

SYRIA

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This country brief reviews the major investment and institutional trends in agricultural research in the Syrian Arab Republic in recent years, drawing from data collected under the Agricultural Science and Technology Indicators (ASTI) initiative (IFPRI 2004–05). The brief also compares results with an earlier study by Al Ahmed (1999).¹

INSTITUTIONAL DEVELOPMENTS

The Syrian Arab Republic (hereafter, “Syria”) is a lower middle-income country in the Middle East with a population of 18 million people. Syria’s gross domestic product (GDP) is primarily derived from oil and agriculture, both of which are subject to considerable uncertainty due to fluctuating world oil prices on the one hand, and water shortages on the other (World Bank 2005a). In 2003, the agricultural sector constituted 23 percent of GDP and employed about 30 percent of the country’s labor force. Agricultural products as a share of exports averaged 14 percent during 1999–2002 but varied considerably from one year to the next. Cotton is the principal cash crop, followed by cereals, vegetables, fruits, and tobacco (World Bank 2005b; FAO 2005; Encyclopedia of the Nations 2005).

Table 1—Composition of agricultural research expenditures and total researchers, 2003

Type of agency	Spending		Researchers (fte’s)	Share		Agencies in sample ^a (number)
	2000 Syrian pounds (millions)	2000 international dollars		Spending (percent)	Researchers	
<i>Public agencies</i>						
GCSAR ^b	842.9	50.3	1,160.0	67.6	74.4	1
Other government ^{c,d}	197.6	11.8	143.6	15.8	9.2	5
Higher education ^{d,e}	197.7	11.8	247.7	15.8	15.9	7
Subtotal	1,238.1	73.9	1,551.3	99.3	99.6	13
<i>Private enterprises^f</i>						
	9.3	0.6	7.2	0.7	0.4	2
Total	1,247.3	74.4	1,558.5	100	100	15

Sources: Compiled by authors from ASTI survey data (IFPRI 2004–05).

^a See note 2 for a list of the 15 agencies included in this sample.

^b Until May 2003, GCSAR funding was administered by MAAR; hence, total spending was estimated based on the remaining eight months of the year.

^c “Other government” includes the General Organization for Seed Multiplication (GOSM), which is officially a nonprofit organization. The 274 staff at the four government agencies and one nonprofit institution spent between 10 and 100 percent of their time on research, resulting in 143.6 fte researchers.

^d Expenditures for GOSM and the seven higher education agencies were estimated based on the combined average expenditures per researcher for GCSAR and the four other government agencies.

^e The 993 professional staff at the seven higher education agencies spent between 20 and 25 percent of their time on research, resulting in 247.7 fte researchers.

^f Expenditures for the business enterprises were estimated using partial spending data for one of the two enterprises.

KEY TRENDS

- During 1998–2003, Syria’s agricultural research staff and spending rose steadily.
- The principal agricultural research agency in Syria, the General Commission for Scientific Agricultural Research (GCSAR), constituted about two-thirds of the country’s agricultural research staff and R&D spending in 2003.
- Only one-quarter of Syrian agricultural researchers held PhD or MSc degrees, which is very low compared with most developing countries.
- Agricultural research in the higher education sector remains weak but is slowly gaining emphasis in agricultural colleges.
- Private-sector involvement in agricultural R&D in Syria is limited.

ABOUT ASTI

The Agricultural Science and Technology Indicators (ASTI) initiative comprises a network of national, regional, and international agricultural R&D agencies and is managed by the International Service for National Agricultural Research (ISNAR) division of the International Food Policy Research Institute (IFPRI). The ASTI initiative compiles, processes, and makes available internationally comparable data on institutional developments and investments in public and private agricultural R&D worldwide, and analyses and reports on these trends in the form of occasional policy digests for research policy formulation and priority setting purposes.

Funding for the ASTI initiative’s survey round in North Africa and the Middle East region was provided by the CGIAR Finance Committee/World Bank, IFPRI unrestricted funding, and the U.S. Agency for International Development (USAID).

About 30 percent of Syria's total land area is cultivated, but only 10 percent is irrigated. Consequently, agricultural production is extremely dependent on rainfall, which has hindered further development of the sector, and in turn the national economy. A serious period of drought occurred in the late 1990s, forcing Syria to import certain crops, such as barley and maize, mainly as animal feed. To expand irrigated land area, the Syrian government increased its investments in development of irrigation schemes, but this process is not expected to be completed until 2015. Water basins are currently insufficient to fulfill the often unsustainable demand for water, which is exacerbated by fast-growing urban water usage (Encyclopedia of the Nations 2005; World Bank 2005a).

We identified 15 agencies involved in agricultural R&D in Syria in 2003; together these agencies employed 1,558 full-time equivalent (fte) researchers and spent more than 1.2 billion 2000 Syrian pounds that year—equivalent to 74 million 2000 international dollars (Table 1).^{2,3} Accounting for more than two-thirds of the country's total agricultural research spending and staff in 2003, the General Commission for Scientific Agricultural Research (GCSAR) is the country's primary agricultural research agency. The commission was established in 2002 under the Ministry of Agriculture and Agrarian Reform (MAAR) through a merger of nine former research entities (see *A Short History on Government-Based Agricultural Research* below). GCSAR is a semi-autonomous body focusing on field crops, vegetables, natural resources (soil and water), horticulture, pesticides, plant protection, livestock, food industry, and socioeconomics. The commission encompasses seven research administrations, two technical administrations, seven technical departments, and eighteen regional centers.

GCSAR is governed by a board that is chaired by the Minister of Agriculture and Agrarian Reform and comprises the director general, deputy directors, and administration heads of GCSAR; deans of colleges of agriculture and veterinary science; scientific experts appointed by the minister; directors of extension and planning within MAAR; and representatives of

farmer organizations and the State Planning Commission. GCSAR is also responsible for formulating national agricultural research policy. With the merger, it inherited all existing facilities resulting in a network of 18 provincial research centers, 54 research stations, and more than 150 smaller research facilities. Plans are under development to further consolidate this extended network.

Four other government organizations are involved in agricultural research in Syria. The Atomic Energy Commission of Syria (AECS) conducts research related to agricultural biotechnology, crop breeding, agronomy, entomology, animal production, and food preservation. AECS falls under the responsibility of the Office of the Prime Minister. In 2003 it employed 58 fte agricultural researchers. The General Organization of Remote Sensing (GORS) under the Ministry of Communications and Technology Transfer conducts research related to remote sensing in areas of geology, geophysics, hydrology, agriculture, and the environment (Al-Ahmad et al. 1999). In 2003, GORS employed 30 fte scientists. The Environmental and Scientific Research Center (ESRC) under the Ministry of Local Administration and Environment is responsible for the country's environmental research. In 2003, it employed 21 fte researchers working on agricultural issues such as soil and water management and the effects of climate and other environmental changes on crops, fisheries, and natural resources. The smallest government agency in terms of research capacity is the General Organization for Tobacco (GOT) under the Ministry of Industry. GOT's research activities include all areas of tobacco production, and in 2003 it employed 5 fte researchers.

The General Organization for Seed Multiplication (GOSM) is an independent, nonprofit organization responsible for the multiplication, sale, and distribution of improved agricultural seeds. GOSM has always undertaken limited research, but since 2002 it has intensified its activities, mainly in the area of developing new techniques for multiplying potato tuber seed and adapting date palm seedlings to the local environment. In 2003, the agency employed 30 fte researchers.

A Short History of Government-Based Agricultural Research

Formal agricultural research in Syria began in the early 1940s with the establishment of experiment farms at Deir Elhajar and Kharabo, close to Damascus. After independence, in 1946, various MAAR directorates (such as horticulture, forestry, animal resources, and plant protection) began to conduct limited agricultural research. In 1952, the Directorate of Cotton Bureau (DCB) was established to supervise cotton growing, provide quality control of cotton fiber, and conduct research. In 1959, an agricultural research council was established to promote and coordinate MAAR's research activities and minimize duplication across directorates.

In 1964, the Directorate of Agricultural Scientific Research (DASR) was established, taking on responsibility for research activities under MAAR (other than for cotton, which remained with DCB). The Soil Department under DASR and the Land Use and Water Department and Directorate of Agricultural Affairs under MAAR were merged to form the Directorate of Soil (DS) in 1970. The Atomic Energy Commission of Syria (AECS) was created in 1979. MAAR formed a technical committee in 1982 to endorse new varieties of cereals, legumes, and forage crops and to coordinate research activities with DASR, ICARDA, and ACSAD. Several bureaus were established under MAAR in the late 1970s and 1980s focusing on commodities like olives and citrus fruits.

In 1986, the National Remote Sensing Center (NRSC) was established, becoming the General Organization of Remote Sensing (GORS) in 1986; the Department of Irrigation and Water Use was established in 1987, becoming the Directorate of Irrigation and Water Use (DIWU) in 2002 at GCSAR and the Environmental and Scientific Research Center (ESRC) was established in 1994. In 2002, the nine existing agricultural research entities under MAAR (focusing on agricultural research, soils, irrigation and water use, animal production, cotton, citrus, olives, sugar beet, and pomegranates) were merged to form GCSAR.

Seven higher education agencies conduct agricultural research activities in Syria.⁴ Together they employed 248 fte researchers in 2003, representing 16 percent of the country's total agricultural research capacity that year. Given the dominant teaching focus in the education sector, university staff only spend 25 percent (or less) of their time on research. The Colleges of Agriculture at the University of Damascus and the University of Aleppo were established in the early 1960s, while the College of Agriculture at the University of Teshreen in Lattakia was established in 1971. These three colleges have the largest capacity (over 200 professional staff each in 2003), representing between 50 to 61 researchers in full-time equivalents. The University of Aleppo's Second College of Agriculture in Deir Alzor employed 23 fte researchers in 2003, and the College of Agriculture at Al Ba'ath University employed 20 fte researchers. Additional agricultural research is conducted by staff at Al Ba'ath University's College of Veterinary Medicine on animal health issues (25 fte researchers in 2003) and at the Marine Research Center of the University of Teshreen on marine biology and physics (4 fte researchers). Agricultural research conducted by the higher education sector remains weak, mostly related to student theses. Specific projects managed and undertaken by faculty staff are limited. Most universities have inadequate funding and equipment for research. Al-Ahmad et al. (1999), however, report that the situation has improved slightly since the mid-1990s. Research was incorporated into the official mandates of the agricultural colleges, research outputs became part of staff evaluations, and financial and other incentives for the publication of scientific papers were instituted.

Private-sector research is also limited in Syria, though some private companies undertake some evaluation activities. We identified two private companies with research programs. Debbane and Co., a marketer and importer of pesticides, fertilizers, seeds, and equipment, tests new fertilizers and pesticides under local conditions. Similarly, the Agricultural Products Company tests new pesticides and fertilizers, but it also researches methods of improving farming practices and reducing pollution from agricultural chemicals. The research units of both companies are small; Debbane and Co. employed 2 fte researchers in 2003, and the Agricultural Products Company employed 5.

Collaboration among the various agricultural research agencies in Syria is limited, although the situation has improved somewhat in recent years, likely as a result of the creation of GCSAR. Linkages with the higher education sector, nevertheless, remain limited to the employment of graduate students. GCSAR has established linkages with various international and regional organizations. Chief among these is the Syria-based International Center for Agricultural Research in the Dry Areas (ICARDA), with which GCSAR collaborates in areas such as cereal, legume, and natural resource development.⁵ In addition, the director general of GCSAR serves on the board of ICARDA as the Syrian government's representative. GCSAR also has a number of joint programs with the Arab Center for the Study of Arid Zones and Dry Lands (ACSAD), which is located alongside the GCSAR headquarters in Damascus. Programs include research on the

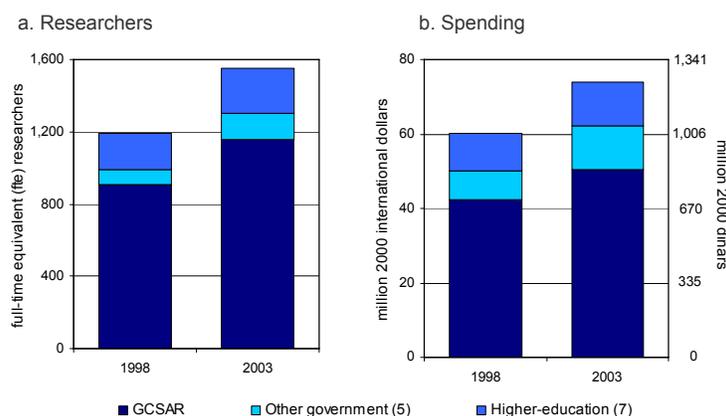
improvement of cereals, sheep, and soils. GCSAR also collaborates with other regional and international organizations on project-based research. Such organizations include the United Nations Food and Agriculture Organization (FAO), the Arab Organization for Agricultural Development (AOAD), the International Fund for Agricultural Development (IFAD), the United Nations Development Program (UNDP), the Global Environmental Forum (GEF), the International Center for Biosaline Agriculture (ICBA), the Japanese International Cooperation Agency (JICA), the International Center for Advanced Mediterranean Agronomic Studies (CIHEAM), the Italian Cooperation Agency, the International Olive Oil Council (IOOC), and the United Nations Industrial Development Organization (UNIDO). Recently GCSAR has also initiated collaboration with agricultural research agencies in neighboring countries in the Association of Agricultural Research Institutions in the Near East and North Africa (AARINENA)

HUMAN AND FINANCIAL RESOURCES IN PUBLIC AGRICULTURAL R&D

Overall Trends

From 1998 until 2003, agricultural spending and researcher numbers grew with 22 and 30 percent, respectively (Figure 1). The increase in capacity was stronger for the other government agencies where fte researcher numbers increased by at least half. GCSAR spending and staffing also increased, though at the lower rate. Overall, average expenditures per researcher totaled at around \$50,000 in 2003. However, this average masks important differences across agencies. Average spending levels at GOR, GOT, and ESRC, for example, were much higher than those at CGSAR. Further, average spending levels per scientist in Syria were much lower than those recorded in Morocco, Tunisia, but similar to those in neighboring Jordan.

Figure 1—Long-term composition of public agricultural researchers, 1998 and 2003



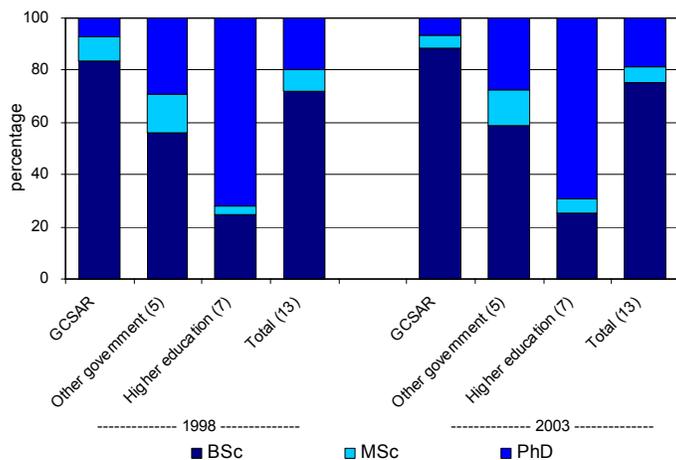
Sources: Compiled by authors from ASTI survey data (IFPRI 2004-05) and Al-Ahmad et al. (1999).

Notes: See Table 1. Figures in parentheses indicate the number of agencies in each category. GCSAR data for 1998 were derived by summing data for five of the nine MAAR entities that were merged to form GCSAR in 2002. "Other government" includes GOSM, a nonprofit institution. Underlying data are available at the ASTI web site (www.asti.cgiar.org).

Human Resources

In 2003, of the near 1,560 fte researchers in a sample of 13 public agencies, 25 percent had received postgraduate training and about 20 percent held doctorate degrees (Figure 2). This was considerably lower than corresponding shares in other developing countries, given the lack of postgraduate training at national universities until the mid-1980s and the resulting high cost of studying abroad. Morocco and Tunisia, for example, reported shares of PhD-qualified staff of over 90 percent, while in neighboring Jordan more than half the fte researchers held MSc or PhD degrees (Stads and Kissi 2005; Stads et al. 2005; Beintema et al. 2006). GCSAR employed comparatively fewer researchers with postgraduate degrees (12 percent) and with doctorate degrees (7 percent). Despite these low qualification levels, most GCSAR staff have worked with the agency and its predecessors for many years, hence they have gained significant experience. Many will be due for retirement in the next decade, however, so staff training remains a priority. As of September 2005, 20 researchers were undertaking PhD training abroad, and more than 125 researchers were pursuing MSc and PhD training at local universities. The share of researchers with postgraduate qualifications is commonly higher in the education sector than in the government sector. This is also the case in Syria, given that 75 percent of the higher education staff hold MSc or PhD degrees. Growth in BSc-qualified staff was comparatively high between 1998 and 2003, hence the share of researchers trained to the postgraduate level fell slightly, from 28 percent in 1998 to the aforementioned 25 percent in 2003. The majority of these new postgraduates are now undertaking MSc training at local universities.

Figure 2—Educational attainment of researchers, 1998 and 2003



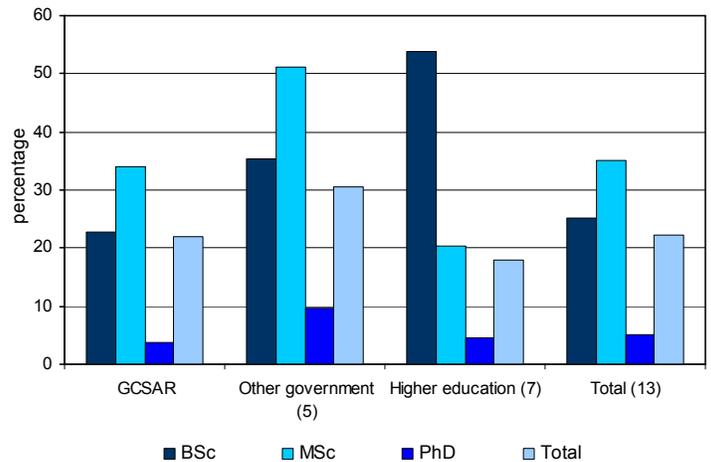
Sources: Compiled by authors from ASTI survey data (IFPRI 2004-05) and Al-Ahmad et al. (1999).

Notes: Figures in parentheses indicate the number of agencies in each category. "Other government" includes GOSM, a nonprofit institution.

Despite a rise in the number of women pursuing scientific careers worldwide, female researchers still tend to be underrepresented in senior scientific and leadership positions (Sheridan 1998), and Syria is no exception. On average, 23 percent of all the fte researchers employed in the public sector in 2003 were female, including 5 percent of all researchers holding doctorate degrees, 36 percent of those holding MSc degrees, and 26 percent of those with BSc degrees (Figure 3). The

comparatively high share of women in the other-government category, at 38 percent, results from high 2003 shares of female researchers at both GORS (63 percent) and GOT (42 percent).

Figure 3—Share of female researchers, 2003

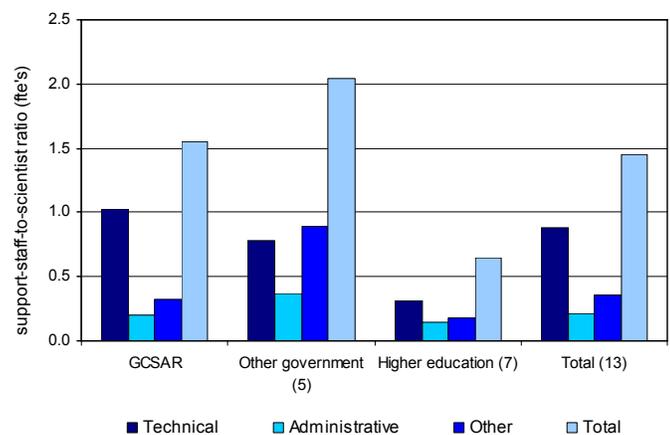


Source: Compiled by authors from ASTI survey data (IFPRI 2004-05).

Notes: Figures in parentheses indicate the number of agencies in each category. "Other government" includes GOSM, a nonprofit institution.

In 2003, the average number of support staff per researcher was 1.4, comprising 0.9 technicians, 0.2 administrative staff, and 0.4 other support staff such as laborers, drivers, and guards (Figure 4).⁶ These ratios are much lower than those of other countries, and, while the support staff ratios were low across all the sample agencies, they were comparatively lower at the higher education agencies. The ratio of other support staff to scientists was particularly low (for example, 0.3 at GCSAR), but GOSM was an exception, reporting 3.4 other support staff per researcher. By way of comparison, comparable numbers of support staff per researcher were 3.9 in Morocco and 6.7 in Tunisia in 2003, while ratios of other support staff per scientist were 2.1 and 5.1 in these countries, respectively (Stads and Kissi 2005; Stads et al. 2005).

Figure 4—Support-staff-to-researcher ratios, 2003



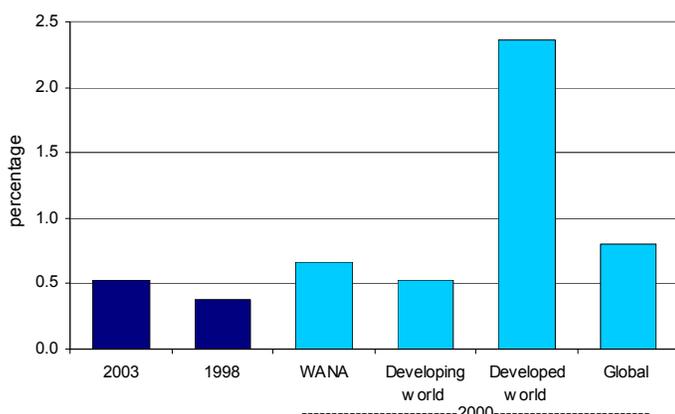
Source: Compiled by authors from ASTI survey data (IFPRI 2004-05).

Notes: Figures in parentheses indicate the number of agencies in each category. "Other government" includes GOSM, a nonprofit institution.

Spending

Total public spending as a percent of agricultural output (AgGDP) is a common research investment indicator that helps to place a country's agricultural R&D spending in an internationally comparable context. In 2003, Syria invested \$0.53 on agricultural research for every \$100 of agricultural output (Figure 5). The intensity in agricultural R&D investments increased during the 1998–2003 period, which resulted from increased agricultural R&D spending and declining agricultural GDP in real terms. The 2003 ratio for Syria was similar to the reported 2000 average for the developing world but lower than the average for West Asia and North Africa (0.66).

Figure 5—Syria's public agricultural research intensity compared regionally and globally



Sources: Syria data are compiled from Figure 1; AgGDP are from World Bank 2005; other intensity ratios are from Pardey et al. 2006.

Since GCSAR's establishment in 2002, salaries have constituted between 40 and 50 percent of total spending. Capital investments have been particularly high, representing a two-thirds share of total spending from 2003 to 2005. This was the result of the construction and renovation of research facilities. The other government agencies reported similar shares of capital investments in the early 2000s.

FINANCING PUBLIC AGRICULTURAL R&D

GCSAR is primarily funded by the Syrian government, through an operating budget, intended to cover salaries and utilities (electricity, and so on), and a much larger investment budget derived from project funding. In recent years, however, the operating budget has been insufficient, forcing the commission to draw on its investment budget to meet the shortfall.

In addition to government funding, GCSAR has numerous ongoing projects jointly implemented and/or funded by international organizations and donors such as the FAO, ICARDA, AOAD, IFAD, UNDP, GEF, ICBA, JICA, CIHEAM, the Italian Cooperation Agency, and IOOC.

(IOOC), and the United Nations Industrial Development Organization (UNIDO).

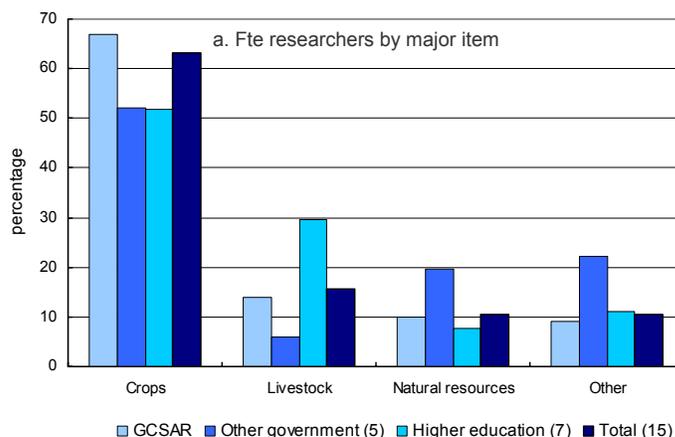
RESEARCH ORIENTATION

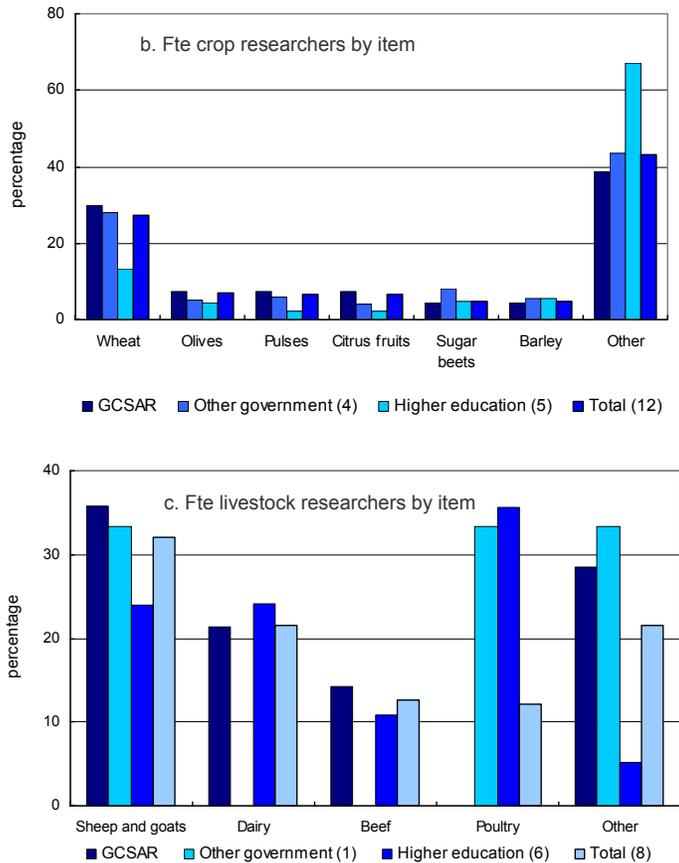
Commodity Focus

The allocation of resources across various lines of research is a significant policy decision; hence detailed survey information was collected on the number of fte-researchers working in specific commodity and thematic areas.

In 2003, 63 percent of the 1,563 fte researchers in a 15-agency sample conducted crop research, 16 percent worked on livestock issues, and 11 percent focused on natural resources (Figure 6a). Researchers at GCSAR spent relatively more time on crop research, while their colleagues in the higher education sector spent relatively more time on livestock research. Crop research in Syria is highly diversified, which explains the high share of "other crops" in the breakdown by crop item (Figure 6b). Twenty-seven percent of fte crop researchers in our sample focused on wheat, while olives, pulses, and citrus fruits accounted for 7 percent each, and sugar beets and barley accounted for 5 percent each. About one-third of the total fte livestock researchers conducted research on sheep and goats (Figure 6c). Other important livestock items were dairy (22 percent), beef (13 percent), and poultry (12 percent).

Figure 6—Commodity focus, 2003



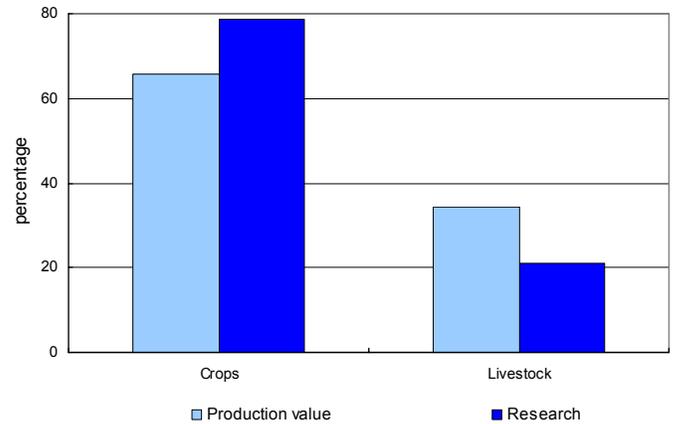


Source: Compiled by authors from ASTI survey data (IFPRI 2004–05).
 Notes: Figure 6b only includes agencies involved in crop research; Figure 6c only includes agencies involved in livestock research. “Other government” includes GOSM, a nonprofit institution. The totals in Figures 6a and 6b include two private companies.

The congruency or parity model is a commonly used method of assessing the allocation of research resources. This usually involves allocating funds (or, in this instance research personnel) among research areas in proportion to their corresponding contribution to the value of agricultural production. For example, if the value of wheat output were twice that of olives, then congruence would be achieved if research on wheat were to receive twice as much funding (or, say, employ twice as many scientists) as olives. The model assumes that an additional dollar spent on research would yield a higher return if spent in areas with a relatively low ratio of research funding to output value, therefore funds should flow toward programs with relatively low research intensities and from those with high research intensities. If research spending or scientist shares were congruent with the corresponding value of output for a particular commodity, then the congruency ratio for that commodity—measuring the commodity share of researchers to the corresponding share of output—would be equal to 1.0.⁷

Figure 7 shows the shares of crops and livestock in gross value of agricultural production with the corresponding share of research staff in these areas. In 2003, 79 percent of the researchers in our subsample conducted crop research—higher than the share of crops in the total value of production (66 percent). The share of livestock researchers was considerably lower than its share in total production value, resulting in a congruency ratio of 0.6.

Figure 7— Congruence between agricultural R&D and production value, 2003



Sources: Figure 6; Production values are from government statistics.
 Note: Crops include postharvest production and research; livestock includes fisheries.

Thematic Focus

Of the 1,563 fte researchers in a 2003 sample of 14 agencies, 11 percent worked on water issues, 11 percent on soil issues, 10 percent on crop genetic improvement, 9 percent on crop pest and disease control, and 9 percent on livestock genetic improvement (Table 2). The remaining researchers were engaged in issues related to other crops (13 percent), other livestock (12 percent), or various other themes. The higher education agencies reported a comparatively lower focus on crop research than the government agencies.

Table 2—Thematic focus, 2003

	Numbers of researchers		Shares	
	GCSAR	Other (13)	GCSAR	Other (13)
	<i>(in fte's)</i>		<i>(percent)</i>	
Crop genetic improvement	116.0	35.3	10.0	8.9
Crop pest and disease control	116.0	22.9	10.0	5.8
Other crop	174.0	29.9	15.0	7.5
Livestock genetic improvement	116.0	19.4	10.0	4.9
Livestock pest and disease control	92.8	36.8	8.0	9.3
Other livestock	174.0	17.3	15.0	4.4
Soil	116.0	52.4	10.0	13.2
Water	116.0	49.3	10.0	12.4
Other natural resources	23.2	48.3	2.0	12.2
Postharvest	0.0	12.2	0.0	3.1
Other	116.0	72.4	10.0	18.3
Total	1,160.0	396.2	100.0	100.0

Source: Compiled by authors from ASTI survey data (IFPRI 2004–05).
 Notes: Figures in parentheses indicate the number of agencies in each category. Table 2 excludes one higher education agency, the Marine Research Center at the University of Teshreen, for which data were unavailable.

CONCLUSION

Overall, agricultural research staff and expenditures in Syria increased in 2003 compared to the 1998 level. Nonetheless, research intensity levels in Syria are still lower than in other countries in West Asia and North Africa. In 2002, the organization of agricultural research in Syria was consolidated with the merger of nine preexisting agricultural research entities under MAAR to form GCSAR, which is largely funded by the national government but receives limited funding for research projects from bilateral and multilateral donors.

Syria has a relatively low percentage of researchers trained to the MSc and PhD levels compared with other Middle Eastern countries and world regions. This is primarily the result of the lack of postgraduate training at Syrian higher education agencies until the mid-1980s. Despite these low qualification

levels, many of GCSAR's researchers are highly experienced due to their longstanding service with MAAR. Many of these senior staff will be due for retirement in the next 10 years, however, so ongoing training remains a high priority.

Agricultural research performed by the higher education sector is generally limited to student theses, although this situation is slowly changing as agricultural colleges incorporate research into their official mandates. While positive steps have been taken, such as establishing incentives toward research, most universities have limited resources in both the facilities and the funding necessary to launch viable research programs.

Insufficient water accessibility is an important constraint for the agricultural sector and water management and related issues are, therefore, significant research areas in Syria.

NOTES

1. The authors are grateful to numerous colleagues in Syria for their time and assistance with the data collection and to Gert-Jan Stads and Kamel Shideed, for their useful comments on drafts of this brief.

2. The 15-agency sample consists of the following agencies:

- five government agencies—the General Commission for Scientific Agricultural Research (GCSAR), the General Organization of Remote Sensing (GORS), the Environmental and Scientific Research Center (ESRC), the General Organization for Tobacco (GOT), and the Syrian Atomic Energy Commission of Syria (AECS);
- one nonprofit organization—the General Organization for Seed Multiplication (GOSM);
- seven higher-education agencies—the College of Agriculture at the University of Damascus; the College of Agriculture and the Second College of Agriculture at the University of Aleppo; the College of Agriculture and the College of Veterinary Medicine at Al Ba'ath University; and the College of Agriculture and the Marine Research Center at the University of Teshreen; and
- two private enterprises—the Agricultural Products Company and Debbane & Co.

This sample excludes some higher education agencies (such as colleges of sciences, economics, and engineering), which may undertake some research related to the agricultural sciences.

3. Unless otherwise stated, all data on research expenditures are reported in 2000 international dollars or in 2000 Syrian pounds.

4. These totals would be slightly higher were the omitted entities referred to in note 2 included. The difference is not significant, however, because these agencies reportedly conduct minimal agricultural research.

5. ICARDA, one of the 15 centers of the Consultative Group on International Agricultural Research (CGIAR), is headquartered in Aleppo.

6. Classification of research and support staff at GCSAR is under reconsideration. Some staff currently classified as "research staff" are being evaluated for reclassification as support staff. This process will be completed around mid-2006.

7. It is important to note, as described in Alston et al. (1998), that the model overlooks key factors affecting the payoff to R&D, such as the differences in probability of research success, likely adoption rates, and the likely extent of research-induced productivity gains. In addition, the model does not account for technology spill-ins from other countries, or differences in costs per scientists among different R&D areas. So, while the congruence rule is both useful for allocating resources and a distinct improvement over precedence and some other shortcut methods, ratios that differ from 1.0 are not necessarily a cause for concern.

METHODOLOGY

- Most of the data in this brief are taken from unpublished surveys (IFPRI 2004-05) and Al-Ahmad et al. (1999).
- The data were compiled using internationally accepted statistical procedures and definitions developed by the OECD and UNESCO for compiling R&D statistics (OECD 2002; UNESCO 1984). We grouped estimates using three major institutional categories—government agencies, higher-education agencies, and business enterprises, the latter comprising the subcategories private enterprises and nonprofit institutions. We defined public agricultural research to include government agencies, higher-education agencies, and nonprofit institutions, thereby excluding private enterprises. Private research includes research performed by private-for-profit enterprises developing pre, on, and postfarm technologies related to agriculture.
- Agricultural research includes crops, livestock, forestry, and fisheries research plus agriculturally related natural resources research, all measured on a performer basis.
- Research personnel numbers are expressed in full-time equivalent (fte) researchers. Fte corrections were made when more than 20 percent of the reported research staff time was spent on activities other than R&D, such as extension, teaching or technical services
- Financial data were converted to 2000 international dollars by deflating current local currency units with a Syrian GDP deflator of base year 2000 and then converting to U.S. dollars with a 2000 purchasing power parity (PPP) index, both taken from World Bank (2005). PPP's are synthetic exchange rates used to reflect the purchasing power of currencies, typically comparing prices among a broader range of goods and services than conventional exchange rates.
- Annual growth rates are calculated using the least-squares regression method, which takes into account all observations in a period. This results in growth rates that reflect general trends that are not disproportionately influenced by exceptional values, especially at the end of the period.

See the ASTI website (<http://www.ASTI.cgiar.org>) for more details on methodology.

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