

THE NATIONAL AGRICULTURAL RESEARCH SYSTEM OF TUNISIA¹

1. HISTORICAL BACKGROUND

Agricultural research (AR) in Tunisia started more than a century ago with the establishment of three institutions: the *Service de l'Élevage* (Animal Production Service) created in 1887, which became the *Institut de Recherche Vétérinaire* (IRV) in 1913; then in 1889, the *Ecole Coloniale d'Agriculture de Tunis* (Colonial Agricultural School of Tunis, for technicians), elevated to the status of *Ecole Supérieure d'Agriculture de Tunis* (ESAT, College of Agriculture for Graduate Studies) in 1955; and the *Service Botanique de Tunisie* in 1913, renamed *Service Botanique et Agronomique de Tunisie* in 1936 (SBAT).

After independence in 1957, the national authorities gave high attention to agricultural research and education, which received support from many cooperating agencies. SBAT became the *Institut National de la Recherche Agronomique de Tunisie* (INRAT, National AR Institute of Tunisia) in 1961, which relied heavily on cooperation with INRA France. New research institutes were established:

- The *Centre de Recherche et d'Expérimentation du Génie Rural* (CREGR, 1959), then renamed *Centre de Recherche du Génie Rural* (CRGR) after merging in 1970 and 1974 with two research and development projects on irrigation²;
- The *Institut du Reboisement* (Institute for Reforestation), opened in 1966 with FAO support, renamed *Institut National des Recherches Forestières* (INRF, 1976);
- The *Institut des Régions Arides* (IRA: Institute for Arid Regions), established in 1976 to capitalize on the experience gained since 1969 in research and studies implemented with French scientists in the south of the country (rangeland management, oases);
- The *Institut de l'Olivier* (IO), established at Sfax in 1981 for promoting the important olive sector;
- The *Institut National des Sciences et Technologies de l'Océanographie et de la Pêche* (INSTOP, 1964), a new name given to a marine center established in 1924.

At the same time, ESAT developed and became the Faculty of Agriculture of Tunis, then the *Institut National Agronomique de Tunis* (INAT) in 1970. The higher agricultural education system expanded dramatically. One veterinary school and seven *Ecoles Supérieures d'Agriculture*, equivalent to colleges, were established during the period 1970–1983, namely:

- *Ecole Nationale de Médecine Vétérinaire* (ENMV, 1974) at Sidi-Thabet (north of Tunis), for training veterinarians until then trained abroad;
- Six agricultural colleges for training technicians and engineers (equivalent to diploma and BS holders) in specialized fields (dry area farming systems, animal production, etc.)³ and one college for training forestry technicians (see Section 2.3).

In 1990, the Ministry of Agriculture (MOA) set up the *Institution de la Recherche et de l'Enseignement Supérieur Agricoles* (IRESA, Institution for Agricultural Research and Higher Education) responsible for the supervision and coordination of the former agricultural research and training institutions (all so far affiliated to MOA), setting their priorities and developmental needs, monitoring and finalizing their research programs and valorizing their findings and results.

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² These projects, sponsored by FAO, were the *Centre de Recherche sur l'Utilisation des Eaux Saumâtres en Irrigation* (CRUESI, 1962–1970), and the *Centre d'Amélioration des Techniques d'Irrigation et de Drainage* (CATID, 1969–1974), respectively focusing on the use of saline water for irrigation and on the improvement of irrigation and drainage techniques.

³ Most of these colleges came before agricultural high schools which trained low- and medium-level technicians.

In 1978, the national research policy was conferred to the Ministry of Higher Education; however, it had very limited influence on the NARS institutions affiliated to other ministries. In 1991, the *Secrétariat d'Etat à la Recherche Scientifique et la Technologie* (SERST), under the Prime Minister's Office, took over very actively this responsibility: it launched the national priority research projects (*Projets Nationaux Mobilisateurs*: Mobilizing National Projects) in line with the development strategy (industrial management, seashore and environment management, water management, remote sensing, desertification control, etc.). It has stimulated collaboration among the national scientific institutions, set up new research units (especially within the universities), and taken direct governance of some research institutes such as IRA and INSTOP (1992).

Lately, IRESA has developed a regionalization scheme articulated around seven “regional development poles.” In 1996, the following changes occurred: CRGR and INRF merged into a single research institute, the *Institut National de la Recherche en Génie Rural Eaux et Forêts* (INRGREF, 1996); IO mandate was extended to fruit trees cultivated in dry areas; and INSTOP became INSTM, *Institut National des Sciences et Techniques de la Mer* (National Institute for Sciences and Techniques of the Sea), after merging with the National Center for Aquaculture (CNA, created in 1985).

2. THE CURRENT NARS

2.1 Overview (see Table 1)

The current (1997) Tunisian NARS is composed of two main sets of institutions:

- Six AR institutes, of which four (INRAT, INRGREF, IO, IRVT) are affiliated to IRESA within MOA, and two are under SERST (IRA, INSTM): they gather around 61% of the potential research years (pRYs or equivalent full-time researchers) and 72% of the total financial resources of the NARS; they are presented in Section 2.2.
- Nine agricultural academic institutions affiliated to IRESA, which meet around 25% of the pRYs and 15% of the total financial resources of the NARS (see Section 2.3).

Some other institutions within different ministries (SERST, MOA, etc.) for which AR activities represent a relatively small part of their mandate, fill the remaining marginal place in the NARS (see Section 2.4).

IRESA¹, on behalf of MOA, has the largest mandate in the national AR policy. SERST is responsible for the overall national research policy and, at the same time, directly governs IRA, INSTM and other research institutions (INRST, CBS, etc.).

2.2 The AR Institutions

The IRESA Agricultural Research Institutes: INRAT, INRGREF, IO and IRVT

Mandate and Organization

Among the four IRESA AR institutes (ARIs), three are mainly involved in research, which mobilizes around 85% of the time of their researchers, with little development (seed/seedling production, soil/water analysis, studies, etc.) and training activities; they are:

- The National Agricultural Research Institute of Tunisia (INRAT, headquarters: Tunis): It is the largest NARS institution, employing 86 graduate staff members, who represent 73 pRYs². It conducts research in almost all agricultural fields, except olive tree research and farm machinery. INRAT is headed by a Director General supported administratively by a Secretary General; the DG chairs a Board where the various scientific and professional partners are represented. It has very strong links with professional organizations.
- The National Research Institute for Water Management, Forestry and Agricultural Engineering (INRGREF, Tunis): The main research thrusts of its 40 graduate staff members are in the areas of soil conservation, land management, irrigation management, crop water use, sewage water use, etc.

¹ IRESA is an administrative division of MOA, with autonomous budget. It is headed by a President and a Director General. Its organizing chart includes five main Directorates: pedagogic affairs; planning, monitoring and evaluation of research programs; transmission of innovations and liaison between research and extension; scientific information; international cooperation.

² pRYs = number of researchers × 85% (percentage of the researchers' time devoted to AR).

- The Olive Institute (IO, Sfax): Its 25 researchers are specialized in research related to fruit trees (production and technology) cultivated in dry areas (mainly olive, and also pistachios and almonds trees).

The Tunisian Veterinary Research Institute (IRVT, Tunis) is mainly involved in development/service activities (vaccine production, food quality control, epidemiology surveys, etc.) which mobilize a major part of its graduate staff's time, with a minor part devoted to research on animal health.

These semi-autonomous ARIs have the status of public administrative institutions; they are financially autonomous and are headed by directors general nominated by the Minister of Agriculture, assisted by scientific councils, comprising researchers and representatives of socioeconomic and professional organizations.

Human, Physical and Financial Resources

The permanent full-time staff of the IRESA ARIs is national and includes (1996):

- 168 graduate staff members (30 PhD holders), who are equivalent to 131 pRYs;
- 197 technicians, i.e. an average of 1.2 technician per researcher (from 1.1 at INRAT to 1.9 at INRGREF), rather low for meeting the research needs;
- 788 other support staff (53 administrative staff and 735 laborers), which means an average ratio per researcher of 4.7; much lower and more satisfactory than 10 years ago (almost 8: ISNAR, 1987). IO is now facing a large deficit (ratio of only 1.8).

The graduate staff members are under two different categories. The largest is the “scientific staff” (around 70%) who is under the “scientific status” obtained in 1987 (see Section 3.1) with its three main grades: director, master and assistant of research, and have, in general, a postgraduate degree (PhD, MS or equivalent). The remaining senior “technical staff” covers three sets of qualified staff: (i) all the IRVT graduates (almost all are veterinarians and till now their diploma has not been taken into account in the IRESA scientific status); (ii) old IRESA researchers who are under the former status applied to the senior staff of the MOA services; these researchers generally were not or could not be integrated in the scientific status because they don't have a postgraduate degree, in spite of (for most of them) their valuable past research experience; and (iii) young researchers who are under contract and are preparing the research assistant examination (and generally a postgraduate degree) while participating in research programs.

The four ARIs have their main laboratories at their headquarters. Their 28 experiment stations (19 belong to INRAT, 8 to INRGREF, 1 to IO; total area: 4,450 ha) spread across the country are too numerous; they suffer insufficient numbers of technicians and laborers (whose number was cut by two-thirds in 15 years), and their management is rather difficult, as each station is supervised by a researcher, responsible for its management, who is generally based in Tunis and does not receive any incentive (material or academic) for his management duties. In general, infrastructure (buildings, offices, labs) and scientific equipment are rather satisfactory, thanks to the renovation and purchases funded by a World Bank loan; however, the number and quality of vehicles are insufficient due to the lack of replacement and maintenance.

In 1996, the total “direct” financial resources¹ of the IRESA ARIs amounted to D 8.28 million (D: Tunisian dinar, almost equivalent to US\$ 1), of which D 6.73 million came from national sources (mainly the state budget, and some self-generated funds), D 1.37 million from a World Bank loan allocated for capital expenditures (US\$ 7 million for 5 years), and D 0.18 million as foreign research grants.

Around D 4 million is allocated to salaries² and D 4.3 million to operation and capital costs (OCC). An estimated D 7.3 million is used for research activities, of which around D 3.8 million is for OCC, including D 2.3 million from national funds and D 1.5 million from external sources (loan and grants). The origin of the OCC (60 and 40% from national and external sources, respectively) reflects the high dependence on external sources, mainly from the World Bank loan. The available OCC for AR represents about D 29,000 per pRY. Although this amount appeared to be reasonable (see Section 4.3), it has actually deteriorated during the last years till the completion of the World Bank loan and its temporary prorogation (1997–1998), such that at present, researchers consider OCC as rather inadequate, as well as largely allocated to the experimental stations and mobilized with difficulty (bureaucratic financial procedures, frequent delays in disbursements).

Research Activities

¹ Without considering the resources used by IRESA Directorate for the overall management of the ARIs.

² Salary costs consume about 70% of the total national budget (79% for INRAT, 50% for IRVT).

Until recently, the research programs were, in most cases, defined mainly by the researchers themselves, taking into account their promotion requirements and the national objectives and needs. The National Committees for Research Planning, set up since 1992 (see Section 4.1), provide the basis for an improved system of priority setting, appropriate budgeting, and monitoring and evaluation; however, these Committees cover priority AR fields and are not fully operational (monitoring and evaluation have not been periodically implemented till the present time).

The SERST-Affiliated Agricultural Research Institutes: IRA and INSTM

The Arid Zones Institute (IRA) - IRA¹ conducts research related to agricultural production and rangeland management in the south of the country under harsh conditions and in oases, and addresses desertification concerns. Headquarters' research at Medenine is primarily concentrated on soil preservation, the Kebili station concentrates on plant protection and protection of highland oases, the Gabès station is responsible for coastal oases concerns, and the Ben Guerdane station works on rangelands.

IRA permanent staff include 43 researchers (all MS), 37 technicians (only 0.8 per researcher) and 133 support staff (33 administrative employees and 100 laborers: 3.1 per researcher). Physical facilities at the headquarters (where most of the laboratories are located) and in the 5 experiment stations (total: 207 ha, of which 167 ha is at Médenine) are rather good. IRA financial resources amount to D 2.4 million (coming essentially from the state budget); around 70% of these resources are allocated to salaries and 30% to OCC (about D 19,000 per pRY).

The National Institute for Sciences and Techniques of the Sea (INSTM) - This new institute is an "administrative scientific institutions;" it combines the former INSTOP and CNA which are still keeping their specificity:

- The "INSTOP branch" (headquarters in Salambo/Tunis) focuses on fish and related research activities. It has 38 researchers, a boat for its research marine campaigns, and an aquaculture center at Monastir.
- This former CNA is specialized in research, experimentation and extension of techniques of aquaculture and fish production. Its mission is to improve breeding and raising techniques of fish and sea organisms, to train professionals in the aquaculture sector, and to promote the sector.

These two units manifest common characteristics (as compared with the IRESA ARIs):

- Their scientific staff has a slightly lower academic level, and they suffer large deficit in technicians and laborers;
- Their financial resources come mainly from the national budget (limited foreign grants, no loan) and are relatively small: the 1996 OCC per pRY was around D 13,000 at INSTOP and D 8,000 at CNA, which is obviously far from meeting the research needs (relatively more expensive for oceanography, fisheries, aquaculture than for crop and animal production).

The IRA and INSTM research missions are closely coordinated with IRESA programs.

2.3 The Nine IRESA Academic Institutions

Overview

The nine IRESA academic institutions are:

- the National Agronomic Institute of Tunis (INAT), the oldest and largest (105 academic staff members: asm), provides training programs for undergraduate and post-graduate degrees (MS and PhD initiated in 1978 and 1988, respectively) in several fields²;
- the National College of Veterinary Medicine of Sidi-Thabet (ENMV, with 47 asm), which offers an MS degree in animal health;
- six specialized colleges which offer technicians' and engineers' degrees (equivalent to diploma and BS): the College for Horticulture and Animal Production of Chott-Mariem (ESHE, created in 1975, 52 asm); the Field Crops College of Le Kef (ESAK, 1983, 20 asm); the College for Animal Husbandry of Mateur (ESAMa, 1976,

¹ IRA was a unique ARI with the status of an "industrial and trading public institution," which allowed flexible financial management, including higher specific salary scales. In December 1998, it got the same status of "scientific and technological public organization" as the other ARIs.

² INAT has 6 large training/research departments: physical, chemical, computer sciences; crop sciences; animal and fishery sciences; applied biology and food technology; agricultural engineering; water management and forestry; rural economics and development.

27 asm); the College for Irrigation, Agricultural Equipment/Machinery of Medjez El-Bab (ESIERM, 1976, 42 asm); the College for Food Industry/Technology of Tunis (ESIAT, 1985, 21asm); the College for Rural Economy of Moghrane (ESAMo, 1981, 36 asm); and

- the Forestry and Pastoral Institute of Tabarka (ISPT, 1970, 12 asm), which trains technicians in forestry and pastoralism.

Academic matters are under the supervision of the Ministry of Higher Education (MES), while administrative aspects are the concern of MOA through IRESA, and research matters supported by IRESA and SERST. The precise task of each ministry is not well defined.

On average, according to the heads of the training institutions, the academic staff members may allocate around 70% of their working time to teaching activities (lectures and student supervision), 25% to AR (see below) and 5% to extension activities (present in the four colleges located outside the large region of Tunisia).

The nine training institutions currently (1997) have 1,122 permanent employees, of whom 362 are academic staff (including 128 PhD) who represent 91 potential RYs¹.

The total annual budget (around D 10.3 million in 1996) is funded essentially (93%) by national sources (state budget; few self-generated funds), with marginal external funds (D 0.4 million from the World Bank loan for research capital expenditures; D 0.3 million from foreign grants). It is mainly used for educational purposes; D 6 million are allocated to salaries and D 6.5 million for all other expenses (including student fellowships and boarding).

Research Activities

Research activities at the academic institutions are generally constrained by many factors (Chennoufi and Nefzaoui, FAO, 1996):

- Limited support staff: the 111 technicians (i.e., 0.3 per asm) and 648 laborers (1.8 per asm) present in the nine academic institutions are insufficient and mainly mobilized for education activities (lab/farm practices).
- Inadequate research physical resources: each institution (except ESIAT) has an experimental farm for education and research work, but laboratories are generally not well equipped, farm machinery and vehicles are insufficient in most cases, and maintenance of research facilities was rated insufficient in five colleges.
- Inadequate research funding: most of the academic institutions have no specific budgets for research activities and have to rely on limited external funds.
- Poor institutional research management: the scientific committees of the academic institutions are expected to orient research programs, and to follow up on their progress, but they only deal with academic aspects; due to this lack of institutional monitoring, most research programs are identified and executed individually.

Finally, AR at the IRESA academic institutions is carried out mainly by young academic staff members and graduate students. Direct involvement in AR of the senior academic staff members is rather limited and actually represents about 10% of their time, which gives around 36 actual RYs for the nine IRESA academic institutions.

2.4 The Other Institutions of the NARS

The Other Scientific Institutions Contributing to the NARS

The Institut National de la Nutrition et de la Technologie Alimentaire (INNTA, Tunis) - Established in 1966, it is affiliated to the Ministry of Health. In addition to research on health through research on diets, research related to agriculture deals with biological analysis of plant and animal/feeding composition, food technology planning and control of the nutrition policy of the population. INNTA has 37 scientists, of whom 16 are involved in food technology. Its total budget is D 1.85 million and the AR-related budget is around D 0.85 million.

The Centre de Biotechnologie de Sfax (CBS) - Created in 1988, it is affiliated to SERST. Around 5 out of its 20 researchers specialize in biotechnology applied to agricultural areas (tissue culture and production of disease-free plant material).

¹ Taking into account the normative rate of 25% of the academic staff members' time allocated to AR activities adopted for the analysis of all the NARSs of the WANA region (see methodology of the study).

The Institut National de la Recherche Scientifique et Technique (INRST) - Created in 1980, it deals with different areas of biology and technology research: tissue culture, plant germplasm conservation, solar energy and other renewable energies and water desalination.

Some Faculties/National Higher Schools of Sciences, Engineering, and Economics (Tunis, Sfax, etc.) employ a large number of staff members qualified in scientific fields related with agricultural and rural activities (plant and animal biology, agricultural engineering, food processing, rural social sciences). A precise inventory of this scientific potential is not available; however, according to a rough survey, this number may reach at least 60 academic staff members, who represent 15 pRYs. Most of the AR, if not all, is carried out through graduate students working on their doctorates. This research is often limited in time and scope but is generally of good quality. Its direct impact on agriculture is insignificant. Professors can devote only little time to carry out research themselves; however, links with AR institutions are good (mainly academic training of junior AR researchers at universities; scientific and physical support given to university students by INRAT and INRGREF scientists; joint publications).

The Other Non-Scientific Institutions Contributing to the NARS

The Bureau pour l'Inventaire et la Recherche Hydrologiques (BIRH) - It is an MOA service created in 1981, based at Tunis. Its 30 graduate staff members are involved in development and research activities related to water resources management. BIRH is responsible for establishing detailed inventories of surface and deep-water reserves of the country. It is also responsible for assessing and following up on rainfall and related rain-off and determining optimum rates of exploitation. Monitoring of these water resources is an essential task.

The Direction des Sols (DS) - This directorate, directly attached to MOA, is located on the INRAT/ INRGREF campus. Eleven scientists are working in the fields of pedological studies and mapping, soil potentiality and fertility.

The Centre National d'Etudes Agricoles (CNEA) - Created by MOA in 1973, CNEA (17 graduate staff members) implements studies in rural socioeconomics, which can be considered as partly similar to research.

The Centre National de Télédétection (CNT: National Center for Remote Sensing) - Established in 1988, CNT is a public institution under the Ministry of Defense. Its primary role in agriculture is to provide reliable data and information to major national production and development projects. Nationally, CNT is responsible for providing directions on national policy regulations in the areas of GIS, aerial photos, etc. It is also the principal national trainer of staff and is in charge of promoting the various remote sensing applications. Its major research thrusts are in the areas of desertification, marine pollution, floods, seashore, and environment management. CNT is the Tunisian partner of all international agencies related to "Agenda 21" and works on sustainable environment projects¹.

3. AR RESOURCES

3.1 Human Resources (see Table 1)

The Tunisian NARS (1996/97) involves around 780 scientific and technical graduate staff (all national), who represent some 400 potential RYs (without counting INRST and CNT for which precise data could not be obtained).

Out of the 638 graduate staff members of the agricultural scientific institutions (ARIs and IRESA academic institutions), 163 have a PhD degree (26%). The level of academic training is much lower in the ARIs (only 18% with PhD degree) than in the academic institutions (35% with PhD). This difference results mainly from past problems of the career scheme/status of the researchers of the ARIs: till 1987, they were considered as MOA senior staff and their salaries were half of those of the academic staff members; therefore, most of the researchers with PhD went to academic institutions. The adoption in 1987 of a status similar to university staff members has partially solved this problem: (i) it dealt mainly with young researchers and left aside many of the old experienced researchers who did not have a PhD to join the new researchers' scheme/status; and (ii) within the IRESA institutions, salaries of the ARI researchers are still slightly lower (10–20% less according to the grades) than those of the academic staff members.

Around 75% of the graduate staff members are located in and around Tunis; in the other regions (except the center-east and the south), the numbers of scientists are obviously too small. No perceptible progress has been made since the elaboration in 1985 of the long-term plan (with the support of ISNAR) which proposed to reduce this percentage to 50%, in spite of the creation of the seven regional development poles during 1997/98 (see Section 4.2).

¹ No precise information on the resources of this Center could be obtained.

In all the NARS institutions, especially in the agricultural colleges, the number and quality of technicians and other support staff (laborers, clerks) are insufficient because of budget constraints and their extremely low salaries which discourage good candidates. This situation is a strong limiting factor for the scientists' research efficiency.

3.2 Physical Resources

The NARS is endowed with a large number of locations and experiment stations (around 40 including college farms, within a total area close to 5,500 ha), scattered throughout the country (with a large concentration around Tunis). Their maintenance costs are all the more very expensive since their good management should require an actual regionalization of motivated scientific staff and a much larger number of technicians.

The current objective of IRESA is to reduce the number of stations belonging to its ARIs, leaving one principal station and two substations per agroecological region.

In the IRESA ARIs, the other physical resources have been renovated or enlarged recently, thanks to the World Bank loan. Conditions are much less favorable in the other NARS institutions.

3.3 Financial Resources

The NARS total AR financial resources in 1996 were estimated at D (or US\$) 15 million (Table 1), of which: 12.8 million came from national sources (public budget and few institutions' self-generated resources), 1.8 million from the World Bank loan, and 0.4 million from external funds secured through bilateral or multilateral grants provided by few donors.

The NARS national and total resources amounted to around 0.53 and 0.63%, respectively, of the Agricultural Gross Domestic Product (AGDP estimated at D 2.4 billion in 1996); such ratios are rather low compared with the 1% ratio recommended by most international organizations.

One major issue is the level and origin of the OCC in the NARS institutions. At the IRESA ARIs, OCC is estimated (see Section 2.2) at D 29,000 per pRY, of which 40% is funded by external sources. All the other institutions which are less endowed, have OCC per pRY that is mainly funded by the state budget and ranges from around D 10,000 to 19,000 (IRA), which are under the "optimal" amount of about US\$ 25,000 to 30,000 per RY used in the long-term plans elaborated by many developing countries. According to this last reference, the Tunisian NARS may total around 200 actual RYs (aRYs), which means that the AR national scientific potential is not fairly mobilized. This situation should be worse without the investment resources made available by the World Bank loan.

Since 1985, before which the NARS enjoyed satisfactory financial resources (see ISNAR, 1987), the evolution has been negative. Taking into account inflation during the period 1986–1996 (around 185%) and the fast growth of the AGDP (almost 60% more in 1996):

- The national and external resources have strongly decreased in real terms: the national funds have dropped from D 10 million in 1985 (equivalent to 18.5 million in 1996 current D) to D 12.8 million in 1996, and the external funds from D 2.4 million in 1985 (equivalent to 4.5 million in 1996 current D, fully secured by grants) to 2.2 million in 1996 (of which only 0.4 million were grants);
- The NARS national and total resources represented 1.15 and 1.5%, respectively, of the AGDP in 1985, against 0.53 and 0.63% in 1996, which means a strong decrease in the relative efforts directed to AR.

4. RESEARCH ACTIVITIES

4.1 Research Orientation

Since 1992, IRESA has identified eleven priority-oriented research programs (crop production, animal husbandry and pasture, fruit production, olive, vegetables, potato production, water use, agricultural mechanization, forestry, agriculture and desertification in the arid zones) and set up corresponding committees¹ (which include researchers, teachers from agricultural academic institutions and agronomists from various development sectors), which deal with

¹ Four fisheries research projects have been also targeted: stock evaluation and identification of new resources, biological studies of marine environment and pollution control, sea products evaluation, and fish farming.

monitoring and evaluation, as well as extension of new technologies developed. These Committees have improved to a certain extent the global management of the NARS; however, they do not cover all the AR fields in a balanced way, they are not fully operational (no monitoring and evaluation of activities is currently practiced), and they have not been able to bring research and academic institutes closer together through financing common research projects (instead of financing the institutions themselves) as expected.

Research programs are generally relevant to the national research objectives, but most of them do not have the critical mass of researchers needed for insuring scientific efficiency, and multidisciplinary projects are rare. It is currently difficult to assess whether their resources are well balanced with regard to the research needs of the agricultural sector. An assessment of the Committees and of the whole national research program is in course.

4.2 Linkages and Collaboration

Linkages between the NARS Institutions

IRESA ensures coordination of research activities and cooperation, and seeks complementarity between research and education institutions at the national level and regional level (through the regional development poles). However, in reality, the director of research in IRESA, who should coordinate all research activities, deals only with ARIs, and cooperation is more often influenced by personal relationships. Linkages with the national universities are very poor.

Relations with Development

Cooperation with development agencies has been improving. Linkage mechanisms that made informal collaboration possible are of different types, including short-term training, field days, joint research programs, research contacts, utilization of libraries and databases, use of laboratories and research stations, and joint publications and reports. The most innovative one has been the establishment of seven “regional development poles” for research (one per large agroecological zones), which offer a good framework for bringing together all partners in research at the regional level, including development agencies¹ and farmers’ representatives (Agricultural Unions, Chambers of Agriculture, Interprofessional Groupings, etc.). But these poles are not fully operational because of the very weak permanent presence of research staff regionally.

Technologies elaborated by the NARS that have been successfully adopted include improved cultivars of cereals, legumes, vegetables and fruit trees; biological and chemical control of plant diseases; better utilization of annual feed resources; and improved local sheep breeds. However, it is difficult to find data for an inventory of research output, or to evaluate the research impacts on agricultural development. This aspect may be explained by the lack of research output evaluation.

The technologies generated appear to be more readily adopted by large-scale farmers, agricultural development agencies, rural development societies and state and cooperative farms, rather than by the majority of medium- and small-scale farmers (Chennoufi and Nefzaoui, FAO, 1996).

International Scientific Cooperation

All agricultural research and training institutions had in the past very strong relations with the international scientific community, both at the institution and scientist levels. During the last decade, these relations have been diminishing and changing from assistance to collaboration. Working relationships with international AR centers (including exchanging information, visits and plant material) remain good, especially with ICARDA. Bilateral relations are now rather weak, but collaborative research programs funded by the European Union are developing. It is worth noting that junior scientists who represent more than 50% of the total staff body of some institutions are working on higher degrees at foreign international universities.

5. CONCLUSION

The Tunisian NARS has been rather dynamic during the past years. A major achievement has been the creation within MOA of IRESA which currently maintains 67% of the pRYs and 87% of the total financial resources of the NARS. This structural improvement has led to many achievements, such as the grouping of some AR institutes, the

¹ Including the *Agence de la Vulgarisation et de la Formation Agricole*, set up to strengthen technology transfer and extension, as well as upgrade competence through training of technical support staff, the MOA Regional Development Bureau (*Commissariats Regionaux de Développement Agricole* or CRDA); and Regional Organizations for Agricultural Development (*Offices*).

setting up of programming committees which have improved priority setting and project formulation, the creation of regional development poles for improving links between research and development, and the valuable results obtained in cereals, food legumes, forages, vegetables and fruit breeding programs which have been widely adopted by farmers.

However, the NARS is still suffering strong weaknesses, such as the coordination between its institutions and the coordination with the other NARS institutions; the extreme concentration of the NARS scientific potential in and around Tunis; the high number of experimental farms with insufficient human and financial resources; the bureaucratic financial procedures; the not fully operational mechanisms for setting priorities, planning, monitoring and evaluation of research activities; and the mechanisms of valorization of research results which have not been sufficiently improved.

Main Acronyms

MOA: Ministry of Agriculture. **MES:** Ministry of Higher Education. **SERST:** Secrétariat d'Etat à la Recherche Scientifique et à la Technologie. **IRESA:** Institution de la Recherche et de l'Enseignement Supérieur Agricoles.

ENMV: Ecole Nationale de Médecine Vétérinaire. **ESAK:** Ecole Supérieure d'Agriculture du Kef. **ESAMo:** Ecole Supérieure d'Agriculture de Mograne. **ESAMa:** Ecole Supérieure d'Agriculture de Mateur. **ESHE:** Ecole Supérieure d'Horticulture et d'Elevage de Chott-Mariem. **ESIAT:** Ecole Supérieure des Industries Alimentaires de Tunis. **ESIERM:** Ecole Supérieure des Ingénieurs et de l'Équipement Rural de Medjez El-Bab. **INAT:** Institut National Agronomique de Tunis. **INRAT:** Institut National de la Recherche Agronomique de Tunisie. **INRGREF:** Institut National pour la Recherche en Génie Rural, Eaux et Forêt. **INSTM:** Institut National des Sciences et Techniques de la Mer. **IO:** Institut de l'Olivier. **IRA:** Institut des Régions Arides. **IRVT:** Institut de Recherche Vétérinaire de Tunisie. **ISPT:** Institut Sylvo Pastoral de Tabarka.

D: Tunisian dinar.

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Table 1 - The National Agricultural Research System (1996^a)

a: Except for IRESA human resources (1997). *Italics*: Approximate data. ...: Data not available. *: See footnotes.

NARS Institutions				AR Scientific & Techn. Graduate Staff (Units)			Potential Res. Years		Total Budget (1000 D)		AR Expendit./Resources (E) (1000 D)			
No.	Name - Acronym Head Office - Year Established	Mandates * AR Fields	Govern. Minist./Body	Nationals Total (PhD - MS)	Exp.	Nat.	Exp.	Nat.	Ext.	Nat. NE	Loan LE	For. HE	Total TE	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
1.1	Institut Nat. Rech. Agronom. de Tunisie, Tunis	INRAT, 1913/61	AR (85%) - All (except 2.1/2.6)	86	20, ...		73		3300	720	3050	610	110	3770
2.1	Inst. Nat. Rech. Génie Rural et Forêts, Tunis	INRGREF, 1959/96	AR (85%) - Water man./machin./forest.	40	5, ...		34		1960	590	1810	590	...	2400
2.2	Institut de l'Olivier, Sfax	IO, 1981	AR (85%) - Olive, pistachio, almonds	25	4, ...		21		890	170	820	170	...	990
2.3	Institut de la Rech. Vété. de Tunisie, Tunis	IRVT, 1887/1970	AR (15%) - Animal product./health	17	1, ...		3		580	70	90		30	120
2.4	Total IRESA Research Institutes			168	30, 100		131		7070*	1550	6060*	1370	140	7570
2.5	Institut des Régions Arides, Médenine	IRA, 1976	AR (85%) - Arid zones	43	0, 43		37		2360	50	2180		50	2230
2.6	Inst. Nat. Sc. Techn. de la Mer, Salambô/Tunis	INSTM, 1924/1996	AR (85%) - Fisheries	65	5, 30		55		1060	-	980		-	980
1-2	Total 6 Agricultural Research Institutes			276	35, 173	0	223	0	10490	1600	9220	1370	190	10780
3.1	Institut National Agronom. de Tunis, Tunis	INAT, 1889/1970	AHE - (AR) - All	105	48, ...				2600					
3.2	Ecole Nat. Médecine Vétérinaire, Sidi-Thabet	ENMV, 1974	AHE - (AR) - Animal prod./health	47	15, ...				1220					
3.3	Ecole Sup. Hortic. et Elevage, Chott-Mariem	ESHE, 1975	AHME - (AR) - Vegetables	52	20, ...				1450					
3.4	Ecole Sup. d'Agriculture, Le Kef	ESAK, 1976/83	AHME - (AR) - Field crops/animals	20	9, ...				950					
3.5	Ecole Sup. d'Agriculture, Mateur	ESAMa, 1976	AHME - (AR) - Animal prod.	27	7, ...		91		820	710	1500	400	250	2150
3.6	Ecole Sup. Ingén. Equip. Rural, Medjez El-Bab	ESIERM, 1976	AHME - (AR) - Irrig., machin., ...	42	7, ...				790					
3.7	Ecole Sup. Industries Alimentaires, Tunis	ESIAT, 1985	AHME - (AR) - Food technology	21	7, ...				640					
3.8	Ecole Sup. d'Agriculture, Moghrane	ESAMo, 1981	AHME - (AR) - Ag. economics	36	9, ...				800					
3.9	Institut Sylvo-Pastoral, Tabarka	ISPT, 1970	AME - (AR) - Agroforestry	12	6, ...				300					
3	Total 9 Agricultural "Colleges"			362	128, 200	0	91	0	10050*	710*	1600*	400	250	2250
4.1	Inst. Nat. Nutrition Technologie Alim., Tunis	INNTA, 1966	R - AR (45%) - Food technology*	16	4, 10	0	16	0	1850	...	850		...	850
4.2	Centre de Biotechnologie, Sfax	CBS, 1988	R - AR (25%) - Biotechnology*	5	2, 3	0	5	0	...	...	250		...	250
4.3	Inst. Nat. Rech. Sci. Tech., Borj Cedria	INRST, 1980	R - (25%) - Diverse	...	..., ...	...	...	...	...	...	...		...	...
4.4	Univ. Tunis, Sfax, ...		AHE - R (AR) (25%) - Diverse*	60	30, 30	0	15	0	...	...	200		...	200
4	Total Other Scientific Institutions			81	36, 43	-	38	0	...	...	1300		...	1300
5.1	Bur. Inventaire et Rech. Hydrologiques - Tunis	BIRH (1981)	AD - (AR) - Water resour. manag.	30	3, 7	0	8		...		350		...	350
5.2	Direction des Sols - Tunis	DS	AD - (AR) - Soil	11	4, 5	0	3		320		120		...	120
5.3	Centre Nat. d'Etudes Agricoles - Tunis	CNEA (1973)	AD - AR (30%) - Ag. economics	17	2, 0	0	5		800		240		...	240
5.4	Centre Nat. de Télé-détection, Tunis	CNT (1988)	D - AD - AR (...%) - Remote sensing	...	..., ...	0	...	...	...	...	...		...	...
5	Total Other Non-Scientific Institutions			58	9, 12	0	16	0	...	...	710		...	710
6	Total NARS			777	208, 428	0	368	0			12830	1770	440	15040
Exchange Rate: US\$ 1 = 1 Tunisian dinar (D) (1996 average rate)				Actual Res. Years (aRYs) (Estimate) --->			200	0	AR Expendit. (million US\$) ->		12.8	1.8	0.4	15

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c. **Mandates:** AR (... %): Approximate average % of financial resources devoted to ag. research (AR); AHE: Ag. higher education; AHME: Ag. higher and medium level education; AD: Ag. development/services (for AR and AHE institutions: seed production, soil analysis, extension, studies, etc.).

* **Notes:** 2.4/j and 2.4/l: ARIs total + 5% for management cost of the Directorate IRESA. 3/k: Including D 310 million from grants (150 to INAT, 110 to ESHE, 50 to ESEK) and 0.4 million from the World bank loan. 3/j and 3/l: Colleges total + 5% for management cost of the Directorate IRESA. 4.1, 4.2, 4.4: Only data/estimate of the AR human and financial resources.

National AR expenditures (NE) = 0.53% of the Agricultural Gross Domestic Product (AGDP = US\$ 2.4 billion in 1996); Total AR expenditures (TE) = 0.63% of the AGDP.