THE NATIONAL AGRICULTURAL RESEARCH SYSTEM OF JORDAN[1]

1. HISTORICAL BACKGROUND

The importance of **agricultural research** (AR) has been recognized early by the Government of Jordan. The first AR station was established in Deir Alla in the Jordan Valley in 1951 and was followed, in the 1950s, by several research stations in the various agroecological zones of the country.

Research programs were initially formulated and carried out by the various technical divisions of the Ministry of Agriculture (MOA): agronomy, horticulture, plant protection, and animal husbandry. In 1958, MOA established the Department of Scientific Agricultural Research, which became responsible for all research activities previously undertaken by the technical divisions of the Ministry.

In 1970, research and extension were merged into one department, the Department of Scientific Research and Agricultural Extension. In 1985, as a result of MOA restructuring, this department was replaced by the National Center for Agricultural Research and Technology Transfer (NCARTT), which later strongly benefited from the National Agricultural Development Project (NADP), funded by the Government of Jordan and USAID.

Agricultural higher education (AHE), with its AR-related activities, started in 1972 with the inception of the Faculty of Agriculture (FA) at the University of Jordan (UOJ), then with the foundation by UOJ in 1974 of the Marine Science Station (MSS) of Aqaba, and in 1982 of the Research Center for Water Studies, renamed as the Water and Environment Research and Study Center (WERSC) in 1992. Later, four other faculties of agricultural sciences were established: FA (1986) and Faculty of Veterinary Medicine (1990) at Jordan University of Science and Technology (JUST), FA at the private Jerash University (1993), and FA at Muta University (1994).

2. THE CURRENT NARS

2.1 Overview (see Table 1)

The Jordanian NARS is made up of two main sets of institutions:

- The scientific institutions which have AR as their central mandate: NCARTT, WERSC, and MSS. These institutions account together for around 67% of the potential research years (pRYs: equivalent full-time researchers) and 79% of the total financial resources of the NARS; they are presented in Section 2.2.
- The five faculties of agricultural sciences, which are more or less involved in AR, accounting for 25% of pRYs and 18% of the total financial resources of the NARS (see Section 2.3).

Few other scientific and technical institutions allocate some resources to AR (around 8% of the pRYs and 3% of the total financial resources of the NARS). These are briefly presented in Section 2.4.

NCARTT is responsible for coordinating all AR and technology transfer activities in Jordan. The Higher Council for Science and Technology (HCST), an autonomous institution established in 1983 and governed by a council chaired by the Crown Prince, is responsible for the national scientific policy, but has a marginal role in AR; it mainly funds AR activities carried out by various institutions of the NARS.

2.2 The AR Institutions

The National Center for Agricultural Research and Technology Transfer (NCARTT)

Mandate

NCARTT is the largest NARS institution (around 61% of the pRYs and 66% of the total financial resources of the NARS). It is an autonomous public institution governed by a council chaired by the Minister of Agriculture[2].

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[2] The membership consists of NCARTT Director General, Secretary General of the Higher Council of Science and Technology, MOA Secretary General, a representative of the Ministry of Planning, a representative of the Ministry of Water and Irrigation, a professor from each of the faculties of agriculture at the public universities, and an individual with experience in the field of scientific research, appointed by the Minister for a period of two years, extendible one time.

According to the Agricultural Policy Charter (November 1996), NCARTT has two main mandates. The major mandate is AR, which mobilizes around 70% of the time of the senior staff; NCARTT carries out applied and adaptive activities in all AR fields, alone or in collaboration with other scientific and technical organizations in and outside Jordan. The second mandate is technology transfer; NCARTT provides technical expertise and backstopping for extension institutions and departments in the form of technical support, publications and recommendations, as well as training for extension personnel, on-farm trials and demonstrations, and provides a mechanism for a regular two-way flow of information and feedback between researchers, extension agents and producers.

Resources

NCARTT has currently (June 1998) around 595 national permanent full-time staff, of whom 173 are scientific and technical graduate staff, who represent around 121 pRYs [1], and 29 technicians. The remaining is support staff (clerks, accountants, laborers, etc.).

The rather low qualification of the 173 graduate staff (16 PhD, 70 MS, 87 BS) can be explained by the large past difference of salaries from those of university staff (salaries of researchers with PhD could be as low as 50% of equivalent academic scientists). However, this situation is changing with the recent improvement (1996) of the -graduate training (17 and 18 are preparing MS and PhD degrees, respectively, at the University of Jordan, Amman).

The ratios of technicians and other support staff to researcher (0.16:1 and 2.3:1, respectively) are much under the general agreed upon standards (2 and 34, respectively); however, many BS holders are actually working as technicians.

The Center operates through:

- of the PhD holders) is concentrated, and includes the central offices, laboratories and library;
- 6 Regional Centers for Agricultural Research and Technology Transfer (RCARTT) located in the major agricultural regions of Jordan (Mushagar, Deir Alla, Rabba, Shoubak, Ramtha, Khaldiah), each endowed with a main building (offices, auditorium and laboratories), a farm-machinery unit, a transport unit and a large experimental farm; and
- 12 research stations associated with this network.

In general, research facilities (offices, labs, farms, equipment, vehicles, etc.), information services, and land resources (total: 12565 ha) are good.

NCARTT financial resources have considerably evolved during the past years. During the period 19871994, the Center benefited from large resources provided by the National Agricultural Development Project (NADP), funded by the Government and USAID, which allowed the physical development of its headquarters and regional centers [2]. After this period, resources largely decreased until 1996[3]. In 1997, they started to steadily improve reaching around Jordanian dinars (JD) 3.4 million (US$ 4.85 million), of which JD 2.5 million came from national sources, JD 0.2 million from a new World Bank loan (US$ 0.9 million for 4 years used for purchasing equipment and training), and JD 0.7 million from external grants (EU, UNDP, etc.); such resources (allocated almost equally between salaries and other costs) are considered sufficient for covering almost all the research needs of the researchers on duty. With the scheduled foreign grants, the financial prospects for the next years look rather excellent.

Research Activities and Linkages

The main research thrusts cover irrigated agriculture (25 researchers), rainfed crops (51), animal production (9), natural resources (16), and technology transfer and economics (4); the remaining researchers are distributed among other units (plant genetic resources, integrated pest management, etc.). Compared with the breakdown proposed by the National Strategy for Agricultural Research and Technology Transfer formulated in 1996 (see Section 4.1), rainfed crops and natural resources appear to be slightly favored at the expense of animal production and technology transfer/economics.

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[1] pRYs = Number of researchers on duty H 70% (percentage of the senior staff time devoted to AR).

[2] At its launching, this Project aimed to develop agriculture in the highlands; later, it expanded to include the Jordan Valley. The scheduled amount of the Project was US$ 62.3 million, including a USAID contribution of US$ 27.5 million (consisting of grants of US$ 20.5 million for facilities, operation, technical assistance, and a loan of US$ 7 million for buildings) and a Government contribution of US$ 30 million (for staffing, land, operational expenses). The national contribution was not fully provided; however, it steadily increased throughout the years (from US$ 1.2 million in 1987 to 2 million in 1993) (see Leroy, 1991).

[3] In 1996, NCARTT resources amounted to JD 2.26 million (US$ 3.19 million), coming mainly from the government budget (JD 2.19 million), with very limited external grants (JD 70,000: GTZ, UNDP, etc.). The operation/equipment budget (around JD 4,400 or US$ 6,300 per pRY) could not cover the research needs and implied a rather large underemployment of the staff.

Scientific cooperation with the other NARS institutions, considered insufficient some years ago[1], has increased, especially with the UOJ Faculty of Agriculture, as a result of the improvement of the financial situation of NCARTT which allowed the association of the academic staff members with the research programs of the Center. Being part of MOA, NCARTT has strong linkages with extension and directorates of agriculture in the governorates of the Kingdom. NCARTT has always given strong attention to scientific relations with institutions of developed countries (USA, Germany, etc.) and intern
collaborative research programs.

The Water and Environment Research and Study Center (WERSC, UOJ)

WERSC is an autonomous institution supervised by a Board of Directors whose members are chosen by the UOJ Council of Deans from inside and outside the University based on their interest in water and environmental issues.

Resources

The Center has 20 full-time scientists on duty (6 PhD, 6 MS, 8 BS), and 3 more preparing PhD degrees outside, who dedicate around 60% of their time to research, 30% to education, and 10% to other activities (services: soil/water analysis; consultancies). Only about 60% of the research activities at WERSC are AR-related (the other 40% concern hydrology, urban water and pollution issues, etc.). Therefore, an equivalent of about 8 full-time WERSC scientists are actually involved in AR. WERSC also mobilizes 20 part-time UOJ staff members working around 20% of their time at the Center (5 from FA, 15 from other faculties). Thus, the pRYs of WERSC amount to 10 (of which 2 come from the other UOJ institutions).

The permanent support staff is limited (3 lab technicians, 3 laborers, 1 secretary); but WERSC uses laborers from the farm of the UOJ Faculty of Agriculture (FA) located in the Jordan Valley.

WERSC physical resources at the UOJ campus are good. It has permanent access to the large water treatment plant close to Amman, and to physical resources of other UOJ units (labs and farm of FA, labs of the Faculties of Sciences and of Medicine).

In 1997, WERSC total annual financial resources amounted to JD 780,000, of which 230,000 came from national sources[2] and 550,000 from foreign grants (through projects funded by the USA, UNDP, EU, Canada, the Netherlands, etc.). The total annual financial resources allocated to AR amount to (approximately) JD 400,000. The operational/equipment budget (around JD 670,000 or US$ 940,000) is largely allocated to research activities, and is considerably high (about US$ 40,000 per pRY).

Research Activities and Linkages

AR projects deal with irrigation at the farm level, water harvesting, and use of wastewater for irrigation (6, 3 and 3 full-time scientists, respectively). They benefit from strong international scientific support. Linkages with the UOJ units (FA, Faculty of Sciences, etc.) are important and are developed through the mobilization of permanent and part-time staff coming from these units. Linkages with NCARTT are rather weak.

The Marine Science Station (MSS) of Aqaba

This Station, which is affiliated to UOJ and Yarmouk University, has 5 full-time researchers (all PhD holders) and 18 support staff (technicians, clerks, etc.), good physical facilities (including seven labs, a research boat, and the Marine Nature Reserve surrounding the Station, with access limited to scientists), and a national budget of JD 200,000.

MSS conducts research activities on oceanography, marine chemistry and pollution, coral reef ecology, fish biology, fisheries and aquaculture. It has published recently two books on the fishes and corals of the Gulf of Aqaba.

2.3 The Five Faculties of Agricultural Sciences (FASs)

Overview

The five FASs are:

- The FA at the University of Jordan (FA/UOJ): It is the oldest and largest FAS with 229 permanent national employees, including 74 academic staff (all nationals, including: 54 PhD, 20 MS), 44 technicians and 111 other support staff (clerks, laborers).

[1] See Snobar and Duwayri (FAO, 1996).

[2] Including about JD 70,000 for salaries, JD 50,000 from UOJ for operation/capital, and JD 110,000 from other sources (Jordan Corporation for Environmental Protection, Higher Council for Science and Technology).

- The FA (40 academic staff, including 2 expatriates) and FVM (23 academic staff, including 12 expatriates) at the Jordan University of Science and Technology (JUST), based at Irbid in the north.
- The FA at Muta University (19 academic staff, including 3 expatriates), in Kerak in the south.
- The FA at the private University of Jerash (24 academic staff, including 6 expatriates), located midway between Amman and Irbid.

The four public universities are autonomous public or semi-public institutions of the Ministry of Higher Education; the private university is governed by a Council of Deans. The main activity of the FASs is teaching: all grant BS degrees, FA/JUST grants also MS degrees, and FA/UOJ MS and PhD degrees.

There are 181 academic staff members with high qualifications in the five FASs: among them are 157 nationals (114, 30, and 13 with PhD, MS, and BS, respectively); and all the 24 expatriates have PhD degrees. Altogether they represent 49 potential RYs [1].

Research Activities

The availability of highly qualified staff and of students who could be associated with research activities (particularly from the graduate study programs) offers large comparative advantages for the FASs to implement AR programs; however, research is constrained by several factors (Snobar and Duwayri, 1996):

- Staff members with PhD degrees are appointed mainly for teaching. Therefore, when they carry out research, it is mostly based on individual initiatives and for academic advancement purposes rather than for the development of the agricultural sector.
- Research at the universities lacks coherent policies and management structures.
- Time available for research is rather limited because of the heavy teaching loads dictated by the excessively high numbers of students: at FA/UOJ and FA/JUST, enrollment totaled 1430 and 600 students, respectively, in 1996/97 (ratio of students to academic staff member 12:1 and 15:1).
- Research resources are rather limited: technicians are scarce (only 0.6 per staff member at FA/UOJ, and 0.3 at FA/JUST) and mainly mobilized by 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.
- Contacts are limited between academic staff members and farmers or extension agents in the field. Therefore, AR activities carried out at the FASs are often not of problem-solving nature, or, when they are, results often remain in publications and not readily available to farmers, and therefore not applied.

So far, only FA/UOJ has been actively engaged in AR (some 500 papers published in various agricultural disciplines since 1972). It is worth mentioning the Jordan Arid Zone Productivity Project (JAZPP), funded by the European Union (US$ 0.9 million for 5 years, of which US$ 0.35 million was in 1997) and implemented with NCARTT[2]. AR

ble impact, particularly in improvement of cereal, food legume and forage production

particularly the Muta and Jerash FAs which have not yet established research facilities. As a consequence, the time actually allocated to research at the FASs should not exceed 10 or 15%, which would give 20 to 30 actual RYs for the five FASs.

1 opted for the analysis of all the WANA NARS (see methodology of the study).

2 JAZPP is an applied research project concerned with improving agricultural productivity in a zone of Jordan that receives between 100 and 200 mm of rain annually. Its approach combines: (i) Evaluation of natural resources at the level of small drainage catchment leading to land use recommendations for each catchment, (ii) Development and testing of appropriate production methods, and (iii) Socioeconomic evaluation of proposed technical acceptability (JAZPP Newsletter, April 1998). JAZPP mobilizes 33 senior team members (20 academic staff members mainly from FAO/UOJ, 5 NCARTT researchers, and 8 professional staff members from MOA) who allocate an average of around 10% of their time to the project, 32 other people (mostly trainees and students from UOJ), and 1 expatriate (research coordinator).

2.4 The Other NARS Institutions[1]

The Other Faculties (Sciences, Economics, etc.)

Some faculties of sciences and economics have a relatively large number of staff members who are highly qualified in AR-related scientific fields (natural resources, plant and animal biology, agricultural engineering, food processing, rural social sciences). A precise inventory of this potential is not available, but according to a rough survey, this number should reach at least 40 academic staff members (including those of the UOJ Faculty of Sciences involved in the AR research activities of WERSC), who represent 10 pRYs.

The Agricultural Marketing Organization (AMO)

AMO, established in 1962 (restructured in 1987), is a semi-autonomous public institution governed by a Board of Directors chaired by the Minister of Agriculture. Its mandate covers marketing policy formulation as well as the provision of several technical and regulatory services framed to develop the marketing system. AMO has a Directorate of Studies and Information and a Directorate of Post-harvest Technology. During the last years it has carried out several market studies that addressed marketing issues of fresh fruits and vegetables. Its 27 full-time senior staff (1 PhD, 10 MS, 16 BS) allocate around 25% of their time to AR.

3. AR RESOURCES

3.1 Human Resources (see Table 1)

In 1997, the Jordanian NARS included almost 450 scientific and technical senior graduate staff (including 24 expatriates), representing around 198 potential RYs.

Out of the 358 national senior staff members of the NARS agricultural scientific institutions (AR institutes and FASs), 141 have PhD degrees (39%), 109 MS (31%) and 108 BS (30%). The level of academic training is quite good at the FASs (73% with PhD degrees) but insufficient at the AR institutes (only 13% are PhD holders, and 9% at NCARTT). The recent improvement of the status and salaries of the NCARTT researchers opens possibilities for better equilibrium in the future.

The high concentration of the scientific potential in and around Amman, justified when the NARS had few qualified staff and limited physical facilities, has decreased throughout the last 10 years with the creation of the NCARTT regional centers and the FASs of the Universities of Irbid, Muta and Jerash. However, it remains too high: NCARTT headquarters and the NARS institutions based in the capital (WERSC, FA/UOJ, AMO) concentrate about 60% of the total senior graduate staff and of the total pRYs, and this ratio is much higher for the PhD holders.

In general, the numbers and skills of technicians and other support staff (laborers, clerks) are insufficient due to the very low salaries offered by the public institutions and to the possibilities for technicians to prepare higher diplomas.

3.2 Physical Resources

The most important physical resources of the NARS are within the NCARTT units (headquarters, regional centers, farms), which are rather well-equipped and evenly distributed in the country. The FASs are less endowed, with the exception of FA/UOJ.

In general, land is sufficient, libraries/documentation services are considered satisfactory, but the other physical resources (offices, farm buildings, laboratories; scientific/computer/transport/communication equipment) will require efforts in the near future for maintenance and/or modernization.

3.3 Financial Resources

In 1997 (see Table 1), the total NARS AR financial resources amounted to around Jordanian dinar (JD) 4.3 million (US$ 6.1 million), of which JD 3 million (US$ 4.3 million) came from national sources (mainly the Government budget, and some self-earned institution resources and donations by private sector organizations in support of special

[1] The following list does not include: (i) the Royal Scientific Society, established in 1970, now one of the HCST research and development institutions, which does not have a section for agriculture, but its agriculture-related activities include the analysis of pesticide residues, recycling of plastic material, and industrial pollution; nor (ii) the private sector: some agricultural and agro-industrial companies have established their own experimental stations, mainly used for testing new crop varieties or agricultural inputs before their release to farmers (a precise inventory of their AR activities and resources should be done).

research activities), JD 0.15 million as a loan (from the World Bank to NCARTT), and JD 1.14 million (US$ 1.6 million) from external grants, essentially secured through bilateral or multilateral donors.

The AR national and total resources amounted to around 0.72 and 1%, respectively, of the Agricultural Gross Domestic Product (AGDP estimated at US$ 600 million in 1996). Such ratios are close to the 1% recommended by some international organizations and are above those registered in most of the WANA countries.

NCARTT and WERSC currently enjoy good financial resources and can provide sufficient means to their researchers on duty. On the other hand, the FASs suffer from low operating and equipment research budgets, which prevent (with other factors) a fair mobilization of their scientific potential. Therefore, the NARS should account for around 120130 actual RYs (about 80 for NCARTT, 8 for WERSC, 2030 for the FASs) against the 198 pRYs estimated above. This statement pledges for an increase of the national financial resources to take into account the needs of the NCARTT and WERSC researchers now on study leaves, the research needs of the FASs, and for keeping an acceptable balance with the foreign grants.

4. RESEARCH ACTIVITIES

4.1 Research Orientation

The National Strategy for Agricultural Research and Technology Transfer, formulated by NCARTT in 1996 with the support of ISNAR and ICARDA, mandated the universities with basic research, while NCARTT was mandated to focus on applied research and transfer of technology. It organized research along three dimensions: production-system research (irrigated agriculture, rainfed agriculture, low rainfall areas, and integrated livestock), commodity research (vegetables, fruits, field crops, etc., forest, sheep and goats, cattle, etc.), and non-commodity research (water resources, soil and land resources, etc.). The main research thrusts favored are irrigated agriculture (23% of the RYs), rainfed agriculture (17%), low rainfall areas (19%), integrated livestock (22%), plant genetic resources (8%) and water management and environment (11%). Forestry and food technology are not adequately covered in the strategy.

This strategy is being followed by NCARTT, but does not serve as an active reference for the FASs and the other NARS institutions.

4.2 Linkages and Collaboration

Linkages between the NARS institutions are achieved through different means (memberships in councils, participation of FAS staff members in the NCARTT research committees, joint research activities and publications by scientists from different institutions, joint field days, seminars), but not through a well-defined system.

A recent review of research and technology transfer activities indicated a substantial gap in the linkages between the NARS institutions, which resulted in duplication of effort and waste of resources. It recommended setting up a broad-based research committee able to strengthen linkages and coordination among these institutions and to determine where AR efforts can best be allocated to meet the most urgent research and technology transfer needs.

Relationships with development agencies, extension services and farmers are, in general, well-established for NCARTT, primarily through the MOA Directorate of Agricultural Extension and Information (AEID, established in 1993), which is mandated to carry out agricultural extension activities and to cooperate with NCARTT in technology transfer and dissemination[1]. The mandate of the FASs does not include any form of institutional relationship with extension services or farmers; thus, contacts with farmers and extension workers are made essentially on an individual basis according to the research outputs available.

International cooperation is widely developed for most of the NARS institutions. It provides technical or financial assistance for training and research activities or for information, and for collaboration with the CGIAR centers (among them, ICARDA is the most important), scientific institutions from developed countries (UK, Germany, USA, etc.), and from neighboring countries. These relationships are strongly supported by international aid agencies (UNDP, World Bank, IFAD, EU, etc.) and by regional organizations (AARINENA, ACSAD, AOAD).

5. CONCLUSION

NCARTT and FA/UOJ are only 13 and 25 years old, respectively. It is dominated by the two main institutions or sets of institutions represented by NCARTT and the FASs, which have complementary characteristics. NCARTT has relatively low-qualified scientists but is endowed with other good human (technicians, support staff), physical, and financial resources. On the other hand, the FASs

[1] This Directorate has recently developed a National Strategy for Agricultural Extension, which will be implemented from 1998.

enjoy an excellent reputation in the region with regard to the quality of their academic staff and graduate students, but such record is not matched in the research area for which research support staff and physical/financial resources are very limited. In these conditions, the weakness of their linkages means a rather unsatisfactory use of the total available resources.

The adoption, in 1996, of a National Strategy for Agricultural Research and Technology Transfer was an important achievement that should put AR in Jordan on the right track, as it identified the national efforts to be devoted to the different subsectors of agriculture, determined the roles of the NARS institutions and their contributions to those efforts, and identified the most appropriate linkages and cooperation modalities among these institutions and between the NARS and the extension services. This should help to achieve stronger interrelationships and active complimentarity, which should be the only proper way to address national issues under the constraints of limited financial resources. However, such objectives require the adoption of numerous measures aimed towards progressive association and integration of the human, physical and financial resources of the two main institutions of the NARS.

The pressure on the agriculture sector in Jordan is increasing due to increasing land fragmentation, continued shortage of water and deterioration of its quality, encroachment of urbanization on prime agricultural land, competition at the international markets, etc. AR will be needed more and more for properly addressing such issues. The growth of the NARS and the development of its capacity will be highly dependent on the quality of output and satisfaction of the clients, and also on the solution of the current dual structure of the NARS, which is necessary for improving the efficiency of the scarce financial resources available.

Main Acronyms

MHE: Ministry of Higher Education. **MOA**: Ministry of Agriculture.

FASs: Faculties of Agric. Sciences (= FAs + FVM/JUST). **FA**: Faculty of Agriculture. **JUST**: Jordan Univ. of Science and Technology (Irbid). **NADP**: National Agric. Devel. Project. **NCARTT**: National Center for Agric. Res. and Technology Transfer. **UOJ**: Un. of Jordan (Amman). **WERSC**: Water and Environment Res. and Study Center.

JD: Jordanian dinar (1 JD = US$ 1.41).

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

a: Most of the human resources: 1998; most of the financial resources: 1997. *Italics*

NARS Institutions				AR Scientific & Tech. Graduate Staff (Units)				Potential Research Years*			Total Budget (1000 JD)		AR Expenditures/Resources (E) (1000 JD)			
No.	**Name** - Acronym Head Office - Year Established	**Mandates** **AR Fields**	**Govern.** **Ministry**	**Nationals** Total - (PhD , MS)		**Exp.**	**Total**	**Nat.**	**Exp.**	Total	**Nat.**	**Exp.***	**Nat.** **NE**	**Loan** **LE**	**For.** **FE***	**Total** **TE**
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q
1.1	National Center for Agr. Res. & Technology Transfer NCARTT Amman 1951-85	AR (70%) - (AD) All	MOA	173	16 , 70	0	173	121		121	2500	900*	2100	150	600	2850
2.1	Water/Environment Research & Study Center WERSC Amman (UOJ) 1982	AR (40%) - R - HE Water	UOJ/MHE	23*	6 , 9	0	23	8		8	230	550	120		280	400
2.2	Marine Science Station MSS Aqaba (UOJ, YarmoukUniv.) 1974	AR (80%) - (AD) Fisheries	UOJ-YU/ MHE	5	5 , 0	0	5	4		4	200		150			150
1/2	**Total AR Institutes**			**201**	**27 , 79**	**0**	**201**	**133**		**133**	**2930**	**1450**	**2370**	**150**	**880**	**3400**
3.1	Fac. of Agriculture, Univ. of Jordan (UOJ) FA/UOJ Amman 1962, 73	AHE - (AR: 30%) All	MHE	74	54 , 20	1*	75	19	1*	20	930	400	*230*		*200*	*430*
3.2	Fac. of Ag. , Jordan Univ. of Sc. & Technol. (JUST) FA/JUST Irbid 1986	AHE - (AR: 30%) All	MHE	38	27 , 1	2	40	10	1	11	630	60*	*190*		*20*	*210*
3.3	Fac. of Veterinary Medicine, JUST FVM/JUST Irbid 1990	AHE - (AR: *25%*) Anim. prod./health	MHE	11	*11* , 0	12	23	3	4	7	430	40	*110*		*10*	*120*
3.4	Fac. of Agriculture , Muta University FA/MU Karak 1994	AHE - (AR: 10%) All	MHE	16	7 , 4	3	19	4	1	5	150	*20*	*10*		*10*	*20*
3.5	Faculty of Ag., Jerash University FA/JU Jerash 1993	AHE - (AR: 10%) All	Private	18	15 , 3	6	24	5	1	6	170	*40*	*10*		*10*	*20*
3	**Total Agricultural Sciences Faculties**			**157**	**114 , 30**	**24**	**181**	**41**	**8**	**49**	**2310**	**560**	***550***		***250***	***800***
4.1	Faculties of Sciences, Economics - UOJ, JUST, ...*	HE - R (AR) Diverse*		*40*	*30 ,10*		*40*	*10*		*10*			80		-	*80*
4.2	Agricultural Marketing Organization AMO Amman 1962-87	AD - AR (25%) Rural economics	MOA	27	1 , 10	0	27	6		6	80	40	20		10	30
4	**Total Other Institutions**			***67***	***31 , 20***	***0***	***67***	***16***		***16***	**80**	**40**	***100***		**10**	***120***
5	**Total NARS** (approximate)			***425***	***172 , 129***	***24***	***449***	***190***	***8***	***198***			***3020***	**150**	***1140***	***4310***
Exchange Rate: 1 Jordanian dinar (JD) = US$ 1.41, US$ 1 = 0.71 JD (*1996* average rate)				**Actual Research Years** (aRYs) (Estimate) →				***120130***			**AR Expendit.** (million US$) →		***4.3***	***0.2***	***1.6***	***6.1***

MOA: Ministry of Agriculture. **MHE**: Ministry of Higher Education.

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. **n**: For the AR ω + 0.5(100% - ω)], ω being the % of time devoted to AR by the graduate staff'. **p:** For estimating the external grants, the cost of the expatriates is calculated on the basis of the average cost of national scientists.

* **Notes**: **1.1**: NCARTT: **m:** Including the World Bank loan. **2.1**: WERSC/UOJ: 23 full-time scientists, of whom 3 are preparing PhD outside + 20 part-time UOJ academic staff members (of whom 5 are from FA) counted in lines 3.1 and 4.1. **3.1**: Researcher. **4.1**: Only academic staff members specialized in AR-related sciences (including the 15 ones from the UOJ Faculty of Sciences working part-time with WERSC) are mentioned.

National AR expenditures (NE): **0.72**% of the Agricultural Gross Domestic Product (AGDP: US$ 0.6 billion in 1996). Total AR expenditures (TE): **1**% of the AGDP.