ASTI Agricultural Science & Technology Indicators
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NARI National Agricultural Research Institute

# ERITREA

## RECENT DEVELOPMENTS IN AGRICULTURAL RESEARCH

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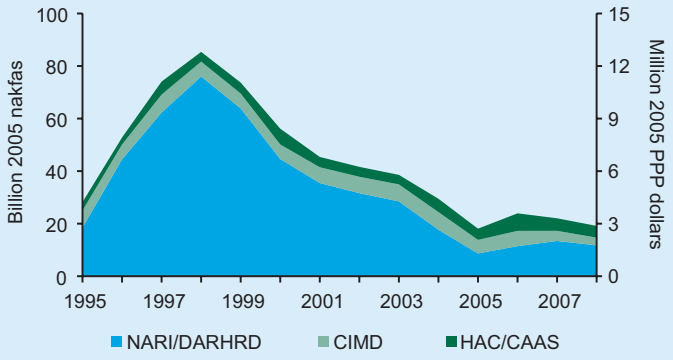
## LONG-TERM INVESTMENT AND CAPACITY PATTERNS IN AGRICULTURAL R&D

When Eritrea achieved independence from Ethiopia in 1993 after a long war, the country's economy was in ruins, and public infrastructure and institutions were seriously damaged or destroyed. The new government faced a long process of establishing public-sector organizations to stimulate economic growth and provide basic services. Strengthening national agricultural research and development (R&D) and extension services was high on the list of priorities. In the first years after independence, the country's agricultural output, as well as its agricultural R&D expenditures, rose rapidly following an influx of support from foreign donors. Nevertheless, renewed conflict with Ethiopia in 1998 led to dramatic cuts in funding from both donors and the national government (Beintema, Okubay, and Debass 2003). In 2008, Eritrea invested 11.7 million nakfas or 1.9 million PPP dollars (in 2005 prices) in agricultural R&D, down from 90 million nakfas or 14 million PPP dollars a decade earlier, which represents a drop of 80 percent (Figure 1; Table 1). Note that, unless otherwise stated, all dollar values in this note are based on purchasing power parity (PPP) exchange rates.[1] PPPs reflect the purchasing power of currencies more effectively than do standard exchange rates because they compare the prices of a broader range of local—as opposed to

### Key Trends Since 2000

- Eritrea's overall agricultural research and development (R&D) expenditures contracted by more than 80 percent during 1998–2008, following severe cuts in donor funding, which nonetheless remains the country's most important funding source.
- In contrast, agricultural research staffing levels nearly tripled in Eritrea during 1998–2008 with the graduation of a large number of BSc students from Hamelmalo Agricultural College (HAC), which was established in 2005. Many of these new recruits were young and an increasingly proportion female.
- Despite this growth, Eritrea continues to have one of the least highly qualified agricultural scientist pools in Africa. Just one-third of agricultural researchers were trained to the postgraduate level in 2008.
- The National Agricultural Research Institute (NARI), the main agricultural research agency in Eritrea, accounted for over 60 percent of agricultural research capacity and spending in 2008.

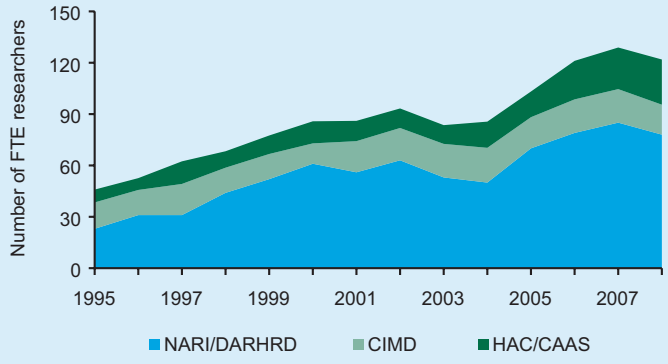
**Figure 1—Agricultural R&D spending adjusted for inflation, 1995–2008**




Sources: ASTI–NARI 2009–10 and Beintema, Okubay, and Debass 2003.

Notes: Figures in parentheses indicate the number of agencies in each category. For more information on coverage and estimation procedures, see the Eritrea country page on ASTI's website at asti.cgiar.org/eritrea.

**Figure 2—Agricultural research staff in full-time equivalents, 1995–2008**




Sources: ASTI–NARI 2009–10 and Beintema, Okubay, and Debass 2003.

Notes: Figures in parentheses indicate the number of agencies in each category. Data include expatriate research staff employed at DARHRD, CIMD, and CAAS in the 1990s.

**Table 1—Overview of public agricultural R&D spending and research staff levels, 2008**

| Type of agency | Total spending | | | Total staffing | |
|---|---|---|---|---|---|
| | Nakfas | PPP dollars | Shares | Number | Shares |
| | (million 2005 prices) | | (%) | (FTEs) | (%) |
| NARI | 11.7 | 1.9 | 61.3 | 78.0 | 64.0 |
| CIMD | 3.0 | 0.5 | 15.4 | 17.5 | 14.4 |
| HAC | 4.5 | 0.7 | 23.3 | 26.4 | 21.7 |
| **Total (3)** | **19.1** | **3.0** | **100** | **121.9** | **100** |

Source: ASTI–NARI 2009–10.

Note: Figures in parentheses indicate the number of agencies in each category.

internationally traded—goods and services. Despite the strong decline in overall R&D investments, Eritrea's total agricultural R&D capacity nearly tripled from 46 full-time equivalent (FTE) researchers in 1998 to 122 FTE researchers in 2008, following large-scale recruitment efforts by the National Agricultural Research Institute (NARI) and the University of Asmara (Figure 2).

NARI was established in 2003 when it replaced the Department of Agricultural Research and Human Resources Development (DARHRD). NARI is a semiautonomous unit of the Ministry of Agriculture and by far the largest agricultural research agency in Eritrea, accounting for over 60 percent of the country's FTE agricultural R&D staff and expenditures in 2008. The institute has adopted an area-specific or strong commodity-based approach in accordance with the government's policy of making agricultural research more impact-oriented. While DARHRD was subdivided into just two divisions (research and training), NARI consists of five commodity-based divisions (natural resources management, crop improvement, livestock research, agricultural engineering, and human resources development). In addition to its headquarters in Asmara, NARI operates regional research stations in Halhale (to fulfill the research needs of the highland and midland regions), Sheib (representing the eastern lowland region), and Goluj (representing the western lowland region), as well as seven substations that concentrate primarily on crops, livestock, natural resources management, and agricultural engineering related to priority commodities and production systems.

NARI's expenditures fell by more than 80 percent during 1998–2008, from 76.0 to 11.7 million nakfas or 12.0 to 1.9 million PPP dollars (in 2005 prices), following severe cuts in donor and government funding. NARI/DARHRD received large amounts of funding as part of the 1996–2005 project *Strengthening Agricultural Research in Eritrea*, which was managed by the Food and Agriculture Organization of the United Nations (FAO) and financed by the Government of Italy (see the section on funding sources for more information). The completion of this two-phase project led to a severe drop in the institute's overall investment levels, which had a seriously negative impact on some of NARI's research programs. On-farm trials have been reduced to a minimum, and the soil, plant protection, and tissue culture laboratories now lack the chemicals, equipment, and other materials necessary to operate efficiently. Despite the large decrease in NARI/DARHRD's investments, the total number of research staff employed at the institute increased from 44 FTEs in 1998 to 78 in 2008. Prior to 2005, few graduate students were able to complete their BSc degrees in agricultural sciences because of limited capacity at the, then, College of Agriculture and Aquatic Sciences (CAAS) within the University of Asmara. When Hamelmalo Agricultural College (HAC), was established in 2005, also under the University of Asmara, the number of BSc students increased fivefold. All students from CAAS and second-year students from Mai Nefhi College of Science were transferred to HAC. In addition, diploma/graduate holders employed at agencies under the Ministry of Agriculture were given the chance to enroll in BSc courses. Many first graduates of HAC have joined NARI as researchers in the past couple of years.

Just one government agency other than NARI is involved in agricultural R&D in Eritrea: the Costal and Island Management Division (CIMD) of the Ministry of Fisheries. In 2008, CIMD employed 18 FTEs, accounting for 14 percent of Eritrea's total agricultural R&D spending and capacity. The focus of CIMD's scientists is mainly on marine fisheries research and natural resources, with inland fisheries accounting for a minor share of the Division's research.

HAC is the only higher education agency in Eritrea involved in agricultural R&D. Hamelmalo was chosen as the location of the college because of its fertile farm land and the diversity of crops that are grown in the region. Since its establishment, basic infrastructure has been constructed on the new campus for both teaching and research purposes. In 2008, HAC's 26 FTE researchers concentrated their research efforts on crop genetic improvement, horticulture, and livestock. The role of the University of Asmara in Eritrean agricultural R&D has steadily increased in recent years. In 2008, HAC's share in the country's total agricultural research capacity was 22 percent, compared with 14 percent for CAAS in 2001. No private (for-profit or nonprofit) agencies were identified as being involved in agricultural R&D in Eritrea.

Traditionally, the role of women in agricultural R&D in Eritrea has been minimal, but this has changed significantly since the turn of the millennium. In 2001, approximately 3 percent of Eritrea's agricultural researchers were female, compared with 31 percent in 2008. A significant amount of women were able to pursue graduate education following an active government policy of gender equity. When HAC was established, the number of women

## ASTI Website Interaction

- More details on institutional developments in agricultural research in Eritrea are available in the 2004 country brief at asti.cgiar.org/pdf/Eritrea_CB2.pdf.
- Underlying datasets can be downloaded using ASTI's data tool at www.asti.cgiar.org/data.
- A list of the 2 government agencies and the higher education agencies included in this brief is available at asti.cgiar.org/eritrea/agencies.

**www.asti.cgiar.org/eritrea**

enrolled in the graduate program increased substantially, and many have attained employment at NARI since. Eritrea's average support-staff-per-researcher ratio has risen slightly since 2001, but nonetheless remains low. In 2008, on average, there were 0.6 technicians, 0.1 administrative support staff, and 0.1 other support staff per FTE researcher. This average masks a significant degree of cross-agency variation. In 2008, NARI employed 1.1 support staff per FTE researcher, whereas CIMD and HAC employed only 0.4 and 0.6 support staff per FTE researcher, respectively.

Total public spending as a percentage of agricultural output (AgGDP)—a comparative indicator of agricultural R&D spending across countries—has steadily declined since 2000 in response to falling agricultural R&D expenditures. In 2008, Eritrea invested $0.53 for every $100 of agricultural output (Figure 3). During the late-1990s, Eritrea had one of the highest research intensity ratios in East Africa (due to the large influx of donor funding), but more recently this ratio has fallen to levels more typical of neighboring countries. In contrast, the number of agricultural researchers per million farmers (in FTEs) increased from 68 in 1998 to 83 a decade later.

## INSTITUTIONAL STRUCTURE AND POLICY ENVIRONMENT

The most important institutional changes occurring between 2000 and 2008 were those already discussed relating to NARI and HAC. The 2003 transition from DARHRD to NARI has given the new institute full authority to manage its financial and human resource capacities, while remaining under the umbrella of the Ministry of Agriculture. Autonomy has not yet been officially approved by the government, but is reportedly imminent.

NARI collaborates closely with a number of centers under the Consultative Group of International Agricultural Research (CGIAR), most notably the International Center for Agricultural Research in the Dry Areas (ICARDA), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Maize and Wheat Improvement Center (CIMMYT), and the International Potato Center (CIP). In addition, being a member of the Association for Strengthening Agricultural Research in East and Central Africa (ASARECA), NARI maintains close linkages with other national agricultural research institutes in the subregion.

### ASTI Website Interaction

- Detailed definitions of PPPs, FTEs, and other methodologies employed by ASTI are available at asti.cgiar.org/methodology.
- The data in this brief are predominantly derived from surveys. Some data are from secondary sources or were estimated. More information on data coverage is available at asti.cgiar.org/eritrea/datacoverage.
- More relevant resources on agricultural R&D in Eritrea are available at asti.cgiar.org/eritrea.

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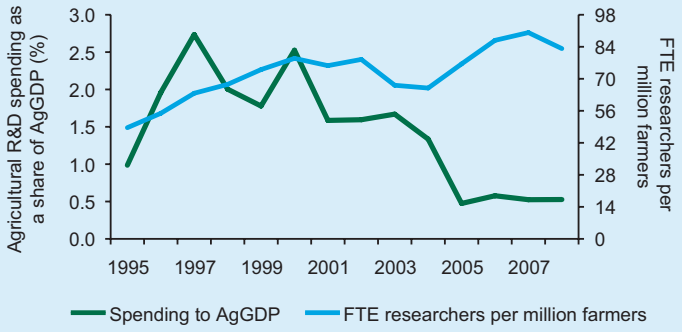
Another interesting development is the establishment of a National Board of Higher Education, which is expected to be launched in the near future and will be charged with harmonizing the country's (agricultural) education and research activities.

## RESEARCH STAFF QUALIFICATIONS AND TRAINING

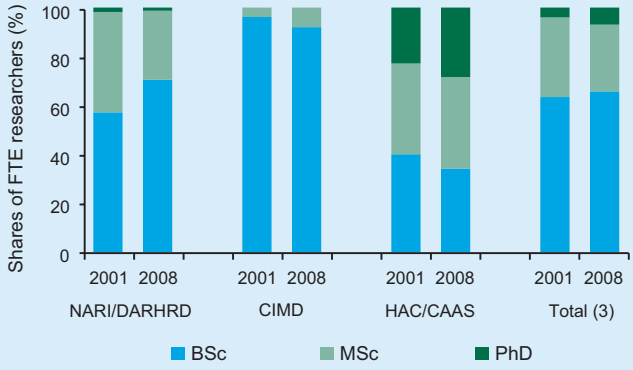
Eritrea's pool of agricultural R&D staff is among the least highly qualified in Sub-Saharan Africa. In 2008, just 7 percent of the country's agricultural researchers held PhD degrees, 27 held percent MSc degrees, and 66 percent held BSc degrees (Figure 4). Faculty staff employed in the higher education sector are more highly qualified than those employed at NARI, which is compatible with findings in most African countries. At NARI the

**Figure 3—Intensity of agricultural research spending and capacity, 1995–2008**




Sources: Calculated by authors from ASTI–NARI 2009–10; Beintema, Okubay, and Debass 2003; FAO 2009; and World Bank 2009.

**Figure 4—Degree level of researchers by institutional category, 2001 and 2008**




Source: ASTI–NARI 2009–10.

Note: Figures in parentheses indicate the number of agencies included in each category.

relative share of researchers that received postgraduate (PhD or MSc) training decreased during 2001–08; however, the absolute number of postgraduate researchers remained stable at 23 to 24 FTEs. Eritrean agricultural scientists cannot enroll for PhD training in their own country, so they are forced to spend a few years abroad to pursue doctorate-level training. HAC aims to begin offering MSc programs in agricultural sciences by 2011. Eleven NARI researchers have already received MSc degrees from HAC during 2005–08 (funded by the Danish International Development Agency [Danida], the Government of Italy, and FAO), but the college will offer MSc training to a much larger number of students in the coming years. Currently, three female scientists from NARI are pursuing MSc training abroad (in the Netherlands and China) and one additional scientist is expected to start MSc training at the University of Nairobi shortly. In addition, some NARI scientists have received short-term training in various locations. For instance, two researchers recently traveled to Egypt for training in tissue culture for three weeks.

Eritrean agricultural researchers are also among the youngest in Africa. NARI scientists, on average, are younger than 30, and even the most senior scientists are younger than 55. Capacity building is one of the key priorities of the Ministry of Agriculture in the coming years, and many NARI scientists are expected to receive training either within Eritrea or abroad.

CIMD has not employed any researchers with PhD degrees since 1997. In 2008, 92 percent of researchers at CIMD held a BSc degree, and only 8 percent were trained to the MSc level. Close to 30 percent of academic staff at HAC held PhD degrees in 2008, a much higher share than at NARI, but very low compared with universities in other African countries. Many HAC scientists have received grants for postgraduate training in recent years, including seven at Chinese universities, five at Italian universities, and two at Indian universities. In addition, three faculty staff members from HAC will be sent to the Netherlands shortly, and one to Japan. The African Development Bank (AfDB) has also recently approved a large-scale capacity building program for Eritrea's higher education sector, which includes HAC. Some HAC scientists are expected to receive training within the next two years as part of this US$ 20.0 million program (Capital Eritrea 2010).

# INVESTMENT TRENDS

## Cost Categories

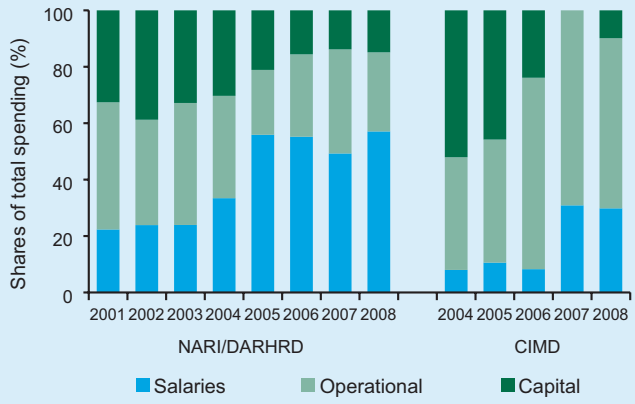
The allocation of research budgets across salaries, operating costs, and capital investments affects the efficiency of agricultural R&D, so detailed cost category data were collected from the government agencies as part of this study. In 2008, salaries accounted for 57 percent of NARI's total expenditures, operating costs accounted for 28 percent, and capital investments accounted for 15 percent (Figure 5). The share of capital spending was much higher during 2001–04 when the institute received important funds as part of the aforementioned project *Strengthening Agricultural Research in Eritrea*. Three large laboratories were built as part of the project, and laboratory and training facilities have also been substantially improved. The completion of the project in 2004/05 prompted a rapid decline in NARI's operating and capital spending. Nonetheless, the continuation of NARI's day-to-day research activities has not been affected as much as the drop in spending levels would suggest because most of the project funding from Italy was invested either in capacity building or in laboratory upgrades. Currently NARI has insufficient funding to operate all of its research programs. Salaries are entirely (and consistently) paid by the Eritrean government, although salary levels at HAC are reportedly more competitive than those at NARI. Plant protection facilities have recently been upgraded through funding from the government.

In 2008, salaries accounted for 30 percent of CIMD's expenditures and operating costs for 60 percent. In 2004–05, capital expenditures accounted for more than half of the Division's total spending. Large sums were invested in the establishment of new facilities and supplies during those years.

## Funding Sources

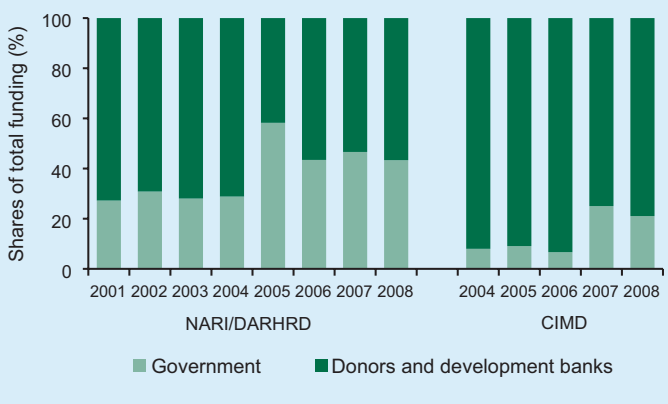
Agricultural R&D funding in Eritrea is derived from two main sources: the national government and (multilateral and bilateral) donors. Private companies, producer organizations, and internally generated resources have yet to play a role in the funding of agricultural R&D in Eritrea, unlike some other countries in Africa. During 2001–08, Eritrean agricultural R&D was one of the most donor-dependent on the African continent. Donors accounted on average for 86 percent of CIMD's total funding and 66 percent of NARI's (Figure 6).

**Figure 5—Cost category shares of NARI and CIMD, 2001–08**




Source: ASTI–NARI 2009–10.

**Figure 6—Funding sources of NARI and CIMD, 2001–08**




Source: ASTI–NARI 2009–10.

Shortly after independence from Ethiopia, Eritrea sought assistance from FAO to develop the country's agricultural research and extension service capacity both through human resource and infrastructure development. Funding for the first phase of the project *Strengthening Agricultural Research in Eritrea*, which ran from 1996 to 2001, totaled US$4.5 million (in current prices). The objective of this first phase was to establish an appropriate level of institutional capacity within the Department of Agricultural Research and Extension (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 (Beintema, Okubay, and Debass 2003). FAO's evaluation of the project concluded that it had successfully built R&D capacity in the Ministry of Agriculture, and that its impact on production systems had been high. FAO also proposed the formulation of a new phase of the project, also funded by the Government of Italy, in order to continue strengthening agricultural research as a way of increasing and sustaining farm-level productivity (FAO 2005). The total budget for the second phase of the project was close to US$3.0 million, and this phase supported the strengthening of human resource capacity at NARI and improving the institute's ability to manage and conduct effective agricultural R&D programs. Phase II was originally scheduled to run from 2001 to 2004 but was extended to 2005 at no additional cost. As previously mentioned, the completion of the project led to a severe drop in NARI's total expenditure levels.

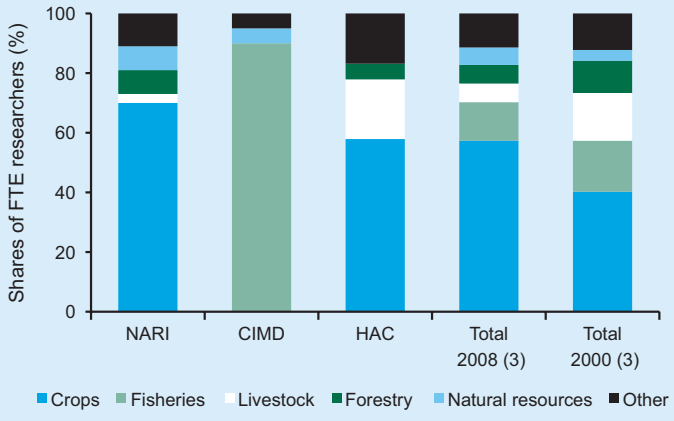
In addition to funding from Italy through FAO, NARI also received a significant amount of funding from the International Fund for Agricultural Development (IFAD) during 2000–08. IFAD's support chiefly focused on the development of spate irrigation, a type of water management, in Eritrea's eastern lowlands, where NARI was involved in developing new varieties of sorghum. IFAD funded the construction of offices and other facilities. NARI also reported funding from Danida (for capacity building activities) and various regional networks and international R&D institutes, including ASARECA, ICARDA, and ICRISAT. NARI is currently expecting additional IFAD funding to strengthen its tissue culture, potato development, and seed multiplication programs, as well as various other small projects. The European Union is expected to provide financial support to rehabilitate the institute's Sheib research station for livestock genetic improvement.

As previously mentioned, CIMD is highly donor-dependent. The Eritrean government pays the salaries of CIMD staff, but actual research activities and capital investments are entirely financed by foreign donors. CIMD's principal donors include the Global Environmental Facility (GEF), FAO, and the United Nations Development Programme (UNDP). Agricultural R&D at HAC is predominantly government-funded, although HAC will be a major beneficiary of the abovementioned US$20.0 million AfDB capacity strengthening project, expected to be launched shortly.

## RESEARCH ALLOCATION

Given that the allocation of resources across various lines of research is a significant policy decision, detailed information was collected on the number of researchers working in specific commodity and thematic areas. In 2008, close to half of Eritrea's 122 FTE agricultural researchers were involved in crop research (Figure 7). Fisheries research accounted for 17 percent, livestock research for 16 percent, forestry research for 11 percent, and natural resources research for 4 percent. The remaining researchers concentrated their efforts on socioeconomic research, postharvest research, or other matters. Notably, over a quarter of Eritrea's agricultural researchers conducted livestock or forestry research in 2001 compared with just 12 percent in 2008. HAC and NARI have increasingly shifted research efforts away from livestock and forestry in favor of crops following the Ministry of Agriculture's policy to concentrate more on developing high quality crop varieties that enhance food security. Significant achievements have been made in recent years in developing high-yielding, drought-tolerant crops thanks to ICARDA and ICRISAT, which have contributed greatly by sharing genetic material. Livestock research requires highly specialized skills that the country currently lacks. The country will need time to develop an effective pool of livestock scientists before it can effectively launch R&D programs focusing on livestock.

**Figure 7—Research focus by major commodity area, 2008**




Source: ASTI–NARI 2009–10.

Note: Figures in parentheses indicate the number of agencies in each category.

**Table 2—Focus of crop and livestock research by major item, 2008**

| | NARI | HAC | Total (2) |
|---|---|---|---|
| **Crop items** | Shares of FTE researchers (%) | | |
| Sorghum | 37.0 | 13.5 | 30.8 |
| Wheat | 13.7 | 9.5 | 12.6 |
| Vegetables | 4.1 | 13.5 | 6.6 |
| Barley | 6.8 | 6.8 | 6.8 |
| Millet | 6.8 | 6.8 | 6.8 |
| Maize | 6.8 | 4.1 | 6.1 |
| Potatoes | 6.8 | — | 5.0 |
| Other crops | 13.7 | 20.3 | 15.4 |
| **Livestock items** | | | |
| Poultry | — | 4.1 | 1.1 |
| Dairy | — | 10.8 | 2.9 |
| Sheep and goats | 4.1 | 10.8 | 5.9 |
| **Total crop and livestock** | **100** | **100** | **100** |

Source: ASTI–NARI 2009–10.

## Commodity Focus

Eritrea's most researched crops are sorghum and wheat, which combined accounted for more than half of total crop and livestock research in 2008. Other important crops include vegetables (7 percent), barley (7 percent), millet (7 percent), maize (6 percent), potatoes (5 percent), and fruits (4 percent) (Table 2). The country's livestock researchers primarily concentrated on sheep and goats (6 percent).

# CONCLUSION

Agricultural R&D investments in Eritrea have declined rapidly since the turn of the millennium, largely due to the completion of the FAO–led project *Strengthening Agricultural Research in Eritrea*, funded by the Government of Italy, and reduced government support. In 2008, the country invested close to 11.7 million nakfas or 1.9 million dollars (in 2005 prices) on agricultural R&D. Despite these sharp reductions, Eritrea's agricultural R&D spending as a share of agricultural output in 2008, at 0.53 percent, was still higher than the ratios recorded in neighboring Ethiopia or Sudan. NARI accounted for more than 60 percent of the country's agricultural R&D investments, but the overall decline in research funding has understandably had a negative impact on NARI's activities. On-farm trials have been reduced to a minimum, and the institute's soil, plant protection, and tissue culture laboratories now have insufficient means of carrying out their work effectively.

In contrast, the country's agricultural R&D capacity nearly tripled during 1998–2008 in terms of FTE researchers. The 2005 establishment of HAC led to a large influx of BSc-qualified agricultural R&D staff, and many of these new scientists were women—a new phenomenon for Eritrea. Nevertheless, despite various donors having funded training efforts over the years (either in Eritrea or abroad), the country's agricultural R&D staff remains one of the least highly qualified in Africa. In 2008, just one-third of researchers held postgraduate degrees. Training of young agricultural scientists to the MSc and PhD levels should be a top priority in the years to come, as a critical mass of highly qualified research staff is crucial to producing high-level research and attracting future R&D funding. A lot has been achieved on the agricultural research front since Eritrea's relatively recent independence in 1993. Establishing a viable and sustainable agricultural R&D system will take time, but the government has taken various important steps in laying the foundations to achieve this goal.

# NOTE

[1] Financial data in current local currencies or constant 2005 U.S. dollars are also accessible via ASTI's data tool, available at <http://www.asti.cgiar.org/data>.

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IFPRI is one of 15 agricultural research centers that receive their principal funding from governments, private foundations, and international and regional organizations, most of which are members of the Consultative Group on International Agricultural Research (www.cgiar.org).

NARI is Eritrea's principal agricultural R&D institute. The institute was established in 2003 and falls under the administrative coordination of the country's Ministry of Agriculture. The institute holds a broad mandate covering crop, livestock, natural resources, and agricultural engineering research.

The Agricultural Science and Technology Indicators (ASTI) initiative compiles, analyzes, and publishes data on institutional developments, investments, and human resources in agricultural R&D in low- and middle-income countries. The ASTI initiative is managed by the International Food Policy Research Institute (IFPRI) and involves collaborative alliances with many national and regional R&D agencies, as well as international institutions. The initiative, which is funded by the Bill & Melinda Gates Foundation with additional support from IFPRI, is widely recognized as the most authoritative source of information on the support for and structure of agricultural R&D worldwide. To learn more about the ASTI initiative visit www.asti.cgiar.org.


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