AGRICULTURAL SCIENCE AND TECHNOLOGY INDICATORS

IFPRI isnar DARHRD

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ERITREA

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Since attaining independence from Ethiopia in 1991, Eritrea has focused on developing its agricultural R&D capacity both through human resources and infrastructure. This country brief reviews the major investment and institutional trends in Eritrea's public agricultural research since the mid 1990s using new survey data collected under the Agricultural Science and Technology Indicators (ASTI) initiative (IFPRI–ISNAR–ASARECA 2001–02).[1]

INSTITUTIONAL DEVELOPMENTS

Eritrea is one of the smallest countries in Africa in terms of agricultural research investment. In 2000, the three agencies involved in agricultural research spent a total of 15 million 1999 Eritrean nakfas—equivalent to $9 million at 1993 international prices[2]—and employed 86 full-time equivalent (fte) researchers (Table 1).[3] The major agricultural research agency is the Department of Agricultural Research and Human Resource Development (DARHRD), which accounted for 93 and 71 percent of total spending and total researchers, respectively. DARHRD is one of four Ministry of Agriculture (MOA) departments; it's mandate is to conduct research on crops, livestock, horticulture, forestry, and agricultural engineering and to provide relevant short- and long-term training.

MOA has been restructured three times since Eritrea's independence (see *A Short History of Government-Based Agricultural Research in Eritrea* on page 2) but only with partial success, largely as a result of poorly defined objectives and directives to the various departmental levels and units (Ministry of Agriculture 2002). A proposal is in preparation to reorganize MOA, re-establishing it as the National Agricultural Research Institute (NARI). NARI would have semi-autonomous status and be governed by a board comprised of representatives from MOA, the University of Asmara , farmers associations, the Ministry of Finance, and the Ministry of Local Government. Semi-autonomous status would provide the twin

Table 1—Composition of agricultural research expenditures and total researchers, 2000

Type of agency	Spending		Researchers[a]	Share	
	1999 nakfas	1993 international dollars		Spending	Researchers
	(*millions*)		(*fte's*)	(*percent*)	
DARHRD	9.3	5.3	61.0	92.7	71.1
RSD/MF[b]	0.5	0.3	11.9	3.5	13.9
CAAS[b, c]	0.6	0.3	12.9	3.8	15.0
Total	**15.4**	**8.9**	**85.8**	**100**	**100**

Sources: Compiled by the authors from survey data (IFPRI-ISNAR-ASARECA, 2001-02).
[a] Include national and expatriate staff.
[b] Expenditures for the RSD/MF and CAAS are estimates based on DARHRD's government expenditures per researcher.
[c] CAAS employed 43 faculty staff dedicating an estimated 30 percent of their time to research. This translates as 12.9 full-time equivalent researchers.

KEY TRENDS

- Eritrea is one of the smallest and youngest Sub-Saharan African countries and has only a few agencies involved in agricultural research.
- DARHRD, the primary agricultural research agency, is highly dependent on donor funding. During 1995–2000, over three quarters of total funding was contributed by donors—mostly from the Italian government through an FAO project and Danida funding.
- As a result of the war with Ethiopia during 1998–2000, government contributions to DARHRD decreased, and many researchers were diverted into national service duty for long periods.
- DARHRD will require substantial ongoing support from the Eritrean government and the donor community, especially in light of the completion of the FAO/Italian government project and the termination of Danida funding in 2003.
- Private-sector involvement in agricultural research is non-existent.

ABOUT ASTI

The Agricultural Science and Technology Indicators (ASTI) Initiative consists of a network of national, regional, and international agricultural R&D agencies managed by IFPRI and ISNAR. The 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).

benefits of secure government funding accompanied by increased decisionmaking ability in terms of general management, expenditure allocation, human resources, and even the generation of further income through private research contracts.

DARHRD has three research stations located in different agroecological zones and production systems (Mesghena and Ghebru 1999). Government and donor funding, however, is well below required levels, so DARHRD's ability to employ researchers—especially those holding postgraduate degrees—is limited. In addition, the department has had inadequate funds for laboratory activities and field materials and for investment in infrastructure and equipment.

The two other agricultural research agencies in our sample are the Research and Statistics Division of the Ministry of Fisheries (RSD/MF) and the College of Agriculture and Aquatic Sciences (CAAS) of the University of Asmara, which together accounted for 7 percent of Eritrea's total agricultural R&D spending and 29 percent of total researchers in 2000. RSD/MF conducts research on marine habitat and fisheries and provides short-term fisheries training, but the division has poor infrastructure for research. CAAS primarily provides BSc training, but an estimated 30 percent of professional staff time is dedicated to basic and applied research. The college has only one research facility—an experimental field on campus—but conducts some research using DARHRD's experimental fields under an agreement between the university and MOA (Mesghena and Ghebru 1999).

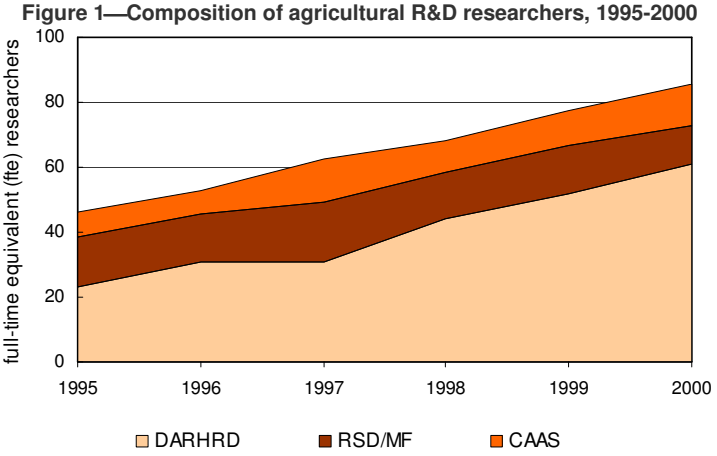
Recently the Hagaz Agricultural and Technical College was established, but seemingly it has not yet initiated significant research activities.

HUMAN AND FINANCIAL RESOURCES IN AGRICULTURAL R&D

Overall Trends

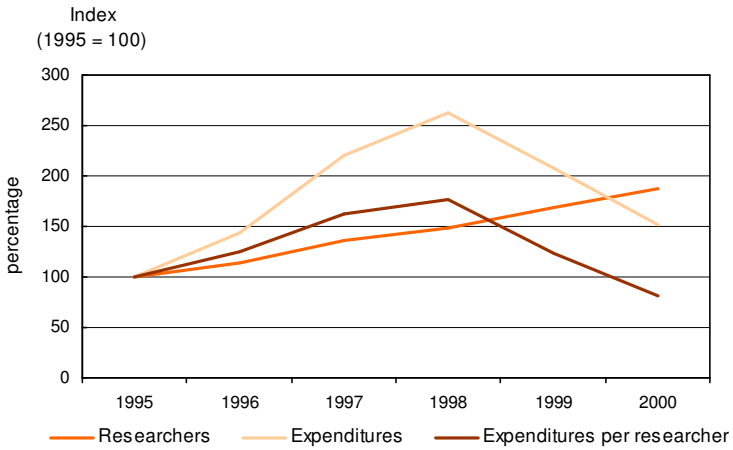
From 1995 to 2000, total fte researchers at the three agricultural research agencies nearly doubled, but from very low initial levels (Figure 1). Most of this growth occurred at DARHRD, where research staff numbers increased from 23 in 1995 to 61 in 2000. Despite this growth, the current number of researchers is still low relative to other African countries. In addition, given the conflict with Ethiopia during 1998–2000, many of the (often young) researchers were required to undertake national service. During 1995–2000, total fte researchers at CAAS also increased, but RSD/MF's total research staff decreased by about a quarter. This is the reflection of national service commitments by which RSD/MF was more severely affected than DARHRD.

Figure 1—Composition of agricultural R&D researchers, 1995-2000



Sources: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02) and ASARECA (1995).

Figure 2—Trends in public expenditures, researchers, and expenditures per researcher, 1995–2000



Sources: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02) and ASARECA (1995).
Notes: See Table 1. Underlying data is available on the ASTI website (www.asti.cgiar.org)

A Short History of Government-Based Agricultural Research

Eritrea fell under colonial rule first by the Italians, during 1880–1941, and then by the British, during 1941–52. Under the auspices of the United Nations, it was finally determined that Eritrea would be federated under the Ethiopian crown in 1952, only to be annexed by Ethiopia ten years later in 1962.

Four research farms were established by the Italian colonial government in 1910 to conduct research on coffee, along with a few other crops. In the 1920s, another farm was established at Tessenei, in the western lowlands, focusing on cotton. The Tessenei farm was taken over by the British, but no information is available on what happened to the other research farms.

In 1976, under Ethiopian rule, the Tessenei farm became a semi-public entity. Two additional research facilities were established at Sembel and Paradiso but were later deserted because of the war. The University of Asmara's Department of Agriculture also established three research sites at Imbatkala, Halhale, and Abarda.

Following independence in 1991, agricultural research was organized under the Department of Agricultural Research and Training (DART), which focused on crop, livestock, and forestry research, as well as vocational training in agriculture. In 1995, DART's mandate was broadened to include extension, while its training component was transferred to another MOA department. As a result DART was renamed the Department of Agricultural Research and Extension (DARE). Further restructuring occurred in 1996 and again in 1997, when DARE was renamed the Department of Agricultural Research and Human Resource Development (DARHRD).

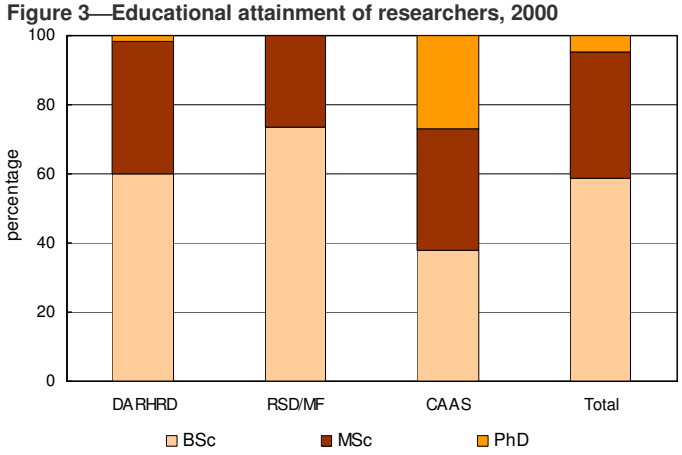
Sources: Mesghena and Ghebru (1999) and Ministry of Agriculture (1995).

During 1999–2000 total spending levels, adjusted for inflation, were considerably lower than the two previous years—a result of the combined effect of lower government contributions and donor funds to DARHRD (Figure 2). Consequently, spending per researcher decreased over the period from more than $200,000 in 1997 and 1998 to only $103,000 in 2000.

Human Resources

In 2000, 41 percent of the 82 fte researchers (excluding expatriate staff) held postgraduate degrees, with only 5 percent holding doctorate degrees (Figure 3). These shares are low compared with other African countries. CAAS, the only higher-education agency involved in agricultural research, had a relatively higher share of research staff trained to postgraduate level, which follows trends in other African countries and regions (Pardey et al. 1997 and Beintema and Pardey 2001).

Figure 3—Educational attainment of researchers, 2000



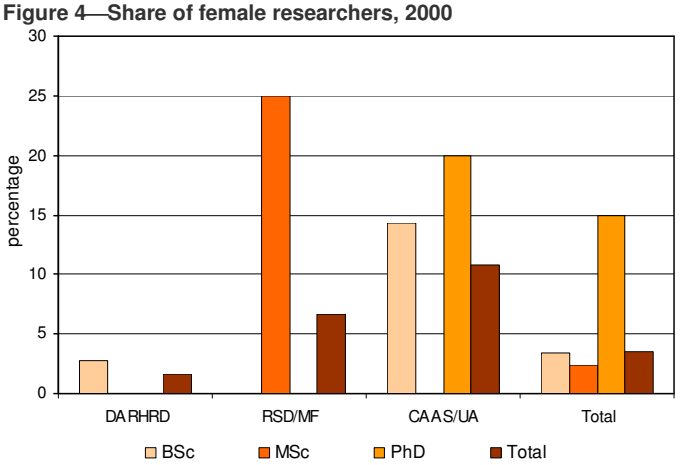
Source: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02).
Note: Figure excludes expatriate staff.

The second phase of the FAO project *Strengthening Agricultural Research in Eritrea*, funded by the Italian government (which spans April 2001 to December 2003) includes a staff training component primarily for short-term training; however, a few researchers have also received MSc training. During the first phase of the project (1996–2000) 9 researchers obtained project-funded MSc degrees, while, as of December 2002, 1 staff member was finalizing doctorate training. In addition, 43 research and extension staff received short-term training. Other training was also funded by the World Bank, the Danish International Development Agency (Danida), and the Norwegian Agency for Development Cooperation (NORAD). Most of the MSc training is attained at South African universities. In addition, MOA and the University of Asmara have developed collaborative linkages with institutions in developed countries to train individuals in research, teaching, and extension.

For Eritrea, like many African countries, the so-called brain drain on research staff is a serious problem, with significant numbers of researchers leaving the government sector for opportunities in Eritrea's private sector or abroad.

In 2000, only 4 percent of total research staff were female, ranging from 2 percent at DARHRD (representing one female researcher with a BSc degree) to 11 percent at CAAS (Figure 4). As with the previous indicators, this share is low compared with other African countries: the corresponding rate for Uganda, for example, was 21 percent in the same year (Beintema and Tizikara 2002).

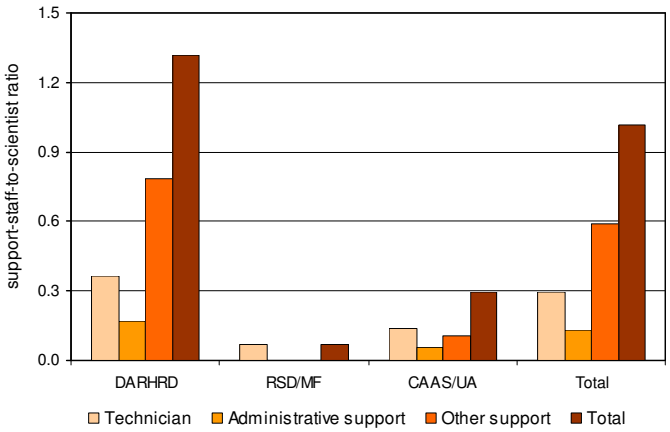
Figure 4—Share of female researchers, 2000



Source: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02).
Note: Figure excludes expatriate staff.

Consistent with this trend, the average number of support staff per scientist was also low compared with other African countries. In 2000, one support staff was employed for each researcher, representing 0.3 technicians, 0.1 administrative personnel, and 0.6 other support staff such as laborers, guards, and drivers (Figure 5). DARHRD had a slightly higher ratio of support staff per scientist (1.3) while RSD/MF only employed 0.1 support staff per scientist.

Figure 5—Support-staff-to-researcher ratios, 2000



Source: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02).
Note: Figure excludes expatriate staff.

Spending

Total public spending as a percentage of agricultural output (AgGDP) is a useful indicator of a county's research investment in the context of internationally comparable agricultural R&D spending. In 2000, Eritrea invested $1.7 for every $100 of agricultural output, which was lower than the $2.2 invested five

years earlier (Table 2). The 1995 investment ratio was high relative to the average for Africa or the developing world (0.9 and 0.6 percent respectively), but Eritrea's other intensity ratios—such as spending per capita and spending per farmer — were lower than the comparable averages for Africa and the developing world that year.

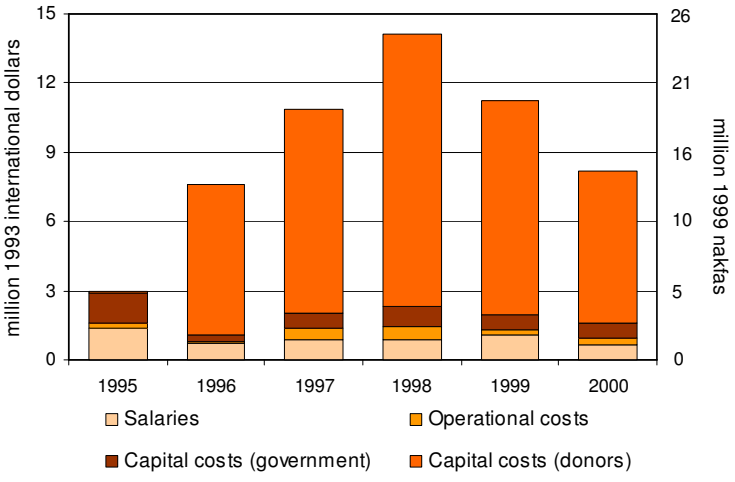
Table 2—Eritrea's agricultural research intensity compared with regional and global equivalents

	Total agricultural R&D spending		
	as a percentage of AgGDP	per capita	per economically actoive population in agricultura
	(*percentage*)	(*1993 international dollars*)	
Eritrea (2000)	1.7	2.4	6.3
Eritrea (1995)	2.2	1.9	4.7
Sub-Saharan Africa (1995)	0.9	2.4	9.4
Developing world (1995)	0.6	2.5	8.5
Developed world (1995)	2.6	12.0	594.1
World (1995)	1.0	4.2	17.7

Source: Eritrea data are compiled from Figure 2; 1995 AgGDP data are from World Bank (2002); 2000 Ag GDP is estimated; total population and economically active population in agriculture are from FAO (2002); and other intensity ratio data are from Pardey and Beintema (2001).

DARHRD has invested significantly in its physical infrastructure and equipment since its establishment. This has largely been made possible by the aforementioned FAO project (the first phase which began in 1996) and Danida funding. It is illustrated by very high average capital costs as a percentage of total spending—8 and 78 percent, funded through government and donor contributions, respectively, during 1995-2000 (Figure 6). In May of 2001, DARHRD inaugurated a new research facility and headquarters at Halhale. Management of agricultural research is now concentrated at this one site, where previously its was divided between Asmara and Halhale. During 2002, the facility at Halhale was being expanded to include a training center managed by the University of Asmara.

Figure 6— Shares of DARHRD's expenditures by cost category, 1995–2000



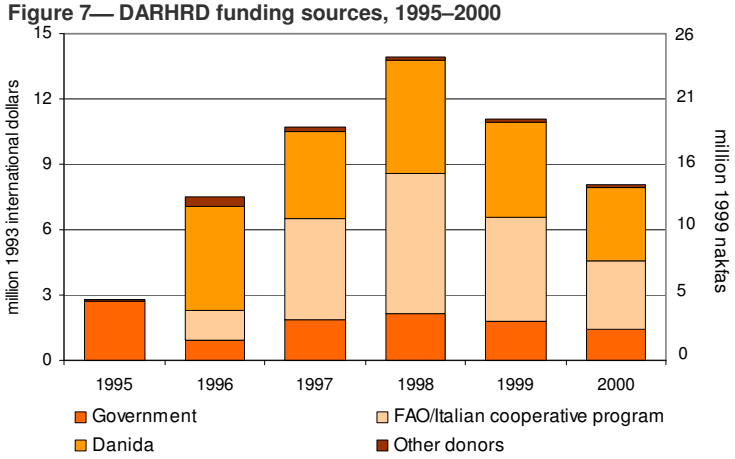
Source: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02).

Total salaries accounted for about 10 percent of total DARHRD spending, while only 3 percent was earmarked for operational expenses.

FINANCING PUBLIC AGRICULTURAL R&D

Eritrea's high dependency on donor funding is consistent with many other countries in the region. During 1995–2000, about 80 percent of DARHRD's total funding was provided by donors, while the share of government aid was only 20 percent (Figure 7). No other sources contributed to DARHRD's total funding (such as private-sector contributions or private research contracts, which are increasingly targeted by most African countries and the developing world generally).

Figure 7— DARHRD funding sources, 1995–2000



Source: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02).

The first phase of the FAO project accounted for about one half of total donor funding during 1995–2000, on average, and funding for this phase of the project totaled US$4.5 million. The objective of the first phase was to establish an appropriate level of institutional capacity within DARE—DARHRD's name prior to 1997—by contributing to the development of sound organizational and management practices, providing short course and degree training for staff, assisting with the development of production systems in the various agroecological zones, and improving the plant protection capacity and technology of the department. The total budget for the second phase of the project (2001–2003) is close to US$3 million; this phase supports further development of DARHRD's facilities, further training, and various research programs.

Danida has also been an important DARHRD donor, accounting for slightly less than one half of total donor funding during 1995–2000. However, with the 2002 change of administration, the Danish government indicated that it would terminate its development assistance to Eritrea's agricultural research from the beginning of 2003.

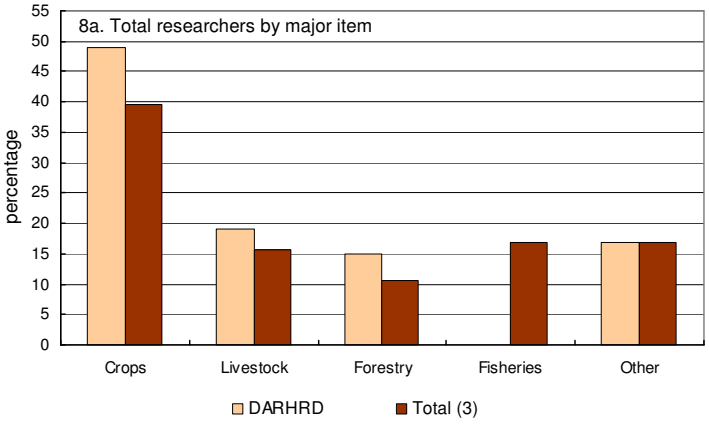
A few other donors have provided funding to DARHRD such as ASARECA, USAID, Bern University and Virginia State University, but their combined share in total donor funding was only 3 percent during 1995-2000.

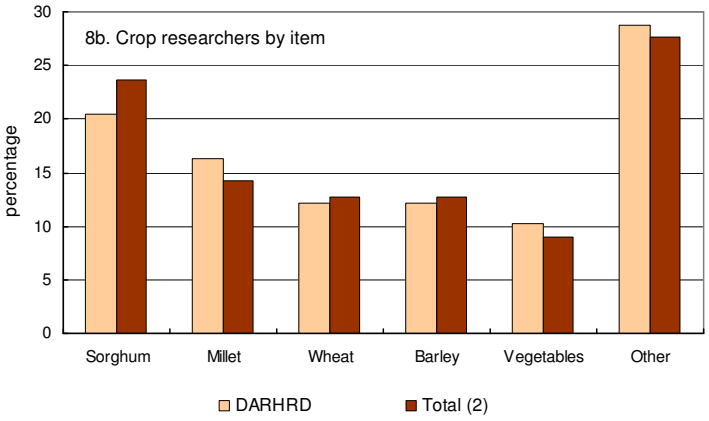
RESEARCH ORIENTATION

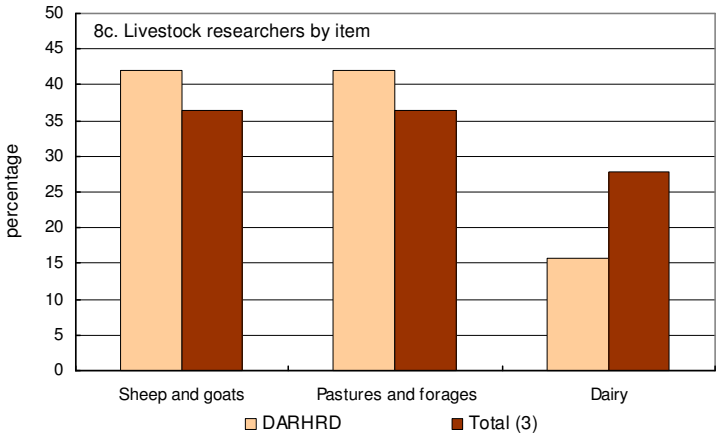
Commodity Focus

The allocation of resources across various research lines 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, 40 percent of the 86 fte researchers conducted crop research. Fisheries and livestock research accounted for 17 and 15 percent, while forestry research accounted for 11 percent of the total (Figure 8a). Noteworthy is the relatively higher share of DARHRD researchers involved in crop research—specifically the intense focus on cereals (Figure 8b).[4] The major crop was sorghum, which accounted for about a quarter of the total fte crop researchers. Other cereals, such as millet, wheat, and barley accounted for 12–14 percent of the total. Similar shares of fte livestock researchers focused on sheep and goats (36 percent), pastures (36 percent) and dairy (28 percent) (Figure 8c).

Figure 8—Commodity focus, 2000







Sources: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02).
Note: Figure 8b excludes RSD/MF, which conducts fisheries research.

Faced with a limited budget and declining external funding, DARHRD is strengthening its Planning and Statistics Unit with a view to prioritizing resource allocation more efficiently and to increase the department's mandate to include socioeconomics research. Specific plans are underway to address the shortage of socioeconomics professionals, and DARHRD is building strategic partnerships with relevant international institutions to complement its efforts in this area.

CONCLUSION

As the new ASTI data presented in the country brief illustrates, despite the substantial expansion of DARHRD's research staff and donor funding during the second half of the 1990s, research facilities, staffing levels, and staff qualifications still fall well below levels that would enable Eritrea's agricultural research organizations to operate at a scale comparable with many other African countries. DARHRD will require substantial ongoing support from the Eritrean government and the donor community, especially in light of the completion of the FAO/Italian government project and the termination of Danida funding in 2003. Successful retraining of demobilized national service personnel could be a valuable contribution to both Eritrea's agricultural research capacity and its social structure, but this will depend on sufficient ongoing funding.

NOTES

1. The authors are grateful to numerous colleagues in Eritrea for their time and assistance with the data collection, and thank Semere Amlesom, Eyob Gezai, Peter Hazell, Sami Mohammed, and Mihreteab Yemane for their useful comments on previous drafts of this brief.

2. Unless otherwise stated, all data on research expenditures are reported in 1999 Eritrean nakfas or in 1993 international dollars.

3. These include national and expatriate research staff, the latter numbering four fte researchers.

4. The high share of cereals in total diet of Eritreans, specifically in rural areas, is very high, which explains the intense focus on cereals research.

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METHODOLOGY

- Most of the data in this brief are taken from unpublished surveys (IFPRI, ISNAR, and ASARECA 2001-02).
- 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 an Eritrea 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 (2002). 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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