

SRI LANKA

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This brief reviews the major investment and institutional trends in agricultural research in Sri Lanka since 1994, using data collected under the Agricultural Science and Technology Indicators (ASTI) initiative (IFPRI–CARP 2004-05).¹

INSTITUTIONAL DEVELOPMENTS

Over the past decade, Sri Lanka's traditionally agriculture-based economy has become increasingly dependent on the manufacturing sector, especially the garment industry. Although the relative significance of the agricultural sector has steadily declined in recent years, it is still an important determinant of the country's gross domestic product (GDP). In 2003, agriculture accounted for roughly one-fifth of Sri Lanka's GDP and 13 percent of total exports and it employed about 40 percent of the country's workforce (World Bank 2005; FAO 2005). Indirectly, its importance is larger than these figures indicate because of the extensive links between agriculture, manufacturing, and services. Areas that are indirectly linked to agriculture, such as the production of food, beverages, chemical products, and rubber-based goods, constitute important manufacturing areas. Agricultural research and development (R&D) is therefore granted an important priority by Sri Lanka's government. In 2003, 21 agencies were involved in agricultural research in Sri Lanka.² Combined, these agencies employed 579 full-time equivalent (fte) researchers and spent 1.2 billion Sri Lankan rupees in 2000 constant prices on agricultural R&D, the equivalent of 61 million 2000 international dollars (Table 1).³

Table 1—Composition of agricultural research expenditures and total researchers, 2002

Type of agency	Spending		Researchers (fte's)	Share		Agencies in sample ^a (number)
	2000 Sri Lankan rupees (millions)	2000 international dollars		Spending (percent)	Researchers	
<i>Public agencies</i>						
MALLI	455.8	23.1	338.0	38.1	58.4	8
MPI	484.4	24.6	124.0	40.4	21.4	4
Other government ^b	108.5	5.5	46.0	9.1	7.9	2
Higher education ^c	142.9	7.3	69.2	11.9	11.9	6
Subtotal	1,191.6	60.5	577.2	99.5	99.7	20
Business enterprises ^d	6.2	0.3	2.0	0.5	0.3	1
Total	1,197.8	60.8	579.2	100	100	21

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

^a See endnote 2 for a list of the 21 agencies included in the sample.

^b Fte researcher and expenditure data for FD are estimates based on 2002 data from Giriagama (2004).

^c Expenditures for the higher-education agencies in our sample are estimates based on the average expenditures per researcher of the 14 government agencies. The 225 faculty staff employed in the six higher-education agencies spent between 20 and 33 percent of their time on research, resulting in 69.2 fte researchers.

^d CIC expenditures are estimates based on the assumption that average spending per researcher at private companies is 50 percent higher than the average expenditures per researcher for government agencies.

KEY TRENDS

- Total agricultural researchers in Sri Lanka rose steadily during 1981-2003. Agricultural R&D expenditures showed an erratic upward trend throughout the same period.
- The Sri Lanka Council for Agricultural Research Policy (CARP) oversees research activities of 20 government and higher-education agencies under five different ministries.
- Agricultural research is primarily financed by the government through a dual funding system. The majority of funds are directly provided to the agencies, while funds for strategic research are channeled via CARP through a Competitive Contract Research Grants Program (CCRGP).
- Over the next ten years, three-quarters of Sri Lanka's agricultural research staff is scheduled for training in the South Asian region as part of a regional training program that CARP is coordinating.
- Private-sector research is still small, but increasing through collaborative work with government agencies and the universities.

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.

Primary funding for the ASTI initiative's survey round in Asia was provided by the CGIAR Finance Committee/World Bank.

The Sri Lanka Council for Agricultural Research Policy (CARP) was founded in 1987 as an umbrella agency charged with coordinating country's agricultural research efforts (see *A Short History of Government-Based Agricultural Research* below). Placed under the Ministry of Agriculture, Livestock, Lands, and Irrigation (MALLI), the Colombo-based council formulates Sri Lanka's agricultural research policy; it organizes, coordinates, plans, and executes agricultural research; and allocates funds for contract research. CARP oversees the research activities of the various government and higher education agencies that are placed under five different ministries: MALLI; the Ministry of Plantation Industries (MPI); the Ministry of Fisheries and Aquatic Resources (MF&A); the Ministry of Environment and Natural Resources (ME&NR); and the Ministry of Education (MHE) (CARP 2005).

In 2003, eight research agencies under MALLI were involved in agricultural R&D in Sri Lanka. Combined, they accounted for close to 60 percent of agricultural research staff and nearly 40 percent of R&D spending. Employing 113 fte researchers in 2003, the Horticulture Research and Development Institute (HORDI) is by far the largest agricultural research agency in Sri Lanka in terms of human resources. Headquartered in Gannoruwa, HORDI generates and disseminates technology for the development of the horticulture sector in Sri Lanka. It was established in 1967 as the Central Agricultural Research Institute (CARI), and renamed in 1994 with the restructuring of the Department of Agriculture and the establishment of commodity research centers. The institute encompasses three agricultural research stations, two regional agricultural R&D centers, a fruit crop R&D center, a natural resources management center, a food research unit, and a plant virus indexing center.

Four other government agencies under MALLI each employed 30 fte researchers or more in 2003: the Field Crops Research and Development Institute (FCRDI), the Hector

Kobbekaduwa Agrarian Research and Training Institute (HARTI), the Veterinary Research Institute (VRI), and the Rice Research and Development Institute (RRDI). The 59 fte researchers at FCRDI focus their research efforts largely on field crops and fruits. The institute dates back to the year 1903 and is currently placed under MALLI's Department of Agriculture. FCRDI encompasses the regional agricultural research and development centers at Angunakolapellassa and Aralaganwila and MALLI's Farm Mechanization Research Division. RRDI's aim is to generate and disseminate technologies to improve the productivity and profitability of rice farming as well as the quality of rice. RRDI's 40 fte researchers are spread out over the institute's headquarters in Batalagoda, its regional agricultural research and development center in Bombuwela, and its four research stations scattered over the country. Colombo-based HARTI's 38 fte researchers focus mainly on socioeconomic research and action research on community development. VRI, headquartered in Peradeniya, is the research division of MALLI's Department of Animal Production and Health, and is the only government agency responsible for livestock research in Sri Lanka. In addition to research, the institute is involved in the manufacture of vaccine and various other products required for the sector, and the delivery of specialized services such as disease diagnosis, training, and advisory services (VRI 2004). In 2003, VRI employed 32 fte researchers.

The remaining three government agencies under MALLI each employed 25 fte researchers or less in 2003. The Anuradhapura-based Institute of Postharvest Technology (IPHT) carries out research on all aspects of postharvest technology pertaining to rice, grains, other field crops, fruits, vegetables, spices, flowers, and plants. The 23 fte research staff at the Research Division of the Department of Export Agriculture (DEA) at Matale concentrate largely on the development of appropriate technologies to increase the

A Short History of Government-Based Agricultural Research

Agricultural R&D in Sri Lanka (formerly Ceylon) began in 1822 with the establishment of the Botanical Gardens at Peradeniya by the British colonizers. These gardens served as a focal point for future agricultural development. In 1904, the Ceylon Agricultural Society started to play an important role in promoting plantation and peasant agriculture. This Society initiated trials throughout the country's dry zone to develop better methods of peasant agriculture by introducing mixed farming where livestock and crops were raised.

Three plantation crop research institutes were established under British colonial rule. The Rubber Research Institute (RRI) was founded in 1910 in Agalawatte and is regarded as the world's oldest rubber research institute. Fifteen years later, the Tea Research Institute (TRI) was established in Talawakkale, and the Coconut Research Institute (CRI) was established in 1928 in Lunuwila. The only plantation crop research institute to be founded after Sri Lanka's independence in 1948 was the Sugarcane Research Institute (SRI). It was established in 1984 at Uda Walawe with the relocation of scientific personnel employed by the Research and Development Division of the erstwhile Sri Lanka Sugar Corporation. All four plantation crop research institutes exist today under the Ministry of Plantation Industries (MPI) and have experienced few institutional changes since their foundation.

Established in 1912, the Department of Agriculture (DOA) was the main agency involved in non-plantation crop research. Its research mandate covered more than 100 crops, dispersed over three main research institutes and six agricultural research and development centers. In 1994, DOA was restructured and various commodity research centers were established: the Rice Research and Development Institute (RRDI, formerly the Rice Research Station), the Horticultural Crop Research and Development Institute (HORDI, formerly the Central Agricultural Research Institute), and the Field Crops Research and Development Institute (FCRDI, formerly the Mahailuppallama Research Station). Another reorganization made these institutes semi-autonomous in 1996.

Research in the livestock sector commenced when the Veterinary Laboratory was founded in Colombo in 1911. This laboratory was upgraded to Veterinary Research Laboratory in 1951 and it was moved to Peradeniya in 1959. In 1967, it gained institute status and became the Veterinary Research Institute (VRI).

In the 1970s and 1980s, the research system was expanded to include other aspects of agriculture with the establishment of the Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI, 1972), the research division of the Department of Export Agriculture (DEA, 1973), and the National Aquatic Resources Research and Development Agency (NARA, 1981).

Source: Kirtisinghe (1999).

production, productivity, and quality of export crops (especially spices) with the exception of tea, rubber, and coconut. As already noted, CARP also conducts limited agricultural R&D. In 2003, the council employed 8 fte researchers involved in socioeconomic and policy research.

The four agencies placed under MPI focus on Sri Lanka's principal export crops: tea, coconut, rubber, and sugarcane. Each agency is governed by its respective commodity board and research activities are largely financed through cess proceeds on exports of the respective commodities. The Tea Research Institute of Sri Lanka (TRI) is by far the country's largest agricultural R&D agency in terms of spending. In 2003, the institute accounted for a quarter of agricultural research expenditures of Sri Lanka's 14 government agencies combined. TRI aims to assist in the sustainability of Sri Lankan tea smallholdings and estates through research and extension. In addition to its headquarters in Talawakelle, TRI has five additional research stations located in Sri Lanka's tea-growing districts. The institute employed 39 fte researchers in 2003.

The 34 fte researchers at the Coconut Research Institute (CRI) in Lunuwila develop appropriate crop production, protection, and processing technologies for coconut through basic and applied research. The 32 fte researchers at the Rubber Research Institute of Sri Lanka (RRI) carry out R&D work to increase the productivity of rubber lands and to help the rubber products industry achieve its goals. Research activities are spread out over the institute's headquarters near Agalawatta, and three additional research stations. The Sugarcane Research Institute's (SRI) 19 fte researchers conduct research on the growth and cultivation of sugarcane and the manufacture of any related products.

Two other government agencies conduct agricultural research in Sri Lanka. The National Aquatic Resources Research and Development Agency (NARA), placed under MF&A, is Sri Lanka's only government agency involved in fisheries research. Headquartered in Colombo, NARA has regional research centers in Kalpitiya, Kadolkele, Rekawa, and Trincomalee. In 2003, the agency employed 40 fte researchers. The research division of the Forest Department (FD) under ME&NR is Sri Lanka's principal body involved in forestry research. In 2003, the agency employed 6 fte researchers. It is headquartered in Battaramulla, and has two substations, one in Kumbalpolu and one in Agarattenna. The department's mandate covers the conservation and maintenance of adequate and sustainable forest cover as well as the protection of soil and water resources and biological diversity of the country's forests (Kirtisinghe 1999).

We identified six higher-education agencies involved in agricultural research in Sri Lanka in 2003. Combined, they accounted for 12 percent of agricultural research staff and spending. The Faculty of Agriculture of the University of Peradeniya is the country's principal agricultural faculty. It currently comprises eight departments, one agri-business center, and one agricultural biotechnology center. In 2003, the faculty's 31 fte researchers focused their activities largely on crop and livestock themes, with forestry, fisheries, and socioeconomic themes representing a non-negligible share. The 17 fte researchers of the Faculty of Agriculture of the University of Ruhuna were spread out over six departments and concentrated their research efforts on a variety of themes, principally crops and agricultural engineering. The remaining four higher-

education agencies active in agricultural research in Sri Lanka each employed 7 fte researchers or less in 2003.

Agricultural R&D performed by the private sector in Sri Lanka is negligible. We identified only one private enterprise directly conducting agricultural research in the country. It accounted for less than 1 percent of Sri Lanka's total agricultural researchers and research spending in 2003. CIC Agribusiness, a subsidiary of Chemical Industries (Colombo) Ltd. (CIC), has a well-equipped tissue culture laboratory, where its 2 fte researchers focus on biotechnology, production and marketing of tissue-cultured and other planting materials, and production and marketing of cut flowers and exotic vegetables.

Sri Lanka's agricultural research agencies also participate in a significant amount of collaborative research nationally, regionally, and internationally. The main partners are the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Rice Research Institute (IRRI), the World Agroforestry Centre, and the World Fish Center—all under the Consultative Group on International Agricultural Research (CGIAR)—as well as the national agricultural research centers of Australia, China, India, Japan, Nepal, and Pakistan. The CGIAR centers support Sri Lanka's research programs through funding, while the national agricultural research centers support the research programs through collaboration. These collaborative programs have brought in experts and provided training for local scientists, improving Sri Lanka's national agricultural research system.

HUMAN AND FINANCIAL RESOURCES IN PUBLIC AGRICULTURAL R&D

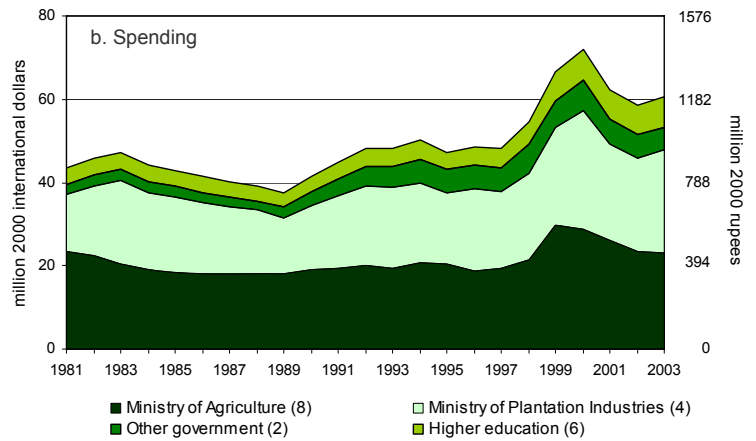
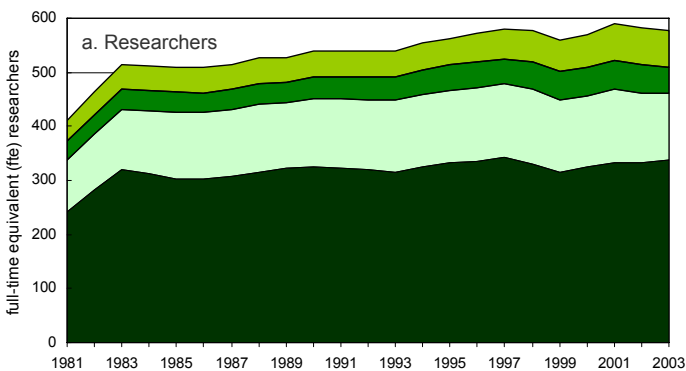
Overall Trends

Besides a temporary drop during 1999-2000 due to restrictions in staff recruitment, the total number of public fte agricultural researchers in Sri Lanka rose gradually during 1981-2003, from 411 in 1981 to 577 in 2003—at an average rate of 1.1 percent per year (Figure 1a). Most of this growth, however, occurred during the 1980s. The growth rate for the higher-education sector was twice the country's average: the total number of fte research staff in this sector rose from an estimated 37 in 1981 to 69 in 2003. Throughout this period, the Faculty of Agriculture and Plantation Management of the Wayamba University of Sri Lanka saw its fte research staff more than quadruple while researcher totals at the Faculty of Agriculture at the Eastern University more than doubled. Fte researcher totals at the government agencies during this period fluctuated between 501 and 524. The stagnating growth rate of combined research staff totals in the government agencies, however, masks the wide differences that exist among the various agencies. Total fte research staff at IPHT, for example, more than quadrupled during 1994-2003 due to a widespread recognition of the importance of postharvest technologies for value addition to agricultural produce. CARP's research staff also doubled during this period as a result of its extended role in disciplines such as plant breeding and biotechnology, plant protection, livestock, fisheries, socioeconomic, and policy analysis. DEA, FCRDI, and SRI, on the other hand, saw their researcher numbers decline by approximately 20 percent each throughout the same period. The reason for the reduction of staff in these agencies was threefold. Firstly, the government imposed a general

restriction on recruitment of staff of all categories (scientific and technical). Secondly, several senior staff with PhD qualifications took up employment at the universities, where salaries and conditions are purportedly better. Finally, many researchers secured employment in foreign research institutions, mainly in Australia, New Zealand, Canada, and the United States.

Agricultural research expenditures in Sri Lanka rose by 2.0 percent annually during 1981-2003 (Figure 1b). After the 2000 peak of \$72 million (due to high investments for the upgrade of laboratories and equipment at TRI, CRI, and RRDI), spending fell by 5.7 percent per year to \$60 million in 2003. Total spending by the four plantation crop research institutes under MPI, the two other government agencies (NARA and the research division of FD), and the higher-education agencies more or less doubled during 1981-2003, while the combined total agricultural R&D expenditures of the eight government agencies under MALLI remained relatively unchanged. However, these averages mask significant disparities between the individual institutes in each category. During 1994-2003, spending at FCRDI fell by nearly half, while expenditures at RRDI and SRI decreased by more than 30 percent, primarily due to staff cuts and lower capital investments. Spending levels at CARP, TRI, and HORDI, on the other hand, rose significantly during the same period. As mentioned earlier, CARP's role has recently been extended and the agency now covers more disciplines than previously. Total R&D spending has risen as a result. TRI's spending nearly doubled throughout 1994-2003. The institute is largely financed by a cess on tea exports, and given increased tea exports, the institute's funds have gradually augmented. HORDI's expenditures fluctuated widely during 1994-2003, but showed an overall increase during this period due to increased funding through CARP and a United States Agency for International Development (USAID) grant for the popularization of underutilized fruit species. In 2003, combined R&D spending by the four plantation crop research institutes under MPI (\$25 million or 41 percent of the

Figure 1—Public agricultural R&D trends, 1991-2003

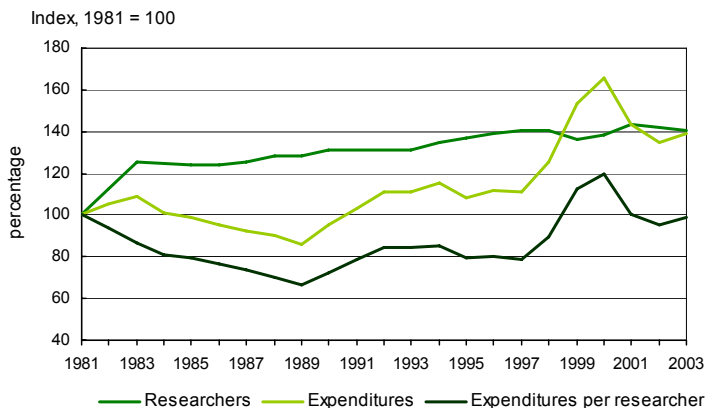


Sources: Compiled by authors from ASTI survey data (IFPRI-CARP 2004-05) and Giriagama (2004). Total research staff and expenditures prior to 1994 are estimated using inter- and extrapolations based on data available for various years and agencies from CARP-ISNAR (1990); Vernon (1989); ISNAR, IFARD, and AOAD (1985); and various other secondary sources.
Notes: See Table 1. Figures in parentheses indicate the number of agencies in each category. Expenditures for the higher-education sector in our sample are estimates based on the average expenditures per researcher of the 14 government agencies. Underlying data are available at the ASTI website (www.asti.cgiar.org).

country's total agricultural research expenditures) was higher than the corresponding level of the eight government agencies under MALLI combined (\$23 million or 38 percent).

A combination of falling agricultural research expenditures and rising research staff caused Sri Lanka's average spending per scientist to decline sharply in the 1980s, from \$106,000 in 1981 to \$71,000 in 1989 (Figure 2). After this low, average expenditures gradually recovered and peaked in 2000 (\$127,000) due to the high capital investments of that year. By 2003, average spending per researcher had declined slightly, bringing it close to the level recorded in 1981.

Figure 2—Trends in public expenditures, researchers, and expenditures per researcher, 1991-2003

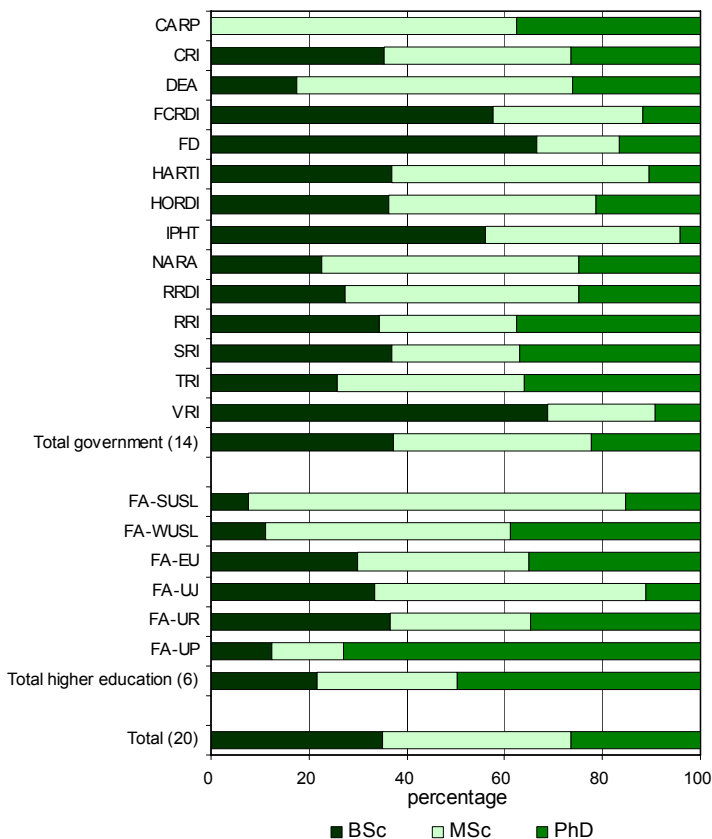


Source: See Figure 1.

Human Resources

In 2003, 64 percent of the 577 full-time researchers in our sample of 20 government and higher-education agencies were trained to the postgraduate level, and 25 percent held PhD degrees (Figure 3). The six higher-education agencies reported a higher share of research staff trained to the postgraduate level (78 percent) than the share reported by government agencies (62 percent). This finding is consistent across most countries in the region and developing countries around the world. However, large discrepancies exist between the various government agencies. In 2003, nearly 70 percent of researchers at VRI and FD for example, were trained to the BSc level. Due to the severe financial crisis in which VRI found itself, many senior and highly qualified research staff members opted for careers abroad or at the neighboring University of Peradeniya, where salaries for senior research staff were reportedly twice as high. Close to 60 percent of research staff at IPHT and FCRDI were also trained to the BSc level. The government agencies with the highest share of researchers trained to the PhD level included CARP, RRI, SRI, and TRI (each between 35 and 40 percent of total research staff).

Figure 3—Educational attainment of researchers, 2003

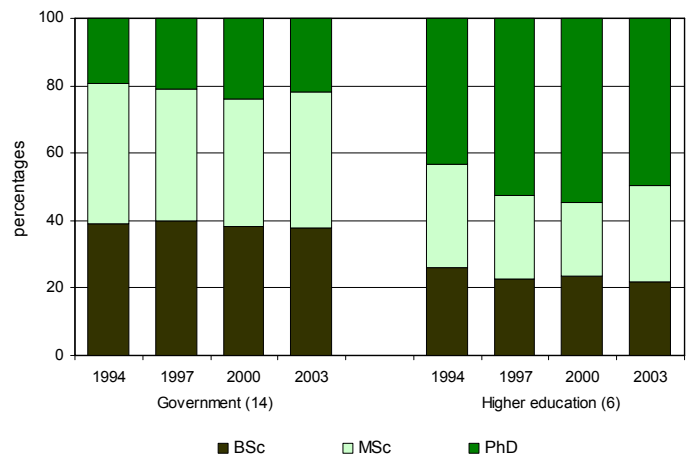


Source: Compiled by authors from ASTI survey data (IFPRI-CARP 2004-05).
Notes: Figures in parentheses indicate the number of agencies in each category. Degree levels for FD are for 2002.

Though research staff at Sri Lanka's six higher-education agencies involved in agricultural R&D were on average much more highly qualified than their counterparts at the 14 government agencies, a large variation in degree levels exists between the different faculties. In 2003, 73 percent of staff at the Faculty of Agriculture of the University of Peradeniya had PhD degrees, a share that was roughly twice as high as the corresponding shares of the Faculty of Agriculture and Plantation Management of the Wayamba University of Sri Lanka, the Faculty of Agriculture of the Eastern University, and the Faculty of Agriculture of the University of Ruhuna (35-39 percent). Though only 15 percent of research staff at the Faculty of Agricultural Sciences of the Subaragamuwa University of Sri Lanka held PhD degrees in 2003, this faculty had the highest share of staff trained to the postgraduate level (92 percent). Two-thirds of researchers at the Faculty of Agriculture of the University of Jaffna had postgraduate training in 2003, with just 11 percent holding PhD degrees.

Long-term educational levels of research staff of the 11 government agencies for which time-series data were available did not evolve much during 1994-2003 (Figure 4). In contrast, the share of researchers with PhD degrees at the six higher-education agencies increased rapidly from 43 percent in 1994 to 55 percent in 1998. After that it fell back to 50 percent in 2003 as a result of a rapid increase in the number of scientists holding a MSc degree. In recent years, many of the staff with doctorates left Sri Lanka seeking better employment opportunities elsewhere. This was particularly true for the younger holders of PhD degrees qualified in disciplines of current importance, such as biotechnology, plant breeding, postharvest technology and food processing, and value addition.

Figure 4—Long-term educational attainment of research staff (1994-2003)



Source: Compiled by authors from ASTI survey data (IFPRI-CARP 2004-05).
Note: Figures in parentheses indicate the number of agencies in each category. Degree level data for FD and VRI for 1994 were interpolated based on data for 1989 and 1996. Degree levels for CRI for 1994-2000 were estimated using the trend for the 13 other government agencies.

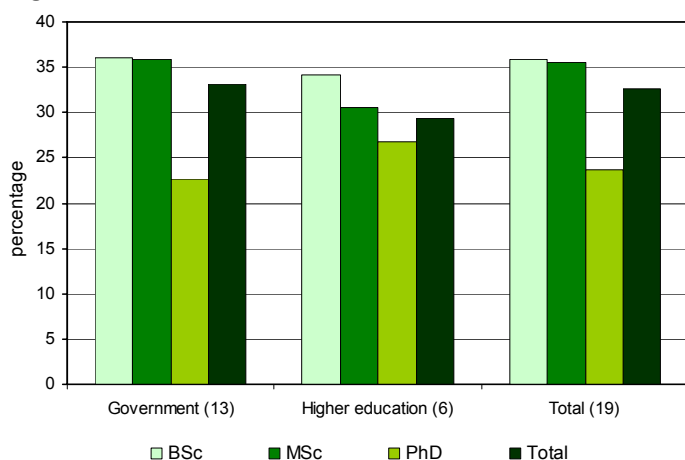
In 2002, close to half the researchers in Sri Lanka's 14 government agencies were 46 years or older, and only 15 percent were under 35 years of age (Girihagama 2004). Most researchers holding PhD degrees found themselves in the older age bracket. Given the high share of researchers approaching

retirement age, policymakers should start planning the replacement of these retiring researchers. The upgrading of MSc research staff to PhD level is also an area that requires special attention.

Since 2002, the national government has provided an annual allocation of roughly 40 million current Sri Lankan rupees to CARP for postgraduate training in other South Asian countries. CARP has entered into Memoranda of Agreement with the Indian Council for Agricultural Research (ICAR), the Nepal Agricultural Research Council (NARC), and the Pakistan Agricultural Research Council (PARC) to hold training programs. The training is either short or long term. Short-term training is aimed at updating the knowledge and skills of scientists in priority disciplines, whereas the long-term training is for postgraduate education. As of early 2005, a total of 42 Sri Lankan scientists received training to the MSc level and 38 to the PhD level as part of the long-term training programs. Training in countries in the region is advantageous because it is of high quality, relevant to local conditions, and comparatively cheap. Furthermore, the chance that trainees will return to Sri Lanka after training in South Asia is greater than if they trained in developed countries. Therefore, the Sri Lankan government's present policy is to conduct postgraduate training of agricultural scientists in other South Asian countries. Seventy-five percent of the scientists are slated for training within the next 10 years.

Despite a rise in the number of women pursuing scientific careers worldwide, females still tend to be underrepresented in senior scientific and leadership positions (Sheridan 1998). Sri Lanka is no exception in this regard. In 2003, 33 percent of Sri Lanka's total fte researchers in a 19-agency sample were female, ranging from 24 percent of those holding doctorate degrees to 36 percent of all researchers trained to the MSc and BSc levels (Figure 5). This share is similar to the share recorded in other Asian countries such as Malaysia and Vietnam. The share of female researchers at the higher-education agencies (29 percent) is lower than the corresponding share recorded at the 13 government agencies (33 percent), indicative of the fact that female research staff is on average more lowly qualified than their male counterparts. In 2003, 18 percent of the female researchers in Sri Lanka held PhD degrees, compared to 29 percent of their male colleagues.

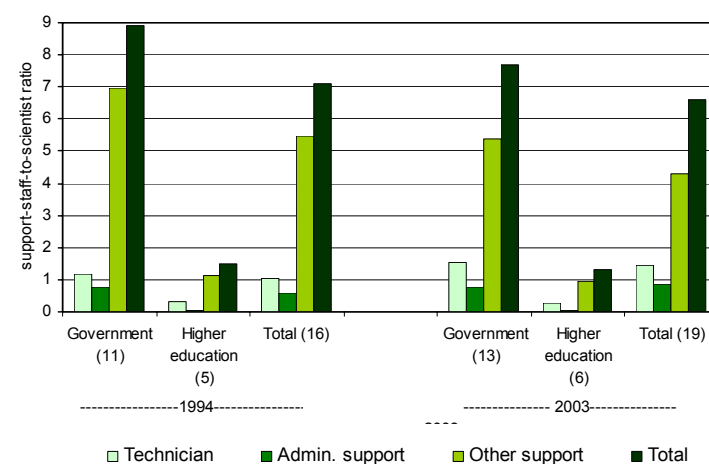
Figure 5—Share of female researchers, 2003



Source: Compiled by authors from ASTI survey data (IFPRI-CARP 2004-05).
Notes: Figures in parentheses indicate the number of agencies in each category. FD is not included in this sample due to data unavailability.

In 2003, the average number of support staff per scientist in a 19-agency sample was 6.6, comprising 1.4 technicians, 0.9 administrative personnel, and 4.3 other support staff such as laborers, guards, drivers, and so on (Figure 6). Consistent with findings in most developing countries, Sri Lanka's 2003 support-staff-per-researcher-ratio for the six higher-education agencies (1.3) was much lower than the corresponding ratio for the 13 government agencies (7.7). Nine years earlier, the average number of support staff per scientist for the government sector was even higher at 8.9. The overall decline was the result in the fall of other support staff per researchers during 1994-2003. In contrast, the number of technicians and administrative support staff per researcher increased during this period.

Figure 6—Support-staff-to-researcher ratios, 1994 and 2003

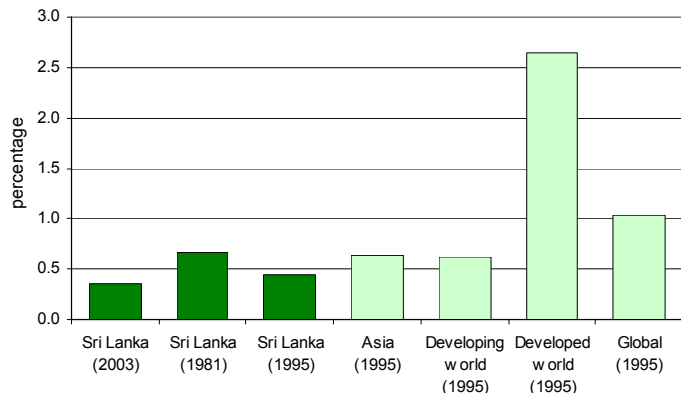


Source: Compiled by authors from ASTI survey data (IFPRI-CARP 2004-05).
Notes: Figures in parentheses indicate the number of agencies in each category. FD, TRI, VRI, and the Faculty of Agriculture of the Subaragamuwa University of Sri Lanka are excluded from the 1994 sample. FD is excluded from the 2003 sample.

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, Sri Lanka invested \$0.36 for every \$100 of agricultural output, which was significantly lower than the corresponding amount in 1981 (\$0.66) (Figure 7). By way of comparison, Sri Lanka's 1995 ratio of 0.45 percent was much lower than the reported 1995 average for Asia (0.63) and the developing world (0.62).

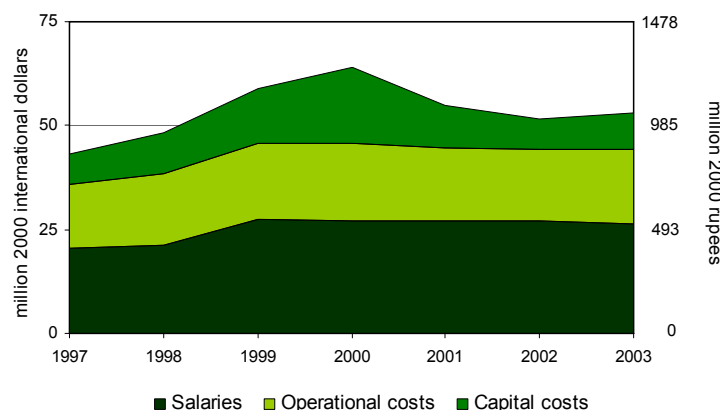
Figure 7—Sri Lanka's public agricultural research intensity compared regionally and globally



Sources: Sri Lanka data are compiled from Figure 2; AgGDP data are from World Bank (2005); all other intensity ratios are from Pardey and Beintema (2001). The intensity ratio for Asia excludes China.

In 2003, salaries accounted for roughly half the expenditures of a sample of 13 Sri Lankan government agencies. Around one-third was spent on operating costs, and one-fifth on capital investments (Figure 8). Salary and operating costs have not fluctuated much during 1999-2003, with salary costs averaging \$27 million annually and operating costs averaging \$18 million per year. Capital investments, on the other hand, showed a more erratic trend, and were highest during 2000, when they reached \$18 million. In that particular year, TRI, CRI, and RRDI spent exceptional amounts on new equipment and laboratories. These overall averages mask considerable variations between the agencies. Salary costs, for instance, accounted for more than 80 percent of 2003 expenditures at HORDI, RRDI, and FCRDI (Figure 9). The share of operating costs as a percentage of total expenditures was in general much lower at the research agencies under MALLI, than the other government agencies. In 2003, SRI, TRI, CRI, NARA, and FD all spent 43 percent or more on operating costs, higher than the average of 34 percent for the 14 government agencies combined. Only two government agencies, TRI and IPHT, had capital expenditure ratio exceeding the 20 percent mark in 2003. In contrast, one half of the 14 government agencies had corresponding ratios of 8 percent or less during the same year.

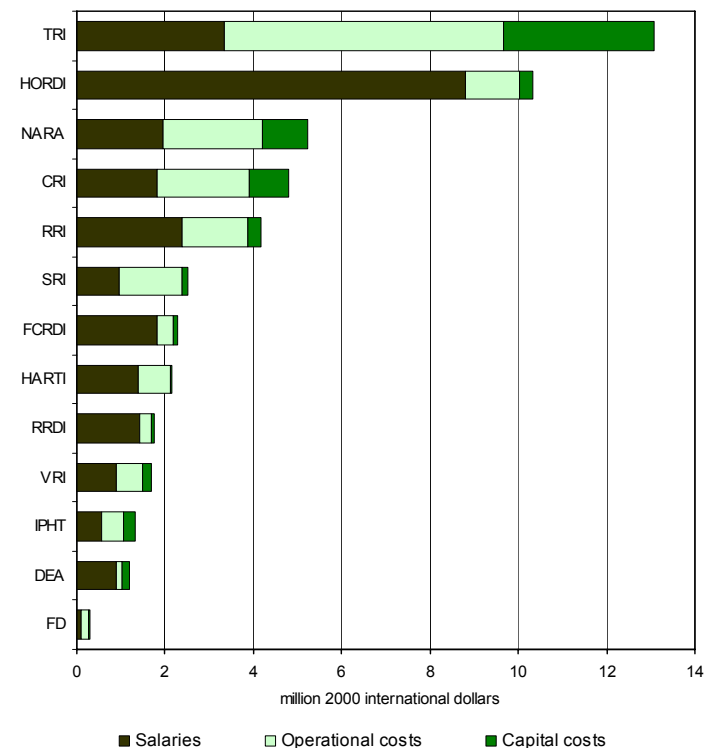
Figure 8—Cost-category shares in expenditures of 13 government agencies, 1997–2003



Source: Compiled by authors from ASTI survey data (IFPRI-CARP 2004-05). Note: Data exclude FD for which no time-series data were available.

The size of the various government agencies, in terms of spending, varied considerably. In 2003, 8 of the 13 government agencies in our sample spent \$3 million or less; spending of the two largest institutes (TRI and HORTI) totaled \$14 and \$11 million, respectively.

Figure 9—Government agency expenditures by cost category, 2003

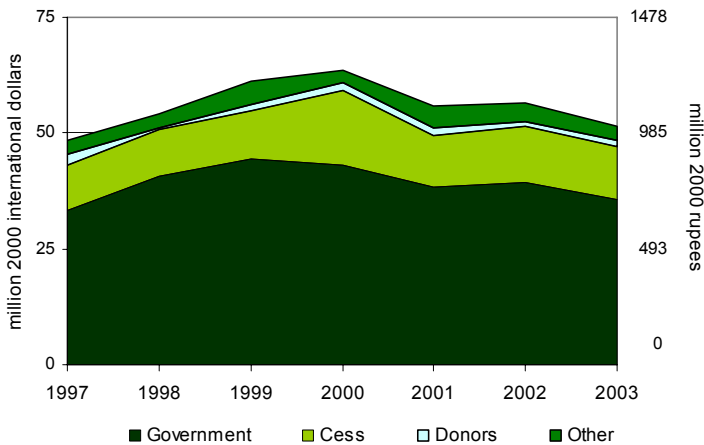


Source: Compiled by authors from ASTI survey data (IFPRI-CARP 2004-05). Notes: Data for FD are for 2002. CARP is excluded from the sample. In 2003, 79 percent of the council's funds were transferred to other research agencies as part of competitive funds.

FINANCING PUBLIC AGRICULTURAL R&D

Over the past decade, funding for agricultural research in Sri Lanka came from a number of sources, principally the national government, cesses imposed on export crop proceeds, donor funding, and internally generated resources. During 1997-2003, 70 percent of the combined budget of 13 Sri Lankan government agencies came from the national government, one-fifth from cess proceeds, and the remainder from internally generated resources, foreign donors, public and private enterprises, and other sources (Figure 10). While shares of funding have remained relatively constant over time, total funding in absolute terms has grown. Like research expenditures, funding increased progressively during 1997-2000, but fell gradually thereafter.

Figure 10—Government agencies' funding sources, 1997-2003



Source: Compiled by authors from ASTI survey data (IFPRI-CARP 2004-05).
Note: Data exclude FD for which no time-series data were available.

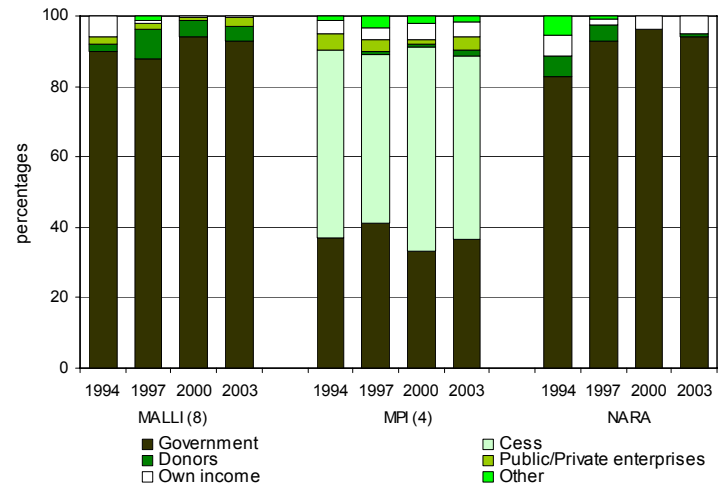
The eight agencies under MALLI relied heavily on financial support from the national government (Figure 11). During 1994-2003, an average of 93 percent of these agencies' funds was provided by the Sri Lankan government, 4 percent by (bilateral and multilateral) donors, and 2 percent by public and private enterprises. These averages mask important differences between the various MALLI agencies. In 2003, sizable shares of the budgets of IPHT (25 percent), RRI (17 percent), and HARTI (14 percent) were financed by public or private enterprises. IPHT received funds from the private sector for the construction of driers of black pepper and the development of storage technologies for onions. RRI and HARTI received similar funds from the private sector for research programs. In contrast, at 19 and 12 percent in 2003, respectively, RRDI and VRI reported a significantly higher dependence on donor funding than other MALLI agencies. RRDI received financial support from the government of China, whereas VRI secured funding from the International Livestock Research Institute (ILRI), the Wellcome Trust from the United Kingdom, and the University of Glasgow.

The composition of funding sources of the four agencies under MPI differed widely from the agencies under MALLI. On average one half of the funds of MPI agencies were financed through cess proceeds during 1994-2003. Close to 40 percent was financed by the government, and 5 percent by internally generated resources. Once again, these averages mask considerable variation between the various MPI agencies. In

2003, TRI (91 percent) and SRI (85 percent) were for the most part financed through a cess, while just 12 percent of TRI was financed this way. In 1992, the Sri Lankan government approved cess funds for TRI research as the normal allocation was inadequate.

During 1994-2003, NARA received less and less financial support from donors and became increasingly dependent on support from the Sri Lankan government.

Figure 11—Funding sources of government agencies, 1994-2003



Source: Compiled by authors from ASTI survey data (IFPRI-CARP 2004-05).
Notes: Figures in parentheses indicate the number of agencies in each category. Data exclude FD for which no data were available. Other includes financial support from producer and marketing boards.

As mentioned earlier, most agricultural R&D in Sri Lanka is financed by the Sri Lankan government, either directly through general government funding, or through CARP. The share of government funding as a percentage of total funding remained unchanged during 1997-2003 at 69 percent. The national government provides financing for recurrent expenditures (payment of salaries and general maintenance) and also for some of the ongoing research programs. CARP funds specific agricultural research programs of the government research agencies, universities, and private sector. It allocates funds based on the research priorities it identifies and these priorities are in keeping with the overall agricultural policy of the government. In support of national agricultural policy, CARP has developed the National Agricultural Research Policy 2003-2010, a document that spells out the policies clearly in order to determine the nature of agricultural research funding.

This dual funding system—by the government and by CARP specifically—has created some problems with regards to the maintenance of research program efficiency. The lack of a good incentive system causes some researchers not to apply for CARP funds at all, and instead rely solely on direct government support. As all promotions are currently based on seniority, an outstanding research track record does not help advance one's scientific career. A clear incentive system to recognize the best research outputs needs to be developed. In this regard, CARP established a National Reward System for Excellence in Agricultural Research in 2003 and gave the first set of awards in November 2004. It also established the Awards for Innovative Agricultural Research in 2005.

The University Grants Commission provides annual funds for Sri Lanka's higher-education agencies in support of research programs. These funds approximate 100 million current Sri Lankan rupees per year and are distributed among the country's 13 universities, regardless of whether they have an agricultural faculty or not. The amount that each university receives for research programs is small compared to government funding. CARP also provides financial support to the universities, in particular to the faculties of agriculture. Annual funding is given based on applications for research grants. In 2003, CARP provided 38 million current Sri Lankan rupees to the universities. In the same year it gave the government agencies 39 million and the private sector 1 million current Sri Lankan rupees. These grants are for individual staff research or for projects involving postgraduate research students. CARP prefers that such students be involved because this helps develop future human resources without any additional cost.

Competitive Contract Research Grants Program

In 2003, the Sri Lankan government allocated 100 million current Sri Lankan rupees to CARP for crop, livestock, forestry, and fisheries research. These funds were available to government, higher-education, and private-sector research agencies for undertaking research on pre-defined, high-priority research areas. CARP allocates these funds through the Competitive Contract Research Grants Program (CCRGP). The funds are intended to support demand-driven research to ensure high factor productivity, sustainable domestic food supplies, and excess production for export (CARP 2005). CCRGP enables effective funding and problem-oriented innovative research, mobilizes research capacity, encourages research partnerships, and provides flexibility in the disbursement of funds. The operation of CCRGP has been highly successful in many respects. The number of applicants for research grants has increased sharply, allowing CARP to award 129 grants in 2003 and an additional 31 grants in 2004. Stakeholder participation has been outstanding, with many universities and private-sector agencies taking part in CCRGP-financed projects. Many of the projects involving private-sector agencies also involve universities or government agencies because the private-sector agencies presently lack research infrastructure and personnel.

In 2004, the Sri Lankan government raised the CCRGP budget to 125 million current Sri Lankan rupees. During that year, CARP also received roughly 15 million current Sri Lankan rupees from the Perennial Crop Development Program funded by the Asian Development Bank (ADB). CARP disbursed these funds in the form of grants as well. The considerable increase in agricultural research funding in 2003 as a result of the government's acknowledgement of the importance of R&D for agricultural productivity growth is a very encouraging trend. Despite a rise in CCRGP funds in recent years, these funds still represent a very small percentage of total agricultural R&D spending.

Cess Revenues for Export Crops

Research agencies in the plantation sector received their budget through cess funds. Therefore, despite their relatively low numbers of research staff, plantation sector R&D agencies accounted for a large share of the national budget compared to other government agencies. The cess arrangement for each plantation crop is as follows:

- The export of tea is subject to a tea cess. This cess is 2.50 Sri Lankan rupees per kilogram. In 2004, 0.625 rupees (25 percent) of the cess collected for each kilogram was allocated to TRI, 0.925 rupees (37 percent) to tea smallholders, and 0.950 rupees (38 percent) to the Sri Lanka Tea Board. These percentages are revised each year. In 2003, for example, TRI's cess allocation was reduced from 30 percent to 26 percent due to falling tea exports as a result of the war in Iraq. Owing to this war, tea exports were restricted during the early part of 2003, causing a delay in the flow of cess funds (TRI 2004).
- The coconut cess is 1 Sri Lankan rupee per kilogram of desiccated coconut exports. This cess is distributed among the coconut sector for development purposes. CRI began receiving cess funds as of 1992, but cess allocation was negligible during the initial years. CRI has received larger cess funds since 1994, but unlike TRI it receives these funds only on a project basis—only those projects approved by the research board are eligible for cess funding. In 2005, CRI received 20 million current rupees of cess funding for the control of the coconut mite, which is spreading rapidly in the dry coconut growing areas of the country.
- In contrast, the cess for sugar is charged on imports instead of exports and totals US\$0.10 per kilogram. Sugar importers have to obtain an official certificate from SRI to declare their imports. SRI receives about 50 to 60 million current Sri Lankan rupees through this sugar cess annually.
- The rubber cess was abolished in 1999 due to sluggish world market prices for this commodity, but it was reintroduced in 2004 when prices rebounded. Rubber product imports are now subject to a 5 percent levy of the cost, insurance, and freight (CIF) value, rubber product exports to a levy of 4 current Sri Lankan rupees per kilogram of natural rubber, and raw rubber exports also to a cess of 4 current Sri Lankan rupees per kilogram. During the first few months of 2005, RRI received 27 million current Sri Lankan rupees through this cess/levy scheme for the replacement of the institute's equipment, nursery inspections, and certification.

PRIVATE AGRICULTURAL R&D

Agricultural R&D conducted by Sri Lanka's private sector is minimal. CIC Agribusiness is the only private-sector agency that we identified as having R&D capacity. Many other private companies are involved in agricultural production but their R&D activities are limited. Historically, government agencies have undertaken agricultural research for the private sector on a service basis. Recently CARP awarded 12 grants to private-sector agencies, but all these projects involve collaboration with universities or government research agencies. However, more and more private-sector companies are planning to open up their own biotechnology laboratories to develop foliage and cut flowers for export. Currently, many of these companies engage in collaborative research programs with government departments and universities. But they fear that their collaborative alliances will lead to new varieties spreading to other growers and thus they want to establish their own laboratories.

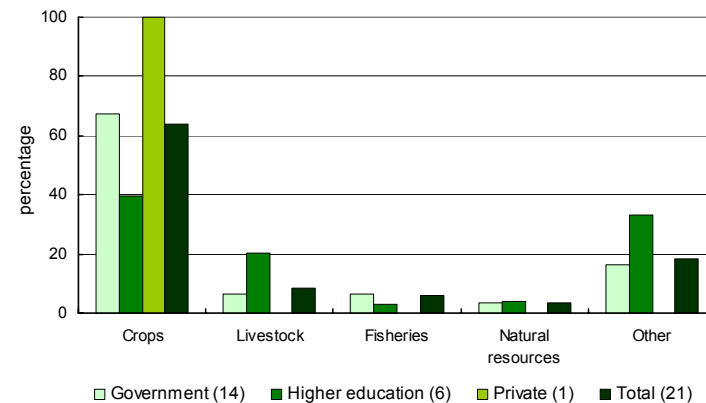
The role of the private sector is growing through other means as well. The National Agricultural Research Policy formulated by CARP covers development and management of technology by improving its effectiveness through several innovative approaches. One of them is to build partnerships with the private sector to increase demand-driven R&D activities. As a result of the policy, the management of crop and livestock extension will be progressively contracted out to the private sector. In 2001, MALLI set up a pilot project phase to invite private-sector participation in the provision of farm advisory services, facilitate loans for the non-plantation perennial crop sector, and develop spice and fruit crops and floriculture in selected districts. Private companies provide these services on a fee-for-service basis in order to increase the effectiveness of farm extension; this is expected to lead ultimately to the commercialization of the agricultural sector (Samarappuli 2003). This initiative has shown positive results, but is still ongoing. Private-sector seed importers have also been undertaking their own extension with the growers (mostly vegetable growers) and in many cases they have been successful.

RESEARCH ORIENTATION

Commodity Focus

The allocation of resources among various lines of research is a significant policy decision, and, accordingly, detailed information was collected on the number of fte researchers working in specific commodity and thematic areas. In 2003, close to two-thirds of the 579 fte researchers in our 21-agency sample conducted crop research. Livestock research accounted for 8 percent of the total, fisheries research for 6 percent, and natural resources for 3 percent (Figure 12). Research staff at the government agencies spent relatively more time on crop and fisheries research than their counterparts at the higher-education agencies, who, in turn, spent a relatively larger share of their time on livestock and other research themes. Exact shares per crop item were unavailable, but a large proportion of crop researchers focused their activities on rice, fruits, vegetables, spices and condiments, sugar, and cereals (Girihagama 2004).

Figure 12—Commodity focus by major item, 2003



Source: Compiled by authors from ASTI survey data (IFPRI-CARP 2004-05).
Note: Figures in parentheses indicate the number of agencies in each category.

Most livestock researchers focused their efforts on poultry (35 percent). Other livestock themes included swine and beef (27 percent), pastures and forages (14 percent), and dairy (12 percent) (IFPRI-CARP 2004-05). Unsurprisingly, close to two-thirds of Sri Lanka's livestock research is carried out by VRI researchers.

Thematic Focus

In 2003, 19 percent of 508 fte research staff at Sri Lanka's 14 government agencies concentrated on crop genetic improvement, 11 percent on crop pest and disease control, and 8 percent on postharvest research. Sixteen percent focused on other crop themes (Table 2). The thematic research focus of the 69 fte researchers at the six higher-education agencies looked quite different. In 2003, 11 percent of these researchers focused on crop genetic improvement, 7 percent on soil research, and 6 percent on crop pest and disease control. The remaining researchers concentrated on other crop (22 percent) and other livestock (17 percent) themes.

Table 2—Thematic focus, 2003

	Numbers of researchers		Shares	
	Govern- ment (14)	Higher education (6)	Govern- ment (14)	Higher education (6)
	<i>(in fte's)</i>		<i>(percent)</i>	
Crop genetic improvement	96.0	7.4	18.9	10.7
Crop pest and disease control	53.5	3.9	10.5	5.7
Other crop	80.6	15.5	15.9	22.4
Livestock genetic improvement	3.2	1.9	0.6	2.7
Livestock pest and disease control	12.8	1.6	2.5	2.3
Other livestock	19.0	11.6	3.7	16.8
Soil	15.5	4.6	3.0	6.7
Water	11.7	2.5	2.3	3.6
Other natural resources	17.0	0.3	3.3	0.4
Postharvest	40.6	3.4	8.0	4.9
Other	158.3	16.6	31.2	24.0
Total	508.0	69.2	100.0	100.0

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

Note: Figures in parentheses indicate the number of agencies in each category.

CONCLUSION

During 1981-2003, the number of agricultural researchers in Sri Lanka increased steadily. Agricultural R&D spending also rose throughout this period, albeit more erratically. In 2003, total expenditures amounted to \$60 million (in 2000 constant prices). Research agencies focusing on export plantation crops reported remarkable increases in their total spending levels over the previous two decades. Combined spending totals at the eight agencies under MALLI, however, remained relatively unchanged during the same period.

With the exception of the plantation crop research institutes, which receive sizable shares of their total budget through cess proceeds, Sri Lanka's government R&D agencies are primarily financed by the national government through a dual funding system. The government directly provides operational and capital funds, and channels funds for strategic research via CARP's CCRGP, a competitive funding mechanism. The introduction of CCRGP is a positive development and one that has already promoted collaboration between the various agencies in the country's national agricultural research system. It has also accelerated private sector involvement in the agricultural R&D field, a phenomenon that had been extremely limited thus far. Total CCRGP funds have risen rapidly in recent years and are expected to rise further in the future as a result of the Sri Lankan government's acknowledgement of the importance of R&D for agricultural productivity growth. Nonetheless, at present, CCRGP funds still represent a very small percentage of total agricultural R&D financing and the program can only run efficiently in the future if a well-functioning incentive system is established that recognizes research outputs and forces more researchers to apply for such funds.

These changes were accompanied by the establishment in 2002 of a training program for research staff. Memoranda of understanding with the principal agricultural research agencies in other South Asian countries allow Sri Lankan researchers to improve their research capacity in contexts relevant to the Sri Lankan situation. In the next ten years, three quarters of Sri Lankan research staff are scheduled for training as part of this program. This will most certainly have a positive effect on the quality of future research outputs in the country.

NOTES

1. The authors are grateful to numerous colleagues in Sri Lanka for their time and assistance with the data collection, and thank Liliane Ndong for her assistance in data inputting. They also thank Nienke Beintema, C. Jayasekare, Ziyad Mohamed, and various directors of Sri Lankan agricultural R&D agencies for their useful comments on drafts of this brief.
2. The 21-agency sample consisted of:
 - 14 government agencies/units: the Sri Lanka Council for Agricultural Research Policy (CARP), the Coconut Research Institute (CRI), the Department of Export Agriculture (DEA), the Field Crops Research and Development Institute (FCRDI), the Research Division of the Forest Department (FD), the Hector Kobbekaduwa Research and Training Institute (HARTI), the Horticulture Research and Development Institute (HORDI), the Institute of Postharvest Technology (IPHT), the National Aquatic Resources Research and Development Agency (NARA), the Rice Research and Development Institute (RRDI), the Rubber Research Institute of Sri Lanka (RRI), the Sugarcane Research Institute (SRI), the Tea Research Institute of Sri Lanka (TRI), and the Veterinary Research Institute (VRI);

- 6 higher-education agencies: the Faculty of Agricultural Sciences of the Subaragamuwa University of Sri Lanka, the Faculty of Agriculture and Plantation Management of the Wayamba University of Sri Lanka, the Faculty of Agriculture of the Eastern University, the Faculty of Agriculture of the University of Jaffna, the Faculty of Agriculture of the University of Ruhuna, and the Faculty of Agriculture of the University of Peradeniya; as well as
 - 1 private enterprise: CIC Agribusiness.
3. Unless otherwise stated, all data on research expenditures are reported in 2000 international dollars or in 2000 Sri Lankan rupees.

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METHODOLOGY

- Most of the data in this brief are taken from unpublished surveys (IFPRI and CARP 2004-05).
- The data were compiled using internationally accepted statistical procedures and definitions developed by the OECD and UNESCO for compiling R&D statistics (OECD 1994; UNESCO 1984). The authors 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. The researchers 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.
- Financial data were converted to 2000 international dollars by deflating current local currency units with a Sri Lankan GDP deflator of base year 2000 and then converting to U.S. dollars with a purchasing power parity (PPP) index for the year 2000, 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 were 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 point of the period.

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

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