

THE NATIONAL AGRICULTURAL RESEARCH SYSTEM OF ERITREA¹

1. HISTORICAL BACKGROUND

The history of agricultural research (AR) in Eritrea can be divided into five periods: the Italian (colonial), British, post-British, Ethiopian and the Eritrean People's Liberation Front (EPLF) (MOA, 1995).

The Italian colonial government established research farms in 1910 at Filfil and Fagena in the eastern slopes and at Keren and Adi Ugri. Introductions of coffee (from Yemen) and several plant species were made. Research in the western lowlands started in the early 1920s with the creation of a research farm constructed at Tessenei (essentially for cotton).

Little information is available on AR in Eritrea during the British period. It is known, however, that the Tessenei cotton farm was taken over by the British in 1939 and mainly sorghum was grown.

When the British left, the Italians took over the Tessenei farm in 1952. Research farms at Sembel, Daro Kawlos (near Asmara) and Adi Ugri (Mendefera) were established as highland and midland sites. Cereals, mainly wheat and barley, were given high priority in the highlands. An international wheat rust nursery was established at Paradiso in the 1960s; varietal introductions and selections were made from Kenya and from CIMMYT in Mexico.

During the Ethiopian period, the Tessenei farm was given to a semi-government enterprise in 1976, which renovated it. Cotton germplasm was introduced from the United States and Israel. Research facilities, including greenhouses, were established at Sembel and Paradiso by the Imperial Ethiopian Government, but these were abandoned because of the war in Eritrea. The original goal of the research sites was to conduct research on highland cereals. Some initiatives were also taken by the University of Asmara (UOA): its Department of Agriculture established research sites at Imbatkala (for dryland agriculture, cowpea and beans, etc.), Halhale (horticulture, cereals) and Abarda (forages), and its Department of Biology created in 1986 a unit of Arid Zone Agriculture.

During the war, EPLF implemented some AR programs (soils, horticulture, agronomy, crop protection, forestry and range management, animal science and farm machinery) in the areas it controlled. A training program was established on general agriculture, animal production, veterinary science, motor-pump maintenance and home economics for farmers and EPLF members.

After independence in 1991, the Department of Agricultural Research and Training (DART) was established in 1992, and was mandated with conducting research in the fields of crop improvement, soil, plant protection, agricultural engineering, livestock and forestry, and also with carrying out vocational training in agriculture. In 1995, DART changed its name to the Department of Agricultural Research and Extension (DARE), with its research mandate remaining the same, while extension was included as an additional mandate, and its training component transferred to another department in the Ministry of Agriculture (MOA). A change in structure took place i name was changed to the Department of Agricultural Research and Human Resource Development (DARHRD).

The UOA Unit of Arid Zone Agriculture became the College of Agriculture and Aquatic Sciences (CAAS) in 1992. The Research and Training Division (RTD) of the Ministry of Marine Resources was created in 1993.

2. THE CURRENT NARS

2.1 Overview

Currently, the Eritrean public NARS consists of three institutions:

- Two institutions mainly specialized in AR: DARHRD of the Ministry of Agriculture (MOA), covering all fields except fisheries, and the Research and Training Division (RTD) of the Ministry of Marine Resources (MMR), for marine research: they account together for 77% of the total potential research years (pRYs: equivalent full-time researchers) and 78% of the total financial resources of all the NARS; these two institutions are presented in Sections 2.2 and 2.3.
- The UOA College of Agriculture and Aquatic Sciences (CAAS), presented in Section 2.4.

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These institutions are not coordinated at any central level, but have rather good relations (see Section 4.2).

Outside the public NARS, AR is carried out by a few private non-profit NGOs, among which World Vision Eritrea¹ is probably the only active one in collaboration with DARHRD.

2.2 The Department of Agricultural Research and Human Resource Development (DARHRD)

Mandate and Organization - DARHRD is an administrative Division of MOA which reports directly to the Vice Minister of Agriculture. It has four sections: agronomy and forestry (supported by two labs: gene bank, plant protection), soil science, animal science, and agricultural engineering. AR activities are essentially applied and adaptive; they mobilize around 70% of the time of the senior staff, the remaining time is devoted to services, extension/development (soil analysis, seed production, on-farm trials, technology information, etc.), and in-service training activities (for MOA staff and farmers).

Resources - The current available permanent staff is about 71, of whom there are 39 researchers (37 nationals: 10 MS and 27 BS holders; 2 expatriates), 26 technicians, and 6 clerks. There are also 50200 daily laborers, depending on the season (planting, weeding and harvesting periods require many laborers).

In spite of recruiting an additional number of staff during the last years (in 1995 there were only 16 national researchers: 5 MS and 11 BS), the shortage of qualified personnel is the limiting factor in DARHRD, which limits its capacity to properly plan and implement AR activities². Considerable efforts are being made to improve human resource capabilities through short- and long-term training programs. The government has introduced a new salary scale (ranging roughly between US\$ 160 and 500 for technicians and senior researchers, respectively) which is believed to be attractive, considering the current economic situation of the country.

DARHRD has established three main research stations, each representing different agroecological zones and production systems. Halhale Research Station (300 ha) in the central highlands zone hosts DARHRD headquarters which moved recently from Paradiso/Asmara; it enjoys new infrastructure (building complex, including offices and laboratories) and fair transportation and communication facilities. Shambuko Research Station (300 ha for research and seed multiplication purposes) in the southwestern lowland zone has also fair infrastructure (well-established office and living quarters for research staff) and transportation/communication facilities. Sheib Research Station (50 ha for research and seed multiplication) in the eastern lowlands (coastal plain zone) is a new station where new offices and housing for researchers are being constructed.

In 1997, total DARHRD financial resources amounted to Birr 9.8 million (US\$ 1.6 million), of which:

- Birr 2.3 million (US\$ 0.4 million) came from national sources (essentially from the government budget, plus some self-earned sources coming mainly from seed sales), with 34% allocated to salaries and wages and the remaining (Birr 1.5 million) to operating/capital costs (OCC); and
- Birr 7.5 million (US\$ 1.2 million) from external grants (DANIDA, FAO/Italian Cooperation, and USAID), covering the cost of the two expatriates, staff training, and contribution to the OCC.

The total OCC amounted roughly to Birr 56 million, which means around US\$ 30,00036,000 per pRY, a largely sufficient amount for providing good research means.

Research Activities and Linkages - In the research planning process, frequent consultations with division heads in the department and individual researchers (which in a way forms an informal technical scientific committee) helps the director to set policies and approve programs and budgets. Steps are being taken to institutionalize the planning and management of research activities.

2.3 The Research and Training Division (RTD) of the Ministry of Marine Resources (MMR)

Mandate and Organization - RTD is now in its earliest stage of development and in the process of building its human resources through training and its research infrastructural capacities. Its mandate equally covers marine research (focussed on marine habitat and fisheries) and training/extension (short-term training of fishermen on navigation, making of fishing nets, and training women on nutrition at its training center located in Hirgigo).

¹ It started adaptive trials in 1996 of some crops (finger millet, groundnut, pigeon pea) in the southern part of Eritrea, aimed to identify and select drought-tolerant, disease-resistant, high-yielding cultivars adapted to the region. The adaptive trials will soon cover additional crops (sorghum, maize, sesame, bean, etc.).

² According to the medium-term plan (MOA, 1995), the required number of researchers and technicians for DARHRD for the year 2002 is 109 (14 PhD, 38 MS, 57 BS) and 128, respectively.

Resources - RTD has a total of 60 permanent staff members, including 36 national senior members (all with BS degree) and four foreign scientists, who represent 20 pRYs. The remaining are support staff, including technicians and workers.

Physical resources are currently meager. The main office is in Massawa and a branch office in Assab, but there is no infrastructure for research, no appropriate station equipped with laboratories, and no research vessel. RTD plans to have additional stations in Dahlak, Tio and Brassole islands.

Funds provided in 1997 by MMR were scarce and amounted to (rough estimate) around Birr 250,000 (around US\$ 40,300), or US\$ 1,000 per professional staff member, all expenses included. There is, however, a number of research funds available from international organizations for joint research programs (roughly estimated at US\$ 0.5 million, including the cost of the four expatriates). The available operation/capital funds, provided by the foreign assistance, may cover the needs of around 10 actual RYs.

Research Activities - Research activities focus on marine habitat and fisheries, and the main activities are baseline data collection on various aspects of the marine environment, surveys of fish stocks (with fishermen), and the creation of environmental awareness for sustainability.

2.4 The College of Agriculture and Aquatic Sciences (CAAS) of the University of Asmara (UOA)

Overview - CAAS is the only source of trained personnel in agriculture in the country. It offers four-year BS programs in plant science/crop production, soil and water conservation, animal sciences, marine biology and fisheries, and soon in agricultural economics. A two-year diploma in general agriculture will be added over the next years.

CAAS has currently 36 academic full-time staff members, including 32 nationals (3 PhD, 15 MS and 14 BS holders) and 4 expatriates. As part of the UOA, which is currently in an aggressive staff-development stage, it is building its human resource capacity steadily but surely. In 1994, it had 19 academic full-time staff members (3 PhD, 10 MS and 6 BS holders), and for the past two years it has trained or is still in the process of training 7 staff members at the PhD level and 9 at the MS level. It is also recruiting senior staff periodically to fill its requirements.

CAAS occupies a building that will soon be refurbished to accommodate four laboratories and a number of lecture halls and staff offices. A college farm and an experimental field exist on the campus. Currently, physical facilities are not optimal for undertaking major research activities, but CAAS also shares the experimental fields of MOA when needed for research.

In 1997, CAAS financial resources amounted to Birr 12.6 million (US\$ 2 million) of which about 10% were funded by the Government and 90% by foreign donors, mostly spent on staff training, equipment and salary of seconded staff.

Research Activities - In addition to being an academic institution, CAAS is mandated to conduct basic and applied research that addresses developmental needs and to disseminate research results through outreach programs. CAAS staff members allocate about 25% of their time at the moment for research in agriculture and marine sciences; this would increase with the availability of research facilities. Research priorities are identified on the basis of its sectorial surveys (CAAS et al., 1996) and in accordance with the national agricultural development policy.

3. AR RESOURCES

NARS in Eritrea has not yet developed a well-structured management and monitoring system for human, material and financial resources. For example, methods and procedures have not been developed strongly for evaluating staff performance capacity, and the management of financial resources is not properly organized, although measures are now being taken by NARS institutions to strengthen their management of available resources.

3.1 Human Resources

Currently (1997) the public Eritrean NARS involves 115 scientific and technical senior graduate staff (including 10 expatriates), who represent around 61 potential RYs. Among the 105 national senior staff, only 3 have a PhD degree, 25 an MS, and 77 a BS. The level of academic training is particularly poor at DARHRD and RTD.

More trained staff, both in number and quality, is needed. For the short-term period, the Government is trying to overcome the shortcomings by contracting foreign nationals, and more importantly, through south-south cooperation. The provision of technical assistance attached to donor projects is another source for meeting some of the critical demands on qualified personnel. For the long-term period, the enhancement of CAAS and the enlargement of its

education mandate should allow intensive undergraduate/postgraduate training courses and also training of technicians, for which increased recruitment of additional staff is strongly required.

3.2 Physical and Financial Resources

The current infrastructure of NARS to carry out effective research plans is very limited. However very important efforts have been made and will be undertaken for the next years to enlarge it in every NARS institutions.

In 1997, the national AR financial resources amounted to around Birr 2.5 million (US\$ 0.4 million), mainly from the government budget, which represent 0.33% of the Agricultural Gross Domestic Product (AGDP estimated at US\$ 120 million in 1996). National/government investment in AR is far from the 1% of the AGDP recommended by some international organizations. However, the figures over the past two or three years indicate signs of good progress. For example, the contribution to AR from the MOA budget was about 0.24% in 1993/94, but has increased to 2.1% in 1997.

AR financial resources from external grants amounted to around Birr 11.4 million (US\$ 1.8 million), which are equivalent to around US\$ 1.4 million (1.2% of the AGDP) when estimated at the "national cost" (evaluating the cost of the expatriates on the basis of the average annual cost of the national scientists). This external support provides the NARS institutions with scientific support and with operational/capital funds necessary for providing satisfactory means for research, except in the case of RTD; and the actual RYs of the NARS should amount to around 50, as opposed to the 61 pRYs.

Total AR fina
thus US\$ 1.8 million (national = US\$ 0.4 million; external: US\$ 1.4 million).

4. RESEARCH ACTIVITIES

4.1 Research Activities and Orientations

AR activities are at an early stage of development, and resources allocated to the programs implemented are constantly moving and increasing. Thus, it is too soon to present a balance on the past and current activities.

Research orientation has been defined by the Government of Eritrea (GOE, 1994) through its medium-term plan (MTP) and strategy (1997/2002), prepared in cooperation with the NARS institutions. As rainfall is the most limiting factor to food production, emphasis is on developing irrigated agriculture by enhancing the productivity of farmers, pastoralists and agro-pastoralists. AR has been prioritized at two levels: commodity and production system. It will emphasize the production of high-value crops and the development of irrigation water resources to support an export-oriented agricultural sector. Improvements in the production levels of national food crops and livestock will also receive enough attention to achieve some level of self-sufficiency. Station-based applied and adaptive research on existing and imported technologies, and on-farm trials and production system improvement activities will be conducted. This will be carried out by research/extension teams; concentrating on farmer participation to adjust research plans and operations.

4.2 National and International Linkages

So far, the limited human and physical resources of the NARS have been limiting its relations with development/extension organizations. The setting up of farming systems research programs scheduled in the medium term should help AR to better contribute to development by identifying production constraints, developing appropriate technologies, and introducing viable alternatives to farmers.

Linkages between the NARS institutions are relatively pronounced. DARHRD and CAAS have strong working relationships that have developed over a relatively short period of time. For example, a joint steering committee drawn from both institutes was established to guide in planning CAAS curricula relevant to the objectives of the country; and a task force representing DARHRD and CAAS was formed to guide in the preparatory process of the MTP and strategy for national agricultural research. MOA and UOA enjoy good bilateral cooperation with various donors in research and training. RTD and the Marine Biology and Fisheries Department of CAAS have a joint steering committee aimed at sharing expertise and information and at combining efforts in marine research; however, this committee has not yet succeeded in bringing changes since both institutes are still in the development process.

International scientific linkages are rather well developed. International research centers and networks are major sources of germplasm, training and technical expertise for DARHRD, which has good working relationships with

ICARDA, ICRISAT, ILRI, CIP and CIMMYT. At the regional level, DARHRD and CAAS collaborate with the Association for Strengthening Agricultural Research in East and Central Africa (ASARECA), which aims at promoting collaboration in AR in the region. CAAS has agreements related to funding, training, exchange of expertise and research collaboration with some European scientific institutions (AS University of Agriculture in Norway; Wageningen University, Larenstein International Agricultural College of Agriculture, and Dronten Agricultural College in the Netherlands).

5. CONCLUSION

The Eritrean NARS is by world standards quite small, with its 61 pRYs and US\$ 1.8 million resources. However, it resulted from very recent efforts, undertaken by the country with strong scientific and financial support from the international community, to build research and education institutions able to support national agricultural development and ensure a sustained output of improved technology to farmers.

Main Acronyms

MOA: Ministry of Agriculture. **MMR:** Ministry of Marine Resources.

CAAS: College of Agriculture and Aquatic Sciences of the University of Asmara (UOA). **DARE:** Department of Agricultural Research and Extension. **DARHRD:** Department of Agricultural Research and Human Resource Development. **RTD:** Research and Training Division of MMR.

Main References

Government of Eritrea - *Macro-policy*.- Asmara, 1994.

MOA - *Medium-Term Plan And Strategy for National Agricultural Research*.- Asmara, June 1995,102 p.

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Table 1 - The National Agricultural Research System (1996/97)

Italics

NARS Institutions				AR Scientific & Technical Graduate Staff (Units)			Potential Res. Years (pRY)		Total Budget (1000 Birr)		AR Expenditures/Resources (E) (1000 Birr)		
No.	Name - Acronym Head Office - Year Established	Mandates AR Fields	Govern. Ministry	Nationals Total - (PhD, MS)		Exp.	Nat.	Exp.	Nat.	Ext.	Nat. E NE	For. E FE	Total E TE
a	b	c	d	e	f	g	h	i	j	k	l	m	n
1.1	Dept. of AR & Human Resource Developm. DARHRD Halhale 1992, 95	AR (70%) - (AD) All exc. fisheries	MOA	37	0 , 10	2	26	1	2,300	7,500	2,000	6,400	8,400
2.1	Research and Training Division RTD Massawa 1993	AR (50%) - AE (AD) Fisheries, Aquacult.	MMR	36	0 , 0	4	18	2	250	3,000	200	2,200	2,400
1-2	Total Agricultural Research Institutes			73	0 , 10	6	44	3	2,550	10,500	2,200	8,600	10,800
3.1	College of Agriculture & Aquatic Sciences CAAS Asmara 1986, 92	AHE - AR (25%) All	ME	32	3 , 15	4	13	1					3,100
3	Total Faculties of Agricultural Sciences			32	3 , 15	4	13	1	1,300	11,300	300	2,800	3,100
4	Total NARS			105	3 , 25	10	57	4	3,850	21,800	2,500	11,400*	13,900
Exchange Rate: US\$ 1 = Birr 6.2 (1997 average official rate)				Actual Research Years (aRYs) (Estimate) →			50		AR Expenditures (million US\$) →		0.4	1.4*	1.8

MOA: Ministry of Agriculture; MMR: Ministry of Marine Resources; ME: Ministry of Education.

c: **Mandates: AR** (.. %): Approximate average % of human resources devoted to ag. research (AR); **R**: Research; **AHE**: Ag. higher education; **AE**: Professional education; **AD**: Ag. development/services (for AR and AHE institutes: seeds production, soil and water analysis, extension, studies, etc.). **h, i**: potential research-year (pRY) = equivalent full-time researcher; for the FASs, the pRYs have been estimated by multiplying the number of academic staff by 0.25. **m**: For the AR institutes, AR financial resources have been roughly estimated through the following formula: Total budget × [(ω + 0.5(100% - ω))], where ω is the % of time devoted to AR by the graduate staff.

* **Note**: The total AR expenditures of the NARS from external grants (Birr 11.4 million or US\$ 1.8 million) are equivalent to around US\$ 1.4 million when estimated at the "national cost" (evaluating the cost of the expatriates on the basis of the average annual cost of the national scientists).

National AR expenditures (NE): **0.33%** of the Agricultural Gross Domestic Product (AGDP: US\$ 120 million in 1996). Total AR expenditures estimated at "the national cost": **1.5%** of the AGDP.