

THE NATIONAL AGRICULTURAL RESEARCH SYSTEM OF TURKEY¹

1. HISTORICAL BACKGROUND

The capacity to provide manpower and new scientific and technical knowledge for agricultural development in Turkey started with the establishment in Istanbul of a Veterinary School in 1842 and an Agricultural School in 1881. Two additional Veterinary Research Centers were established in Istanbul and Ankara in 1914 and 1921, respectively. After the foundation of the Turkish Republic in 1923, a viable pattern of organization for agricultural research (AR) within the Ministry of Agriculture and the universities emerged and has been expanding.

In the 1930s, several separate AR stations and institutes (RIs) were founded in various fields: the Poultry RI of Ankara; the Viticulture RIs of Manisa and Tekirdai (founded in 1930); the Plant Protection RIs of Adana and Izmir (1931); the Citrus RI of Antalya and the Cotton Research Institute of Nazilli (1934); the Mediterranean Agricultural RI of Antalya (1935); the Olive RI of Izmir, the Livestock RI of Ankara and the Fruit RI of Malatya (1937); and the Fig RI of Aydin (1938). No significant institutional development was recorded during the 1940s except for the establishment of a research station in Samsun on the Black Sea coast in 1944.

In 1950s, three Veterinarian Research and Control Institutes were founded in Konya, Elazii and Izmir, and a Plant Protection Research Station in Diyarbakir. The first Forest Research Institute (FRI) was created in 1952 at Bolu (first station), then moved to Ankara where the center headquarters managed a network of 8 regional RIs and 7 research forests. Regional RIs were established in Adana, Diyarbakir, Izmir, Erzurum, and Edirne in 1961, 1962, 1963, 1969, and 1970, respectively. The Foot and Mouth Disease Research and Vaccine Production Institute was established in 1967 in Ankara and the Poultry Diseases and Vaccine Production Institute in 1985 in Manisa.

Agricultural higher education (AHE) of modern Turkey started with the first agricultural higher school, named the Higher Agricultural Institute, which was established in 1933 in Ankara and consisted of five faculties (agriculture, agricultural arts, veterinary sciences, forestry, and natural sciences). Later, in 1946, Ankara University was established; in 1948, the Agricultural and Veterinary Faculties joined this new establishment, and the Forestry Faculty was transferred to Istanbul University.

Agricultural sciences education and research have received increasing attention since the 1950s. During 1958–1967, three faculties of agriculture (FOAs) were established in Erzurum, Izmir, and Adana; their number increased to seven in the period 1981–1985; nine more FOAs were created by 1993, and this speedy increase continued in recent years, the total reaching 23. After the establishment of the first veterinary faculty in Ankara in 1933, a second one was founded in Elazii in 1970; three other faculties of veterinary medicine (FVMs) were opened in Istanbul, Bursa and Konya in the 1970s; then the number of FVMs increased rapidly, especially during the last decade, to the current total of 14. The first faculty of forestry (FF) was established in Istanbul in 1948; Trabzon FF is the second oldest; and the remaining seven current FFs were established only recently.

After 1923, governmental work related to the agriculture sector was distributed among several ministries. The Ministry of Agriculture (MOA) came to existence, for the first time, in 1937; at that time, it consisted of three General Directorates (GDs): Agriculture, Veterinary Service, and Forestry. For the planning and coordination of research activities, each GD had a research division. The following years, 1937 until the 1980s, the number of GDs of MOA reached 23. In 1971, most of the AR activities of MOA were grouped, with the exception of animal health, within a separate GD of AR (GDAR), which was abolished in 1981 and merged with the Extension Division in an enlarged GD for Agricultural Affairs (GDAA). The merging in 1983 of the Ministries of Agriculture and Rural Affairs into the Ministry of Agriculture, Forestry and Rural Affairs (MAFRA) and the consecutive administrative reorganization led to the termination of GDAA and splitting its research activities into five GDs: the GD of Projects and Implementation (GDPI), responsible for research on crops, forages, agronomy, and animal husbandry; the GD of Protection and Control (GDPC), for research in plant protection, animal health, food, feed, and seed quality control; the GD of Rural Services (GDRS), for soil and water management research; the GD of Forestry, for forestry research; and the GD of Organization and Support (GDOS), for handicraft and leather research. In 1987, MAFRA established the High Council for Research and Development (HCRD) for coordinating AR activities and for general guidance of AR policy (priorities, linkages, research/development, manpower, etc.).

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The initiation of the Turkish AR Project (TARP) in 1990 opened the doors for significant new changes, facilitated by the resources available through a large World Bank loan (see Section 3.3). In 1991, MAFRA split into the Ministry of Agriculture and Rural Affairs (MARA) and the Ministry of Forestry (MOF). The same year, MARA established a new GD of AR (GDAR), which merged AR resources and activities of the previous GDPI, GIPC, and GDOS. In 1993, the Rural Affairs Division with its AR institutes (ARIs) were combined into the GD of Rural Services (GDRS) under the governance of the Prime Ministry.

2. THE CURRENT NARS

2.1 Overview (see Table 1)

Currently, the Turkish NARS consists of the following three main components:

- The governmental AR institutions involved mainly in AR: (i) the General Directorate of Agricultural Research (GDAR) within the Ministry of Agriculture and Rural Affairs (MARA), which governs 55 ARIs; (ii) the Agricultural Economics Research Institute, also governed by MARA; (iii) the Research Division of the General Directorate of Rural Services (GDRS), affiliated to the Prime Ministry, which manages 11 national ARIs specialized mainly in soil and water management; and (iv) the Research Directorate of the Ministry of Forestry (MOF), with its 11 ARIs. All these institutions account for about 50% of the potential research years (pRYs or equivalent full-time researchers) and 78% of the total financial resources of the NARS. They are presented in Section 2.2.
- The 46 faculties of agricultural sciences (FASs, including the faculties of agriculture, veterinary medicine, forestry, and fisheries) under the governance of the Ministry of Education through the Higher Education Council. These FASs meet around 37% of the pRYs and 4% of the total financial resources of the NARS (see Section 2.3).
- The “other NARS institutions” (some research institutes, many university institutions, some public agro-industrial enterprises and development organizations) in which AR activities cover a more or less small part of their mandate. They meet the remaining resources of the NARS (around 13% of the pRYs and 18% of the total funds) (see Section 2.4).

The Scientific and Technical Research Council of Turkey (STRCT), directly governed by the Prime Ministry, has an official mandate for defining national research policies in all domains, including agriculture. Its main role is to financially support research of individuals, teams, or collaborative programs. STRCT has several functional groups, such as the Agriculture and Forestry and the Veterinary and Livestock groups, to evaluate project proposals and define priority areas or topics. The US\$ 4 million allocated from TARP for the management of STRCT has significantly improved its activities in recent years.

Currently, there is no single national AR authority which is officially responsible for direction of the overall national AR policy. The Cabinet- and Ministerial-level decisions, such as employment and funding policies, are supervised by the State Planning Organization (SPO) and related ministries, but GDAR, GDRS, the universities, and the other NARS institutions and their respective ministries make research-policy decisions independently from each other. However, it is worth mentioning some major facts:

- Most of the ARIs affiliated to MARA, GDRS, and other bodies have complementary mandates; accordingly, overlapping of activities is essentially between these ARIs and the FASs.
- Within MARA, whose ARIs gathers around 39% of the pRYs and 55% of the total financial resources of the NARS, the High Council of Research and Development (now called the High Council of Agriculture), chaired by the Minister of Agriculture, develops, together with MARA’s Research, Planning and Coordination Council (RPCC), macro-level research policies for MARA, which serve as an implicit reference for the overall national AR policy. This, together with TARP, results in rather efficient coordination with GDRS, MOF, and other institutions (see Section 4.2).

The international connections of the Turkish NARS were established in the 1960s, and have grown strong in recent years with the support of the World Bank, FAO, UNDP, EU, and other international institutions. Various research and development projects have been executed, improving agricultural productivity and AR capacity. As a consequence of these efforts, a number of institutions with international status have been established in recent years. Among these are the Central Veterinary Research Institute in Istanbul (1965); the International Center for Winter Cereal Improvement, established in Konya (1987); and the International Agro-Hydrology Research and Training Center established in Menemen-Izmir (1996).

2.2 The Governmental Agricultural Research Institutions

The General Directorate of Agricultural Research (GDAR)

Mandate and Organization

Considering the number of research entities, land, physical plants, trained research staff, and financial resources available, institutions affiliated with GDAR constitute the most important component of the NARS; they account for around 39% of the pRYs and 55% of the total financial resources of the NARS.

GDAR has a national research mandate in the fields of agronomy, horticulture, plant protection, animal husbandry and health, fisheries, food technology, and other related areas. It governs 55 semi-autonomous ARIs¹ scattered all over the country (see Table 2), including:

- 7 central ARIs, specialized in field crops, horticulture, plant protection, food technology, livestock, fisheries, and animal health, responsible for coordination and guidance of the other GDAR ARIs in their fields;
- 18 single or multiple crop-commodity ARIs (in addition to 2 central ARIs), which generally deal with breeding, agronomy, and quality aspects of the relevant crop(s);
- 3 plant protection ARIs (in addition to 1 central ARI), which conduct applied research on pests, diseases, nematodes, and weed problems of major crops;
- 8 animal husbandry and breeding ARIs (in addition to 1 central ARI), which carry out production-related research covering relevant aspects, including leather research;
- 9 veterinary control and research institutes (in addition to 1 central ARI), which work mainly on disease prevention and control;
- 2 fishery ARIs (in addition to 1 central ARI), which carry out preliminary research on both marine and freshwater environments; and
- 8 regional pluri-sectorial ARIs, responsible for searching for solutions to overcome production constraints of all the major commodities in the mandate region.

An AR Council (ARC) develops and oversees the AR policy for GDAR as a basis for funding its research programs. Three Research Advisory Committees (RACs) on field crops, horticulture, and livestock provide advice to ARC on GDAR's research programs and projects, and recommend annual funding allocations for them. Eight technical departments (field crops, horticulture, livestock and fisheries, plant protection, animal health, food technology, research management, coordination) manage research programs in their fields; they are responsible for planning, monitoring and evaluating research activities within programs. The 7 central ARIs are responsible for establishing joint research activities among institutions as well as providing technical support, training, and information exchange. The ARI Directors are responsible for managing their institutes and research projects.

The main mandate of the GDAR institutes is research (essentially strategic, applied, and adaptive) which mobilizes around 65% of the time of the graduate scientific and technical staff, the rest of their time is devoted mostly to development activities (seed and animal vaccine production, regulatory and control services, extension support, producing reports for decision makers, etc.).

Human, Physical and Financial Resources

GDAR currently (November 1998) has around 4,915 permanent full-time staff, all nationals, consisting of

- 1,355 scientific and technical graduate staff (265 PhD, 310 MS, 780 BS), who represent around 881 pRYs²;
- 130 technicians and 3420 other support staff (clerks, accountants, laborers, etc), who are far from covering the needed numbers³.

In most of the ARIs, infrastructure, such as land (total: around 9,000 ha), buildings, and laboratories, are usually adequate and well equipped. But library and documentation facilities in some research institutions need

¹ The ARIs directly receive their governmental budget (not through GDAR).

² pRYs = Number of researchers on duty × 65% (percentage of the graduate staff's time devoted to AR).

³ The ratios of technicians and other support staff to researcher (0.1 and 2.6, respectively) are below the general agreed upon standards (2 and 3–4).

improvement. To develop the existing search capacity of the libraries, a communication system network has been installed, which facilitates electronic communication among the institutions of GDAR. A central library (with CD-ROM search facility), which is accessible on-line to all research institutes, has also been installed.

In 1997, GDAR's total financial resources amounted to 11,300 billion Turkish lira (TL) (US\$ 72.6 million), consisting of

- US\$ 66.7 million from national sources, mainly from the government budget (US\$ 59.9 million)¹ and from self earned funds (US\$ 6.8 million)²; and
- US\$ 5 million from a World Bank loan³ and US\$ 0.9 million from other external grants (principal donors: CIMMYT, ICARDA, IFAD).

Salaries absorb 79% of GDAR's total resources; the remaining 21% is allocated to operational/capital costs (OCC) which amount to US\$ 15.2 million, i.e., US\$ 11,200 per graduate staff member, which is about half the budget needed for providing satisfactory resources for research (see Section 4.3).

Research Activities and Linkages

With the initiation of the Turkish AR Project (TARP), a national, multidisciplinary, multi-institutional research program concept has been accentuated and encouraged, and GDAR developed a research master plan that established formal priority-setting mechanisms for its research agendas. Within this framework, during the last two years GDAR identified 17 research priority areas, each with several research programs, headed by a research program coordinator residing at the lead ARI, and a program manager positioned at the headquarters. Six of the research priority areas are high priority (oil seeds and food legumes, dairy and beef, industrial crops, cereals, fruits, vegetables), 6 are medium priority (processed food, feed and forages, fish and poultry, sheep, nuts, natural resources), and 5 are low priority ones (pharmaceuticals and agricultural chemicals, apiculture, silk, processed animal products).

GDAR's major research programs aim to develop better-yielding, high-quality crop varieties and crop production technologies for durum wheat, bread wheat, barley, food legumes, sunflower, cotton, forage crops, maize, potato, and various vegetable crops and fruit trees. High-priority programs also cover integrated pest management of several field and horticultural crops. Programs of animal husbandry, breeding and health in addition to fisheries have received strong emphasis. Conservation of genetic resources has been identified as an important area to be supported in the future and a specific project on *in situ* conservation has been launched.

Currently, GDAR's research capacity is more pronounced in some research areas or disciplines. The majority of scientists (380) are employed in institutes whose major responsibility is in field crops research, while the minority (72) are employed in fishery ARIs. The numbers of research scientists at the institutes working on horticulture, animal diseases, livestock, and plant protection are 300, 257, 114, and 135, respectively⁴.

There is a strong imbalance in the allocation of human and research funds among the regions. According to Mizrak et al. (1997), in 1993, the developed regions located in the western and southern parts of the country (central north, Aegean, Marmara-Thrace, and Mediterranean), which include 52% of the arable lands and 51% of the agricultural holdings, employ approximately 80% of the researchers and absorb 82% of the budget, while the underdeveloped regions located in the eastern and northern parts (northeast, southeast, Black Sea, central east, and central south), almost equally important as the previous ones, receive less attention. In recent years, a gradual shift towards better regionalization has been observed with positive (mainly stronger interaction with farmers and agricultural industries) and negative effects (higher fragmentation of the available resources, less efficient overall coordination, etc.).

¹ From the Ministry of Finance (MF) for salaries and MARA (through the State Planning Organization) for OCC.

² These self-earned resources (revolving funds) include revenues from sales of farm produce (improved varieties, animal breeds, etc.) and services (analysis, consultancies, etc.), and revenues from research contracts with STRCT, some national agro-food industries, and international research organizations.

³ The originally agreed upon World Bank loan of US\$ 55 million for the period of 1992–1998 was reduced to US\$ 49 million in 1997. Of this total, US\$ 16 million were allocated to GDAR, 11 to GDRS, 7 to MF, 4 to the Agricultural Economics Institute, 4 to STRCT, and 7 were not allocated. By October 1998, GDAR had spent the US\$ 14 million of its allocation.

⁴ The qualifications of the scientists vary significantly according to the ARI; in terms of the proportion of PhD or MS holders to total researchers, the plant protection ARIs come first with 65% and the animal husbandry and breeding institutes come last with 7%. This proportion in other domains (e.g., field crops, horticulture, animal diseases and fisheries) is around 40%.

GDAR has provided valuable research output to the nation's agriculture mainly in plant breeding and crop management and protection, where it has a relatively well-trained scientific cadre and adequate research facilities. In addition, it has a core group of qualified research staff and growing research capacity in plant genetic resources conservation. However, GDAR's research potential and past accomplishments have been rather limited in animal breeding, husbandry, health, and fisheries.

GDAR ARIs have strong connections with international scientific organizations, especially with international AR centers, which support research activities and out-of-country training. These relationships began with the initiation of collaborative activities with the Rockefeller Foundation (1969) and CIMMYT (1971), especially for the improvement of wheat and corn; this collaboration helped to improve the research capacity of the ARIs in terms of physical infrastructure and human resources. Relationships with ICARDA started in 1986 and have been intensifying in recent years, especially through collaborative activities with the Central RI for Field Crops (CRIFC, Ankara). These joint efforts have resulted in the establishment of the International Winter and Facultative Wheat Improvement Program (IWWIP), based in Turkey, and jointly executed by Turkey/CIMMYT/ICARDA together with Oregon State University. International relationships are being strengthened with CIHEAM as well as with neighboring countries and countries of the former Soviet Union.

The Agricultural Economics Research Institute (AERI)

AERI, which was established in 1996, is affiliated with MARA Research, Planning and Coordination Council (RPCC), not GDAR. It is responsible for conducting research and studies in agricultural economics on related issues, such as land use and production, producer and input prices, investment policies, export opportunities, marketing and trade policies and their effects on farm income and employment, etc.

AERI is located in Ankara, and currently employs 15 permanent staff members, of whom 12 are researchers (4 PhD, 2 MS, 6 BS), and a large number of consultants. Its total budget for 1997 was approximately US\$ 1 million, with a large TARP contribution.

The Research Division of the General Directorate of Rural Services (GDRS)¹

Mandate and Organization

The GDRS Research Division, the second largest NARS organization, is responsible for the overall coordination (research resources and planning, assessment, etc.) of 11 ARIs (1 national and 10 regional)² (see [Table 3](#)), whose research mandates focus on soil fertility, soil and water conservation, hydrology, irrigation and soil physics, drainage and land reclamation, and mechanization, especially under irrigated conditions.

Each ARI has a Research Council, and there are seven research working groups for different research areas. Research plans are developed by Research Councils of each ARI through consultation with the working groups. The Research Council meets annually with all institute members to review the progress of research activities and make recommendations.

The main mandate of the GDRS ARIs is research (essentially adaptive), which mobilizes around 70% of the time of their scientific and technical graduate staff. The remaining time is mostly devoted to development activities, such as soil and water analysis for various parties (farmers, institutions), mapping of soil characteristics, consultation and preparation of reports on related issues, etc.

Human, Physical and Financial Resources

GDRS ARIs currently (November 1998) have 204 graduate staff (including 35 PhD, 100 MS, 87 BS)³, who represent around 143 pRY. This graduate staff enjoys relatively better employment conditions than GDAR researchers and better labor resources, which explains their higher academic level. GDRS ARIs also employ 100 support staff (technicians, clerks, accountants) and 1,330 laborers (approximately 60% are part-time workers).

GDRS ARIs possess about 17,000 ha at different locations, which are sufficient for research activities. Offices, laboratories, vehicles, and equipment are adequate for the research activities, mainly due to TARP contribution in recent years, though strengthening is required in specific areas. Information services of GDRS are one of the best among the governmental institutions, with sufficient printing and computer resources and access to Internet.

¹ GDRS, directly governed by the Prime Ministry, is responsible for developing research and developmental activities for improvement of rural affairs, soil fertility, and water use in the country. The Research Division is within the Planning and Coordination Department, one of the 17 GDRS Departments.

² The Research Division is also responsible for the International Agro-Hydrology Research and Training Center (IAHR TC).

³ Without counting IAHR TC (9 researchers).

The total 1997 financial resources of the GDRS Research Division (without the International AHRTC) amounted to around US\$ 19.6 million¹ (TL 3,060 billion), consisting of

- US\$ 16.4 million from national sources, mainly from the government budget (and US\$ 0.2 million from self-earned funds);
- US\$ 3 million from the World Bank loan, and approximately US\$ 0.2 million from external grants (principal donors: ICARDA, IWMI, STOAS/Netherlands, CEMAGREF/France).

Salaries absorbed 83% of the total resources of the GDRS Research Division, while OCC amounted to around US\$ 3.3 million, i.e., an average of US\$ 16,200 per graduate staff member.

Research Activities and Linkages

Like GDAR, GDRS ARIs designed a research master-plan priority-assessment initiative which resulted in four major research priority areas: catchment management, soil management, water management and investment management, including research programs addressing the problems of water storage, irrigation, soil and water conservation, soil management, wastewater use, soil reclamation, irrigation and drainage management systems, and socioeconomic issues in land and water use.

In general terms, the research contribution of GDRS ARIs has been important in past development efforts of Turkish agriculture. However, such development efforts seem to have taken place unevenly throughout the country.

The GDRS research staff has had relatively more training opportunities than that of GDAR's. GDRS relationships with international institutions are improving; currently, research projects are being executed, at various scales, with ICARDA, IWMI, STOAS/Netherlands, CEMAGREF/France and Cranfield University/UK.

The Research Institutes of the Ministry of Forestry (MOF)

Eleven individual RIs, officially called Research Directorates, are coordinated by the Research, Planning and Coordination Council based at the MOF headquarters in Ankara. Of these institutes (see [Table 4](#)):

- one is a subject-specific RI: the Poplar and Fast Growing Tree Species RI (PFGTSRI), based in Izmir Kocaeli. It focuses on the improvement of *Populus*, *Salix* and *Eucalyptus* for planting on private land, rural construction, sawn timber, fuel, etc. It is also involved in developmental activities in connection with other institutions;
- one is a breeding RI: the Forest Tree Breeding and Seed Improvement RI (FTBSIRI), located in Ankara, which concentrates its activities on the improvement and multiplication of various forest tree species for use mainly in reclamation purposes; and
- nine are Regional Forest RIs: they are located in Ankara, Antalya, Tarsus, Izmir, Istanbul (Pendik), Bolu, Trabzon, Erzurum and Elazig, and are responsible for forest research in the regions of Central Anatolia, west Mediterranean, east Mediterranean, Aegean, Marmara, west Black Sea, east Black Sea, Eastern Anatolia and Southeastern Anatolia, respectively. Their research activities cover silviculture, forest and soil protection, and forest products at the regional level; they involve close collaboration with regional representatives of various directorates, such as forest reclamation and erosion control, as well as international connections with various institutions (FAO, etc.).

The main mandate of these RIs is research (essentially adaptive) which mobilizes around 70% of the time of the scientific and technical graduate staff, the rest of their time being mostly devoted to development activities.

Currently, the MOF RIs employ 175 graduate staff members (including those at the headquarters), who represent 123 pRYs. Human resources need improvement in terms of training, number, and balancing among the regions. Only 38% of the research scientists have postgraduate qualification (17 PhD, 49 MS), indicating the urgent need for training. The numbers of researchers are sufficient in institutions in the central, southern and western parts of the country, but those in the north and east suffer seriously from the lack of adequate numbers of researchers.

Forest RIs have no shortage of field resources for research since the state forests provide sufficient areas. Laboratory facilities have been improved in recent years, but equipment and information facilities in the RIs require modernization.

The estimated 1997 total budget of the Forest RIs was approximately US\$ 8.6 million (TL 1,330 billion), of which US\$ 7.6 million came from national sources, US\$ 0.9 million from the World Bank loan, and US\$ 83,300 from

¹ The total 1997 financial resources of the GDRS Research Division (with IAHRTC) amounted to US\$ 20.5 million, against US\$ 9.3 million in 1995.

other sources. The allocations for salaries and research were US\$ 7.1 million and 1.4 million, respectively. The US\$ 8,000 OCC allocation per researcher requires urgent improvement.

2.3 The Faculties of Agricultural Sciences (FASs)

Overview (see Tables 6 and 7)

Presently, there are 19 Faculties of Agriculture (FOAs), 14 Faculties of Veterinary Medicine (FVMs), 9 Faculties of Forestry (FOF), and 10 Higher Schools and Faculties of Fisheries. Four new FOAs and 5 new FVMs are being established. Higher education institutions are scattered throughout the country. The main mandate of the FASs is undergraduate and graduate teaching; AR activities are implemented within the scope of their research and educational aims and the academic staff members are supposed to allocate 20 to 30% of their time to research-related activities, but the actual time devoted to these activities is much lower (see below).

All FOAs grant a BS degree (four years), the majority grant MS degrees, and a few grant also PhD degrees. About 25,000 undergraduate and approximately 6,000 graduate students are enrolled in the FOAs. A fully developed FOA would be composed of 13 departments¹. The majority of the FOAs have fewer departments depending on the history of development, while four of the most developed faculties (Ankara, Erzurum, Izmir and Adana) have almost all the departments.

All FVMs grant a DVM degree (five years); five offer PhD programs. The FVMs host a total of 5,800 undergraduate and approximately 250 graduate students. They have three departments: veterinary basic sciences, animal breeding and nutrition, and animal diseases and clinic.

In 1997, the 52 FASs employed 3,360 graduate staff members, including 1935 academic staff members (academicians), all PhD holders, and around 1,425 young research assistants, most of them MS holders preparing for their PhDs, who usually act as support/technical staff for the former.

Almost all FASs have rather fair physical resources (lecture halls and rooms, tutorial labs and farms², etc.), mainly adapted to their education mandate; however, these resources become more and more insufficient with the increase of student enrollment.

The FASs' estimated financial resources are approximately US\$ 40 million (TL 6,200 billion), of which US\$ 34 million (85%) are for salaries and US\$ 6 million (15%) for OCC (training and research), which means an extremely low average of US\$ 1,780 per academic staff member. However, these resources do not take into account the numerous research contracts funded directly by other NARS institutions in which academic staff members participate.

Research Activities and Linkages

The availability of relatively highly qualified staff and of students, particularly those in the graduate study programs who are involved in research activities for their theses, offers large comparative advantages for the FASs to implement AR programs. However, research is constrained by many factors:

- Academic staff members with PhD degrees are appointed mainly for teaching. Their time available for research is rather limited because of the excessive teaching loads implied by the very large numbers of students. For example, in 1998, there were 215 academic staff members for almost 3,405 enrolled students, supported by 22 lecturers and 126 research assistants at the FOA of Ankara University, which has one of the best ratios (15.8) of students per academic staff member (data from Arli, M., personal communication). In most of the other FOAs, this ratio varies from 25 to 40 (see Tekinel et al., 1992).
- The lack of coherent policies for agricultural research. The FASs have no governmentally defined specific research responsibilities; they establish their own individual research policies and plans. Research policy decisions for universities are usually made at the faculty boards and departments as well as at the Turkish Scientific and Technical Research Council (STRCT). However, most of the research carried out is based on individual initiatives (either for the academicians' advancement purposes or for postgraduate theses) than for development of the agricultural sector.

¹ The standard, full-fledged FOA has the following 13 programs: soil science, farm structures and irrigation, field crops, horticulture, plant protection, animal husbandry, fisheries, landscape architecture, farm mechanization, food engineering, dairy technology, leather and fiber technology, agricultural economics.

² The majority of the FASs have a farm for student training, production, research, and, to some extent, for seed multiplication purposes; its size varies from 2 to 500 ha.

- Research resources are rather limited. Technicians are scarce (an average of only 0.25 technician per scientist) and mainly mobilized by the education activities. For most of the FASs, physical and financial resources are essentially allocated to training activities, and research facilities, equipment, and funds are considered insufficient, especially within the FASs established in recent years.
- The links with both the national ARIs and external educational and/or research institutions are not sufficiently strong and are limited to a few well-developed faculties.
- Due to the lack of effective linkage mechanisms, university research has little connection with farmers, development/extension organizations, and agricultural industries, though there are exceptions. Therefore, AR activities carried out at the FASs are often not of a problem-solving nature, and results often remain in publications and not readily available to users. The research activities and findings of Çurukova and Harran FOAs in Harran Plain through the Southeastern Anatolia Project (GAP: see below) may be considered as an exception, together with some others.

Due to these constraints, it is estimated that the FAS scientists may spend actually no more than 10% of their time on research-related activities. Thus, although the theoretical pRYs are 840 (using the normative ratio used for all the NARSs of the WANA region), the actual pRYs for the FASs would be around 340.

2.4 The Other Institutions Involved in Agricultural Research

The “other NARS institutions” are those in which AR activities cover a more or less small part of their mandate. They include some AR units managed by research or development institutions, many university institutions, and some public agro-industrial enterprises and development organizations.

Agricultural Research Units Managed by Research or Development Institutions

Within this category, there are mainly the Scientific and Industrial Research Institutes of the Marmara Research Center (MRC), and the Nuclear Agricultural and Animal Research and Training Center (NAARTC):

- MRC, created in 1972 at Gebze/Kocaeli on 720 ha land belongs to STRCT. It executes research programs of high standard, with its 203 researchers, in a large span of domains: chemical, electronic, energy, mechanical, etc. It has two AR-related institutes: (i) the Institute of Genetic Engineering and Biotechnology (47 researchers: 25 PhD, 9 MS, 13 BS) specialized in molecular biology applied to agriculture and medicine, and (ii) the Institute of Food Technology (29 researchers: 9 PhD, 13 MS, 7 BS) specialized in advanced research in nutrition and food technology. The approximate annual budget for each of these two institutes is US\$ 3.5 million.
- NAARTC, based in Saraykoy-Ankara, run by the Turkish Atomic Energy Authority (TAEA, established in 1982), resulted from the merging in 1999 of two centers related to agricultural sciences: one for plant sciences and one for animal sciences, both in Ankara until recently. NAARTC conducts research for utilization of nuclear techniques in plant sciences and animal diseases. It currently employs 75 researchers (39 PhD, 31 MS, 5 BS) with a budget of US\$ 7 million (sum of the 1998 budgets of the two previous centers).

These research units have highly qualified researchers supported by comfortable financial resources and physical facilities of international standard.

University Institutions

Most of the universities have, apart from their FASs, various units or departments covering disciplines related, one way or another, to agricultural sciences.

- Faculty Departments and Higher Schools: Biology is covered in the Faculties of Science, machinery in the Faculties of Mechanical Engineering, soil science in the Faculties of Geology, rural socioeconomics in the Faculties of Economics, rural geography in the Faculties of Arts or Education, and microbiology and nutrition in the Faculties of Medicine. Food science is also taught in several Food Engineering Faculties. Programs for fisheries are offered by several Higher Schools of Fisheries.
- The Institutes of Universities: Almost all universities have an “Institute of Sciences” which is responsible for the administration of postgraduate education. The postgraduate activities take place at related faculties, departments or institutes.

In addition to these Institutes of Sciences, some universities also have other institutes that conduct research and have research infrastructure, such as the Institute of Technology¹; the Institute of Marine Sciences and Technology (9 September University) at Urla, Izmir²; and the Institute of Marine Sciences (IMS) at Erdemli, Icel (MET University)³.

Establishment of an accurate and complete inventory of these units is almost impossible since the activities of researchers in the same unit are diverse, some related to agriculture and some not. Thus, it is difficult to have a precise estimate of the total number of scientists concerned. However, a rough survey of some universities indicates that, at the national level, this number could be considered as 10% of the FASs', which can be rounded to 340, representing 85 pRYs.

In these units, AR resources are rather limited and largely directed to scientists on an individual basis rather than through their institutions. However, these resources are certainly slightly higher than at the FASs, and the concerned scientists may actually spend around 15% of their time on AR-related activities, representing roughly around 40 actual pRYs.

Research Institutes Affiliated to State Enterprises

State enterprises working on sugar beet, tea, and tobacco, have their own RIs that carry out significant research on their mandate crops, independently from GDAR, GDRS, and the university research sub-systems (see [Table 5](#)).

- The Sugar Beets RI of the Sugar Factories Enterprise, under the Ministry of Industry and Trade (MIT) - This unit employs (November 1998) around 29 researchers (of whom 20 are PhD or MS holders) and 30 permanent support staff, most of them located at the Ankara headquarters (with a number of stations in other locations). Its physical resources are satisfactory, except for information, communication and documentation resources which require strengthening. Its 1997 total budget was rather generous: US\$ 3 million, 65% of which was for salaries and 35% for OCC (about US\$ 48,000 per researcher).
- The Tea Institute of the ÇAYKUR Enterprise, under the Ministry of Finance and Customs (MFC) - This Institute, established in 1974, has (November 1998) 10 researchers (of whom 5 are PhD or MS holders) and 6 permanent staff. All research activities take place at the province of Rize (eastern part of the Black Sea coast) in the major tea-producing region. Field resources (5 ha) are adequate, but offices, laboratories and information resources require improvement. Its 1997 total budget amounted to US\$ 0.3 million, 15% for OCC, which means a poor US\$ 4,500 per researcher.
- The Monopole RI of the Monopole Enterprise, also affiliated to the Ministry of Finance and Customs - Its 24 researchers (of whom 4 are PhD or MS holders), 70 permanent support staff, and 76 temporary laborers are based at Istanbul. The physical resources are satisfactory but personnel capacity requires strengthening. The 1997 total budget was US\$ 2.9 million, 39% of which was for OCC (about US\$ 48,000 per researcher).

The three RIs account for 63 pRYs (63 full-time researchers) and US\$ 6.2 million financial resources.

Agricultural Development Organizations

The major institution in this category is the Southeastern Anatolia Project (GAP), a regional development administration established in 1989 for the management of comprehensive socioeconomic development in the less developed southeastern region of Turkey. GAP aims to improve the living standards in the region by mobilizing the natural resources of the area, where an irrigated scheme for 1.7 million ha is being created. GAP is under the auspices of the Prime Ministry.

GAP carries out research activities in areas related to agriculture and rural development through its own staff or finances research projects prepared by other NARS institutions. It has 20 agricultural scientists in its Agricultural Department in charge of planning and implementing research and development projects. Its 1998 budget was US\$ 32 million, of which 5 % (approximately US\$ 1.5 million) was allocated for research activities.

¹ This Institute, established in the industrial town of Gebze in 1992, has extremely high standards of its capacity and resources, with 184 highly qualified academicians and 143 support staff. It covers various sectorial fields in various departments, including disciplines related to agriculture, such as biology, molecular biology, hydrobiology, and bioengineering.

² This Institute, established in 1975, has 61 academicians (48 PhD, 13 MS) and 45 support staff; its research activities are carried out in marine biology and oceanography.

³ This Institute (1975), which is part of the Middle East Technical University (METU), has 35 researchers with postgraduate qualifications working on marine biology (oceanography, ocean chemistry, ocean geology, marine products). Its facilities are modern and well established in Erdemli-Içel on the Mediterranean coast.

Recently, GAP has signed a collaboration agreement with ICARDA to implement joint projects and to develop a Regional Agricultural Research and Training Center in the GAP region.

3. AR RESOURCES

3.1 Human Resources

Around 5,660 graduate and postgraduate staff members are working in the NARS (of whom 1,746 are in the public ARIs and 3,360 in the FASs), representing 2,288 pRYs.

There is a serious imbalance between the level of academic training among the graduate staff of the FASs (all with PhD or MS degrees) and that of the ARIs affiliated to GDAR and MOF (42 and 38% with PhD or MS degrees, respectively), justified by the differences in salaries¹ and the past migration of the best-trained ARI researchers to the universities and the private sector. The proportion of PhD or MS holders (66%) at the GDRS Research Division is relatively better than at other public institutes. These differences result largely from differences in employment conditions in terms of salary, status, working environment and housing, which are better for the university staff and, to some extent, the GDRS staff than for MARA and MOF researchers who have employment conditions similar to administrative staff; this constitutes a major constraint to the development of AR within these two ministries.

The management of MARA research staff suffers other constraints and weaknesses. Staff stability has been limited due to transfers to other positions within or outside the MARA research system, regardless of the research programs under way. Consultation with RI directors on the recruitment of new staff for their institutes is limited, and the regulations which formerly provided a career-development structure within the research system is not functioning. Opportunities for improvement of status and salary are related to taking up administrative and managerial positions. These constraints are magnified in the less developed regions where living conditions are harsher than in other parts of the country, and where, until recently, no added compensation was offered for residing under these conditions. The situation for the MOF researchers is similar, although less severe and without the problem of frequent transfers.

Considering the large number of newly recruited researchers for GDAR and GDRS, it can be concluded that the number of research staff has reached a satisfactory level for many of their ARIs. However, in spite of the efforts during the last decade to train researchers (many young researchers received higher degrees and short-term training opportunities abroad within the framework of TARP), a major portion of the research staff is inexperienced and not adequately trained in general, particularly in some specific disciplines such as animal husbandry and breeding, forage crops, fisheries, and forest research.

As seen above, the high concentration of the NARS scientific potential in the developed regions of the country remains a challenge for the future.

In general, the number and quality of technicians are insufficient in almost all the NARS institutions due to the very low salaries offered by the public institutions and to the possibilities for technicians to prepare higher diplomas. This situation is a strong limiting factor for the scientists' research efficiency.

3.2 Physical Resources

In the majority of the ARIs of GDAR and GDRS, the state industrial enterprises, and developed academic and research institutions, research facilities (land, buildings, laboratories, etc.) are adequate both in quantity and quality, although strengthening in some institutions may be required in certain fields. The situation is less favorable in the other NARS institutions.

For the whole NARS, these facilities are considerable both in number and size (for instance, its farms total more than 40,000 ha), but are not well distributed in the country (relatively few in the underdeveloped regions). However, they constitute a huge set of separate units and infrastructures, the management and maintenance of which are very costly. Obviously, the situation could be rationalized and improved by gathering most of them in a small number of "campuses" (at least one per large region) accommodating critical masses of human and physical resources. This should allow providing common infrastructures and services (conference halls, library, communications, purchase offices, etc.) at a much lower cost and offering more opportunities for interaction and collaboration among scientists.

¹ Average salary of researchers with a PhD and 10 years of professional experience is US\$ 400–500 at the ARIs and US\$ 1,000 at the universities.

However, having already established individual infrastructures for each institution, bringing them together on campuses would require enormous expenses and also strong political and bureaucratic support.

3.3 Financial Resources

In 1997, the total AR financial resources of the NARS (see Table 1) reached around US\$ 110.7 million, of which:

- US\$ 99.6 million came from national sources (governmental allocations and institutions' self-generated funds);
- US\$ 9.9 million loan from the World Bank;
- US\$ 1.2 million from external grants, mainly secured by a few donors (ICARDA, CIMMYT, IFAD, etc.).

National and total resources represent 0.36 and 0.40%, respectively, of the Agricultural Gross Domestic Product (AGDP, estimated at US\$ 28 billion in 1996). Such percentages are relatively low compared to the 1% ratio recommended by some international organizations (World Bank, European Union, etc.).

In most of the NARS institutions, salaries absorb the major portion of the budget, and at the GDAR, GDRS, and MOF ARIs, the available OCC per scientific and technical graduate staff member amounts to around US\$ 11,000, 16,000, and 8,000, which represents around US\$ 14,000, 19,500, and 9,700 per pRY, respectively¹. Such OCCs are much under the "optimal" amount of US\$ 25,000–30,000 per RY used in the long-term plans designed by many developing countries, which means that the AR scientific potential is currently far from being fully mobilized.

According to this last reference, the GDAR, GDRS and MOF ARIs—the driving force of the Turkish NARS—would have roughly 460, 105, and 45 actual RYs (aRYs), respectively (as opposed to the 881, 143 and 123 pRYs estimated above), i.e., a sub-total of around 610 aRYs. However, as the capital costs currently needed are lower because of the large investments made under TARP in recent years, it is reasonable to assume that this sub-total may reach (roughly) around 700 aRYs.

Adding the rounded 580 aRYs estimated for the other institutions of the NARS², the NARS would total around 1,280 aRYs, against 2,288 pRYs estimated above.

It is worth mentioning that the US\$ 9.9 million loan provided by the World Bank in 1997, allocated mainly to OCC, may provide research resources for around 360 aRYs. This indicates that the current mobilization of AR scientific potential strongly relies on external loans/funds and, for sustainability of this mobilization, alternative resources will be necessary in the near future.

Such global estimates are not available for previous years; however, referring to the evolution of the resources of GDAR and some other NARS institutions, it seems that since the early 1990s:

- government funds for AR have been declining;
- this decrease has been compensated for by the availability of the World Bank loans, the increase of the institutions' self-generated funds, and the utilization of other funding options.

As the World Bank loans will be available for only another two years, prospects are not very bright. The recent evolution brings out the problem of sustainability of adequate funding for the medium term.

It is also worth mentioning that the governmental NARS institutions are all governed according to the regulations applicable generally across the state sector, and have little flexibility for research administrators in resource development and management. Such initiatives would require enormous bureaucratic procedures that would discourage researchers and administrators from taking such actions. The constraints in personnel management regulations are also reflected in financial matters. The regulatory weakness of administrators in arranging personnel recruitment and transfer results in ineffective use of financial resources.

Revolving funds of the institutions (strong in some) are very useful for some operational expenses, but regulations do not allow enough flexibility (for example, purchase of capital items and turnover from year to year are not allowed) for utilization of these funds. Other funding options at national and international levels have been realized as alternative

¹ OCC per pRY is higher than OCC per graduate staff member as the number of pRYs is lower than the number of graduate staff members and part of the OCC is allocated to other activities than research (see Table 1, note j).

² 10 aRYs at AERI, 128 aRYs at the MRC Institutes and NAARTC/TAEA, and 15 aRYs in GAP (all institutions where OCC is high or sufficient and aRYs are equal to pRYs); 340 aRYs at the FASs (see Section 2.3); 40 aRYs at the university institutions; and around 50 aRYs at the RIs of the Industrial State Enterprises (see Section 2.4).

sources, but little progress has been made, mostly at a few developed institutions. This is expected to improve in the future, though not rapidly, together with human resource development efforts. A significant improvement can be made for securing financial resources through: (i) increasing public and political awareness of AR, resulting in allocation of more funds from the central governmental budget, not only for salaries of the employees, but also for operational expenses of research projects; (ii) establishment of a research project and funding philosophy based on demand-driven research activities, i.e., projects should be financed by the end users; and (iii) in connection with item (ii), little and applicable amount of levy may be charged to produce sold, at least to the state or cooperatives, and transferred to research funds.

4. RESEARCH ACTIVITIES AND LINKAGES

4.1 Research Activities

In the near past, the funding process for most of the research carried out by the GDAR, GDRS and MOF research institutions and the universities was not based on systematically determined research priorities at the national level. As a result, there were too many small under-funded projects that tended to be discipline-based and duplicative in some cases. However, there were some exceptions, the most well-known example being the large Coordinated National Commodity Research Projects within GDAR for some major crops such as wheat and pulses. Some of these national projects are still ongoing and are expected to be replaced by newly designed larger research programs.

With the implementation of TARP, both GDAR and GDRS developed research master plans that established formal priority-setting mechanisms for their research agendas and set up systematic national, multidisciplinary, multi-institutional research programs for all research activities and topics. Similarly, some FASs have started to establish research priority areas. At the national level, the Agriculture and Forestry Group of the STRCT has recently proposed priority AR areas in remote sensing, development of more efficient irrigation techniques, quality and resistance breeding for major crops, fertilizer-use efficiency and crop nutrition, novel tillage and mechanization techniques, pesticide residue issues, integrated pest management (IPM), post-harvest physiology, database development for agriculture, soil conservation and range amelioration, biotechnology, and food technology.

In general, these national research programs have given high attention to biological and physical sciences, with some questionable sub-emphasis on animal husbandry, pasture improvement and fisheries. For a long time, rural socioeconomic research has been marginalized (there are still a few trained economists and almost no social scientists within the ARIs), and its contribution to the national research program has been very little; the recent establishment of AERI within MARA offers new prospects.

4.2 Linkages with Development

In recent years, within the framework of the Agricultural Extension and Applied Research Project (AEARP), linkages between some GDAR ARIs and farmers have been established through on-farm research activities in the project area and through the creation of a Research-Extension Liaison Department in some of the ARIs. The recent establishment of extension and training departments at the central ARIs of GDAR is expected to strengthen the linkage between the ARIs and extension units.

However, linkages with development institutions and end users require further strengthening. The Extension Service, farmers' unions, and cooperatives¹ are not represented in the directive boards of the NARS institutions and were not actually involved in their research priority setting, planning, implementation, and evaluation of research activities. Therefore, contribution of the farmers as organized bodies to the NARS research activities is not satisfactory due to insufficient liaison and this has to be improved in order to enhance the strength of the AR system.

Increased support and incentives for scientists to undertake collaborative research with other institutions or entities that have complementary skills, facilities, and common interests, would encourage better linkages. The recently established Local Area Network (LAN) and WAN (Wider Area Network) at GDAR and those considered for the GDRS research system will help enhance linkages and communication among research institutions.

¹ Farmers' cooperatives and similar organizations are government-controlled and operated, and independent producers' associations or cooperatives do not exist.

4.3 International Linkages

The international connection of the Turkish NARS has grown very strong through the support of the World Bank and FAO for execution of various research and development projects. Collaboration with international AR centers has been intensified in the last decade, especially with CIMMYT and ICARDA, and the resulting establishment of the International Winter and Facultative Wheat Improvement Program (IWWIP) could be considered as a model of international collaboration which would be highly profitable for all partners involved.

International relationships are also being strengthened with CIHEAM. Bilateral cooperation is growing rapidly with the neighboring Central Asian Republics of the former Soviet Union and with the north and south Mediterranean countries (mainly through CIHEAM and ICARDA), but remain insufficient with other developed countries.

5. CONCLUSION

Currently, the Turkish NARS is made up of a large number of research, academic, and technical institutions governed by several ministries and universities. Due to the large size of GDAR, which mobilizes 55% of the financial resources of the NARS, it may be considered as rather "institutionally" or "structurally" concentrated. However, the overall fragmentation of the NARS makes it difficult to allocate and administer the resources effectively. The efficiency of coordination of research activities within and outside research organizations is required for avoiding or limiting the overlapping of responsibilities and duplication of research efforts.

The NARS is endowed with human, physical, and financial resources, which appear, at first glance, important, but actually suffer several weaknesses:

- Most of the research institutions are constrained by the academic level of the graduate scientific staff, still insufficient in spite of the recent training efforts, and by the lack of adequate incentives for research scientists, staff instability, and understaffing in less developed regions. In all institutions, technicians are too few and are strongly limiting the efficiency of the scientists.
- Physical resources are huge and, globally, rather good, but the excessive fragmentation of the infrastructures results in high costs for their management and maintenance, and for communication and collaboration between scientists.
- Almost all AR organizations are funded by a general government budget. The major part of the government allocation goes to salaries. Research funds are not sufficient due to financial constraints, especially for operational and capital costs. This situation prevails even at GDAR and GDRS which benefit from a large World Bank loan. Therefore, the NARS scientific potential is far from being fully utilized.

The implementation of TARP has produced very positive changes in the research activities at GDAR and GDRS by promoting multidisciplinary and multi-institutional research programs. This was achieved by focusing the available resources, through their master plans, on priority research programs and directing the use of these resources properly through concentrating on fewer ARIs which possess better prospects for development. In the long run, other changes are expected to induce investment increases in AR, development of more effective organizations and management systems, improvement of effective use of research resources, improvement of collaboration among NARS institutions, and strengthening linkage mechanisms between research and extension.

Turkey is experiencing a rapid transformation from an essentially rural society to a mainly urban and industrial one. Yet, nearly 40% of the population is engaged in agricultural production. Its agriculture has wide agroecological diversity and large natural resources (land, water, genetic resources). The country is self-sufficient on a large scale; however, increasing productivity is essential for meeting the food needs of the fast-growing population (2.3% annually) and to take advantage of the emerging agro-industries and export opportunities. Such objectives can be achieved through sustainable and efficient use of these resources and improved agricultural technologies. Thus, AR is of vital importance to the nation. Historically, AR carried out in the past has made significant contributions to innovation and technical change in Turkish agriculture. The future challenge could be met only through acceleration of the structural changes implemented by TARP and also by a significant increase of the financial resources through a much-expanded public investment and through non-governmental sources.

Main Acronyms

MARA: Ministry of Agriculture and Rural Affairs. **MOF:** Ministry of Forestry. **GAP:** Southeastern Anatolia Project. **TARP:** Turkish Agricultural Research Project. **STRCT:** Scientific and Technical Research Council of Turkey.

GDAR: General Directorate of Agricultural Research. **GDRS:** General Directorate of Rural Services. **RI:** Research Institute. **FOA:** Faculty of Agriculture.

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Table 1 - The National Agricultural Research System (1997/98)*

* Most of the human resources: 1998; most of the financial resources: 1997. *Italics*: Approximate data.: Data not available. *: See footnotes.

NARS Institutions				AR Scientific & Techn. Graduate Staff* (Units)		AR Potential Res. Years	Total Budget (million US\$)		AR Expenditures/Resources (E) (million US\$)				
No.	Name - Head Office Acronym - Year Established	Mandates AR Fields	Govern. Ministry	Total - (PhD, MS)			Nat.	Ext.	Nat. NE	Loan LE	For. FE	Total TE	
a	b	c	d	e	f	g	h	i	j	k	l	m	
1/2	General Directorate for AR (55 ARIs) Ankara (see Table 2)	GDAR 1991	AR (65%) - (AD) All (except 2.2, 2.3, forest,...)	MARA	1355	265, 310	881	66.7	5.9	55	5	0.9	60.9
2.2	Agricultural Economics RI - Ankara	AERI, 1996	AR (80%) - Ag. Eco.	MARA	12	4, 2	10	0.-	1	0.-	1		1
2.3	Research Division, General Direct. for Rural Services (11 RIs) - Ankara (see Table 3)	GDRS 1993	AR (70%) - (AD) Soil, water, ...	PM	204	35, 100	143	16.4	3.2	13.9	3	0.2	17.1
2.4	Forestry RIs (11 RIs) Ankara (see Table 4)	1952	AR (70%) - (AD) - Forestry	MOF	175	17, 49	123	7.6	1	6.5	0.9	0.1	7.5
1-2	Total Agricultural Research Institutes				1746	305, 479	1157	90.7	11.1	75.4	9.9	1.2	86.5
3.1	19 Faculties of Agriculture (see Table 6, 7)	FOA, 1933-...	AHE - (AR)	MHE	1957	1196, 761	489	21.1		3.8			3.8
3.2	14 Faculties of Veterinary Medicine (see Table 6, 7)	FVM, 1842-...	AHE - (AR)	MHE	898	483, 415	224	9.8					
3.3	8 Faculties of Forestry (see Table 6, 7)	FOF, 1933-...	AHE - (AR)	MHE	240	143, 97	60	2.9					
3.4	10 Faculties of Fisheries (see Table 6, 7)	FF, 1965-...	AHE - (AR)	MHE	265	113, 152	67	4.5					
3	Total Faculties of Agricultural Sciences				3360	1935, 1425	840	38.3	...	3.8	...	...	3.8
4.1	Marmara Res. Center Scient. & Indust. Res. Inst.*	MRC - 1972	R (AR)	STRCT	53	22, 18	53	5.1	...	5.1	...	...	5.1
4.2	Nucl. Ag. & Anim. Res. & Train. Centre, TAEA*	NAARTC - 1999	AR	PM	75	39, 31	75	7	...	7	...	...	7
4.3	Other University Institutions (see Section 2.4)		HE - (R/AR)	MHE	340	200, 150	85	...	...	0.6	...	...	0.6
4.4	Indust. Enterprises (3 AR institutes) (see Table 5)*	1927-74	AR - Sugar, tea, tobacco	MIT, MFC	63	29*	63	6.2	...	6.2	...	...	6.2
4.5	Southeastern Anatolia Project*	GAP, 1989	AD - (AR) All	PM	20	... , ...	15	*	...	1.5	...	...	1.5
4	Total Other Institutions				551	... , ...	291			20.4		...	20.4
5	Total NARS				5657	... , ...	2288	...	...	99.6	9.9	1.2	110.7
Exchange Rate: US\$ 1 = 156,000 Turkish lira (TL) (1997 average rate)				Actual Research Years (aRY) (Estimate) --->		1280							

MARA: Min. of Agriculture and Rural Affairs. **MFC:** Min. of Finance and Customs. **MHE:** Min. of Higher Education. **MIT:** Min. of Industry and Trade. **MOF:** Ministry of Forestry. **PM:** Prime Minister. **STRCT:** Scientific and Technical Research Council of Turkey.

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

***Notes:** **e, f:** All the AR scientific and technical graduate staff members are national. **4.1:** Marmara Research Center Scientific and Industrial Research Institutes (MRC, Gebze/Kocaeli, with its Institute of Genetic Engineering and Biotechnology and its Institute of Food Technology (see Section 2.4). **4.2:** Turkish Atomic Energy Authority (TAEA, Ankara). **4.4:** Sugar Beet RI (Sugar Factories Enterprise/MIT, Ankara); Tea Institute (ÇAYKUR Enterprise/MFC, Rize); Monopole RI (Monopole Enterprise, Istanbul); 29 PhD or MS holders. **4.5:** The GAP total 1998 budget is US\$ 32 million. **4.1, 4.2, 4.3, 4.4:** Only the human and financial resources allocated to AR are mentioned.

National AR expenditures (NE) = **0.36%** of the AGDP (US\$ 28 billion in 1996). Total AR expenditures (TE) = **0.40%** of the AGDP.

Tab. 2 - The GDAR Agricultural Research Institutes

GDAR Research Institutes					Scientific & Technic. Graduate Staff (Units)	
No.	Name	Head Office	Year Estab.	Mandates % AR* - AR Fields	Total	PhD or MS holders
A.1	Central Res. Inst. for Field Crops (CRIFC)	Lodumlu/Ankara	1986	Field crops	73	26
A.2	Ataturk Central Hort. Res. Inst (ACHRI)	Yalova/Istanbul	1961	Horticulture	43	25
A.3	Central Livestock RI	Lalahan	1937	Livestock	25	0
A.4	Central Food Technology RI	Bursa	1961	Food technology	36	11
A.5	Central Plant Protection RI	Ankara	1934	Plant protection	51	11
A.6	Central Veterinary Control and RI	Etilik/Ankara	1921	Animal health	91	28
A.7	Central Fisheries RI	Trabzon	1987	Fisheries	29	8
A	Total 7 Central AR Institutes				348	109
B.1	Cukurova Agricultural Res. Inst (ÇARI)	Adana	1961	Various	35	14
B.2	Mediterranean ARI	Aksu/Antalya	1935		31	13
B.3	Southeastern Anatolia ARI	Diyarbakir	1962		12	7
B.4	Thrace ARI	Edime	1970		17	10
B.5	Eastern Anatolia ARI	Erzurum	1969		29	12
B.6	Anatolian ARI	Eskisehir	1925		36	17
B.7	Aegean ARI	Menemen/Irmir	1963		48	41
B.8	Black Sea ARI	Samsun	1944		34	19
B	Total 8 Regional AR Institutes				242	133
C.1	Bahri Dagdas Intern. Wint. Cereals R.C.	Konya	1987	Winter cereals	13	5
C.2	Cotton Res. Inst.	Nazilli/Aydin	1934	Cotton	24	17
C.3	Sakarya Agricultural Res. Inst.	Sakarya	1926	Cereals	11	2
C.4	Horticultural Res. Inst.	Erdemli/Icel	1968	Horticulture	34	20
C.5	Horticultural Res. Inst.	Erzincan	1987	Horticulture	21	5
C.6	Fruit Res. Inst.	Malatya	1937	Fruit	13	6
C.7	Citrus (Green House) Res. Inst.	Antalya	1994	Fruit	81	24
C.8	Hazelnut Res. Inst	Giresun	1936	Hazelnut	7	2
C.9	Olive Res. Inst.	Bomova/Izmir	1937	Olive	27	26
C.10	Viticulture Res. Inst.	Manisa	1930	Viticulture	13	10
C.11	Viticulture Res. Inst.	Tekirdag	1930	Viticulture	14	12
C.12	Pistachio RI	Gaziantep	1937	Pistachio	13	5
C.13	Fig Res. Inst.	Erbeyli/Aydin	1938	Fig	12	3
C.14	Potato Research Institute	Nigde	1996	Potato	7	1
C.15	Horticulture RI	Egirdir/Isparta	1987	Horticulture	21	3
C.16	Harran ARI	Akçakale/S. urfa	1987	Cotton +	5	3
C.17	Kahramanmaraş ARI	Kahramanmaraş	1972	Cotton +	15	6
C.18	Islahiye Agr. Res. Inst.	Islahiye/G. Antep	1998	Viticult/Olive	1	1
C	Total 18 Subject AR Institutes: Plant Breeding and Agronomy				332	150
D.1	Plant Protection Res. Inst.	Adana	1931	Plant protect.	35	25
D.2	Plant Protection Res. Inst.	Bomova/Izmir	1931	Plant protect.	34	31
D.3	Plant Protection Res. Inst.	Diyarbakir	1956	Plant protect.	15	4
D	Total 3 Subject AR Institutes: Plant Protection				84	60
E.1	Livestock RI	Konya	1937	Livestock	25	0
E.2	Mohair Goat RI	Yerkoy/Yozgat	1942	Livestock	3	0
E.3	Kocatepe ARI	Afyon	1962	Livestock +	9	1
E.4	Poultry RI	Ankara	1930	Poultry	19	2
E.5	Mamara Livestock RI	Bandirma/Balikesir	1935	Livest/Sheep	7	4
E.6	Sericultural RI	Bursa	1988	Silk	21	1
E.7	Apiculture RI	Ordu	1995	Apiculture	5	1
E.8	Leather RI	Kartal/Istanbul	1971	Leather	8	2
E	Total 8 Subject Research Institutes (GDAR): Animal Husbandry and Breeding				97	11
F.1	Veterinary Control and RI	Adana	1964	Animal health	17	2
F.2	Veterinary Control and RI	Samsun	1957		8	
F.3	Veterinary Control and RI	Elazig	1952		24	8
F.4	Veterinary Control and RI	Erzurum	1976		7	7
F.5	Veterinary Control and RI	Konya	1950		14	4
F.6	Veterinary Control and RI	Pendik/Istanbul	1914		37	11
F.7	Veterinary Control and RI	Bomova-Izmir	1953		24	19
F.8	Poultry Diseases & Vaccine Prod. Inst.	Manisa	1982		13	2
F.9	Foot & Mouth Disease Inst. (FMDI)	Ankara	1967		22	14
F	Total 9 Subject Research Institutes: Animal Disease				166	65
G.1	Fisheries Res. Inst.	Egirdir/Isparta	1986	Fisheries	21	3
G.2	Fisheries Res. Inst.	Bodrum/Mugla	1987		22	14
G	Total 2 Subject Research Institutes: Fisheries				43	17
H	General Directorate- Headquarter	Ankara	1991		53	30
Total 55 GDAR Research Institutes				65% *	1355	575

Newly founded Islahiye RI is excluded in calculations. *: Average % of the graduate staff members' time allocated to AR.

Table 3 - The GDRS Agricultural Research Institutes

GDRS Research Institutes						Scientific & Technic. Graduate Staff (Units)	
No.	Name	Head Office	Year Estab.	Mandates		Total	PhD or MS holders
				% AR* -	AR Fields		
1	Rural Services Research Institute	Ankara	1962		Soil, irrig., fertiliz.	30	27
2		Erzurum	1979			19	7
3		Eskisehir	1953			12	7
4		Kirklareli	1981			14	8
5		Konya	1985			13	7
6		Menemen	1949			21	16
7		Samsun	1970			15	12
8		Sanliurfa	1976			17	13
9		Tarsus	1947			9	6
10		Tokat	1963			14	9
11	Soil and Fertilizer Res. Inst.	Ankara	1954			29	17
	Headquarte- Resarch Division, RPCD	Ankara	1993			11	7
Total 11 GDRS AR Institutes				70%*		213	135

GDRS also governs the International Agro-hydrology Research and Training Center (Izmir-Menemen, created in 1996; 9 researchers, of whom 6 are PhD and MS holders), which is not fully part of the NARS. *: Average % of the graduate staff members' time allocated to AR (same for the following tables).

Table 4 - The Research Institutes affiliated to the Ministry of Forestry

Italics: Approximate numbers.

RIs of the Ministry of Forestry						Scientific & Technic. Graduate Staff (Units)	
No.	Name	Head Office	Year Estab.	Mandates		Total	PhD or MS holders
				% AR* -	AR Fields		
1	Poplar & Fast Grow. Forest Sp. RI (PFGFSRI)	Kocaeli, Izmir	1962		Forestry	42	12
2	Forest Tree Breeding & Seed Improv. RI	Ankara	1964			18	7
3	Central Anatolia Forest RI	Ankara	1952			33	7
4	West Mediterranean For. RI	Antalya	1953			14	8
5	Eastern Mediterranean For. RI	Tarsus	1992			7	4
6	Aegean Forestry RI	Bornova-Izmir	1977			25	13
7	Marmara Forestry RI	Istanbul	...			7	2
8	Western Black Sea Forestry RI	Bolu	...			5	2
9	Eastern Black Sea Forestry RI	Trabzon	...			8	3
10	Eastern Anatolia Forestry RI	Erzurum	...			4	1
11	Southeastern Anatolia Forestry RI	Elazir	...			4	1
	Research Division, RPCD, Headquarter	Ankara				8	6
Total 11 GDRS AR Institutes				70%		171	64

Table 5 - The Public Enterprise Research Institutes

Agricultural Research Institutes of Public Enterprises						Scientific & Technical Graduate Staff (Units)	
No.	Name	Head Office	Year Estab.	Ministry	Mandates AR Fields	Total	PhD or MS holders
1	Sugar Res. Institute	Ankara	1937	MIT	Sugar beet	29	20
2	Tea Research Institute	Rize	1974	MFC	Tea	10	5
3	Monopole Research Institute	Istanbul	1927	MFC	Tobacco	24	4
Total 3 ARIs of Public Enterprises						63	29

MIT: Ministry of Industry and Trade. MFC: Ministry of Finance and Customs.

Table 6 - General Overview of the Faculties of Agricultural Sciences

FASs	Academic Staff							Number of Students				Students /Staff	1997 National Budget (US\$ million)*
	Distribution of Staff in Terms of Titles				With PhD	Without PhD	Total	Under-graduate	MS	PhD	Total		
	Full Prof	Assoc. P	Asst. P	Others									
19 FOAs	443	198	291	1025	1196	761	1957	24467	2871	1489	28827	14.7	21.1
14 FVMs	139	122	143	494	483	415	898	5835	179	941	6955	7.7	9.8
8 FOFs	59	28	24	157	143	97	240	3095	378	124	3597	15	2.9
10 FFs	32	13	34	186	113	152	265	2479	292	188	2959	11.2	4.5
All FASs	673	361	492	1862	1935	1425	3360	35.866	3720	2742	42338	12.6	38.3

**Table 7 - The Faculties of Agricultural Sciences:
Agriculture (FOA), Veterinary Medicine (FVM), Forestry (FOF), Fisheries (FF)**

Faculties of Agricultural Sciences						Graduate Staff (Units)	
No.	Faculty	Location	University	Year Estab.	Diplomas delivered	Total	PhD holders
1	FOA	Aydin	Adnan Menderes	...	...	56	35
2		Antalya	Akdeniz	1984	...	56	37
3		Ankara	Ankara	1930	...	374	257
4		Erzurum	Atatürk	1958	...	152	107
5		Çanakkale	Çanakkale	...	...	17	3
6		Adana	Çukurova	1967	...	229	164
7		Diyarbakir	Dicle	...	...	16	5
8		Izmir	Ege	1955	...	259	181
9		Tokat	Gaziosmanpaga	1982	...	135	61
10		Urfa	Harran	1981	...	62	28
11		Kahramanmaraş	Kahramanmaraş	1985	...	59	19
12		Trabzon	Karadeniz T.Ü.	...	...	17	5
13		Hatay	Mustafa Kemal	...	...	43	25
14		Samsun	Ondokuz Mayıs	1976	...	88	50
15		Konya	Selçuk	1982	...	64	38
16		Isparta	Süleyman Demirel	...	...	26	14
17		Tekirdağ	Trakya	1982	...	120	72
18		Bursa	Uludağ	1981	...	115	62
19		Van	Yüzüncü Yıl	1982	...	69	33
A	Total 19 Faculties of Agriculture					1957	1196
1	FVM	Aydin	Adnan Menderes	...	...	43	15
2		Burdur	Akdeniz	...	...	16	6
3		Ankara	Ankara	...	...	171	115
4		Diyarbakir	Dicle	...	...	12	3
5		Kayseri	Erciyes	...	...	10	1
6		Elazığ	Firat	...	...	132	77
7		Urfa	Harran	...	...	23	3
8		Istanbul	Istanbul	...	...	63	42
9		Kars	Kafkas	...	...	98	39
10		Konya	Selçuk	...	...	99	60
11		Bursa	Uludağ	...	...	93	55
12		Van	Yüzüncü Yıl	...	...	79	42
13		Afyon	Afyon Kocatepe	...	...	44	16
14		Kirikkale	Kirikkale	...	...	15	9
B	Total 14 Faculties of Veterinary Medicine					898	483
1	FOF	Abant İzzet Baysal	Bolu	...	...	19	8
2		Ankara	Ankara	...	...	5	2
3		Istanbul	Istanbul	...	...	79	64
4		Kafkas	Kars	...	...	20	10
5		Kahramanmaraş	Kahramanmaraş	...	...	27	5
6		Karadeniz T.Ü.	Trabzon	...	...	61	41
7		Süleyman Demirel	Isparta	...	...	12	2
8		Zonguldak Karaelmas	Zonguldak	...	...	17	11
C	Total 8 Faculties of Forestry					240	143
1	FF	Çanakkale	Çanakkale 18 Mart	...	...	9	1
2		Adana	Çukurova	...	...	12	4
3		Izmir	Ege	...	...	93	53
4		Elazığ	Firat	...	...	31	10
5		Istanbul	Istanbul	...	...	42	18
6		Trabzon	Karadeniz T.Ü.	...	...	11	4
7		Mersin	Mersin	...	...	8	2
8		Hatay	Mustafa Kemal	...	...	2	0
9		Samsun	Samsun 19 Mayıs	...	...	26	8
10		Isparta	Süleyman Demirel	...	...	31	11
D	Total 10 Faculties of Fisheries					265	113
E	Total Agricultural Sciences Faculties (A + B + C + D)					3360	1935