

THE NATIONAL AGRICULTURAL RESEARCH SYSTEM OF LEBANON¹

1. HISTORICAL BACKGROUND

Public agricultural research (AR) in Lebanon dates back to the establishment of Tal Amara station in the Bekaa Valley immediately after independence (1946) as an agricultural training center, supported by French technical assistance. Later, in 1957, it became the Department of Agricultural Scientific Research (DASR) of the Ministry of Agriculture (MOA). Other stations were established at Terbol (Bekaa) for animal production, Kfardane (Bekaa) for dryland farming, Abde (north) and Tyre (south) for citrus.

In 1964, DASR was reorganized as an autonomous public institution and became the Lebanese Agricultural Research Institute (LARI) affiliated to MOA. More research stations were established at Fanar (Mount Lebanon) for animal health and agriculture, at Kfarshakhna (north) for olive and citrus improvement. Both Terbol and Kfardane research stations were later (in the late 1970s) handed over to the International Center for Agricultural Research in the Dry Areas (ICARDA).

The National Council for Scientific Research (NCSR or *Centre National de la Recherche Scientifique*: CNRS) was established in 1962 with the mandate of promoting, supporting, and coordinating the national research policy. It has also direct responsibility of five specialized centers, one of which is the National Marine Research Center set up in 1975 at Jounieh, then moved to Baroun and renamed the National Center for Marine Sciences (NCMS)². NCSR supports some contracted AR projects at both LARI and the university research system.

The first faculty of agriculture (FA) established in Lebanon was the (private) Faculty of Agricultural and Food Sciences (FAFS, 1952) of the American University of Beirut (AUB). Other FAs were opened later: the Faculty of Agricultural Sciences of the (public) Lebanese University (FAS/LU, 1985), and two other private ones (ESIAM/USJ, 1979; FSA/USEK, 1988).

2. THE CURRENT NARS (1996)

2.1 Overview

The Lebanese NARS is made up of three sets of institutions:

- The scientific institutions which have AR as their central mandate: LARI and NCMS: they account together for 65% of the potential research years (pRYs: equivalent full-time researchers) and 88% of the total financial resources of all the NARS; these two institutions are presented in Section 2.2.
- The four faculties of agriculture, which are more or less involved in AR, account for 28% of the pRYs and 11% of the total financial resources of the NARS (see Section 2.3).
- Few other scientific institutions, which allocate some resources to AR (around 7% of the pRYs and 1% of the financial resources of the NARS); they will be briefly seen in Section 2.4.

NCSR, responsible for the national scientific policy, has a limited role in the NARS. There is no body for coordinating the NARS institutions; however, LARI is recognized as the national AR leader. It is worth mentioning that it was responsible for the preparation in 1996 of the Lebanese AR Strategy (LARS) adopted by the Government.

Outside the NARS, AR activities are also carried out by: (i) some private business companies aiming at promoting sales of seeds, transplants, fertilizers, pesticides, new products and modern technology outputs; (ii) ICARDA at the Terbol and Kfardane stations; and (iii) some NGOs (see Section 4.2).

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² The other Centers are related to scientific computing; geophysics; solar energy; remote sensing, atomic energy, documentation, scientific information.

2.2 The AR Institutions

The Lebanese Agricultural Research Institute (LARI)

Mandate and Organization - LARI is the main NARS institution: it gathers around 53% of the pRYs and 85% of the total financial resources of the NARS. It is an autonomous public institution governed by a council which includes representatives of the main scientific institutions and agricultural stakeholders¹. Its main mandate is AR, which occupies more than 90% of the time of the senior research staff. AR undertaken is in all major fields: field crops, horticulture, crop protection, animal production and health, food technology, and socioeconomics. LARI also conducts some development activities (production of quality seeds, soil analysis, food quality control, etc.).

Human, Physical and Financial Resources - In 1975, LARI had 55 researchers (supported by 66 technicians). This number was highly affected by the civil conflict and sharply reduced through immigration, retirement and death, and through the low salaries and benefits which were not conducive for retaining the remaining research staff. Till 1995, attempts to recruit researchers were hampered by governmental restrictions and by the low salaries. Realizing that most of the researchers were over 50 years old, the Government recently recognized the importance and urgency of new recruitments, offering competitive salaries.

LARI currently (April 1998) has around 329 national permanent full-time staff, including:

- 49 graduate research staff, of whom 48 are nationals (18 PhD, 15 MS, and 15 BS and equivalent diploma in veterinary degrees and chemical engineers), and one expatriate, who represent 44 pRYs²;
- 50 laboratory and field technicians and 230 other supporting staff (clerks, accountants, laborers, etc).

The new recruited senior researchers are mostly fresh graduates from European universities (mainly France, the United Kingdom, Italy and Germany) and are of the age group of 30–40 years. They receive salaries comparable to those of professors at the national university, which range between US \$1000 and 1500 monthly. The research assistants are also young fresh graduates (BS and MS) from Lebanese, Arab or European universities.

The current ratio of technicians per researcher is around 1, which is below the accepted standard of 2 technicians per researcher, whereas the ratio of other support staff per researcher is around 5, which is slightly higher than the general standard of 3–4.

The Institute operates through seven experimental stations (Tal Amara, Terbol, Kfardane, Kfarshakhna, Abdeh, Sour, Fanar; total area: 280 ha), located in all the agroecological zones of the country. The stations are divided into units or sections either by discipline or by crop. During the years of civil conflict, all research stations suffered from intensive loss in most physical resources such as buildings, farm machinery, field and laboratory equipment, transport vehicles, supplies and support services. Towards the end of 1990, rehabilitation of all stations started, beginning with the main station of Tal Amara. At present, the main stations have generally sufficient land allocated for field research, relatively adequately equipped laboratories, and some transport vehicles. What is still not available are the research support services such as libraries, documentation centers, computer networks, maintenance and repair workshops for equipment and machinery, genebank collections, etc.

The actual annual governmental budget allocated to LARI for 1997/98 amounted to around US\$ 3 million³, of which 60% was allocated to salaries and 40% to operation/capital costs (OCC). The contribution of NCSR through contracted research projects (around US\$ 10,000) and the support through bilateral and multinational donors (estimated at US\$ 250,000, without considering fellowships) were essentially allocated to OCC. Accordingly, OCC amounted to around US\$ 1.26 million, i.e., around US\$ 26,000 per pRY, which allows an actual full employment of the researchers⁴.

Research Activities and Linkages - Although researchers were recruited at LARI from various disciplines, there are still several areas of research in which specialists are missing and accordingly research is lacking. These include, among others, horticulturists, fruit tree breeders and postharvest technology specialists, nematologists, animal breeders and veterinary doctors, ecologists and forestry specialists, economists, sociologists, statisticians and computer specialists. Disciplines required are clearly described in the 1996 national Lebanese Agricultural Research

¹ Among the members: representatives from MOA, some FAs, and the private sector, besides the LARI Director General.

² pRYs = Number of researchers on duty × 90% (percentage of the researchers' time devoted to AR).

³ The LARI official budget was double, but only one-half of it was actually allocated.

⁴ Which means a slightly higher amount per pRY, very close to the "optimal" amount of OCC used in the long-term plans drawn up by some developing countries in similar agroecological conditions, estimated at US\$ 25,000–30,000 per pRY.

Strategy (LARS, 1996). Although research at LARI has been oriented towards the projects proposed by LARS, the very limited recruitment of researchers since that time did not allow the fulfillment of the proposed goals.

Cooperative research projects at LARI are implemented in various fields with some foreign/international institutions: wheat, barley, grain legumes, pasture and forage with ICARDA; olive propagation and improvement with FAO; quality control on food and water with FAO; plant protection (insect male sterile technique on the citrus Mediterranean fruit fly) with IAEA and in collaboration with NCSR; certification program for fruit tree production with CIHEAM; etc. International agencies such as FAO, UNDP and ICARDA, who sponsored LARI in the past, are expected to continue their support for local and regional development and progress.

Several other collaborative projects are being conducted with regional institutions, mainly in Syria (citrus and sugar beet improvement research), as well as with national institutions, such as all the FAs, NCSR, and various ministries.

NCSR - National Center for Marine Sciences (NCMS)

NCMS currently has 15 national permanent staff, including 11 researchers (3 PhD, 4 MS, 4 BS)¹ and 3 technicians. Research in NCMS is conducted on biological oceanography, aquaculture and environmental monitoring studies on fresh and seawater.

The Center is furnished with laboratory equipment needed for conducting basic studies in freshwater and the coast, but is in need of further laboratory equipment, a boat to conduct studies at further depths of the sea, and of more researchers, technicians and administrators.

Research at NCMS is usually done in cooperation with national institutions such as the Ministries of Agriculture and Environment, the Lebanese Army Marine, and the national FA, as well as some European and Syrian research institutions. Several research projects are undertaken with the support and collaboration of international and Mediterranean organizations and networks.

2.3 The Faculties of Agriculture

Overview - The four FAs are:

- The Faculty of Agricultural Sciences of the Lebanese University (FAS): It is the unique public FA; it mobilizes 32 permanent national academic staff (22 PhD, 8 MS and 2 BS including research assistants) and around 42 part-timers; it hosts 240 students.
- The private Faculty of Agricultural and Food Sciences of the American University of Beirut (FAFS/AUB): It is the oldest FA, with around 40 full-time academic staff (24 PhD, 3 of whom are expatriates, 6 MS and 10 BS), supported by 3 part-time academic staff members and 7 part-time research assistants; among its 300 students, around 77 are graduate (MS studies).
- The private *Ecole Supérieure des Ingénieurs Agronomes Méditerranéens* of the Saint Joseph University (ESIAM/USJ): It has a small permanent academic staff (5 nationals, including 3 PhD and 2 MS; 2 expatriates), supported by 32 part-time staff (coming mostly from FAS); its total student body is around 80.
- The private *Faculté des Sciences Agronomiques du Saint-Esprit* (FSA/USEK): It is the youngest FA, with a limited permanent academic staff (10 nationals: 3 PhD, 5 MS, 2 BS), supported by 47 part-timer staff (coming also mostly from FAS); it hosts 160 students.

All the FAs offer BS or “*ingenieur*” degree (5 years). FAFS/AUB also offers an MS degree. A new joint DEA program (equivalent to MS) has been recently set up by the French-speaking universities (FAS, ENSIAM, FSA) with the support of AUPELF and France (which provide teaching/research staff coming mainly from INRA and INAP/G)²; during the academic year 1996/97, 12 students were registered for this DEA program.

Resources - The four FAs have 89 academic and senior research staff members, of whom 84 are nationals, including 49 PhD and 21 MS holders. They form the large majority of the highly qualified staff of the NARS.

¹ The Center also has 5 senior researchers from other institutions (mainly the Faculty of Sciences of the Lebanese University: see Section 2.4), who collaborate on a project basis.

² AUPELF: *Association des Universités Parlant Entièrement la Langue Française* (Association of the Francophone Universities). INRA: *Institut National de Recherche Agronomique*, INA P/G: *Institut National Agronomique de Paris-Grignon*.

All of the private FAs enjoy relatively good physical resources. The public FAS enjoys good laboratory facilities developed mainly through international cooperative programs and donations from France and Italy, but does not have a training and research farm. FAFS has a well-equipped Agricultural Research and Educational Center (AREC) of an area of 120 ha located at Haouch Sneid (Bekaa Valley), which includes experimental and production fields; greenhouses; poultry houses; dairy cow, sheep and goat barns; machinery sheds and workshops; lecture halls; laboratories; offices; dormitories; a cafeteria; and faculty residence buildings. ESIAM has faculty teaching and laboratory buildings in Taanayel, the Bekaa, and has a large farm (200 ha) with fruit tree orchards, vineyards, fields, and animal barns designated for production, student training and research activities; its laboratories are furnished with modern equipment sponsored by the French Government.

The financial resources of the FAs come from a number of sources (government allocation, national private sector, self-generated resources, external funds), which have been roughly estimated at more than US\$ 1.8 million, including US\$ 1 million from national sources and 0.8 from external sources (which definitely sponsor a large part of the financial resources at ESIAM and FSA).

Research Activities - Research is recognized to be as important as education by the FAs, which have rather good comparative research advantages over other institutions. These are the presence of highly qualified scientists, good physical facilities, need for students to undertake a research project to fulfill their graduation requirements (during the fifth year for FAS, ESIAM and FSA, and during the MS graduate program at FAFS). However, AR in the FAs suffer from a number of major constraints and limitations, which are mainly:

- The lack of research policy of the FAs.
- The limited availability of academic staff members for research activities, due to the heavy teaching loads induced by the rather high number of students (an average of 9 students per permanent academic staff member in the four FAs) and, often, to the needs (with regard to their low salaries) for getting complementary income through extra-hour courses or other activities.
- The lack of skilled technicians and the limited national and external funds for research.
- Limited financial research resources, coming mainly from low internal university funds, research contracts with NCSR, cooperation projects with LARI, local private sector, or external support (bilateral agencies, international AR centers).

Accordingly, AR is currently carried out mainly by young staff members and graduate students, with limited direct involvement of the academic staff (especially in ESIAM and FSA); and it seems realistic to consider that the FAs actually dedicate around 10 to 20% (as an average) of their human and financial resources to AR, which means that the four FAs represent around 9 to 18 actual RYs.

2.4 Other NARS Institutions

Outside the FAs, other public and private faculties have highly qualified scientists in AR-related fields (plant and animal biology, agricultural engineering, food processing, rural social sciences); a precise inventory of this scientific potential and these research activities is not available, but 16 academic staff members are currently benefiting from research funds from NCSR, including 12 at the Faculty of Sciences of the Lebanese University, involved part-time in research on hydrobiology and entomology; and 4 at the Department of Biology of AUB, involved in research on crop biology, water management and animal physiology. Two researchers from the National Center for Remote Sensing of the NCSR are involved in a research project on crop production, funded by NCSR.

The Tobacco Monopoly (*Régie des Tabacs*), a public enterprise, is conducting research on tobacco, but no published information is available on the related activities and resources.

3. AR RESOURCES

3.1 Human Resources

In 1997 the Lebanese NARS involved 159 scientific and technical senior graduate staff (including 5 expatriates), who represent around 83 potential RYs (see Table 1).

Among the national senior staff, around 78 have a PhD degree (49%), 52 an MS (33%), and 29 a BS (18%). The level of academic training is quite good in all the FAs (58% with PhD) and less at LARI (38% with PhD). The recent improvement of the status and salaries of LARI researchers opens possibilities for better equilibrium in the future.

NARS scientists are highly concentrated in and around Beirut (64% of the total graduate staff), but LARI is contemplating allocating a large part of the newly recruited researchers in stations in other parts of the country.

Salaries of researchers in the NARS vary between the public and private institutions. Recently, LARI was able to attract new research staff by providing salaries that are comparable to those of the academic staff at FAS. In both public institutions, however, salaries are still way below (almost half) those at the private FAs.

In all the Lebanese NARS institutions, there is still a need for highly qualified and trained technicians and the number of supporting staff is relatively on the lower end.

3.2 Physical Resources

The research activities in Lebanon are implemented in a network of laboratories and research stations that are rather well distributed, with research stations in the coastal areas (Beirut/Fanar, Sour, Abde, Kfarshakha of LARI and the main laboratories of FAFS and FAS in Beirut), and three in the inland country: Tal Amara, Terbol and Kaa (LARI), Haouch Sneid (FAFS/AUB), and Taanail (ESIAM/USJ).

As previously mentioned, physical resources are generally adequate for adaptive and some basic research, especially at LARI, FAFS/AUB, and ESIAM/USJ, and new equipment is being purchased or provided through foreign assistance. Research support services, which include libraries and documentation centers, computer networks and statistical analysis facilities, and workshops for maintaining and repairing expensive equipment, are still generally less satisfactory.

3.3 Financial Resources (see [Table 1](#))

Despite the difficulties faced in collecting precise data related to the financial resources, the total (national and external) AR financial resources of the NARS in 1997 was roughly estimated at around US\$ 3.75 million, of which US\$ 3.25 million came from national sources (mainly the government budget, some self-earned institution resources, and donations by private sector organizations in support of special research activities), and US\$ 0.5 million from external funds essentially secured through bilateral or multilateral grants.

The NARS national and total resources amounted to around 0.20% and 0.23%, respectively, of the Agricultural Gross Domestic Product (AGDP estimated at US\$ 1.6 billion in 1996). These ratios are much far from the 1 or 2% recommended for developing countries by some international organizations (World Bank, EU); they show that Lebanon is certainly giving low attention to AR.

It is also worth to mention that, except at LARI, most of the NARS institutions suffer low research operating and capital budgets, which prevent the full employment of their scientific potential. Thus, the total number of actual RYs of the NARS may reach around 60, against the 83 pRYs estimated above.

4. RESEARCH ACTIVITIES

4.1 Lines of Research

Food crops, vegetables, fruit trees, roots and tubers are among the most favorite AR areas. In livestock research, poultry, cattle and veterinary medicine received good efforts, while sheep and goats attract medium efforts. There is a definite shortage of research activities in forestry (agroforestry, wood processing, natural and plantation forests), other animals (rabbits, pigs) and freshwater fish, and, to a lesser extent, in ornamental and medicinal plants, and in farming systems and catchment area management.

The national AR strategy prepared in 1996 with the support of ISNAR and IDRC provides a valuable reference for better equilibrium in the future.

In general, scientists may handle several research projects at one time as most of them are working part-time on research. Their involvement is thus too diluted and their efficiency limited, particularly at the FAs where the objectives of the research projects are largely identified and chosen more on a personal-interest basis than according to the priority needs of the agricultural sector.

AR results of the NARS are published in various scientific journals; international, regional or national. Commonly, research undertaken at the FAs is published in refereed journals and, to a lesser extent, in the scientific publications of NCSR. Previously, LARI had several publications of its own, which, however, were discontinued during the years of

the war. Research results are also presented in bulletins of the NARS institutions, in national and international scientific congresses and meetings, as well as during the annual presentation sessions of the contracted research projects of NCSR.

4.2 Relations with Development and International Cooperation

These relations are, on the whole, quite satisfactory. The private sector is very active and covers many gaps unwillingly neglected by the research institutions. Research findings are directly transferred to the farming community in the following areas: cereals, root crops, pastures, grain legumes, veterinary medicine, plant nutrition and pest management. Hybrid seed, tissue culture and biotechnology output also reach the former via the multi-channel system available in the country (public and private institutions, and the private sector).

As public and local governmental staff and extension agents are few, local, national and international NGOs¹ are playing an increasing role in transferring AR results to the farmers in the various regions of the country as well as in obtaining feedback from the rural community as to their technology adoption and prioritization of needs, and even in applied and field research. The socioeconomic context, usually underestimated by the NARS scientists, is a major component in the approach of the NGOs who are better suited to facilitate local contacts and speed up the spread of on-farm research. NGOs often have good relations with the NARS.

Cooperation emphasizes all possible ways to accomplish better research results and expand it to areas presently not well covered. There exists excellent cooperation with regional and international centers (AARINENA, ACSAD, CIHEAM, ICARDA, CIMMYT, ISNAR, IPGRI, etc.) and organizations (FAO, UNDP, the World Bank, IDRC, etc.). Bilateral cooperation with developed countries (France, Italy, USA) is also important for the NARS.

5. CONCLUSION

The NARS of Lebanon is almost as old as independence. Over the past 15 years, three new faculties of agriculture were established to add to the formerly existing institutions. The Ministry of Environment and the Ministry of Culture and Higher Education (MCHE) have added more awareness to agricultural and urban practices, which negatively contribute to natural balances in living organisms and to environmental hazards. Rebuilding infrastructure and manpower is a time-consuming process, and the shortage in qualified staff is evident in almost all institutions. What was accomplished in the past few years should be credited to all Lebanese individuals, communities and authorities.

Some important accomplishments have been achieved during recent years such as the recruitment in the various NARS institutes of young, highly qualified researchers; the new infrastructure developed, especially at LARI; the development of the Lebanese AR Strategy; the establishment by NCSR of the National Center for Remote Sensing and the National Atomic Energy Center, which could both provide support to AR in the near future.

However, the NARS is currently suffering major constraints, including the very insufficient levels of national and external resources, the weak coordination between the various NARS institutions, the lack of coordination with respect to international cooperation, the absence of a clear national agricultural policy and of an efficient and effective agricultural extension service, and the lack of basic reliable national data (on population and economic indicators as well on natural resources and agriculture).

¹ Local NGOs involved in agricultural development are: Aarsal Rural Development Association (Bekaa region), Green Triangle (south Lebanon), Social Youth League (north Lebanon); they get financial support commonly from international NGOs or through associated projects with the universities and ministries, often via the “national” NGOs. The main NGOs working at the national level are Greenline Association (environmental/agricultural/cultural heritage group; mostly agricultural professors and students from UAB), the *Société pour la Protection de la Nature* (SPN; environmental association), Liban Nature and Environment (LINEE; an environmental awareness organization which campaigns with schools), and Green Forum; these receive funds from international agencies through association in research and development projects with universities, ministries, and international research organizations. The international NGOs concerned in Lebanon are Oxfam, Save the Children Federation, World Vision, etc., supported by funds mostly from USA or sometimes European agencies.

Main Acronyms

MOA: Ministry of Agriculture. **MCHE:** Ministry of Culture and Higher Education. **NCSR (CNRS):** National Council for Scientific Research.

AUB: American Univ. of Beirut. **ESIAM:** Ecole Supérieure d'Ingénieurs Agricoles Méditerranéens. **FAFS:** Faculty of Agricultural and Food Sciences. **FAS:** Faculty of Agricultural Science. **FSA:** Faculté des Sciences Agronomiques (Agric. Faculty). **LARI:** Lebanese Agric. Research Institute. **LU:** Lebanese Un.. **NCMS:** National Center for Marine Sciences. **USEK:** Un. Saint-Esprit de Kaslik (Holy-Spirit University). **USJ:** Un. Saint-Joseph

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

Italics: Approximate data. ...: Data not available.

NARS Institutions				AR Scientific & Technical Graduate Senior Staff (Units)			AR Potential Res. Years		Total Budget (1000 US\$)		AR Expenditures/Resources (E) (1000 US\$)				
No.	Name - Acronym Head Office - Year Established	Mandates AR Fields	Govern. Ministry	Nationals Total - (PhD , MS)		Exp.	Total	Nat.	Exp.	Nat.	Ext.	Nat. NE	For. FE	Total TE	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	
1.1	Lebanese Agricultural Research Institute Tal Amara/Beirut	LARI 1957	AR (90%) - (AD) All	MA	48	18 , 15	1	49	43	1	3,100	250	2,950	250	3,200
2.1	National Center for Marine Sciences/NCSR Batroun	NCMS/NCSR 1975	AR (90%) - (AD) Oceanog., fisheries	NCSR/PM	11	3 , 4		11	10		70	50	60	50	110
1/2	Total Agricultural Research Institutes				59	21 , 23	1	60	53	1	6070	250	3,010	300	3,310
3.1	Faculty of Agricultural Sciences/Lebanese Univ. Beirut	FAS/LU 1985	AHE - AR (25%) All	MCHE	32	22 , 8		32	8		300	50	200	200	400
3.2	Fac. of Agricultural and Food Sciences/American Univ. Beirut, Beirut (private status)	FAFS/AUB 1952	AHE - AR (25%) All	MCHE	37	21 , 6	3	40	9	1	600	150			
3.3	Ecole Sup. d'Ingénieurs d'Agronomie Medit./Univ. St-Joseph, Beirut (private status)	ESIAM/USJ 1979	AHE - AR (10%) All	MCHE	5	3 , 2	2	7	1	1	50	500			
3.4	Fac. des Sciences Agronomiques/Univ. St-Esprit Kaslik, Jounieh (private status)	FSA/USEK 1988	AHE - AR (10%) All	MCHE	10	3 , 5		10	3		100	100			
3	Total Agricultural Sciences Faculties				84	49 , 21	5	89	21	2	1050	800	200	200	400
4.1	Faculty of Sciences/Lebanese Univ., Beirut	FS/LU 1985	AR (25%) :	MCHE	12	... , ...		12	4		...	...	40		40
4.2	Department of Biology/Amer. Univ. Beirut, Beirut	DB/UAB 1952	Diverse (see text)	MCHE	4	... , ...		4	1		...	...	
4.3	National Center for Remote Sensing/NCSR Beirut	19...	Remote sensing	NCSR/PM	2	... , ...		2	1		...	...	
4	Total Other NARS Institutions				16	8 , 8		16	6	0	...	...	40		40
6	Total NARS		Total --->		159	78 , 52	6	165	80	3	...	...	3,250	500	3,750
			Private (included in total) --->		56	... , ...	5	61	14	2			150	150	300
Exchange Rate: US\$ 1 = LL 1545 (1996 average rate)				Total NARS Actual Research Years (aRY) (Estimate) --->				60							

MA: Ministry of Agriculture. **MCHE:** Ministry of Culture and Higher Education. **NCSR:** National Council for Scientific Research. **PM:** Prime Minister. **NCSR (CNRS):** National Council for Scientific Research.
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.). **h, j:** Potential research year (pRY) = equivalent full-time researcher; for the FASS, the pRYs have been estimated by multiplying the number of academic staff by 0.25. **m:** For the AR institutes, AR financial resources have been roughly estimated through the following formula: Total budget × [ω + 0.5(100% - ω)], ω being the % of time devoted to AR by the graduate staff'.

National AR expenditures (NE): **0.20%** of the Agricultural Gross Domestic Product (AGDP: US\$ 1.6 billion in 1996). Total AR expenditures (TE): **0.23%** of the AGDP.