ASTI Agricultural Science & Technology Indicators

INIA IFPRI

ASTI Country Brief No. 43 • December 2008

URUGUAY

By Gert-Jan Stads, Beatriz Cotro, and Mario Allegri

Quantitative data are important in measuring, monitoring, and benchmarking the inputs, outputs, and performance of agricultural science and technology (S&T) systems. They are an indispensable tool when it comes to assessing the contribution of agricultural S&T to agricultural growth and, more generally, to economic growth. S&T indicators assist research managers and policymakers in policy formulation of and decision making about strategic planning, priority setting, monitoring, and evaluation. They also provide information to government and other institutions (e.g., policy research institutes, universities, and the private sector) involved in the public debate on the state of agricultural S&T at the national, regional, and international levels. This country brief reviews the major investment, capacity, and institutional trends in public agricultural research in Uruguay since 1981, using data recently collected under the Agricultural Science and Technology Indicators (ASTI) initiative (IFPRI 2007–08).[1] It provides important updates on trends in *Uruguay's public agricultural research previously published by Beintema et al.* (2000).

INSTITUTIONAL DEVELOPMENTS

Located between Brazil and Argentina, Uruguay is one of South America's smallest countries in terms of surface area and population. The country's geography makes the nation well-suited to pastoral agriculture; close to 80 percent of the country's land area is devoted to livestock production and the cultivation of crops. Cattle and sheep meat, dairy

Table 1—Composition of public agricultural research expenditures and research staff, 2006

Type of agency[a]	Total spending: Current Uruguayan pesos	Total spending: 2005 Uruguayan pesos	Total spending: 2005 international (PPP) dollars	Total research staff	Share: Spending	Share: Research staff
		(millions)		*(fte's)*	*(percentage)*	
INIA	507.4	475.1	35.8	142.0	59.9	35.6
Other government (6)[b]	110.6	103.5	7.8	69.8	13.0	17.5
Nonprofit agencies (4)[c]	26.0	24.3	1.8	17.2	3.1	4.3
Higher education (9)[d]	203.8	190.8	14.4	170.4	24.0	42.7
Total (20)	**847.8**	**793.7**	**59.8**	**399.4**	**100**	**100**

Sources: Compiled by authors from ASTI survey data (IFPRI-INIA 2007-08) and estimations based on UdelaR (2008).
Note: The numbers in brackets denote the number of agencies included in each category.
[a] See note 3 for a list of the 20 agencies included in this sample and their respective institutional categories.
[b] Staff employed in the 6 other government agencies spent between 20 and 50 percent of their time on research, resulting in 69.8 fte researchers.
[c] Staff employed in the four nonprofit agencies spent between 30 and 80 percent of their time on research, resulting in 17.2 fte researchers.
[d] Staff in the higher education sector spent between 10 and 30 percent of their time on research, resulting in 170.4 fte researchers. Expenditures for UCUDAL, UDE, and UTU were estimates based on average estimated expenditures at UdelaR.

KEY TRENDS

- Total agricultural R&D spending in Uruguay rebounded rapidly after the 1999-2003 economic crisis, reaching 848 million Uruguayan pesos in 2006 (in current prices).
- Instituto Nacional de Investigación Agropecuaria (INIA) and Universidad de la República (UdelaR) are Uruguay's largest agricultural R&D agencies; combined, they account for more than three-quarters of the country's agricultural research capacity.
- INIA is largely financed through a commodity tax levied on Uruguay's total sales value of agricultural commodities and an equal contribution from the government as counterpart.
- The private sector plays a negligible role in Uruguay.
- Overall, average qualification levels of Uruguayan agricultural R&D staff improved significantly during 1996–2006.

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 activities in Latin America was provided by the Inter-American Development Bank (IDB), the World Bank via the Consultative Group on International Agricultural Research (CGIAR) and the International Food Policy Research Institute (IFPRI).

cereals (rice, wheat, maize), fruits, forest products, and vegetables make up the lion's share of the agricultural sector in the country. In 2006, agriculture contributed 9 percent to Uruguay's gross domestic product (GDP) and is by far the country's most important export sector (70 percent of total exports), with beef, rice, fruits, leather products, wool, and dairy products all representing important export commodities (MGAP-DIEA 2007). The manufacturing and services sectors accounted for 30 and 61 percent of Uruguay's GDP in 2006, respectively (World Bank 2008). It is important to note that in order to make a proper assessment of the importance of agriculture to Uruguay's economy, it is necessary to take agribusiness linkages into account. The share of agribusiness in total GDP was estimated to be between 30 and 35 percent in 2004 (IICA 2004). The role of the agricultural sector in the overall economy is therefore much larger than the official agricultural gross domestic product (AgGDP) figures indicate.

After experiencing a period of substantial growth in the 1990s, Uruguay's agricultural sector and the economy more generally experienced a period of sustained crisis during 1999-2003.[2] After 2004, Uruguay's economy started to recover. The country's long-term challenge is to sustain growth and boost employment by increasing productivity and diversifying exports. Strengthening Uruguay's capacity to innovate holds considerable promise for responding to this challenge (World Bank 2008).

SCIENCE AND TECHNOLOGY POLICY

Gross domestic investment in (agricultural and non-agricultural) research and development (R&D) was low in Uruguay, but has been increasing. In 2002, the country invested 0.22 percent of its GDP in R&D, reflecting insufficient government prioritization of S&T investments and weak private sector demand for knowledge and technology. Uruguay's 2002 R&D expenditures as a percentage of GDP were less than half the regional average for Latin America and the Caribbean (LAC) (0.54 percent) and significantly below the total level of R&D expenditures expected based on Uruguay's level of income, which is much higher than the LAC average (World Bank 2007). In comparison, neighboring Argentina and Brazil spent 0.46 and 0.82 percent of their GDP on R&D in 2005, respectively (RICyT 2008). The government predominates when it comes to S&T spending in Uruguay and the rest of Latin America, which sharply contrasts S&T spending in high-income countries. And while the country's overall investments in S&T are comparatively low, its agricultural S&T investments are substantial, as the evidence provided below will show.

Since the late 1980s, Uruguay has implemented a set of S&T policies; yet—despite these efforts—the main constraint to the country's development of scientific and technological capabilities has been a lack of well-articulated policies and coordinated research efforts among the various entities. In 2004, shortly after the economic crisis, the Uruguayan government launched a recovery program that included necessary structural reforms to enhance national competitiveness and ensure greater integration into the global economy by deepening the diversification of the country's export markets. Innovation was prioritized and stipulated as one of six pillars of the national development program. The Uruguay Innovador pillar focuses on the need to promote S&T in order to revive the economy and stimulate growth. The pillar lays out goals to enhance the institutional framework for innovation; reinforce applied research, as well as linkages between scientists and the productive sector; and support innovation in priority sectors (World Bank 2007).

To coordinate its efforts the Uruguayan government has established an Interministerial Innovation Cabinet (GMI), which is composed of the ministers of Agriculture, Livestock, and Fisheries (MGAP); Industry, Energy and Mining (MIEM); Education and Culture (MEC); and Economy and Finance (MEF); as well as the Director of the Office of Planning and Budget (OPP). The Cabinet's objective is to define and coordinate strategies, policies, priorities, and government actions linked to S&T investments. The GMI is also tasked with proposing necessary institutional reforms within relevant government entities (World Bank 2007). Between the introduction of Uruguay Innovador in 2004, funding toward innovation is estimated to increase ninefold by 2010 (Astori, Bergara, and Lorenzo 2007).

INSTITUTIONAL DEVELOPMENTS IN AGRICULTURAL R&D

The current study identified 20 public-sector agencies involved in agricultural research in Uruguay in 2006.[3] Combined, these 20 agencies employed 399 full time equivalent (fte) researchers and spent 848 million Uruguayan pesos on agricultural R&D, the equivalent of 794 million Uruguayan pesos in 2005 constant prices or 60 million PPP dollars in 2005 constant prices, using a purchasing power parity (PPP) index (See Table 1 on page 1).[4] PPPs are synthetic exchange rates used to reflect the purchasing power of currencies typically comparing prices among a broader basket of goods and services than do conventional exchange rates. Uruguay's principal agricultural R&D agency is the National Agricultural Research Institute (INIA).[5] In 2006, INIA accounted for more than one-third of Uruguay's agricultural research staff and 60 percent of agricultural R&D spending. INIA is a public institution under private administrative regulations, which was established in 1989 (See A Short History of Government-Based Agricultural Research on page 3). It can make independent decisions regarding personnel policies and procedures, including offering competitive salaries, and entering into research contracts with the private sector and international agencies. INIA's current organizational model includes three areas: Policy, Management, and Programming & Operation. The policy area is overseen by the Board of Directors and the National Director. The board consists of two government representatives (one of which serves as INIA's president), and two members appointed by farmer associations. The management area includes the National Director and four management offices: Programming & Operation, Administration & Finance, Human Resources and Technology Business. Both, the policy and the management areas are headquartered in Montevideo. INIA's research activities are organized in a Programming and Operational Matrix integrated in national research programs and technical units. There are eight national research programs according to value chains (rainfed crops production, rice production, dairy production, meat and wool production, forestry production,

horticulture production, fruits production, citrus production) and three research programs according to strategic areas (pastures and forages, family farm production, and production and environmental sustainability). Besides there are five technical units (biotechnology, agroclimate and information systems, seeds, communication and technology transfer, and international cooperation). The Programming and Operational Matrix is integrated in INIA's five regional experiment stations (La Estanzuela, Las Brujas, Salto Grande, Tacuarembó and Treinta y Tres). These experiment stations are managed by regional directors (INIA 2008).

The National Directorate of Aquatic Resources (DINARA), previously known as the National Fisheries Institute (INAPE), is Uruguay's principal agency charged with fisheries research. The agency is placed under the Ministry of Livestock, Agriculture, and Fisheries (MGAP) and its 29 fte scientists are involved in a wide variety of activities encompassing industrial and biological aspects of fresh-and salt-water fisheries, ranging from models of fish population dynamics to quality control and resource management. DINARA operates headquarters in Montevideo, and three research stations in the departments of Salto, Maldonado, and Rocha (DINARA 2008).

As its name implies, the Institute of Biological Research Clemente Estable (IIBCE) under the Ministry of Education and Culture (MEC) is charged with research on different fields of life sciences. In 2006, IIBCE employed 18 fte's working on agriculture-related research.

Uruguay's official veterinary research agency is the Directorate of Veterinary Laboratories (DILAVE) under MGAP. The agency's research is mainly focused on disease diagnosis and prevention. In 2006, DILAVE employed 14 fte researchers dispersed among a central laboratory in Montevideo and three regional laboratories in Paysandú, Tacuarembó, and Treinta y Tres. The remaining three government agencies—the Technological Laboratory of Uruguay (LATU), the National Winemaking Institute (INAVI), and the National System of Protected Areas (SNAP)—each employed 5 or fewer fte's in 2006.

The nonprofit sector plays a limited role in conducting agricultural R&D in Uruguay. None of the country's four nonprofit agencies employed more than 5 fte agricultural researchers. In 2006, the nonprofit sector accounted for just 4 percent of agricultural research staff in Uruguay.[6]

Uruguay's higher education sector plays an important role in agricultural R&D. Nine higher education agencies were involved in agricultural R&D in 2006, accounting for 43 percent of the country's agricultural research staff. The largest institute in this category is the Universidad de la República (UdelaR), which oversees six faculties involved in agricultural R&D. The 66 fte agricultural scientists at UdelaR's Faculty of Agronomy focus on areas of crop production, fruits and vegetables, plant breeding, dairy, pasture, soil science and biological sciences (i.e., botany, biochemistry, and plant physiology). The faculty also has an animal production research unit, which focuses on anatomy, nutrition, and zootechnics. UdelaR's Faculty of Veterinary Science employed 62 fte researchers in 2006 who conduct research on animal nutrition and reproduction, morphology and development, cellular and molecular biology, physiology, and the prevention and control of animal disease. The faculty also operates a fisheries research center that works closely with DINARA. UdelaR's Faculty of Chemistry is also involved in agricultural research. Nineteen fte agricultural researchers were active at this faculty in 2006. The remaining three faculties under UdelaR (Faculty of Engineering, Faculty of Science, and the Faculty of Social Science) each employed nine or fewer fte's. Three higher education agencies outside UdelaR were identified as being involved in agricultural R&D in Uruguay: the Faculty of Engineering, Science, and Food

A Short History of Government-Based Agricultural Research in Uruguay

Agricultural research in Uruguay began in 1914 with the establishment of a plant breeding station, the National Institute of Plant Breeding, which included a nursery. The Colonia-based institute conducted breeding activities on the major agricultural crops at the time (wheat, flax, barley, corn, oats, and alfalfa) and, under the direction of Dr. Alberto Boerger, became the leading cereal breeding institute in Latin America. The institute was substantially restructured in 1961 and renamed the Alberto Boerger Agricultural Research Center (CIAAB). CIAAB became the main unit responsible for crop and livestock research within the Ministry of Livestock, Agriculture, and Fisheries (MGAP) and it broadened its research program to include a wider spectrum of crops, as well as pasture, beef, sheep, and dairy production. Livestock research was also conducted by the "Dr. Miguel Rubino" Veterinary Research Center (CIVET), established in 1932 as the Animal Biology Laboratory.

The 1960s were successful years for CIAAB, partly due to the strong financial support from the government and important donor funding. A number of existing and newly established experiment stations were incorporated into CIAAB. During 1973-85, while the country was under military dictatorship, agricultural research in Uruguay faltered. Financial support from the government declined considerably, as did funding from international donor and lending agencies. At the same time, many well-trained research staff left the country for political or economic reasons.

Following the country's return to democracy in 1985, the government established a commission to review the agricultural R&D system. These efforts resulted in the creation of the National Agricultural Research Institute (INIA) in 1989, an autonomous national agricultural research institute independent from MGAP with a flexible management structure akin to that of a private enterprise. INIA inherited CIAAB's five experiment stations, and the institute's agenda was broadened to include forestry research, which prior to 1989 was conducted by MGAP's Directorate of Forestry. A loan was secured from IDB in order to modernize the existing experiment stations, acquire new equipment, and fund graduate-level training. Notably, INIA's basic organizational structure has remained more or less unchanged since its inception, despite regular modification of its management practices and details of its research programs.

Originally it was planned to group all agricultural research under INIA, but ultimately CIVET was merged with the Directorate for the Control of Foot and Mouth Disease (DILFA) becoming the Directorate of "Miguel C. Rubino" Veterinary Laboratories (DILAVE) in 1994. Similarly, the National Fisheries Research Institute (INAPE; currently known as DINARA) was established in 1975 as a separate body under MGAP to take over responsibility for the fisheries development program that was established a year earlier.

Source: Beintema et al. (2000).

Technology under the Catholic University of Uruguay "Damaso Antoño Larrañaga", the School of Viticulture "Presidente Tomas Berreta" under the Universidad del Trabajo del Uruguay, and the Faculty of Agricultural Sciences under the Universidad de la Empresa. In 2006, each of these agencies employed only 4 or fewer fte researchers, showing that research activities conducted by these three agencies are significantly overshadowed by those of UdelaR.

National private companies with noteworthy agricultural R&D programs are limited in Uruguay. A number of national private companies engage in some research from time to time, but their contributions to total agricultural research are inconsequential. While some multinationals do fund research projects in Uruguay, the value of this funding is very small—a situation that contrasts with neighboring countries such as Argentina and Brazil, where numerous multinationals conduct research locally (which is probably the main reason for their absence in Uruguay). These occasional, often ad hoc, research activities are not included in the data analysis in the remainder of this brief because they are difficult to measure and only account for a minor share of total agricultural R&D in Uruguay.

Collaboration efforts

Uruguay's agricultural R&D agencies participate in a significant amount of collaborative research nationally, regionally, and on an international basis. INIA actively pursues strategic alliances with a large number of Uruguayan and foreign agencies. Cooperation is formalized through agreements, joint ventures, and so-called cooperation networks that allow for effective, efficient, and complementary action. At the national level, INIA works closely with most of the Uruguayan agencies described above, as well as with a large number of producer organizations, private enterprises, and public and academic institutions. At the international level, INIA has formalized cooperation with national agricultural research institutes in a large number of countries in Latin America, including Argentina, Brazil, and Chile. INIA also conducts joint research with a large number of universities and agricultural agencies in Oceania, Europe, and North America. In addition, INIA has close ties with the Regional Fund for Agricultural Technology (FONTAGRO), the Food and Agriculture Organization of the United Nations (FAO), the Cooperative Program for Food and Agroindustrial Development of the Southern Cone (PROCISUR), the Inter-American Institute for Cooperation on Agriculture (IICA), the Japan International Cooperation Agency (JICA), and a number of centers under the Consultative Group of International Agricultural Research (CGIAR), including the International Maize and Wheat Improvement Center (CIMMYT), the International Center for Tropical Agriculture (CIAT), the International Potato Center (CIP), and Bioversity International (INIA 2008). UdelaR also reported close collaboration with a number of national and international agencies (UdelaR 2008).

HUMAN AND FINANCIAL RESOURCES IN PUBLIC AGRICULTURAL R&D

Overall Trends

1981-2006 timeseries data on agricultural R&D staff were only available for INIA and its predecessor, the Alberto Boerger Agricultural Research Center (CIAAB). During this period, the total number of agricultural researchers rose by 3.1 percent per year, on average (Figure 1a). Growth did not occur evenly over time, however. CIAAB's total research capacity remained fairly constant during the 1980s, averaging 77 fte's. Following the establishment of INIA in 1989, research staff numbers increased substantially. Since 1992, however, INIA's total number of researchers has plateaued at levels between 130 and 140 fte's. In 2006, the institute employed 142 fte researchers.

INIA is generally regarded as a highly attractive employer for agricultural scientists and, unlike some counterpart institutes in other Latin American countries that have lost researchers to the private or higher education sectors, it has been able to hold on to its most qualified research staff. The institute offers competitive salaries, ongoing training, and adequate funding for research projects and infrastructure. In addition, researchers are actively encouraged to participate in national and international conferences and scientific exchange programs. INIA has the flexibility to incorporate new staff and it has established a retirement incentive for staff over the age of 60.

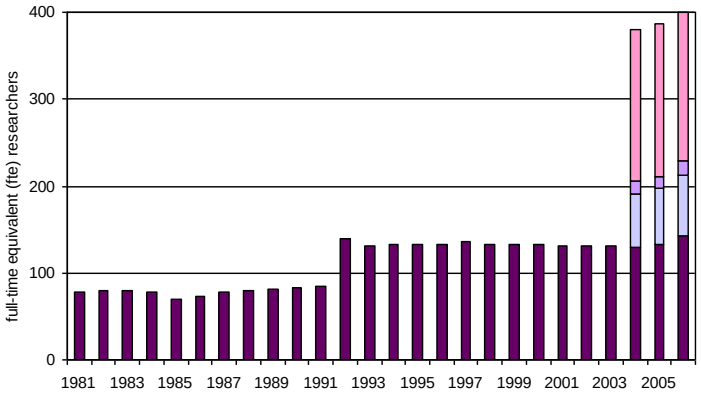
For the remaining agencies, research staff data were only available for the 2004-06 period. Overall, total agricultural R&D staff in Uruguay increased slightly from 380 fte's in 2004 to 399 in 2006. Total researcher numbers in the higher-education sector remained relatively flat during the three-year period.

Research expenditures at INIA and its predecessor quadrupled in constant prices during 1981-2006, from 120 million to 475 million Uruguayan pesos (in 2005 constant prices) (Figure 1b). However, the trend at which this occurred was far from linear. In the 1980s CIAAB's expenditures remained fairly constant with some minor yearly fluctuations. During the early 1990s, however, INIA's total spending grew considerably partly as a result of the large-scale funding from the Inter-American Development Bank (IDB). However, during the years following the completion of this IDB-financed project in 1996, growth in INIA's expenditures stalled.

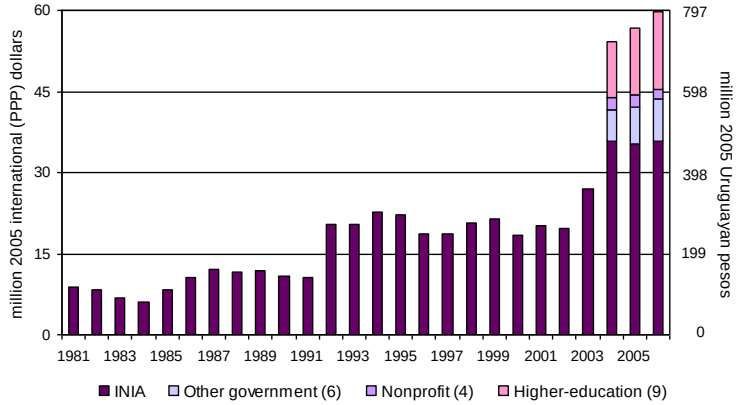
INIA's budget is linked directly to Uruguay's AgGDP, as will be discussed in more detail in the Financing Agricultural R&D section of this brief. Sudden fluctuations in AgGDP therefore have an immediate impact on INIA's and indirect impact over the country's) agricultural R&D expenditures. As mentioned, during 1999-2003, Uruguay went through the harshest economic and financial crisis in recent history, mostly arising from external factors. The economic crisis had a severely negative impact on the overall economy and agricultural sector, specifically. As a result, expenditures at INIA and the other Uruguayan agricultural R&D agencies plummeted during those years. In 2002, when the economic crisis was still ongoing, agricultural production value began to increase again, with rapidly rising R&D spending as a result.

Figure 1—Composition of public agricultural R&D staff, 1981–2006

a. Research staff



b. Expenditures

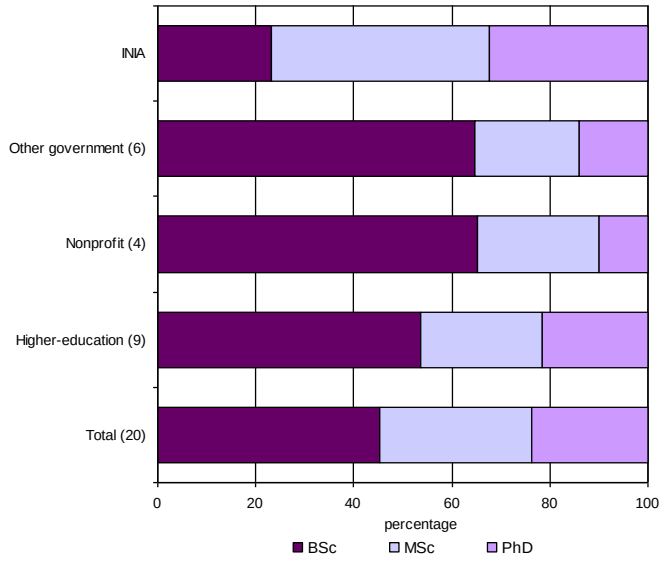


Sources: Compiled by authors from ASTI survey data (IFPRI-INIA 2007-08) and Beintema et al. (2000).
Notes: See Table 1. Figures in parentheses indicate the number of agencies in each category. 1981-2003 data for government agencies other than INIA, nonprofit institutions, and higher education agencies were unavailable.

Human Resources

In 2006, 55 percent of the 399 fte researchers in the 20-agency sample were trained to the postgraduate level, and 24 percent held PhD degrees (Figure 2). Postgraduate shares were much higher at INIA than at the remaining public agricultural R&D agencies, which is in sharp contrast with trends observed in most other countries in the region or developing countries worldwide, where research staff at higher-education agencies tend to be the most highly qualified (Pardey and Beintema 2001). More than three-quarters of INIA research staff held postgraduate degrees, and close to one-third was trained to the PhD level. Postgraduate shares of research staff in the other government and nonprofit categories are relatively low at 35 percent each. 46 percent of the agricultural scientists in Uruguay's higher education sector held postgraduate degrees in 2006, which was lower than the corresponding shares recorded in other countries in South America such as Colombia (55 percent) and Chile (73 percent) (Stads and Romano 2008; Stads and Covarrubias Zuñiga 2008).

Figure 2—Educational attainment of researchers by institutional category, 2006

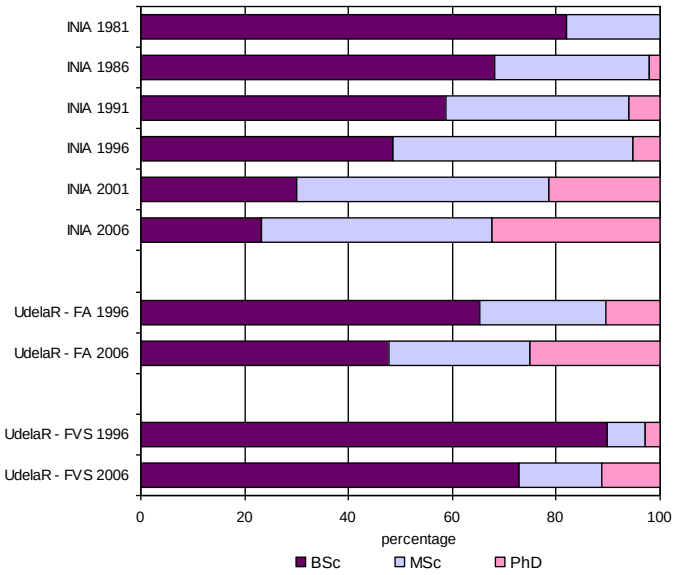


Source: Compiled by authors from ASTI survey data (IFPRI-INIA 2007-08).
Note: Figures in parentheses indicate the number of agencies in each category.

Timeseries data were available for the three largest public-sector agricultural R&D agencies in Uruguay: INIA and the Faculties of Agriculture and Veterinary Science of UdelaR. Combined, these three agencies accounted for two-thirds of Uruguay's total public agricultural research staff in 2006. Average qualification levels of staff at these three agencies have improved considerably over the past decade (Figure 3). The two UdelaR faculties experienced increases in the absolute numbers of PhD-qualified scientists, whereas numbers of BSc-qualified staff fell. Only 3 percent of research staff at the Faculty of Veterinary Science held PhD degrees in 1996 compared with 11 percent in 2006. Similarly, the share of PhD holders at the university's Faculty of Agriculture rose from 10 to 25 percent over the same period. Furthermore, during 1996-2006, UdelaR made great strides in setting up its own postgraduate training programs in agricultural sciences. In 1996, the majority of UdelaR researchers with MSc or PhD degrees at the faculties of agronomy and veterinary science obtained their degrees in Europe, other Latin American countries, or the United States. The situation has recently changed, however, and Uruguayan agronomists and veterinarians no longer need to go abroad to pursue MSc-level training in particular agriculture-related fields. The Faculty of Agriculture has offered an MSc-level program in Agrarian Sciences since 2004 and one in Sustainable Rural Development since 2005. Similarly, in 2003, the Faculty of Veterinary Science introduced MSc programs in Animal Production, Animal Breeding, Animal Health, and Ruminant Nutrition (UdelaR 2008). No Uruguayan universities currently offer PhD-level training in agricultural sciences, so scientists still need to go abroad for doctorate degrees. The main funding sources for postgraduate training of Uruguayan agricultural scientists include agencies'own budgets, international agencies and foreign universities through graduate assistantships. In addition, postgraduate training at UdelaR is largely funded by the Sectorial Commission for Scientific

Research (CSIC), which manages a competitive program; foreign donors (including IDB); the Program for the Development of Basic Sciences (PEDECIBA); and the National Council of Science and Technology (CONICYT).

Figure 3—Educational attainment of researchers by institutional category, 1981- 2006



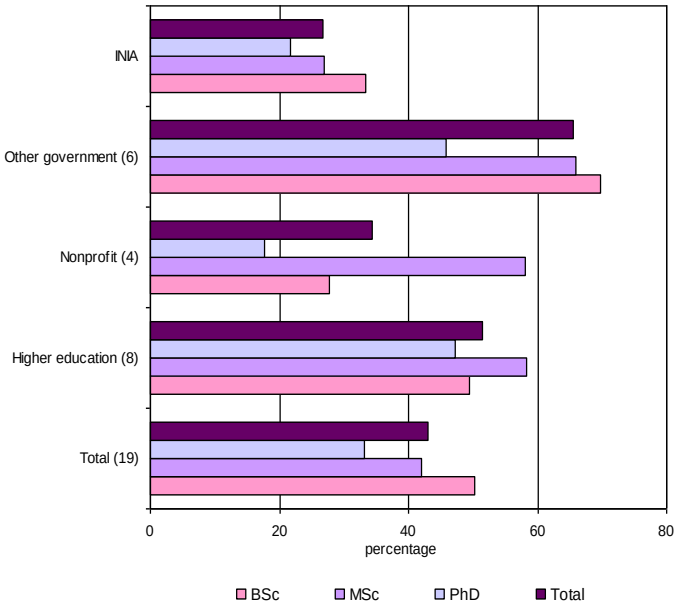
Sources: Compiled by authors from ASTI survey data (IFPRI-INIA 2007-08) and Beintema et al. (2000).
Note: 1996 shares for UdelaR differ slightly from shares previously published in Beintema et al. (2000) due to minor fte revisions.

INIA also experienced tremendous improvements in average qualification levels of its researchers. Early in 1972, CIAAB employed three researchers with doctorate degrees, but during 1974-86, no PhD-qualified researchers were on staff. The second half of the 1990s saw a substantial increase in the share of researchers with postgraduate degrees from around 40 percent in 1991 to 70 percent in 2001. Thereafter, this share continued to grow, such that, by 2006, 77 percent of INIA's scientists were trained to the postgraduate level. This share is significantly higher than for comparable institutes like INIA in Chile (60 percent), CORPOICA in Colombia (54 percent), or INTA in Argentina (13 percent) (Stads and Covarrubias Zuñiga 2008; Stads and Romano 2008; Stads, Ruíz, and De Greef 2009). The actual number of PhD-qualified scientists at INIA nearly multiplied by seven from 7 to 46 fte's during 1996-2006. The sharp increase in the share of postgraduate research staff trained at INIA in the 1990s can be largely attributed to two IDB-financed training programs. A number of other agencies also financed graduate training at INIA in the 1990s, including the UK Department for International Development (DFID), the government of New Zealand and Canada. In recent years, the US Institute of International Education's (IIE's) Fulbright program, the Spanish Agency for International Cooperation and Development (AECID), various university scholarships, and INIA's own budget have financed postgraduate training too.

In addition to postgraduate training, INIA implements continuous on-the-job and non-degree-level training for its staff members. The institute's training budget is currently at around 2 percent of its total expenditures, and it is expected to reach 3 percent in the coming 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 (IAC 2006). Although male researchers still dominate, the share of female researchers in Uruguay is much higher than in most other countries in Latin America. In 2006, 43 percent of the country's total fte researchers in a 19-agency sample (excluding UdelaR's Faculty of Veterinary Science) were female. 33 percent of the agricultural scientists holding doctorate degrees, 42 percent of the researchers trained as MSc and 50 percent of the researchers trained to the BSc level were women (Figure 4). In comparison, corresponding 2006 ratios for countries such as Chile (30 percent) and Colombia (32 percent) were well below those recorded in Uruguay (Stads and Covarrubias Zuñiga 2008; Stads and Romano 2008). With just 38 of its 142 fte researchers being women, INIA employed comparatively fewer female researchers than the other government, nonprofit, and higher education categories. The share of female scientists at the other government category was particularly high. Close to two-thirds of agricultural research staff in this category were women, mostly stemming from the high shares of female researchers at agencies such as IIBCE and DINARA. The higher education agencies also employed relatively more female than male researchers in 2006.

Figure 4—Share of female researchers, 2006

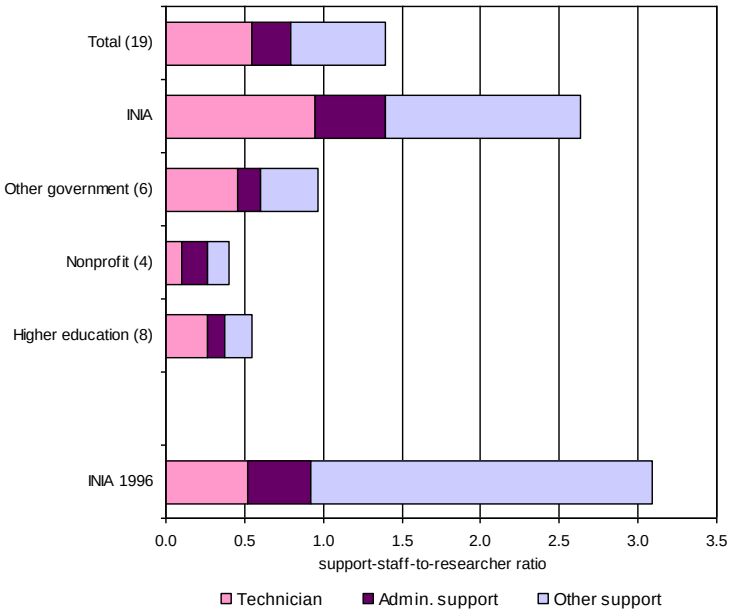


Source: Compiled by authors from ASTI survey data (IFPRI-INIA 2007-08).
Note: Data exclude the Faculty of Veterinary Science of UdelaR.

INIA's share of female agricultural researchers steadily increased over the past years from 21 percent in 1996 to 27 percent in 2006.

That year, the average number of support staff per scientist in a 19-agency sample (excluding UdelaR's Faculty of Chemistry) was 1.4, comprising 0.5 technicians, 0.2 administrative personnel, and 0.6 other support staff such as laborers, guards, drivers and so on (Figure 5). Average numbers of support staff per scientist were much higher at INIA (2.6) than at agencies in the other three categories. Overall, average support-staff-per-scientist levels have fallen slightly in Uruguay over the past decade. Time-series data on support staff were available for INIA. While remaining low, the number of technicians per researcher doubled from 0.5 in 1996 to 1.0 in 2006 due to rapid increases in the total number of technicians at INIA. However, severe retrenchments have occurred in the other support staff category, thereby causing the total number of support staff per scientist to drop slightly.

Figure 5—Support-staff-to-researcher ratios, 2006

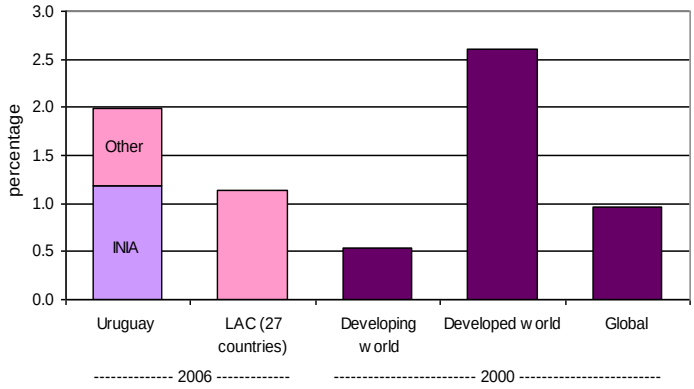


Source: Compiled by authors from ASTI survey data (IFPRI-INIA 2007-08).
Note: Figures in parentheses indicate the number of agencies in each category. Data exclude the Faculty of Chemistry of UdelaR.

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 2006, Uruguay invested $1.99 on agricultural research for every $100 of agricultural output (Figure 6). INIA invested $1.19 for every $100 of Uruguay's agricultural output in 2006. The remaining $0.80 is spent by other government and nonprofit agencies and the country's university sector. Uruguay's research intensity ratio is among the highest in Latin America and the developing world. By way of comparison, the 2006 intensity ratios for other countries in the region such as Argentina (1.27), Brazil (1.68), and Chile (1.22) were well below those recorded in Uruguay (Stads and Beintema 2009). In fact, the 2006 ratio for Uruguay reaches levels close to developed country averages (Beintema and Stads 2008).

Figure 6—Uruguay's agricultural research intensity compared regionally and globally



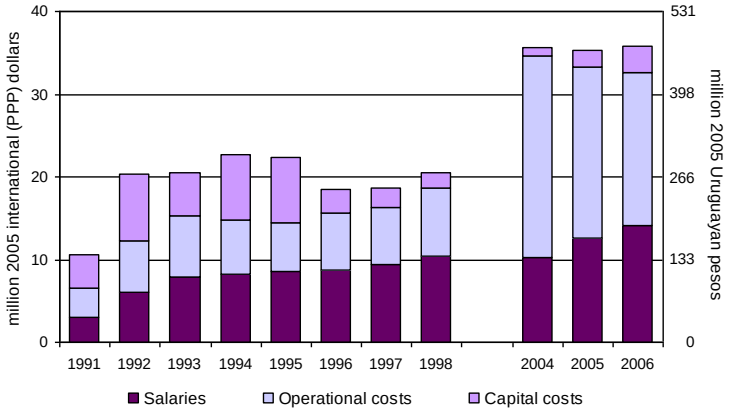
Sources: Uruguay data are compiled from Figure 1b; AgGDP data are from World Bank (2008); LAC's intensity ratio is from Stads and Beintema (2009), 2000 ratios are from Beintema and Stads (2008).
Note: LAC stands for Latin America and Caribbean.

It should be noted, however, that using intensity ratios as a rule of thumb is not always appropriate because they do not take into account the policy and institutional environment within which agricultural research takes place, or the broader size and structure of a country's agricultural sector and economy. For example, small countries need more investments in research because they cannot benefit from economies of scale in the same way that larger countries can. Countries with greater agricultural diversity or more complex agroecological conditions also have more complex research needs and hence require higher funding levels (Beintema and Stads 2008). Studies by IICA suggest that the contribution of agriculture to the overall economy is much higher when considering the linkages of agriculture with farm input and food processing and distribution industries (Trejos, Segura, and Arias 2004). In the case of Uruguay, it could be argued that official AgGDP figures do not fully reflect the importance of the agricultural sector to the national economy. In 2006, agriculture accounted for 9 percent of the country's GDP. However, the country's estimated

expanded AgGDP is much higher, because it includes agribusiness linkages (which account for a considerable part of the country's economy). It is very difficult to measure the exact linkages of Uruguay's agricultural sector with the country's manufacturing and distribution sectors. It is clear that Uruguay's expanded AgGDP is much higher than the country's official AgGDP and that the country's agricultural research spending as a share of expanded AgGDP would be much lower than agricultural research spending as a share of official AgGDP.

As previously mentioned, INIA experienced a sharp increase in its total expenditure levels during 1991-2006, from $11 million to $36 million (in 2005 constant prices). The cost structure of INIA's spending has changed markedly over the years (Figure 7). During the late-1980s and particularly following the creation of INIA—which facilitated the acquisition of nongovernment funding—total operational and capital expenditure increased substantially in absolute terms, but also relative to salaries. The large increase in capital costs in the early-1990s was the result of the aforementioned IDB loan, used in part to fund new equipment and to upgrade INIA's experiment stations. Upon the completion of the IDB project in early 1996, capital spending dropped markedly. During the years after the financial crisis (2004-06), operating costs accounted for more than half of INIA's spending.

Figure 7—Cost category shares in INIA's expenditures, 1991-1998 and 2004-06



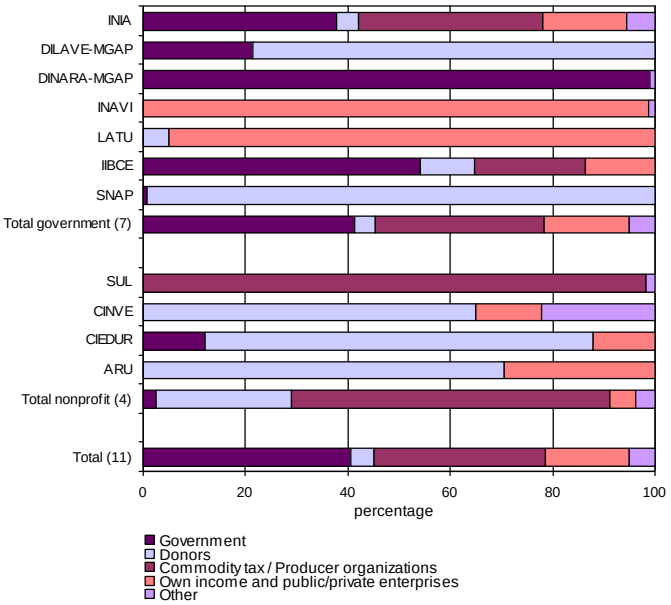
Sources: Compiled by authors from ASTI survey data (IFPRI-INIA 2007-08) and Beintema et al. (2000).

Notably, INIA's spending on operating costs as a share of total expenditures was relatively high (52 percent in 2006) compared with counterpart institutes in other Latin American countries, such as INIA in Chile (40 percent), DIA in Paraguay (31 percent), and INTA in Argentina (20 percent), all of which spent most of their budgets on salaries (Stads and Covarrubias Zuñiga 2008; Stads and Santander 2008; Stads, Ruíz, and de Greef 2009). The fact that Uruguay's INIA spent comparatively less on salaries and more on research is an indication of its relatively robust cost structure compared with institutes in some of its neighboring MERCOSUR countries.

FINANCING PUBLIC AGRICULTURAL R&D

Uruguay's agricultural R&D agencies in the government and nonprofit sectors receive funding from a variety of sources. In 2006, 41 percent of financial resources for a sample of 11 agencies was provided by the Uruguayan government; 33 percent was derived through commodity taxes and producer organizations; 16 percent was internally generated; and the remainder was contributed by donors (4 percent), the private sector (0.1 percent), or other sources (5 percent) (Figure 8). These averages mask significant differences among the various government and nonprofit agencies as well as over time. In 2006, the only year for which funding data were available, agricultural research at DINARA and IIBCE are largely funded through government sources, while R&D activities at LATU and INAVI are predominantly financed through internally generated resources. LATU finances it research activities through the revenues of a tax on non-traditional exports and the provision of services. INAVI finances its research activities through the revenues of a tax that is charged over domestic and imported wines. In addition, SUL funds its research almost entirely by a commodity tax on wool production. In contrast, DILAVE, CINVE, CIEDUR, and ARU depend on foreign donor support for 65 percent or more of their total research funding.

Figure 8—Funding sources of government and nonprofit agencies, 2006



Source: Compiled by authors from ASTI survey data (IFPRI-INIA 2007-08).
Note: The higher education agencies were excluded due to a lack of available data. Funding data were only available for 2006 and may have been fluctuating from year to year.

In 2006, INIA's funding totaled 36 million dollars (in 2005 PPP prices). The institute's funding structure is unique compared with agencies in other Latin American countries in that it is founded in law and is primarily derived from a sales tax on agricultural commodities, together with a government allocation of approximately equal amount. While the commodity tax/government funding shares change little from year to year (in 2006 they were 36 percent and 38 percent respectively), the actual amounts vary according to Uruguay's national value of agricultural production. In years of falling production levels or market prices, the institute's budget can drop markedly—as was the case during the economic crisis of 1999–2002. Since 2003, however, economic growth in the agricultural sector has positively affected INIA's budget. The remainder of INIA's budget is largely generated internally or derived from bilateral foreign donors or multilateral development banks.

Funding from foreign donors and multilateral development banks has always been important but varied markedly from year to year. IDB has been a consistent donor to agricultural research in Uruguay and to INIA in particular, as the IDB-financed Program for Agricultural Technology Development and Transfer (1989–96) helped to lay the foundations for INIA. The project cost a total of US$33 million, US$20 million of which was financed through IDB loans and the remainder through counterpart funding by the Uruguayan government. The second IDB loan was approved in 1998 and ran until December 2005. Its purpose was to boost the efficiency of production in the agricultural and agro-industrial sectors. The program included a sub-program of a total US$7.8 million and fell under the responsibility of INIA. It contributed to the technological transformation of the chain of agricultural production through investment in strategic projects and applied and adaptive research projects. Eleven strategic research projects were selected for the program, which were executed by INIA mainly through strategic alliances with other specialized public- and private-sector organizations. Funds for the projects were provided on a competitive basis. The projects in this component sought to solve specific, well-defined obstacles to the technological development of the farm sector. They were allocated for activities not specified under INIA's research plans and were executed by universities and private and public organizations (IDB 1998). Since 1996, approximately an annually 3 percent of Uruguay's GDP has been allocated to education, 0.6 percent of which is channeled to UdelaR. The target is to increase this allocation to 4.5 percent in 2010. The funds are divided among the various faculties. Generally, UdelaR has earmarked an increasing share of its total budget to research. Funds disbursed by the university's central administration are the consistent major source of support for agricultural research at the faculties of agronomy and veterinary science. In addition, the faculties receive funds from contracts with private and other agencies, but these sources fluctuate considerably from year to year (Beintema et al 2000). Most of these funds are managed by CSIC, which is the aforementioned central body charged with allocating competitive grants throughout the university. CSIC's research expenditure decreased slightly, in inflation-adjusted terms, from $4.3 million in 1998 to $4.1 million in 2004. Of the 701 submitted project proposals in 2004, only 273 were approved by CSIC. Of these 701 projects, 91 were related to agriculture, and 37 of these were approved in 2004 (Hein and Buti 2008). CSIC funding is deemed insufficient to meet research needs, hence supplementary funding sources—such as other national public institutions and private enterprises, as well as from international foundations—are becoming increasingly important in the funding of research at UdelaR.

Competitive Funds

The creation of INIA prompted the establishment of the Agricultural Technology Development Fund (FPTA). INIA policy states that FPTA should be used to strengthen agricultural research in areas complementing INIA's research activities, and that the research should be conducted by non-INIA agencies or research staff. By law, INIA contributes 10 percent of the combined funding it receives through the revenues from the aforementioned commodity taxes and the equal contribution from the government as counterpart funding to R&D projects carried out by other Uruguayan agencies.[7]

FPTA is a competitive fund that disburses research funding annually in response to a call for proposals. Successful proposals can be allocated full or partial funding, depending on cofunding by other agencies. INIA's Projects Unit coordinates this process, assessing the proposals and presenting them to INIA's Board of Trustees for approval. An INIA researcher is assigned to oversee each approved project, and INIA's Finance and Administration Unit manages the disbursal of the funds.

The first call for FPTA proposals was in 1991. During 1999-2006, US$13.5 million were approved for 245 individual research projects. Close to one half of these projects were executed by UdelaR. The private sector also received a significant share of the total funds.

RESEARCH ORIENTATION

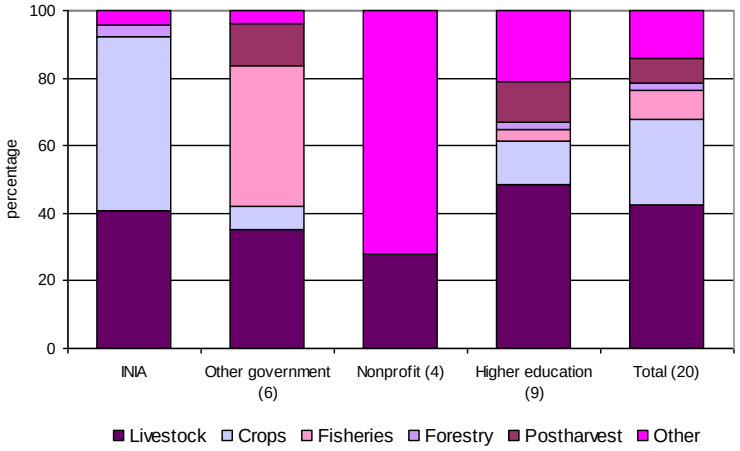
Commodity Focus

The allocation of resources among various lines of research is a significant policy decision, and so detailed information was collected on the number of fte researchers working in specific commodity and thematic areas. In 2006, 43 percent of the 399 fte researchers of the 20-agency sample conducted livestock research. Crop research accounted for 25 percent of the total, fisheries research for 9 percent, and postharvest research for 7 percent (Figure 9a). The importance of the livestock sector to Uruguay's national economy is reflected in these figures. Uruguay is unique in Latin America in that its agricultural scientists focus their R&D efforts more on livestock than on crops. Livestock research accounts for between 28 percent for the nonprofit institutions combined to 48 percent at the higher educations. Crop research, on the other hand, is mostly an INIA affair (51 percent). The other government agencies focus a relatively high share of their human resources on fisheries research (42 percent), but this is not surprising given the inclusion of DINARA in this category. In addition, the nonprofit institutions combined focus mostly on other research areas. Of all the crops research in the country, fruits accounted

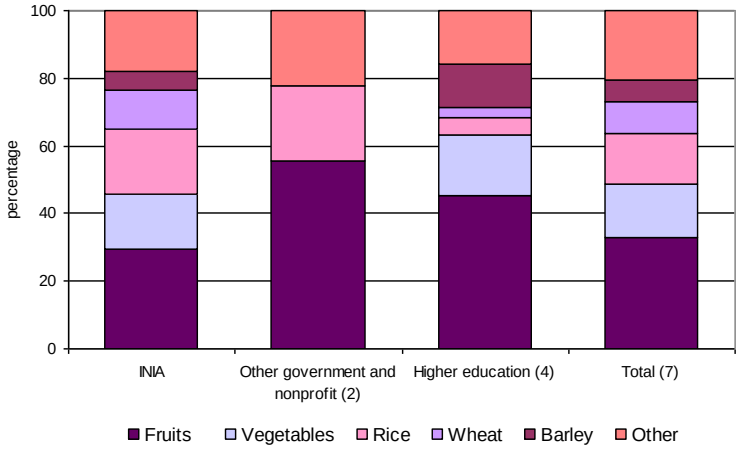
for roughly one-third of all research (9 percent on grapes, 26 percent on other fruits) while cereals accounted for more than one third (rice 15 percent, wheat 9 percent, barley 7 percent, and other 5percent) . In addition, vegetables and potatoes accounted for 16 and 4 percent of total crop research (Figure 9b). Of note is the very high share (56 percent) of fruits (grapes) research in the other government and nonprofit category, which is due to the inclusion of INAVI in this category. Most livestock researchers focused their research efforts on pastures and forages (23 percent), sheep and goats (21 percent), beef (19 percent), and dairy (14 percent) (Figure 9c).

Figure 9a—Commodity focus, 2006

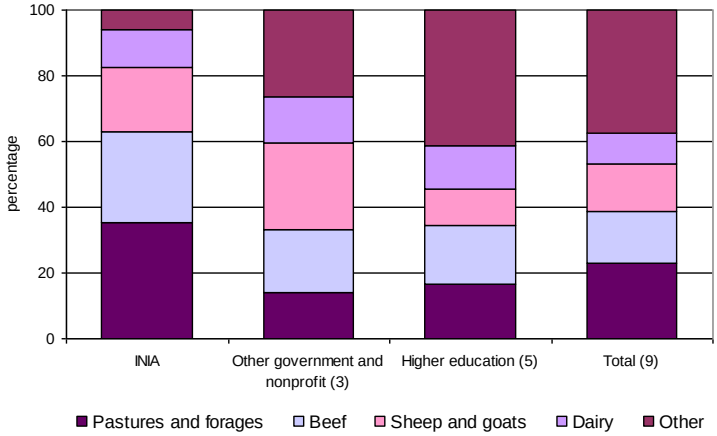
a. By major item



b. By crop item



c. By livestock item



Source: Compiled by authors from ASTI survey data (IFPRI-INIA 2007-08).
Notes: Figures in parentheses indicate the number of agencies in each category. Figure 9b only includes agencies involved in crop research; Figure 9c only includes agencies involved in livestock research.

CONCLUSION

In 2006, Uruguay employed roughly 400 fte researchers and spent 848 million Uruguayan pesos (in current prices) on agricultural research. INIA's funding structure is unique in Latin America in that it receives the proceeds of a commodity tax levied on the total sales value of agricultural commodities in Uruguay and an equal contribution from the national government as counterpart funding. In light of this, INIA is highly dependent on the total production value of Uruguay's agricultural sector. During 1999–2003, the country underwent the worst economic crisis in its recent history, which in turn led to a contraction of agricultural output and, as a result, overall funding to INIA. In 2004, Uruguay's economy began to recover, resulting in rapidly rising agricultural R&D spending.

Uruguay compares favorably with many of its Latin American counterparts in a number of key agricultural S&T indicators. For example, its agricultural research expenditures as a share of AgGDP (at close to 2.0 percent) are much higher than in other Latin American countries. It is important to note, however, that in order to make a proper assessment of the importance of agriculture to Uruguay's economy, it is necessary to take agribusiness linkages into account. The resulting indirect role of the agricultural sector in the overall economy is therefore much larger than official AgGDP data indicate, so the country's high agricultural research intensity ratio should be assessed from this perspective.

NOTES

1. The authors are grateful to numerous colleagues in Uruguay for their time and assistance with the data collection, and thank Nienke Beintema for her useful comments on drafts of this brief.
2. The main causes of this crisis are linked to external factors such us a) a contraction of capital inflows from abroad to Latin America and the region as a result of the effects of the Asian and Russian; b) the marked loss of competitiveness vis-à-vis Brazil and recession and deflation in Argentina; c) the strengthening of the dollar against the euro, which contributed to falling prices of raw materials measured in dollars; d) the deteriorating terms of trade by falling international prices of agricultural products since 1998, and the rise in oil prices since 1999; and e) the epidemic of mouth disease in April 2001 that determined the closure of markets for non-mouth Uruguayan meat knocking one of the country's principal export sector.
3. The 20-agency sample consisted of:

   - 7 government agencies/units: the Instituto Nacional de Investigación Agropecuaria (INIA); the Division Laboratorios Veterinarios (DILAVE) *"Miguel C. Rubino"* and the Dirección Nacional de Recursos Acuaticos (DINARA), both of which are placed under the Ministerio de Ganadería, Agricultura y Pesca (MGAP); the Instituto Nacional de Vitivinicultura (INAVI); the Laboratorio Tecnológico del Uruguay (LATU); the Instituto de Investigaciones Biologicas Clemente Estable (IIBCE); and the Proyecto Fortalecimiento del Proceso de Implementación del Sistema Nacional de Áreas Protegidas de Uruguay (SNAP);

   - 4 nonprofit agencies: the Asociación Rural del Uruguay (ARU); the Centro Interdisciplinario de Estudios sobre el Desarollo (CIEDUR); the Centro de Investigaciones Económicas (CINVE); and the Secretariado Urugayo de la Lana (SUL);

   - 9 higher education agencies: the Facultad de Agronomía, the Facultad de Veterinaria, the Facultad de Química, the Facultad de Ingeniería, the Facultad de Ciencias, and the Facultad de Ciencias Sociales, all of which are placed under the Universidad de la República (UdelaR); the Escuela de *Viticultura "Presidente Tomas Berreta"* under the Universidad del Trabajo del Uruguay (UTU); the Facultad de Ingeniería, Ciencias y Tecnologías de la Alimentación under the Universidad Católica del Uruguay (UCU); and the Facultad de Ciencias Agrarias under the Universidad de la Empresa (UDE).
4. Unless otherwise stated, all data on research expenditures are reported in 2005 international dollars or in 2005 Uruguayan pesos.
5. English translations of agency names have been used throughout the brief except in note 2, where the original Spanish is provided.
6. The Institut Pasteur de Montevideo (IPMONT) was established in December 2006. Given that our data set covers the period 1981-2006, IPMONT was excluded.
7. The amount is automatically deposited into a separate account. However, the full 10 percent is not necessarily approved for allocation to R&D projects each year, FPTA funds are disbursed as grants, [DELETE].
8. It is important to note, as Alston et al. (1998) describe, 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. It also does not account for the spill-in of technologies from other countries or differences in the costs per scientists among different areas of R&D. So, while the congruence rule is a useful tool for allocating resources, and a distinct improvement over precedence and some other shortcut methods, congruency ratios that differ from 1.0 are not necessarily a cause for concern.

REFERENCES

Alston, J.M., G.W. Norton, and P.G. Pardey. 1998. Science under scarcity: Principles and practice for agricultural research evaluation and priority setting. Wallingford, United Kingdom: CAB International.

Astori, D., M. Bergara and F. Lorenzo. 2007. La consolidación fiscal y financiera: plataforma para el cumplimiento del programa de gobierno. Presentation given at the Foro empresarial en ACDE . 6 December.

Beintema, N. M., G. G. Hareau, M. Bianco and P. G. Pardey. 2000. Agricultural R&D in Uruguay: Policy,investments,and institutional profile. Washington, D.C.: International Food Policy Research Insitute, National Agricultural Research Institute, and Regional Fund for Agricultural Technology.

Beintema, N. M. and G. J. Stads. 2008. Measuring agricultural R&D investments: A revised global picture. ASTI Background Note. Washington, D.C.: International Food Policy Research Institute.

DINARA (National Directorate of Aquatic Resources). 2008. Dirección Nacional de Recursos Acuaticos homepage. <http://www.dinara.gub.uy/web_dinara/>. (accessed April 2008).

Hein, P. and A. Buti. 2008. Proyectos de investigación (Investigación y Desarollo, Iniciación a la Investigación). <http://www.csic.edu.uy/CSIC%20en%20cifras/capitulo%20proyectos%20csic %20cifras.htm>. (accessed February 2008).

IAC (Inter-Academy Council). 2006. Women for science: An advisory report. Amsterdam.

IDB (Inter-American Development Bank). 1998. Agricultural Services Program (UR-0116). Loan Proposal. Washington, D.C.

IFPRI-INIA (International Food Policy Research Institute and National Agricultural Research Institute). Agricultural Science & Technology Indicators survey for Uruguay. Unpublished surveys. Washington, D.C. and Montevideo.

IICA (Interamerican Institute for Cooperation on Agriculture). 2004. El agronegocio uruguayo: Pilar del país productivo. Proyecto agropecuaria Uruguay 2020. San José, Costa Rica.

INIA (National Agricultural Research Institute). 2008. Instituto Nacional de Investigación Agropecuaria. <www.inia.org.uy>. (accessed April 2008).

MGAP (Ministry of Livestock, Agriculture, and Fisheries). 2007. Valor de la producción bruta de la actividad agropecuaria, por año, segun subsector (en miliones de doláres corrientes). <http://www.mgap.gub.uy/Diea/Anuario2007/pages/DIEA-Anuario-2007-cd_021.html>. (accessed February 2008).

MGAP-DIEA (Ministry of Livestock, Agriculture, and Fisheries – Agricultural Statistics Directorate). 2007. Anuario estadístico agropecuario 2007. Montevideo.

OECD (Organisation for Economic Co-operation and Development). 2002. Frascati manual: Proposed standard practice for surveys on research and experimental development. Paris.

RICYT (Ibero-American and Inter-American Network on Science and Technology Indicators). 2008. Indicadores comparativos. <http://www.ricyt.edu.ar/interior/interior.asp?Nivel1=1&Nivel2=2&Idioma=>. (accessed February 2008).

Stads, G. J. and C. Covarrubias Zuñiga. 2008. Chile. ASTI Country Brief No. 42. Washington, D.C. and Santiago de Chile: International Food Policy Research Institute and National Agricultual Research Institute (INIA).

Stads, G. J. and L. Romano. 2008. Colombia. ASTI Country Brief No. 39. Washington, D.C.: International Food Policy Research Institute.

Stads, G. J. and V. Santander. 2008. Paraguay. ASTI Country Brief No. 40. Washington, D.C.: International Food Policy Research Institute.

Stads, G. J. and N. M. Beintema. 2009. Public agricultural research in Latin America and the Caribbean: Investment and capacity trends. ASTI regional report. Washington, D.C.: International Food Policy Research Institute and Inter-American Development Bank (forthcoming).

Stads, G. J., A.M. Ruíz, and G. de Greef. 2009. Argentina. ASTI Country Brief No. 44. Washington, D.C.: International Food Policy Research Institute and National Agricultural Technology Institute (in preparation).

Trejos, R., O. Segura, and J. Arias. 2004. More than food on the table: *Agriculture's true contribution to the economy*. San Jose, Costa Rica: Inter-American Institute for Cooperation on Agriculture.

UdelaR (Universidad de la República). 2008. Universidad de la República – Uruguay. <www.universidad.edu.uy>. (accessed April 2008).

UNESCO (United Nations Educational, Scientific and Cultural Organization), Division of Statistics on Science and Technology. 1984. Manual for statistics on scientific and technological activities. UNESCO, Paris. Mimeo.

World Bank. 2007. Project information document (PID). Appraisal stage. UY promoting innovation to enhance competitiveness. Report No. AB2653. Washington D.C.

World Bank. 2008. World development indicators 2008. Washington, D.C. CD ROM.

METHODOLOGY

- Most of the data in this brief are taken from unpublished surveys (IFPRI 2007-08) and Beintema et al. (2000).
- 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). 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 2005 international dollars by deflating current local currency units with a Uruguayan GDP deflator of base year 2005 and then converting to U.S. dollars with a 2005 purchasing power parity (PPP) index, taken from World Bank (2008). 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.

ABOUT THE AUTHORS

Gert-Jan Stads (g.stads@cgiar.org) is a program coordinator for the ASTI initiative within the ISNAR division of IFPRI.
Beatriz Cotro (bcotro@inia.org.uy) is an agricultural engineer at INIA.
Mario Allegri (mallegri@inia.org.uy) is the director general of INIA.

CONTACT INFORMATION

IFPRI ROME/INTERNATIONAL SERVICE FOR NATIONAL AGRICULTURAL RESEARCH (ISNAR) DIVISION

Nienke Beintema
Head Agricultural Science and Technology (ASTI) initiative
c/o ESA, Food and Agricultural Organization (FAO), Room B524b
Viale delle Terme di Caracalla 00153 Rome, ITALY
Phone: +39-06-570-53192 Fax: +39-06-570-55522
Skype: ifpriromeoffice

IFPRI HEADQUARTERS

International Food Policy Research Institute (IFPRI)
2033 K Street, NW
Washington, DC 20006 USA
Phone: +1-202-862-5600 Fax: +1-202-467-4439
Skype: ifprihomeoffice

WWW.ASTI.CGIAR.ORG ASTI@CGIAR.ORG

WWW.IFPRI.ORG IFPRI@CGIAR.ORG