

5. MONOGRAPHS OF THE NATIONAL AGRICULTURAL RESEARCH SYSTEMS OF THE NILE VALLEY
AND RED SEA REGION

EGYPT

ERITREA

ETHIOPIA

SUDAN

THE NATIONAL AGRICULTURAL RESEARCH SYSTEM OF EGYPT¹

1. HISTORICAL BACKGROUND

The first school of agriculture in Egypt was established in 1869 and the first directorate of agriculture in 1875. During the 19th century, **agricultural research** (AR) was carried out by the Egyptian Royal Society, and as early as 1897, a number of experimental farms were established at various locations. In 1910, the Agricultural Authority was established under the Ministry of Public Works; it was responsible for conducting research and producing seed, extending methods to farmers in crop production, especially cotton, analyzing soil and fertilizers, controlling pests, and producing scientific and technical publications. A royal decree established the Ministry of Agriculture (MOA) in 1913. Following that, decrees were issued to organize research bodies and to coordinate between them and the farmers. For that purpose, the Cotton Research Council was created in 1919 and included plant, chemistry and pest experts in cotton. The Council offered services to Egyptian agriculture and paved the road for various field crop research endeavors. The formation of the Technical Research Committee in 1928 was the beginning of technical coordination and organized recording of research between the different MOA departments.

A presidential decree issued in 1957 represented the cornerstone for scientific research. The decree stated that research departments were to be formed within the different ministries and government agencies. Among the first departments within MOA were Plant Breeding, Horticulture, Chemistry, Entomology, Agricultural Education, Veterinary Medicine, and Agricultural Inspection. Ministerial offices opened in various regions of the country.

MOA has undergone several dramatic reforms in the past decades. It has grown from only seven major departments in 1913, and 28 in 1950, to 194 in 1963; 92 of these dealt with various aspects of agricultural production. Among the major departments were Agriculture, Horticulture, Plant Protection, Soil, Animal Production, Veterinary Laboratories and Seed Production. These research departments were reorganized in 1971 into one research body within the Ministry of Agriculture and Land Reclamation named the General Authority for Agricultural Research, which was later (1983) renamed the Agricultural Research Center (ARC), and evolved as the major institution for agricultural research and extension in Egypt.

In 1939 the Desert Institute was established to explore the desert and evaluate and develop its rich natural resources, and was officially inaugurated in 1950. In 1990 the institute became the Desert Research Center (DRC), and with its new name, it acquired new structures, laws and bylaws. During its early period, the institute operated under several authorities and organizations, including the Permanent Council for National Production, the National Research Center, the General Agency for Desert Rehabilitation, the Ministry of Scientific Research, the Ministry of Land Reclamation, and, finally, the Ministry of Agriculture and Land Reclamation (MALR).

Research in oceanography and fisheries began with the Alexandria Institute of Hydrobiology, established in 1927 by the Ministry of Agriculture, and the Red Sea Branch of the University of Cairo (1932). The Institute of Oceanography and Fisheries (IOF) merged these two units in 1962, added a new branch specialized in inland water and aquaculture (1967), and was renamed in 1986 as the National Institute of Oceanography and Fisheries (NIOF).

Agricultural higher education (AHE) started in Egypt in the first half of the nineteenth century by establishing higher institutes in several fields including agriculture and veterinary science. Although the first university was established in Cairo in 1908, it did not incorporate agriculture in its programs. In 1935 its name became the Egyptian University, then Cairo University, and, at that time, was expanded to include agriculture. Later, university education in agriculture grew: Alexandria University was established in 1942, Ain Shams in 1950, and many others over the years. As of 1996, there were 28 faculties of agricultural sciences (18 faculties of agriculture, 8 faculties of veterinary medicine², and 2 institutes for agricultural cooperation training) throughout the country, the last of which (Faculty of Agriculture, South Valley University) was established in 1996.

Other institutions include AR departments/units. The National Research Center (NRC) was established in 1956 as a governmental program for conducting theoretical and applied research in natural sciences, and passed through several stages of development, with the inclusion in 1968 of all AR under a food and agriculture program and from 1973 higher emphasis given to orienting research activities to serve the specific needs of national end users. The Water

¹ By **Dr Saad Nassar**, Director, Agricultural Research Center, **Dr Abdel Wahab Abdel Hafez**, former President, Ain Shams University, and **Dr Hala Hafez**, Consultant, ICARDA.

² At the time of finalizing this monograph, three new faculties of veterinary medicine had been established (Mansoura, Menoufia and South Valley/Qena); however, it was too late to include information related to them.

Research Center (WRC), which was created in 1975, was reorganized in 1994 as the National Water Research Center (NWRC). The Atomic Energy Authority (AEA), which was established in 1955, has now four centers, of which two (the Nuclear Research Center and the National Center for Radiation Research and Technology, established in 1955 and 1972, respectively) include AR departments.

In this historical overview of the NARS, it is worth to mention:

- the implementation of the National Agricultural Research Project (NARP), funded by USAID from 1985 to 1995, which integrated the different AR institutions (ARC, faculties of agriculture, DRC, NRC, AEA and the private sector), provided huge grants (see Section 3.3) for human resource development, capacity building, interdisciplinary and collaborative research through local and international linkages, and initiated institutional reforms; and
- the establishment by MALR in 1992 of the National AR Council (NARC) and four regional agricultural research and extension councils (affiliated to this National Council), which are responsible for setting up the AR policy at the national and regional levels, respectively.

2. THE CURRENT NARS

2.1 Overview (see Table 1)

The **public** NARS currently includes a large number of scientific institutions within different ministries which may be grouped into three main categories:

- The institutions mainly involved in AR: the Agricultural Research Center (ARC) and the Desert Research Center (DRC) within the Ministry of Agriculture and Land Reclamation (MALR), and the National Institute of Oceanography and Fisheries (NIOF) within the Ministry of Scientific Research and Technology (MSRT); they gather around 3800 potential research years (pRYs or equivalent full-time researchers), i.e., 57% of the pRYs, and 77% of the total financial resources of the NARS. These institutions are presented in Section 2.2.
- The 18 faculties of agriculture (FA) and 8 faculties of veterinary medicine (FVM) affiliated to the Ministry of Education: they meet around 22% of the pRYs and 6% of the financial resources of the NARS (see Section 2.3).
- The “other NARS institutions” in which AR activities cover a more or less small part of their mandate: the National Research Center (NRC), the National Water Research Center (NWRC), the Atomic Energy Authority (AEA), and diverse faculties/universities: these institutions affiliated to different ministries meet the remaining resources of the NARS (21% of the pRYs, 17% of the funds) (see Section 2.4).

Since 1992, the National Agricultural Research Council (NARC)¹ has had the mandates at the national and regional levels (see Section 4.3) for (i) designing the general policies for AR plans, programs and projects in different research disciplines, (ii) investigating methods for funding and supporting them, and (iii) integrating and coordinating between them, and monitoring them. Since the creation of MSRT and NARC, the Academy of Scientific Research and Technology (ASRT), established in 1971 for strengthening scientific research and technological development in the country through diverse activities², does not have a significant role in the governance of the NARS.

The **private sector** is increasingly getting involved in AR, particularly that dealing with seeds, tissue culture, and agrochemicals; however, no precise information is available on the related activities and resources. The private American University in Cairo has a Desert Development Center (established in 1985), with some research on sustainable development of the desert (conducted on an area of 240 ha northwest of Cairo in addition to an area of 12 ha near Cairo where the Center is located).

¹ Composition of the Council: Chairman: the Minister of Agriculture; rapporteur: the Director of the ARC; members: Director and Deputy Directors of the ARC; Presidents and Deputies of the agriculture universities; Director of the NWRC; representatives of the Academy of Scientific Research and Technology (ASRT) (Chairman, Head of the Food, Agriculture and Irrigation Research Council, and Head of the Animal Wealth and Fisheries Research Council), NRC (Chairman), and DRC (Director); Consultants to the Minister of Agriculture; Head of the Extension Sector of MALR; and 4 representatives of non-governmental universities and the agricultural private sector.

² Such as defining priorities for research of major development areas; formulating policies that strengthen linkages between science and technology organizations; procuring financial support to priority research programs; organizing state scientific awards; supporting scientific societies; etc. These activities were guided by a broad-based Council, with the support of 14 specialized councils, including the Food, Agriculture and Irrigation Research Council and the Animal Wealth and Fisheries Research Council.

Outside the NARS, Egypt is hosting regional bases of some international agricultural research centers (CIP, ICARDA¹ and ICLARM), which are also involved in the collaboration among Egypt and other countries. FAO has its Near East Office in Giza.

2.2 The AR Institutions

The Agricultural Research Center (ARC)

Mandate and Organization

ARC is the largest institution of the NARS (around 47% of its pRYs and 61% of its financial resources). It is an autonomous institution governed by a Board of Directors, chaired by the Minister of Agriculture, and composed of the director and deputy directors of ARC, directors of the research institutes, three eminent professors from the universities, the chairpersons of NWRC and NRC, and one representative of the private sector.

In addition to the Directorate for General Administration and Financial Affairs, ARC has three directorates which are in charge of the main mandates: the Directorate for Research which oversees the 24 semi-autonomous research institutes and central laboratories (see below); the Directorate for Extension (see below: relations with development); and the Directorate for Production, responsible for the management of the research stations and ARC state farms (totaling 12,600 ha), primarily devoted to the production of foundation seed of major crops.

ARC Research Units

AR activities are implemented by 24 semi-autonomous units: 16 research institutes (RIs) and 8 central laboratories (CLs) listed in Table 2, which cover all fields, except marine fisheries, and present very different profiles as follows:

- Their mandate: AR mobilizes between 20 and 100% of the time of the graduate scientific and technical staff of the research units, with an ARC average of 56%; the remaining time is allocated to development, extension or technology transfer², and to education activities (lectures at the faculties of agriculture and faculties of veterinary medicine; support to graduate students; training for extension personnel). Most of the units carry out basic, applied and adaptive AR, with more emphasis on basic or "high-tech" research in some of the relatively recent and considerably innovative units, e.g., the Agricultural Genetic Engineering RI (74 graduate staff members, gsm) and Agricultural Expert Systems CL (17 gsm).
- Their size according to their human and financial resources: the largest RIs have more than 500 gsm (Horticulture RI: 748 gsm; Soil, Water and Environment RI: 610 gsm; Field Crops RI: 581 gsm; Plant Protection RI: 542 gsm), and the smallest ones less than 50; total budgets (1996) vary from LE 0.5 million (US\$ 0.15 million) to 24.4 million (US\$ 7.2 million for the Animal Production RI).

AR Human, Physical and Financial Resources

The 24 ARC research units have a total of about 5,620 graduate scientific and technical staff members (2,700 PhD, 1,400 MS and 1,520 BS holders)³ who represent 3,140 pRYs⁴. Continuous efforts are being exerted to upgrade staff qualifications; during the period 1981–1993, ARC scientists obtained 1,607 MS and 1,441 PhD degrees prepared at Egyptian universities, and 20 MS and 90 PhD degrees prepared abroad through NARP, in addition to 2,150 post-doctoral and other training opportunities provided by the same project.

The graduate staff is unevenly distributed among the different regions. Most are concentrated at the institute headquarters in Cairo (4,693 = 83.5%) and in the regional stations in the Delta (700 = 12.5%); an area which represents 51.3% of the irrigated area of the country. The others are in Middle Egypt (111 = 2%) and Upper Egypt (113 = 2%), which have respectively 16.1 and 14.1% of the national irrigated area.

¹ The ICARDA regional office, established in Cairo in 1979, oversees the Nile Valley and Red Sea Regional Program (NVRSRP) which includes national scientists from Egypt, Sudan, Ethiopia and Yemen, and covers research on food legume crops, cereals and natural resource management.

² Through diverse activities, such as production of seeds and vaccines; services (biological, chemical analysis; soil mapping; studies; consultancies; etc.); and backstopping for extension institutions in the form of technical support and publications, recommendations, on-farm trials and demonstration.

³ ARC totals 37,300 permanent employees, including the 5,620 graduate scientific and technical staff mentioned above; 15,800 research support degree holders and 16,900 support-service staff (administrators, technicians and workers).

⁴ Calculated from: pRYs = number of the ARC graduate scientific and technical staff × 55% (approximate overall average % of their time devoted to AR).

The 15,800 technicians and 16,900 other support staff members (clerks, laborers, etc.) are considered sufficient or, rather, in excess (2.8 and 3 per graduate scientific and technical staff member, respectively).

ARC operates 10 regional research stations throughout the country, to which 37 specialized subregional research and trial stations belong; of these stations, 22 possessing a total land area of about 1,500 ha are distributed all over the different governorates. Physical facilities are unevenly distributed: thanks to NARP, labs and offices located at the headquarters of the institutes (especially the newly established ones) and 19 research stations are in good condition and are rather well equipped (US\$ 32 million invested); and a very modern library (the Egyptian National Agricultural Library, ENAL) was established in 1995 in Giza, serving ARC and all MALR services. ENAL fully utilizes computerized information storage and retrieval systems, electronic network, etc. (cost: US\$ 6.3 million).

In 1996, the total direct financial resources of the 24 research units amounted to around LE 163 million (US\$ 48 million), of which about LE 140 million were from a national origin (mostly MALR annual budgetary allocation) and the remaining from grants secured by numerous bilateral and multilateral donors, the major ones being the USA (about 50%), European Union (about 10%), the World Bank (about 10%), European countries, Canada, Japan, FAO, IFAD and UNDP. These grants have dramatically decreased since the completion of the US-funded NARP in 1995 (see Section 3.3). In addition, the financial resources of the general ARC administration related to the research units may reach some LE 16 million. Total AR expenditures are roughly estimated at LE 143 million (see Table 2), of which around LE 72 million are in salaries and 71 in operating and capital costs (OCC)¹; this means an average OCC amount of LE 22,600 (US\$ 6,600) per pRY, which is rather low and far from matching the financial research needs (see Section 3.3).

Research Activities and Linkages

ARC is implementing its fourth research plan (1997/98–2001/02) which is guided by the strategy for agricultural development, in line with what has been accomplished during the previous research plans. This plan, as the others, has been prepared and is implemented closely with the other national institutions and scientists associated with the ARC programs. It carries out a 13-program national AR plan encompassing all areas of agricultural production.

Relations with development are structurally organized: the ARC Directorate for Extension is technically responsible for the Central Administration for Agricultural Extension (CAAE), which supervises the activities of the MALR extension service². They have been recently improved after the creation of the regional research and extension councils and the establishment of the national campaigns for commodities (see Section 4.3).

ARC has set up a dense network of external scientific relations, particularly with some AR international centers (IRRI, ICARDA, CIMMYT, CIP, IPGRI, IIMI, IFPRI, ICRISAT and ICLARM) and with scientific organizations of developed countries (USA, EU, European countries, etc.). It also plays a major role in regional training and research activities with Middle Eastern, African, and Asian countries.

The Desert Research Center (DRC)

DRC activities are devoted primarily (around 70% of its resources) to research for the development of the desert and newly reclaimed areas. Other activities cover development, extension and services, especially through its “private service unit” involved in surveys (underground water, soils), chemical analyses (water, soils), feasibility studies, etc.

DRC is composed of four divisions, which demonstrates the large spectrum of its research fields:

- Water Resources and Desert Soils (with 9 departments, including Geophysical Exploration, Renewable Energy, Hydrology, Pedology, Soil Fertility and Microbiology, Soil and Water Conservation, etc.);
- Ecology and Dry Land Agriculture (with 6 research departments, including Genetic Resources, Plant Production, Plant Ecology and Range Management, Sand Dune Fixation, etc.);
- Animal and Poultry Production (with 5 research departments, including Animal and Poultry Breeding, Animal and Poultry Nutrition, Animal and Poultry Breeding Physiology, etc.); and
- Socioeconomic Studies (with 3 research departments, including Agricultural Economics, Agricultural Extension,

¹ Estimate based on two reasonable hypotheses: (i) the distribution of the national expenditures in the research units is the same as for the whole ARC (1996 total resources, including the production sector, extension, central administration for regional research stations, and general administration: LE 232 million, of which 135 million [58%] are in salaries and LE 97 million [42%] in operating and capital costs); and (ii) the external grants are essentially directed to operation and capital costs.

² CAAE is administratively affiliated to MALR; it employs more than 22,000 extension specialists in various fields of agriculture, distributed at village, district and governorate levels.

etc.).

It also has three associated units: the Tissue Culture Laboratory, the Geo-Information Systems Center, and the Satellite Receiving Station.

DRC has 1,093 permanent staff of whom 327 are researchers (183 PhD, 84 MS and 60 BS holders), while another 341 graduates with BS assist in research. There are 108 technicians, 193 administrative staff and 124 laborers. DRC has 70 laboratories, 4 experimental stations, and 4 smaller field stations located throughout Egypt to serve the local farming communities. In general, physical facilities (labs, equipment) are moderate, except in some units that are well endowed (such as the three associated units established in the 1980s and 90s: the Tissue Culture Laboratory, the Geo-Information Systems Center, and the Satellite Receiving Station).

The total budget of DRC amounted to LE 23.8 million (US\$ 7 million) in 1996, mostly from national sources (LE 23 million), with actual salaries being LE 9 million and OCC LE 14.8 million. AR expenditures are estimated at LE 20.7 million (see Table 1), of which around LE 7.8 million are in salaries and LE 12.9 million in OCC; this means an average OCC amount of LE 56,000 (US\$ 16,500) per pRY.

The Center has been collaborating with a large number of national, foreign and international scientific organizations and development organizations. However, funds provided by France, Germany, the European Union, and ACSAD are currently relatively limited (LE 0.8 million).

The National Institute of Oceanography and Fisheries (NIOF)

NIOF is mandated with maintaining and developing water bodies and their natural resources; proposing measures for the protection of the aquatic environment; and organizing, conducting and supervising research on fisheries, freshwater aquaculture, mariculture and seafood technology for the better management of the country's aquatic resources. Applied research to address national and regional problems is the main activity of the Institute.

NIOF is organized in four divisions (Oceanography and Marine Ecology; Aquaculture; Fisheries; and Freshwater and Man-Made Lakes) with a number of specialized, well-equipped laboratories. The scientific divisions and research laboratories are encompassed into four main branches (Mediterranean and Northern Lakes, Inland Waters, Suez and Aqaba Gulf, and the Red Sea), with nine field stations including fish farms and aquariums, throughout the country, with many more stations proposed for the future.

It has around 1,500 permanent staff, among whom 428 are graduate researchers (136 PhD, 132 MS and 160 BS holders). Its 1996 total budget (which also represents its AR expenditures since AR mobilizes 100% of NIOF's resources) amounted to LE 14.3 million (US\$ 4.2 million), of which LE 12.3 million were from national sources and LE 2 million from external grants, with salaries being LE 9 million and OCC LE 5.3 million, which means an average OCC amount of LE 12,400 (US\$ 3,600) per pRY.

NIOF has collaborative research programs and activities funded/supported by ASRT, Canada, USAID, UNEP, WHO and FAO.

2.3 The Faculties of Agricultural Sciences (FASs)

Overview (see Table 3)

Egypt has 18 faculties of agriculture (FAs) and 8 faculties of veterinary medicine (FVMs)¹, designated later on as FASs. Teaching is their main mandate; research and extension activities are generally limited (see below). All FASs provide BS programs and most offer MS and PhD graduate programs; in addition, they often offer Diploma programs. The current (1997/98) number of undergraduate students enrolled in the FASs is 30,350, while graduate students are 8,060, of which 4,800 students are registered for MS and 3,260 for PhD programs².

The FASs are within universities which are affiliated to the Ministry of Education. At the national level, they are run by the Supreme Council of Universities, consisting mainly of the university presidents, and chaired by the Minister

¹ Moreover, Egypt has 2 institutes for agricultural cooperation training (the Agriculture Cooperation Institute in Shoubra El-Kheima and the Cooperative Extension Institute in Assiut, established in 1960 and 1970, respectively), which are not engaged in AR, and only produce graduates who work in agricultural cooperatives in the different villages.

² In 1994, these numbers were: 28,170 undergraduate students, 4,824 graduate students (3,108 and 1,716 registered for MS and PhD programs, respectively).

of Education. The Council has an Agricultural Sector Committee¹ responsible for the overall FAS policy (curriculum changes, establishment of new FASs, initiation of special units, etc.). At the university level, a FAS is managed by the University Council, chaired by the University President, which consists of all the deans of the different faculties and three vice-presidents (for research and graduate studies, for educational affairs and students, and for community affairs and environmental development). Every FAS is headed by a Dean, assisted by three deputies (homologous to the three vice-presidents of the University); the Dean chairs the Faculty Council².

The FASs have a total of around 5,900 academic staff members (asm) (4,640 at the FAs and 1,250 at the FVMs), of whom 4,060 are PhD holders, 750 MS and 1,080 BS holders, most of them preparing higher degrees. They represent around 1,470 pRYs³.

The most important FASs are generally the oldest: the FAs of Cairo University in Giza (868 full-time academic staff members, asm), Ain Shams University in Cairo (499 asm), Alexandria University in Alexandria (498 asm), Zagazig University (475 asm), and the FVM of Cairo University in Cairo (334 asm). The most recent ones are also the smallest; they are the FAs of Suez Canal University in El-Arish (31 asm), Alexandria University in Damamhour (34 asm), Tanta University in Tanta (45 asm), and South Valley University in Sohag (19 asm).

The FASs are unevenly distributed among the regions: 20 out of the 26 faculties are in Cairo, the Delta and surroundings, where most of the academic staff (about 84%) are located.

Research Activities (Hamdi and Sabbah, FAO, 1996)

Research at the FASs is currently carried out by three categories of researchers, namely the staff members (PhDs), the assistant staff, and the graduate students. Except for the graduate students who are preparing their MS or PhD theses, a good number of staff members are reluctant to conduct sustainable research, especially those who have become professors. This is probably due to a combination of factors, including:

- A general feeling that the main role of the staff member is teaching;
- The lack of team-work, as single-author publications are given more credit when assessing possible promotion, and this leads to young researchers wishing to work individually rather than as part of a team;
- The lack or inadequacy of national research funding for the professors and the graduate students⁴;
- The lack of skilled technicians; and
- The lack of coherent policies for AR.

Accordingly, the percentage of human and financial resources allocated to AR activities does not actually exceed 10%. However, MALR and ARC have been exerting great efforts to involve university scientists and graduate students in national research programs, especially through NARP (in the period 1985–1995). Moreover, joint research and collaborative links with AR institutes (ARIs) are numerous: ARI researchers undertake graduate studies at the universities; ARI directors are members of the Faculty Councils; deans and professors participate in the governing bodies of the ARIs and also participate with ARI leaders in the regional agricultural research and extension councils and the commodity campaigns (see Section 4.3), etc.

2.4 The Other NARS Scientific Institutions

AR activities generally cover a more or less small part of the mandate of these “other NARS institutions.” They are mainly the National Research Center (NRC), National Water Research Center (NWRC), and Atomic Energy Authority (AEA), affiliated respectively to the Ministries of Scientific Research and Technology; Public Works and Water Resources; and Electricity and Energy.

¹ This committee is composed of deans of the FASs, university presidents and vice presidents with agricultural backgrounds, a number of First Deputy Ministers of Agriculture and a number of senior, usually emeritus, professors of agriculture.

² This Council consists of the chairpersons of the academic departments and a professor from each department in rotation, the three faculty deputies, two associate professors and two assistant professors, in addition to five distinguished professors from the faculty members and three eminent personalities from outside the faculty, to be nominated by the Faculty Council and approved by the University Council.

³ Based on the normative percentage (adopted for all the study) of 25% of the time of the academic staff members potentially allocated to AR activities (pRYs = number of asm × 25%).

⁴ For example, the funds allocated for research in the FA, Alexandria University, in the academic year 1993/94 was only LE 15000, to be shared among 436 faculty members and 103 support staff, i.e., about LE 30 per member per year for research.

The National Research Center (NRC)

NRC consists of 59 departments grouped into 13 divisions, four of which carry out research related to agriculture and mobilize together important human and financial resources (see Table 4).

- Two of these divisions specialize totally in AR: the Agricultural and Biological Research Division (botany, plant protection, soil and water, animal production, animal diseases, field crops, horticulture, etc.), which is one of the largest of all the 13 divisions, with its research staff (580 researchers, of whom 420 are PhD and 130 MS holders) representing about 25% of the total research staff of all the divisions; and the Food Industry Research Division (food and dairy industries, fats and oils, food and nutrition) (300 researchers, of whom 110 are PhD and 50 MS holders).
- The two others conduct AR besides other research activities: the Basic Sciences Research Division (microbial chemistry, flora and plant taxonomy, etc.) (200 researchers, of whom 120 are PhD and 60 MS holders); and the Genetic Engineering and Biotechnology Research Division (cellular biology, plant cell and tissue culture, etc.) (100 researchers, of whom 50 are PhD and 40 MS holders).

Agricultural field research facilities of the NRC include two research farms in the Delta and New Valley, four research stations in Cairo, Giza, West Delta, and the Red Sea region, and three pilot units in the NRC premises.

Activities of the NRC are not conducted on department or division basis, but rather on program basis and are multidisciplinary in nature. A large number of projects (138) are conducted under three programs: priority, development and basic research. Some projects, especially the one on optimizing fertilizer use on a national level, are conducted in collaboration with universities, ARC, a number of Arab countries, European countries, and international research and donor organizations (GTZ, IDRC, USAID, EU, CIP, etc.).

The National Water Research Center (NWRC)

NWRC consists of 12 research institutes (RI) and a training center. Each institute conducts research in a specific field. Two of these institutes, the Water Management RI and the Drainage RI, deal directly with AR (see Table 4).

The Water Management RI: WMRI has 60 graduate scientific staff members (including 20 PhD and 15 MS holders) and 11 experimental research stations. It is engaged in research on crop water requirements, water distribution, water losses, on-farm irrigation, and water quality control. It carries out applied research programs on farmers' fields in three regions: the Delta, Upper and Middle Egypt, and Giza, which represents areas subject to urbanization. Several projects are implemented by the Institute, including one that is financed by the German Technical Cooperation Agency (GTZ).

The Drainage RI: Scientists at DRI (70 graduate scientific staff members, including 10 PhD and 25 MS holders) conduct research on different drainage systems and reuse of drainage water. One experimental field, 100 monitoring stations along the main drains in the Nile Delta and Fayoum, and a number of laboratories are dedicated to the institute's research. In addition to a number of national institutions, the institute cooperates with many international organizations in the Netherlands, the USA, Italy, the UK and Canada.

The Atomic Energy Authority (AEA)

AEA is affiliated to the Ministry of Electricity and Energy and includes two centers involved in AR (see Table 4):

- The Nuclear Research Center has three agriculture departments within one of its four divisions (Radioisotope Applications Division): a soil and water department, a biological applications department, and a botany department, with 230 scientists (100 PhD, 60 MS, 70 BS);
- The National Center for Radiation Research and Technology has two agriculture departments within one of its three divisions (Radiation Research Division): a radiation microbiology department and a natural products department, with 100 scientists (40 PhD, 20 MS).

The departments are involved in research centering around the peaceful application of nuclear science and technology in agriculture, specifically on studies of soil, water, fertilizer, plant production (field, horticultural, and oil crops, and medicinal and aromatic plants), animal production, entomology, pathology, and the application of radiation technology to identify, evaluate, and reduce microbial toxins in food products and to evaluate the resistance of plant varieties to salinity, drought and viral diseases, etc. Research is conducted in a number of central labs and experimental farms. The departments have close cooperation with the International Atomic Energy Agency (IAEA) in Vienna and the National Science Foundation (USA), and have cooperative research agreements with institutions in Italy and Germany.

Other University Units

A large number of university units (Faculties of Sciences with departments of biology; Faculties of Engineering; Faculties of Economics; Faculties of Arts or Education, with departments of geography; etc.; Higher Institute of National Health, with departments of microbiology, nutrition, etc.) have large numbers of highly qualified scientists in sciences related to AR in general (plant/animal biology, including breeding, pathology, entomology, microbiology; mechanization; food technology; human nutrition; rural economics and sociology; etc). A precise inventory of this potential is not available, but according to a rough survey, this number should reach at least 400 academic staff members (rough estimate), who should represent 100 pRYs.

3. AR RESOURCES

3.1 Human Resources

Graduate staff (see Table 1): About 14,300 scientific and technical graduate staff (all national) are working in the agricultural sciences in Egypt and represent around 6,700 pRYs; 39% of these scientists are working at ARC and 41% at the FASs. Among them, 57% possess PhDs and 20% MSs. The FASs have the largest number of the highest trained scientists (4,070 PhD holders, i.e. 49% of the total). Strong attention has been given in the last decade to upgrading the academic level of the scientists in all the NARS institutions.

Research staff at the research institutions (ARC, DRC, etc.) follow the same career scheme as at the universities, although the titles may differ. Salaries may appear rather low (LE 1,500 or US\$ 440 per month for a senior researcher with PhD; LE 600 for a researcher with MS), but scientists receive other incentives (extra academic load/teaching, supervision of postgraduate students, etc.), and a few (those working in the regional research stations or regional universities) are either provided with housing or housing allowance. Moreover, those salaries are relatively high in term of "parity revenue" (according to the cost of life)¹.

Too large a proportion of the scientists are located in Cairo and the Delta region, amounting to around 96% for the ARC, 84% for the FASs, and quite almost the same for the other NARS institutions. But as noted above, these regions represent about 51% of the irrigated area of the country and may contribute a similar proportion to the national Agricultural Gross Domestic Product (AGDP).

Other staff In general, support staff numbers at the research institutes are satisfactory, with even excess of administrative and non-skilled laborers; but the FAS scientists suffer an acute lack of support staff. These categories of staff are much underpaid (LE 150 or US\$ 44/month for a technician or a secretary).

3.2 Physical Resources

In general, material resources of ARC are now good, partly due to NARP, which has contributed since 1985 to the renovation of many of the infrastructures/facilities of the institutes, central labs and research stations, and provided them with modern scientific/farm equipment, vehicles, information/communication services, etc.

DRC and NIOF have also rather good physical facilities, which have been in general funded jointly by the Government and external grants.

The other NARS institutions are far from being well endowed; however, some of the FASs have received some funds from NARP for improving their facilities.

3.3 Financial Resources

In 1996, total funding amounted to around LE 230 million (US\$ 68 million), of which LE 207 million (US\$ 61 million) came from national resources (the Ministry of Treasury and the institutions' self-generated resources), and 23 million (US\$ 6.8 million) secured through grants provided by bilateral or multilateral numerous donors.

The national and total AR financial resources represent respectively 0.50 and 0.56% of the AGDP (US\$ 12.1 billion in 1996). With respect to 1985, national resources registered a high increase in absolute terms (almost 60% in US\$), and decreased in relative terms (compared to the AGDP)². With respect to the last year, the completion of the huge

¹ They are much above the average income per capita in the country which amounts (1995) to US\$ 1070/year or US\$ 89/month (according to the official rate of exchange) and US\$ 3,850 in terms of "parity revenue" estimated by the World Bank.

² In 1985, the national AR financial resources were estimated at US\$ 40 million and represented 0.7% of the AGDP according to available incomplete data (Casas, CIHEAM, 1988).

NARP¹ resulted in a significant decrease of the NARS resources; during the fiscal year 1991/92, the estimated total resources of the NARS amounted to around 1.2% of the AGDP.

Areas of expenditure vary considerably between the institutions. As seen above, at ARC, salaries represent a little more than 50% of the total financial resources, and operation/capital costs (OCC) amount to LE 22,600 (US\$ 6,600) per pRY, which is only around 22–24% of the "optimal" amount of US\$ 25,000–30,000 per RY used in the long-term plans elaborated by many countries in similar agroecological conditions.

However, the capital costs (CC) currently needed are lower because of the large investments made under NARP, and considering that the CC represents around 30% of the OCC in the well-endowed ARIs, it is reasonable to estimate that the currently available OCC allows an actual employment of around 27–33%, which means that ARC actually has between 850 and 1040 actual RYs (aRYs), against 3,140 pRYs estimated above.

In the other institutions of the NARS, in general, salaries represent a higher proportion of the total resources, OCC per pRY are often much lower (except for DRC)², and recent investments have been relatively moderate or weak; this means that the ratios of actual employment are probably much lower than those estimated for ARC.

With ratios of actual employment between 15 and 20% for the other institutions, the whole NARS has (roughly) between 1,400 and 1,800 actual RYs (aRYs), against the 6,710 pRYs estimated above, which means that the AR scientific potential is actually far from being fully mobilized.

4. RESEARCH ACTIVITIES

4.1 Research Orientation

To overcome the challenges facing Egypt, in line with the agricultural development strategy aiming at optimizing crop yields per unit of land and water, and concentrating on increasing production, studying patterns of food consumption and reducing it, and minimizing production losses, effort was exerted at ARC in preparing the fourth five-year (1997/98–2001/02) research/extension/training plan. The plan focuses on adopting integrated and applied research programs together with extension and training programs, basically to develop new high-yielding cultivars and new technologies, and to find the most efficient methods for water use, and on the coordinated efforts of the different research institutes of ARC and other institutions for its implementation.

Based on the total number of researchers at ARC and NIOF, a breakdown of researchers between the large research fields and/or production branches indicates that about 41% are engaged in research on field and industrial crops, 24% on horticultural crops, 19% on animal production, and 16% on aquaculture/fisheries. With the FASs, these percentages may be more or less similar. From their comparison with the breakdown of the AGDP between the corresponding branches (field and industrial crops: about 40% of the AGDP; horticultural crops: 28%; animal production: 28%; fish production: 4%), it can be deduced that research on animal production (which generally demands more resources than research in other branches) is under-emphasized, and fish research over-emphasized.

There is a lack of a permanent unit (research institute) on farming systems at ARC. Integrated multidisciplinary research at the national level is essential for proposing more intensified and sustainable farming systems. However, some experiences are ongoing in that direction. Rather than AR and development efforts being directed at the issue of productivity and how to increase it, the emphasis has now shifted towards ensuring the sustainability of production and the implications of agricultural intensification on the natural-resource base (soil and water) and the environment, in general. In cooperation with ICARDA and through financial support of the EU, ARC initiated new long-term research activities (Resource Management Program) as part of the Nile Valley and Red Sea Regional Program (NVRSRP), where multidisciplinary research teams from different institutes of ARC, DRC, NWRC, and several universities participate in planning, implementing, and following up of two main activities, namely, long-term trials and long-term monitoring on farmers' fields.

¹ From 1985 to 1994, NARP resources amounted to US\$ 270 million, of which US\$ 205 million were provided by the USA and US\$ 65 million by Egypt. Only about half of these resources were really going to research activities; the average external contribution to AR was US\$ 13 million or LE 45 million per year (i.e., around 30% of the 1996 ARC total resources) (see [Annex 1 on NARP](#)).

² For DRC, OCC per pRY is LE 54,100 (US\$ 15,900), for NIOF LE 12,400 (US\$ 3,600), for NRC LE 4,400 (US\$ 1,290), and for FASs about LE 600 (US\$ 180) (based on AR expenditures).

4.2 National and International Linkages¹

Linkages between the NARS Institutions

Linkages, until recently, were limited. It is true that FAS staff is sufficient and there is no absolute need for external expertise, and this argument is valid also for most of the ARIs, as there are abundant research scientists and so no obvious need for joining forces. However, the joint participation of FAS and ARI scientists is always helpful, as benefit from complementary expertise is maximized through synergism.

Some success stories of linkages have been developed in the past², and for a few years now, they have been increasing in number, improving in quality, and becoming more equitable, particularly through the regional agricultural research and extension councils and the commodity campaigns (see below).

Relations with Development

These relations have been rather weak for a long time and were hampered by many factors, such as the lack of extension policy, the lack of coordination inside MALR directorates and between ministries concerned, overstaffing and low qualified staff (especially at the middle level) and poor physical facilities in the extension services, lack of adequate attention to farmers' commercial needs, etc. (Rivera and Elkalla, 1997). However, relations with development have been largely improved during the last six years as a result of establishing the national campaigns for commodities and forming the regional research and extension councils.

National campaigns for commodities: Among the main activities of the Food, Agriculture and Irrigation Research Council of the ASRT are the national campaigns to improve production of cereals (maize, rice and wheat), oil crops, sugar crops, citrus and banana, which were launched in the early 1980s and expanded in 1994. In these campaigns, experts and scientists from research centers, universities and implementing agencies work together in order to guide producers to the use of technology packages developed by researchers³.

Regional research and extension councils: In order to promote direct and indirect interaction, coordination and cooperation between scientists, researchers, extensionists, technologists, decision-makers and farmers on a regional basis, four regional research and extension councils⁴ were established in 1992 in four different targeted agroecological zones in Egypt: the Delta, the West Delta and the Northern Coast, the East Delta and Sinai, and Middle and Upper Egypt. The major objectives of these councils are to identify zonal constraints, support research programs and provide technological packages together with extension. The councils are responsible for:

- Discussing problems of agricultural production in the zone and suggesting solutions;
- Discussing and approving research and extension programs in the zone;
- Suggesting methods for funding and supporting research and extension programs in the zone;
- Coordinating and integrating between research programs in the different research institutions;

¹ Most of this section relies on Hamdi and Sabbah (FAO, 1996).

² Some examples of success stories developed by FA Alexandria: (i) The Farmers' Association established in 1983, with activities carried out in cooperation with NRC and ARC staff; (ii) A Laboratory for Animal Nutrition established jointly with NRC in 1980, which originated the National Program for Animal Nutrition since 1984, with continuous cooperation between some FAs (Alexandria, Mansoura, Ain Shams) and NRC; (iii) The Balba Group for Soil and Water Research, a scientific society formed in 1981 with the support of ASRT for strengthening scientific relations among the scientists concerned from universities and ARIs, arranging symposia, lectures, coordinating research activities among its members, publishing various periodicals and newsletters (*Alexandria Science Exchange, Advances in Soil and Water Research in Alexandria, Sahara Review, Alexogram*).

³ For example, the National Campaign for Rice involves officials, experts and scientists from various sectors: MALR; ARC; ASRT; and FASs of the universities of Cairo, Alexandria, Tanta, Zagazig and Mansoura; Credit Bank; Ministry of Public Works and Water Resources; and the Society for Rice Producers. Of this group of 112 cooperators, 18 were from the universities.

⁴ Each of the councils includes as members the deputy directors of the ARC, deans of the faculties of agriculture and veterinary medicine in the region, director of CAEE, representatives of other research institutions (DRC, NIOF, etc.) and ASRT, directors of the regional research stations, heads of the agriculture sector in the region, three directors of specialized agricultural research stations (crops, horticulture and animal production), chairman of the board of the Principal Bank for Development and Agricultural Credit (PBDAC) in the major governorate in the region, agricultural extension directors in the regional governorates, the seed director in the principal governorate, the under secretary of the Ministry of Irrigation for the region, and farmers and representatives of agricultural industries in the region.

- Monitoring and evaluating the achievements in research and extension programs in the zone.

The councils focus on specific local problem-solving activities related to the socioeconomic context of a region. Rural family development activities are also overseen by the regional councils.

Impact on production: Impact of AR on production is difficult to estimate as progress in production results also from many other factors and from the agricultural reform policies. What is sure is that without the AR support and results, the large increases in the yields of major crops (wheat, maize, rice, etc.¹) observed during the last 10 years would not have taken place, and perspectives on the national food balance would not have changed so dramatically: according to the 1994 statistics, the food gap for grain by the year 2000 was estimated at 4.5 million tons, against 26 million tons according to 1982 statistics, recording a reduction of about 83%.

International Scientific Cooperation

As seen above, most of the NARS institutions have developed rather strong collaboration with a large number of external scientific institutions, among them are the international AR centers (IRRI, ICARDA, CIMMYT, CIP, IPGRI, IIMI, IFPRI, ICRISAT and ICLARM), US universities, and European AR institutes. These relations have been supporting research and training activities funded most often by donors (see Section 3.3).

5. CONCLUSION

The Egyptian NARS has numerous strengths. Its structure is globally satisfactory: the NARS is relatively not much fragmented, with a relatively few number of well-established and experienced main institutions, and a unique body responsible for the overall AR policy (the National AR Council). It has a high number of well-trained scientists and technical support staff, rather good infrastructure and research facilities, and benefits from the full confidence of the national authorities and has strong international scientific and financial support.

However, the NARS is facing some major weaknesses and constraints. Its high scientific potential is actually rather poorly mobilized due to the limited financial capacity of the country, the weight of salary costs and the low operation and capital budgets available. As almost all the agricultural administration², the NARS is certainly overstaffed, as a direct result of the Government's previous guaranteed employment policies for university and secondary school graduates. With the same financial resources, a more equilibrated allocation with lower salary expenditures and improved operation/capital budgets would allow to increase the efficiency of the staff and the NARS.

Even if there is considerable documented evidence of increasing and successful collaboration, linkages within the Egyptian NARS, especially between the ARIs and the FASs, remain limited compared to total activity in the agricultural research and education sector.

Relations with development are improving; however, the relatively weak permanent presence in the Upper and Middle Nile Valley (which results from the excessive concentration of scientific potential in Cairo and the Delta) is a very limiting factor for more efficient cooperation.

The NARS is moving and will certainly be able to take advantage of opportunities for greater efficiency, sustainability and impact.

Main Acronyms

ME: Ministry of Education. **MALR:** Ministry of Agriculture and Land Reclamation, formerly Ministry of Agriculture. **MSRT:** Ministry of Scientific Research and Technology. **MPWWR:** Ministry of Public Works and Water Resources.

ARC: Agricultural Research Center. **ASRT:** Academy of Scientific Research and Technology. **DRC:** Desert Research Center. **ENAL:** Egyptian National Agricultural Library. **FAS:** Faculty of Agricultural Sciences. **FA:** Faculty of Agriculture. **FVM:** Faculty of Veterinary Medicine. **NARC:** National Agricultural Research Council. **NARP:** National Agricultural Research Project. **NIOF:** National Institute of Oceanography and Fisheries. **NRC:** National Research Center. **NWRC:** National Water Research Center.

¹ The national yields for wheat, maize and rice have increased from 3.20, 4.13 and 5.70 t/ha in 1982 to 6.07, 7.88 and 8.33 t/ha, respectively, in 1995.

² Which employs close to half a million people, almost 12% of the formal agricultural labor force as well as 12% of total Government employees (Rivera and Elkalla, 1997).

LE: Egyptian Pound.

Main References

- FAO (Watson J.M.) - *Comparative study of agricultural research organization and administration in the Near East Region.*- Rome, FAO, 1964, pp. 31–35.
- Ministry of Agriculture - *Allocation of resources in agricultural research. Arab Republic of Egypt.*- Cairo, (summary in English of an MOA/IDRC study published in Arabic), November 1983, 31 p.
- FAO (Smith F.W. et al.) - *Report of an FAO agricultural research review and planning mission to Egypt.*- Rome, May 1985, 45 p.
- Shehata A.M. - *Agricultural research system in Egypt.*- Cairo, ARC, August 1987, 30 p.
- Abdelsalam M.W. - *Agricultural and irrigation education in Egypt.*- In Agronomic training in countries of the Mediterranean Region, CIHEAM (Ed.: Hervieu B.), April 1988, pp. 17–38.
- El-Sharkawy A. - *The agricultural research system in Egypt.*- In CIHEAM (Ed.: Casas J.), Dec. 1988, pp. 19–22.
- Casas J. - *An analysis of national agricultural research in the Mediterranean region.*- In CIHEAM (Ed.: Casas J.), December 1988, p. 175.
- FAO - *Country profiles: Agricultural research. Egypt.*- Rome, 1989, 13 p.
- FAO (Abercrombie K.C. and El Moursi A.W.) - *Agricultural research systems in the Near East and North Africa.*- Rome, 1990, pp. 25–32.
- ISESCO - *Research centers in Islamic countries: Potential and activities. Les centres de recherche dans les pays islamiques: Potentialités et activités.*- Rabat, juillet 1991, pp. 91–125.
- Ayari Ch. - *La recherche scientifique et technologique en Egypte.*- In "Enjeux méditerranéens. Pour une coopération euro-arabe", Tunis, IPC, mars 1992, pp. 133–138.
- Momtaz A. - *The Egyptian Agricultural Research Center's experience working with universities and other research agencies in Egypt.*- In The role of Universities in national agricultural research systems, Rome, FAO, Res. and Techn. Paper 5, 1993, pp. 220–232.
- El-Beltagy A. - *Integrating national agricultural research imperatives and capacity building in food security in Egypt.*- In CIHEAM (Ed.: Plaza P.), 1993, pp. 61–68.
- Ministry of Agriculture and Land Reclamation (MALR) - *Agricultural Genetic Engineering Research Institute (AGERI). Research capability and program.*- Cairo, 1993, 66 p.
- ARC - *Human resources of agricultural research in Egypt.*- Dec. 1994 (summary of a study publ. in Arabic), 20 p.
- MALR – *A series of monographs on the ARC and its research institutes and labs, and their research capability and program.*- Cairo, 1994/95 (22 monographs of around 60 pages each).
- MALR - *Desert Research Center. Research capability and program.* Cairo, 1995, 84 p.
- MALR/ARC/NARP – NARP Accomplishment Conference. Views and Highlights.- MIS Unit/NARP, Cairo, January 1995, 147 p.
- Hamdi Y.A. and Sabbah M.A. - *The role of Universities in the National Agricultural Research Systems of Egypt, Jordan, Morocco, the Sudan and Tunisia. Case Study no. 1: Egypt.*- Rome, FAO (Research and Technology Development Service), 1996, pp. 13–30.
- Rivera W.M. and Elkalla M.A. - *Restructuring agricultural extension in the Arab Republic of Egypt.*- Europ. Journal of Educ. and Extens., 1997, 3 (4), pp. 251–260.
- Khalifa M.A. - *Agricultural research systems in Egypt with an emphasis on the Agricultural Research Center (ARC).*- Florence, Intern. Seminar on Regionalisation of AR in the Mediterranean and Near-East Countries, May 1997, 17 p.
- Abdel Monem M., Khalifa H.E., Solh M. - *Building and sustaining the high production capacity of Egypt's irrigated lands: A long-term research program.*- Journal of Sustainable Ag., 1998, 11 (2/3), pp. 7–18.

**Annex 1 - Some Information on the National Agricultural Research Project (NARP)
(MALR/ARC/NARP, 1995)**

NARP was implemented by the Egyptian Government with the support of USAID from 1985 to 1995. Its main objectives were human resource development, capacity building, interdisciplinary and collaborative research through local and international linkages, generating improved and new agricultural technology through research, initiating institutional reforms, and building more effective links between research and extension entities and farmers for diffusion of new technologies and feedback from farmers to research on their needs and constraints.

- NARP resources: USA: US\$ 205 million, Egypt: LE 219 million (around US\$ 65 million).

- US grant components: Research: 64%, technology transfer: 11%, seed technology: 8%, policy analysis: 3%, “new initiatives” (mullet fish, crop biotechnology, rinderpest, anaplasmosis, soybean, poultry, whitefly, machinery, and agroforestry): 12%, economic studies on new lands development, commodity marketing systems): 1%.

- Research components:

- Research support program for the ARC: US\$ 12m (10 for operation): 284 grants, more than 3,000 researchers;
- Research grants for universities and non-ARC research institutes: US\$ 9m (3 for operation): 201 grants, more than 1,800 scientists; including: US\$ 7.7m (5 for operation) and 175 grants for universities;
- Collaborative research program for joint research programs with US research institutions and universities: US\$ 20m, more than 300 scientists;

Other items: US\$ 58m (ENAL: US\$ 6m; Renovation of AR facilities: 29 sites in 19 research stations: US\$ 7m; ARC labs, offices, research stations: US\$ 25m; ARC land improvement in 13 research stations: US\$ 13m; on-farm trials (field and horticultural crops): US\$ 1m; IRRI joint program: US\$ 4m, ICARDA/CIMMYT joint program: US\$ 2m).

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

Rounded numbers (see Tables 2,3, 4). <i>Italic s</i> : Approximate data. -: Data not available. *: See footnotes. NARS Institutions				AR Scientific & Technical Graduate Staff (Units)			Potential Res. Years		Total Budget (1000 LE)		AR Expenditures/Resources (E) (1000 LE)				
No.	Name - Acronym Head Office - Year Established	Mandates AR Fields	Govern. Ministry	Nationals (PhD , MS)		Exp.	Nat.	Exp.	Nat.	Ext.	Nat. NE	For. FE	Total TE		
				e	f									g	h
1.1	Agricultural Research Center: 24 res. units Cairo (see Table 2)	ARC 1869, 1983	AR (55%) - (AD) All exc. fish.	MALR	5620	2700 , 1400			3140		232,000*	23,000*	124,500	18,200	142,700
2.1	Desert Research Center Cairo	DRC 1939, 90	AR (70%) - (AD) All exc. fish.	MALR	330	180 , 80			230		23,000	800	20,000	700	20,700
2.2	Nat. Inst. of Oceanography & Fisheries Alexandria	NIOF 1927, 1986	AR (100%) Oceano., aquac.	MSRT	430	140 , 130			430		12,000	2,000	12,000	2,000	14,000
1-2	Total AR Institutes				6380	3020 , 1610	0		3800	0	267,000	25,800	156,500	20,900	177,400
3.1	18 Faculties of Agriculture Cairo, Alexandria, etc. (see Table 3)	FA 1935-96	AHE - (AR) All	ME	4640	3260 , 540			1160		111,000	4,500	11,100	450	11,550
3.2	8 Faculties of Veterinary Medicine Cairo, Alexandria, etc. (see Table 3)	FVM 1935-90	AHE - (AR) An. prod/health	ME	1260	810 , 210			320		32,000	600	3,200	50	3,250
3	Total Faculties of Agricultural Sciences				5900	4070 , 750	0		1480	0	143,000	5,100	14,300	500	14,800
4.1	National Research Center * Cairo (see Table 4)	NRC 1956	R - (AR) Diverse	MSRT	1180	700 , 280			950		29,000	1,500	25,800	1,300	27,100
4.2	National Water Research Center * Cairo (see Table 4)	NWRC 1975, 1994	R - (AR) Irrigation	MPWWR	130	30 , 40			100		3,500	600	2,900	600	3,500
4.3	Atomic Energy Authority * Cairo (see Table 4)	AEA 1955	R - (AR) Diverse	MEE	330	140 , 80			280		6,900	-	6,300	-	6,300
4.4	Fac. of Engin., Sciences, Econ., etc. (see Section 2.4)		E - (AR: div.)	ME	400	280 , 60			100		-	-	800	-	800
4	Total Other Scientific Institutions				2040	1150 , 460	0		1430	0	39,400	2,100	35,800	1,900	37,700
5	Total NARS				14320	8240 , 2820	0		6710	0	455,300	33,000	206,600	23,300	229,900
Exchange Rate : US\$ 1 = LE 3.4 (Average rate for 1997)				Actual Research Years (aRYs) (Estimated) →					1400 - 1800	0	AR Expenditures (million US\$) →		60.8	6.8	67.6

ME: Ministry of Educ. MEE: Min. of Electricity & Energy. MALR: Min. of Agric. & Land Reclamation. MSRT: Min. of Scient. Res. & Technology. MPWWR: Min. of Public Works and Water Resources.

c; Mandates: AR (.. %): Approximate average % of graduate staff's time devoted to ag. research (AR); R: Research; AHE: Ag. higher education; AD: Ag. development/services (for AR and AHE institutes: seed production, soil analysis, extension, etc.). i, j: potential research year (pRY) = equivalent full-time researcher; for the FASs, pRYs were estimated by multiplying the number of academic staff by 25%.

*Notes: 1.1: Total budget only of the 24 research units of ARC. 4.1, 4.2, 4.3: data related only to the units of these institutions which are mainly involved in AR.

National AR expenditures (NE): 0.50% of the Agricultural Gross Domestic Product (AGDP: US\$ 12.1 billion in 1996). Total AR expenditures (TE): 0.56% of the AGDP.

Table 2 - The Agricultural Research Center (ARC): Its Institutes and Central Laboratories (1996/97)

ARC Research Institutes (RI) and Central Laboratories (CL)					Graduate Scient. & Tech. Staff (Units)		Potent RYs*	Total Budget (1000 LE)		AR Expenditures/Resources (E) (1000 LE) *		
No.	Name – Acronym Year Established - Mandates (% of resources devoted to AR) *				Nationals Total - (PhD , MS)		Nat.	Nat.	Ext.	Nat. NE	For. FE	Total TE
1	Soil, Water and Environment RI	SWERI	1903, 71	50%	610	369, 183	305	20,900	2,500	15,700	1,900	17,600
2	Field Crops RI	FCRI	1903, 73	75%	581	282, 82	436	9,800	1,000	8,600	900	9,500
3	Horticulture RI	HRI	1911, 71	50%	748	239, 183	374	18,000		13,500		13,500
4	Sugar Crops RI	SCRI	1913, 83	50%	156	49, 41	78	3,500	700	2,600	500	3,100
5	Cotton RI	CRI	1920, 71	75%	184	140, 19	138	4,500		3,900		3,900
6	Agric. Genetic Engineering RI	AGERI	1989	80%	74	17, 29	59	1,000	4,000	900	3,600	4,500
7	Plant Pathology RI	PPATHRI	1919, 73	75%	371	191, 100	278	6,300	3,000	5,600	2,600	8,200
8	Plant Protection RI	PPRI	1889, 83	50%	542	323, 151	271	10,200		7,600		7,600
9	Animal Production RI	APRI	1908, 71	60%	296	202, 66	178	21,000	3,400	16,800	2,700	19,500
10	Animal Reproduction RI *	ARRI	1968, 83	60%	152	56, 28	91	3,200	€	2,600	€	2,600
11	Animal Health RI	AHRI	1904, 83	40%	360	274, 72	144	9,100		6,400		6,400
12	Veterinary Serum & Vaccine RI	VSVRI	1903, 83	40%	298	96, 59	119	5,300	4,900	3,700	3,400	7,100
13	Agricultural Engineering RI	AENRI	1983	50%	97	27, 58	49	3,200	900	2,400	700	3,100
14	Food Technology RI	FTRI	1991	60%	283	116, 48	170	5,800		4,600		4,600
15	Agricultural Economics RI	AERI	1943, 71	60%	192	115, 58	115	4,500	300	3,600	200	3,800
16	Agr. Extension & Rural Devel. RI	AERDRI	1943, 77	60%	185	64, 73	111	2,100		1,700		1,700
17	CL for Agricultural Climate	CLAC	1996	40%	94	11, 32	38	1,100	500	700	300	1,000
18	CL for Date Palm Res.	CDPR	1996	100	13	4, 3	13	500		500		500
19	CL Agricultural Pesticides Lab	CAPL	1963, 83	50%	169	59, 25	85	4,100	1,000	3,100	800	3,900
20	Lab of Residue Analysis of Pestic.	LRAP	1995	20%	22	4, 7	4	900	600	500	400	900
21	CL for Aquaculture Res.	CLAR	1987, 91	40%	69	22, 38	28	500		300		300
22	CL for Food and Feed	CLFF	1980, 85	25%	44	16, 17	11	3,100		1,900		1,900
23	CL for Design & Stat. Anal. Res.	CLDSAR	1940, 71	60%	60	16, 22	36	800		600		600
24	CL Lab for Agric. Expert Systems	CLAES	1989, 91	40%	17	5, 5	7	700	400	500	200	700
A	Total Institutes & Central Labs				5617	2697, 1399	3138	140,100	23,200	108,300	18,200	126,500
B	ARC General Administration				-	..., ...		92,100	-	16,200*	-	16,200
C	Total ARC				5617	2697, 1399	3138	232,200	23,200	124,500	18,200	142,700

*: Notes:

- Mandates: Average % of time devoted by the graduate staff members (gsm) to AR.
- PRYs = potential research years = number of gsm × average % of time devoted by the gsm to AR.
- Total budget and AR expenditures: rounded numbers. For the RI number 10, external grants: € = LE 30,000.
- In general, AR activities are more expensive than the other activities conducted by the research units (development, extension, training), thus, the AR expenditures have been roughly estimated from the following formula: Total budget × [% resources devoted to AR + 0.5(100% - % resources devoted to AR)]/100.
- In row B, the amount LE 16,200 million represents 15% of the AR national financial resources of the ARC research units, considered as a rough estimate of the general administration/management costs devoted to the concerned units by the ARC Directorate.

Table 3 - Faculties of Agriculture (FA) and Veterinary Medicine (FVM) (1996/97)

Faculties			Graduate Acad. Staff Members (Units)		Potent RYs *	Total Budget (1000 LE) *		AR Expendit./Res (E) (1000 LE) *		
	Name Location - Year Established	Mandates	Nationals Total - (PhD , MS)		Nat.	Nat.	Ext.	Nat. NE	For. FE	Total TE
1	FA-Cairo Un./Giza 1935	All	868	538 , 75		10,800	600			
2	FA-Cairo Un./Fayoum 1976	All exc. fish	203	118 , 42		3,900	250			
3	FA-Ain Shams Un./Cairo 1950	All	499	371 , 60		16,800	900			
4	FA-Alexandria Un./Alex., El-Shatby 1942	All	498	392 , 63		19,000	800			
5	FA-Alexandria Un./Alex., Sabba Pasha 1959*,75	All	84	66 , 9		1,600	100			
6	FA-Alexandria Un./Damanhour 1987,91	All exc. fish	34	21 , 3		600	50			
7	FA-Al Azhar Un./Cairo 1963	All	322	239 , 42		4,700				
8	FA-Suez Canal Un./Ismailia 1976	All	169	114 , 37		2,800	400			
9	FA-Suez Canal Un./El-Arish 1990	Agr, environ	31	22 , 8		2,000				
10	FA-Zagazig Un./Zagazig 1957,69	All exc. fish	475	230 , 22		12,500	450			
11	FA-Zagazig Un./Moshtohor 1957,74	All	185	141 , 28		4,400	100			
12	FA-Assiut Un./Assiut 1959	All exc. fish	298	213 , 50		5,200	200			
13	FA-Mansoura Un./Mansoura 1957,69	All exc. fish	217	186 , 23		3,800	150			
14	FA-Minia Un./Minia 1957,69	All exc. fish	221	178 , 37		4,700	100			
15	FA-Menoufia Un./Shebin El-Kom 1957,69	All exc. fish	235	206 , 18		10,200	100			
16	FA-Tanta Un./Kafr El-Sheikh 1957,69	All exc. fish	240	186 , 22		6,400	200			
17	FA-Tanta Un./Tanta 1993	All exc. fish	45	29 , 3		1,000	100			
18	FA-South Valley Un./Sohag 1996	All exc. fish	19	6 , 1		800				
A	Total 18 Faculties of Agriculture (FA)		4643	3256 , 543	1160	111,200	4,500	11,100	450	11,550
19	FVM-Cairo Un./Cairo 1935	Liv.	334	264 , 26		14,600	200			
20	FVM-Cairo Un./Beni Suef 1982	Liv., fish.	83	51 , 10		1,550				
21	FVM-Alexandria Un./Alex. 1975	Liv.	100	75 , 18		2,400	150			
22	FVM-Suez Canal Un./Ismailia 1986	Liv.	154	38 , 50		3,100	100			
23	FVM-Assiut Un./Assiut 1961	Liv.	123	100 , 15		3,400	100			
24	FVM-Zagazig Un./Zagazig 1969	Liv., fish.	257	175 , 32		4,300	70			
25	FVM-Zagazig Un./Banha 1982	Liv.	111	72 , 24		1,250	20			
26	FVM-Tanta Un./Kafr El-Sheikh 1990	Liv.	89	31 , 32		1,000				
B	Total 8 Faculties of Veterinary Medicine (FVM)		1251	806 , 207	313	31,600	640	3,200	50	3,250
C	Total Faculties of Agriculture and of Veterinary Medicine		5894	4062 , 750	1473	142,800	5,140	14,300	500	14,800

*: Notes:

- PRYs = potential research years = number of graduate academic staff members × 25% (= normative average % of time potentially devoted to AR).
- Total budget and AR expenditures: rounded numbers.
- AR expenditures: estimated roughly as 10% of the total expenditures (see Section 2.3).

Table 4 - The Other Institutions of the NARS (1997): AR in NCR, NWRC and AEA

NARS Institutions			AR Scientific & Technical Senior Staff (Units)			Potential Res. Years		Total Budget (1000 LE)		AR Expenditures/Resources (E) (1000 LE)			
No.	Name - Acronym (Head Office - Year Established)	Mandates AR Fields	Nationals Total - (PhD , MS)		Exp.	Nat.	Exp.	Nat.	Ext.	Nat. NE	Loan LE	For. FE	Total TE
a	b	c	f	g	h	i	j	k	l	m	n	o	p
1	<i>National Research Center/Cairo</i> NRC-1956	R - (AR: all) - (AD)											
	a. Agr. and Biological Res. Division 1968	AR 90%	580	420 , 130		520		15,000	1,500	14,300		1,300	
	b. Food Industry Res. Division 1968	AR 90%	300	110 , 50		270	3,000	2,900					
	c. Basic Sciences Res. Division 1977	AR 50%	200	120 , 60		100	4,000	3,000					
	d. Genetic Engin. & Biotech. Res. Division 1986	AR 60%	100	50 , 40		60	5,000	4,000					
	Total AR Units in the National Research Center		1180	700 , 280		950	0	29,000*	1,500	25,800*		1,300	27,100
2	<i>National Water Res. Center/Cairo</i> NWRC-75	R - (AR) - (AD)											
	a. Water Management Res. Inst. WMRI-1975	AR 50% (land, water)	60	20 , 15		30		2,300		1,700			1,700
	b. Drainage Res. Inst. DRI-1976	AR 100% (land, water)	70	10 , 25		70		1,200	600	1,200		600	1,800
	Total AR Units in the National Water Research Center		130	30 , 40	0	100	0	3,500	600	2,900		600	3,500
3	<i>Atomic Energy Authority/Cairo</i> AEA-1955	R - (AR) - (AD)											
	a. Nuclear Research Center NRC-1955												
	- Biological Applications Dept. 1965	AR 85% (zool. entomo.)	110	45 , 30		94		1,900	-	1,800		-	1,800
	- Soil and Water Dept. 1974	AR 80% (soil, water)	35	20 , 5		28		800	-	700		-	700
	- Botany Dept. 1995	AR 80% (agron. hortic.)	85	35 , 25		68		2,000	-	1,800		-	1,800
	b. Nation. Center for Radiation Res. & NCRRT.72												
	- Radiation Microbiology Dept. 1972	AR 90% (microbio.)	50	20 , 10		42		900	-	800		-	800
	- Natural Products Dept. 1995	AR 90% (genetics, physio.)	50	20 , 10		48		1,300	-	1,200		-	1,200
	Total AR Units in the Atomic Energy Authority		330	140 , 80	0	280		6,900	-	6,300		-	6,300
4	Total 1 + 2 + 3		1640	870 , 400	0	1330	0	39,400	2,100	35,000		1,900	36,900

*: NCR: An amount of LE 2 million from national sources (e.g., ASRT) is shared among the divisions; this has been multiplied by an average calculated from the % resources devoted to AR of the four divisions and added to the national component of AR expenditures.

Note: For a better appraisal of the AR financial resources of these three institutions, it is necessary to take into account the administration/ management costs devoted to the concerned units at the level of the directorates of these institutions; accordingly, Table 1 reports the above national AR financial resources with a 15% increase.