

MALAWI

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This country brief reviews the major investment and institutional trends in Malawi's agricultural research system since the early 1970s, including a new set of survey data for the 1990s collected through the Agricultural Science and Technology Indicators (ASTI) initiative (IFPRI–ISNAR 2003).¹

INSTITUTIONAL DEVELOPMENTS

With around two-thirds of its population living below the poverty line, Malawi is one of the poorest countries in Sub-Saharan Africa. In 2001, about 85 percent of the country's population lived in rural areas, and over 80 percent of the laborforce worked in the agricultural sector. About two-thirds of these workers were (often resource-poor) small-scale farmers. In 2001 agriculture accounted for over one-third of gross domestic product (GDP); in 2002 it accounted for 83 percent of the country's export earnings—mainly through tobacco, at 62 percent, and tea and sugar, at 10 and 7 percent, respectively (Mataya et al. 1998; World Bank 2003; FAO 2004).

Given the pivotal role that agriculture plays in Malawi's economy, agricultural research and development (R&D) is extremely important. We identified

Table 1—Composition of agricultural research expenditures and total researchers, 2001

Type of agency	Spending		Researchers ^a (fte's)	Share		Agencies in sample ^b (number)
	1999 kwachas (millions)	1993 international dollars		Spending (percent)	Researchers (percent)	
<i>Public agencies</i>						
DARS	86.9	5.9	70.0	45.3	46.9	1
Other government ^c	20.0	1.3	26.1	10.4	17.5	3
Nonprofit ^d	61.6	4.2	34.0	32.1	22.8	2
BCA ^e	18.0	1.2	16.2	9.4	10.9	1
<i>Subtotal</i>	<i>186.5</i>	<i>12.6</i>	<i>146.3</i>	<i>97.2</i>	<i>98.0</i>	<i>7</i>
<i>Business enterprise^f</i>						
	5.4	0.4	3.0	2.8	2.0	1
Total	191.9	13.0	149.3	100	100	8

Sources: Compiled by authors from ASTI survey data (IFPRI–ISNAR 2003).

^a Include national and expatriate staff.

^b For a list of the eight agencies included in the sample see note 3.

^c Expenditure data for the Central Veterinary Laboratory (CVL) and FRU were estimated using 1991 data from Roseboom and Pardey (1993) and the spending-per-researcher trend for DARS from 1991 to 2001. Total researcher numbers for the Fisheries Research Unit (FRU) were estimated using 1991 data from Roseboom and Pardey (1993). Staff at the other three government agencies spent between 50 and 100 percent of their time on agricultural research.

^d Expenditure data for the Tea Research Foundation (TRF) were estimated using 1998 data from IFPRI–ISNAR (2003) and the spending-per-researcher trend for DARS from 1998 to 2001.

^e Expenditure data for BCA were estimated based on average expenditures per researcher at the government agencies. The 54 faculty staff employed at BCA spent an estimated 30 percent of their time on research, resulting in 16.2 fte researchers.

^f Expenditure data for SUCOMA, the only business enterprise in our sample, were estimated based on average expenditures per researcher at the nonprofit institutions.

KEY TRENDS

- Since the mid-1980s, agricultural research investments have declined in real prices (adjusted for inflation) in part as a result of high inflation rates in Malawi.
- Despite a higher decline in resources in the 1990s relative to other organizations, the Department of Agricultural Research Services (DARS) remains the primary agricultural research agency in Malawi; it accounted for nearly half the country's agricultural research spending and researcher numbers in 2001.
- About half of the research positions at DARS were vacant as of early 2003. Until recently, low salary levels and limited promotional opportunities have hindered retention of well-qualified staff, and attrition has also resulted from deaths from AIDS and other causes. A 1990s recruitment freeze further exacerbated this situation.
- Tobacco and tea research are conducted by the nonprofit sector, which accounted for a 33-percent share of total agricultural research spending in 2001.

ABOUT ASTI

The Agricultural Science and Technology Indicators (ASTI) initiative comprises a network of national, regional, and international agricultural R&D agencies and is managed by the International Service for National Agricultural Research (ISNAR) division of the International Food Policy Research Institute (IFPRI). The ASTI initiative compiles, processes, and makes available internationally comparable data on institutional developments and investments in public and private agricultural R&D worldwide, and analyses and reports on these trends in the form of occasional policy digests for research policy formulation and priority setting purposes.

Primary funding for the ASTI initiative was provided by the CGIAR Finance Committee/World Bank with additional support from the Australian Center for International Agricultural Research (ACIAR), the European Union, and the U.S. Agency for International Development (USAID).

eight agencies involved in agricultural R&D in Malawi in 2001.² Together these agencies employed about 150 full-time equivalent (fte) researchers and spent 192 million 1999 kwachas on agricultural research—equivalent to \$13 million in 1993 international prices (Table 1).³

The Department of Agricultural Research Services (DARS) under the Ministry of Agriculture, Irrigation, and Food Security (MAIFS) is Malawi's principal agricultural research agency.⁴ In 2001 it accounted for about 45 percent of the country's agricultural research staff and expenditures. DARS is responsible for crop and livestock research, with the exclusion of tobacco, tea, and sugarcane. In 2002, the department was reorganized to give more administrative autonomy to its three main research stations, and to have those stations oversee the four remaining experiment stations and nine substations. Each of the major stations has its own mandate. Chitedze Agricultural Research Station, in the centre of the country, is the largest of the three, employing about half of DARS's researchers in 2001, and is responsible for research on field crops, livestock, farm machinery, soil fertility, plant genetic resources, and seed services; Bvumbwe Agricultural Research Station in the southern region focuses on horticultural and plant protection research; and Lunyangwa Agricultural Research Station, located in the northern region, principally serves as a regional center for all commodities. DARS headquarters, which was relocated from Lilongwe City to Chitedze Agricultural Research Station in November 2003, now coordinates and facilitates the research activities, as well as monitoring and evaluating them. DARS's research activities are structured around seven multidisciplinary commodity teams, each headed by a national research coordinator. In addition to research, DARS provides services such as soil and plant analysis, seed testing and certification, training, pest and disease identification, produce inspection, plant quarantine, and plant genetic resource conservation.

In 1997, MAIFS underwent a review that recommended the partial decentralization of decisionmaking processes and

upgrades to departmental buildings. This review excluded DARS and, as a result, had the effect of restricting promotional opportunities, which frustrated staff. A second review that focused solely on DARS was undertaken in 2001, this time recommending modifications to position classifications and salaries as a means of attracting and retaining well-qualified staff—a plan that was implemented shortly thereafter. The department's most recent name change occurred at this time, and additional changes were made to the function and grouping of the research programs. Another proposal was the separation of DARS from MAIFS to give it financial and managerial autonomy (receiving funding directly from the Treasury, for example). The government has yet to approve this change, and has instead requested further reviews.

We identified three other government agencies involved in agricultural research in Malawi. The Central Veterinary Laboratory (CVL), which also falls under the responsibility of MAIFS, employed 6 fte researchers in 2001. CVL is a national referral veterinary laboratory, which is supported by two regional nine district laboratories. CVL's mandate includes veterinary research, diagnostic, public health, and animal quarantine services. The Forestry Research Institute of Malawi (FRIM) and the Fisheries Research Unit (FRU) both fall under the Ministry of Forestry and Environmental Affairs (MFEA). FRIM conducts forestry and related natural resources research, and employed 13 fte researchers in 2001. FRU conducts research on aquaculture and capture fisheries and employed 8 fte researchers in 2001 (Mataya et al. 1998).

Two nonprofit institutions conduct research on tobacco and tea—two of Malawi's important export crops. Together these agencies accounted for one-third of the country's total agricultural research spending and close to a quarter of its fte researchers in 2001. The Tea Research Foundation of Central Africa (TRF) is located in Malawi but conducts tea research for Malawi, Zimbabwe, South Africa, and Zambia. TRF is mainly funded by the Tea Associations of Malawi and Zimbabwe. The

A Short History of Government-Based Agricultural Research

Agricultural research in Malawi began in the early 1900s, primarily undertaken by the Department of Agriculture—under the colonial government prior to independence in 1964, and under the Government of Malawi thereafter—as well as commodity organizations, such as the Empire Cotton Growing Organization. The early days of research focused on varietal testing of export commodities like coffee, cotton, and tobacco, among others.

The first experiment station was established in 1940 at Bvumbwe, managed by the Department of Agriculture, and over the years many other stations were established. After independence, the research division of the Department of Agriculture became the Department of Agricultural Research (DAR) and continued to focus on export crops. In 1967, cotton research was temporarily relocated to the Agricultural Research Council of Malawi (ARCM) until ARCM's demise in 1975.

DAR was reorganized in 1985 with a view to integrating and coordinating research activities undertaken by the various stations throughout the country. This consolidation resulted in a structure of six research programs (including one adaptive research program) and one technical services unit. The Agricultural Research Council was created by the Ministry of Agriculture in 1985 to provide guidance on the focus of research programs and to provide administrative oversight in activities like budgeting.

Veterinary research began in the late 1920s with the creation of the Department of Veterinary Services. In 1951, the first veterinary research laboratory was established: the Animal Diseases Diagnostic Laboratory in Blantyre. Along with an existing station at Mzuzu, the laboratory was made a regional station under the Central Veterinary Laboratory when it was established in Lilongwe in 1979.

Formal forestry research began in 1957 with the establishment of the Silvicultural Research Branch (SRB) within the Forestry Department. SRB was transferred to the Forestry Research Institute of Malawi (FRIM) in 1969. The first fisheries research station was established in 1954 as part of the Joint Fisheries Research Organization (JFRO) under the governance of Northern Rhodesia and Nyasaland (the colonial forerunners of Zambia and Malawi). When JFRO was disbanded in 1961, the fisheries research activities of Nyasaland were transferred to the Monkey Bay Research Station, which became part of the Fisheries Research Unit of MFEA's newly established Fisheries Department in 1965.

Sources: Roseboom and Pardey (1993).

Agricultural Research and Extension Trust (ARET) was established in 1995 through a merger of the Tobacco Research Institute of Malawi (TRIM) and the Estate Extension Service Trust (EEST), under the Tobacco Association of Malawi (TAMA). The objective of this merger was to improve linkages between research and extension and to maximize efficient resource use. ARET comprises two main units, Agricultural Research Services (ARS) and Extension and Specialist Services (ESS). Research is demand driven, ultimately aiming to develop improved technologies, such as varieties and production techniques that increase the production of high quality tobacco (ARET 1998). ARET employed 15 fte researchers in 2001. The Sugar Company of Malawi (SUCOMA) has a small R&D unit, employing 3 fte researchers who focus on sugar-related agronomic research and herbicide use. The company is apparently interested in expanding its research activities and contracted DARS to conduct quarantine research. All newly introduced sugarcane varieties are developed and tested abroad, although they may undergo additional testing within Malawi.

Bunda College of Agriculture (BCA) is the only higher-education agency in Malawi involved in agricultural research. It had only one faculty—the Faculty of Agriculture—until 2002, when the Faculty of Environmental Sciences was established. BCA conducts research on crops, livestock, fisheries, natural resources, food processing and storage, economics, and agroforestry. It is part of the University of Malawi but has substantial autonomy in terms of fundraising and staff recruitment.

The various agricultural research agencies in Malawi collaborate with each other as well as with regional and international organizations. For example, four centers of the Consultative Group on International Agricultural Research (CGIAR)—the International Center for Tropical Agriculture (CIAT), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Institute for Tropical Agriculture (IITA), and the World Agroforestry Centre have established offices within DARS stations, which has strengthened collaboration in the areas of germplasm exchange, capacity building through postgraduate and internal short training activities. Some of these activities are part of regional Southern African Development Community (SADC) projects.

HUMAN AND FINANCIAL RESOURCES IN AGRICULTURAL R&D

Overall Trends

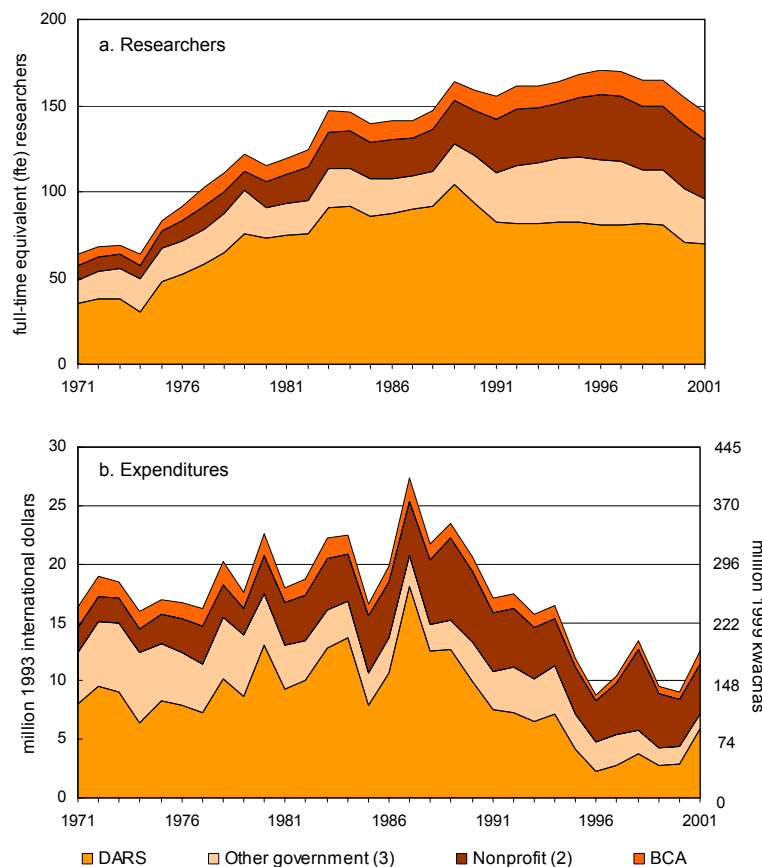
After considerable growth in the 1970s, total fte researcher numbers grew by an average of 2 percent per year from 1981 to 1995 (Figure 1a).⁵ Thereafter, numbers began to fall, from 170 in 1996 to 146 in 2001 (nearly 15 percent), although most of this decline occurred at DARS and FRIM. Losses resulted from staff departures, particularly because of the comparatively low salary levels at MAIFS agencies; deaths from the AIDS epidemic and other causes; and retirement of senior staff. An IMF-induced freeze on overall government recruitment exacerbated this situation, as did the limited opportunities for promotion at DARS at this time (see the section on financing for more information). Early in 2003, only 65 of the 115 professional positions at DARS were filled. In contrast, total fte researcher

numbers at BCA continued to rise—though moderately—during 1996–2001.

Until the mid-1970s, agricultural research in Malawi was mainly conducted by expatriate staff, but thereafter—following trends in other African countries in the decade or so after independence—the share of expatriate researchers declined quickly. More than half of all fte agricultural researchers in Malawi were expatriates in the early 1970s (Roseboom and Pardey 1993), whereas by 1991 the corresponding share was 9 percent, and by 2001 the share had fallen to only 2 percent, or two fte researchers.

In contrast, total agricultural R&D spending declined by an average of 1.7 percent per year in the three decades from 1971. After 15 years of limited growth, total spending was cut by almost half, from \$22 million in the mid-1980s to less than \$13 million in 2001 (Figure 1b). The trend was also very erratic over this period because of the variability of government contributions to DARS and the other government agencies. Because of these declines at the government agencies, the nonprofit sector's share of total spending increased from 13 percent in 1971 to over 40 percent during the late 1990s, though in real terms it grew more moderately from \$2.2 million in 1971 to \$4.2 million in 2001.

Figure 1—Public agricultural R&D trends, 1971-2001

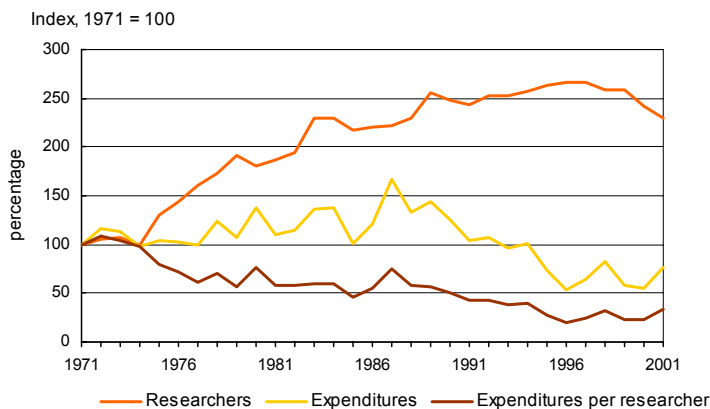


Sources: Compiled by authors from ASTI survey data (IFPRI–ISNAR 2003) and Roseboom and Pardey (1993).

Notes: See Table 1. Figures in parentheses indicate the number of agencies in each category. Underlying data are available at the ASTI website (www.asti.cgiar.org).

With the fall in total spending and total growth of researcher numbers, spending per scientist dropped to very low levels. In 2001, total spending per researcher averaged \$59,000—less than a quarter of the average level in the early 1970s (Figure 2). The 2001 level was also much lower than comparable levels in most African countries. For example, in 2000/01, researcher spending in Botswana and Mauritius averaged \$169,000 and \$153,000, respectively (Beintema et al. 2004; Beintema et al. 2003).

Figure 2—Long-term public agricultural R&D trends, 1971–2001



Source: Figure 1.

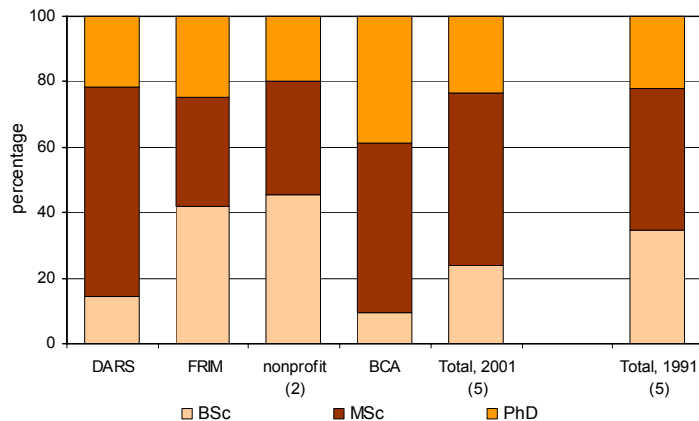
Human Resources

In 2001, 76 percent of the 132 fte researchers in a 5-agency sample were trained to the postgraduate level, and nearly a quarter held doctorate degrees (Figure 3). DARS and BCA employed comparatively more researchers with postgraduate degrees (86 and 91 percent respectively), while FRIM and the two nonprofit institutions employed more researchers with BSc degrees. BCA, the only higher-education agency in Malawi conducting agricultural research, also employed comparatively more researchers with doctorate degrees (39 percent)—a common (and unsurprising) trend in Africa and the rest of the world. The quality of staff at the government agencies—measured in terms of the share of researchers with PhD and MSc degrees—increased from 65 percent in 1991 to 76 percent in 2001, mostly from increases in the number of researchers with MSc degrees. The absolute number of researchers with doctorate degrees at DARS actually dropped, from 19 in 1991 to 15 in 2001, representing a 2-percent decline.

Most training of DARS research staff occurred in the 1980s and early 1990s as a result of the National Agricultural Research Project (NARP), which was largely funded by a World Bank loan and a grant from the United States Agency for International Development (USAID) under the Malawi Agricultural Research and Extension (MARE) project. The World Bank loan supported MSc training for 4 researchers and PhD training for 9, while the USAID funding supported MSc training for 27 researchers and PhD training for 4. A large number of researchers and support staff also received short-term training within Malawi and abroad (World Bank 1994). The Agricultural Services Project (ASP), which ran from 1994 until 1999, funded through a second World Bank loan, also supported training for researchers to obtain their MSc degrees.

As of 2003, training of researchers was still occurring abroad, funded by donors such as the Rockefeller Foundation and the Fulbright scheme, but the government had begun to facilitate training of newly hired young researchers in plans to replace senior scientists due for retirement in the coming years.

Figure 3—Educational attainment of researchers, 1991 and 2001

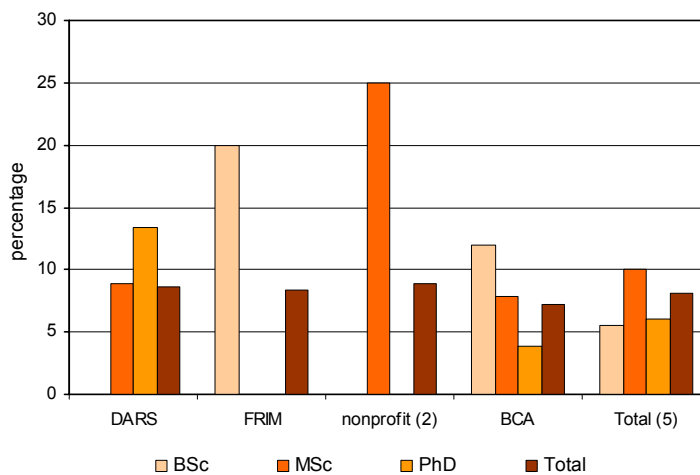


Source: Compiled by authors from ASTI survey data (IFPRI–ISNAR 2003) and Roseboom and Pardey (1993).

Note: Figures in parentheses indicate the number of agencies in each category. Data exclude expatriate staff.

On average, 8 percent of all fte researchers in a 5-agency sample in 2001 were female, including 6 percent of all researchers holding doctorate degrees, 10 percent of all researchers with MSc degrees, and 6 percent of BSc-trained researchers.

Figure 4—Share of female researchers, 2001

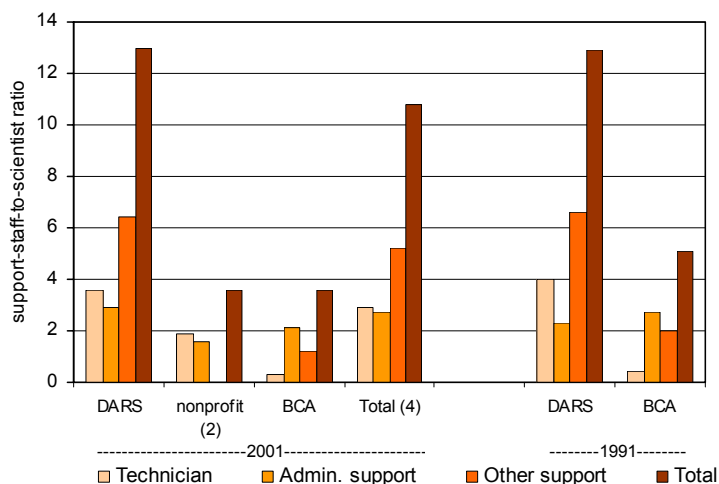


Source: Compiled by authors from ASTI survey data (IFPRI–ISNAR 2003).

Note: Figures in parentheses indicate the number of agencies in each category. Data exclude expatriate staff.

Malawi has one of the highest support-staff-per-scientist ratios in the region, at an average of 10.8 for a 5-agency sample in 2001, and comprising 2.9 technical staff, 2.7 administrative personnel, and 5.2 other support staff such as laborers, guards, and drivers (Figure 5). For DARS, the 2001 ratio was 13.0, similar to the corresponding 1991 ratio. At 3.6, the 2001 BCA ratio was significantly lower, and represented a decline from the 1991 ratio of 5.1. The two nonprofit agencies had on average a similar ratio of support staff per scientist (3.6) for 2001 while no data were available for 1991.

Figure 5—Support-staff-to-researcher ratios, 1991 and 2001

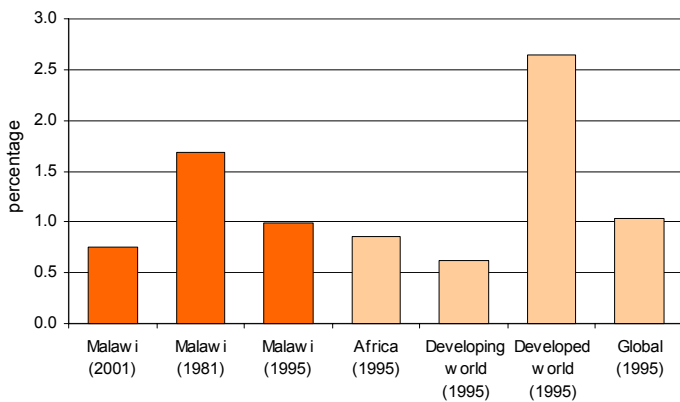


Source: Compiled by authors from ASTI survey data (IFPRI-ISNAR 2003).
Note: Number of agencies in sample shown in brackets. Figure excludes expatriate staff.

Spending

Total public spending as a percentage of agricultural output (AgGDP) is a commonly used indicator for comparing agricultural R&D spending across countries and regions. In 2001, Malawi invested \$0.75 for every \$100 of agricultural output, which is about one-third of the 1981 level of \$1.69 (Figure 6). The 1995 ratio of 0.99 percent, however, was higher than the average ratio for Africa (0.85) and the developing world (0.62) that year.

Figure 6—Malawi's public agricultural research intensity compared regionally and globally



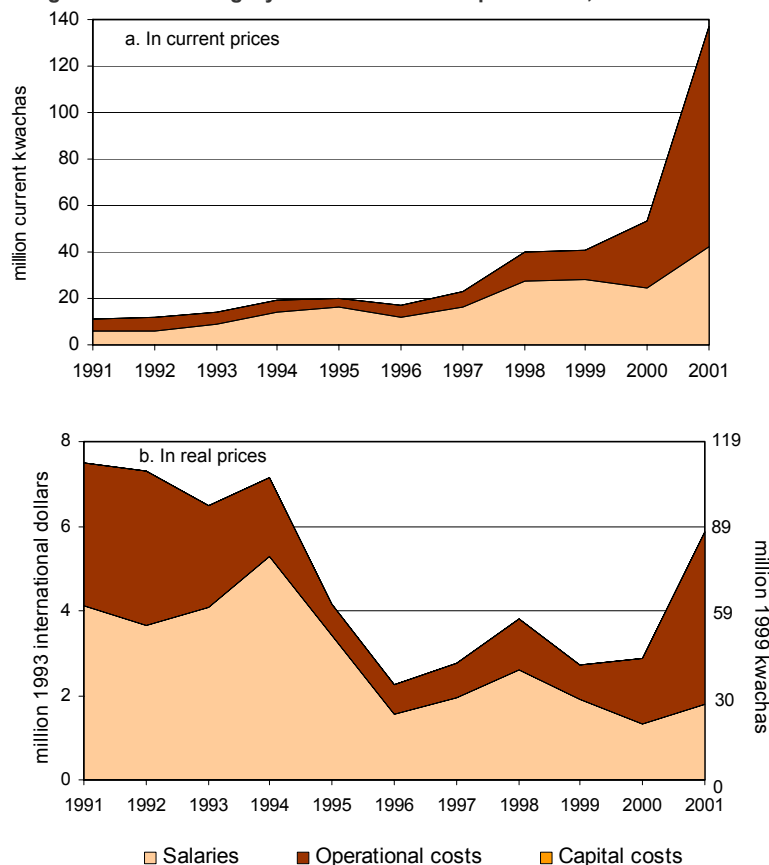
Sources: Malawi compiled from Figure 1b; AgGDP from World Bank (2003); other intensity ratios from Pardey and Beintema (2001).

Although DARS' spending in current prices increased during 1991–2000 (Figure 7a), in real terms it declined significantly in the early 1990s because of the very high inflation rates in Malawi at that time (Figure 7b). The strong recovery in spending in 2001 reflects an increase in government support to DARS (see details in the section of financing to follow.)

On average, salaries accounted for over half the total spending at DARS during 1991–2001 though this share fell in recent years with the strong increase in operational costs.

Capital costs peaked in the late 1980s and early 1990s, when DARS invested significantly in its physical infrastructure and equipment. These improvements were largely made possible by the previously mentioned NARP initiative. ASP, which followed NARP, enabled DARS to purchase much-needed vehicles to ease transportation constraints in the second half of the 1990s. ASP did not, however, provide for maintenance of infrastructure developed under NARP, so no further infrastructure spending occurred in the late 1990s and early 2000s. From 2000 to 2001, operating expenditure at DARS more than tripled in current prices because of a strong increase of government funding for this purpose.

Figure 7—Cost-category shares in DARS' expenditures, 1991–2001



Source: Compiled by authors from ASTI survey data (IFPRI-ISNAR 2003).

FINANCING PUBLIC AGRICULTURAL R&D

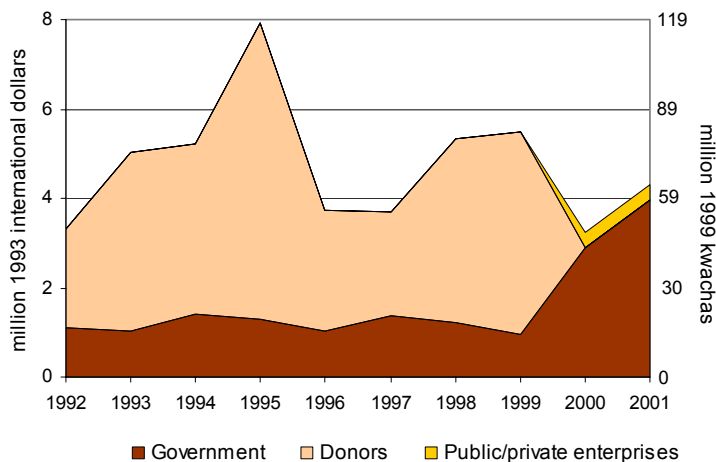
Agricultural research in Malawi has been largely funded by the government, loans from the World Bank, and contributions from foreign donors. In the 1990s, DARS received most of its funding from the national government and the World Bank (see below). FRIM also depended on government and donor funding during this time. In addition to World Bank-supported projects, major contributors included the U.K.'s Department for International Development (Dfid), Japan International Cooperation Agency (JICA), the European Union, USAID, and the Center for International Forestry Research (CIFOR). BCA receives only limited funding for its research activities from national sources, mainly from MAIFS, but most project funding

was contributed through donors such as the Rockefeller Foundation, Dfid, USAID, and JICA. Many of BCA's projects are joint collaborations with agencies in Malawi or abroad. ARET receives its funding through a levy of 1 percent on the gross proceeds of tobacco sales (at auction). About one-third of these revenues supports administrative expenses; while the remainder is split equally between ARET's research and extension services. Although the tobacco price per unit has decreased, production has increased to such a degree that overall levy earnings have increased, though with yearly fluctuations. Other, minimal, funding sources for ARET have been the proceeds from seed sales and interest on levy funds. TRF receives most of its funding from the Tea Associations of Malawi and Zimbabwe, but it also received project funding from the World Bank, the European Union, Dfid, and the United Nations Development Programme (UNDP).

Department of Agricultural Research Services

During 1992–2001, nearly two-thirds of total funding for DARS was provided by donors; the national government contributed the remaining third (Figure 8). In 2000 and 2001 DARS received no donor funding; hence, government contributions increased significantly to redress the shortfall. Over this time DARS also received about 10 percent of its funding from private companies, mainly as payments for testing new crop varieties, seeds, and pesticides

Figure 8—DARS funding sources, 1992–2001



Source: Compiled by authors from ASTI survey data (IFPRI–ISNAR 2003).

Most of the funding for DARS during 1992–2001 was derived through the two previously mentioned World Bank-supported projects, NARP and ASP. NARP ran from 1986 to 1993 (including three one-year extensions) and its principal objectives were (a) to improve the focus and quality of Malawi's agricultural research programs through the development of an agricultural research strategy, (b) to strengthen research–extension–farmer linkages, and (c) to improve overall efficiency. The project's revised budget totaled US\$59.8 million—US\$33.7 million through the World Bank loan, US\$9.2 million from USAID, and US\$16.9 million through counterpart funding from the national government.⁶

Most of the project's objectives were met, with the World Bank rating outcomes as satisfactory: the research structure was reorganized, master and action plans were developed, infrastructure and human resources at DARS were upgraded, and collaboration with international organizations was strengthened. Some problems did occur, however, such as failure to improve working conditions of staff and operational management (purchasing, planning, and so on) at DARS, and—importantly—failure to retain researchers trained under NARP, given 30 percent attrition (World Bank 1994).

The principal objective of ASP, which ran from 1994 to 1999, was to reform and integrate research, extension, and input supply services in order to provide profitable and sustainable technologies for small-scale farmers, enhance their incomes, and improve food security by increasing productivity and diversification. ASP's budget totaled US\$64.8 million—US\$45.8 million through the World Bank loan, US\$12.7 from contributions by the African Development Bank (AfDB), and US\$6.3 million through counterpart funding from the national government. At a base cost of US\$18.1 million, \$15.6 million of which constituted the World Bank loan, the agricultural research component of ASP was very much a follow-on from NARP. It focused on ongoing formulation and implementation of research action plans; further strengthening of research–extension–farmer linkages; the diversification of participation in public funded research through a contract research program; improved priority setting, and funding allocation; and improved management and morale at DARS. Expenditure at the end of the project totaled US\$52.8 million, with only US\$6.5 million (about a third of the original budget) disbursed under the research component. ASP's objectives were not met satisfactorily; this was partly because of the political environment in Malawi at the time, exacerbated by external factors such as the AIDS crisis. Research objectives were partially met, particularly in terms of the contract research program. Disappointingly, however, farmer involvement in the development of research programs at DARS remained minimal and linkages with the extension services poor; moreover, management did not improve and staff morale remained low. The funding shortage also meant that much of the planned expenditure on vehicles and laboratory, plant, and field equipment had to be abandoned (World Bank 1993 and 2000).

RESEARCH ORIENTATION

Commodity Focus

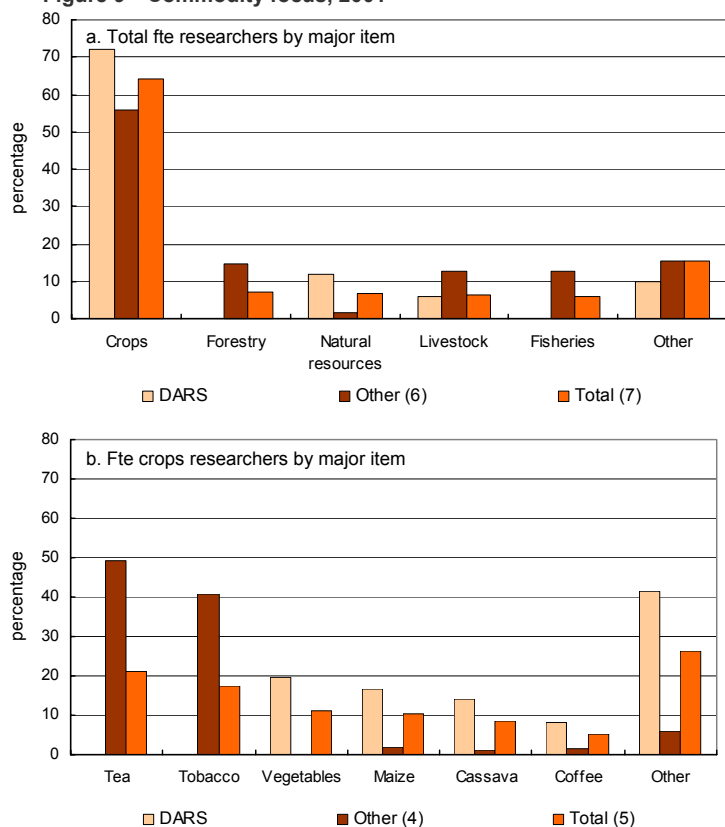
The allocation of resources across various lines of research is a significant policy decision; hence detailed survey information was collected on the number of fte-researchers working in specific commodity and thematic areas.

In 2000, about two-thirds of the fte researchers in our 7-agency sample conducted crop research (Figure 9a). Forestry and natural resources each accounted for 7 percent of researchers, while livestock and fisheries each accounted for 6 percent. DARS researchers spent relatively more time on crop research, while, the other agencies, focused relatively more time on livestock, forestry, and fisheries research.

The major crops being researched were tea and tobacco, accounting, respectively, for 21 and 17 percent of the research activities of the 88 fte crops researchers in our sample (Figure 9b). Other major crops being researched were vegetables, maize,

cassava, and coffee, each accounting for between 5 and 11 percent of all crop research undertaken. DARS researchers focused mainly on vegetables, maize, and cassava, at 14, 12, and 10 percent of total fte researcher, respectively.

Figure 9—Commodity focus, 2001



Sources: Compiled by authors from ASTI survey data (IFPRI–ISNAR 2003).

Note: Figures in parentheses indicate the number of agencies in each category. Figure 9b only includes agencies involved in crop research.

CONCLUSION

After a period of growth, total spending on agricultural research in Malawi was cut by half between the mid-1980s and 2001 despite two consecutive World Bank–supported projects. Substantial investments were made under NARP to improve infrastructure, management, and capacity at DARS, then a second, less successful project—ASP—attempted to continue to strengthen the system. In 2000/01 overall agricultural research investments increased as a result of a substantial increase in government contributions to DARS, but the 2001 level was still far from total investment levels during the 1970s and 1980s.

Unfortunately the modest gains made under NARP have since been eroded, in part because of the short-fall in funding to ASP (only a third of the original research budget was disbursed) and inability to redress management and staff morale problems at DARS. Total fte researcher numbers have declined since the mid-1990s, mainly because of departures from DARS and FRIM, and as of early 2003, about half of the research positions at DARS were vacant

NOTES

1. The authors are grateful to numerous colleagues in Malawi for their time and assistance with data collection, and Mr. Chamango, Dr. Phiri, and Dr. Wanda for useful comments on drafts of this brief.
2. The eight-agency sample consisted of:
 - Four government agencies: the Ministry of Agriculture, Irrigation, and Food Security (MAIFS)'s Department of Agricultural Research Services (DARS) and Central Veterinary Laboratory (CVL); the Ministry of Forestry and Environmental Affairs (MFEA)'s Forestry Research Institute of Malawi (FRIM) and Fisheries Research Unit (FRU);
 - One higher-education agency, the Bunda College of Agriculture (BCA);
 - Two nonprofit institutions, Research Services Department (RSD) of the Agricultural Research and Extension Trust (ARET) and the Tea Research Foundation of Central Africa (TRF); and
 - One private enterprise, the Sugar Corporation of Malawi (SUCOMA).

3. Unless otherwise stated, all data on research expenditures are reported in 1993 international dollars or in 1999 kwachas.
4. From 1988 until 2002 DARS was known as the Department of Agricultural Research and Technical Services (DARTS), and prior to 1988 it was called the Department of Agriculture (DAR); prior to 2002, MAIFS was known as the Ministry of Agriculture and Irrigation (MAI).
5. Annual growth rates are calculated using the least-squares regression method, which takes into account all observations in a period. This results in growth rates that reflect general trends that are not disproportionately influenced by exceptional values, especially at the end point of the period.
6. The actual expenditure at the end of the project was slightly less, at US\$58.2 million, while the original budget was lower still, at US\$49.9 million total and US\$23.8 in World Bank loans (World Bank 1994).

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METHODOLOGY

- Most of the data in this brief are taken from unpublished surveys (IFPRI and ISNAR 2003).
- The data were compiled using internationally accepted statistical procedures and definitions developed by the OECD and UNESCO for compiling R&D statistics (OECD 1994; UNESCO 1984). We grouped estimates using three major institutional categories—government agencies, higher-education agencies, and business enterprises, the latter comprising the subcategories private enterprises and nonprofit institutions. We defined public agricultural research to include government agencies, higher-education agencies, and nonprofit institutions, thereby excluding private enterprises. Private research includes research performed by private-for-profit enterprises developing pre, on, and postfarm technologies related to agriculture.
- Agricultural research includes crops, livestock, forestry, and fisheries research plus agriculturally related natural resources research, all measured on a performer basis.
- Financial data were converted to 1993 international dollars by deflating current local currency units with a Malawi GDP deflator of base year 1993 and then converting to U.S. dollars with a 1993 purchasing power parity (ppp) index, both taken from World Bank (2003). Ppp's are synthetic exchange rates used to reflect the purchasing power of currencies, typically comparing prices among a broader range of goods and services than conventional exchange rates.
- The salaries and living expenses of many expatriate researchers working on donor-supported projects are paid directly by the donor agency and are often excluded in the financial reports of the agricultural R&D agencies. These *implicit* costs have been estimated using the average cost per researcher in 1985 to be \$160,000 1993 international dollars and backcasting 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 has the assumption that the personnel-cost trend for US researchers is a reasonable proxy of the trend in real costs of internationally recruited staff in the agricultural R&D agencies.

See the ASTI website (<http://www.ASTI.cgiar.org>) for more details on methodology.

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