures and related subjects	79	13	88	340	520
Dept. of Veterinary Services	GOM	142,308	Lilongwe	Veterinary research	22[c]	3	7	46	78
Tobacco Research Authority	The Tobacco Association of Malawi	506,154	Lilongwe	Research on all types of tobacco in Malawi	11	4	7	48	70
Tea Research Foundation	Tea Research Foundation of Central Africa	576,923	Mulanje	Research on tea in Malawi and Southern Africa	21	2	5	28	56
Bunda College of Agriculture	Malawi University	51,000	Zomba	Research on annual crops; agricultural engineering, livestock, and Rural Development	43[d]	–	10	190	243

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 5: Agricultural Research Institutions: Funding, Location, Activities and Staff, 1984 (cont.)

Institution	Funding[a]		Location of Headquarters	Principal Research Activities	Number of Staff				
	Source	Amount (US$)			Professional	Administrative	Technical[b]	Support Services	Total
Sugar Corp. of Malawi (SUCOMA)	Lonrho Ltd.[e]	113,846	Blantyre	Variety evaluation, plant analysis and herbicide evaluation	1	-	3	7	11
TOTAL		3,953,069			177	22	120	659	978

[a]Funding from internal government and private sources only.

[b]Technical = diplomate.

[c]In terms of research this number is equivalent to only 9.5 full-time person-years.

[d]In terms of research this number is equivalent to 5.8 full-time person-years.

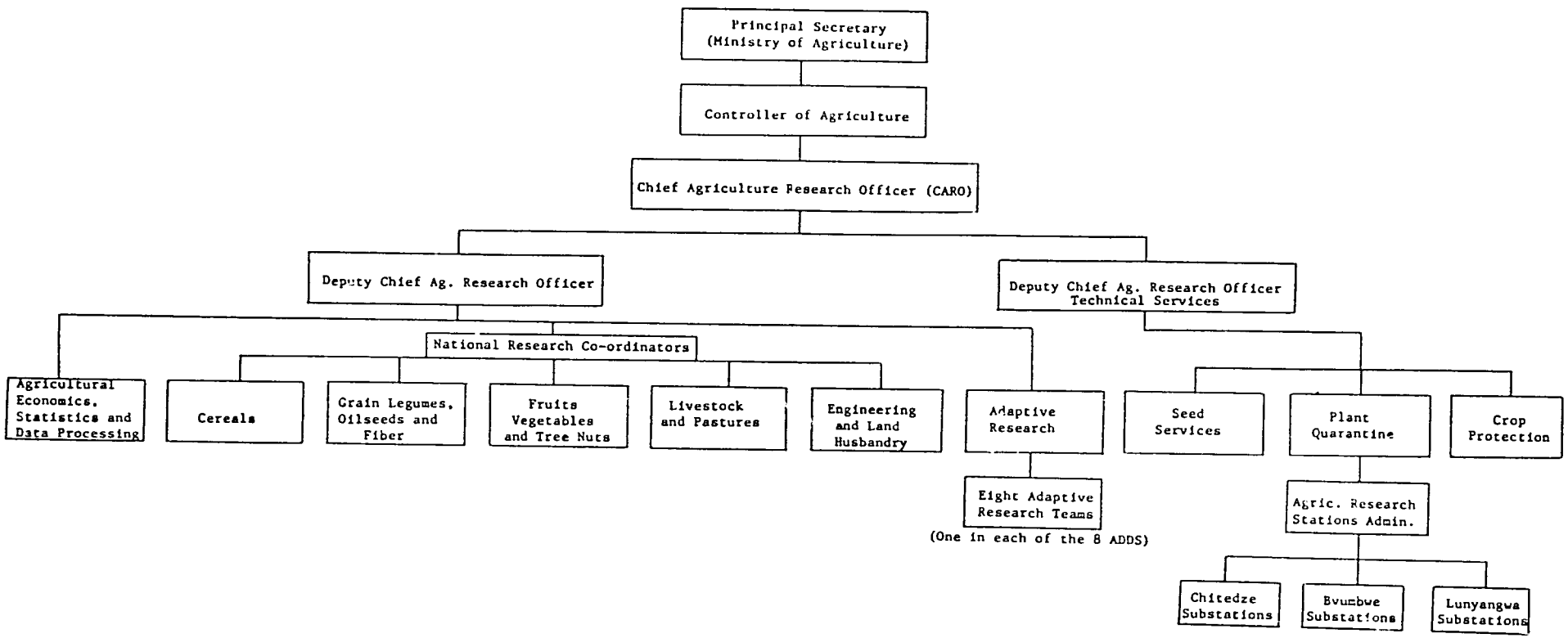
[e]Lonrho Limited = London-Rhodesia Limited.

Source: Data collected from DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

Table 6: Linkages of Malawi's Agricultural Research System with International Research Centres

Organisation	Activity
CIMMYT	Provision of wheat and maize germ plasm and information and training from its farming systems research training centres in Kenya and Mexico.
IITA	Contribution of support for cowpeas, cassava nurseries, and maize variety testing; conduct of training (at IITA) in crop agronomy; provision of assistance in the biological control of green spider mite and various mealybug pests.
ICRISAT	Assistance with training in groundnuts, pigeon peas, chickpeas, and sorghum production; provision of information and assistance from an ICRISAT regional sub-station for groundnut research (an activity that SADCC has proposed to CDA to be converted to a regional grain legume project).
ILRAD	Provision of vaccine to combat animal diseases.
CIAT	Contribution to enable inclusion of *Phaseolus* beans in the grain legume programme.
ILCA	Provision of support for small farm animal power and small farmer dairy research.
IRRI	IRRI staff visits and provision of new rice varieties for testing in Malawi.
USAID/CRSP	Contribution of resources to enable Michigan State University's involvement in the bean and cowpea research project of the Department of Crop Production and Bunda College of Agriculture.
OTHERS	Cooperation with the International Red Locust Organization, International Seed Testing Association (ISTA), and SADCC.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1983.



MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Figure 5: Organisation Chart of the Department of Agricultural Research

Source: Data collected from the Department of Agricultural Research, Ministry of Agriculture, Lilongwe, 1983

Currently there are proposals to organise the DAR on a commodity basis. Such commodity research groups may embrace several or all of the existing research stations and substations.

b. Research programmes

The emphasis in the Department of Agricultural Research is on improvement of maize, cotton, groundnuts, rice, and horticultural crops. Programmes also exist in farm machinery development, crop storage, and livestock improvement. Significant research has been undertaken on sorghum and pearl millet, Phaseolus beans, wheat and triticale, root crops (sweet potatoes and European potatoes), pastures, and legume microbiology. The bean/cowpea Collaborative Research Support Programme (CRSP) of Michigan State University, funded by USAID, is collaborating on the bean research programme. Programmes being undertaken at the various research stations are listed in Table 7.

The responsibility for livestock research at the national level is divided between the Chief Veterinary Officer and the Chief Agricultural Research Officer. The emphasis of both departments, however, has been on cattle; very little research has been done on poultry, goats (the most numerous livestock), and sheep.

Researchers and extension officers participate together on a number of committees. The Research Liaison Committee, established before the Agricultural Development Divisions (ADD) structure was implemented, is still operating, mainly in the northern and southern regions. The Committee now includes the ADD leadership as well as the researchers in the region. Research and extension headquarters staff may also be invited to participate.

Research personnel are currently attached to some of the ADDs (e.g., at Ngabu and Liwonde). With the introduction of Adaptive Research Units, one of which is attached to each ADD, greater ties between the ADDs and research can be expected.

Technical information in extension circulars and handbooks is reviewed by DAR staff before publication. Informal linkages affecting research programme content also include on-farm trials.

c. Human resources

The DAR has a total staff of 520 persons which include support staff (such as clerical workers, security guards and skilled field labour), technical assistants, and senior technical and administrative staff.

There are three levels of qualifications for DAR staff directly involved in research: Professional Officers (POs), each of whom has as a minimum a BSc degree; Technical Officers (TO), each of whom has at least a diploma in agriculture; and Technical Assistants (TA), each

of whom holds a certificate in agriculture. The Technical Assistants thus are included in the Support Services category on Table 5, and comprise about half of the total.

As of July, 1984, 16 PO posts were vacant. Table 6 shows the present staff situation at the station and substation levels.

The DAR's policy is to provide promising staff with opportunities for advanced training. At this time, for example, a joint GOM/USAID project, also funded by the EEC and implemented by the University of Florida is supporting over 20 junior scientists for BSc, MSc or PhD training.

The possible reorganisation of the DAR will provide staff for additional programmes, especially in the farming systems research area. In addition, specialised staff, including a librarian, administrative officer and controller, will be recruited locally.

d. Research facilities

(1) Land

Descriptive data on the land and its use at each of the 11 research stations is given in Table 8. A comparison of Tables 7 and 8 reveals little correlation between the amount of land and the number of staff at each station.

(2) Buildings

All of the research stations have at least some offices, with the most at Chitedze (67), followed by Bvumbwe (46) and Makoka (20). The first two of these have five laboratories each for studies in the basic discipline areas of soils and chemistry, pathology, entomology, crop storage, and seed technology (Chitedze) or nematology (Bvumbwe). The only other labs (c) are at Makoka. There are 15 greenhouses at Chitedze and two at Makoka, with a total space of 375 m^2. All research stations have workshops for the maintenance of vehicles and machinery.

(3) Equipment

No field or laboratory equipment with a replacement value of over US$ 5000 was identified, other than vehicles and tractors. The DAR has 21 tractors, 40 vehicles and 23 motorcycles. The biometrics unit of the DAR is located at the Makoka Research Station and has a Hewlett-Packard HP85 micro-computer.

The DAR has five other micro-computers; four of these are Apple IIs, located at the Main Station at Chitedze, and one is a Burroughs, located at headquarters in Lilongwe.

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 7 : Location, Major Activities, Staff and Funding of Agricultural Research Branch Stations, 1984

Institution	Branch Station/ Location	Principal Research Activities	Number of Staff: Professional/ Administrative[a]	Technical: Diplomate	Technical: Certificate	Support Services	Total	Budget (US$)
Dept. of Agricultural Research	Chitedze Research Station in Lilongwe	Crop breeding, agronomy, soils, seed services, livestock, pastures, farm machinery, crop storage.	>40	>30	>50	>40		252,592
	Bvumbwe Research Station in Blantyre	Tree and horticulture, crops, soil productivity, plant quarantine and protection, crop storage.	>10	>20	>50	>40		221,462
	Makoka Research Station in	Cotton breeding, agronomy, entomology, biometrics and root crops.	>10	>5	>30	>30		162,050
	Lunyangwa Research Station in Mzuzu	General agronomy, coffee, livestock, pastures, crop storage, rice & root crops.	1	>5	10	>10		67,231

Table 7 : Location, Major Activities, Staff and Funding of Agricultural Research Branch Stations (cont.)

Institution	Branch Station/ Location	Principal Research Activities	Number of Staff: Professional/ Administrative[a]	Technical: Diplomate	Technical: Certificate	Support Services	Total	Budget (US$)
Dept. of Agricultural Research, cont.	Lifuwu Research Station in Salima	Rice breeding and agronomy (rainfed and irrigated rice) mango, cashew and sugar cane.	2	3	6	14		146,923
	Kasinthula Research Station in Chikwawa	Substation of Bvumbwe Research Station, irrigated crops, maize, rice, groundnuts, cotton, cocoa and fruits.	3	3	7	12		141,854
	Chitala Research Station in Salima	Trial site of Chitedze, research on cereals, groundnuts, cotton, tree crops and livestock.	-	2	8	16		63,846
	Ngabu Research Station in Chikwawa	Research on semi-arid crops, cotton, sorghum, millets, guarbeans, maize, groundnuts and cowpeas.	2	1	14	-		84,615

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 7 : Location, Major Activities, Staff and Funding of Agricultural Research Branch Stations (cont.)

Institution	Branch Station/ Location	Principal Research Activities	Number of Staff: Professional/ Administrative[a]	Technical: Diplomate	Technical: Certificate	Support Services	Total	Budget (US$)
Dept. of Agricultural Research, cont.	Baka Research Station in Karonga and the Meru Trial site	Substation of Lunyangwa serving the extreme north of country for variety evaluation, agronomy, cotton and plant protection and seed services.	-	5	14	18		66,923
	Makhanga Research Station in Nsanje	Research on rainfed and irrigated crops; maize, rice, groundnuts, cotton, cocoa.	-	-	9	12		59,938
	Soil Survey Research Unit in Lilongwe	Soil and land use classification.	<5	1	6	2		18,908
	Lilongwe Headquarters	Administration of the Research Dept. Institution.	8	1	-	7		1,276,496
Dept. of Veterinary Services	Lilongwe Central Laboratory	Bacteriology, virology and feed analysis.	<5	<5	<5	<10		NA[b]

Table 7 : Location, Major Activities, Staff and Funding of Agricultural Research Branch Stations (cont.)

Institution	Branch Station/ Location	Principal Research Activities	Number of Staff: Professional/ Administrative[a]	Technical: Diplomate	Technical: Certificate	Support Services	Total	Budget
Dept. of Veterinary Services, cont.	Blantyre Veterinary Laboratory	Bacteriology and diagnosis	1	<5	< 5	< 10		NA
	Mzuzu Veterinary Laboratory	Bacteriology and diagnosis	1	<5	< 5	< 10		NA
Tobacco Research Authority	Kandiya Research Station	Burley and fire-cured tobacco	5	<5	< 10	< 10		NA
	Mwimba Research Station	Flue-cured and oriental tobacco	1	<5	< 5	< 10		NA
Tea Research Foundation	Swazi Research Station	Biochemistry, soil analysis, pathology, entomology, processing engineering, tea factory, breeding agronomy and horticulture	<3	<5	< 5	< 10		NA
	Mimosa Research Station	Agronomy, plant breeding and horticulture	<5	<5	< 5	< 10		NA

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 7 : Location, Major Activities, Staff and Funding of Agricultural Research Branch Stations (cont.)

Institution	Branch Station/ Location	Principal Research Activities	Number of Staff: Professional/ Administrative[a]	Technical: Diplomate	Technical: Certificate	Support Services	Total	Budget (US$)
Tea Research Foundation	Thyolo Research Station	Agronomy, plant breeding and horticulture	5	5	5	10		NA
Bunda College of Agriculture	Bunda College of Agriculture	Annual crops, agricultural engineering, livestock and rural development	40	-	10	100		11,538
Sugar Corp. of Malawi (SUCOMA)	SUCOMA Nchabo	Variety evaluation, plant analysis, and herbicide evaluation	1	-	3	7		113,846

[a]Professional means BS and above

[b]Breakdown on Branch station basis for budget not available. See Table 5 for total institutional budget.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

Table 8: Ecological Description and Land Use of the Department of Agricultural Research Stations

Station	Altitude	Major Soil Type	Annual Rainfall (mm)	Total Area (ha)	Cultivated (percent)	Comments
Chitedze	1150 m	sandy clay loam	750-875	560	48	20 percent of plots used for experiments 20 percent of land under pasture
Bvumbwe	1145 m	sandy clay loam	1207	260	-	
Makoka		sandy loam to sandy clay loam	1014	100	-	
Kasinthula	100 m	-	800	300	83	66 percent of plots irrigated
Lifuwu	500 m	clay	1130	202	45	41 percent of plots used for seed multiplier 4 percent of plots used for experiments 20 percent of plots irrigated
Ngabu	100 m	-	-	30	99	
Mbawa	1100 m	sandy clay loam	855	480	33	
Baka	457 m	sandy clay loam	1200	240	6	

Table 8: Ecological Description and Land Use of the Department of Agricultural Research Stations (cont.)

Station	Altitude	Major Soil Type	Annual Rainfall (mm)	Total Area (ha)	Cultivated (percent)	Comments
Makhanga	-	-	-	83	50	58 percent of plots used for experiments 41 percent of plots used for seed multiplication 75 percent of plots irrigated
Chitala	600 m	sandy clay loam	895	495	-	
Lunyangwa	1342 m	deep dark-red clays	1270	800	13	

Source: Data collected from the Department of Agricultural Research, Ministry of Agriculture, Lilongwe, 1983.

(4) Library and publications

The main library is located at the Chitedze research station. This library has approximately 3,000 books and acquires 30-50 books per annum. It receives approximately 250 scientific journals and periodicals. It also has access to the library resources of the University of Florida and the Tropical Development and Research Institute (TDRI) in the UK.

While Malawi does not have a national agricultural research journal, agriculture-related articles are published in the Malawi Journal of Science, an organ of the Association for the Advancement of Science in Malawi. Scientists also can report on their work in the Research Bulletin, Research Circulars, the Guide to Agricultural Production in Malawi, and Research Highlights. The first two are published monthly in Malawi, and the second two are produced yearly. Scientists are also free to publish their results in international research journals.

e. Financial resources

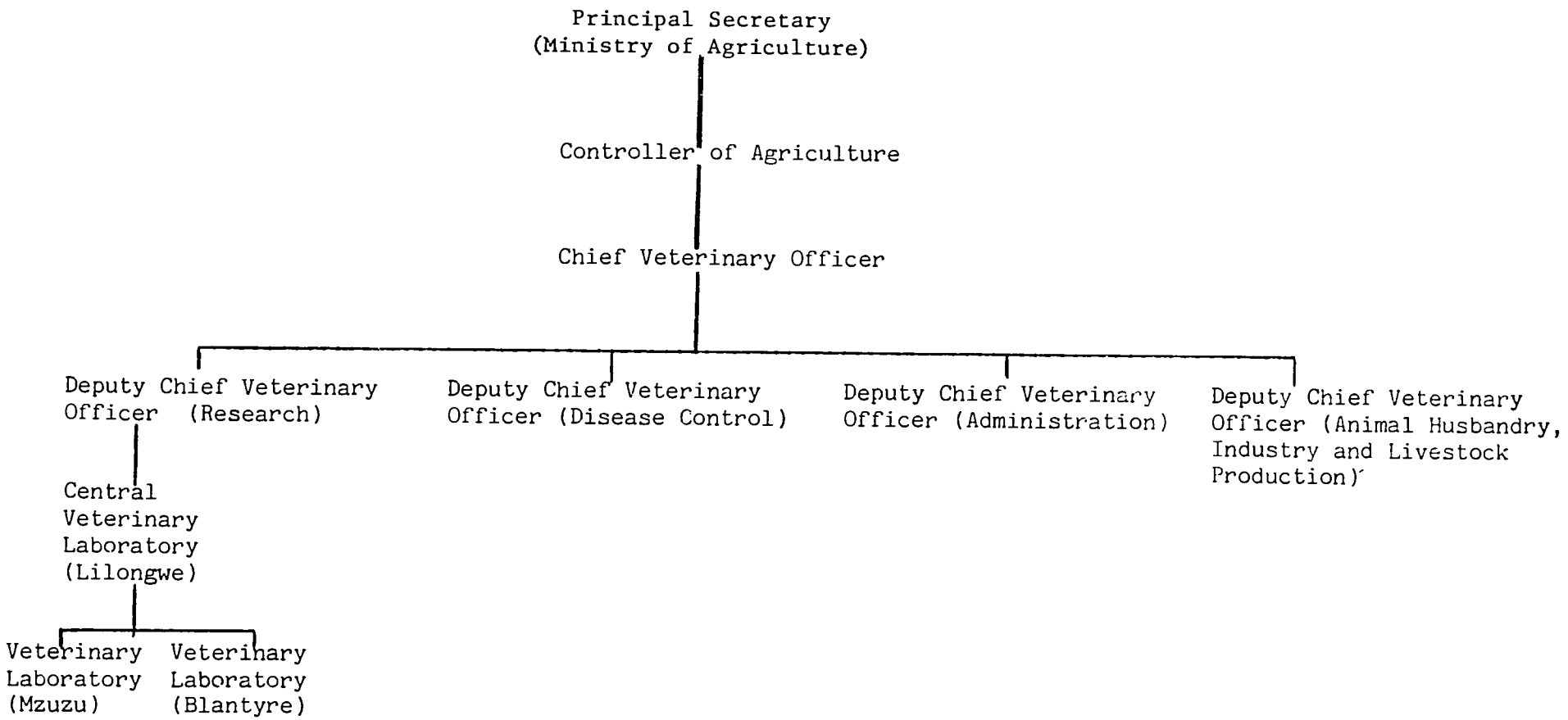
The DAR had a total recurrent operating budget of US$ 2.6 million for its programmes in 1984/1985. The three main stations account for 80 percent of the DAR's professional and technical staff, yet they receive less than one-fourth of the total research budget. The DAR is currently evaluating its allocation of research funds. There is a proposal, as part of the suggested reorganisation, to direct funds through commodity catagories rather than through research stations and substations, to help overcome the tendency for expenditures to be heavily weighted toward overhead and services rather than toward actual research operations and programmes.

Overall, the DAR spends nearly 50 percent of its operating budget on wages and salaries, 29 percent on maintenance and operating expenses and less than 10 percent on utilities.

2. Department of Veterinary Services

a. Organisational structure and purpose

The Department of Veterinary Services (DVS) of the Ministry of Agriculture has three major functions: research, extension and provision of services. DVS' research is principally conducted at the central veterinary laboratory in Lilongwe; field services (extension) are based in each ADD. The DVS provides services to small farmers principally through its 17 livestock production centres distributed throughout the country. Its facilities are also used for in-service training for technical officers. The Chief Veterinary Officer has overall responsibility for the Department, as is shown on the organisation chart. (Figure 6.)



MALAWI: AGRICULTURAL RESEARCH RESOURCES ASSESSMENT

Figure 6: Organisation Chart of the Department of Veterinary Services

Source: Data collected from the Deparment of Veterinary Services, Ministry of Agriculture, Lilongwe, 1983.

b. Research programmes

The research conducted by the DVS falls under its Livestock Development Programme. In addition to research, other components of the programme are extension and the provision of cross-bred cattle for sale to small farmers. The purpose of the programme is to improve the quality of livestock through better disease control, nutrition, and management. To achieve this, the Department currently has three research projects: the East Coast Fever Project, the African Swine Fever Project, and the Newcastle Disease Project.

(1) East Coast Fever Project

The East Coast Fever Project was begun in 1980 to develop immune mechanisms against the disease. It is funded for four years for US$ 314,300. Six researchers (two PhDs and four BVMs), four technical officers, and three technical assistants are involved.

(2) African Swine Fever Project

The African Swine Fever project was begun in 1980 to study the spread of swine fever and to develop control measures. It is funded by the Government of Malawi for three years for US$ 87,750. One researcher with a PhD is assisted by a technical officer and a technical assistant.

(3) Newcastle Disease Project

The Newcastle Disease Vaccine V4 Project was begun in 1981 to develop the V4 strain into a vaccine for poultry. It is funded by the Government of Malawi for three years for US$ 87,750. One researcher with a Bachelor's degree is assisted by a technical officer and a technical assistant.

The research programme has links locally with Bunda College of Agriculture and externally with a number of countries and organisations, including:

- FAO's East Coast Fever Project in Zambia;
- The Department of Veterinary Services in Zimbabwe; and
- ILRAD, ICIPE in Muguga, and the Government Veterinary Laboratory in Nairobi, Kenya.

c. Human resources

The DVS staff of 78 includes 22 professional officers. However, most of the professional staff are involved with the provision of services and extension; the equivalent of only 9.5 full-time persons are dedicated to research. There are eight technical

officers directly involved in research. The 46 support staff members also have responsibility for research, extension and the provision of services.

d. Research facilities

(1) Land and buildings

The department has five laboratories: three at Lilongwe, and one each at Blantyre and Mzuzu. There are five offices in excellent condition at the central veterinary laboratory in Lilongwe, three offices in poor condition at Blantyre, and one in good condition at Mzuzu. There are three livestock compounds at Lilongwe:

- A small animal compound for poultry, pigs, rabbits, and guinea pigs, with approximately 200 m^2 in area;
- A large-animal compound with a protected environment used for East Coast Fever immunisation, with approximately 150 m^2 in area; and
- A large-animal complex of 1.2 ha with sheds, also used for the East Coast Fever project.

(2) Equipment

The following items were reported to have replacement values above US$ 5,000: a stereoscope microscope, a gas chromatograph, an autoclave (semi-room), a centrifuge, and liquid nitrogen apparatus.

In addition, the DVS has approximately 60 vehicles, 15 tractors, and 100 motorcycles.

(3) Library

The library at the central veterinary laboratory has 5,000 books and 20 scientific journals. The department has not issued any publications during the last five years.

e. Financial resources

The DVS has a total budget of US$ 3.08 million for research and extension services. About 15 percent of this comes from government funds. The balance comes from several sources, including the UNDP/FAO, EEC, CIDA, DANIDA, and ODA of the UK. It is estimated that US$ 140,000 is dedicated to the research programmes of the DVS.

3. Bunda College of Agriculture

a. Organisational structure and purpose

The Bunda College of Agriculture of the University of Malawi was created in 1965, and is described in detail in the next chapter on agricultural training.

Research programmes are conducted within each of the four departments of the college: Crop Production, Agricultural Engineering, Livestock Production, and Rural Development. Bunda College cooperates with the Ministry of Agriculture, to ensure that projects undertaken are related to the country's development needs and to avoid duplication of efforts. In some cases, Bunda staff are participants or consultants on research projects carried out at government research stations.

b. Research programmes

There are seven research projects in the Crop Production Department, two in the Agricultural Engineering Department, four in the Livestock Production Department and two in the Rural Development Department. The projects and their objectives are summarised in Table 9.

c. Human resources

The professional staff of Bunda College number 43, but since they have a variety of responsibilities, including teaching and research, the equivalent of about only six full-time persons are dedicated to research.

d. Financial resources

Bunda College's budget for the 1983-1984 year was US$ 936,000. The research budget was about US$ 51,000; about one-fifth of this came from University funds, the balance from donor funds including IDRC, FAO, IFS and USAID.

4. Tea Research Foundation

a. Organisational structure and purpose

The private Tea Research Foundation (TRF) of Central Africa undertakes research in all aspects of tea production. It also provides advisory and extension services to tea producers in Malawi and Zimbabwe, and to private companies in South Africa. The TRF maintains close contact with the following organisations, each of which contributes to its operation: Tea Association of Central Africa, Zimbabwe Tea Growers Association, SAPEKO (private companies in South Africa), and the Transkei Tea Development Cooperative.

Table 9: Research Projects at Bunda College of Agriculture by Department

Department	Objective	Research Projects
Crop Production	To improve crop production at smallholder and estate	o Studies on maize/legume rotations o Selection studies with UCA maize o Pasture and fodder production and utilization o Insect pest and entomophagous arthropod population status in a mixed cropping system o Evaluation of beans, cowpeas, groundnuts, and pigeon pea cultivars for resistance to root-knot nematode o Selection for yield in pigeon pea cultivars o Bean improvement project
Agricultural Engineering	To diminish post harvest losses in storage by small farmers	o Grain drying and storage
	To obtain soil-erodability factor for some soils in the Bunda area	o The determination of the USLE (Universal Soil Loss Equation) erodability factors for soils around Bunda College
Livestock Production	To improve disease control, proper housing and feeding using locally available materials	o Studies on the effect of bitter cassava on growth and reproduction of pigs o Evaluation of crop residues--maize stover, groundnut and bean hulls--as feed for goats
	To assess reproductive performance of cattle, pigs, goats and poultry, mainly for the smallholder sector	o Evaluation of various types of rabbit housing which could be used by smallholder farmers o Evaluation of the effects of drying and temperature on protein quality in terms of available lysine
Rural Development	To help hasten agricultural change and development in rural farming communities	o Studies of agricultural change and rural development in the Lilongwe Rural Development Project o Analysis of the application of appropriate technology to farm systems in Malawi

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1983.

The Director reports to the Board of Directors and has an assistant director.

Tea research is carried out at the Foundation headquarters in Mulanje, which has two substations (Mimosa and Nsuwadzi), and at Thyolo Tea Research Station.

b. Research programmes

Research projects have been undertaken in the following areas: agronomy, plant improvement and physiology, plant pathology, entomology, tea biochemistry and technology, and tea manufacture.

Since tea is largely an estate crop, and since much of the research program is industry-financed, most of the research is aimed at estate production. However, the plant improvement and physiology programme is conducting a project for the Smallholder Tea Authority.

Two professional officers, the Assistant Director and the Advisory Services Officer, are specialists in tea cultivation and provide extension advice to growers. The station holds annual field days and *ad hoc* training courses for research personnel and farmers.

c. Human resources

The resident research staff is comprised of a full-time Director and his Deputy, Professional Officers, Technical Officers, and Technical Assistants. The total number of staff, including support staff, is 56. A breakdown of professional research staff by research discipline and qualification is provided in Table 10.

d. Research facilities

The main research station is in a high-rainfall forest zone with 1100-1650 mm of rainfall and sandy clay loams. It has 175 ha of cultivated land, of which 70 percent is used for experiments, 28 percent for crop production and 2 percent for seed/plant material multiplication. Twenty ha of the cultivated land are irrigated. About 30 ha of the cultivated land are in pasture for a dairy herd which provides the staff with milk products.

The Tea Research Foundation has three laboratories in fair to good condition, a greenhouse at Nsuwadzi in poor condition, and a maintenance workshop at Mimosa in fair condition. No conference facility is available.

A cold room and high-pressure liquid chromatograph are the only equipment belonging to the Foundation which have a replacement value above US$ 5,000.

Table 10: Tea Research Foundation Professional Staff by Discipline and by Qualification

Professional Post	Qualifications of Staff[a]					Total Filled Posts[a]
	Diploma	Bachelor's	Master's	Doctorate	Vacant	
Director & Ass't/Advisor	-	2	2(2)	1(1)		5(3)
Agronomist	-	2	-	-		2
Plant Breeder	-	1(1)	1	-		2(1)
Plant Pathologist/ Entomologist	-	-	-	1(1)		1(1)
Process Engineer	-	-	1(1)	-		1(1)
Chemist	1	-	-	-		1
Biochemist	-	-	-	-	1	-
Tea Seed Oil Researcher	-	1	-	-		1
Productivity Officer	-	1(1)	-	-		1(1)
Horticulturist	1	-	-	-		1
TOTAL	2	7(2)	4(3)	2(2)	1	15(7)

[a]Numbers in parenthesis indicate those of total who are expatriates.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1983.

The library has about 3,000 books and an annual acquisition rate of approximately 20 books. It also receives about 500 periodicals and scientific journals.

e. Financial resources

There are three main sources of funding for the TRF: the tea industry, revenue from the Foundation's experimental tea crop and planting material; and the UNDP.

In the 1983 ARRA study, the TRF reported spending an annual average of US$ 43,900 on capital development and US$ 438,900 on recurrent costs. In 1984, the total budget was US$ 577,000.

5. Tobacco Research Authority

a. Organisation and purpose

The Tobacco Research Authority (TRA) was created by the Malawi Government in 1980 to undertake research and to disseminate results; it is, however, a private institution. It conducts its work at two research stations, Kandiya (in Lilongwe) and Mwimba (in Kasungu).

The General Manager has overall responsibility and, in turn, delegates administrative duties to officers-in-charge and senior officers. There are departments of plant production, plant breeding, plant protection and liaison.

b. Research programmes

The TRA's research programme is primarily concerned with developing improved: plant varieties; methods of control of diseases, insects and other pests; and machinery for planting, reaping, curing, and marketing. The programme is both estate- and smallholder-oriented. The research work includes studying the effects of tobacco rotation with other food crops and Katambora grass. Flue-cured, fire-cured, burley and oriental tobacco varieties are currently being researched.

TRF's research activities are in nine areas. These areas, with the specific projects, are:

- Flue-cured agronomy--fertiliser and herbicide trials;
- Flue-cured physiology--curing experiments for efficient use of fuelwood, minimum tillage using draught animals; and inter-cropping of tobacco and eucalyptus;
- Flue-cured breeding--variety trials; nitrogen responses, and trials to test resistance of varieties to *Fusarium*;

- Engineering--comparison of performances of rectangular vs. conventional flues, and testing effects of forced draft to the furnace under varying circumstances;

- Fire-cured breeding--testing of new fire-cured breeding lines, varietal responses to fertilisers, assessment under smallholder conditions of selection of crosses, selection of foundation seed stock;

- Burley breeding--evaluation of the breeding carrying the Aurea Colour gene, making of crosses and single plant selections, and breeding of high-yield Burley varieties with resistance to Fusarium wilt and nematodes;

- Burley agronomy--effects of topping height, spacing within the row, and levels of nitrogen upon yields, and quality and proportion of red leaf on variety Banket Al; effects of nematicides in various combinations with and without ethylene dibromide; comparison of the effects of different sources of nitrogen; and determination rates of nitrogen necessary to produce burley tobacco on soils traditionally used in flue-cured tobacco;

- Pathology--determination of the effects, if any, of topping methods on the incidence of hollow stalk; and

- Oriental tobacco--comparison of four varieties to different nitrogen levels and ridge spacing, and comparison of manure and chemical fertiliser on five oriental varieties.

The Chitedze and Bvumbwe Research Stations of the GOM provide TRA with soil analysis and phytosanitary services. Estate representatives attend meetings of the TRA Board when it is planning research. Each station has a liaison officer who organises courses for MOA extension field staff. Extension staff courses have been held at Namiasi and Tuchila Training Centres.

A pamphlet on tobacco diseases was recently rewritten and updated. Eleven issues of the newsletter were produced in conjunction with the National Bank of Malawi, and were sent to all registered growers.

Linkages exist between TRA and the Kutsaga Tobacco Research Station in Zimbabwe, North Carolina State University, and the Tobacco Research Institute at Rustenburg in South Africa.

c. Human resources

The Tobacco Research Authority employs 15 Professional Research Officers (four of these assist as part-time research administrators), seven Technical Officers, and 48 Technical Assistants and support staff. The total staff is comprised of 70 persons.

While there are no vacant positions, a Malawian is being recruited as an understudy to the engineer, who is an expatriate. There is a plan to expand staff to twelve Professional Officers, consisting of four agronomists, one physiologist, one soil chemist, two breeders, one entomologist, one nematologist and two liaison officers.

d. Research facilities

The Kandiya Research station has 23 offices in good condition, four research laboratories, four growth rooms for tea breeding, four maintenance shops, and three 200-300 m^2 barns for curing. The Mwimba station has four offices and a motor vehicle maintenance shop, but no laboratory or electricity. All the facilities are in good condition. The headquarters at Kandiya also has a conference room, with a capacity for 30 persons, and a computer room.

The following field and laboratory equipment have replacement values above US$ 5,000: four motor vehicles, five tractors, one computer (TRS-80), a spectro-photometer and a cold room.

TRF has a small library of ten books, with approximately two books acquired per year, and six scientific journals. The research staff has access to the Chitedze Research Station and Bunda College libraries, as well as to the British Council Library.

e. Financial resources

TRA is a commodity-financed institution, relying on a growers' levy and programme income. However, the FAO has assisted with the provision of the General Manager and scholarships, with a total value of US$ 150,000. In the 1983 ARRA study, the TRA reported spending an annual average of US$ 175,000 on capital development and US$ 351,000 on recurrent costs. In 1984, the total budget was US$ 506,000.

6. Sugar Corporation of Malawi

The Sugar Corporation of Malawi (SUCOMA) is a subsidiary of Swaziland Milling Co. Ltd. and is entirely funded by Lonrho Ltd. There currently is very little research being done on sugarcane beyond the importation and testing of varieties. The small research unit which started in 1968 at the Nchalo Sugar Estate aims principally at investigating problems associated with sugarcane production at that estate. All funds for research are provided by the estate; the estate manager has overall responsibility for research activities.

The research unit is mainly concerned with variety introduction and testing, disease trials, and furrow irrigation trials.

Four people are involved in research on the estate: one agronomist and three Technical Officers. There are seven support staff members who assist in field work and in the laboratory.

SUCOMA has a budget of US$ 114,000 for these research programmes.

C. Total Human Resources Available for Research in Malawi

1. Staffing patterns

Table 11 provides a summmary of staff engaged in agricultural research. While there are 1,229 authorised posts in all institutions reported, 978 are currently occupied. 943 of these are held by nationals. There are 38 expatriate staff; 18 of these are serving in authorised posts, 20 in non-authorised posts. Twenty-two of the total staff are in administrative positions. The rest of the staff may be categorised as follows: 177 are professionals, each with at least a BSc degree; 120 are technical staff, each with a diploma; and the remainder, 659, are certificate-holders and support staff. At this time, about 4 percent of the staff are in training in Africa or elsewhere.

Table 12 shows that, while about 38 percent of the professional staff time is spent on research on commercial crops, only 13 percent is spent on food crop research and 13 percent on livestock research.

Table 13 describes the discipline areas of the professional staff in the various programme areas and their levels of training. Food crop research programmes involve 27 professionals; 20 of these are nationals (14 with BSc degrees, four with with MSc degrees, and two with PhDs), and seven are expatriates (all with PhD degrees). The major discipline areas represented are plant breeding, agronomy, crop physiology, entomology, nematology, farming systems and pathology.

Commercial crop research programmes involve 41 professionals. Among these are: seven PhD degree-holders (three of whom are expatriates); 15 MSc degree-holders (three of whom are expatriates); and 19 BSc degree-holders (two of whom are expatriates). Discipline areas represented are crop science (including plant breeding), agronomy, crop physiology, entomology, pathology and agricultural engineering.

Working in the livestock research programme area are 37 professional staff. Nineteen of these, including one expatriate, are BSc degree-holders. Five, including three expatriates, are MSc degree-holders, and 13, including three expatriates, have PhDs. The discipline areas represented are animal science, breeding, nutrition, pathology, physiology, production, range ecology and pasture management.

In the other research areas (including farming systems, soil and water management, irrigation, farm power, agroforestry, farm storage, crop processing and agricultural economics/policy) there are 51

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 11: Total Agricultural Research Staff, 1984

	Administrative	Professional[a]	Technical[b]	Support Staff	Total
Total Authorized Posts	18	184	158	869	1229
Positions Vacant	1	37	38	210	286
Nationals (Citizens)					
Staff in training	-	39	8	1	48
Staff on long-term leave[c]	-	1	-	-	1
Number of nationals currently in posts	14	147	120	659	943
Expressed as a percent of authorized posts	78	80	76	76	77
Expatriates					
Serving in authorized posts[d]	3	15	-	-	18
Expressed as a percent of authorized posts	17	8	-	-	1
Not in authorized posts	5	15	-	-	20
Total number of expatriates	8	30	-	-	38
Total Number of Staff	22	177	120	659	978

[a]Professional = BSc or above.

[b]Technical = diplomate.

[c]Long-term leave is leave of three months or more.

[d]Irrespective of source of funding.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 12: Summary of Professional Staff Effort and Source of Funds by Programme Area of Agricultural Research, 1984[a]

Commodity-Related Programme Areas	FTE[b]	Source of Funds	Percentage of National Research Effort
Food Crops			
Maize	5.8	MOA, University	4.8
Sorghum	1.5	MOA	1.3
Millet	1.0	MOA	0.8
Cassava and sweet potatoes	1.6	MOA, University	1.3
Pulses (Beans, Peas)	1.5	University	1.3
Other (Pigeon Pea)	0.3	University	0.3
Rice	2.0	MOA	1.7
Wheat	2.5	MOA	2.1
Subtotal, Food Crops	16.2	MOA, University	13.5
Commercial Crops			
Cotton	7.3	MOA	6.3
Sugar Cane	1.0	Private (Sucoma)	0.8
Fruit & Vegetables	6.8	MOA, University	5.7
Tea	9.8	Private (Tea Research Foundation)	8.2
Coffee	1.2	MOA	0.8
Tobacco	11.0	Private (The Tobacco Association of Malawi)	9.2
Groundnuts	8.6	MOA, University	7.2
Subtotal, Commercial Crops	45.7		38.0

Table 12: Summary of Professional Staff Effort and Source of Funds by Programme Area of Agricultural Research, 1984[a] (cont.)

Commodity-Related Programme Areas	FTE[b]	Source of Funds	Percentage of National Research Effort
Livestock/Fisheries			
Cattle beef & dairy	6.1	MOA, University	5.1
Sheep	1.0	MOA	0.8
Poultry	1.0	MOA	0.8
Swine	1.3	MOA	1.1
Goats (meat)	1.3	MOA, University	1.1
Veterinary	0.3	University	0.2
Range management	1.0	MOA	0.8
Other (Animal nutrition)	1.3	MOA, University	1.1
Pasture management	1.4	MOA, University	1.2
Animal husbandry	1.0	MOA	0.8
Dogs (Rabies)	0.2	MOA	0.4
Subtotal, Livestock/Fisheries	15.9		13.0
Other Programme Areas			
Agricultural Policy (Economics)	9.0	MOA	7.5
Rural Institutions	0.2	University	0.2
Biometrics	3.0	MOA	7.5
Other	30.5		
Subtotal, Other Programme Areas	42.7		35.5
TOTAL	120.5		100.0

[a]Professional staff are those with a BSc degree or above.

[b]FTE = Full Time Equivalent.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

Table 13: Disciplines of Professional Staff Related to Agricultural Research Programme Area, 1984

Programme Area	Discipline Areas	Number of Professionals[a]						
		Nationals			Expatriates			
		BSc	MSc	PhD	BSc	MSc	PhD	Total
Food Crops								
Maize	Crop science (breeding) agronomy, crop physiology, entomology, farming systems	3	2	-	-	-	3	8
Sorghum	Crop science (breeding)	1	-	-	-	-	-	1
Millet	Crop science (breeding)	1	-	-	-	-	-	1
Cassava	Agronomy, entomology, pathology	2	1	-	-	-	-	3
Pulses	Crop science (breeding), agronomy, physiology, microbiology, nematology, pathology, entomology	4	-	2	-	-	4	10
Tubers (Potatoes)	Crop science (breeding), horticulture, pathology	3	1	-	-	-	-	4
Subtotal, Food Crops		14	4	2	-	-	7	27

Table 13: Disciplines of Professional Staff Related to Agricultural Research Programme Area, 1984 (cont.)

Programme Area	Discipline Areas	Number of Professionals[a]						
		Nationals			Expatriates			
		BSc	MSc	PhD	BSc	MSc	PhD	Total
Commercial Crops								
Cotton	Crop science (breeding), agronomy, entomology	5	2	1	-	-	-	8
Sugarcane	Crop science, agronomy, pathology	2	-	1	-	-	-	3
Fruit/Vegetables	Entomology, crop science, horticulture, nematology, pathology	3	5	-	-	-	1	9
Tea	Crop science (breeding), agronomy, entomology, horticulture, pathology, biochemistry, agricultural engineering, extension specialists	3	2	-	1	2	2	10
Coffee	Agronomy, entomology, pathology	1	1	1	-	-	-	3
Tobacco	Crop science (breeding), agronomy, crop physiology, nematology, pathology, agricultural engineering, extension specialists	3	2	1	1	1	-	8
Subtotal, Commercial Crops		17	12	4	2	3	3	41

Table 13: Disciplines of Professional Staff Related to Agricultural Research Programme Area, 1984 (cont.)

Programme Area	Discipline Areas	Number of Professionals[a]						
		Nationals			Expatriates			
		BSc	MSc	PhD	BSc	MSc	PhD	Total
Livestock								
Cattle	Animal sciences, breeding, nutrition, pathology, physiology, production, biochemistry	5	1	7	-	1	2	16
Sheep	Animal science	1	-	-	-	-	-	1
Poultry	Animal science	2	-	-	-	-	-	2
Swine	Animal science	2	-	-	-	-	-	2
Goats, mohair milk	Animal science	3	-	-	-	-	-	3
Veterinary	Animal pathology	4	1	2	1	1	1	10
Range management	Range ecology	1	-	-	-	-	-	1
Pasture management	Pastures	-	1	1	-	-	-	2
Subtotal, Livestock		18	3	10	1	2	3	37

Table 13: Disciplines of Professional Staff Related to Agricultural Research Programme Area, 1984 (cont.)

Programme Area	Discipline Areas	Number of Professionals[a]						
		Nationals			Expatriates			
		BSc	MSc	PhD	BSc	MSc	PhD	Total
Other								
Farming Systems	Crop science agronomy, agric. economics, extension specialists, rural sociology	9	-	-	1	-	1	11
Land, soils and water management	Soils, microbiology, agric. chemistry	4	5	2	-	1	-	12
Irrigation	Crop science, agronomy, soils	1	1	-	-	1	-	3
Farm Power	Farm power, farm mechanization, farm structures	4	2	-	-	-	-	6
Agroforestry	Agronomy	-	-	1	-	-	1	2

Table 13: Disciplines of Professional Staff Related to Agricultural Research Programme Area, 1984 (cont.)

Programme Area	Discipline Areas	Number of Professionals[a]						
		Nationals			Expatriates			
		BSc	MSc	PhD	BSc	MSc	PhD	Total
Other								
Farm Storage	Crop science, entomology, pathology	-	3	1	-	-	-	4
Crop Processing	Seed technology	1	2	-	-	-	-	3
Agric. Policy	Agricultural economics	4	4	-	-	-	2	10
Subtotal, Other		23	17	4	1	2	4	51
TOTAL		54	28	17	3	5	15	122

[a]The total number of professionals shown does not include professionals assigned to administrative and other duties.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

professional staff. Twenty-four of these, including one expatriate, have BSc degrees: 19, including two expatriates, have MSc degrees and eight, including four expatriates, have PhDs.

A total of 191 agricultural research professionals are classified according to their technical skills (as measured by their highest academic degree held) in Table 14.

2. Staff training

The research institutions currently have 12 staff in PhD-level training in crop science, animal science, veterinary science, agricultural economics and soils. (See Table 15.) There are also 27 in MSc-level training: 14 in crop science, three in animal science, seven in agricultural economics, and three in other fields. Women are underrepresented in graduate-level training. Only one of the 11 PhD candidates and four of the 27 MSc candidates are women.

The DAR is the only research institution which has a definite training programme for the next five or more years, and which has MSc- and PhD-level training as its major focus. The other institutions all have proposals for such training, but no definite schedules are available.

D. Total Financial Resources Available for Research in Malawi

1. Government research institutions

The research programmes of the Ministry of Agriculture's DAR and DVS are funded by the national budget (see Table 5) and by external donors. (See Table 16.) Notable in this regard are the funding from USAID and the UK's technical assistance support of the DAR. The DVS is assisted by DANIDA and UNDP/FAO funds. Table 16 provides details of this support as well as of support from other sources.

The research activities of Bunda College receive technical assistance from the UNDP and the UK. In addition, Bunda receives support for its research programmes from the DAR and other donors, including USAID, IDRC, IFS and FAO.

2. Private research institutions

The private research institutions are funded by their organisations, generally through levies on the commodities sold. The tea and tobacco research institutions also receive technical assistance from the UNDP/FAO and the UK.

Table 14: Summary of Technical Skills of Agricultural Research Professionals by Degree Held, 1984

Discipline Areas	Nationals								Expatriates								Total
	BSc		MSc		PhD		Subtotal		BSc		MSc		PhD		Subtotal		
	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	
Plant/Soil Sciences																	
Crop sciences	1	8	–	3	–	3	1	14	–	1	–	1	–	7[a]	–	9	24
Agronomy	1	11	–	3	–	–	1	14	–	–	–	–	–	1	–	1	16
Crop physiology	–	2	–	1	–	–	–	3	–	–	–	–	–	2	–	2	5
Entomology	–	3	1	4	–	–	1	7	–	–	–	–	–	1	–	1	9
Horticulture	–	2	–	4	–	–	–	6	–	–	–	–	–	1	–	1	7
Microbiology	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	–	1
Nematology	–	1	–	–	–	1	–	2	–	–	–	–	–	–	–	–	2
Pathology	1	3	–	1	–	1	1	5	–	–	–	1	–	–	–	1	7
Range ecology	–	1	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1
Pasture	–	–	–	1	–	1	–	2	–	–	–	–	–	–	–	–	2
Seed technology	1	–	–	1	–	–	1	1	–	–	–	–	–	–	–	–	2
Soils	1	3	–	5	–	3	1	11	–	–	–	–	–	1	–	1	13
Other (and general agriculture)	–	19	–	–	–	–	–	19	1	–	1	–	–	–	2	–	21
Subtotal, Plant/Soil Sciences	5	53	1	24	–	9	6	86	1	1	1	2	–	13	2	16	110
Animal Sciences																	
Animal sciences (general)	–	–	–	–	–	2	–	2	–	–	–	–	–	–	–	–	2
Animal breeding	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	1
Animal nutrition	–	–	–	–	–	2	–	2	–	–	–	–	–	1	–	1	3
Animal pathology	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	1
Animal physiology	–	1	–	–	–	1	–	2	–	–	–	–	–	–	–	–	2
Animal production	–	3	–	1	–	–	–	4	–	–	–	–	–	1	–	1	5
Other (health)	–	–	–	–	–	2	–	2	–	–	–	–	–	–	–	–	2
Subtotal, Animal Sciences	–	4	–	1	–	8	–	13	–	–	–	–	–	3	–	3	16

Table 14: Summary of Technical Skills of Agricultural Research Professionals by Degree Held, 1984 (cont.)

Discipline Areas	Nationals								Expatriates								Total
	BSc		MSc		PhD		Subtotal		BSc		MSc		PhD		Subtotal		
	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	
Other Disciplines																	
Agriculture/bio-chemistry	–		–	1	–	1	–	3	–	–	–	1	–	1	–	2	4
Agr. economics	1	8	1	4	–	1	2	13	–	2	–	–	–	3	–	5	20
Agr. engineering	–	1	–	1	–	1	–	3	–	–	–	2	–	1	–	3	6
Extension specialists	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	–	1
Food Sciences (human)	1	–	–	–	1	–	2	–	–	–	–	–	–	–	–	–	2
Information specialists	–	1	–	3	–	1	–	5	–	–	–	–	–	1	–	1	6
Rural sociology	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	1
Statistics	–	3	–	–	–	1	–	4	–	–	–	–	–	–	–	–	4
Systems specialists	–	1	–	–	–	–	–	1	–	–	–	–	–	1	–	1	2
Home economics	2	–	1	–	1	–	4	–	–	–	1	–	–	–	1	–	5
Farm management	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	–	1
Farm machinery	–	4	–	3	–	–	–	7	–	–	–	–	–	–	–	–	7
Mathematics and physics	–	1	1	–	–	–	1	1	–	–	1	–	–	–	1	–	3
Librarianship	–	–	1	1	–	–	1	1	1	–	–	–	–	–	1	–	3
Subtotal, Other Disciplines	4	18	4	15	2	6	10	40	1	2	2	3	–	7	3	12	65
TOTAL	9	75	5	40	2	23	16	139	2	3	3	5	0	23	5	31	191

[a]Includes two expatriates on the ICRISAT groundnuts research.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

Table 15: Training Plans for Staff of Research Institutions, 1984

Level	General Field of Study										Total	
	Crop Science		Animal Science		Veterinary		Economics		Other			
	F	M	F	M	F	M	F	M	F	M	F	M
Doctorate	-	6	-	1	-	1	1	1	-	2[a]	1	11
Masters	1	13	-	3	-	-	2	5	1[a]	2[b]	4	23
Bachelor	-	4	-	1	-	-	-	-	-	-	-	5
Diploma	-	-	-	-	-	-	-	-	-	-	-	-
Certificate	-	-	-	-	-	-	-	-	-	-	-	-
Short Courses	-	4	-	1	-	1	-	-	-	-	-	6

[a]Soils.

[b]Farm machinery.

Source: Agricultural Research Strategy Plan for Malawi, 1983.

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 16: Donor-funded Agricultural Research Activities, 19 4

Donor Country	Activity	Expected Results	Duration	Expatriate Technical Support (FTE)	Country Contribution (US$)	Donor Contribution (US$)
United States						
USAID	Agricultural Research	Building, equipment, and training of research personnel	1980-1984	8	135,133[a]	2,265,124[a]
USAID	Bunda College Bean/Cowpea Research	Breeding of varieties of beans/cowpeas	1982-1985	1	-	87,399[a]
United Kingdom						
UK/TC	Tobacco Research Authority	Provision of Tobacco Plant breeder	1982-	1	-	47,656[b]
UK/TC	Tea Research Foundation	Provision of biochemist and processing engineer	1982-	2	-	95,313[b]
UK/TC	Bvumbwe Agricultural Research Station	Provision of entomologist	1982-	1	-	47,656[b]
UK/TC	Chitedze Agricultural Research Station	Seed technology services, crop storage and farm machinery	1982-	1		203,482[c] 20,462[d]

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 16: Donor-funded Agricultural Research Activities, 1984 (cont.)

Donor Country	Activity	Expected Results	Duration	Expatriate Technical Support (FTE)	Country Contribution (US$)	Donor Contribution (US$)
Denmark						
DANIDA/FAO	East Coast Fever Immunization	Testing of methods of immunization in cattle against East Coast fever diseases	1982-1986	4	-	814,362
Canada						
IDRC	Bunda College Animal Nutrition Research	Mineral nutrition trends in natural forages	1984-1986	-	-	61,000
Others						
UNDP/FAO	Tobacco Research	Technical assistance for tobacco research expert and tobacco engineer	1982-1986	2	-	958,389
UNDP/FAO	Veterinary Services and Laboratories	Provision of one fellowship in Kenya	1982-1983	-	-	11,095

[a]1984. USAID contribution to the Department of Agricultural Research from 1980-1984 is approximately US$ 10 million and to the CRSP programme from 1981-1985 is approximately US$ 550,000.

[b]Initial contribution made in 1982, expended over several years until funds are exhausted. Subject to renewal.

[c]1980.

[d]1982.

Source: United Nations Development Programme, Development Assistance Report for Malawi, 1982, March, 1984.

IV. AGRICULTURAL TRAINING INSTITUTIONS

A. Overview of Agricultural Training in Malawi

The Malawi public school system includes basic agricultural training at the primary standard six level and continues it through secondary school up to form four. After completing form two, some secondary students elect to enter the Natural Resources College (NRC) where technical certificates are offered. Others, having completed form four, may enter the Bunda College of Agriculture for work toward diplomas. After completing the three-year diploma course, they may be selected for an additional two years of training for a BSc in general agriculture.

From 1978 to 1981, about 3 percent of the form two secondary graduates entered Colby College of Agriculture (now the Natural Resources College); 10 percent of the form four graduates enrolled at Bunda College.

The numbers of staff and students of the various programmes of Bunda College and the National Resources College are shown in Table 17.

B. Agricultural Training Institutions

1. Bunda College of Agriculture

a. Organisational structure and purpose

The Bunda College of Agriculture of the University of Malawi was established in 1966. Ninety percent of its students come from rural areas. It has four departments: Agricultural Engineering, Crop Production, Livestock Production, and Rural Development. While the College is under the jurisdiction of the Ministry of Education, it also has strong links with the Ministry of Agriculture.

b. Training programmes

Bunda College offers diplomas (three years) and BSc degrees in agriculture (an additional two years), with no optional specialisations. The entry-level requirements for the diploma programme include a full certificate at the O level with credits in English, mathematics, biology or general science, and agriculture. One-fourth to one-third of those who complete the diploma level are selected for the BSc degree course. Diploma graduates who go into the field may return to complete the additional two years of training required to obtain the BSc degree.

All students who obtain BSc degrees are offered employment by the Ministry of Agriculture and the private sector. Of those receiving diplomas, employment opportunities are evenly divided between the

Table 17: Agricultural Training Institutions: Degrees Offered, Number of Staff and Students, 1984

Name of Institution	Degrees, Diplomas, or Certificates Offered	Number of Staff[a]	Enrollment		
			F	M	Total
Bunda College of Agriculture	BSc degree in Agriculture	89[b]	9	21	30
	Diploma in Agriculture	89[b]	14	77	91
Natural Resources College	Certificate in Agriculture	41[c]	4	158	162
	Certificate in Veterinary science	41[c]	1	61	62
TOTAL		130	28	317	345

[a]Degree and diploma holders.

[b]Common teaching staff for both diploma and degree students.

[c]Common teaching staff for both agriculture and veterinary students.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

private sector and the MOA. Male and female students who graduate at the degree or diploma level are equally qualified to accept these positions, since their training is the same (with the sole exception that women take a course in home economics rather than in agricultural engineering).

The College offers no postgraduate courses; however, the curriculum is currently being revised to introduce some specialisation. The teaching staff in each department undertakes research projects in addition to their classes. They cooperate with the MOA to ensure that projects undertaken are related to the development needs of Malawi, and to avoid duplication of effort. In some cases, members of Bunda's staff act as consultants to research projects carried out at government research stations. In addition, the College has conducted short courses for both extension and research personnel of the Ministry.

c. Human resources

The staff available for teaching and research at Bunda College number 89. (See Table 18.) This number includes administrative staff.

The College has 28 PhD and 23 MSc degree-holders among its current staff members. The discipline areas in which the staff have received training are also included in Table 18. The teaching and research staff are assisted by ten technical officers and nine technical assistants as well as by support staff. One expatriate, a plant breeder with a PhD, is assigned to Bunda from the USAID-funded Cooperative Research Support Project (CRSP) on beans and cowpeas and works full-time on research.

d. Training facilities

(1) Buildings and equipment

The College has 42 offices, two lecture halls and four classrooms, all of which are in good condition. The two lecture halls are used for conferences and have capacities of 200 and 120 persons, respectively. The classrooms are considered too small. The College also has six laboratories (one each for chemistry, biology, plant science, soils, livestock and home economics) and two greenhouses, which are used for both teaching and research and which are also in good condition.

The following items owned by the College are identified as having replacement values of US$ 5,000 or more: nine vehicles, one photocopying machine, one set of welding equipment, and one maize sheller.

Table 18: Qualifications of Teaching Staff of Bunda College Departments, 1984[a]

Department/Discipline	Doctorate	Master's	Bachelor's	Other	On Leave[b]
Crop Production			-	-	
Seed Physiology	1(1)[c]	-	-	-	
Plant Breeding	1(1)	-	-	-	
Plant Pathology	2	-	-	-	
Horticulture	2	1	-	-	
Crop Physiology	3	1	-	-	
Soil Science	1	2(1)	1	-	
Environmental Biology	-	1(1)	-	-	
Entomology	1(1)	1	-	-	
Biometry	1	-	-	-	
Feature Agronomy	-	1	-	-	
Agriculture	-	-	-	-	
Subtotal, Crop Production	10(3)	7(2)	1	-	4 MSc, 1PhD, 1 BSc
Livestock Production					
Livestock Production	1	1	-	-	
Animal Health	2	-	-	-	
Animal Breeding	1	-	-	-	
Ag. Chemistry	1	1(1)	1	-	
Poultry Management	-	-	-	-	
Animal Nutrition	2(1)	-	-	-	
Animal Physiology	1	-	-	-	
Subtotal, Livestock Production	8(1)	2(1)	1	1	2 MSc, 1PhD 1 BSc

Table 18: Qualifications of Teaching Staff of Bunda College Departments, 1984[a] (cont.)

Department/Discipline	Doctorate	Master's	Bachelor's	Other	On Leave[b]
Agricultural Engineering					
Farm Power & Mach.	1(1)	1(1)	2	1	
Soil & Water Eng.	2(1)	1	1	-	
Mathematics		1(1)	-	-	
Environmental Eng.	-	-	-	1	
Farm Structures	-	1	-	-	
Subtotal, Agricultural Engineering	3(2)	4(2)	3	2	3 MSc, 1 PhD, 1 BSc
Rural Development					
Ag. Economics	1(1)	2(1)	1	1	
Communications	1	1(1)	-	-	
Human Nutrition	-	-	1	-	
Home Economics	1	1(1)	1	-	
Farm Management	-	1	-	-	
Extension & Rural Soc.	1	1	-	-	
Subtotal, Rural Development	4(3)	6(3)	3	-	1 MSc, 2 PhD, 1 BSc
Administration					
Senior Administration	2	-	2	-	
Librarian	-	2	-	1	
Support	1	2	2	3	
Subtotal, Administration	3	4	4	4	0
TOTAL STAFF, 1984	28(9)	23(8)	12	7	19

[a]Teaching and research staff are assisted by ten technical officers and nine technical assistants.

[b]On leave comprises those receiving training and those on sabbatical.

[c]Numbers in parenthesis indicate the number of expatriates in each category.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1983.

(2) Library and publications

The library has a total of 25,000 books and 350 scientific journals and periodicals, with an annual acquisition rate of approximately 600 books. The learning resources section, which is separate from the university library, has film and overhead projectors, photocopiers, and microfilm and microfiche readers. The library is open for 68 hours a week during the school term but only 42 hours during vacation.

The College has its own publication, Research Bulletin of Bunda College of Agriculture, which is compiled by the research committee and distributed by the library to approximately 300 institutions on an exchange basis.

(3) Land

Bunda College has a multi-purpose farm, with approximately 1800 ha, that is used for teaching and research as well as for commercial production.

The farm has 523 ha of arable land which are primarily used for growing maize, tobacco, beans and horticultural crops. Sixty-three ha consist of grass and legume-improved pastures; another 109 ha are in dambo (Vlei) pastures, which are natural grasslands. Approximately 70 ha are set aside for research and teaching purposes. There are 47.5 ha of forest.

The college farm is used for practical instruction in both crop and livestock husbandry. Crops grown by students include maize, beans, cotton, groundnuts and tobacco. Livestock enterprises include beef and dairy cattle, sheep, pigs and layer and broiler chickens. Livestock research units include rabbits, goats, beef stall feeding, a farrowing house for pig research, and a small animal unit. Fish are produced in a 12.5 ha pond and eight other freshwater ponds.

e. Financial resources

The recurrent budget of Bunda College in 1983-1984 was US$ 936,200. The capital development budget is sought from donor agencies when needed. The Government of Malawi pays all student fees and allowances.

2. Natural Resources College

a. Organisational structure and purpose

The Ministry of Agriculture had conducted training of Field Assistants at the Colby College of Agriculture and Farm Home Assistants at the Thuchila Farm Institute. Colby College's training programme was for two years; the Thuchila course was a one-year programme especially designed for rural women. The new Natural

Resources College (NRC), which opened in October 1983, brought together on one campus certificate training of natural resources personnel at the Technical Assistant (TA) level (in agriculture, home economics, veterinary science, fisheries, wild life and game). The college will also offer a diploma in soil survey. The new institution hopes to offer in-service training courses for teaching staff and TAs who were trained years ago. Colby College has been offering courses to TAs in dairy-related subjects, army worm control, land and water conservation and use, and technical teaching methods.

b. Training programmes

About 95 percent of NRC students come from rural areas, 5 percent from urban areas. The entry-level requirement is the Junior Certificate with passes in mathematics, two science subjects and English. The government pays all student fees, including allowances, and each student receives a travel warrant for the journey from home to school and back.

In addition to the NRC's 162 students in agriculture (1983-1984 admissions), there are 62 veterinary students and 26 farm home instructor students. The college also has other certificate students in programs peripherally related to agriculture.

c. Human resources

The NRC has a teaching staff of approximately 40, in addition to the Principal and his Deputy. Three people are receiving further training in the UK: one man and one woman at the BSc level, and one woman at the certificate level. It is hoped that in the future the new college will build its staff to 22 Professional Officers, 13 Chief Technical Officers, 13 Senior Technical Officers, 6 Technical Officers, 16 Senior Technical Assistants, and 5 Technical Assistants.

d. Training facilities

(1) Buildings

The NR has two conference rooms, each with a capacity of 30 seats, and 14 classrooms, each 68 m^2 with a capacity for 32 students. None of its equipment was valued above US$ 5,000.

(2) Library

The agricultural training section of the NRC library has 4,000 books and acquires approximately 500 books per year; it is planning to acquire a total of 10,000 books. The library, which is open seven days a week, also receives seven journals.

(3) Land

The NRC has a total land area of 292 ha, of which 100 ha are arable. 68 ha are reserved pastures and demonstration plots; 19 ha are improved pastures.

e. Financial resources

When the decision to build the Natural Resources College was made five years ago, capital investment at the other colleges was halted in order to concentrate all available capital development in the NRC. The other colleges received only recurrent budgets.

The recurrent budget for the NRC for 1984-1985 is US$ 819,000, which is provided by the GOM's revenue account. It also has a capital budget of US$ 5,331,000, provided by CIDA for the completion of the college development.

C. Total Human Resources Available for Training in Malawi

1. Staffing patterns

There are 155 authorised posts for training officers in agriculture. At present, 112 of these posts are filled by Malawians; of these, 11 are administrative posts, 76 are for professionals (with at least a BSc degree) and the remainder are for diploma-holders. There are 18 expatriate officers at this time, for a total of 130 staff in posts. (See Table 19.)

The levels of academic training and disciplines of the professional teaching staff are shown in Table 20. Only one of eight of these professionals is a woman.

2. Staff training

The training institutions have ongoing programmes of training for their staff. At this time there are six men in training for PhD degrees, two of which are in crop science, one in animal science, two in agricultural economics and one in agricultural engineering. There are ten men in MSc-level training as follows: four in crops, two in livestock, and four in agricultural engineering. One woman is in MSc training in home economics. Three staff are in BSc training, one woman in agricultural economics and one man each in engineering and livestock. (See Table 21.)

D. Total Financial Resources Available for Training in Malawi

It is impossible to calculate the percentage of the general education budget which is used for agricultural training in the primary and secondary schools. The funding levels for the two schools described in this chapter have already been discussed. It is

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 19: Total Agricultural Training Staff, 1984

	Administrative	Professional[a]	Technical[b]	Total
Total Authorized Posts	11	107	37	155
Positions Vacant	-	21	11	32
Nationals (Citizens)				
Staff in training	-	20	1	21
Staff on long-term leave[c]	-	2	-	2
Number of nationals currently in posts	11	76	25	112
Expressed as a percent of authorized posts	100	71	68	72
Expatriates				
Serving in authorized posts[d]	-	7	-	7
Expressed as a percent of authorized posts	-	11	-	11
Not in authorized posts	-	-	-	-
Total number of expatriates	-	18	-	18
Total Number of Staff	11	94	25	130

[a]Professional = BSc or above.

[b]Technical = diplomate.

[c]Long-term leave is leave of three months or more.

[d]Irrespective of source of funds.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 20: Disciplines of Teaching Professionals, 1984[a]

Discipline Areas	Nationals								Expatriates								Total
	BSc		MSc		PhD		Subtotal		BSc		MSc		PhD		Subtotal		
	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	
Plant/soil Science																	
Crop science, general	2	2	–	–	–	–	2	2	–	–	–	–	–	1	–	1	5
Agronomy	–	1	–	–	–	–	–	1	–	–	–	–	–	1	–	1	2
Crop physiology	–	2	–	–	–	–	–	2	–	–	–	–	–	1	–	1	3
Entomology	–	–	–	1	–	–	–	1	–	–	–	–	–	1	–	1	2
Horticulture	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	–	1
Nematology	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	1
Pathology	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	–	1
Range ecology	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	–	1
Soils	–	3	–	1	–	1	–	5	–	–	–	–	–	1	–	1	6
Subtotal, Plant/ Soil Science	2	8	–	5	–	2	2	15	–	–	–	–	–	5	–	5	22
Animal Science																	
Animal science, general	–	2	–	–	–	–	–	2	–	–	–	–	–	–	–	–	2
Animal breeding	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	1
Animal nutrition	–	–	–	–	–	1	–	1	–	–	–	–	–	1	–	1	2
Animal physiology	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	1
Animal production	–	1	–	1	–	–	–	2	–	–	–	–	–	–	–	–	2
Other (animal health)	–	2	–	–	–	2	–	4	–	–	–	–	–	–	–	–	4
Subtotal, Animal Science	–	5	–	1	–	5	–	11	–	–	–	–	–	1	–	1	12

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 20: Discipline of Teaching Professionals, 1984[a] (cont.)

Discipline Areas	Nationals								Expatriates								Total
	BSc		MSc		PhD		Subtotal		BSc		MSc		PhD		Subtotal		
	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	
Other Discipline Fields																	
Agricultural biochemistry	–	1	–	2	–	1	–	4	–	–	–	1	–	–	–	1	5
Agr.economics	–	1	–	3	–	–	–	4	–	–	–	–	–	1	–	1	5
Agr.engineering	–	1	1	2	–	1	1	4	–	–	–	–	–	1	–	1	6
Extension specialists	–	–	–	3	–	–	–	3	–	–	–	–	–	–	–	–	3
Food sciences(human)	1	–	–	–	1	–	2	–	–	–	–	–	–	–	–	–	2
Information specialists (library)	–	–	1	1	–	–	1	1	–	–	–	–	–	–	–	–	2
Rural sociology	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	1
Statistics	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	1
Communication	–	1	–	2	–	1	–	4	–	–	–	1	–	–	–	1	5
Home economics	1	–	1	–	–	–	2	–	–	–	1	–	–	–	1	–	3
Farm management	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	–	1
Farm structures	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	–	1
Farm power & machinery	–	2	–	2	–	–	–	4	–	–	–	–	–	–	–	–	4
Mathematics & physics	–	1	–	–	–	–	–	1	–	–	1	–	–	–	1	–	2
Biology	–	1	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1
Agric. education	–	–	–	2	–	–	–	2	–	–	–	–	–	–	–	–	2
Bachelor of Education	–	2	–	–	–	–	–	2	–	–	–	–	–	–	–	–	2
Subtotal, Other Disciplines	2	10	3	19	1	5	6	34	–	–	2	2	–	2	2	4	46
TOTAL	4	23	3	25	1	12	8	60	–	–	2	2	–	8	2	10	80

[a]This table excludes staff at diploma and certificate levels who are also engaged in teaching.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 21: Training Plans for Staff of the Training Institutions, 1984

Level	Crop Science		Animal Science		Economics		Other		Total	
	F	M	F	M	F	M	F	M	F	M
Doctorate	–	2	–	1	–	2	–	1[a]	–	6
Masters	–	4	–	2	1	–	–	4[b]	1	10
Bachelors	–	–	–	1	1	–	–	1	1	2

[a]Agricultural engineering.

[b]Agricultural engineering, farm mechanization.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

important to note that these institutions have received substantial donor contributions for capital improvements, technical assistance and training. The UK and USAID have supported Bunda College; CIDA has assisted the NRC.

At the time this report was written, Bunda College had a total recurrent budget of US$ 936,000 but no capital development budget. The NRC, on the other hand, had a recurrent budget of US$ 819,000 and a capital development account of US$ 5.3 million.

V. AGRICULTURAL EXTENSION INSTITUTIONS

A. Overview of Agricultural Extension in Malawi

The primary responsibility for agricultural extension service in Malawi rests with the Ministry of Agriculture through the Department of Agriculture (DOA). However, other institutions also conduct some extension programmes. The Department of Veterinary Service of the MOA has an extension programme and works closely with the DOA. The private Tea Research Foundation and Tobacco Research Authority both have small extension components to their programmes. Since these other programmes have already been described, the DOA will be the only institution described in this chapter.

B. Department of Agriculture

1. Organisational structure and purpose

The Department of Agriculture of the MOA is organised into nine technical sections and eight Agricultural Development Divisions, and is also integrated into the National Rural Development Programme (NRDP). The general organisation of DAD is shown in Figure 7.

The Ministry of Agriculture's Chief Agricultural Officer has overall responsibility for the service. At the headquarters in Lilongwe, in addition to the Chief Agricultural Officer and a deputy, are the nine technical sections, each headed by a subject matter specialist. These are: Extension and Training; a Women's Programme; Food and Nutrition; Land Husbandry; Credit; Extension Aids; Marketing; and Inputs and Crops (including a Horticultural Unit and Farm Machinery Extension).

The country has been divided into eight Agricultural Development Divisions (ADDs). Several subject matter specialists are posted in each ADD with skills relevant to its agriculture. The number of professional and technical staff in each ADD is shown in Table 22.

The next level of organisation is a Rural Development Project (RDP). There may be several such units in an ADD: the number ranges from two in the Koronga ADD to five in the Lilongwe ADD. (See Table 23.) There currently are 27 RDPs in all. The final level of organisation is the Extension Planning Area (EPA); there are several EPAs in each RDP, with a total of 180 in the country.

The subdivision of the country into eight ADDs has resulted in each having from 25,000 to 30,000 farm families. Each ADD is administered by a programme manager who is supported by two assistants and several technical specialists.

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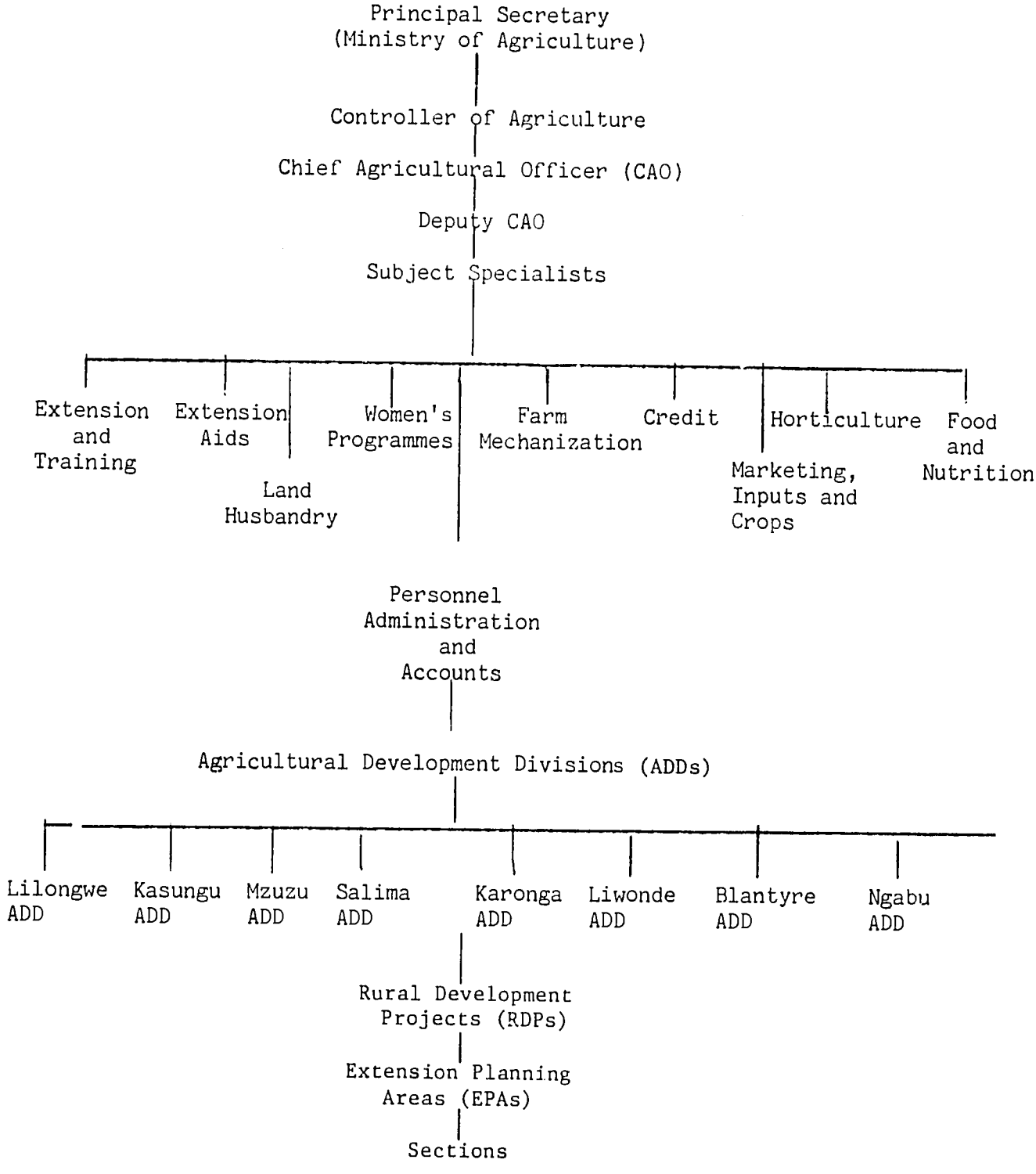

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Figure 7: Organisation Chart of the Department of Agriculture

Source: Data collected from the Department of Agricultural Development, Ministry of Agriculture, Lilongwe, 1983.

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 22: Agricultural Extension Institutions: Locations and Staff, 1984

Institution	Location of Regional Offices	Authorized Posts[a]	Professionals[b]				Technical				Total
			Nationals		Expatriates		Diplomate		Certificate		
			F	M	F	M	F	M	F	M	
Ministry of Agriculture, Department of Agriculture	Lilongwe (Headquarters)		18		-		3		5		26
	Lilongwe Agric. Development Division		20		3		154		632		809
	Blantyre Agric. Development Division		22		-		51		329		402
	Liwonde Agric. Development Division		16		3		38		258		315
	Ngabu Agric. Development Division		16		2		23		345		386
	Kasungu Agric. Development Division		24		3		41		287		355
	Karonga Agric. Development Division		4		1		24		179		208
	Mzuzu Agric. Development		13		2		44		255		314
	Salima Agric. Development Division		17		-		32		229		278
TOTAL		3,829	6	144	1	13	26	384	195	2,324	3,093

[a]Authorized posts and male/female data not available except for over-all totals.

[b]Academic degree holders.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

Table 23: The Subdivision of Agricultural Development Divisions into Rural Development Project Areas, Source and Amount of Funds

ADD	RDP	Funded by	Total Budget 1984/1985 (US$)
Karonga	Chitipa	IBRD/IDA	1,322,360
	Karonga	IBRD/IDA	
Mzuzu	Mzimba South	IBRD/IDA	
	Mzimba-Rukuru-Kasitu	IBRD/IDA	490,000
	Henga-kasitu	EDF	
	Nkhata Bay	IBRD/IDA	
Kasungu	Kasungu	IFAD	
	Mchinji	IFAD	
	Dowa West	IFAD	1,513,846
	Ntchisi	EDF	
Salima	Nkhotakota	EDF	
	Salima	EDF	2,636,154
	Bwanje	EDF	
Lilongwe	Lilongwe	IBRD/IDA	
	Lilongwe North-East	IBRD/IDA	4,190,526
	Thiwi-Lifidzi	IBRD/IDA	
	Ntcheu	IBRD/IDA	
	Dedza Hills	IBRD/IDA	
Liwonde	Kawinga	FRG	
	Namwera/Mangochi	ADB	
	Balaka	FRG	3,883,919
	Zomba	ADB	
Blantyre	Shire Highlands	ADB	
	Mwanza	Revenue	2,460,769
	Phalombe/Mulanje	UK	
Ngabu	Chikwawa	Revenue	1,026,025
	Nsanje	Revenue	

Source: Data collected from the Department of Agriculture Ministry of Agriculture, Lilongwe, 1983.

Forty Rural Development Projects (RDPs) are planned for phased implementation during a 15-20 year period; 27 are already in operation. Each RDP is headed by a Project Officer who is supported by a number of subject matter specialists. Senior Field Officers assist the Project Officers with the supervision of all field services, particularly agricultural extension. Project Officers are responsible for a number of Extension Planning Areas (EPAs) which geographically are relatively uniform. Each EPA has a headquarters with an office for the Field Supervisor (Development Officer) and day training facilities for both farmers and field staff. One female extension worker or farm house assistant, generally holding a certificate in agriculture with some further training in a specific field, is also based at each centre.

Each EPA is further subdivided into sections containing from 500 to 700 families, depending on such factors as the terrain, population density, and ease of communication. Each section is headed by a Field Assistant who holds a certificate in agriculture.

2. Extension programmes

Extension services are directed principally toward smallholder farmers. While priority is given to food crops such as maize, beans, cassava and millet, some attention is also given to smallholder cash crops such as groundnuts, cotton and rice. In the livestock category, cattle is the highest extension priority, followed by poultry and pigs. No extension services are provided for goats. The ADD staff also works closely with the DVS staff as the DVS carries out its animal health programmes.

Very few extension services are provided to the estate sector. Recently there have been requests for extension services for tobacco, despite the fact that the Tobacco Research Authority trains Field Assistants in tobacco production.

The emphasis of the extension effort is on improving productivity per unit of land. All extension workers are required to encourage their farmers to form or join Farmers' Clubs. Dairy farmers, for example, organise themselves into associations that sell milk, buy cross-bred heifers with calf on credit, and manage communal stall-feeders.

A system of committees or action groups is designed to disseminate policy and strategy issues to farmers. In each Field Assistant's Section there are Section Planning Committees which consist of representatives from Village Planning Committees. In turn, each Section Planning Committee nominates representatives to an EPA Planning Committee. Farmers and extension services are also represented on District Development Committees.

The Department of Agriculture has an Extension Aids Branch whose purpose is to disseminate useful information to the smallholder sector. The Branch has two mobile film units in each of four ADDs (Ngabu, Karonga, Salima and Lilongwe). It produces an annual average of: seven circulars on food crops, tea and tobacco; four circulars on livestock; and one circular on pastures (mainly for estate farmers). In addition to circulars, the Branch publishes bimonthly newsletters and farmers' magazines, and annual extension workers' guides.

The Branch also produces six radio programmes: "Modern Farming", "Farm Forum", "Farmer's Voice", "Family Serial", "Cotton Broadcast", and "Farmer's Notebook".

3. Human resources

a. Staffing patterns

About 17 percent of the authorised posts in the Department of Agriculture are vacant. Nonetheless, there are over 3,000 extension staff members, excluding the support staff. (See Table 24.) 124 of these are professional staff, each with at least a BSc or the equivalent. There are 514 technical officers, each with a diploma, 2,519 technical assistants, each with a certificate, and 1337 support staff. Excluding the support staff, women account for slightly over 7 percent of the staff.

About one-half of the professional extension staff time is related to multidisciplinary extension programmes, especially those involving soil and water conservation, farm management, farming systems, and rural women's programmes. (See Table 25.) An additional 22.5 percent of staff time is directed to extension dealing with commercial crop production (tea, coffee, tobacco, vegetables and fruit, and the short-term credit related to these crops). Food crop production accounts for about 16 percent of professional staff time, livestock extension for 12 percent.

While none of the professional staff holds a PhD, at headquarters three men have MSc degrees (two in extension and the other in land husbandry), and three men hold BSc degrees and diplomas in extension. The Department has one graduate horticulturist and a graduate social economist, also at Headquarters. The ADDs have eight economists with advanced degrees.

b. Staff training

The DOA has 11 staff members in degree-level training. Of these, two are women; one is studying home economics, the other food and nutrition. Of the men, four are studying crop sciences, one each is studying land husbandry, crop protection, and development planning, and two are studying farm management. (See Table 26.)

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 24: Total Agricultural Extension Staff, 1984

	Administrative	Professional[a]	Technical		Total
			Diplomate	Certificate	
Total Authorized Posts	26	162	591	3,060	3,839
Positions Vacant	1	38	81	541	661
Nationals (Citizens)					
Staff in training	4	15	3	-	22
Staff on long-term leave[b]	-	-	-	-	-
Number of nationals currently in authorized posts	25	114	510	2,519	3,168
Expressed as a percent of authorized posts	96	75	86	82	83
Expatriates					
Serving in authorized posts[c]	-	10	-	-	10
Expressed as a percent of authorized posts	-	7	-	-	1
Not in authorized posts	1	-	4	-	5
Total number of expatriates	1	10	4	-	15
Total Number of Staff	26	124	514	2,519	3,183

[a] Professional = BSc or above.

[b] Long-term leave is leave of three months or more.

[c] Irrespective of source of funds.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

Table 25: Summary of Professional Extension Staff Effort and Source of Funds Related to Programme Area, 1984[a]

Programme Area	Funding Source	FTE	Percentage of Total Staff Time[b]
Commodity-Related			
Food Crops	MOA		
Maize	MOA	6.5	6.5
Sorghum	MOA	1.5	1.5
Millet	MOA	0.5	0.5
Cassava	MOA	0.5	0.5
Pulses	MOA	0.4	0.4
Tubers	MOA	0.3	0.3
Other rice	MOA,Germany	2.0	2.0
Crops inputs	MOA	4.0	4.0
Subtotal, Food Crops		15.7	15.8
Commercial Crops			
Cotton	MOA	3.0	3.0
Tea	MOA, Tea Industry	1.5	1.5
Coffee	Smallholder Coffee Authority	3.0	3.0
Tobacco	MOA,Tobacco Association of Malawi	3.0	3.0
Vegetables	MOA	0.5	0.5
Fruit	MOA	0.5	0.5
Cash crop credit	MOA	11.0	11.0
Subtotal, Commercial Crops		22.5	22.6

Table 25: Summary of Professional Extension Staff Effort and Source of Funds Related to Programme Area, 1984[a] (cont.)

Programme Area	Funding Source	FTE	Percentage of Total Staff Time[b]
Livestock			
Cattle, beef and dairy	CIDA	2.5	2.5
Poultry	MOA	1.5	1.5
Veterinary	MOA, CIDA	1.5	1.5
Range management	West Germany	1.0	1.0
General animal husbandry	MOA, CIDA	5.5	5.5
Subtotal, Livestock		12.0	12.0
Multi-Disciplinary			
Farming systems	MOA, West Germany	3.0	3.0
Soil & water conservation	MOA	29.0	29.0
Farm management	MOA	7.5	7.5
Rural women programme	MOA	2.0	2.0
Economics	British VSO	8.0	8.0
Subtotal, Multi-Disciplinary		49.5	49.6
TOTAL		99.7	100

[a]This total represents estimated effort of discrete programme areas; additional staff effort not shown includes service activities as well as general extension and extension training services.

[b]Discrepancies between individual and subtotal percentages are due to rounding.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

MALAWI: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 26: Training Plans for Staff of Extension Institutions, 1984

Level	Crop Science		Other		Total[a]	
	F	M	F	M	F	M
Doctorate	-	-	-	-	-	-
Masters	-	5	1[b]	4[c]	1	9
Bachelors	-	-	1[d]	-	1	-

[a]Totals shown are far less than those indicated elsewhere because the remainder are in certificate and other short-term specialist training.

[b]Food and nutrition.

[c]Development Planning, crop protection and farm management.

[d]Home Economics.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

The majority of the field staff are either diploma- or certificate-holders who receive annual in-service training to acquaint them with new practices. Apart from local in-service training conducted by the DAR and the DVS, each year a number of staff members are sent outside the country for post-graduate training or specialised short courses.

4. Extension facilities

The Department maintains 147 day training centres, 121 residential training centres, and three farm institutes for training purposes. A day training centre and a demonstration facility are located at each EPA centre.

Day training centres each have a capacity for 20-30 participants, residential training centres for 30-100. Teaching facilities at the residential centres are more elaborate, and include demonstration gardens for field and horticultural crops, as well as areas for livestock and poultry. Agricultural courses each last one week; home economics courses last for two. While training is conducted year-round at the day training centres, residential training centres operate from the end of the growing season to the beginning of the next crop season.

Each ADD has its own fleet of vehicles, tractors and motorcycles. There is a total of 401 vehicles, of which 137 are at Lilongwe.

Linkages between the extension and research services of the MOA have already been discussed in the chapter on agricultural research.

5. Financial resources

The DOA funding amounts to K 56.03 million or US$ 43.1 million for the present year. Of this, about 42 percent is from the GOM revenue account and 58 percent is from donor agencies. (See Table 27.)

Table 27: Budget of the Department of Agriculture, 1980/81 to 1984/85
('000,000 US$)

	1980/81		1981/82		1982/83	1984/85
	Budgeted	Expended	Budgeted	Expended	Budgeted	Budgeted
Recurrent account	4.7	4.9	5.5	7.0	10.2	18.1
Capital account	14.9	15.1	20.3	22.1	18.1	25.0
TOTAL	19.6	20.0	28.8	29.1	28.3	43.1

Source: Data collected from the Department of Agricultural Development, Ministry of Agriculture, Lilongwe, 1983.

VI. CONSTRAINTS TO AND THE POTENTIAL FOR INCREASED PRODUCTIVITY

A. Food Crops

1. Maize

Maize is the main staple food of Malawi. Annual per capita consumption is 225 to 250 kg (shelled). At least 90 percent is produced by smallholders. Maize occupies about three-fourths of the cultivated area available to smallholders, although much of this is inter-cropped with beans, cowpeas, pigeonpeas, groundnuts and other crops. Average smallholder farmer yields are low (1,000 kg/ha), compared to those achieved by government research stations (reported to be as much as 9,000 kg/ha) and commercial estates (4,000-6,000 kg/ha).[1]

Malawi has moved from being an importer to a net exporter of maize in recent years, due in large part to a rise in relative farmgate prices of maize. In addition, while Malawi had to import food following the drought-damaged crop of 1980, it has not suffered from drought since then. In 1983, a record crop of 1.5 million MT of maize was produced. A sizeable surplus over and above domestic requirements during the 1982-83 season--about 100,000 MT--was exported in 1983. Surplus production is likely to be maintained during the 1983-84 harvest year.

There is little potential for expansion of the area planted to maize. If yields are to continue to increase under smallholder production, they must occur on a unit area basis to sustain Malawi's self-sufficiency and export status in the Southern African region.

Two types of maize are grown in Malawi:

- Composites (white flints and semi-flints) which are popular among local rural populations. These are less susceptible to pest (weevil) attack under field and storage conditions, and are well-adapted to traditional milling processes; and

- Hybrids, which are regarded as a cash crop to be sold by smallholder farmers to ADMARC. These are high-yielding under good management (e.g., with the use of fertiliser, etc). They are softer than the composites, however, do not store well, and have a less acceptable taste.

The slow rate of adoption of improved maize varieties is a major constraint to increased productivity. Less than 10 percent of the maize crop area is planted to improved varieties. The number of smallholder farmers using fertiliser on maize, while large, is not available. One reason for low maize productivity is that inputs for growing hybrid maize varieties are expensive and are not available in a timely manner. In areas marginal for maize production, the

probability of crop failure from low moisture may discourage the use of fertiliser. In this case, farmers may prefer to plant a larger area to maize and accept lower yields, rather than seeking higher yields from a smaller area, since this spreads their vulnerability to rainfall.[2]

In a survey conducted by the ARRA in 1983 to determine perceptions of smallholders' constraints to achieving higher yields of major crops, the inadequate distribution of rainfall was considered by far the most serious constraint regarding maize production. (See Table 28.)

2. Rice

Malawi produces both upland or rainfed (Faya) rice and irrigated (Blue Bonnet) rice. Most of the Blue Bonnet rice is exported, while Faya rice supplies domestic needs. Average smallholder farmer yields (1,100 to 2,900 kg/ha) are relatively low compared to those achieved under government research station conditions (2,300 to 4,000 kg/ha). This low productivity is attributed to:

- The susceptibility of the Faya rice to blast disease, lodging and grain shattering;
- A lack of acceptable, high-quality, moderate-yield potential, long-grained varieties of other than Blue Bonnet; and
- The susceptibility of Blue Bonnet to low temperatures at the seedling stage of growth, which retards its growth rate and extends the growing period well into the dry season.

In the ARRA survey, price policy was considered the most serious constraint to increased rice production.

3. Wheat

Wheat is grown in small quantities as a cool season (winter) crop in the Highland areas. Rainfed production has been severely limited by the climate and by predators. Local production meets less than 5 percent of national requirements. Yield estimates from smallholder production (500-900 kg/ha) are very low compared to those achieved on research stations and commercial farms (1,500 to 2,500 kg/ha). The major constraints appear to include the lack of adaptable varieties that could grow in the wet season, and the lack of supplemental irrigation facilities to sustain the cool season's wheat production. The ARRA survey respondents considered predators a serious constraint.

Table 28: Perceptions of Severity of Constraints to Achieving Higher Crop Yields[a]

Contraints	Maize	Sorghum	Pulses	Vegetables/ Fruits	Wheat	Rice	Cassava	Tobacco	Cotton	Average
Physical/Biological										
Climate	2.5	1.0	2.1	2.0	2.5	2.7	1.7	1.1	1.7	2.0
Annual rainfall	1.8	1.0	1.4	2.0	2.0	1.8	1.5	2.0	1.7	1.7
Rain distribution	3.9	3.0	2.6	2.3	3.0	2.7	1.8	2.3	2.7	2.8
Soil suitability	1.7	1.0	1.4	1.6	2.0	2.2	1.5	1.4	1.8	1.7
Soil degradation	2.6	1.5	1.4	2.0	1.5	2.4	2.4	2.6	2.0	2.1
Soil topography	1.5	1.0	1.4	1.6	2.5	2.4	2.2	1.2	2.1	1.8
Weeds	1.5	1.0	1.4	1.6	2.5	2.4	2.2	1.2	2.1	1.8
Plant diseases	1.8	1.0	2.2	2.3	2.5	2.2	3.1	2.8	1.5	2.2
Pests/Insects	2.3	3.0	2.2	3.0	1.5	2.7	2.7	2.1	3.5	2.6
Predators	1.9	2.0	1.1	1.3	3.5	2.2	2.0	1.1	1.2	1.9
Varieties/Species	2.8	3.5	2.1	1.6	2.5	2.7	3.0	1.8	1.4	2.4
Human power	2.4	2.0	1.6	2.0	3.0	2.5	1.4	2.0	2.5	2.2
Animal power	2.2	1.0	1.2	2.0	2.0	2.5	1.2	1.6	2.1	1.8
Economic/Policy										
Prices	2.2	4.0	3.0	2.5	2.0	3.6	2.8	2.8	3.5	3.0
Marketing	1.3	1.0	1.5	2.5	1.0	1.6	2.6	1.8	1.8	1.7
Short-Term credit	2.0	1.5	1.4	1.0	1.0	2.0	1.6	3.0	2.0	1.8
Long-Term credit	1.6	1.0	2.1	2.5	1.0	2.0	1.6	3.0	2.3	2.0
Government subsidy	1.1	1.0	1.0	1.0	1.0	1.6	1.5	2.0	1.0	1.3
Import policies	1.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1
Traditional										
Land tenure	1.2	1.0	1.0	1.0	1.0	1.1	1.0	1.6	1.0	1.2
Farm size	1.3	1.0	1.5	4.0	1.0	1.6	1.0	1.0	1.6	1.6
Education	1.9	1.0	1.1	2.0	1.0	1.7	1.6	1.8	2.0	1.6
Role of women	1.9	1.0	1.1	2.0	1.0	1.7	1.6	1.8	2.0	1.6
Institutional										
Research	1.9	1.0	1.1	2.0	1.0	1.7	1.6	1.8	2.0	1.6
Training	1.9	1.0	1.1	2.0	1.0	1.7	1.6	1.8	2.0	1.6
Extension	1.9	1.0	1.1	2.0	1.0	1.7	1.6	1.8	2.0	1.6
Overall Average	2.0	1.5	1.6	2.0	1.8	2.1	1.9	1.9	2.0	1.9

[a] Weighted average of respondent rankings: 1 = Not serious, 5 = Very serious. Number of Respondents varied by crop from 2 to 11.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1983/84.

4. Beans

Beans are an important part of the Malawian diet. They also benefit smallholder farming systems through their ability to fix nitrogen. Partly because of the latter characteristic, beans are grown in combination with several other crops, especially maize. Smallholder yields are generally lower than those achieved on research stations, where beans are usually grown in pure stands.

5. Sorghum/millet

In the pre-Independence days, sorghum and millet were important food crops in the semiarid rainfall (800 mm) areas, especially in the Upper and Lower Shire Valley. They have largely been replaced by more adaptable, short-duration maize varieties. Sorghum and millet are now mostly used for beer brewing. White sorghum and some bulrush millet are grown for feed. Smallholder yields are low at 250 to 2500 kg/ha as compared to 2500 to 3500 kg/ha on research stations. This is due to the lack of suitable, high-yielding, short-duration varieties. In the ARRA survey, price policy was considered a major disincentive for increased sorghum production.

B. Commercial Crops

1. Groundnuts

Groundnuts are particularly important to smallholder agriculture, since they contribute significantly to diet, provide between one-quarter and one-third of smallholder cash income, and improve soil fertility and structure. Both confectionary nuts and nuts for oil extraction are grown. Groundnuts are Malawi's fourth most important export crop, following tobacco, sugar and tea. They supply about 50 percent of the country's edible oil. Groundnut production has declined since the late 1960s, due to a combination of low relative prices paid to farmers and diseases, especially cercospora leafspot and rosette. Yields achieved by smallholder farmers (260 to 1,200 kg/ha) are low compared to the 1,500 to 3,000 kg/ha achieved on government research stations. This is due mainly to late planting. Groundnuts are planted late because they compete for labour with, and are considered secondary to, the main crops of maize and/or tobacco.

2. Cotton

Whereas cotton was grown as an estate crop in the early part of the century, in the early 1930s it became almost entirely a smallholder crop. The varieties grown have a medium-long, fine, strong fiber, and command a premium in the Liverpool market in the UK. Smallholder yields of 260 to 480 kg/ha are low compared to those of 2,000 kg/ha achieved on government research stations. Yields and production have fluctuated during the past two decades, without upward trends. To standardise production and output, the government policy

is that all producers will grow one variety until the next new variety is released, at which time all producers will switch to the new variety. Varieties are changed about every five years.

The high costs of production, especially the cost of insecticides, and the relatively low prices paid to the farmers for the product are considered the major constraints to increased cotton productivity. (See Table 28.) With slightly more favourable prices, insect control would receive more attention. The lack of access to capital and unavailability of inputs and sprayer parts for insecticides have also been constraints to cotton productivity.

3. Tobacco

Varieties of tobacco, especially the flue-cured, sun-air cured and oriental tobaccos, are important cash crops grown by smallholder farmers. Ten percent of the total is produced by smallholders. ADMARC has a market monopoly for smallholder tobacco. Farmers' production of these tobaccos is controlled by a quota system to help ensure product quality and market stability. Tobacco yields on smallholder farms are fairly static; yields of dark fire-cured tobacco (the type grown by 80 percent of smallholders) in the northern division have fluctuated around 375 kg/ha. Farmers reportedly use only some of the recommended practices, although the management practices used are fairly demanding. Smallholders do not use the full package of recommended technology because they do not seem to be sure that the extra expenses (for fertiliser, for example) would result in an increased return on their investment. While flue-cured tobacco is usually restricted to commercial estates, some 1,000 smallholders, under the auspices of the Kasungu Flue-cured Tobacco Authority, produce that tobacco more profitably than other tobaccos.

4. Tea, coffee and sugar

While tea traditionally has been produced on commercial estates, some 4,000 smallholder farmers grow about 2,000 ha of tea, under the auspices of the Smallholder Tea Authority. A similar Authority has been working to develop a smallholder coffee industry. Both these crops receive help from the UK-based Commonwealth Development Corporation. Sugar production under smallholder authority has been established since the inception of the second sugar mill at Dwangwa on the Central Lakeshore Littoral. Data comparing smallholder and commercial productivity for tea, coffee and sugar are not available.

C. Livestock

The cattle population increased by about 18 percent between 1976 and 1980, while that of sheep and goats declined by nearly 17 percent. The cattle herd is presently 870,000, and is growing at 5 percent per year.[3] Only about 4 percent of the total herd is held on commercial estates; ownership of cattle is limited to about 11 percent of all

rural families. Marketed offtake is currently 9-10 percent but, of this total, only about 25 percent pass through formal markets and the Cold Storage Company's abattoirs. In 1981 the smallholder fattening scheme (based on crop residues and some improved forages) involved about 1,500 head and contributed about one-third of higher-grade beef supplies, about two-thirds coming from a feedlot enterprise at Ngabu in the Lower Shire Valley.

In the ARRA study, a number of informed persons were surveyed concerning their perceptions of smallholders' major constraints to increased livestock productivity. The major constraints identified for beef were the climate, inadequate fodder and forage supplies, high prices of inputs, and herd and range management practices. (See Table 29.)

Overgrazing is a major problem in specific areas, due to communal ownership of grazing rights in which nobody takes responsibility for range management and improvement. However, the potential exists for the national herd to continue its expansion rate into the 1990s, after which time Malawi's carrying capacity in terms of natural communal grazing resources may have been reached. The main constraint to increased cattle productivity is the unavailability of sufficient high-quality forage during the dry months. The land tenure system also results in a lack of incentives for smallholder farmers to engage in improved pasture and management technology. The latter might be overcome through a more favourable pricing policy for animals offered for sale. So far, the increase in the cattle population has been attributed to an increase in dip tanks and improved cattle husbandry practices.

Milk production on the three major dairies (Blantyre, Lilongwe and Mzuzu) increased from 3.2 million litres in 1976 to 5.3 million litres in 1980, but in 1981 it decreased 26 percent from the 1980 production level. Lack of improved management of both the Malawi Zebu-Friesian cross dairy breeds and of forage resources appear to be the major constraints to increased milk production by smallholders in the three dairies.

Goats (720,000 head), pigs (200,000 head), sheep (85,000 head) and poultry (8,000,000) provide the main sources of meat in the rural areas. Only an insignificant proportion of these animals are marketed on a formal basis, or reach the Cold Storage Commission or urban butchers. This situation is unlikely to change in the foreseeable future.[4]

The nuclei of both commercial pig and poultry industries exist, although both are currently in decline as a result of a cost/price squeeze worsened by problems of feed availability and quality.

Table 29: Perceptions of Severity of Constraints to Achieving Higher Livestock Productivity[a]

Constraints	Beef Cattle	Dairy Cattle	Goats	Sheep	Pigs	Poultry	Average
Physical/Biological							
Climate	4.1	4.0	2.0	2.3	2.3	2.0	2.8
Annual rainfall	2.6	1.0	2.0	2.0	2.0	2.0	2.0
Rain distribution	3.0	1.0	2.3	2.3	2.0	2.0	2.2
Soil suitability	2.1	1.0	1.6	1.3	1.6	1.6	1.6
Soil degradation	2.0	1.0	1.0	1.6	1.0	1.0	1.3
Soil topography	2.0	1.0	1.3	1.3	2.0	1.3	1.5
Natural forage supply	4.0	NA[b]	NA	4.0	NA	NA	4.1
Fodder supply	4.3	NA	NA	5.0	NA	NA	4.7
Other fodder supply	4.0	NA	NA	4.0	NA	NA	4.1
Water supply	3.3	NA	NA	4.0	NA	NA	3.7
Water access	3.3	NA	NA	4.0	NA	NA	3.7
Disease prevention	3.6	NA	NA	5.0	NA	NA	4.4
Curative problems	3.1	4.0	1.0	3.0	2.3	2.3	2.7
Pests/Insects	3.2	2.0	2.0	2.3	2.0	2.0	2.3
Predators	2.3	1.0	1.6	1.6	1.3	3.3	1.9
Species/Breeds	3.2	1.0	2.5	3.0	3.0	5.0	3.0
Economic/Policy							
Input prices	4.3	NA	NA	3.0	NA	NA	3.7
Animal prices	3.3	1.0	3.3	2.0	2.6	2.6	2.5
Marketing	2.3	1.0	3.0	3.3	3.0	3.0	2.7
Short-Term credit	3.1	NA	1.0	2.0	2.0	2.0	2.1
Long-Term credit	3.0	3.0	1.0	2.0	2.0	NA	2.3
Government subsidy	2.5	NA	1.0	2.0	1.0	NA	1.7
Import policy	2.2	NA	1.0	2.5	1.0	NA	1.7
Traditional							
Land tenure	2.4	1.0	1.0	1.6	1.0	1.0	1.4
Farm size	3.7	3.0	1.0	2.0	NA	1.0	2.2
Farm labor	3.6	NA	NA	2.0	NA	NA	2.9
Education	2.3	NA	NA	1.0	NA	NA	1.7
Role of women	2.0	NA	NA	1.0	NA	NA	1.6
Management Factors							
Herd management	4.0	NA	NA	4.0	NA	NA	4.1
Range management	4.6	NA	NA	4.0	NA	NA	4.4
Health management	3.6	NA	NA	4.0	NA	NA	3.9
Overall Average	3.2	1.8	1.7	2.7	1.9	2.2	2.8

[a]Weighted average of respondent rankings: 1 = Not serious, 5 = Very serious. Number of respondents varied by type of livestock from 2 to 6.

[b]NA = Not Available, Not Applicable or No Answer.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1983/84.

D. Summary of Major Constraints to Achieving Increased Productivity of Crops and Livestock

Annual rainfall variation (amount and distribution) has such marked effects on rainfed crop yields that yield trends are difficult to discern, even when area and production figures are available. Smallholders use such a large portion of their land and labour resources to produce maize for food that improved maize technology is central to increasing smallholder productivity. Better smallholder maize technology would free land and labour that could be used for other productive enterprises, and thus would increase family incomes. Similarly, a technology that would allow the integration of draught oxen into smallholder farming would supply power for early-season land preparation and weeding, allow more crops to be planted earlier and thus take advantage of the full growing season. In the Upper and Lower Shire Valley, better semiarid cereal crops technology could provide smallholders with a more dependable food supply.

The marketing structure and pricing policies, the lack of capital for purchase of inputs, and the high risk associated with large debts in relation to annual family cash flows have had a major influence on the level of technology used by smallholders (e.g. in tobacco and cotton) for farm enterprises. If smallholder productivity is to increase, a more favourable economic environment and a flow of improved technology that fits smallholder needs are required. The more favourable economic environment must develop as the research system continues to provide policy-makers with a more comprehensive information base for their decisions. Improved technologies that fit smallholders' production needs will come from an infusion of essential resources and a reorientation of the research system to be adaptive in its approach.

For livestock, the existing network of veterinary and marketing services to the sector is fairly well developed, but it requires additional funding for both capital and operating costs. The Department of Animal Health and Industry in the Ministry of Agriculture operates 44 rural markets which are well used; however, losses estimated at an average of 50 kg livemass per cattle head are experienced by cattle trekking from northern markets to the Lilongwe Abattoirs. Furthermore, the existing trek route system requires rehabiltation. The Cold Storage Company, the main commercial wholesaler, has a low throughput of 24 percent of capacity in its abattoirs; it makes an average annual return of about 16 percent only because of its monopoly trade in the purchase and export of hides and skins. However, the little competition between the Cold Storage Company and butchers maintains a relatively buoyant beef cattle market.

The principal constraint to the livestock sector is the inappropriate nature of existing pricing guidelines. At present, pricing guidelines are laid down by Ministry of Agriculture (for producer prices) and Ministry of Trade, Industry and Tourism (for

wholesale and retail prices). The two Ministries operate different review mechanisms at which representations are made by commercial producers, wholesalers, and butchers. There is no firm data base on which the various decisions can be taken, and questionable criteria are used. This has resulted in the cost/price squeeze in which commercial producers have found themselves, and has contributed to the near-collapse of the pig and poultry industries.

Little research work has been done on goats and sheep to evaluate their present potential or to indicate the scope for improvement by cross-breeding.

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[1]Department of Agricultural Research, Ministry of Agriculture, Malawi: Guidelines for Preparing an Agricultural Research Master Plan 1983, Lilongwe, Malawi.

[2]International Service for National Agricultural Research, Report to the Government of Malawi - A Review of the Agricultural Research System in Malawi, August 1982.

[3]Booker Agriculture International, Limited, Livestock and Meat Study Final Report, Vol. 1.

[4]Ibid.

VII. STAFF ASSESSMENT OF INSTITUTIONS

A. Agricultural Research

In the opinion of some DAR senior staff interviewed, a limited recurrent budget places a serious constraint on research activities.

The rapid expansion of DAR's professional staff, and the fact that 60 percent of them have served less than five years, have resulted in a shortage of experienced researchers to guide the newer personnel. The older researchers tend to be drawn in o administration, because promotional opportunities and salaries in the professional positions continue to be less than in the administrative positions.

The senior staff also indicated that laboratories and equipment are inadequate and that the quality of work by service and maintenance staff is sometimes hampered by a shortage of spare parts.

In the DVS, the inadequate recurrent budget was reported by both respondents as a serious constraint on the Department's ability to accomplish its objectives. They especially noted constraints on funds for travel. The service and maintenance staff were reported as being unsatisfactory and inexperienced.

A senior official of the Tea Research Foundation indicated that continuity in research was seriously hampered by the loss of qualified staff who obtain more attractive posts in urban areas. The need for continuity also conflicts with the need for younger staff to continue their off-site training.

According to staff members, the Tobacco Research Authority has had to restrict its research programmes as a result of budget limitations.

B. Agricultural Training

At Bunda College, the three staff members interviewed were of the opinion that, while the recurrent budget for teaching and research were both inadequate, the research budget was more inadequate than the teaching budget. Further training of present staff and of additional staff are sorely needed. The respondents estimated that four additional classrooms and laboratories are needed. At present, since laboratories are small, faculty must provide several sessions of a given class. While there may be a large number of post-secondary school students interested in undertaking studies in agriculture, the capacity of the college will limit enrollment.

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C. Agricultural Extension

According to staff members interviewed, the limited recurrent budget seriously hampers the Department of Agriculture's ability to accomplish its objectives. The lack of sufficient funds has especially serious implications for projects not included in the recurrent budget, which are expected to run on programme income or obtain outside support.

Staff members felt that the most limiting result of the budget constraint was the lack of sufficient funds to maintain the DOA's fleet of vehicles, motorcycles and tractors. When compared to the number of staff (Table 24), the estimated number of available vehicles (401), motorcycles (400) and tractors (34) seems small. Both limitations together impede farm visits by DOA's staff.

It was felt that the senior technical staff are inadequately trained. There are no specialised personnel, with the exception of the land husbandry staff. Even the subject matter specialists have not received specialisation in their respective fields of work. The accounting staff in the Department is both understaffed and poorly-trained.

The lack of inputs and their untimely delivery are considered other serious problems for the ADD. For example, in most years the supply of fertiliser has been inadequate and has been delivered late due to transport problems beyond the government's control.

Senior officials in the Department feel that, even though they have access to research, many of the research findings have little to offer in solving farmers' problems. It was felt that researchers do not have adequate funds to undertake research which would be useful to extensionists, and that, since there were very poor linkages between research, extension and smallholders, research generally was not problem-oriented. With the creation of adaptive research units, however, the relevance of research to small farmers' problems should improve.

The high percentage of vacancies--17 percent of DOA's authorised posts--imposes a serious limitation on the dissemination of information by the Department.

VIII. CONCLUSIONS AND RECOMMENDATIONS

The constraints discussed in Chapters VI and VII will not be reviewed in detail in this chapter. Those which are viewed as being highly significant will be noted in relation to the actions recommended.

A. Strengthening Malawi's Agricultural Institutions

1. Research institutions

Several courses of action which were recommended in earlier studies[1] and have already been initiated should continue to be implemented. These include:

- Strengthening links between the research programmes and staff and those of the ADD;
- Increasing significantly the coordination between research and extension in implementing development programme goals, particularly at the local level; and
- Strengthening farmer involvement in the research system, particularly at the local level, including increased on-farm adaptability trials and farmer evaluations of research technologies.

In addition to these, the following actions seem essential:

- Provision of research programmes and projects with adequate and timely recurrent budget support which is consistent with the design of the activity and adequate for the tasks proposed; and
- Increases over time in the investments in agricultural research from the present 0.3 percent of the agricultural GDP to a level within the 1.0 to 2.0 percent level recommended by international agencies.[2]

2. Training institutions

Efforts to amalgamate the training institutions offering certificate-level training are essentially complete at this time. Bunda College should now be upgraded to offer MSc degrees in a few disciplines, building on its respected experience as a diploma- and BSc degree-granting institution. These degrees should be offered particularly in crop production and, over time, in animal production. There are well-recognised advantages to doing in-country training for advanced degrees, rather than using institutions abroad where the agricultural focus and technologies used may not be relevant to Malawi's situation.

3. Extension institutions

The discussion above on research institutions indicates the current strengthening of linkages between extension and research, especially at the local level. The information gathered in this ARRA strongly supports further recommended action, currently under consideration, to shift the emphasis of extension to achieve an overall programme which is better balanced between food and commercial crops.

The conclusions and recommendation discussed in the following sections in relation to crop and livestock production will include further suggestions for research and extension.

B. Dealing with Constraints Affecting Crop Production

1. Food crops

The direct, physical and biological constraints to food crop production discussed earlier include:

- Limited new land for expansion of cultivation;
- Limited and irregularly-distributed rainfall; and
- Unavailability of locally-adapted, high-yielding varieties.

The indirect constraints include:

- Inappropriate pricing policies and inadequate marketing;
- High costs of, and limited access to, inputs; and
- Nonacceptance of present technological packages by smallholders.

A large portion of Malawi's agricultural research human resources (38 percent) and financial resources are directed to the commercial crop sub-sector. The trend of decreasing surpluses of food crops provides a strong reason to reexamine research priorities and extension foci. There should, therefore, be increased investments in the refinement, on-farm testing, and extension of technologies appropriate to smallholder conditions, to increase production of food crops in general and of maize in particular.

The development of improved technological packages for smallholder food crop production is dependent upon increased understanding of the agronomic factors which directly constrain crop production and of the socioeconomic factors which influence farm-level practices. Combining social and economic research with more conventional biological and physical research would allow issues to be

addressed such as price policy, alternative marketing strategies, input pricing, access to credit, smallholder decision-making and motivation, and similar indirect constraints to expanding productivity. Without including these as part of the research matrix, policies and programmes leading to successful and widespread adoption of production-increasing technologies cannot be developed. For example, specific economic analyses might include cost-benefit studies of alternative approaches to meeting smallholders' needs for power and machinery or for supplemental irrigation. The direction and focus of research and extension efforts and the curricula for lower-level training institutions are apt to be affected by a new balance of agronomic and socioeconomic investigations.

2. Commercial crops

The direct, physical and biological constraints commercial crop production noted earlier include:

- Limited availability and irregular distribution of rainfall;
- Limited availability of and experience with irrigation; and
- Limited experience in meeting international quality standards.

The indirect constraints include:

- Inadequate marketing services and price policies;
- Limited access to credit; and
- Limited access to and utilisation of inputs and technology by smallholder producers.

Increased production of most of Malawi's commercial crops (cotton, maize, groundnuts, coffee, tea and tobacco) is largely dependent on improved yields from smallholder production. Research programmes must take into account the practical limitations facing smallholders, including those of resources, labour and draught power, land (soils and topography), climate, and management skills. Commercial crop research should continue to focus on the breeding and management of crops adapted to the various ecological zones (and to the variation in available rainfall); however, it should emphasise the development of practices appropriate to smallholder resources and management skills. The research programme should include on-farm experiments with supplemental irrigation. On-farm demonstration programmes of the Extension Service should be improved as well to provide better and more convincing proof of the economic benefits of the technical packages recommended.

Many of the indirect constraints which have been identified by agricultural experts in Malawi (e.g., that farmgate prices and untimely credit are major factors impeding production) are often based on conventional wisdom. These assumptions need to be carefully researched so that policy decisions can be made which will truly be effective in improving cash crop productivity.

C. Dealing with Constraints Affecting Livestock Production

1. Beef and dairy cattle

The direct, physical and biological constraints to production of beef and dairy cattle include a number related to poor animal nutrition: poor-quality rangeland, inefficient pasture and range management practices, limited forage, and poor feed storage practices. In addition, livestock breeding has not focussed on improved breeds which are well-adapted to smallholders' conditions and management potential. The indirect constraints, noted earlier, are related to livestock marketing, access to and terms of credit, and access to inputs and technology.

The coordination between the DAR crops research units and the DVR pasture and range research units should be improved. Joint DAR and DVR research programmes could be developed collaboratively and implemented cooperatively which would draw on the complementary skills and experiences of both crop researchers and pasture/range management researchers. Both research units would benefit from a "team research" approach to large animal pasture, range, nutrition and feed storage programmes. Such programmes would be of value to both dairy and beef cattle research programmes. Similarly, extension and training activities should also be more closely coordinated in this area.

There is little hard evidence to support or repudiate opinions regarding the possible effects of price or simplified marketing and credit provisions on smallholder production of large animals. Research programmes should be established to analyse and evaluate the potential impacts of alternative marketing and pricing policies on smallholder livestock production.

2. Small stock and poultry

The direct, physical and biological constraints to increased productivity of small stock include poor breeds and breeding practices, poor nutrition, disease and internal parasites, and non-intensive husbandry and management practices. The indirect constraints identified include: limited access to and poor quality of commercial (and local) feeds; importation policies (both for breeding stock and for animal products); inappropriate price policies; and poorly-understood rural traditions and taboos.

Small stock--goats, sheep, pigs--and poultry have been the subject of little research in Malawi. A research programme should be developed which includes the following elements:

- A breeding and selection programme to develop breeds which are well-adapted to smallholders' resource base and management capabilities;
- Continued investigation of the nutritional content of local plants and by-products;
- Development of standards for feedstuffs, concentrates, and additives; and
- Development of field-tested management practices, including general care and sanitation, to upgrade production.

Improving the extension and information services to smallholders on management practices alone has potential for substantial improvements in production. These efforts, however, must be sensitive to local traditions, and should not establish unrealistic targets or expectations.

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[1]International Service for National Agricultural Research, Report to the Government of Malawi - A Review of the Agricultural Research System in Malawi (the Hague, Netherlands: International Service for National Agricultural Research, 1982).

[2]Ibid.