



AgEcon SEARCH

RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

Statistical Brief

No. 3

September 1993

Statistical Brief on the National Agricultural Research System
of
MALAWI

Johannes Roseboom
Philip G. Pardey

ISNAR INDICATOR SERIES PROJECT: PHASE II
International Service for National Agricultural Research
with support from
the Government of Italy
and
Special Program for African Agricultural Research (SPAAR)

ISNAR INDICATOR SERIES PROJECT PHASE II

Decision making in the agricultural research policy area in either domestic, regional, or international fora can only be aided by access to reliable and comprehensive data on these systems. It is for this reason that ISNAR initiated its Indicator Series Project in 1986. The major objective of this project is to collect, process, and analyze reliable and comprehensive time-series data on national agricultural research systems (NARSs) throughout the world in order to identify and report on major trends and emerging policy issues with regard to the development of NARSs. To this end a database has been developed that contains time-series data on agricultural research expenditures and personnel for more than 150 developing and developed countries. These data provide a quantitative basis for more in-depth research policy studies by ISNAR and others.

During the first phase of the project (1986-91), the Indicator Series project team produced two major publications published by Cambridge University Press, namely:

Pardey, P.G., and J. Roseboom. (1989) *ISNAR Agricultural Research Indicator Series: A Global Data Base on National Agricultural Research Systems*, 547 pp.; and

Pardey, P.G., J. Roseboom, and J.R. Anderson, eds. (1991) *Agricultural Research Policy: International Quantitative Perspectives*, 462 pp.

The first publication is a statistical reference volume that provides system-level data on agricultural research personnel and expenditures for 154 countries. The second publication draws on the database to report on the major policy dimensions of agricultural research, with a primary focus on less-developed countries.

Phase II of the Indicator Series Project was initiated in 1992 and seeks to update the database and the policy analyses that accompany it. New ISNAR survey data are being used in conjunction with a large variety of published and "informal" reports in order to produce reliable as well as up-to-date information and statistics about the NARSs.

The country-level data are being published in a series of NARS Statistical Briefs. These briefs include more detailed descriptive information about the institutional structure of the NARS as well as a more comprehensive set of statistics than were reported in the 1989 Indicator Series volume. It is envisaged the country-level data will be assembled and analyzed in a series of regional research reports.

These statistical briefs are not official ISNAR publications; they are not edited or formally reviewed by ISNAR. The information and data presented have been collected and compiled with due care and all reasonable efforts have been made to ensure their accuracy. Comments, corrections, and additions to the material reported in this brief are welcomed. These briefs may be cited with due acknowledgment.

ISNAR ♦ P.O. Box 93375 ♦ 2509 AJ The Hague, The Netherlands.
Tel: (31) (70) 349-6100 ♦ Fax: (31) (70) 381-9677
Email: Internet: ISNAR@CGIAR.ORG

Statistical Brief on the National Agricultural Research System

of

MALAWI

Johannes Roseboom

Philip G. Pardey

ISNAR INDICATOR SERIES PROJECT: PHASE II

Acknowledgments

The authors are especially grateful to C.J.A. Makato for undertaking the data collection in Malawi. They would also like to thank Nienke Beintema for her very able research assistance and Fionnuala Hawes for assistance in preparing the graphics for this report and general secretarial support to the project. Helpful comments and assistance with data gathering were obtained from G.K.C. Nyirenda, B. Ndisale, T.P.E. Makhambera, D. Twedde, Z.M. Kasomekera, R.C.J. Mkandawire, A.M. Whittle, M. Dagg, and B. Nestel.

Contents

1.	Introduction	1
2.	Agricultural Research Institutions	2
	2.1 Historical Evolution	2
	2.2 Present Structure	4
3.	NARS Statistics	6
	3.1 Long-Term Development	6
	3.2 Human Resources	7
	3.3 Financial Resources	9
	3.4 Research Focus	10
	Bibliography	14
	Appendix 1: Country background information	17
	Appendix 2: Definitions and concepts	18
	Appendix 3: Organizational charts of the agricultural research institutes	20
	Appendix 4: Addresses of the agricultural research institutes	22
	Appendix 5: Researcher and research expenditure totals, 1961-91	23
	Appendix 6: Research staff development by institute, 1961-91	25

Acronyms

ARCM	Agricultural Research Council of Malawi	IITA	International Institute of Tropical Agriculture
BCA	Bunda College of Agricultural	ILCA	International Livestock Center for Africa
CC	Chancellor College	ILRAD	International Laboratory for Research on Animal Diseases
CIAT	International Centre for Tropical Agriculture	ISNAR	International Service for National Agricultural Research
CIDA	Canadian International Development Agency	JFRO	Joint Fisheries Research Organization
CIP	International Potato Centre	MARE	Malawian Agricultural Research and Extension Project
CIMMYT	International Centre for Maize and Wheat Improvement	NARP	National Agricultural Research Project
DANIDA	Danish International Development Agency	NARS	National Agricultural Research System
DAR	Department of Agricultural Research	NTRA	Nyasaland Tea Research Association
DVS	Department of Veterinary Services	ODA	Overseas Development Agency (UK)
FAO	Food and Agricultural Organization	OECD	Organization for Economic Cooperation and Development
FRIM	Forestry Research Institute of Malawi	SACCAR	Southern African Centre for Cooperation in Agricultural Research
FRU	Fisheries Research Unit	TRF	Tea Research Foundation of Central Africa
FTE	Full-Time Equivalents	TRIM	Tobacco Research Institute of Malawi
ICIPE	International Centre for Insect Physiology and Ecology	UNDP	United Nations Development Program
ICLARM	International Center for Living Aquatic Resources Management	UNESCO	United Nations Educational, Scientific and Cultural Organization
ICRAF	International Centre for Research in Agro-forestry	USAID	United States Agency for International Development
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics		
IDRC	International Development Research Centre (Canada)		

1. Introduction

The primary purpose of this brief is to provide various statistical and institutional details on the development and current status of the public agricultural research system in Malawi. This information has been collected and presented in a systematic way in order to inform and thereby improve research policy formulation with regard to the Malawi NARS. Most importantly, these data are assembled and reported in a way that makes them directly comparable with the data presented in the other country briefs in this series. And because institutions take time to develop and there are often considerable lags in the agricultural research process, it is necessary for many analytical and policy purposes to have access to longer-run series of data.

NARSs vary markedly in their institutional structure and these institutional aspects can have a substantial and direct effect on their research performance. To provide a basis for analysis and cross-country, over-time comparisons, the various research agencies in a country have been grouped into five general categories; government, semi-public, private, academic, and supranational. A description of these categories is provided in table 1.

Table 1: *Institutional Categories*

Category	Description	Examples
Government	Agencies directly administered by government.	Research department within a ministry
Semi-public	Agencies not directly controlled by government and with no explicit profit making objective.	Research institute under a commodity board
Private	Agencies whose primary activity is the production of goods and services for profit.	Agricultural machinery or chemical company
Academic	Agencies that combine university-level education with research.	Faculty of agriculture
Supranational	Agencies whose mandate covers more than one country.	CGIAR institutes

Note: Adapted from OECD (1981).

The concept of a NARS used throughout this report includes only those institutes that can be classified as government, semi-public, and academic agencies. Where it is useful to do so, private and supranational research agencies have been discussed, but for reasons of comparability they are not included in the NARS data reported here. More detailed information on the definitions and concepts used in this brief is provided in appendix 2.

Section 2 provides a brief description of the institutional development and current structure of the NARS. Section 3 presents a statistical overview of the longer-run investment trends in agricultural research along with a more detailed look at contemporary investment orientations. The appendices provide further descriptive details and present the basic research personnel and expenditure data in disaggregated fashion. For general background information and statistics on Malawi we refer to appendix 1.

2. Agricultural Research Institutions

2.1 Historical Evolution¹

Agricultural research in Malawi began at the turn of this century. It was undertaken largely as a sideline activity in the course of providing general agricultural services by the colonial government's Department of Agriculture and commodity organizations such as the Empire Cotton Growing Organization. This early research primarily involved varietal screening trials on various experimental farms for export commodities such as coffee, cotton, tea, tobacco, and tung.

The research division of the locally administered Department of Agriculture established its first agricultural research station in 1940 at Bvumbwe. This was followed by stations at Chitedze (1949), Mbawa (1950), Chitala (1955), Ngabu (1967), Lunyangwa (1969), Makoka (1969), Baka (1972), Lifuwu (1975), Kasinthula (1975), and Mkondezi (1989). Not mentioned here are several stations that over the course of the past 50 years were established but subsequently closed down.

At independence in 1964, the research division of the Department of Agriculture, which eventually evolved into the Department of Agricultural Research (DAR), was staffed with 22 researchers, of whom 21 were expatriates. The department's research focused mainly on export crops, particularly tea, tobacco, and cotton, while livestock research received only marginal attention. In 1967, cotton research was transferred from DAR to the Agricultural Research Council of Malawi (ARCM). Financial support for cotton research was provided at that time by the Cotton Research Corporation (previously the Empire Cotton Research Corporation) and the British Cotton Growing Association. When, in 1975, ARCM ceased to exist, the responsibility for research on cotton, grain legumes, and soil productivity shifted to DAR. In 1979, research on tobacco was transferred from DAR to the newly established Malawi Tobacco Research Authority.

In 1985 DAR was transformed from a fairly decentralized association of research stations, wherein the officers-in-charge were directly responsible for all research projects at their respective stations, to a nationally coordinated and integrated institute with a multidisciplinary team-approach to research. The department was reorganized into five commodity research programs, one adaptive research program, and a technical services unit. Each of the programs is led by a national research coordinator who is a senior research scientist responsible for overseeing the scientific aspects of the various research activities but not their administration.

Also in 1985, a new (see below) Agricultural Research Council (ARC) was formed within the Ministry of Agriculture as the research policy advisory board for DAR. ARC's main function is to establish the overall orientation of the department's research program, approve programs and budgets, and release government funds to DAR.

In 1961 the Federation of Rhodesia and Nyasaland (today's Zimbabwe, Zambia, and Malawi) established the Agricultural Research Council of Central Africa with support from the British government. The Council, modeled after the Agricultural Research Council of East Africa, soon

1. The material presented in this section draws largely from Agricultural Research Council of Malawi (1972), Maida (1982), ISNAR (1982), Welsch, et al. (1987), Department of Agricultural Research (1988), and World Bank, et al. (1991).

established its own research activities and facilities in each of the countries alongside the national research facilities. But the Council disbanded after only a few years in operation as a result of the dissolution of the federation in 1963. In Malawi the research activities of the regional council were taken over by the Agricultural Research Council of Malawi (ARCM), established in 1967. The British government paid 80% of the initial capital needed to set up ARCM and more than half its recurrent budget during its first three years of operation. In 1970, the forestry research activities of the Council were transferred to the newly established Forestry Research Institute of Malawi (FRIM). ARCM was finally abolished in 1975 and its cotton, grain legumes, and soils research was transferred to DAR.

The earliest veterinary research in Malawi can be traced to the establishment of the Department of Veterinary Services in 1929. The oldest existing research laboratory in the country, the Animal Diseases Diagnostic Laboratory in Blantyre, was established in 1951. In 1973 the country's veterinary research capacity was substantially expanded when the Central Veterinary Laboratory was built at Lilongwe with support from the Danish government. The Blantyre station and a station at Mzuzu are presently regional subsidiaries of the Central Laboratory.

Forestry research formally began in Malawi with the establishment of a Silvicultural Research Branch within the Department of Forestry in 1957. In 1969 the Research Branch was transformed into the Forestry Research Institute of Malawi (FRIM) to facilitate collaboration with ARCM. It remained, however, a public institute within the Forestry Department. Collaboration with ARCM began in 1967 and ended in 1971. During that period ARCM supplied two or three researchers to FRIM.

The first fish from Lake Malawi to be collected and preserved date from the expeditions of Dr. Livingstone in the late 1850s. For a long time research on the Lake Malawi fisheries was restricted to taxonomic studies of preserved collections in natural history museums. In 1939, the first fisheries survey of the lake was conducted, followed by a survey of the southeastern arm of the lake during the years 1945-47.

The first fisheries research station was established at Nkhata Bay in 1954 under the Joint Fisheries Research Organization (JFRO) of the Governments of Northern Rhodesia and Nyasaland. In 1961 JFRO was disbanded and the Nyasaland fisheries research activities were transferred to the Monkey Bay Research Station, established in 1962. In 1965 the Fisheries Department was created within the Ministry of Forestry and Natural Resources. The Fisheries Research Unit of the Fisheries Department has had significant collaboration with the University of Malawi as well as with several foreign agencies such as FAO and ICLARM.

Historically, research on tobacco production in Malawi was strongly linked to the Tobacco Research Board of Rhodesia and Nyasaland which was based in Southern Rhodesia (Zimbabwe). After Malawi gained independence in 1964 this regional collaboration ceased and DAR assumed responsibility for tobacco research. In 1980 a parastatal organization, the Malawi Tobacco Research Authority, was created and took over the research on tobacco from DAR. Following the creation of a trust fund by the Tobacco Association of Malawi, the Tobacco Research Institute of Malawi (TRIM) was established in 1989 with a mandate to carry out tobacco research.

Tea research in Malawi began in 1929 when British tea planters established the Nyasaland Tea Research Association (NTRA), initially to investigate the problem of "tea yellows". However, when the Tea Association of Central Africa formed in 1934, NTRA dissolved and the responsi-

bility for research passed to the colonial government, which set up a special unit in the Department of Agriculture. At the end of 1959, the responsibility for tea research again reverted to the industry and since that time a major share of the financing of tea research has been borne by the Malawi tea industry. At first the industry took direct responsibility for operating the tea research stations, but in 1966 it established the Tea Research Foundation of Central Africa (TRF) to directly oversee the operations of these stations. TRF also receives funds from the tea industry in Zimbabwe and Zambia and, in past years, from some tea estates in South Africa and Mozambique.

Bunda College of Agriculture (BCA) was established as part of the University of Malawi in 1966. The university received substantial support from USAID to set up the college and undertake a program of staff development. BCA provides education primarily at the Diploma and BSc level. Post-graduate degrees have been granted to individual candidates since the early 1970s. In 1987 full-time post-graduate programs were initiated. Although restricted by their teaching responsibilities and availability of research funds, faculty are reported to spend around 25% of their time doing research (ISNAR 1992).

Chancellor College became part of the University of Malawi in 1965. The college has a wide range of departments, spanning from biology and chemistry through to history and law. It is the Department of Biology that undertakes some crop and fisheries research.

2.2 Present Structure

The present structure of the national agricultural research system of Malawi is given in table 2. The Department of Agricultural Research (DAR) is the principal agricultural research organization in Malawi with more than half of the country's total number of FTE researchers. Its research mandate covers crop and livestock production, natural resources, agro-forestry, farming systems, and agricultural engineering. Veterinary, fisheries, and forestry research are essentially covered by units of other government departments.

Research on Malawi's two major export crops, tobacco and tea, is conducted by two semi-public research organizations. They are not funded from general government revenues but through a cess on exports, sales of products, and donor support.

The academic component of the NARS comprises Bunda College of Agriculture and the Department of Biology of Chancellor College. Together they represent a substantial number of relatively well-trained professionals. However, faculty spend most of their time on teaching. In addition, the limited amount of time available for research is spread across numerous individuals, disciplines, and research areas.

Not included in table 2 is the research unit of the Sugar Corporation of Malawi. The unit was established in 1968 to undertake research for a private-for-profit organization and employs one or two researchers. There is no publicly sponsored or executed research on sugar in Malawi.

The Malawian NARS is linked to a wide variety of regional and international research organizations and donors. A good deal of Malawi's regional collaboration is channeled through SACCAR. The international centers, including ICRISAT, CIMMYT, IITA, CIAT, CIP, ILCA, ILRAD, ICIPE, ISNAR, ICLARM, and ICRAF, all have provided support of one sort or another, with varying degrees of intensity, during the past decade. The two major donors to the system are USAID and the World Bank, but DANIDA, CIDA, FAO, IDRC, ODA, and UNDP, to mention but a few, have also provided (financial) support.

Table 2: Overview of Present NARS Structure

Institutional category	Executing agency				Staffed research sites ^a	Number of researchers			FTEs
	Supervising agency	Name	Acronym	Research focus		National	Expats	Total	
Government	Ministry of Agriculture	Department of Agricultural Research	DAR	Crops, livestock, agro-forestry, natural resources, farming systems, and agricultural engineering	13 (10)	12	106	106.0	
		Department of Veterinary Services	DVS	Veterinary medicine	3 (3)	9	18	18.0	
	Ministry of Forestry and Natural Resources	Fisheries Department, Fisheries Research Unit	FRU	Fisheries	1 (1)	4	9	8.8	
		Forestry Department, Forestry Research Institute of Malawi	FRIM	Forestry	1 (1)	11	11	11.0	
Semi-public	Tobacco Research Authority	Tobacco Research Institute of Malawi	TRIM	Tobacco	2 (2)	13	13	13.0	
		Tea Research Foundation	TRF	Tea and coffee	3 (2)	15	18	18.0	
	University of Malawi	Bunda College of Agriculture	BCA	Crops (in particular dry beans), livestock, agroforestry, fisheries, agr. engineering, and socio-economics	1 (1)	27	31	7.8	
Academic	Chancellor College, Department of Biology	Department of Biology		Crops and fisheries	1 (1)	6	10	2.4	
					25 (21)	179	37	216	184.9
Total									

Source: 0999.

Note: The information in this table refers to 1991. ^a Staffed with researchers and/or technicians. Bracketed sites are staffed with researchers.

The organizational structure of DAR, DVS, FRU, FRIM, TRIM, TRF, BCA, and CC are shown in diagrammatic form in appendix 3. As discussed in section 2.1, DAR's new organizational structure consists of five commodity-oriented programs (cereals; grain legumes, fibers, and oil-seeds; livestock and pastures; soils, land husbandry, and agricultural engineering; and horticulture), one adaptive research program, and one technical services unit. Each commodity program comprises several multidisciplinary research teams. These teams are led by a commodity team leader who is an active research scientist located at a research station where that crop is especially important.

The Adaptive Research Program consists of eight adaptive research teams, one in each of the eight Agricultural Development Divisions into which the country has been divided. The teams work in collaboration with counterparts in extension with regard to on-farm testing and adaptation of the technologies developed by the commodity programs. They also identify technical and socio-economic problems faced by the farmers and bring them to the attention of the appropriate commodity research team.

DAR's Technical Services unit is a conglomeration of activities that do not fit in one particular commodity program such as soil and plant analyses and library and information services, or activities that are more service- than research-oriented, such as plant protection and quarantine services and the regulation of pesticides.

3. NARS Statistics

Questionnaire responses were received from DAR, DVS, FRU, TRF, and Bunda College and combined with data and information from sources cited at the conclusion of this report. More detailed institutional level data are provided in appendices 5 and 6.

The expenditure data presented in this brief include an estimate of donor expenditures on salaries and supplements of expatriate researchers that were presumed not to be included in the expenditure data reported by the national institutes (see appendix 2 for details).

3.1 Long-term development

Both in terms of research staff and expenditures the Malawian NARS has grown steadily during the past three decades (table 3). Since expenditures have grown somewhat slower than the number of researchers, expenditures per researcher have declined, in keeping with the trend noted in most other sub-Saharan African countries (Pardey, Roseboom, and Anderson 1991).

The number of researchers per million farmers has more than tripled during the past three decades and has remained above the regional average throughout the whole period.

Agricultural research expenditures as a percentage of AgGDP have fluctuated markedly over the past three decades due to instability in both the research expenditure and agricultural output series. By contrast with most other less-developed countries, Malawi has experienced relatively high levels of support for agricultural research. In 1961-65, developing countries spent, on average, half a percent of AgGDP on agricultural research and in 1981-85 nearly one percent. In both periods, Malawi spent more than double this developing-country average.

Table 3: *NARS Researcher and Expenditure Series, 1961-91*

	1961-65	1966-70	1971-75	1976-80	1981-85	1986-90	1991	annual growth rate ^a
								%
Researchers (FTEs)	34.4	62.6	86.8	113.2	141.3	158.7	184.9	6.1
Expenditures (millions 1985 Kwachas per year)	4.209	7.292	8.712	9.802	11.006	13.091	12.652	4.0
Expenditures (millions 1985 PPP dollars per year)	9.174	15.894	18.988	21.365	23.989	28.532	27.576	4.0
Expenditures per researcher (1985 PPP dollars per year)	267,000	259,000	219,000	189,000	170,000	181,000	149,000	-1.9
Number of farmers (millions)	1.7	1.9	2.0	2.2	2.4	2.6	2.7	1.7
Researchers per million farmers	19.9	32.9	42.5	51.0	58.2	60.7	67.8	4.3
AgGDP (million 1985 PPP dollars)	721	831	1020	1297	1293	1428	1670	2.9
Expenditures as a % of AgGDP	1.26	1.88	1.81	1.66	1.85	2.02	1.66	1.2

Source: See appendices 5 and 6.

Note: Includes DAR, ARCM, DVS, FRU, FRIM, TRIM, TRF, BCA, and CC-Biology Department.

^a Least squares growth rate for the 1961-91 period.

3.2 Human Resources

Degree and Nationality Status of Researchers

Table 4 presents a fairly detailed, long-run view of developments concerning the country's agricultural research staff. At independence in 1964, all but one of the country's research positions were held by expatriates. BSc-level training in the agricultural sciences in Malawi did not get underway until 1966. Although quite a number of Malawians were appointed to research positions during the first ten years of independence, the research system remained heavily reliant on expatriate researchers. In fact, the number of expatriate researchers increased until the early 1970s. It was only in the second half of the 1970s that the number of national researchers exceeded the number of expatriate researchers. By 1991 expatriate researchers accounted for less than 20% of the research staff compared with nearly 100% in 1964.

In addition to the nationalization of the research staff, table 4 reveals a significant and sustained improvement in the educational status of the national research staff. Initially the major growth of the national research staff was in the BSc category. More recently, however, post-graduate staff have increased at a more rapid rate and since 1981-85 the number of national researchers with a BSc degree has actually decreased in absolute terms.

Table 4: *Educational and Nationality Status of Researchers*

Institutional category	Researcher status	1961-65	1966-70	1971-75	1976-80	1981-85	1986-90	1991
		<i>(full-time equivalents)</i>						
Government	PhD	0	1.2	1.7	4.3	9.7	9.6	14.0
	MSc	0	1.5	6.5	19.1	20.6	51.6	72.8
	BSc	1.0	8.6	20.1	46.8	65.5	47.3	31.0
	Subtotal	1.0	11.2	28.3	70.2	95.9	108.6	117.8
	Expat	30.4	38.9	41.5	19.4	12.1	15.4	26.0
	<i>Total</i>	<i>31.4</i>	<i>50.1</i>	<i>69.8</i>	<i>89.5</i>	<i>108.1</i>	<i>124.0</i>	<i>143.8</i>
Semi-public	PhD	0	0	0	0	0	4.4	5.0
	MSc	0	0	0	1.1	3.0	1.9	2.0
	BSc	0	0	2.4	3.3	8.6	13.9	21.0
	Subtotal	0	0	2.4	4.5	11.6	20.2	28.0
	Expat	3.0	6.8	7.2	8.3	9.1	4.2	3.0
	<i>Total</i>	<i>3.0</i>	<i>6.8</i>	<i>9.6</i>	<i>12.8</i>	<i>20.7</i>	<i>24.4</i>	<i>31.0</i>
Academic	PhD	0	0.5	1.0	0.8	3.3	5.3	6.0
	MSc	0	0.3	0.2	0.8	2.8	3.4	1.8
	BSc	0	0.3	1.0	2.0	1.6	0.2	0.5
	Subtotal	0	1.1	2.2	3.5	7.7	8.9	8.3
	Expat	0	4.6	5.2	7.3	5.0	1.4	1.9
	<i>Total</i>	<i>0</i>	<i>5.7</i>	<i>7.4</i>	<i>10.9</i>	<i>12.6</i>	<i>10.3</i>	<i>10.1</i>
Total	PhD	0	1.6	2.7	5.1	13.0	19.4	25.0
	MSc	0	1.8	6.7	21.0	26.4	57.0	76.5
	BSc	1.0	8.9	23.5	52.1	75.7	61.3	52.5
	Subtotal	1.0	12.3	32.9	78.2	115.2	137.7	154.0
	Expat	33.4	50.2	53.9	35.0	26.2	21.0	30.9
	<i>Total</i>	<i>34.4</i>	<i>62.6</i>	<i>86.8</i>	<i>113.2</i>	<i>141.3</i>	<i>158.7</i>	<i>184.9</i>

Source: see appendix 6.

Note: These data were constructed by first estimating the average proportion of staff in each category in each period for those institutions for which data are available, and then applying this proportion to the respective personnel totals.

Gender

Over the period 1985 to 1991, between six and eight percent of Malawi's agricultural researchers were female. Most of them were employed by DAR, while two institutes, FRU and TRF, had no female researchers.

Staff Composition

Table 5 provides a detailed breakdown of each institute's total permanent staff. The number of technical support staff per researcher ranges between 2.1 (FRU) and 4.7 (DVS). A long-run data series (1965-88) indicates that DAR has maintained a rather stable ratio of around four technical support staff per researcher (ISNAR 1982 and Swanson et al. 1986).

Table 5: *Staffing Structure*

Staff Category	DAR		DVS		FRU		TRF	
	1986-90	1991	1986-90	1991	1986-90	1991	1986-90	1991
	<i>(number of personnel)</i>							
Research ^a	92	106	na	18	5	9	13	18
Support ^b								
Technical	360	369	na	84	16	19	54	47
Administrative	179	158	na	12	7	7	13	13
Other	623	611	na	0	23	28	1058	1068
Sub-total	1162	1138	na	96	46	54	1125	1128
Total	1254	1244	na	114	51	63	1138	1146

Source: 999.

^a Includes nationals and expatriates. Directors, deputy directors, and so on, are included in this category if they have a research background. The financial director, however, is classified as administrative support staff.

^b Technical and administrative support staff are defined as those staff that have at least a secondary education plus additional professional training or equivalent experience.

The “administrative support” and “other support” categories exhibit much more variation among the different institutes. DAR has a relatively large administrative support staff, while TRF employs a large number of “other support” staff (agricultural laborers, watchmen, drivers, and the like). A closer look at the data provided by TRF shows that a significant share of its funding is derived from the sale of tea (table 8), which suggests TRF operates substantial tea plantations requiring relatively large numbers of laborers.

3.3 Financial Resources

Expenditures

Table 6 provides a breakdown of agricultural research expenditures by institutional category. One of the more apparent findings is that the share of the government institutes in agricultural research declined substantially from 92% in 1961 to 59% in 1991. By contrast, the semi-public institutes grew most rapidly, increasing their share of total expenditures from 8% to 32% over the 1961-91 period. Part of this trend can be attributed to the fact that tobacco research was transferred from DAR to TRIM in 1980.

Table 6: *Agricultural Research Expenditures*

Institutional category	1961-65	1971-75	1981-85	1986	1987	1988	1989	1990	1991
	<i>(millions 1985 PPP dollars per year)</i>								
Government	8.175	15.080	16.971	16.683	25.451	18.879	18.062	18.145	16.313
Semi-public	0.933	2.082	4.699	5.339	5.280	6.365	8.456	7.526	8.740
Academic	0.066	1.826	2.320	2.698	2.653	2.446	2.106	2.571	2.523
Total	9.174	18.988	23.989	24.720	33.384	27.690	28.623	28.243	27.576

Source: 0999.

The annual data for the years 1986 to 1991 reveal a substantial degree of instability in total real agricultural research expenditures. This partly reflects the high rate of inflation experienced in

Malawi during the late 1980s (prices more than doubled between 1985 and 1989) but is also the consequence of major capital investments funded by donors in certain years.

Factor Mix

Table 7 provides a breakdown of the expenditures by cost category. It shows very volatile shares of expenditures going into the different cost categories, particularly for DAR and TRF. For both institutes most of the fluctuation stems from the capital and training expenditures. These expenditures are mainly paid by donors. In the bottom half of the table a breakdown of recurrent local expenditures (i.e., net of donor-sourced funds) is provided. This expenditure component is much more stable. Overall, operating and maintenance expenditures appear not to have given way to personnel expenditures as so often is the case.

Table 7: *Breakdown of Expenditures by Cost Category*

Institute	Cost category	1985	1986	1987	1988	1989	1990	1991
<i>(percentages)</i>								
<i>Total expenditures (including donor contributions)</i>								
DAR	Personnel	46.1	35.3	20.1	32.0	na	na	44.1
	Operating	41.8	31.4	23.0	19.0	na	na	32.2
	Maintenance	1.9	1.3	1.1	6.4	na	na	4.4
	Training	0.0	27.0	0.4	2.2	na	na	8.8
	Capital	10.3	5.0	55.4	40.4	na	na	10.6
	Total	100	100	100	100	na	na	100
FRU	Personnel	na	48.4	43.0	47.8	56.1	69.8	77.4
	Operating	na	25.1	17.9	26.4	16.3	14.0	10.6
	Maintenance	na	6.0	8.1	8.8	4.8	3.1	6.5
	Training	na	0.0	0.0	0.0	0.0	0.0	0.0
	Capital	na	20.5	31.0	17.0	22.9	13.1	5.6
	Total	na	100	100	100	100	100	100
TRF	Personnel	43.1	43.6	44.0	40.4	24.8	24.7	41.4
	Operating	26.3	29.3	26.2	23.5	21.9	22.2	25.9
	Maintenance	10.3	13.4	11.8	9.7	7.3	7.7	10.0
	Training	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Capital	20.2	13.7	18.0	26.3	46.1	45.3	22.7
	Total	100	100	100	100	100	100	100
<i>Local recurrent expenditures (excluding donor contributions)</i>								
DAR	Personnel	46.8	47.2	39.2	48.6	na	na	46.1
	Operating	50.9	50.7	58.0	38.5	na	na	47.4
	Maintenance	2.3	2.1	2.8	13.0	na	na	6.5
FRU	Personnel	na	41.3	49.9	40.6	45.0	48.1	48.6
	Operating	na	47.3	34.6	44.5	42.5	42.5	31.9
	Maintenance	na	11.4	15.5	14.8	12.5	9.4	19.5
TRF	Personnel	42.0	38.5	44.6	43.3	38.3	41.1	48.7
	Operating	41.6	42.2	38.3	40.1	46.4	43.7	37.0
	Maintenance	16.3	19.3	17.2	16.6	15.4	15.2	14.3

Source: 0999.

Source of Funds

While the dependency on expatriate researchers has declined markedly over the past 30 years, the financing of agricultural research in Malawi has remained heavily reliant on donor-sourced funds (table 8). Although complete data are not available for all institutes, the donor share has remained well above 40% for most years after 1984. The two years 1985 and 1986 appear to be exceptional in this regard. They fall between a major training and capital investment project funded by USAID that ran from 1980 to 1984 and two major projects that were launched in the second half of the 1980s, namely the National Agricultural Research Project (NARP) funded by the World Bank and the Malawi Agricultural Research and Extension Projects (MARE) funded by USAID.

Table 8: *Source of Funding*

Institute	Source of funding	1984	1985	1986	1987	1988	1989	1990	1991
					<i>(percentages)</i>				
DAR	Government	49.1	71.2	65.0	28.5	37.6	na	na	45.3
	Sale of products	0.0	3.0	2.6	1.5	2.0	na	na	0.0
	Donor	50.9	25.8	32.4	70.0	60.4	na	na	54.7
	Total	100	100	100	100	100	na	na	100
DVS	Government	15.0	na	na	na	na	10.0	29.8	12.0
	Sale of products	0.0	na	na	na	na	0.0	0.0	0.5
	Donor	85.0	na	na	na	na	90.0	70.2	87.6
	Total	100	na	na	na	na	100	100	100
FRU	Government	na	na	58.0	59.2	50.5	39.7	33.4	25.2
	Sale of products	na	na	0.0	6.1	1.9	5.1	1.6	0.9
	Donor	na	na	42.0	34.7	47.6	55.2	65.0	73.9
	Total	na	na	100	100	100	100	100	100
TRF	Sale of products	na	49.2	34.7	23.5	19.8	10.7	25.3	19.8
	Taxes	na	30.5	47.0	31.0	38.7	19.4	49.9	46.6
	Interest	na	1.9	0.7	1.0	0.3	4.4	3.8	0.3
	Donor	33.5	18.5	17.5	44.5	41.2	65.6	21.0	33.4
	Total	100	100	100	100	100	100	100	100
BCA	Government	na	51.1	50.1	49.8	51.5	46.8	49.3	48.4
	Donor	na	48.9	49.9	50.2	48.5	53.2	50.7	51.6
	Total	na	100	100	100	100	100	100	100
Donor funding (weighted average)		50.9	27.5	33.4	64.1	55.7	62.5	43.1	53.4

Source: 0999 and 0005.

Note: Expatriate staff costs have been included in donor contribution.

3.4 Research Focus

In 1991, the total research staff of the NARS spent 49% of their time on crop research, 16% on livestock research, 10% on forestry research, 6% on fisheries research, 6% on natural resources, and 13% on non- or cross-commodity research. In the latter category, some 60% was spent on

farming-systems research, 25% on agricultural engineering, and the remaining 15% on socio-economic topics.

The crops receiving most attention are tea and tobacco. Of the 90 FTE researchers working on crops in 1991, 15 of them worked on tea and 13 on tobacco research. Livestock research at DAR focuses mainly on cattle, at DVS on animal diseases, and at BCA on swine and small ruminants.

Agro-forestry falls within DAR’s mandate, while FRIM undertakes a program of research in silviculture, tree breeding, forest soils, pest and disease control, and wood utilization.

Table 9: *Research Focus, 1991*

Research focus	DAR	DVS	FRU	FRIM	TRIM	TRF	BCA	CC	Total	
									FTE	Share
									<i>(full-time equivalents)</i>	
									%	
Crop	55.6	0	0	0	13.0	18.0	2.3	1.2	90.1	48.7
Livestock	10.9	18.0	0	0	0	0	1.6	0	30.5	16.5
Forestry	8.2	0	0	11.0	0	0	0	0	19.2	10.4
Fisheries	0	0	8.8	0	0	0	0.3	1.2	10.3	5.6
Natural resources	10.9	0	0	0	0	0	0.6	0	11.5	6.2
Other	20.4	0	0	0	0	0	3.0	0	23.4	12.6
Total	106.0	18.0	8.8	11.0	13.0	18.0	7.8	2.4	184.9	100.0

Source: 0999.

Note: The “natural resources” and “other” categories include research that could not otherwise be allocated to a specific commodity or commodity group. The natural resource category refers to unallocatable soils, land use, and water research.

Bibliography

This bibliography comprises three different sets of references. The “references” section relates to references cited in the text, the “data sources” to references from which data have been extracted to construct the time series (see appendix 5 and 6), and “other references” to references that have been consulted in the process of data collection but not used.

References

Agricultural Research Council of Malawi (ARCM). *The Annual Report of the Agricultural Research Council of Malawi 1971*. Thondwe, Malawi: ARCM, 1972.

Department of Agricultural Research. *Agricultural Research Master Plan*. Lilongwe: Ministry of Agriculture, July 1988.

Europa Publications. *Africa South of the Sahara 1992*. 21st Edition. London: Europa Publications Ltd., 1992.

FAO. *AGROSTAT Diskettes*. Rome: FAO, 1993.

ISNAR. *Report to the Government of Malawi: A Review of the Agricultural Research System of Malawi*. The Hague: ISNAR, August 1982.

Maida, J.H.A. “Development and Administration of Agricultural Research and Its Contribution to Agricultural Development in Malawi.” 1982. Mimeo.

OECD. *The Measurement of Scientific and Technical Activities: Frascati Manual 1980*. Paris: OECD, 1981.

Pardey, P.G., and J. Roseboom. *ISNAR Agricultural Research Indicator Series: A Global Data Base on National Agricultural Research Systems*. Cambridge, UK: Cambridge University Press, 1989.

Pardey, P.G., J. Roseboom, and J.R. Anderson, eds. *Agricultural Research Policy: International Quantitative Perspectives*. Cambridge, UK: Cambridge University Press, 1991.

Pardey, P.G., J. Roseboom, and B.J. Craig. “A Yardstick for International Comparisons: An Application to National Agricultural Research Expenditures.” *Economic Development and Cultural Change* Vol. 40, No. 2 (January 1992): 333-349.

Roseboom, J., and P.G. Pardey. “Measuring the Development of National Agricultural Research Systems.” *Scientometrics* Vol. 23, No. 1 (1992): 169-190.

Summers, R., and A. Heston. “The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950-1988.” *The Quarterly Journal of Economics*, May 1991.

Swanson, B.E., et al. “An INTERPAKS Case Study of the Agricultural Technology System in Malawi.” INTERPAKS / University of Illinois, Urbana, Illinois, March 1986. Mimeo.

UNESCO Office of Statistics - Division of Statistics on Science and Technology. *Manual for Statistics on Scientific and Technological Activities*. Paris: UNESCO, June 1984.

Welsch, D., J. Flora, H. Foth, T. Westing, and G. Hansen. *Malawi: Bunda Agricultural College*. AID Project Impact Evaluation Report No. 64. Washington, D.C.: AID, July 1987.

World Bank. *World Tables Diskettes (Version 2.5)*. Washington, D.C.: World Bank, April 1992.

World Bank, UNDP, CEC, and FAO. *Fisheries and Aquaculture Research Capabilities and Needs in Africa*. World Bank Technical Paper No. 149. Fisheries Series. Washington, D.C.: World Bank, 1991.

Data Sources (listed by source code)

0005 SADCC, and DEVRES, Inc. *Agricultural Research Resource Assessment in the SADCC Countries, Volume II: Country Report Malawi*. Washington, D.C.: DEVRES, Inc., January 1985.

0010 Boyce, J.K., and R.E. Evenson. *National and International Agricultural Research and Extension Programs*. New York: Agricultural Development Council, Inc., 1975.

0011 ISNAR. *Report to the Government of Malawi: A Review of the Agricultural Research System of Malawi*. The Hague: ISNAR, August 1982.

0027 Harvey, N., ed. *Agricultural Research Centers: A World Directory of Organizations and Programmes*. Seventh Edition, Two Volumes. Harlow, U.K.: Longman, 1983.

239 “Development and Administration of Agricultural Research and Its Contribution to Agricultural Development in Malawi.” n.d. Mimeo.

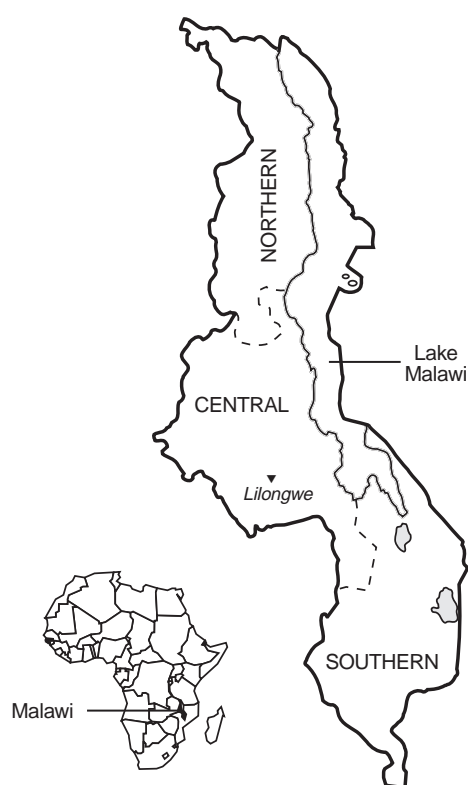
0242 Commonwealth Agricultural Bureaux (CAB). *List of Research Workers in Agricultural Sciences in the Commonwealth 1981*. Slough, England: CAB, 1981.

0243 Commonwealth Agricultural Bureaux (CAB). *List of Research Workers in the Agricultural Sciences in the Commonwealth and*

- in the Republic of Ireland 1978. Slough, England: CAB, 1978.
- 0244 Commonwealth Agricultural Bureaux (CAB). *List of Research Workers in the Agricultural Sciences in the Commonwealth and in the Republic of Ireland 1975*. Slough, England: CAB, 1975.
- 0279 Commonwealth Agricultural Bureaux (CAB). *List of Research Workers in the Agricultural Sciences in the Commonwealth and in the Republic of Ireland 1972*. Slough, England: CAB, 1972.
- 0285 Commonwealth Agricultural Bureaux (CAB). *List of Research Workers in the Agricultural Sciences in the Commonwealth and in the Republic of Ireland 1969*. Slough, England: CAB, 1969.
- 0286 Commonwealth Agricultural Bureaux (CAB). *List of Research Workers in Agriculture, Animal Health and Forestry in the Commonwealth and in the Republic of Ireland 1966*. Slough, England: CAB, 1966.
- 0439 Swanson, B.E., et al. "An INTERPAKS Case Study of the Agricultural Technology System in Malawi." INTERPAKS / University of Illinois, Urbana, Illinois, March 1986. Mimeo.
- 0467 DEVRES, Inc. *The Agricultural Research Resource Assessment Pilot Report for Botswana, Malawi and Swaziland*. Washington, D.C.: DEVRES, Inc., November 1983.
- 0532 UNESCO Field Science Office for Africa. *Survey on the Scientific and Technical Potential of the Countries of Africa*. Paris: UNESCO, 1970.
- 0589 Kassapu, S. *Les Dépenses de Recherche Agricole dans 34 Pays d'Afrique Tropicale*. Paris: Centre de Développement de l'OCDE, 1976.
- 0653 Webster, B.N. *Index of Agricultural Research Institutions and Stations in Africa*. Rome: FAO, n.d.
- 0871 Department of Agriculture Nyasaland/ Malawi. *Annual Report of the Department of Agriculture for the Years 1959/60, 1960/61, 1963/64, and 1967/68*. Part II. Zomba, Nyasaland/Malawi: The Government Printer, various years.
- 0922 Hilmi, H.A. *World Compendium of Forestry and Forest Products Research Institutions*. Rome: FAO, 1986.
- 0925 Vernon, R., ed. *Directory of Research Workers in Agriculture and Allied Sciences*. Oxon, United Kingdom: CAB International, 1989.
- 0947 Nyiira, Z.M. *Research Resources in National Research Institutions in Eastern and Southern Africa*. Canada: IDRC, April 1991.
- 0976 Burley, J., F.B. Armitage, R.D. Barnes, et al. *Forestry Research in Eastern and Southern Africa*. Oxford: Oxford Forestry Institute, 1989.
- 0999 ISNAR. "Survey of National Agricultural Research Systems: Unpublished Questionnaire Responses." ISNAR, The Hague, 1992. Mimeo.
- 1000 Association of Universities of the British Commonwealth. *Commonwealth Universities Yearbook*. London: The Association of Commonwealth Universities, various years.
- 1004 Ntokotha, E.M. *Recruitment and Selection of Staff in the Department of Agricultural Research, Malawi: A Case Study*. Training Research Series Human Resource Management No. 12. The Hague: SACCAR, and ISNAR, October 1990.
- 1005 Agricultural Research Council of Malawi (ARCM). *The Annual Report of the Agricultural Research Council of Malawi 1971*. Thondwe, Malawi: ARCM, 1972.
- 1006 Welsch, D., J. Flora, H. Foth, T. Westing, and G. Hansen. *Malawi: Bunda Agricultural College*. AID Project Impact Evaluation Report No. 64. Washington, D.C.: AID, July 1987.
- 1007 Hoffmann, H.K.F. *Strengthening Bunda College of Agriculture, University of Malawi*. FAO/UNDP Project Formulation Mission 4-27 November 1977. FAO, n.d..
- 1012 *Agricultural Research Centres: A World Directory of Organizations and Programmes*. Ninth Edition, Two Volumes. Harlow, U.K.: Longman Group UK, 1988.
- 1014 FAO. *Provisional Forestry Research Compendium for Africa*. Addis Ababa, Ethiopia: FAO, September 1984.
- Other Sources (listed by source code)**
- 0002 SADCC, and DEVRES, Inc. *Agricultural Research Resource Assessment in the SADCC Countries, Volume I: Regional Analysis and Strategy*. Washington, D.C.: DEVRES, Inc., January 1985.
- 0014 Judd, M.A., J.K. Boyce, and R.E. Evenson. "Investing in Agricultural Supply." Economic Growth Center, Yale University, New Haven, Connecticut, 1983. Mimeo.
- 0016 Oram, P.A., and V. Bindlish. *Resource Allocations to National Agricultural Research: Trends in the 1970s*. The Hague and Washington, D.C.: ISNAR and IFPRI, November 1981.
- 0022 UNESCO. *Statistical Yearbook 1983*. Paris: UNESCO, 1983.
- 0023 Bennell, P. *Agricultural Researchers in Sub-Saharan Africa: An Overview*. Working

- Paper No. 4. The Hague: ISNAR, October 1985.
- 0026 Oram, P.A., and M. Gieben. "Document Summaries." ISNAR, The Hague, 1984. Mimeo.
- 0073 Oram, P.A., and V. Bindlish. "Investment in Agricultural Research in Developing Countries: Progress, Problems, and the Determination of Priorities." IFPRI, Washington, D.C., January 1984. Mimeo.
- 0163 CGIAR. "National Agricultural Research." CGIAR, Washington, D.C., 1985. Mimeo.
- 0164 Association for the Advancement of Agricultural Sciences in Africa (AAASA). *Proceedings of the Workshop on Agricultural Research Administration, Nairobi, Kenya, 27-30 June 1977*. Proceedings Series PE-4. Addis Ababa, Ethiopia: AAASA and IDRC, August 1979.
- 0165 Evenson, R.E., and Y. Kislev. *Agricultural Research and Productivity*. New Haven: Yale University Press, 1975.
- 0175 Cooper, St.G.C. *Agricultural Research in Tropical Africa*. Kampala: East African Literature Bureau, 1970.
- 0238 World Bank. "Malawi National Rural Development Program Review." World Bank, Washington, D.C., 1982. Mimeo.
- 0240 Ministry of Agriculture — Department of Agricultural Research. "Staff and Expenditure — Department of Agricultural Research." Ministry of Agriculture, Malawi, 1981. Mimeo.
- 0241 Department of Agricultural Research — Ministry of Agriculture. *Malawi Agricultural Research Strategy Plan*. Malawi: Ministry of Agriculture, September 1983.
- 0266 UNESCO. *National Science Policies in Africa*. Science Policy Studies and Documents No. 31. Paris: UNESCO, 1974.
- 0287 Commonwealth Agricultural Bureaux (CAB). *List of Research Workers in Agriculture, Animal Health and Forestry in the British Commonwealth, the Republic of Sudan and the Republic of Ireland 1959*. Slough, England: CAB, 1959.
- 0360 Cooper, St.G.C. "Towards Trained Manpower for Agricultural Research in Africa." Paper presented at the Conference on Agricultural Research and Production in Africa, organized by the Association for the Advancement of Agricultural Sciences in Africa (AAASA), Addis Ababa, 29 August-4 September 1971.
- 0385 SADCC, and DEVRES, Inc. *SADCC Region Agricultural Research Resource Assessment — Data Base Management Information System: Diskettes and User's Guide*. Printouts. Washington, D.C.: SADCC, and DEVRES, Inc, n.d.
- 0400 UNESCO. *The Promotion of Scientific Activity in Tropical Africa*. Science Policy Studies and Documents No. 11. Paris: UNESCO, 1969.
- 0445 Swanson, B.E., and W.H. Reeves. "Agricultural Research Eastern and Southern Africa: Manpower and Training." World Bank, Washington, D.C., August 1986. Mimeo.
- 0446 Kyomo, M.L. "Agricultural Research in Eastern and Southern Africa: Issues and Priorities." Southern African Centre for Cooperation in Agricultural Research of SADCC, Gaborone, Botswana, 1986. Mimeo.
- 0738 Mkandawire, N.A. "Study on Small Countries Research: Report on Malawi." IDRC, Ottawa, April 1986. Mimeo.
- 0740 Sands, C.M. "The Theoretical and Empirical Basis for Analyzing Agricultural Technology Systems." PhD diss., University of Illinois, Urbana-Champaign, Illinois, 1988.
- 0847 Kimura, J.H. "Financial and Administrative Management of Research Institutions in Eastern and Southern Africa: Report on Responses to a Questionnaire." In *Promotion of Technology Policy and Science Management in Africa*, edited by Karl Wolfgang Menck and Wolfgang Gmelin. Bonn: Deutsche Stiftung für Internationale Entwicklung (DSE), 1986.
- 0852 Evenson, R.E., and Y. Kislev. *Investment in Agricultural Research and Extension: A Survey of International Data*. Center Discussion Paper No. 124. New Haven, Connecticut: Economic Growth Center, Yale University, August 1971.
- 0872 Department of Agricultural Research Malawi. *Annual Report of the Department of Agricultural Research for the Years 1971/72, 1972/73, and 1973/74*. Zomba, Malawi: The Government Printer, various years.
- 0886 Evenson, R.E., and Y. Kislev. "Investment in Agricultural Research and Extension: A Survey of International Data." *Economic Development and Cultural Change* Vol. 23 (April 1975): 507-521.
- 0971 SACCAR. *Current Agricultural Research in SADCC Member Countries: Botswana, Malawi, Swaziland, Zambia*. SACCAR Occasional Report No.8, 1990. Gaborone, Botswana: SACCAR, 1990.
- 1013 World Bank, UNDP, CEC, and FAO. *Fisheries and Aquaculture Research Capabilities and Needs in Africa*. World Bank Technical Paper No. 149. Fisheries Series. Washington, D.C.: World Bank, 1991.

Appendix 1: Country background information



Geography

Area: 11.8 million ha

Location: Landlocked in Southern Africa, Malawi lies along the western side of Lake Malawi on the eastern wall of the Rift Valley with Mozambique to its south, Tanzania to the north and Zambia to its west.

Agroecological features: There are three main zones. 1) The Rift Valley floor comprising the narrow coastal plain of the Lake at altitudes of 40 to 500 m: rainfall is low, less than 700 mm p.a., and irrigation is desirable or necessary. 2) The medium altitude plateau area ranging from 750 to 1400 m with 700-2000 mm of rainfall p.a. between November and May: it is an important agricultural area for rainfed conditions. 3) The highland ranging from 1400 to 3000 m altitude: this area is important for forests, tea and temperate fruit trees. Important communication routes are mainly to the south. The southern part of the country is most densely populated.

Population

Total (1991): 8.8 million

Annual growth rate (1981-90)^a: 3.3%

Literacy (1990): 46.2%

Life expectancy (1991): 46 years

Economy (values reported in 1985 PPP dollars)

Gross Domestic Product (1991): 5,170 million dollars

Per capita GDP (1991): 588 dollars

Agricultural GDP (1991): 1,670 million dollars

Share of agriculture in GDP (1991): 32.3%

Annual growth rates (1981-90)^a

GDP: 3.1%

GDP per capita: -0.2%

AgGDP: 2.3%

Trade (values reported in current dollars)

Net surplus total trade (1991): -230 million dollars

Net surplus agricultural trade (1991): 397 million dollars

Agricultural imports as a % of total imports: 7.6%

Agricultural exports as a % of total exports: 94.7%

Major agricultural import commodities (1991): maize (43%)^b, forestry products (18%), and wheat (13%)

Major agricultural export commodities (1991): tobacco (79%)^b, tea (8%), and raw sugar (4%)

Agriculture

Agricultural land (1990): 4.3 million ha

Annual growth rate (1981-90)^a: 0.3%

Percentage arable: 56.1%

Percentage permanent crop: 0.7%

Percentage permanent pastures: 43.2%

Percentage irrigated arable and permanent cropland: 0.8%

Economically active agricultural population (1991): 2.7 million

Annual growth rate (1981-90)^a: 1.6%

Percentage in total economically active population: 74.5%

Fertilizer use per ha arable land (1990): 19.8 kg

Annual growth rate (1981-90)^a: 4.5%

Major crops (in order of value of production): maize, tobacco, groundnuts, dry beans, tea, potatoes, and sugar

Source: Europa Publications (1992), FAO (1993), and World Bank (1992).

^a Least squares growth rate.

^b Bracketed percentages represent value share of the respective total.

Appendix 2: Definitions and concepts

NARS

The construction of quantitative and internationally comparable expenditure, personnel, and related measures of a national agricultural research system (NARS) requires a precise idea of what, in fact, is being measured. Since the term NARS is subject to a variety of interpretations, it is necessary to define rather precisely the NARS concept used here. Our approach adheres, wherever possible, to the internationally accepted statistical procedures and definitions developed by the OECD and UNESCO for compiling R&D statistics (OECD 1981 and UNESCO 1984). For statistical purposes a NARS is defined in terms of the following characteristics:

(a) *National*. The concept of a “national” system used in this report refers to domestically targeted research activities funded and/or executed by the *public* sector of a particular country. A relatively broad concept of the public sector is taken to include government, semi-public, and academic research institutes. However, private, for-profit research as well as the research activities of supranational research agencies that are not executed through national institutes are excluded. Also excluded is research undertaken by short-term development projects.

(b) *Agricultural*. Agricultural research, as defined here, includes crop, livestock, forestry, and fisheries research, as well as research on agricultural inputs, the natural resource base, and socio-economic aspects of primary agricultural production. It excludes, where possible, research concerning the off-farm storage and processing of agricultural products, commonly referred to as post-harvest research and food-processing research. This delineation corresponds with the national accounts definition of the agricultural sector.

(c) *Research*. Research is often performed in conjunction with other activities such as extension, education, and production. To the extent possible, research activities (in terms of expenditures and staff) are differentiated from these other activities. However, if non-research activities were an integral part of an institute’s research activities and accounted for less than 20% of the resources of the institute, it was expedient to classify all the activities of the institute as being research-related.

Full-Time Equivalent (FTE)

A full-time equivalent researcher year is taken to be a person who holds a full-time position as a researcher during the whole year. Adjustments to full-time equivalents have only been made when: (a) a research position was part-time; (b) a research position was not

filled for the whole year; or (c) if the position explicitly involved tasks other than agricultural research. In the latter case an estimate was made of the time spent on agricultural research. No adjustments were made, however, for vacation or sick leave nor for time spent on administration, meetings, travel or other activities that form part of the normal duties required to support a research endeavor. Following this line of reasoning, professional staff in management positions were classified as researchers.

The degree status of researchers is determined on the following basis: 3-4 years full-time university education (BSc), 5-6 years (MSc), and more than 6 years plus doctorate thesis (PhD).

Expatriate Researcher Costs

Many expatriate researchers working on donor-supported projects in NARSs are paid their salaries and living expenses directly by the donor agency. All (or some substantial fraction) of these costs do not get included in the financial reports of the agricultural research organizations. To calculate these *implicit* costs we took the average cost per researcher in 1985 to be 120,000 “1985 PPP dollars” and backcast this figure using the rate of change in real personnel costs per FTE researcher in the US state agricultural experiment station system. This extrapolation procedure makes the assumption that the personnel-cost trend for US researchers is a reasonable proxy of the trend in real costs of internationally recruited staff working in NARSs. Unless otherwise stated, FTE expatriate researchers were costed at \$80,000 “1985 PPP dollars” per researcher for the 1961-65 period, \$85,000 per researcher for 1966-70, \$90,000 per researcher for 1971-75, \$110,000 per researcher for 1976-80, and \$120,000 per researcher for 1981-91.

Deflators and Exchange Rates

All expenditure figures were first compiled in current local currency units (appendix 5). In order to facilitate comparisons over time and across countries these figures are deflated with a local GDP deflator to base year 1985, and then converted to a common currency (US dollars) using the 1985 purchasing power parity (PPP) over GDP. PPPs are synthetic exchange rates that attempt to reflect the purchasing power of a country’s currency. The PPPs used here are derived from the Penn World Table (Mark 5), which is based on the benchmark studies of the International Comparison Project (Summers and Heston 1991). For additional information on currency conversion methods in this context see Pardey, Roseboom, and Craig (1992).

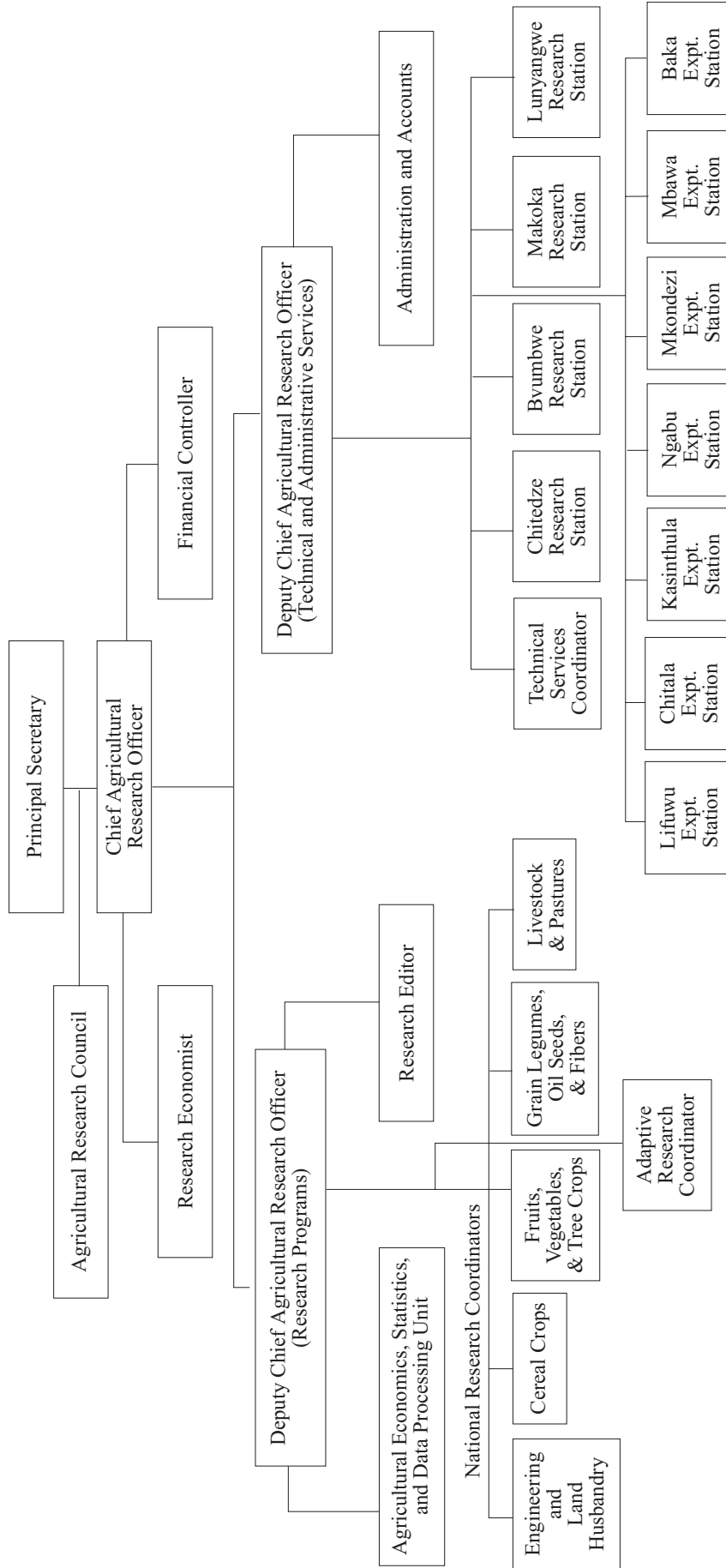
Nomenclature for tables in text

A zero indicates an actual observation of zero, a dash indicates an observation is not relevant (due to institutional mergers, closures, and so on), while “na” indicates an observation that is not available.

In the text we note any marked deviations from these data compilation norms and include points of clarification if warranted.

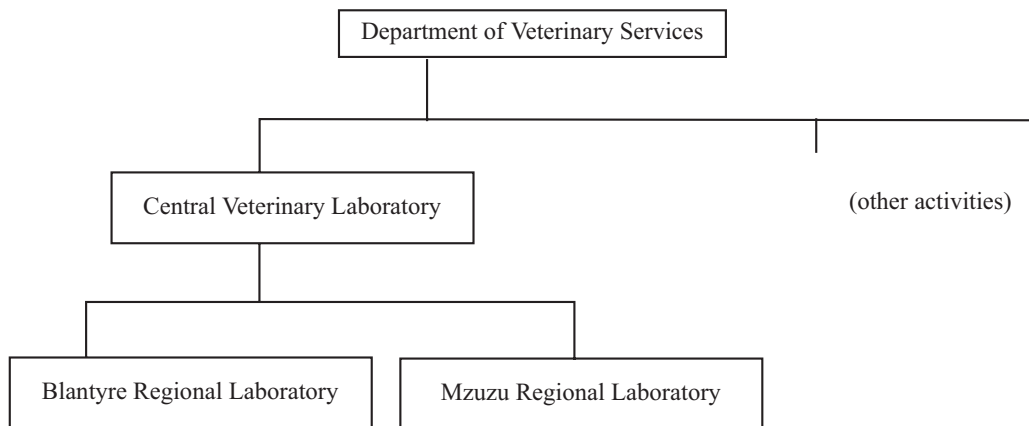
Appendix 3: Organizational charts of the agricultural research institutes

Department of Agricultural Research (1991/92)

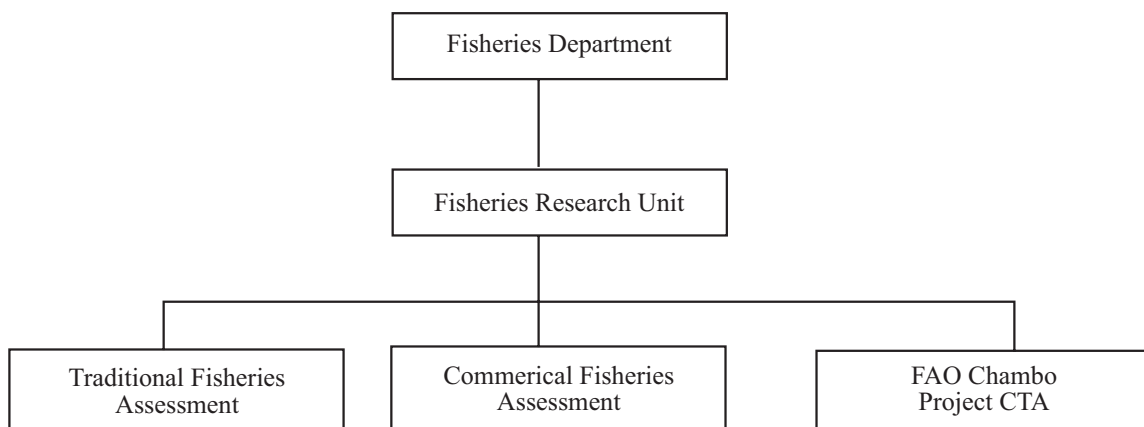


Appendix 3: Organizational charts of the agricultural research institutes (contd.)

Department of Veterinary Services (1991/92)

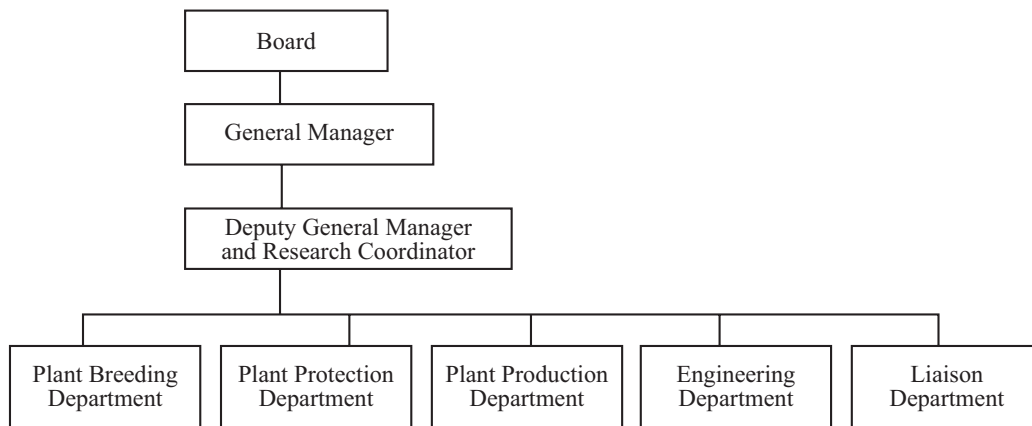


Fisheries Research Unit (1991/92)

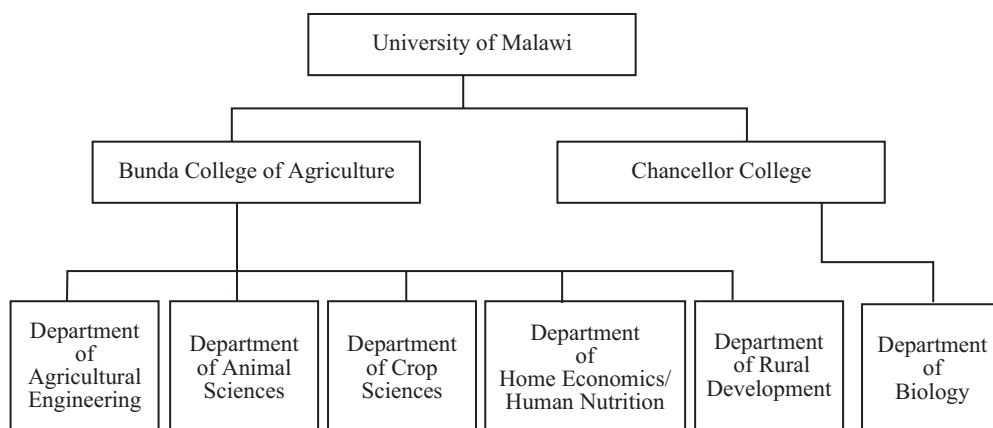


Appendix 3: Organizational charts of the agricultural research institutes (contd.)

Tobacco Research Institute of Malawi (1991/92)



University of Malawi (1991/92)



Appendix 4: Addresses of the agricultural research institutes

Chief Agricultural Research Officer
Department of Agricultural Research
Ministry of Agriculture
P.O. Box 30134
Lilongwe 3
MALAWI

Chief Veterinary Officer
Department of Veterinary Services
Ministry of Agriculture
P.O. Box 30372
Lilongwe 3
MALAWI

Deputy Chief Veterinary Officer (Research)
Central Veterinary Laboratory
P.O. Box 527
Lilongwe
MALAWI

The Chief Fisheries Officer
Department of Fisheries
Ministry of Forestry and Natural Resources
P.O. Box 593
Lilongwe
MALAWI

Senior Fisheries Research Officer
Fisheries Research Station
P.O. Box 27
Monkey Bay
MALAWI

Director
Tea Research Foundation of Central Africa
P.O. Box 51
Mulanje
MALAWI

The General Manager
Tobacco Research Institute of Malawi
P.O. Box 478
Lilongwe
MALAWI

The Assistant Chief Forestry Officer (Research)
Forestry Research Institute of Malawi
P.O. Box 270
Zomba
MALAWI

The Principal
Bunda College of Agriculture
University of Malawi
P.O. Box 219
Lilongwe
MALAWI

The Principal
Chancellor College
P.O. Box 278
Zomba
MALAWI

Appendix 5a: Research totals, 1961-91

Total Number of Researchers		1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Category	Name institute																
Government	DAR	21.0	21.3	21.7	22.0	23.0	23.0	25.0	25.0	32.0	32.0	35.0	38.0	38.0	30.0	48.0	52.0
	ARCM	4.0	4.0	4.0	4.0	4.0	6.0	8.0	10.0	13.0	16.0	15.0	18.0	15.5	13.0		
	DVS	1.2	1.4	1.6	1.8	2.0	2.0	2.0	2.0	2.0	2.2	2.5	2.0	3.7	5.3	7.0	7.7
	FRS	0.0	1.0	1.8	2.5	3.2	4.0	4.0	4.8	5.5	6.2	7.0	8.0	9.0	10.0	11.0	10.2
	FRIM	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	5.0	6.0	7.0	5.0	5.0	5.0	5.0	6.0
Subtotal		28.2	29.7	31.0	32.3	34.2	37.0	41.8	47.5	59.5	64.5	65.0	73.7	73.8	66.0	70.6	75.2
Semi-public	TRIM																
Subtotal	TRF	2.0	2.5	3.0	3.5	4.0	3.0	5.0	7.0	9.0	10.0	8.0	11.0	11.0	8.0	10.0	12.0
		2.0	2.5	3.0	3.5	4.0	3.0	5.0	7.0	9.0	10.0	8.0	11.0	11.0	8.0	10.0	12.0
Academic	BCA							3.0	4.1	5.2	5.5	5.8	5.0	4.2	5.0	5.5	6.8
	CC					1.2	1.5	1.8	2.2	2.8	2.4	2.0	2.1	2.2	2.5	2.8	2.2
Subtotal						1.2	1.5	1.8	2.2	2.8	2.4	2.0	2.1	2.2	2.5	2.8	2.2
Total		30.2	32.2	34.0	35.8	39.5	41.5	51.5	60.9	76.5	82.4	80.8	91.8	91.3	81.5	88.8	96.2
Source		871			1004	10	239	239	239	532	239	279	239	1000	244	1000	1000
						286	653	976	285	1000	532	1000	1005	1000	1006		

Category	Name institute	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Government	DAR	58.0	65.0	76.0	73.0	75.0	76.0	91.0	92.0	86.0	87.0	89.5	92.0	104.0	105.0	106.0	
	ARCM																
	DVS	8.0	8.3	8.7	9.0	9.2	9.5	9.5	9.8	10.0	10.0	10.0	11.0	11.0	16.0	17.0	18.0
	FRS	8.8	8.0	7.2	6.5	5.8	5.0	4.4	4.4	3.8	3.2	4.0	5.0	4.2	5.5	8.5	8.8
	FRIM	7.0	10.0	13.0	6.0	7.5	9.0	13.0	13.0	13.0	13.0	11.0	9.0	10.0	10.0	11.0	11.0
Subtotal		81.8	91.3	104.9	94.5	97.5	99.5	118.2	118.8	112.2	112.0	113.5	117.2	135.5	141.5	143.8	
Semi-public	TRIM																
	TRF	14.0	12.3	10.7	9.0	11.5	14.0	13.0	12.5	12.0	13.0	11.0	12.0	12.5	13.0	13.0	13.0
Subtotal		14.0	12.3	10.7	15.0	18.2	21.3	21.0	21.3	21.6	23.4	22.2	25.0	25.5	26.0	31.0	
Academic	BCA	8.8	9.2	8.8	8.3	7.8	9.2	10.2	13.0	8.8	8.5	8.5	8.8	8.8	7.8	7.8	
	CC	2.4	2.5	2.6	2.7	2.8	3.0	3.2	2.8	2.2	2.0	1.8	1.5	1.5	2.5	2.4	
Subtotal		11.2	11.8	11.4	11.0	10.5	12.2	13.5	12.2	11.0	10.5	10.2	10.2	10.2	10.2	10.2	
Total		106.9	115.4	127.0	120.5	126.2	133.1	146.7	155.9	144.8	145.9	146.0	152.5	171.2	177.8	184.9	
Source		239	239	11	11	11	11	5	5	922	439	999	925	947	999	999	
		243	1000	947	242	467	27	467	999	999	976	1012	999	999	1000	1000	
		1007				1000	1006	1000	1014	1000	999	1000	1000	1004	1000		

Note: Italicized figures represent data that are either constructed or interpolated.

Appendix 5b: Expenditure totals 1961-91

Total Research Expenditures		Currency: million Kwachas															
Category	Name institute	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Government	DAR	0.500	0.495	0.520	0.547	0.656	0.539	0.658	0.898	0.876	0.953	0.981	1.230	1.306	1.182	1.607	1.756
	ARCM	0.100	0.097	0.101	0.104	0.120	0.176	0.316	0.331	0.339	0.289	0.371	0.484	0.450	0.439		
	DVS	0.023	0.026	0.031	0.037	0.047	0.044	0.042	0.056	0.049	0.058	0.045	0.093	0.148	0.260	0.249	0.277
	FRU	0.040	0.039	0.034	0.051	0.077	0.088	0.101	0.153	0.135	0.163	0.179	0.228	0.277	0.409	0.348	0.343
	FRIM	0.663	0.676	0.727	0.781	0.947	0.897	1.160	1.546	1.515	1.602	1.675	2.141	2.304	2.445	2.380	2.638
Semi-public	TRIM																
	TRF	0.055	0.067	0.083	0.101	0.132	0.192	0.138	0.192	0.226	0.253	0.264	0.303	0.317	0.261	0.356	0.506
Subtotal	Academic	0.055	0.067	0.083	0.101	0.132	0.192	0.138	0.192	0.226	0.253	0.264	0.303	0.317	0.261	0.356	0.506
	BCA							0.079	0.109	0.137	0.153	0.171	0.151	0.142	0.205	0.237	0.319
Subtotal	CC					0.035	0.040	0.042	0.059	0.074	0.069	0.063	0.068	0.079	0.104	0.125	0.117
						0.035	0.040	0.042	0.059	0.074	0.069	0.063	0.068	0.079	0.104	0.125	0.117
Total (current Kwachas)		0.718	0.743	0.810	0.881	1.114	1.129	1.418	1.905	1.952	2.077	2.172	2.664	2.841	3.015	3.098	3.580
		19.3	18.8	19.4	20.1	23.1	23.1	21.4	22.8	23.3	25.3	27.3	27.6	30.1	35.6	38.5	42.5
Deflator (1985=100)		3.722	3.956	4.166	4.378	4.823	4.893	6.626	8.361	8.377	8.203	7.964	9.659	9.436	8.458	8.041	8.427
		8.113	8.623	9.081	9.542	10.512	10.666	14.442	18.224	18.258	17.879	17.359	21.053	20.566	18.435	17.526	18.367
Total (constant 1985 PPP dollars)						10	239	239	1005	1005	1005	10	239	239	10	239	11
	Source						589	1005	1005	1005	1005	589	239	239	1005	239	1007

Category	Name institute	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Government	DAR	1.842	2.640	2.340	4.166	3.417	4.795	5.849	6.782	4.283	6.577	13.094	11.687	13.376	13.281	13.224	
	ARCM																
	DVS	0.292	0.361	0.317	0.518	0.469	0.544	0.651	0.754	0.611	0.833	1.446	1.558	1.999	3.589	3.655	
	FRU	0.319	0.346	0.285	0.374	0.291	0.286	0.295	0.289	0.199	0.474	0.428	0.492	0.731	1.048	1.151	
	FRIM	0.367	0.565	0.807	0.434	0.650	0.546	0.607	0.558	0.835	0.814	0.546	0.886	0.967	1.038	1.170	
Subtotal	TRIM	2.820	3.912	3.729	5.492	4.826	5.572	7.402	8.383	5.928	8.697	15.514	14.623	17.073	18.956	19.200	
	TRF	0.670	0.575	0.496	0.910	1.277	1.611	1.761	1.841	1.662	1.852	2.188	3.716	6.771	6.489	5.794	
Subtotal	BCA	0.399	0.438	0.411	0.430	0.465	0.528	0.580	0.823	1.014	1.097	1.305	1.588	1.663	1.959	2.211	
	CC	0.124	0.132	0.132	0.147	0.170	0.188	0.209	0.198	0.305	0.310	0.312	0.307	0.327	0.727	0.758	
Subtotal		0.523	0.570	0.543	0.578	0.635	0.715	0.788	1.022	1.319	1.407	1.617	1.894	1.990	2.686	2.969	
		4.013	5.056	4.768	6.980	6.738	7.898	9.952	11.246	9.760	12.888	20.350	21.448	27.057	29.505	32.457	
Total (current Kwachas)		48.1	48.1	49.7	57.5	66.9	73.4	81.6	91.8	100.0	113.6	132.9	168.8	206.0	227.7	256.5	
		8.341	10.507	9.594	12.142	10.071	10.760	12.193	12.248	9.760	11.342	15.317	12.704	13.132	12.958	12.652	
Total (constant 1985 PPP dollars)		18.179	22.901	20.912	26.464	21.950	23.453	26.575	26.696	21.272	24.720	33.384	27.690	28.623	28.243	27.576	
	Source	11	11	11	11	439	976	976	5	976	976	999	999	999	999	999	999

Appendix 6: Research staff development by institute

Department of Agricultural Research (DAR)																
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals																
PhD	0			0	0			0			1					
MSc	0			0	0			1			3					
BSc	0			1	2			5			7					
Subtotal	0			1	2	5	6	6	10	11	11	14	18	23	35	42
Expatriates	21			21	21	18	19	19	22	21	24	24	20	7	13	10
Total	21	21.3	21.7	22	23	23	25	25	32	32	35	38	38	30	48	52
Sources:	871			1004	239	239	239	239	239	239	239	239	239	239	239	239
											279					
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																
PhD				4		4			13			10	9		14	
MSc				19		10			25			37	45		58	
BSc				49		53			42			35	46		22	
Subtotal	49	58	70	72	72	67	79	82	80	80.7	81.3	82	100	97	94	
Expatriates	9	7	6	1	3	9	12	10	6	6.3	8.2	10	4	8	12	
Total	58	65	76	73	75	76	91	92	86	87	89.5	92	104	105	106	
Sources:	239	239	11	11	11	11	467	5	999	439		999	1004		999	
				242												

Department of Veterinary Services (DVS)																
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals																
PhD					0	0		0			0			0		
MSc					0	0		0			0			0		
BSc					0	0		0			0			3		
Subtotal	0	0	0	0	0	0	0	0	0.0	0	0	1.0	2.0	3	3.2	3.3
Expatriates	1.2	1.4	1.6	1.8	2	2	2	2	2.2	2.5	2	2.7	3.3	4	4.2	4.3
Total	1.2	1.4	1.6	1.8	2	2	2	2	2.2	2.5	2	3.7	5.3	7	7.3	7.7
Sources:					286	653		285		532	279			242		
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																
PhD				1				2				1		0	0	
MSc				1				1				2		6	6	
BSc				3				4				4		3	3	
Subtotal	3.5	3.7	3.8	4	4.8	5.5	6.2	7	7	7	7	7	8	9	9	
Expatriates	4.5	4.7	4.8	5	4.5	4.0	3.5	3	3	3	3	4	8	8	9	
Total	8	8.3	8.7	9	9.2	9.5	9.8	10	10	10	10	11	16	17	18	
Sources:				242				5	999	999	999	925	999	999	999	
												999				

Appendix 6: Research staff development by institute (contd.)

Forestry Research Institute of Malawi (FRIM)																
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals																
PhD					0		0	0			0				0	
MSc					0		0	0			0				0	
BSc					0		0	0			1				2	
Subtotal	0	0	0	0	0	0	0	0	0	1	1	1.2	1.5	1.8	2	2.5
Expatriates	2	2	2	2	2	2	2	5	5	6	4	3.8	3.5	3.2	3	3.5
Total	2	2	2	2	2	2	2	5	6	7	5	5.0	5.0	5.0	5	6
Sources:					286		976	285		532	1005				244	
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																
PhD	0			0									0			
MSc	2			3									5	6		
BSc	1			0									4	5		
Subtotal	3	4	5	3	4.5	6	10	9.5	9	8	7	8	9	11	11	
Expatriates	4	6	8	3	3	3	3	3.5	4	3	2	2	1	0	0	
Total	7	10	13	6	7.5	9	13	13	13	11	9	10	10	11	11	
Sources:	243		947	242		27	1014		922	976	1012	925	947	999		

Fisheries Research Unit (FRU)																
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals																
PhD														0		
MSc														0		
BSc														3		
Subtotal														3		
Expatriates														8		
Total	0	1	1.8	2.5	3.2	4.0	4.8	5.5	6.2	7	8	9	10	11	10.2	9.5
Sources:										532				244		
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																
PhD										0	0	0	0	0	0	
MSc									0	2	3	3	3	3	2.75	
BSc									1.25	0	1	0	0	1	1	
Subtotal									1.25	2	4	3	3	4	3.75	
Expatriates									2	2	1	1.25	2.5	4.5	5	
Total	8.8	8.0	7.2	6.5	5.8	5	4.4	3.8	3.25	4	5	4.25	5.5	8.5	8.75	
Sources:						27			999	999	999	999	999	999	999	

Appendix 6: Research staff development by institute (contd.)

Agricultural Research Council of Malawi (ARCM)																
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals																
PhD					0			1			0	0		0		
MSC					0			0			1	1		2		
BSc					0			1			4	2		1		
Subtotal	0	0	0	0	0	0.7	1.3	2	4.3	6.7	5	3	3	3		
Expatriates	4	4	4	4	4	5.3	6.7	8	8.7	9.3	10	15	12.5	10		
Total	4	4	4	4	4	6.0	8.0	10	13	16	15	18	15.5	13		
Sources:					286			285		532	279	1005		244		

Note: The pre-1967 data relate to the research staff of the Agricultural Research Council of Central Africa in Malawi.

Tobacco Research Institute of Malawi (TRIM)																
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																
PhD							0							4		
MSC							2							1		
BSc							3							8		
Subtotal				3	3.7	4.3	5	6.0	7.0	8.0	9.0	10.0	11.5	13	13	
Expatriates				3	3	3	3	2.8	2.6	2.4	2.2	2.0	1.0	0	0	
Total				6	6.7	7.3	8	8.8	9.6	10.4	11.2	12	12.5	13	13	
Sources:				242			467					925		999		

Institute: Tea Research Foundation of Central Africa (TRF)																
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals																
PhD								0			0			0		
MSC								0			0			0		
BSc								0			1			3		
Subtotal	0	0	0	0	0	0	0	0	1	1	1	2.3	3.2	3	3.3	3.7
Expatriates	2	2.5	3	3.5	4	3	5	7	8	9	7	8.7	7.8	5	6.7	8.3
Total	2	2.5	3	3.5	4	3	5	7	9	10	8	11	11	8	10	12
Sources:					10	653		285	532	10	279	10	10	244		
Nationals																
PhD	0			0			0		0	0	1	1	1	1	1	
MSC	1			1			1		1	1	1	1	1	1	1	
BSc	3			3			5		6	7	5	5	7	9	13	
Subtotal	4	4	4	4	5.2	6.3	6	6.5	7	8	7	7	9	11	15	
Expatriates	10	8.3	6.7	5	6.3	7.7	7	6	5	5	4	6	4	2	3	
Total	14	12.3	10.7	9	11.5	14	13	12.5	12	13	11	13	13	13	18	
Sources:	243			242		27	5		999	999	999	999	999	999	999	

Appendix 6: Research staff development by institute (contd.)

Bunda College of Agriculture (BCA)		1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals										1		3		3	1	3	3
PhD								0		2		0		1	1	2	1
MSc								0		3		6		2	3	2	8
BSc								0	3	6	7.5	9	7.5	6	5	7	12
Subtotal								0	3	6	7.5	9	7.5	6	5	7	12
Expatriates								12	13.5	15	14.5	14	12.5	11	15	15	15
Total								12	16.5	21	22	23	20	17	20	22	27
FTE Researcher								3.0	4.1	5.2	5.5	5.8	5.0	4.2	5.0	5.5	6.8
Sources:								1000	1000	1000	532	1000	1000	1000	1006	1000	1000
		1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																	
PhD			3			6	5	11	16	14	14	17	18	18	22	21	
MSc			4		6	6	8	13	11	14	17	14	14	14	6	6	
BSc			5		1	1	9	5	8	0	0	0	0	0	0	0	
Subtotal			15	12	12.8	13	22	29	35	28	31	31	32	32	28	27	
Expatriates			20	22.5	20.2	18	15	12	17	7	3	3	3	3	3	4	
Total			35	37	33	31	37	41	52	35	34	34	35	35	31	31	
FTE researcher			8.8	9.2	8.8	7.8	9.2	10.2	13.0	8.8	8.5	8.5	8.8	8.8	7.8	7.8	
Sources:			1007	1000		467	1006	467	5	999	999	999	999	999	999	999	

Note: The percentage of faculty time spent on research has been estimated at 25%.

Chancellor College, Department of Biology		1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Nationals																	
PhD						0		1		2		2		1		1	0
MSc						0		1		0		0		0		0	1
BSc						0		0		0		0		1		1	1
Subtotal						0	1	2	2	2	2	2	2	2	2	2	2
Expatriates						5	5	5	7	9	7.5	6	6.5	7	8	9	7
Total						5	6	7	9	11	9.5	8	8.5	9	10	11	9
FTE researcher						1.2	1.5	1.8	2.2	2.8	2.4	2.0	2.1	2.2	2.5	2.8	2.2
Sources:						1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
		1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																	
PhD			0			2		3		3			3	3	4		2
MSc			0		1	1		1		0			0	0	2		0
BSc			1		1	1		3		1			1	1	0		4
Subtotal			1.5	2.0	3.0	4	5.5	7	5.5	4	4	4	4	4	6	6	6
Expatriates			8	8.3	7.7	7	6.5	6	5.5	5	4	3	2	2	4	3.5	3
Total			9.5	10	10.3	11	12	13	11	9	8	7	6	6	10	9.5	9
FTE researcher			2.4	2.5	2.6	2.8	3.0	3.2	2.8	2.2	2.0	1.8	1.5	1.5	2.5	2.4	2.2
Sources:			1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

Other statistical briefs published in this series are:

1. *Statistical Brief on the National Agricultural Research System of Rwanda*, September 1993, by J. Roseboom and P.G. Pardey.
- 2.* *Statistical Brief on the National Agricultural Research System of Niger*, September 1993, by V. Mazzucato and S. Ly.
3. *Statistical Brief on the National Agricultural Research System of Malawi*, September 1993, by J. Roseboom and P.G. Pardey.
4. *Statistical Brief on the National Agricultural Research System of Botswana*, September 1993, by J. Roseboom and P.G. Pardey.
5. *Statistical Brief on the National Agricultural Research System of Kenya*, November 1993, by J. Roseboom and P.G. Pardey.
6. *Statistical Brief on the National Agricultural Research System of Colombia*, December 1993, by C.A. Falconi and P.G. Pardey.
7. *Statistical Brief on the National Agricultural Research System of Ethiopia*, April 1994, by J. Roseboom, N. Beintema, and P.G. Pardey.
8. *Statistical Brief on the National Agricultural Research System of Ghana*, April 1994, by J. Roseboom and P.G. Pardey.
- 9.* *Statistical Brief on the National Agricultural Research System of Burkina Faso*, April 1994, by V. Mazzucato.
- 10.* *Statistical Brief on the National Agricultural Research System of Senegal*, April 1994, by V. Mazzucato and M.E.H. Ly.
- 11.* *Statistical Brief on the National Agricultural Research System of Mali*, April 1994, by V. Mazzucato.
- 12.* *Statistical Brief on the National Agricultural Research System of Madagascar*, June 1994, by J. Roseboom and P.G. Pardey.
13. *Statistical Brief on the National Agricultural Research System of Namibia*, September 1994, by N.M. Beintema, P.G. Pardey, and J. Roseboom.
14. *Statistical Brief on the National Agricultural Research System of Cape Verde*, December 1994, by N.M. Beintema, P.G. Pardey, and J. Roseboom.
15. *Statistical Brief on the National Agricultural Research System of Nigeria*, December 1994, by J. Roseboom, N.M. Beintema, P.G. Pardey, and E.O. Oyedipe.
- 16.* *Statistical Brief on the National Agricultural Research System of Côte d'Ivoire*, December 1994, by J. Roseboom and P.G. Pardey.
17. *Statistical Brief on the National Agricultural Research System of Mauritius*, January 1995, by N.M. Beintema, P.G. Pardey, and J. Roseboom.
18. *Statistical Brief on the National Agricultural Research System of Lesotho*, January 1995, by N.M. Beintema, P.G. Pardey, and J. Roseboom.
19. *Statistical Brief on the National Agricultural Research System of Swaziland*, February 1995, by N.M. Beintema, P.G. Pardey, and J. Roseboom.
20. *Statistical Brief on the National Agricultural Research System of Zimbabwe*, March 1995, by J. Roseboom, P.G. Pardey, N.M. Beintema, and G.D. Mudimu.
21. *Statistical Brief on the National Agricultural Research System of Zambia*, August 1995, by J. Roseboom and P.G. Pardey.

22. *Statistical Brief on the National Agricultural Research System of Sudan*, August 1995, by N.M Beintema, P.G. Pardey, and J. Roseboom.
23. *Statistical Brief on the National Agricultural Research System of South Africa*, September 1995, by J. Roseboom, P.G. Pardey, H. Satorius von Bach, and J. van Zyl.
24. *Statistical Brief on the National Agricultural Research System of Togo*, May 1996, by N.M. Beintema, P.G. Pardey, and J. Roseboom.

** Also available in French.*