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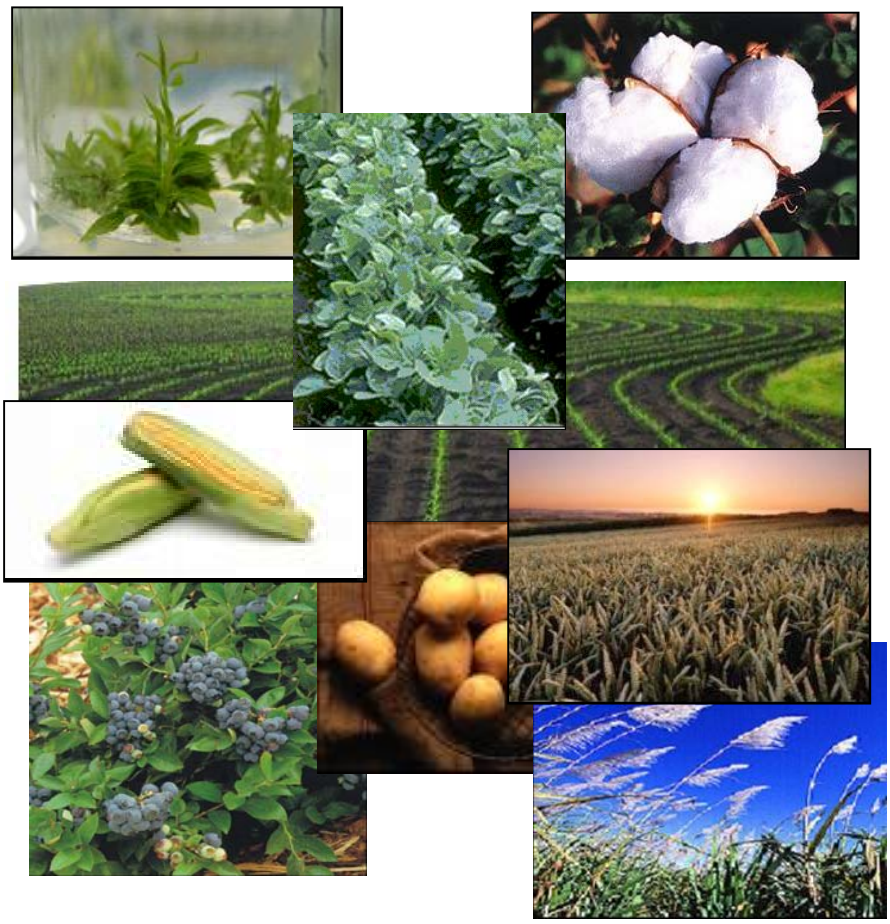
MARKET REVIEW



PLANT BIOTECHNOLOGY in ARGENTINA

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FOREWORD

The image of Argentina in The Netherlands is strongly related to gauchos, tango, our future queen and a soccer team that we always have to beat to get glory in the World Cup. When it concerns the Argentine economy, only one image can spring to mind: that of agriculture, and vast areas of productive land.

Indeed, agriculture has been the engine of the economic growth of the recent years in Argentina. Grains, beef, wine, fruits and dairy products have made their way to the world market and have gained the country a reputation as one of the true agricultural superpowers of the world. It was not without reason that the Dutch minister of Agriculture, Nature and Food Quality visited Argentina in the summer of 2006.

One of the fields of cooperation that were identified during the visit is plant biotechnology. Argentina has a lot to offer in this field. The country is the 2nd largest producer of genetically modified crops in the world, and research efforts rank high by all standards. Almost one thousand field trials were authorized between 1991 and 2006, and its location offers possibilities for counterseasonal production.

As not that much is known in The Netherlands about Argentine biotechnology, the ministry of Agriculture, Nature and Food Quality commissioned Mr. Pepijn Verhey MBA, president of the Agri-Food Business Consultancy firm Agrivalue SA, to write a review covering all aspects of the sector. His report is based on interviews with many stakeholders and inputs from various previously published documents on biotechnology in Argentina. The report offers an excellent overview of all current developments and the main players, highlighting many opportunities for cooperation, trade and investments.

The department for Industry & Trade of the ministry of Agriculture, Nature and Food Quality and the Agricultural Section of the Netherlands Embassy in Buenos Aires welcome your comments and suggestions, in particular in relation to a ministry-led biotechnology mission that is planned.

Frederik Vossenaar
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Main acronyms

AACREA	Argentine Association of Regional Consortiums for Agricultural Experimentation (Asociación Argentina de Consorcios Regionales de Experimentación)
AAPRESID	Argentine No Till Farmers Association (Asociación Argentina de Productores de Siembra Directa)
ARPOV	Association for the Protection of Plant Varieties (Asociación Argentina de Protección de las Obtenciones Vegetales)
ASA	Argentine Seed Growers Association (Asociación de Semilleros Argentinos)
BO	Biotechnology Office of the Secretariat of Agriculture, Livestock, Fisheries and Food (Oficina de Biotecnología, SAGPyA)
BSP	Cartagena BioSafety Protocol
CONABIA	National Advisory Commission on Agricultural Biotechnology (Comisión Nacional Asesora de Biotecnología Agropecuaria)
CONASE	National Seed Commission (Comisión Nacional de Semillas)
CONICET	National Council of Scientific and Technical Research (Comisión Nacional de Investigaciones Científicas y Técnicas)
EEA	Agricultural Experimental Station (Estación de Experimental Agropecuaria)
FAO	Food and Agriculture Association of the United Nations
FELAEB	Latinamerican Federation of Associations of Biotechnology Companies (Federación Latinoamericana de Asociaciones de Empresas de Biotecnologia).
FONTAR	Technological Argentine Fund (Fondo Tecnológico Argentino)
FONCyT	Fund for Scientific and Technological Research Fondo Nacional de Ciencia y Tecnología
INASE	National Institute of Seeds (Instituto Nacional de Semillas)
INTA	National Institute of Agricultural Technology (Instituto Nacional de Tecnología Agropecuaria)
SAGPyA	Secretariat of Agriculture, Livestock, Fisheries and Food (Secretaría de Agricultura, Ganadería, Pesca y Alimentación)
SECyT	Secretariat of Science, Technology and Productive Innovation (Secretaría de Sciencia, Técnologia y Innovación Productiva)
SENASA	National Agrifood Health and Quality Service (Servicio Nacional de Sanidad y Calidad Agropecuaria)
UBA	University of Buenos Aires (Universidad de Buenos Aires)

EXECUTIVE SUMMARY

Argentina is the third biggest Latin America economy after Brazil and Mexico. 90% of its population of 38,7 million people is concentrated in cities and is largely of European origin, the indigenous population accounting for slightly less than 3% of the total.

The country is rich in natural resources with a geological and climatic situation particularly suitable for developing forestry, agriculture, mining and fisheries. Five percent of the Gross Domestic Product (GDP) of $404 billion in Argentina is produced in the agriculture sector. The country has a skilled and dynamic labour force.

Argentina has a 2,74 million sq. ka. land area, of which 9% is arable land and 0.8% is cropland. The climate is mostly temperate. Argentine main crops are sunflower seeds, lemons, soybeans, grapes, corn, tobacco, peanuts, tea and wheat.

Argentina[1] occupies the 8th place in the ranking of companies that invest in biotechnology in the world, with a total of 84 companies that apply biotechnology processes in agricultural production (54), food (10) and medicines (20). These companies invoiced about U$S 310 million dollars in biotechnological products between 2003 and 2004 and employed 5.000 people.

Argentina is the world's second largest producer of GMO crops behind the United States, with ten biotech crop varieties approved for seeding: one for soy, two for cotton and now seven for corn, according to biotech lobby ArgenBio[2].

Three biotech crops[3] (soybeans, cotton, and maize) were grown in Argentina on 17,1 million hectares in 2005, and the combined biotech market value was $8,9 billion.

Argentina[4] is the world's third-largest soybean producer. Practically 100% of the soy was from genetically modified varieties in 2005/06. Cotton was planted on 410,000 hectares in 2003/04. The adoption rate is assumed to have risen to 70%, generating over $75 million in market value attributed to biotech cotton. During the campaign 2005/2006, 70% of the cultivated maize in Argentina corresponded to biotech varieties.

The National Advisory Committee for Agricultural Biotechnology (Conabia) database of government regulatory approvals indicates:

Soybean:
- Monsanto Roundup-Ready (line GTS 40-3-2) glyphosate herbicide tolerance full approval 1996.

Cotton:
- Monsanto Bollgard resistant to lepidopteran pests including, but not limited to, cotton bollworm, pink bollworm, and tobacco budworm (lines MON531 only, not lines MON757/MON1076).

Environmental release and food/feed consumption approvals in 1998
- Monsanto Roundup-Ready glyphosate herbicide tolerance (line MON1445 only not also lineMON1698), approved for environmental release 1999, and for food/feed use in 2002.

Maize:
- Bayer Liberty-Link (lines T14, T25) Phosphinothricin (PPT) herbicide tolerance, specifically gluphosinate ammonium. Approved for environmental release and food/feed use in 1998.
- DeKalb Bt Xtra (line TBD-418) resistance to European corn borer (Ostrinia nubilalis) and phosphinothricin (PPT) herbicide tolerance, specifically gluphosinate ammonium. Environmental release approval 1998.

[1] Agrivalue SA interview with Alberto Diaz, one of the authors of “Las empresas de biotecnología en Argentina”
[2] Agrivalue SA interview with Dra. Gabriela Levitus, Executive Director of ArgenBio
[3] James, C. 2005. Executive Summary of Global Status of Commercialized Biotech/GM Crops: 2005. ISAAA Briefs No. 34. ISAAA: Ithaca, NY.
[4] The Global Diffusion of Plant Biotechnology: *International Adoption and Research in 2004* C. Ford Runge, Ph.D. Distinguished McKnight University Professor of Applied Economics and Law Director, Center for International Food and Agricultural Policy University of Minnesota Barry Ryan, M.S. Research AssociateUniversity of Minnesota December 8, 2004

- Monsanto Yieldgard (line MON810) resistance to European corn borer (Ostrinia nubilalis), full approval in 1998.
- Monsanto Roundup-Ready (line GA21) glyphosate herbicide tolerance, environmental release approval in 1998.
- Syngenta NaturGard KnockOut (line SYN-176) resistance to European corn borer (Ostrinia nubilalis) and phosphinothricin (PPT) herbicide tolerance, specifically gluphosinate ammonium approved for environmental release in 1996, and food/feed approvals in 1998.
- Syngenta line SYN-BT11 with phosphinothricin (PPT) herbicide tolerance, specifically gluphosinate ammonium, environmental release and food/feed use in 2001.

The FAO "Biotechnologies in Developing Countries" database shows that Argentina has carried out the following field studies and laboratorial trials:

Field study (the whole information regarding field trials performed from 1991 to 2004 is available at SAGPyA website: http://www.SAGPyA.mecon.gov.ar)

- o Alfalfa - Lepidoptera resistant, herbicide tolerant
- o Cotton - Lepidoptera resistant, herbicide tolerant
- o Maize - Herbicide tolerant, fungal resistant, oil composition
- o Potato - PVY virus resistant
- o Soybean - Lepidoptera resistant, herbicide tolerant, oil composition
- o Sugar beet - Herbicide tolerant
- o Sunflower - Herbicide tolerant, fungal resistant, Lepidoptera resistant
- o Tomato - Virus resistant
- o Wheat - Herbicide tolerant, fungal resistant, high gluten content

A merely numerical analysis[5] of the authorizations for GMO's field trials, that have been granted by the Argentine National Advisory Commission on Agricultural Biotechnology (CONABIA) since 1991, shows that of the total 495 field trials authorized until 2001, 380 trials were requested by multinational corporations, 72 by national companies, 38 by public research institutes, and 5 by public universities. In 2002, 71 further authorizations were issued, 98 in 2003, and 121 in 2004 showing the same patterns. From 1991 to 2004, 788 field releases were authorized. All commercial approvals granted as of September 2005 have to do with events developed by multinational firms.

About the GMO's involved, from 1991 to 2004, corn leads with 54 percent of authorized field trials, followed by soybean with 15 percent, sunflower with 10 percent, cotton with 7 percent, rice with 4 percent, potato with 3 percent, wheat and alfalfa with 2 percent. Among others (3 percent) there are tobacco, fruits, and vaccines. Regarding the incorporated features, insect resistance leads with 26 percent of the field trials, followed by herbicide tolerance with 25 percent, both characteristics with 26 percent, quality traits with 10 percent, virus resistance with 3 percent, pathology resistance with 2 percent, while other characteristics represent 8 percent of approved field trials. According to Trigo et al (2002) only in potato and alfalfa there is an important presence of local R&D, particularly by INTA.

Laboratory Trials

- o Alfalfa - Fungal resistant, veterinary edible vaccines
- o Barley - Unspecified
- o Potato - PVY virus resistant
- o Sugar cane - Unspecified
- o Tobacco - Salt tolerant

The responsibility for biotechnology research in agriculture corresponds to:

- o Secretariat of Agriculture, Livestock, Fisheries and Food at the Ministry for Economics and Production; (SAGPyA)
- o Secretariat of Science, Technology and Productive Innovation (SeCyT)
- o National Council for Scientific and Technical Research (CONICET)
- o Ministry for Culture and Public Education
- o National Advisory Committee for Agricultural Biotechnology (CONABIA)

[5] NYU Project on International GMO Regulatory Conflicts Argentina, GM nation. Chances and choices in uncertain times by Ana María Vara Centro de Estudios de Historia de la Ciencia José Babini Escuela de Humanidades, Universidad Nacional de General San Martín (UNSAM) September, 2005

The main Argentine agricultural biotechnology research institutions include:
o National Institute of Agricultural Technology (INTA)
o Institute for Physiological and Ecological Agriculture-related Research (IFEVA)
o Institute of Genetic Engineering and Molecular Biology (INGEBI)
o Centre for Studies on Photosynthesis and Biochemistry (CEFOBI)

According to Lic. Marcelo Argüelles[6], President of Sidus Pharmaceuticals and President of Bio Sidus (for more information on these companies see paragraph 4.2.3), Argentina has an enormous potential for Biotechnology and R&D as the country holds excellent academic and scientific quality, especially in the biological sciences. Three Nobel Prize recipients have been Argentinean scientists: Bernardo Houssay, Luis F. Leloir and César Milstein. This level of knowledge, mostly cultivated at public and private universities, supported by public and private investments, brings about excellent results. However, these efforts will not lead to short-term responses as scientific research proceeds on its own schedule and therefore a sustained financial investment over time is required. For this year, investments are concentrated on production facilities for the bio-generics market. With a proper integration between science and business, satisfactory results will surely project Argentina as an important scientific destination for the rest of the world.

So far the genetically modified varieties in Argentina are mainly developed by multinational companies, that later on adapt their innovations locally. The research and development is realized abroad. Generally speaking, only the stage of phyto-improvement (adapting the GMO varieties to the local conditions) is realized locally; for instance, the soy resistancy against Glyphosate and Maize Bt commercialized by Monsanto was done in Argentina.

The local companies, within the plant area, except some few exceptions, have concentrated on developments that are not linked to the use of DNA recombinant skills, but focus generally on the field of tissue culture with applications directed to ensure the genetical and sanitary quality of plant propagation crops. This is partly due to the high amount of capital required for the acquisition of equipment and also to the lack of resources to face this type of high-risk investments and the complexity of the biosafety stages of the transgenic products.

In order to implement its R&D activities, almost all the national companies have been active in obtaining financing through public sources, via project presentations to state programs that have as main purpose stimulating the development of innovations, such as the Technological Argentine Fund (FONTAR), a program belonging to the National Agency of Scientific and Technological Promotion. FONTAR has financed more than 60 projects linked to the agri-food sector and the development of biotechnology products.

Interviews with both private and public parties in the market have shown that future cooperation opportunities within the area of plant biotechnology between Argentina and the Netherlands are expected in the following areas:

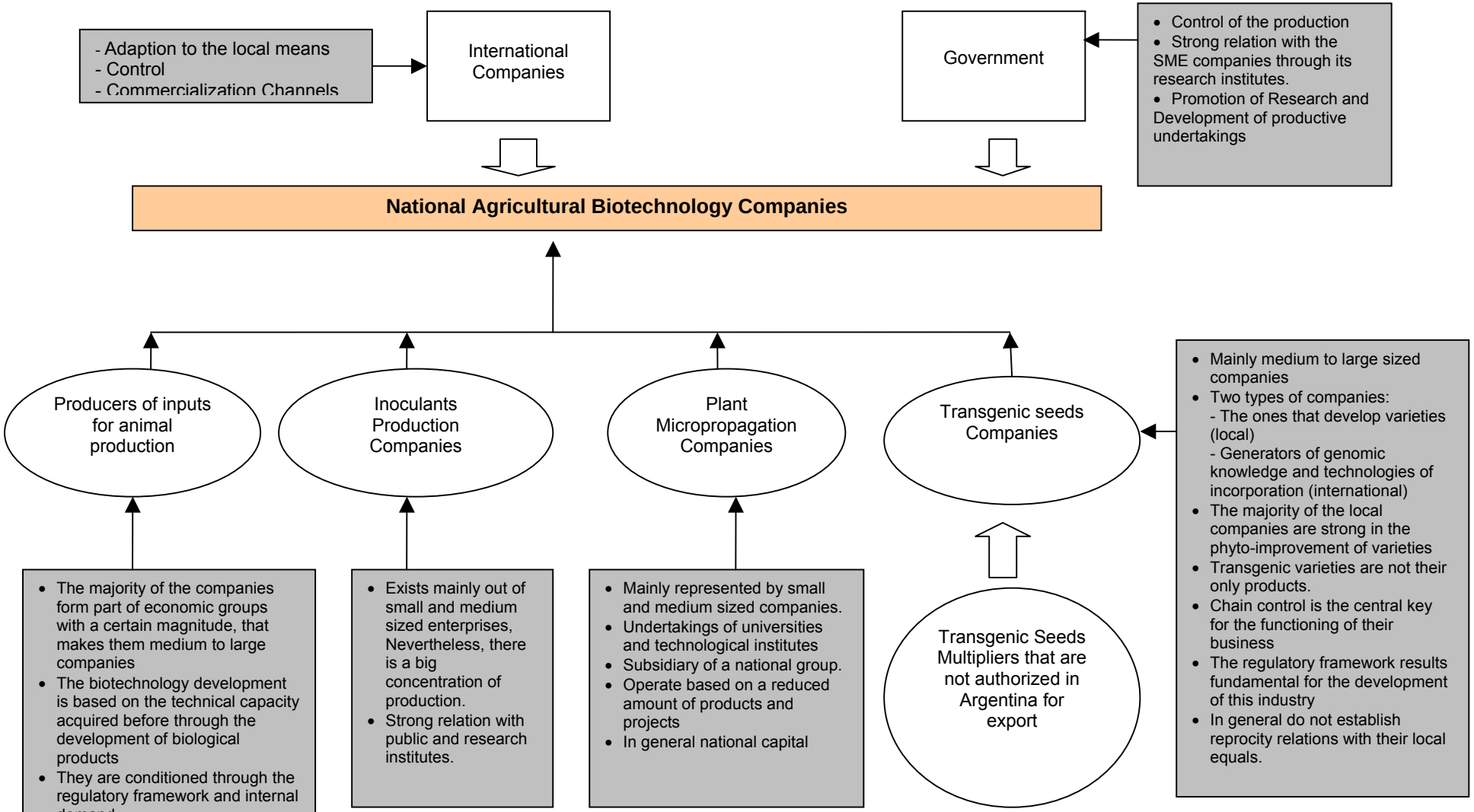
1) Field trials in Argentina (regulatory experience available)
2) Interchange of Phd and Post-doc students
3) Financing of Argentine incubators

Besides, of the traditional crops cultivated in Argentina, the potato is becoming an important biotech product to be taken into account by the Dutch. Co-existance is an interesting topic, as Argentina is an important producer of organic crops as well.

Below in figure 1, an overview of the main actors within the Argentine Biotechnology sector and its interrelations (inoculants, seeds, vaccines and plantlets) is presented. In figure 2, the main private organizations of each group are identified:

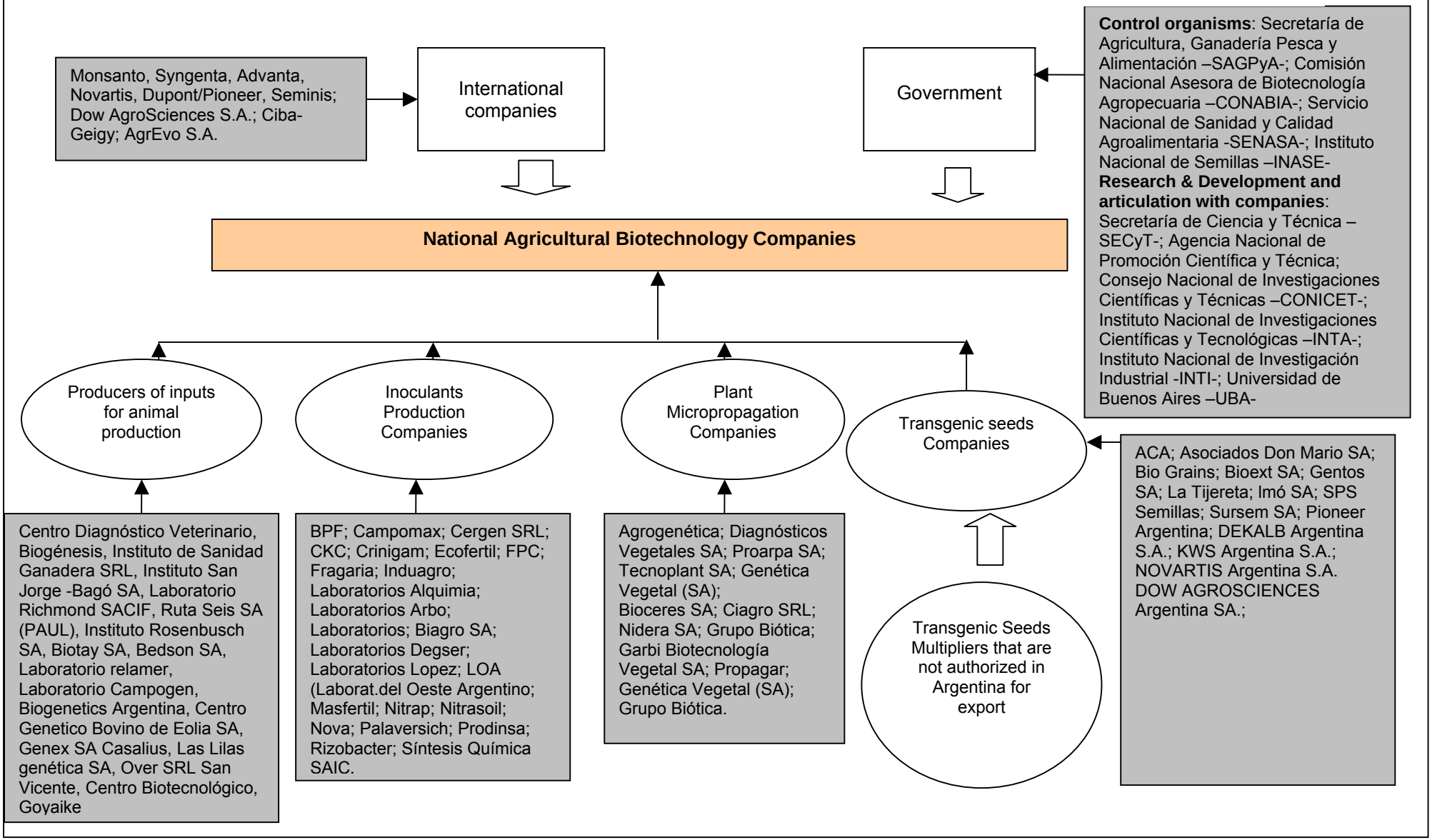
[6] Movers & Shakers interview with Lic. Marcelo Argüelles, date Published: 30 Jun 2006 By Federico O'Conor, Research Analyst, Healthcare Latin America

Figure 1. System of Argentine Agro-Biotechnology Companies (Inoculants, Seeds, Vaccines, and Plantlets)



Source: Agrivalue based on information by Eduardo Trigo and Bisang et al 2005

Figure 2. Companies and Institutes identified within the Agro-Biotechnology System (Inoculants, Seeds and plantlets)



Source: Agrivalue based on information by Eduardo Trigo and Bisang et al 2005.

STATE-OF-THE-ART PLANT BIOTECHNOLOGY ARGENTINA

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I Regulatory Framework on Agricultural Biotechnology

II GMO Evaluations in Argentina in 2005

III Identified Biotechnology Companies and Associations in Argentina

IV Argentine Biotechnology Companies: Inoculants

V Argentine Biotechnology Companies: Agricultural and Plant Sector

1 INTRODUCTION: BIOTECHNOLOGY IN PLANT PRODUCTION AND PROTECTION[7,8]

Agriculture is expected to feed an increasing human population, forecast to reach 8.000 million by 2020, of which 6,700 million will be in the developing countries. Although the rate of population growth is steadily decreasing, the increase in absolute numbers of people to be fed may be such that the carrying capacity of agricultural lands could soon be reached given current technology. The technological challenge is to obtain this agricultural productivity improvement without destroying the global natural resource base. New technologies, such as biotechnology, if properly focused, offer a responsible way to enhance agricultural crop productivity for now and the future.

The main biotechnological applications in crop biotechnology include tissue culture, marker-assisted selection and transgenic technology.

Tissue culture includes micro-propagation; embryo rescue; plant regeneration from callus and cell suspension; and protoplast, anther and microspore culture, which are used particularly for large-scale plant multiplication. Micro-propagation has proven especially useful in producing high quality, disease-free planting material of a wide range of crops. Tissue culture also provides the means to overcome reproductive isolating barriers between distantly related wild relatives to crops through embryo rescue and in vitro fertilization or plant protoplast fusions.

Molecular marker technology is useful for assisting and speeding up selection through conventional breeding. It is a powerful method for identifying the genetic basis of traits and is used to construct linkage maps to locate particular genes that determine beneficial traits. Using molecular markers, genetic maps of great detail and accuracy have been developed for many crop species. Markers are particularly useful for analyzing the influence of complex traits like plant productivity and stress tolerance and are being employed to develop suitable cultivars of the major crops.

Generation of genetically modified transgenic plants with a range of added traits, uses advanced recombinant DNA techniques including genetic engineering and cloning. Several transgenic cultivars of major food crops, such as soybeans, maize, canola, potatoes and papayas, have been commercially released incorporating genes for resistance to herbicides, insects and viruses. It is estimated that the global area planted with transgenic crops has risen from 1,7 million hectares in 1996 to 44,2 million hectares in 2000 and more than doubles since then to over 90 million hectares in 25[9].

Crop improvement continues to benefit from advances in plant molecular biology and genomics. The completion of the genome sequence of the mustard (Arabidopsis thaliana) and rice and the continuing work on functional genomics has tremendous direct benefits both for dicotyledons and monocotyledons. The increase in understanding of gene regulation and expression will allow crops to be modified to provide food, fiber, medicine and fuel as well as tolerance to environmental stresses. The tools are in place to meet future food demand through increases in crop productivity with less land and water to meet the demand of the population increase.

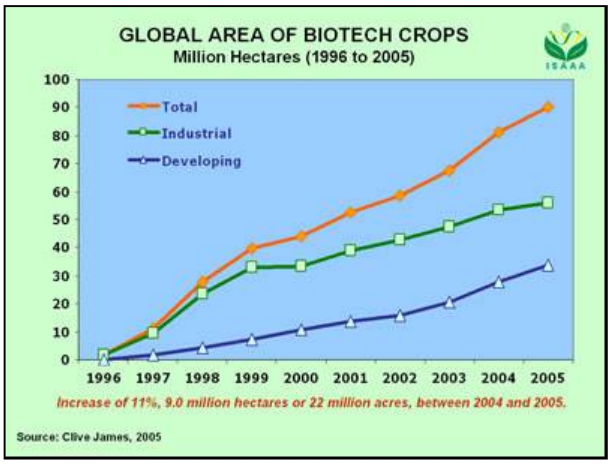
[7] http://www.fao.org/biotech/sector2.asp

[8] Definitions of Biotechnology and its Component Technologies Biotechnology is any technique that uses living organisms or substances derived from these organisms to make or modify a product, improve plants or animals or develop microorganisms for specific uses (Cohen 1994). Modern biotechnology refers to the applications of new developments in recombinant DNA technology, advanced cell and tissue culture techniques and modern immunology. The key components of modern biotechnology are:

- Genomics: the molecular characterization of all species;
- Bioinfomatics: the assembly of data from genomic analysis into accessible forms;
- Transformation: the introduction of single genes conferring potentially useful traits into plants, livestock, fish and tree species that are then called transgenic or genetically modified organisms;
- Molecular Breeding: the identification and evaluation of desirable traits in breeding programs by the use of marker assisted selection;
- Diagnostics: the use of molecular characterization to provide more accurate and quicker identification of pathogens;
- Vaccine Technology: the use of modern immunology to develop recombinant DNA vaccines for improving control of lethal diseases.

[9] ISAAA Briefs 34-2005: Global Status of Commercialized Biotech/GM Crops: 2005

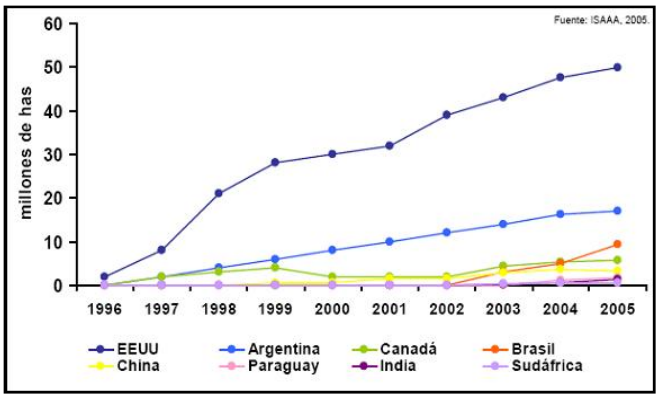
Graph 1 Transgenic crops Evolution of the sown area period 1996-2005



Source: Clive James, 2005

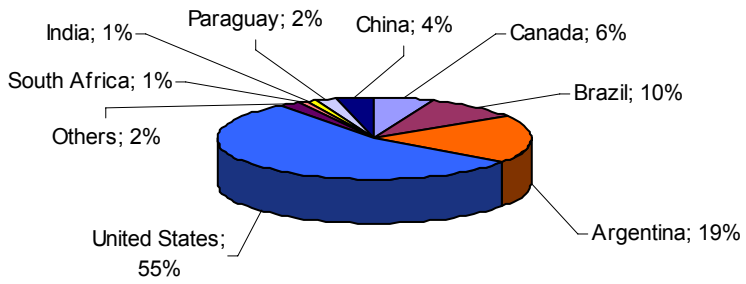
It is however, important to recognise that possible environmental risks can be caused by transgenic gene escape and genetic erosion and new products of biotechnology, mainly involving genetically modified crops, have raised such concerns. Adequate biosafety regulations, risk assessment of transgenic crops and establishment and compliance with appropriate mechanisms and instruments for monitoring use are needed to ensure that there will be no harmful effects on the environment or for the users.

Graph 2 Adoption of GMO's in Agriculture



Source: ISAAA, 2005

Chart 1 Distribution of the sown GMO area in the world by country



Source: Agrivalue SA based on ISAAA 2005 data

2 BIOTECHNOLOGY IN ARGENTINA

Argentina[10], is one of the largest producers of transgenic crops in the world. Its transgenic crops vary from soybeans, maize, sunflower, to tomatoes, rape, sugar and cotton. Moreover, it has developed biotechnologies of its own. An introduction about the early adoption of biotechnology in Argentina;

Argentina has attained world renown as an agricultural nation. This reputation has been based principally on the quantity and high quality of its meat and grain exports, which result from a combination of conditions, including favorable climate, fertile soil, and a limited population. Argentina has been able to produce foodstuffs far beyond its own domestic requirements, and every indication is that this condition will prevail for some time to come[11].

The Pampa[12], Argentina's area of highest agricultural productivity, is also worldwide one of the naturally most productive areas. Its fertile loess soil and mild climate the whole year round provide a natural competitive advantage over other regions. Traditionally, cultivation of grains has been alternated with fallow seasons to grow cattle pasture.

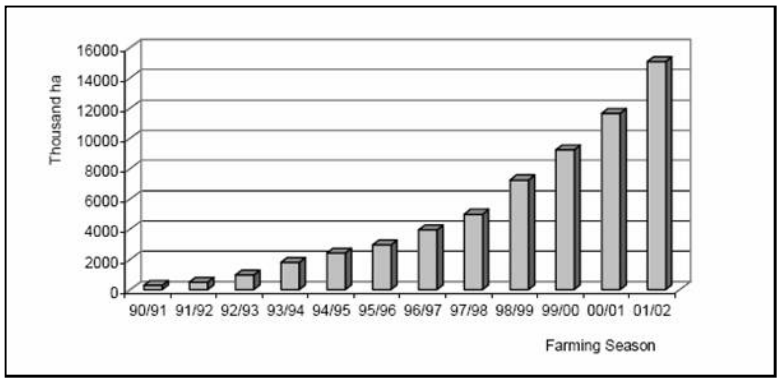
At the beginning of the 1980's, world market prices for grains and oilseeds increased, while at the same time productivity of raising cattle declined. Permanent crop cultivation became more lucrative, since the production of soybean in rotation with wheat, maize or sunflower allows for 3 harvests in 2 years. Furthermore, in 1991 the end of hyperinflation due to the fixation of the Argentine peso against the US dollar and abolition of export duties on agricultural products triggered an investment in new technologies.

This new framework favoured the import of machinery and agricultural inputs such as pesticides and fertilizers at low prices and their use in oilseed production for export markets. The intensification of the production system was followed by a decline in soil fertility. Consequently, fertilizer consumption stepped up from 0,3 million tonnes in 1990 to 2,5 million tonnes in 1999.

Technological Innovation

To combat increased erosion, a new sowing technology called no-tillage was introduced by the leader group in the process of technological innovation in Argentine's agriculture, AAPRESID[13] (the Argentinean No Till Farmers Association, see also paragraph 4.4). No-tillage maintains a permanent or semi-permanent organic soil cover (e.g. a growing crop or dead mulch) that protects the soil from sun, rain and wind and allows soil micro-organisms and fauna to take on the task of "tilling" and soil nutrient balancing - natural processes disturbed by mechanical tillage.

Graph 3 No-Till Area Evolution (1990 / 2002)



Source: AAPRESID
Total area 26 million ha.
No-Till adoption 60%

At present it accounts for 60 per cent of soybean planted in rotation with maize and 85 per cent of this oilseed in rotation with wheat. In contrast to the conventional method of ploughing the field before planting to eliminate weeds, no-tillage means that seeds are sown directly into the soil with a drilling

[10] Azuaga, F. Professor University of Buenos Aires www.genomicsforum.ac.uk/documents/fabianaLecture.ppt
[11] Shellenberger, J. A. (1945), "Argentina's agricultural future," *The Scientific Monthly*, Vol 60, No. 4 (April), pp. 257-260.
[12] Lehmann, V. and Pengue, W. A. (2000), "Herbicide tolerant soybean: Just another step in a technology treadmill?" Biotechnology and Development Monitor, No. 43, p. 11-14.
[13] The Impact of the Introduction of Transgenic Crops in Argentinean Agriculture by Eduardo J. Trigo and Eugenio J. Cap Grupo CEO S.A., Buenos Aires, Argentina; INTA, Buenos Aires, Argentina

device and that weeds are controlled by herbicides. Thus, the spread of no-tillage lead to an increase in herbicide use.

In this cascade of technological measures herbicide-tolerant soybean was only the next consequence to increase productivity, which by now has to be seen as a mutually reinforcing package.

Early Adoption of GMO's in Argentine Agriculture
It is within this framework, that the amazingly rapid adoption of soybean tolerant to Monsanto's (USA) glyphosate herbicide Roundup took place in Argentina. After first being commercially grown on 800,000 hectares in 1996, transgenic Roundup Ready (RR) soybeans cover an estimated 7 million hectares in the 1999/2000 season, more than 80 percent of the total soybean acreage of 8.3 million hectares. During the same period, no-tillage sowing doubled and glyphosate use tripled.

Transgenic varieties of lepidoptera-tolerant corn and glyphosate-tolerant cotton were commercially released somewhat later. Since their release, these technologies have been adopted at an impressive rate. The area sown with herbicide-tolerant soybean increased from less than 1% of the total soybean planted area in 1996/97 to over 90% of the 12 million hectares planted in 2001/02.

The diffusion of lepidoptera-resistant corn, released in 1998, has also been significant (to a lesser degree), reaching about 25% of the total planted area in the last growing season. However, diffusion curves are steeper than those of soybeans at the same stage of the process[14]. Bt cotton varieties, also released in 1998, show a less dynamic performance, currently representing only about 8% of total planted area.

As of 2004[15], with 16,2 million ha planted with GM crops, Argentina rates second in the world after the USA with 47,6 million ha; and before Canada with 5,4 million ha.[16] Argentina stands alone among developing countries[17] regarding the number of commercially approved events: ten for three crops, as of September 2005.

Argentina's status regarding GM crops is mostly due to GM soybean: almost 100 percent[18] of the 14,4 million ha devoted to soybean in 2004/2005 has been planted with RR soybean. Argentina's total soybean production for 2003/2004 was 31,5 million tons, and for 2004/2005 it could have been 38 million tons. Thus, RR soybean represents almost 50 percent of Argentina's commodity crops production: the total area planted in 2004/2005 is 29,4 million ha; and total production was 69,7 million tons in 2003/2004. It may have reached 83,5 million tons in 2004/2005, which would represent a new record.[19] Soybean (in the form of whole beans, soy meal for animal feed, and soy oil) represented more than a fifth of Argentina's exports in 2004 (U$S 7,100 million out of U$S 31,491 million).[20]

By 2001, GM corn covered only 20 percent of the total corn area. [21] But it continued to grow steadily, and in 2003/2004 GM corn represented around 50 percent of the total area planted with corn.[22]

[14] Regúnaga, M. (2003, August). Análisis del impacto de la incorporación de los cultivos GM en Argentina. Paper presented at Los nuevos desafíos de la Biotecnología. Buenos Aires, Argentina.
[15] NYU Project on International GMO Regulatory ConflictsArgentina, GM nation Chances and choices in uncertain times by Ana María Vara Centro de Estudios de Historia de la Ciencia José Babini Escuela de Humanidades, Universidad Nacional de General San Martín (UNSAM) September, 2005
[16] James, Clive (2004), *Global Status of Commercialized Biotech crops:* 2004 – ISAAA *Briefs* No. 32, ISAAA, Ithaca, NY, p. 4.
[17] Atanassov, Atanas, Ahmed Bahieldin, Johan Brink, Moisés Burachik, Joel I. Cohen, Vibha Dhawan, Reynaldo V. Ebora, José Falck-Zepeda, Luis Herrera-Estrella, John Komen, Fee Chon Low, Emeka Omaliko. Benjamin Odhiambo, Hector Quemada, Yufa Peng, Maria Jose Sampaio, Idah Sithole-Niang, Ana Sittefeld, Melinda Smale, Sutrisno, Ruud Vayasevi, Yusuf Zafar, and Patricia Zambrano (2004), *To Reach the Poor – Results from the ISNAR-IFPRI* Next Harvest *Study on Genetically Modified Crops, Public Research and Policy Implications*. EPTD Discussion Paper No. 116, International Food Policy Research Institute, Washington D.C., March, p. 2. When this paper was prepared, Argentina had only commercially approved seven events.
[18] James (2004), p. 6.
[19] Estimations of area and production are taken from two official documents: SAGPyA (2005), *Estimaciones Agrícolas. Informe Semanal al 29-04*-2005, p. 14-15; and SAGPyA (2005), Campaña *Agrícola 2004-2005. Cifras Oficiales al 13/05/2005* Regarding soybean in Argentina, USDA's figures as of May 2005 are slightly different: the estimated area planted is 14 million ha for 2003/2004, and 14.40 for 2004/2005. Soybean production is estimated in 33 million tons for 2003/2004, and 39 million tons for 2004/2005. Available at: http://www.fas.usda.gov/psd/complete_tables/OIL-table11-184.htm
[20] Galli, Emiliano (2005), "De la chaucha de soja al reactor nuclear de investigación", *La Nación*, Comercio Exterior section p. 2, January 4.
[21] Trigo *et al.* (2002), p. 88.
[22] SAGPyA (2005), "Tipos de semillas," in *Maíz*. Available at: http://www.SAGPyA.mecon.com.ar.

However, it is certainly GM cotton the least successful GM crop commercially approved in Argentina so far. Historically the genetical improvement of cotton in Argentina has been dominated by the public sector, mainly by INTA. In 1998, Genética Mandiyú, commercialized the first cotton Bt variety. In 2001, after four years of its introduction, Bt cotton only represented 7 to 8.5 percent of the total cotton area in Argentina.

By 2003/2004, it is estimated that Bt cotton represented 20 percent of the area planted. The production of cotton in Argentina is a regional activity centralized in the Chaco and Santiago del Estero region. The surface sown fluctuates in function of the international price and has decreased considerably during the last year. As shown in the table below the share of Bt Cotton within the total surface of cotton production has grown each year.

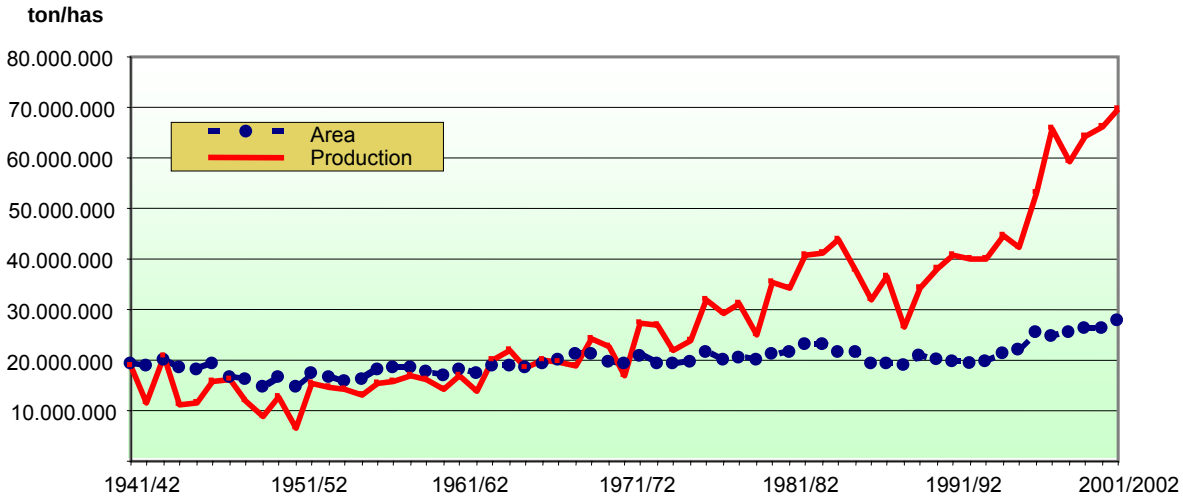
Table 1 Adoption of Cotton Bt in Argentina (1998-2002)

Campaign	Total Cotton Surface (hectare)	Cotton Bt Surface (hectare)	Percentage (%)
1998-1999	750.930	5.500	0.7
1999-2000	331.890	12.000	3.6
2000-2001	409.950	25.000	6.0
2001-2002	169.000	10.000	6.0
2002/2003	100.000	20.000	20.0

Source: Agrivalue SA based on ASA data (2003)

The graph below shows the considerable increase of productivity per hectare since the introduction of no-tillage sowing techniques and genetically modified crops in Argentina as from the beginning of the nineties.

Graph 4 Evolution of cultured area and crop production in Argentina[23]:

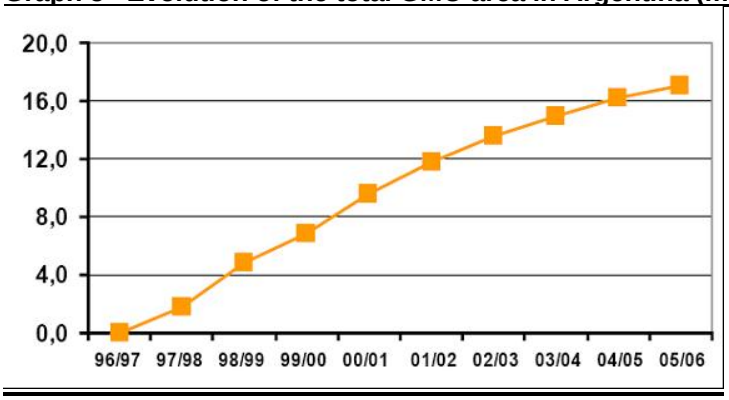


Source: Bioceres

[23] Bioceres: "Argentine farmers new challenge: scouting business opportunities in the biotechnology frontier"

Graph 5 shows the evolution of the total GMO area in Argentina, which doubled since the beginning of the year 2000.

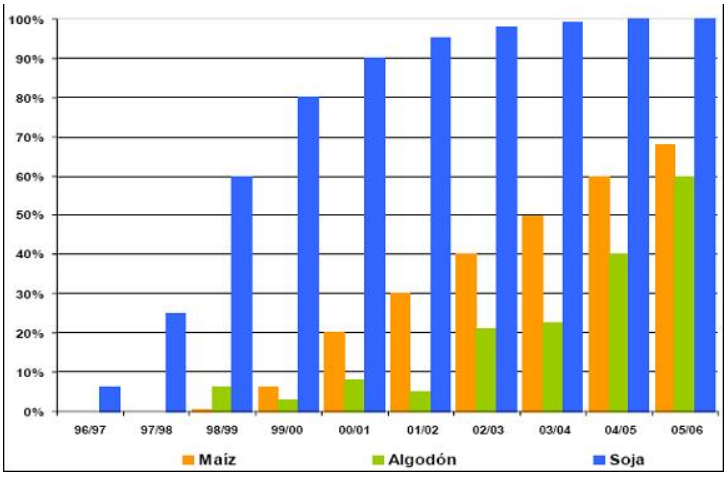
Graph 5 Evolution of the total GMO area in Argentina (million hectares)



Source: Argenbio 2006

In the campaign 2005/2006, practically 100% of the soy surface was sown with soy tolerant to glyphosate herbicide (there are more than 70 varieties of soy tolerant to glyphosate available in the market produced by 7 national and foreign companies). The transgenic maize and cotton occupied almost 70% and 60% of the area designated to these crops, respectively. Of this cotton 88% (165.000 ha) corresponded to cotton tolerant to glyphosate, and the remaining 12% (22.500 ha) to cotton Bt. In its second campaign since its approval, maize tolerant to glyphosate was sown in 70.000 ha (3% of the total maize), while the rest of the transgenic maize corresponded to Bt hybrids (around 1,6 mln ha). The total surface of transgenic crops in Argentina reached more than 17,1 million hectares, about 6% more than in the previous campaign.

Graph 6 Adoption rate of transgenetic crops in Argentina (1996-2006)



One of the main reasons for the rapid adoption is that the new technologies were a very good deal for farmers. Current estimates place cost reductions in the case of soybeans at about US$20 per hectare, mainly because of the reduction in energy costs resulting from more effective weed management techniques. Moreover, when the adoption process started, the patent for Roundup (Monsanto's commercial brand of glyphosate) had expired several years earlier; thus, there was already a significant increase underway in the competitiveness of the glyphosate market, which translated into significant price reductions. By 2001, the price of glyphosate was less than 30% of its 1993/94 level[24].

Regulatory Mechanisms

Another key factor was that at the time when the first GM crops became available in the United States, Argentina had already established the required regulatory mechanisms to evaluate this type of technology. The creation of the National Seeds Institute (Instituto Nacional de Semillas, or INASE)

[24] Trigo E., Chudnovsky, D., Cap, E., & Lopez, A. (2002). Genetically modified crops in Argentine agriculture: An open ended story. Buenos Aires, Argentina: Libros del Zorzal.

and the National Advisory Agricultural Biotechnology Commission (Comisión Nacional Asesora de Biotecnología Agropecuaria, or CONABIA) in 1991 was key in facilitating and speeding up the evaluation and approval process. Given that the Argentinean crop growing areas are analogous to those in the northern hemisphere for which the technologies were originally developed, the existence of the appropriate institutional framework created an ideal scenario for technology transfer and for Argentina to benefit from important spillover benefits; it had to bear only the costs of backcrossing the new genes into already existing varieties well adapted to local conditions—a process which is much simpler than the actual development of a transgenic plant. Actually, the diffusion process was based not on a local research and development effort, but rather on the importation of the innovation by multinational seeds and agricultural input companies, which also seized the opportunity to exploit technological spillovers from their headquarters. The importance of multinational seed companies in the development of the technologies is clearly seen from the records on applications for field trial permits submitted to CONABIA, where they represent almost 80% of the total, compared to less than 1% of applications coming from the traditional agricultural research community (governmental institutions and universities). This trend seems to be characteristic of GMO development in every country where such technologies have become important.

Intellectual Property

The issue of intellectual property rights (IPR) protection or rather the weakness of the existing system (refer to paragraph 3.7 for further information) has also been mentioned as a facilitating mechanism for the rapid adoption[25]. In the case of soybeans, the herbicide-tolerance genes could not be patented; however, this was not due to a breach in the law, but was a consequence of a series of circumstances that made the gene non-patentable in Argentina at the time when the formal application was submitted[26].

A different issue is the existence of a black market for seeds, which, together with the fact that the country's seed law is based on UPOV 78 (1978 Convention of the Union for the Protection of New Varieties of Plants, which allows farmers to keep seed for planting), makes it less expensive than under UPOV 91 rules. In spite of this, it should be noted than in the case of maize, where protection comes from the hybrid nature of the seed, diffusion is taking place at a fast pace as well. The importance of IPR, however, is clearly shown by the case of Bt cotton, where the suppliers of the technology have been able to exert a greater control on seed availability, through individual contracts with farmers and other mechanisms. Existing studies[27] clearly show that adoption rates would have been much higher if seed pricing policies had been more flexible.

Public Perception

Under the UNEP-GEF project[28] (United Nations Environment Program – Global Environment Facility), SAGPyA has performed and released a survey among producers and consumers that provided the following results:

Producers (survey conducted at the two most important local farm shows)

- 90% of the consulted producers assured that, albeit confusion and hesitation, they knew, worked or at least heard about GMO
- 75% assured that consumption of GMO's do not present any risks to the human health
- 12% expressed that they know the Argentine regulatory system, and half of them considered that it is safe
- 57% assured that if the Argentine government decides to segregate, they will still use GMO seeds
- 82% expressed that biotechnology is a tool that solves problems that no other technology has been able to solve
- 49% assured that biotechnology does not present a serious ethical problem.

Consumers (survey conducted in various supermarkets):

- 80% are informed mainly through TV, 55% through radio and 50% by means of newspapers,
- 13% do not read the label of a product before purchasing it
- 60% have confidence in what they consume

[25] Qaim, M., & Traxler, G. (in press). Roundup Ready soybeans in Argentina: Farm level, environmental and aggregate welfare effects. Agricultural Economics.
[26] Trigo E., Chudnovsky, D., Cap, E., & Lopez, A. (2002). Genetically modified crops in Argentine agriculture: An open ended story. Buenos Aires, Argentina: Libros del Zorzal.
[27] Qaim, M. (2002). Bt cotton in Argentina: Analyzing adoption and farmer's willingness to pay. Unpublished manuscript.
[28] http://www.unep.ch/biosafety/partcountries/ARcountrypage.htm

- 64% of the consulted consumers assured that, albeit confusion and hesitation, they heard about GMO's
- 43% agreed on the use of biotech in agriculture
- 40% assures that consumption of biotech products poses some risks to human health, and 84% out of that 40% identified the risks
- 94% of all consulted (both producers and consumers) expressed that the government should provide more information regarding the benefits and risks of biotech products.

Projects and Studies

According to Moisés Burachik, general coordinator of the Biotechnology Office of the Secretariat of Agriculture there are various projects[29] and studies being realized at the moment. Bioceres will finance for 10 years the Program of Wheat Improvement of INTA. Another project is the genetical transformation of soy with anti-fungi genes, an agreement signed between the Foundation of the Faculty of Exact and Natural Science (Fundación de la Facultad de Ciencias Exactas y Naturales) and Bioceres.

In INTA Castelar, under the direction of Dr. Esteban Hopp, and the work of Dra. Mariana del Vas, Ing. Dalia Lewi, and Lic. Juan Pablo Allocati, obtaining transgenic maize crop to be resistant against a local virus "Virus del Mal de Río Cuarto" is being studied. The work plan includes various phases until reaching market approval and involves a cost of U$S 245.000 dollars (financed by 100 investors) during a 5-year period. Obtaining wheat, maize and soy tolerant to drought and saltiness is another investment project. A group of the Facultad de Agronomía of the University of La Plata is working on delaying the ageing, which consists of prolonging the photosynthesis. At INDEAR (Instituto Nacional de Agrobiotecnología) they are analyzing the resistance against biotic and abiotic stress of crops and molecular farming related with genetical modification of plants to function as bioreactors. This aims at food fortification, such as the modification of acid fats of oils. Besides, they are developing genomic projects aiming at sequencing plant genome regions, that are suitable for future researchs and developments. For the INDEAR projects, an estimated 60-million-dollar investment is required. It will be the major concentration of scientists and researchers in plant genomics of Latin America.

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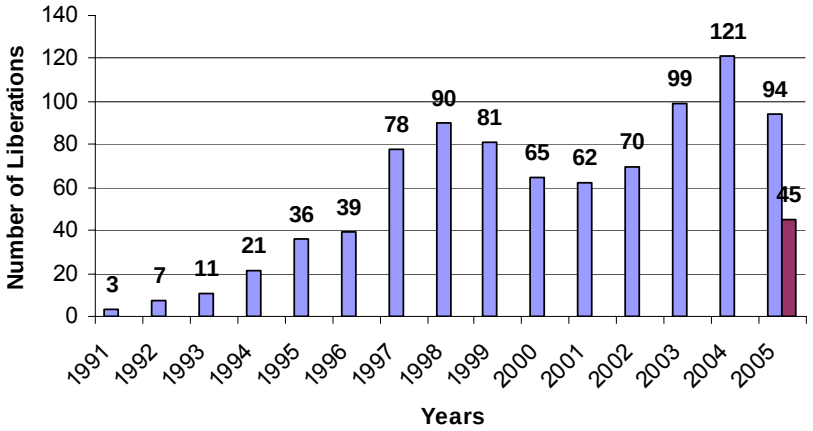
Graph 7 Field trials of transgenetic crops in Argentina (1991-2005)

Total amount of field trials realized (1991-2005): 922



Source: Agrivalue SA based on Conabia data – red table represents not allowed field trials in 2005 due to withdrawal of the application or by lack of fulfillment of biosafety requirements

[29] Biotecnología a la argentina : En el país hay varias iniciativas orientadas a resolver problemas locales. Ramos, Eliana para InfoCampo 2006-03-01

Table 2 Species, phenotype, transformation events and applicants of transgenic crops

The following species count on permission by CONABIA for the second phase of evaluation in Argentina (flexibilization of the conditions of experimentation and/or liberation to the environment)[30]

Specie	Introduced Characteristic	Transformation Event	Applicant	Resolution
Soy	Tolerant to glyphosate	"40-3-2"	Nidera S.A.	SAGPyA N° 115 (07-03-96)
Maize	Resistance against lepidopterans	"176"	Ciba-Geigy	SAGPyA N° 458 (02-08-96)
Maize	Tolerant to gluphosinate	"T25"	AgrEvo S.A.	SAGPyA N° 77 (11-02-98)
Maize	Resistant against lepidopteros	"MON 810"	Monsanto Argentina S.A.I.C.	SAGPyA N° 289 (29-03-98)
Cotton	Resistant against lepidopterans	"MON 531"	Monsanto Argentina S.A.I.C.	SAGPyA N° 290 (29-05-98)
Maize	Tolerant to glyphosate	"GA 21"	Monsanto Argentina S.A.I.C.	SAGPyA N° 79 (08-10-98)
Cotton	Tolerant against glyphosate	"MON 1145"	Monsanto Argentina S.A.I.C.	SAGPyA N° 721 (11-11-99)
Maize	Resistant against lepidopterans	"Bt 11"	Novartis Argentina S.A.	SAGPyA N° 442 (16-08-00)
Soy	Tolerant to gluphosinate	"A2704-12" and "A5547-127"	Hoechst Schering and AgrEvo S.A.	SAGPyA N° 47 (07-05-01)
Maize	Tolerant to glyphosate	"NK 603"		SAGPyA N° 361 (02-05-03
Maize	Tolerant to gluphosinate and resistant against lepidopterans	"TC1507"	Dow AgroSciences S.A. and Pioneer Argentina S.A.	SAGPyA N° 209 (01-09-03)

Source: Agrivalue SA based on Conabia data

The following materials and its derivates count on commercialization authorization within Argentina:

Specie	Introduced Characteristic	Transformation Event	Applicant	Resolution
Soy	Tolerant to glyphosate or RR	"40-3-2"	Nidera S. A.	SAPyA N° 167 (25-3-96)
Maize	Resistant against Lepidópterans or Bt	"176"	Ciba-Geigy	SAPyA N° 19 (16-1-98).
Maize	Tolerant to Gluphosinate-ammonium	"T25"	AgrEvo S. A.	SAGPyA N° 372 (23-6-98)
Cotton	Resistant against Lepidópterans or Bt	"MON 531"	Monsanto Argentina S.A.I.C.	SAGPyA N°428 (16-7-98).
Maize	Resistant against Lepidópterans	"MON 810"	Monsanto Argentina S.A.I.C.	SAGPyA N° 429 (16-7-98).
Cotton	Tolerant to glyphosate or RR	"MON 1445"	Monsanto Argentina S.A.I.C.	SAGPyA N° 32 (25-4-01).
Maize	Resistant against Lepidópterans	" Bt 11"	Novartis Agrosem S.A.	SAGPyA N° 392 (27-7-01).
Maize	Tolerant to glyphosate	" NK 603 "	Monsanto Argentina S.A.I.C.	SAGPyA N° 640 (13-7-04).
Maize	Resistant against Lepidópterans (Bt) and tolerant to Gluphosinate-ammonium	"TC 1507"	Dow AgroSciences S.A. and Pioneer Argentina S.A	SAGPyA N° 143 (15-03-05)
Maize	Tolerant to Glyphosate or RR	"GA 21"	Syngenta Seeds S.A.	SAGPyA N° 640 (22-08-05)

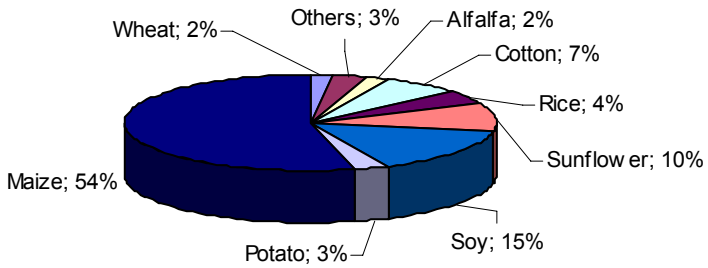
Source: Agrivalue SA based on Conabia data

[30] http://www.SAGPyA.mecon.gov.ar/new/0-0/programas/conabia/bioseguridad_agropecuaria2.php
Bioseguridad Agropecuaria: la experiencia de la CONABIA

Actually all the above mentioned crops are cultivated, except for the maize tolerant to gluphosinate-ammonium, which has never been adopted significantly, and the maize resistant against lepidopterans (Bt) due to the fact that it has been approved recently.

So far, in Argentina a total of 922 plant field trial evaluations have successfully passed the Conabia requirements. The crops with the highest number of field trials authorized were maize, soy and sunflower.

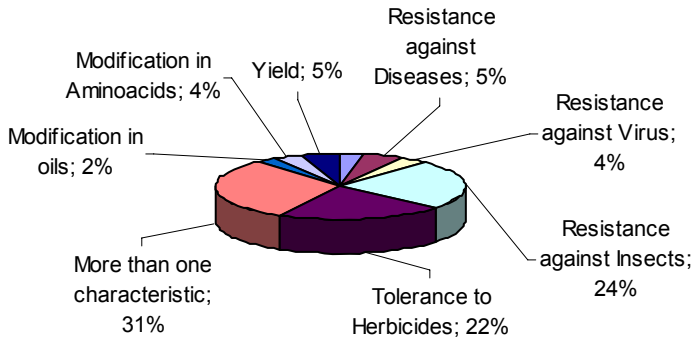
Chart 2 Field trials of transgenic crops in Argentina (1991-2005)



"Others" represents white clover and sugarcane among others
Source: Agrivalue based on Conabia data

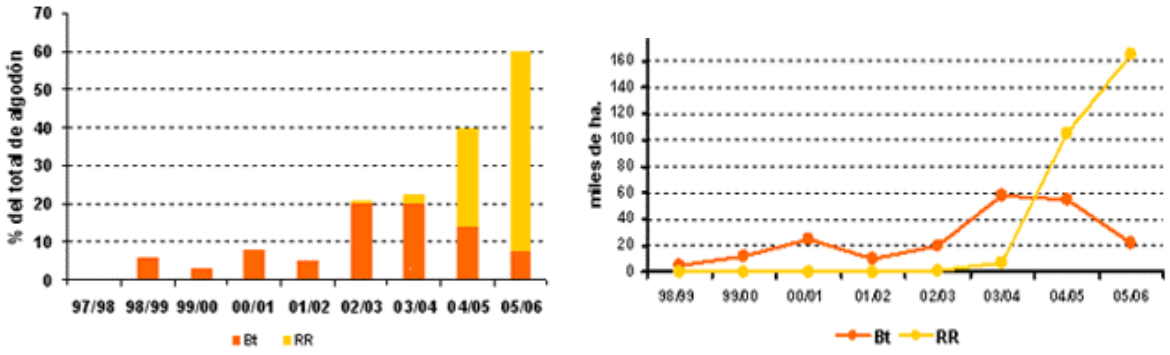
Chart 3 Incorporated Characteristics (2001 - 2005)

The main characteristics introduced are tolerance to herbicides and resistance against insects.



Source: Agrivalue SA based on Conabia data

Graph 8: Evolution of the transgenic cotton sown area in Argentina in percentage and hectares



Source: Argenbio, 2006

Table 3 Evolution of the GMO sown are in Argentina in hectares (* 1,000)

Crops	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06
Soy RR	37	1,756	4,800	6,640	9,000	10,925	12,446	13,320	14,058	15,200
Maize Bt	-	-	13	192	580	840	1,120	1,600	2,008	1,625
Maize RR	-	-	-	-	-	-	-	-	14.5	70
Cotton Bt	-	-	5	12	25	10	20	58	55	22,5
Cotton RR	-	-	-	-	-	-	0,6	7	105	165
Total	37	1,756	4,818	6,844	9,605	11,775	13,587	14,985	16,241	17,083

Source: Agrivalue SA based on Argenbio 2006 data

3 REGULATORY FRAMEWORK

Argentina[31] was one of the first countries that established a regulatory system for GMO's. It was set up in 1991, not only as a result of local existing or projected needs, or due to any particular biosafety concern, but mostly due to corporate demand, particularly in the field of agricultural biotechnology. Hereafter a review of Argentina's regulatory system will be offered.

3.1 General Framework

Argentina[32] is a Federal State divided into provinces, consequently there is federal and provincial legislation. The preservation of the biodiversity is a constitutional duty of authorities to safeguard the natural environment from the biological risks to which it is exposed as stated in the 1994 Constitution[33]. Article 41 of the National Constitution provides that "it is the duty of the Nation to issue regulations that contain minimum budgets for protection, and the duty of the provinces to issue any necessary regulations to supplement them, without the national regulations altering jurisdictions."

Whereas other countries in the region have enacted a specific law on biosafety, Argentina has not yet done so, making it a special case considering that agriculture is the most important sector of the economy and Argentina is one of the largest producers of GMO's. It has new guidelines regarding modern biotechnology, which have arisen in response to the inquiries of the companies for authorisation of activities related to GMO's[34]. At the moment there are also three legislative proposals that are at the level of evaluation in the National Congress of Argentina. One is a draft on national biosafety law, the second is on risk assessment and the third on labeling issues.

The Biosafety system has been established since 1991, due to the fact that United States multinational companies were interested in establishing branch offices with the view to perform "off-season" trials. Argentina, did not ratify the rules on regulating trade in Living Modified Organisms (LMO's) but does adhere to the Cartagena Biosafety Protocol (BSP).

3.2. Scope of applications of laws

According to the Resolution No.289 of 1997 a genetically modified organism is considered to be "any organism with genes or other genetic material that has been modified through the following techniques":

- The insertion by any means of a virus, bacterial plasm or other vector system of nuclei acid molecule, which has been produced by any method outside this virus, bacterial plasm or other vector system, in order to produce a new combination of genetic material which is capable of being inserted in an organism in which this combination does not occur naturally and within which it will be inheritable genetic material.
- The insertion in an organism, by micro-injection, micro-encapsulation or other direct means, of inheritable genetic material prepared outside this organism.
- Use of recombinant DNA molecules in *in vitro* fertilisation that involves the genetic transformation of eukaryotic cell.

3.3. Advisory and regulatory agencies[35]

Agricultural biotechnology activities and products in Argentina have been totally handled within the Secretariat of Agriculture, SAGPyA, and (part of the Ministry of Economy). The Ministry of Health and Environment also has a minor, essentially advisory, role in agricultural biotechnology regulatory oversight. The industry, other governmental offices, public research institutions and one consumers group have representatives in at least one of the two SAGPyA technical advisory committees, CONABIA and TAC – SENASA (see below).

[31] NYU Project on International GMO Regulatory Conflicts. Argentina, GM nation
Chances and choices in uncertain times by Ana María Vara Centro de Estudios de Historia de la Ciencia José Babini Escuela de Humanidades, Universidad Nacional de General San Martín (UNSAM) September, 2005
[32] Claudia Martans, Implementing the biosafety protocol, June 2002
[33] Branes and Rey, supra note 18, p. 14.
[34] Branes and Rey, supra note 18, p. 15.
[35] Legislation http://agrobio.org/legislacion_3_detalle.php?sec_id=0&id=1

Argentina's system on Biosafety takes into account five agencies for the development and the surveillance of GMO's.

1) The National Advisory Commission on Agricultural Biotechnology (CONABIA). This governmental office in charge of analyzing GMO's biosafety, was created within the then Secretariat of Agriculture, Livestock, and Fisheries (SAGyP, now SAGPyA),[36] "in response to domestic interest and research in GM technologies and the desire by US and transnational seed companies to use Argentina as a location for off-season GM seed production and field trials.[37] Three applications for field trials were presented and authorized in 1991; the three of them from multinational corporations[38].

   CONABIA was created to advise on technical and biosafety requirements to be fulfilled in case of genetic materials obtained by biotechnological procedures, prior to its release into the agro ecosystem. This commission is integrated by representatives of public and private organisms whose competencies are related to agricultural biotechnology.

   Its main task is to advice national authorities on biohazard technical requirements in the management of GMO's towards their incorporation in agriculture, and to propose the procedures and regulation for the safe implementation of field trials and commercial liberation of GMO's.

   CONABIA is a multidisciplinary and inter-institutional committee of technical experts representing both public (CONICET, INTA and Universities) and private (Farmers and Industry Associations) areas. The Commission engages in both local initiatives and regional cooperation with other Latin American countries, for example, by extending training to countries in the region. Other international efforts include the Argentinean-Brazilian Center for Biotechnology (1986), Bilateral Cooperation with India (2004), the European Union-Mercosur Agreement on Biotechnology (2005), the Argentinean-Algerian Center for Biotechnology (2005) and the Bilateral Spanish-Argentinean Center for Plant Biotechnology 2005.

2) CONABIA makes recommendations to the Secretariat of Agriculture, Livestock, Fisheries and Food (SAGPyA) regarding the issue of permits for the field trials, flexibility and commercialization[39]. In other words, the Commission evaluates the information, and thereafter makes a report to the SAGPyA concerning the approval or rejection of a permit. CONABIA has also certain operational functions such as dealing with the applications for laboratory and greenhouse testing, field trials and flexibility conditions. Moreover, the Commission drafts regulations concerning activities related to GMO.

   In 2004 the Biotechnology Office (BO) was created also within SAGPyA. It supersedes CONABIA and is intended to coordinate efforts regarding activities related to biotechnology and biosafety, the definition of policies, and the diffusion of activities.

3) The Technical Advisory Committee (Comité Técnico Asesor - TAC), within The National Agrifood Health and Quality Service (SENASA), an agency inside SAGPyA with the competence to regulate food safety and quality, animal products and pesticides. This authority is legally entitled to propose legislation in the field of food and GMO derived food[40].

   The mission of the Technical Assessor Committee is to advise national authorities on the requirements for animal and human use of GMO's and on the evaluation of the verification of these requirements.

[36] SAGPyA, for Secretary of Agriculture, Livestock, Fisheries, and Food.
[37] Cohen, Joel I., Patricia L. Traynor, Moisés Burachik, Magdy Madkour and John Komen (2001a), "Biosafety Studies in Egypt and Argentina: Two Pathways to Implementation," in Mclean, M. A., R. J. Frederick, P. L Traynor, J. I. Cohen, and J. Komen (eds.), *A Framework for Biosafety Implementation: Report of a Meeting*, The Hague, The Netherlands: International Service for National Agricultural Research Biotechnology Service, p. 23.
[38] Calgene Inc. asked permission to test a Bt and Bromoxynil-tolerant cotton; Nidera S. A., to test a glyphosate-tolerant soybean; and Ciba Geigy Arg. S.A.I.C to test marker genes in corn. SAGPyA wesbsite: www.SAGPyA.mecon.gov.ar.
[39] Burachik, M. & P Traynor, Analysis of a National Biosafety System: Regulatory Policies and Procedures in Argentina. ISNAR country report 63 (2002)
[40] Ibid. Burachik and Traynor, supra note 112, p. 14.

TAC is a multidisciplinary and inter-institutional Committee constituted by technical experts of both public (CONICET, INTA and Universities) and private (Farmers and Industry Associations) areas.

3) The National Institute of Seeds (INASE) is the agency in charge of registering and controlling marketable seeds. It also monitors the tests.

4) National Commission on Biotechnology and Health (Comisión Nacional de Biotecnología y Salud - CONByS): the main objective of this commission is to produce documents with regulatory frameworks related to the preparation and approval of biotechnological products for human consumption[41].

3.4 Public Policies[42]:

So far in Argentina the following legal initiatives have been developed:

Legal initiatives
- Technology transference Law (Ley 23877)
- Science and Technology Law
- Biohazard Law (in discussion)
- Biotechnology Promotion Law (under discussion)
- Intellectual Property Law and international agreements (Trips –WTO)

In paragraph 4.2 a presentation of the related public policies developed by the Secretariat of Technology, Science and Productive Innovation is given.

On the website[43] of the Argentine Secretariat of Agriculture, Livestock, Fisheries and Food (SAGPyA) a summary of current regulations on agricultural biotechnology in Argentina is presented. The material reflects the way in which the Argentine government has applied the precautionary and security principles in the development of the agricultural biotechnology from the very beginning, covering the process of GMO safety assessment from the first stages of field testing to the commercialization (see also annex 1).

3.5. Regulatory Process

Argentina regulates final products not the process. However, it requires risk assessment on a case by case basis.

Argentina biosafety system allows licenses for experimentation and/or release into the environment in four instances:

- Greenhouse research with transgenic plants.
- Environmental release of plants and microbes for field tests and unconfined plantings.
- Food safety
- The handling and confined release of transgenic animals.

3.5.1. Review and approval process

The process of commercial release of GM crops encompasses three steps: analysis of the environmental risk assessment by CONABIA, food-safety assessment by SENASA and market evaluation performed by the Directorate of Agri-Food Marketing (DNMA). First of all, field-test applications[44] are received by INASE, then forwarded to CONABIA for the assessment. If some

[41] Hervé, D. “Estudio de Derecho Comparado caso: Argentina” Universidad de Chile, Centro de Derecho Ambiental.” (2002) p. 22. For details see: http://www.derecho.uchile.cl/cda/investigacion
[42] Bioceres presentatie landbouwraad
[43] www.SAGPyA.mecon.gov.ar
[44] In order to apply for formal authorisation the applicant must submit certain information such as: summary of the general information; general information regarding the release of GMO; if the material is imported (permit, granting institution, type of permit granted); objective of the release; transport of GMO; characteristics of the introduction into the country of the GMO; characteristics of the release; description of the GMO (e.g. donor, principal gene, marker and/or selector gene, recipient

information is missing or inadequate, the applicant will be requested to complete or correct the information. When all the CONABIA members are satisfied that they have sufficient knowledge of the application, a decision is taken for approval or rejection. Once the application has been approved by Commission, it sends the application file with a letter of recommendation to the SAGPyA for approval. Within the letter it is specified that there is no environmental risk involved in the release. Licenses may contain certain conditions. The CONABIA and SAGPyA monitor compliance with these conditions[45].

These conditions are inter alia, to inform CONABIA in advance (through INASE) of the times at which the timetable of activities will be completed (introduction, sowing, flowering, harvest, completion of the trial and all treatments proposed). In order to prevent accidental releases, the GMO must be handled according to risk management guidelines set out by the Commission; it must comply with the regulations concerning plant health in order to prevent the dissemination of plant diseases. Furthermore, access must be provided to the inspectors appointed by the competent authority to accomplish periodical inspections[46]. As regards confidential information the applicant, when filling out the form or the additional information, must mark it with the abbreviation CID (Confidential Information Deleted).

When the application is completed, it is submitted to the members of CONABIA. After, a review of the application by the full Commission, a letter of approval is sent to the applicant, generally stating additional requirements for ensuring biosafety. The applicant must acknowledge the receipt of the letter and must comply with its requirements.

3.5.2. Flexibilisation License.

After a GMO plant has been field tested, the applicant may request that the crop is being flexibilised[47]. It can be said that this flexibilisation[48] does not mean approval for commercial release within Argentina. It preempts unconfined use[49]. Furthermore, CONABIA´s risk assessment for flexibilisation evaluates the GMO's outcrossing potential, weediness potential or its capacity to survive, potential for horizontal transfer of gene exchange, nature of product sequences, pathogenicity to other organisms, potential harmful effects on humans including allergenicity, and potential effect on rate of resistance development in pest populations[50]. Moreover, the petitioners must take into account some food-related issues when applying for flexibilisation, for instance, equivalence, safety, composition and food characteristics. It is worth mentioning that after the crop has passed environmental and food safety studies and the license for flexibilisation has been granted, isolation distances or other means of confinement are no longer needed.

3.5.3. Food-safety review

SENASA is in charge of the protection of human health from the products derived from biotechnology. The technical advisory committee evaluates food-safety issues in GMO foods and feeds. This committee forwards its comments and observations to SENASA. Moreover, SENASA is the competent authority for granting or rejecting the approval for commercialization.

3.5.4. Market Analysis

The DNMA reviews the market potential and takes into account the benefits and disadvantages of approving the crop. DNMA makes a technical report, in where it is assess the impact of GMO´s commercialization on Argentina´s international trade. It also includes which GMO varieties seeds companies sold to Argentine farmers. This report thereafter, is forward to CONABIA, SENASA, in order to be reviewed and then proceed to grant approval for commercial use of GMO.

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organism, vector or vector agent and organism or product; detailed description of biosafety measures for preventing the contamination or release.

[45] Annex I, Part D of the Resolution No. 289/97

[46] For more details, see the webpages of the SAGPyA has details about the information required. http:www.SAGPyA.mecon.gov.ar

[47] The flexibilisation is authorised through the Resolution No.131/98 of the SAGPyA.

[48] Flexibilisation is once a plant GMO has been sufficiently tested, the applicant may request that the crop be "flexibilised" that is, be approved for unconfined use. However, flexibilisation does not constitute approval for commercial release within Argentina. It only entails unconfined use usually for large-scale planting.

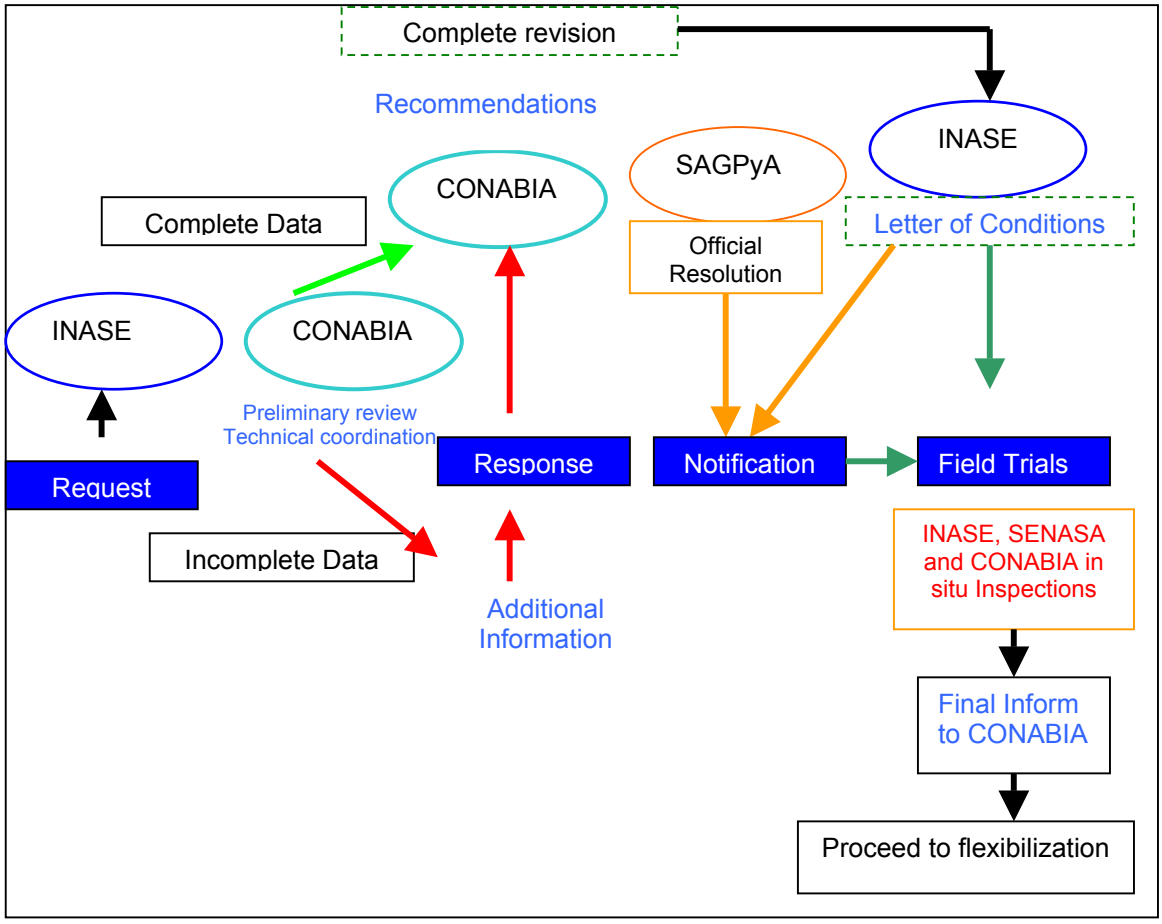
[49] Burachik and Traynor, supra note 112, p. 24.

[50] Burachik & Taylor, supra note 112, p. 24.

3.6. Monitoring and Reporting

The inspectors from INASE or SENASE are responsible for the inspections of the field trials. Their report is submitted to CONABIA in order to monitor that the licensee is complying with the law and the requirements set out by CONABIA.

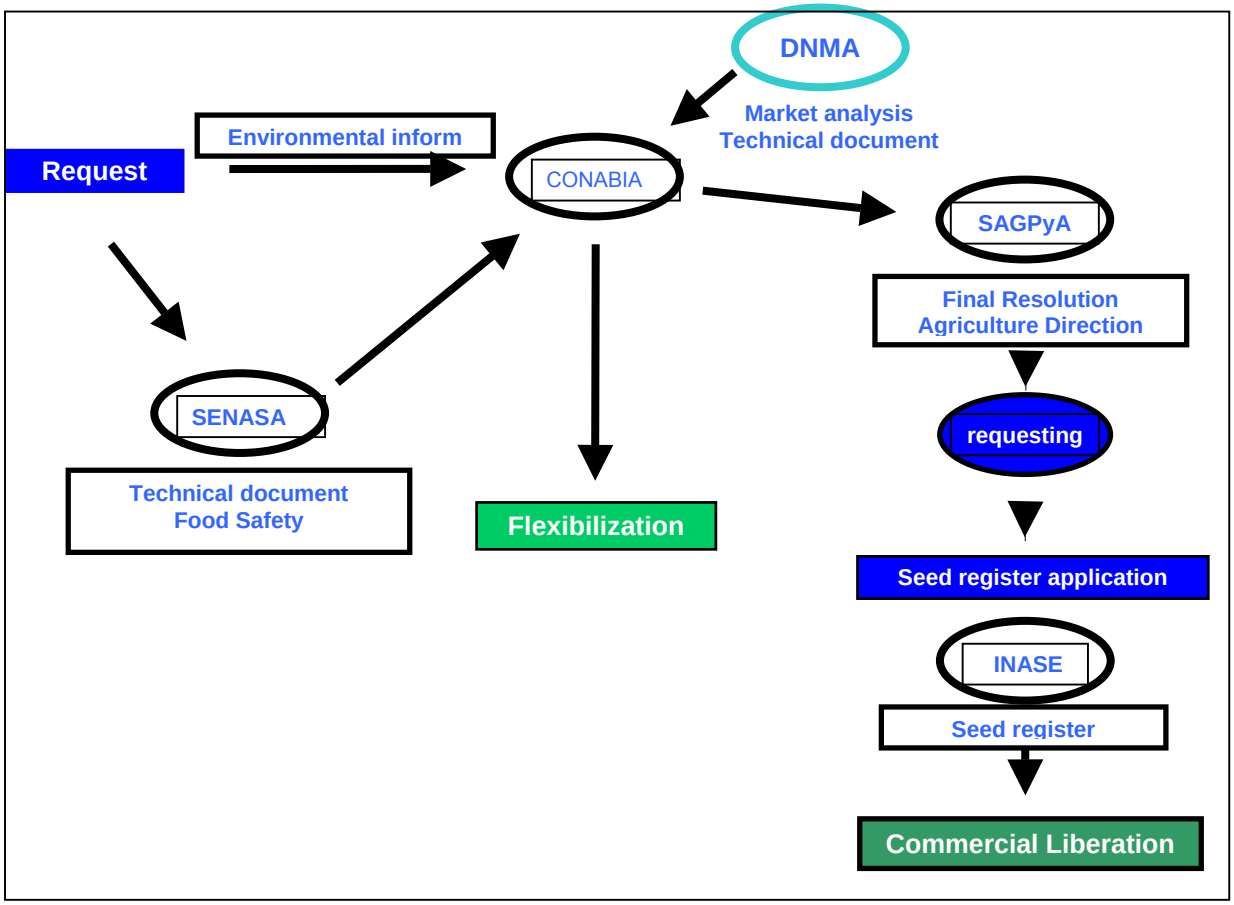
Figure 3 Approval Procedure of Field assays of Transgenic cultures in Argentina[51]



Source: Agrivalue SA based on Bioceres presentation

[51] Presentation by Bioceres for Dutch Agricultural Attaché in Argentina

Figure 4 Commercial procedure for liberation of Transgenic cultures in Argentina[52]



Source: Agrivalue SA based on Bioceres data

3.7 Intellectual Property[53]

In Argentina, the National Institute of Intellectual Property (INPI) and in particular, the Agency for the Promotion of Science and Technology (ANPCyT), deals with the enforcement and management of intellectual property law. While the INPI grants patents, the ANPCyT focuses on the financing of patent applications in public institutions and small and medium enterprises, the training of experts in IP management and provides access to patent databases. The use of public databases is particularly important in order to perform thorough examinations that allow inventors and their sponsors to assess the possibility of obtaining a patent. The Agency administers two funds to promote innovations FONCyT and FONTAR (for more information on these funds refer to paragraph 6.3).

Concerns about the current IP system include the high costs of patenting, lack of awareness about the patent system that has an economic impact on public research institutions, lack of harmonization in IP regulation between institutions, limited access to patent databases, the absence of a repository for microorganisms and lack of evaluation of potential markets for new innovations. These problems are evident when one examines the fact that in 2000, Argentinean residents filed 1,062 patents but the patent office granted only 145 applications.

One of Argentina's problems in the biotechnology area is the lack of repositories for biological material. To patent a biotechnology innovation, a sample of the organism must be deposited in a

[52] Presentation by Bioceres for Dutch Agricultural Attaché in Argentina
[53] Biotechnology and Intellectual Property: Reinventing the Commons Workshop Report Montreal, Canada, September 25-27, 2005

repository but these repositories are difficult to access and therefore samples must be sent abroad. This increases the cost for Argentinean inventors to patent their inventions.

4 PLANT BIOTECHNOLOGY MARKET PARTICIPANTS

4.1 Government Institutions

4.1.1 SAGPyA – Secretariat of Agriculture, Livestock, Fishery and Food

The Secretariat of Agriculture, Livestock, Fishery and Food is the responsible organism for the elaboration and execution of plans, programs and policies on production, commercialization, technology, quality and health in agricultural, fishery, forestry and agro-industrial matters, coordinating and conciliating the interests of the national government, the provinces and the different sub-sectors. SAGPyA depends on the Ministry of Economy and Production.

In March 2006 the SAGPyA presented a strategic plan for the development of agricultural biotechnology 2005-2015. In this plan the vision for the year 2015 has been described as follows:

"Modern biotechnology is an integrated component of all Argentinean agricultural production branches. Its incorporation is accepted by our external clients, and its application contributes to the environment preservation. Finally, it has reached a high maturity level that provides increased productivity combined with technological self-sufficiency, and is available for any stakeholder that requires it". The executive summary of the plan is published on the website of the Secretariat and can be completely downloaded in Spanish[54].

The Strategic Plan forecasts a future scenario, which is the context of the vision proposed. Policies are defined and an action plan is outlined for the realisation of that vision. Objectives are classified into areas of strategic concentration to define the main issues addressed.

A future with many challenges has been predicted for the agricultural production; and biotechnology is proposed as the main source of technological solutions to confront these challenges. But biotechnology is not just a technological matter, its development involves cutting-edge science, political, legal and economic variables, and external and internal negotiations.

The main idea is that, in a period of ten years from now, all the tools of modern biotechnology will be applied to any possible branch of the agriculture and related productive activities.
The plan proposes to diversify the application of biotechnology, both in the number of tools and in receiving productive activities.

The Plan considers creating a favourable environment (in political, legal and public acceptance matters) for the creation and development of biotechnology-based companies, and also for the consolidation of the existing companies. It proposes to increase agricultural production, while preserving and improving the life quality of the present population and future generations.

One strength of the Plan resides on its flexibility: the accomplishment of the plan has been based on an implementation scheme that is built almost simultaneously along its execution, including the revision of objectives, goals and main actions during key years.

Another strength of the plan is the collective bias of its elaboration: stakeholders of the agricultural and livestock sectors took part in different discussions, and they contributed with relevant elements that promoted both the quality and the general acceptance of the document. For several agricultural biotechnology strategic questions, a regional treatment has been anticipated with the purpose of preserving the federal range of the plan, and the attention to local issues. Finally, the relationships with countries of different blocks are defined in terms of technological co-operation, and commercial exchange or competition.

Secretariat of Agriculture, Livestock, Fisheries and Food
Av. Paseo Colón 922 Piso 2º Oficina Nº 247
(1063) Capital Federal
Tel / Fax: 54 11 4349-2198/2178
biotecnologia@mecon.gov.ar

[54] http://www.SAGPyA.mecon.gov.ar/new/0-0/programas/biotecnologia/plan_estrategico_en.php

4.1.2 Biotechnology Office

The Biotechnology Office was established within the SAGPyA to provide advice and support on the supervision of activities related to agricultural biotechnology and biosafety, especially those concerning authorizations for the environmental release and commercialization of genetically modified plants and animals (to be used in agricultural/livestock and aquaculture activities); it is also devoted to define policies, and to design specific regulations, and to aid in the public diffusion of the SAGPyA activities related to biotechnology issues.

Executive areas:

1) Dr. Moisés Burachik is the general coordinator of the Biotechnology office and his main functions are:

- To assist the SAGPyA in the issues within the competence of the Biotechnology Office, in order to provide a stable and simultaneous development of the policies, the implementation rules and the regulation procedures.
- To assist the SAGPyA in the actions concerning other areas and related organisms.
- To develop and to suggest the promotion of issues of interest for the development of the activities, and everything that allows the solicitors to appreciate the institutional work of the SAGPyA as a regulatory authority, from the process of environmental release of a GMO to the granting of the corresponding trading permits.
- To be in charge of the executive Secretariat of CONABIA

2) Executive Coordinator
His/her function is to assist the General Coordinator, and to replace him/her in case of absence or impediment, especially regarding the management of the regulation actions.

3) Technical Co-ordination on Biosafety Issues

His/her functions are to propose and execute actions for the suitable treatment of biosafety issues related to agricultural/livestock or aquaculture biotechnology activities, in particular the assessment of agro-ecosystem environmental impact due to experimentation and release of GMO's. Besides, he/she is an additional member of CONABIA

4) Technical Co-ordination of Policy Analysis and Formulation

His/her functions are to propose and to carry out actions related to biotechnology and biosafety policies concerning agriculture, livestock and aquaculture activities, and their co-ordination with other policies. To suggest strategies regarding international negotiations, market intelligence and strategic alliances of national interest, the identification of biotechnological products, and any other aspect related to the biotechnology matter, with respect to both vegetal and animal GMO's.

5) Technical Co-ordination on Regulatory Design
His/her functions are to advice about the current national and international regulations that rule biotechnology and biosafety activities in agriculture/livestock and aquaculture, proposing the formulation or improvement of regulations and the appropriate implementation of them.

4.1.3 Ministerio de Salud y Ambiente de la Nación
Ministry of Health and Environment

In the Resolution 904/2002, the Ministry of Health and Environment granted to the Secretariat of Environment and Sustainable Development, through the Coordination of the Biodiversity Conservation, the following faculties:

To take part in all aspects referring to the practical application of technologies that use biological systems and organisms, alive or their derivates for the creation or modification of products or processes for specific uses, in particular, those tending to guarantee an adequate level of protection in the sphere of the transference, safe manipulation and use of the modified alive organisms resulting from the modern biotechnology that can have adverse effects on the conservation and the sustainable use of the biological diversity.

Besides, Decree 487/2004 establishes as one of the objectives of this Secretariat to take part in the development of biotechnology according to its competence.

Finally, as for the international instruments, particular relevance receives the introduction of the Protocol of Cartagena, which not only regulates the transborder movements of GMO's aimed at being released into the environment, but also has specific demands as regards risk evaluation and identification of those products for human or animal consumption or processing.

Secretariat of Environment and Sustainable Development
San Martín 451
(C1004AAI)
Cuidad de Buenos Aires
Argentina
Tel (54) (11) 4348 8200
Fax (54) (11) 4348 8300
www.ambiente.gov.ar

4.1.4 SENASA – Servicio Nacional de Sanidad y Calidad Agroalimentaria
The National Agrifood Health and Quality Service

The National Agrifood Health and Quality Service (SENASA) is an agency inside SAGPyA with the competence to regulate food safety and quality, animal products and pesticides. This authority is legally entitled to propose legislation in the field of food and GMO derived food.

Its regulatory authority has been granted under Law 18284 on Argentine Food Codex; Decree 1585/96 on the creation and jurisdiction of SENASA; Decree 4238 on meat inspection; and Decree 815/99 on the food-control system. It is a fully empowered agency, which can issue its own administrative resolutions, and which can also develop rules applicable to outside institutions, such as grocery stores. [55]

In order to deal with GMO's, a Technical Advisory Commission on the Use of GMO's (TAC) was created within SENASA, through Resolution 1265, issued in 1999. TAC includes representatives of public and private sector research institutions, government agencies, industry chambers, farmers associations, and consumer groups.

Its main purpose is to provide SENASA with an external, multidisciplinary advisory body that will give a broader base to its regulatory decisions. TAC activities started with a thorough review of Resolution No. 511/98. As a result of this review, in 2002 SENASA issued the already analyzed Resolution No. 412. .

[55] Idem, p. 14.

Table 4 Competencies of SENASA

a) Animal Health
- Epidemiology, risk analysis, epidemiological vigilance and sanitary emergencies
- Animal quarantine, quarantine norms, exotic diseases, certification
- Sanitary campaigns, control and eradication
b) Plant Protection
- Plant health
- Plant quarantine
- Vigilance and monitoring
c) Agrifood Inspection
- Plant inspection
- Inspection of products of animal origin
- Agri-food quality
- International trade
d) Agro-chemicals, veterinarian and pharmacological products
- Agrochemicals and biological products
- Pharmaceutical and veterinary products
e) Laboratory and technical control
- Animal laboratory
- Plant Laboratory
- Operative Integration

4.1.5 SECYT - Secretaría de Ciencia, Tecnología e Innovación Productiva. Secretariat of Science and Technology

The public system of Science and Technology has as national body of policies, the Secretariat of Science and Technology (SECYT). SECYT depends on the Ministry of Science and Public Education.

Two organisms depend from this Secretariat: the National Council for Scientific and Technical Research (CONICET) and the National Agency for the Promotion of Science and Technology (ANPCYT). For further information on ANPCyT and its financial instruments refer to paragraph 6.4)

The Secretariat of Science and Technology was created to directly support research and development in academic institutions, providing a quick and efficient source of information. President of SECYT is Dr. Lino Barañao.

SECYT
Agencia Nacional de Promotion Cientifica y Technologica
Av. Córdoba 831
(1054) Capital Federal
Tel: 54-11-4313-14774
Fax: 54-11-4312-8364
www.secyt.gov.ar

4.1.6 INASE Instituto Nacional de Semillas
The National Institute of Seeds

The National Institute of Seeds (INASE)[56] is the SAGPyA agency in charge of registering and controlling all commercially marketed seeds. GM varieties are treated similarly to new non-GM hybrids, and submitted to the same performance tests. After reviewing the results, a Technical Advisory Committee of the National Seed Commission (CONASE) decides if the materials submitted qualify as a new variety.

INASE also plays a role in the biosafety system by receiving and sorting applications of authorization for field trials. Confidential information is filed at INASE. Its personnel inspect field trials of GM crops, checking for compliance with CONABIA biosafety requirements. [57]

INASE was dissolved in 2000 as part of a process of modernization of the state, this decision was reversed in 2003 after much stakeholders' criticism. The organism was reinstated with the same attributions it used to have.

The current INASE board consists of a president, a vice-president, and eight directors. Only the president receives a salary, all other positions are ad honorem. A representative from the Federal Agricultural Council (CFA serves as vice-president. The eight directors include a representative from SAGPyA, a representative from the INTA and six representatives from different private sectors involved in the commercial marketing and use of seeds.

4.1.7 INTA - Instituto Nacional de Tecnología Agropecuaria. The National Institute of Agriculture Technology

Table 5 Organization structure:

15 Regional Centers
47 Experimental Stations
240 Extension Units
3 Research Centers a) Agronomy and Veterinary: - Institute of Agronomic Microbiology and Zoology - Institute of Biotechnology - Institute of Genetics - Institute of Pathobiology - Institute of Vegetable Physiopathology and Physiology - Institute of Virology b) Natural Resources - Institute of Climate and Water - Institute of Biological Resources - Institute of Soil c) Agro industry - Institute of Food Technology - Institute of Rural Engineering
12 Research Institutes

INTA counts on a human resource capacity of 1642 professionals, 2535 technical personnel, 253 graduate students and 700 extra-INTA personnel.

<u>INTA institutes dedicated to plant biotechnology are among others:</u>

I Biotechnology Institute INTA Castelar
II Genetic Institute "Ewald A. Favret" IGEAF
III Plant Physiology and Phytopathology Institute (IFFIVE-INTA Cordoba)

[56] http://www.inase.gov.ar/tikiwiki/tiki-index.php?page=biotecnologia
[57] Idem, p. 15.

Furthermore, INTA has various experimental centers that are involved in plant biotechnology

For detailed information on all INTA research institutes and their biotechnology projects refer to paragraph 4.3.3.2.

4.1.8. CONICET - Consejo Nacional de Investigaciones Científicas y Tecnológicas National Council of Scientific and Technological Research

The National Scientific and Technical Research Council, CONICET, is an Argentine government agency which directs and co-ordinates most of the scientific and technical research done in public universities and institutes.

CONICET is the main institution devoted to research and promotion of science and technology in Argentina. Its activities are developed in four major areas:

- Agricultural Engineering and Materials.
- Biology and Health.
- Exact and Natural Sciences
- Social and Human Sciences.

CONICET was established in 1958 by a national decree. Its first director was Medicine Nobel Prize winner Bernardo A. Houssay.

For further information on Conicet research institutes refer to paragraph 4.3.3.1.

CONICET
Avda. Rivadavia 1917
CP C1033AAJ
Buenos Aires
Tel: ++54 -11 - 4953-7230/39
www.conicet.gov.ar

4.2 PRIVATE MARKET PLAYERS

4.2.1 General Overview:

Argentina[58] occupies the 8th place in the ranking of companies that invest in biotechnology in the world, with a total of 84 companies that apply biotechnology processes in agricultural production (54), food (10) and medicines (20). These companies invoiced about U$S 310 million dollars in biotechnological products between 2003 and 2004 and employed 5,000 people.

In Argentina there are about 22 companies involved in plant biotech products from breeding, vegetal micro propagation, herbicides resistance, infirmities resistance and inoculants to bio insecticides.

Seed Industry: Syngenta, Dow AgroSciences, Monsanto, Advanta, Nidera, Don Mario Pioneer, KWS, Bayer Crop Science

Biotechnology: Bioceres, BioSidus Ag, Genésica, Chacra Experimental SA

Bacterial inoculants: Laboratorios Lopez, Rizobacter Argentina, CKC Argentina, Nitragin SA Sintesis Quimica S.A.I.C.

Micro propagation: Tecnoplant, Garbi, Agrogenética

According to Bernardo Kosacoff[59], director of CEPAL, the Argentine private biotechnology sector can be characterized as follows:

- The biotechnology sector is not a "mass" business sector
- There are only a few companies, but of high impact
- Argentina has, compared to other countries, a minimum "critical mass" of biotechnology companies
- Expanding this "critical mass" of biotech companies is a key factor for the strategic development of relevant sectors of the national economy (agro/cattle, health and food)

Table 6 Argentine Biotechnology Company List 2002-2003[60]

Sector		Total (#)	Sector Participation in Biotechnology Sales (%)
Agro	Inoculants	25	7.51
	Seeds and plantlets	20	41.05
	Animal Health	10	24.78
Food Ingredients for Bioprocessing		10	15.37
Human Health		20	11.30
Total		**85**	**100**

Table 7 International Overview of Biotechnology Companies 2002-2003[61]

Country / Region	Number of Biotechnology Companies	
	Private	Public
United States	1,159	314
Canada	389	81
China / Hong Kong	126	10
Australia	168	58
Germany	339	11
Sweden	168	9
Israel	133	5
Argentina (private companies)	**84**	

[58] Interview with Agrivalue Alberto Diaz, one of the authors of "Las empresas de biotecnología en Argentina"
[59] Presentation by Bernardo Kosacoff, Director CEPAL – Oficina de Buenos Aires Biolatina Congress August 29, 2006
[60] Bisang, R. Gutman G, Lavarello P., S. y Diaz. La economía Política de la Biotecnología Argentina". Ed. Prometeo
[61] Bisang, R. Gutman G, Lavarello P., S. y Diaz. La economía Política de la Biotecnología Argentina". Ed. Prometeo

Table 8 Estimated Sales of Own Production by Selected Argentine Biotechnology Companies (2002-2003)[62]

Sector		Sales (*1.000 ARP)		Structure per sector o Bio Sales	b/a
		Total	Biological / Biotechnological		
Agro	Inoculants	162,630	71,322	8	44
	Seeds and plantlets	4,462,535	390,000	41	9
	Animal Health	377,500	235,525	25	62
Food Ingredients for Bioprocessing		237,140	146,030	15	62
Human Health		321,175	107,383	11	33
Total		**5,560,968**	**950,160**	**100**	**17**

Note: 71 companies taken into account

Some local private companies have been active in biotechnology since the '80's, almost simultaneously with the first internationally registered advances. The developments are verified in plant and animal genetics, food and medicine, three important areas where Argentina has natural advantages and strong previous production developments. In the activities related to agro (seeds and plantlets, animal health and inoculants) there are 54 companies operating that account for 73.3 percent of the turnover of biotechnology companies, thanks to the strong participation of transgenic seeds production.

The economists Roberto Bisang and Graciela Gutman and the chemist Alberto Díaz realized a study in which they estimated that these companies invoiced 5,560 million pesos, of which 950 million (17 percent) corresponds to biotechnological products. Almost 25 percent of this production is exported revealing its high competitiveness. Within the sector there are three types of companies;

- Small local firms with a minimum team of researchers, with strong ties to the public sector and an economic activity limited to biotechnology.
- Small and medium sized companies that do research with their own teams in association with academic centers, and realize other activities such as the production of traditional medicines or seeds.
- Subsidiaries of multinational mega-companies such as Monsanto and Pioneer that form part of a global network of research and development.

At the local level there is only a small number of innovative developments, which are more related to the adaptation than to the generation of new knowledge. The above mentioned companies invested (in the country) 50 million pesos in research and development of biotechnology, equivalent to 0.9 percent of the total sales of these companies, superior to the average of the industrial activity in total, which is estimated at 0.26 percent. If only biotechnology sales are taken into account, this percentage increases to 5.2 percent. Compared to international percentages these figures show similarity to the ones invested by the big multinationals, yet the absolute numbers show a huge difference.

In 2003, for instance, Bayer Crop invested 872 million dollars only in research and development; Monsanto, 527 million and Syngenta 727 million. The difference in numbers shows that Argentina is still far from generating radical technological changes as the multinationals have been realizing. The country does have a private company basis that might serve as a platform for future developments. For this reason, the government is taking measures for the promotion of the development and research of biotechnology applied to the production of goods and services.

[62] Bisang R.; Gutman g.; Szultwark S.; Diaz A. " La economia politica de la biotecnologia Argentina". Ed. Prometeo (in press)

4.2.2 SEED COMPANIES

Table 9 Main Seed Companies in Argentina

Grains		Oilseeds	
Wheat	**Maize**	**Soy**	**Sunflower**
Producem	Dekalb	Monsanto	Producem
Buck	Nidera	Novartis	Monsanto
Klein	Pioneer	Cargill	Nidera
Nidera	Zeneca	Producem	Pioneer
Relmó	Cargill	Cyanamid	Don Mario
AFA	Novartis	La Tijereta	
Micogen	AgarCross	Advanta	
Druertto	Relmó		
	Don Mario		
	Aventis		
	Micogen		
	Transgenes BT)	**Transgenes (RR)**	
	Morgan (Dow)	Nidera	
	Pioneer	Monsanto	
	Novartis	Pioneer	
	Monsanto (**)	Novartis	
	La Tijereta		
	Relmó (*)		
	Don Mario (*)		

Note (*) with license of Monsanto, (**) Monsanto is the only seller of Maize resistant against glyphosinate.
Source: Bisang et al. (2000)

4.2.2.1 Advanta Semillas S.A.I.C.

Advanta[63] is the culmination of a joint venture between two well-established and progressive seed enterprises: the Royal Vanderhave Group from the Netherlands and Zeneca Seeds from the United Kingdom. Established in 1996, the business has developed into a major force in a rapidly changing seed industry. Advanta has a rich tradition in plant breeding. The foundations of important R & D programmes in maize, grasses, cereals and sugar beet were laid in the first half of the 20th century. Nowadays, this experience is combined with modern science and technology.

In Argentina, the professionals of Advanta[64] conduct research programs, which are managed at the Research Stations in the locations of Venado Tuerto, Junín and Balcarce. There is a Biotechnology Centre in Balcarce and a Processing Plant in Murphy, offering the farmer a technical service.

Advanta Semillas S.A.I.C.
Ruta 7 Km. 261 - Casilla de Correo 91
(6000) Junin
Buenos Aires Province
Tel.: (54) 2362-433406

Biotechnology Center
Ruta 226 Km. 60
(7620) Balcarce
Buenos Aires Province
Tel.: (54) 2266-430001

[63] www.advantaseeds.com
[64] http://www.advanta.com.ar/english/company.htm

4.2.2.2 Bayer Cropscience Argentina[65]

Bayer CropScience , resulting from the acquisition by Bayer AG of Aventis CropScience SA, is one of the world's leading innovative crop science companies in the areas of crop protection, non-agricultural pest control, seeds and plant biotechnology. Bayer CropScience offers an outstanding range of products and extensive service backup for modern, sustainable agriculture and for non-agricultural applications. Bayer Crop Science is represented in 122 countries and employs 22,000 people world-wide.

Crop protection: Bayer Crop Science has a wide range of effective solutions for crop protection, including Insecticides, Fungicides, Herbicides, Seed Treatment and Plant Growth Regulators

Environmental Science: Offers solutions to control pests and weeds aims at improving the quality of life of professional users and consumers. This area covers among others; Branded Lawn & Garden Products, Green Industry, Professional Pest Management and Vector and Locust Control

BioScience: Is a global player in the research, development and marketing of seeds and solutions derived from modern plant technology.

Its business operations unit, BioScience, is a seed business that uses plant biotechnology and modern plant breeding techniques to improve the quality of crops and vegetables. Together with Crop Protection, BioScience offers an integrated portfolio of high quality seeds, trait technologies and high performance crop protection products.

BioScience activities are focused on three areas: vegetable seeds, agricultural seeds and research activities into, novel plant-based solutions for agriculture, nutrition, health and biomaterials.

Vegetable seeds - researching, breeding, processing and marketing high quality vegetable seeds and services. The vegetable seed operations are leading international developers and suppliers of high quality vegetable seeds and services. Under the global Nunhems brand, the company markets 2,500 varieties in 28 species around the globe to professional growers, plant propagators, seed dealers and the fresh produce and food processing industries. Their main crops include carrots, onions, tomatoes, leeks and melons.

Agricultural Seeds (AgSeeds) - holding a strong competitive position in high value markets
Our AgSeed focuses on improving the agronomic performance of three strategic crops: cotton, canola and rice, using modern plant breeding and plant biotechnology innovations.

High-value plant-based solutions for use beyond the agricultural commodity markets:
There is a strong demand for innovative products across a range of industries, as well as a real demand for renewable resources. BioScience has been developing applications of plant biotechnology beyond the farm gate for a number of years and has diverse research programs involving a number of crops and applications.

Its research efforts are focused on creating novel, plant-based solutions for the health, nutrition and biomaterial markets, building on our existing assets and competencies in enabling technologies, gene expression, carbohydrate metabolism and strategic crop platforms.

Bayer Crop Science Argentina
Ricardo Gutiérrez 3652 (1605) Munro
Tel: (54 11) 4762- 9470
Fax: (54 11) 4762-7000

[65] http://www.bayercropscience.com.ar

4.2.2.3 Monsanto Argentina S.A.I.C.

Monsanto Argentina is a subsidiary of the North American Monsanto Inc., the global provider of agricultural products and integrated solutions that include chemicals, seeds and biotechnology with the objective to improve the productivity of the land and the quality of the food.

Monsanto produces leading seed brands in large-acre crops like corn, cotton, and oilseeds (soybeans and canola), as well as small-acre crops like vegetables. It also produces leading in-the-seed trait technologies for farmers that are aimed at protecting their yield, supporting their on-farm efficiency and reducing their on-farm costs. In addition to the seeds and traits business, Monsanto manufactures the world's best-selling herbicide, Roundup®, and other herbicides - used by farmers, consumers and lawn-and-garden professionals.

Monsanto has structured its business in two segments:
1) Seeds and Genomics: the company's global seeds and traits business, and genetic technology platforms - including biotechnology, breeding and genomics.
2) Agricultural Productivity: primarily of crop protection products, residential lawn-and-garden herbicide products, and the company's animal agricultural businesses.

Monsanto opened in 1956 its Zárate Plant as a polystyrene operation, being the first Monsanto facility in Latin America. Several styrenic polymers such as PS (polystyrene), SAN (styrene acrilonitrile), ABS (acrilonitrile butadiene styrene), and other chemical products (PVC, Santoflex, etc) were made in the following decades.

In 1982 the first batch of Roundup® herbicide was produced, initiating Monsanto's agricultural chemical operations in Latin America South (includes Argentina, Uruguay, Paraguay, Chile, and Bolivia). In 1987, the first glyphosate unit was started up with the original sulfuric process that was run until 1992.

In 1996, the acetochlor formulation unit was started up with Harness® and Guardian® herbicides, and in 1998 Flusol herbicide (fluorochloridone-based) was incorporated to this unit.

In 1996, the Blending & Packaging operation for NutraSweet brand sweetener was launched, incorporating liquid sweetener formulations in 1997. In 1997, the Plastics business was divested and sold to Unistar (including the manufacturing operation) and the Zárate Plant became an agrichemical facility. In March, 2000, the business for NutraSweet was sold to Merisant. Roundup®, Harness® and Guardian® are registered trademarks of Monsanto Technology LLC.

Soy was one of the first products in incorporating Monsanto's Rounduo Ready technology, introduced in the market in 1996. Later the Bt technology allowed the development of crops protected against insects, which were allowed in Argentina in 1998. The cotton Roundup Ready is commercialized since 1997 in the United States and is available in Argentina since 2001.

Table 10 Approval in Argentina of Monsanto GMO crops:

Crop	Transformation Event	Technology	Approval
Soy	GTS 40-3-2	RR	1996
Cotton	MON1445	RR	2001
Cotton	MON531	Bt	1998
Maize	MON810	Bt	1998
Maize	NK603	RR	2004

Monsanto Argentina SAIC
Headquarters
Maipú 1210, 10° floor
Buenos Aires - C1006ACT
Tel: (5411) 4316-2429
Fax: (5411) 4316-2447
http://www.monsanto.com.ar

4.2.2.4 Dow Agrosciences Argentina

With head offices in Indianapolis, United States, Dow AgroSciences is a company that supplies products for the management of plagues and weeds in agricultural crops and biotechnology tools.

In 1998, Mycogen, a biotech company, became a wholly-owned subsidiary of Dow Agrosciences. The company specializes in maize, sunflowers, soybeans, canola and alfalfa.

Dow AgroSciences is owner of Mycogen Seeds, that develops and comercialises seeds and is leader in the development of genetically strengthened harvests.

Its crop protection and plague control activities include the following crops: winter cereals, maize, soybean, cotton, rice, fruits, horticulture, turf, ornamentals and pastures.

Dow AgroSciences Argentina supplies through its seeds line “Semillas Hibridas Morgan”, innovating technology to satisfy its clients production requirements (Morgan™ Semillas: maize, sorghum and sunflower).

Dow Agrosciences Argentina S.A.
Av. Alem 855 Piso 12
C1001ADD Buenos Aires
Tel.: (54 11) 4510-8600
Fax: (54 11) 4510-8652
www.dowagro.com.ar

4.2.2.5 Asociados Don Mario S.A.

Don Mario Semillas is a solid Argentine company (100%) created in 1980. Initially, it focused on the development of soybean seeds (30% of the sown hectares have Don Mario seeds). Later, the company started with other crops such as wheat, maize and sunflower. Besides, Don Mario develops grass seeds business through an alliance with Forratec and Biodiesel energy through Bioenerg (in May 2003 Don Mario Semillas financed the first soy grain based biodiesel plant in Argentina, located in Chacabuco with a total yearly capacity of 600,000 liters of biodiesel).

Don Mario Semillas employs 160 people and counts on the highest technology for research, development, production, commercialization and distribution of seeds in the entire Republic of Argentina and the neighbouring countries of the MERCOSUR.

Don Mario has a genetical improvement program, with a total investment of 2 million dollars a year, in soy research. Besides, the company does research in maize, wheat and sunflower seeds. Don Mario realizes the entire development of the research, takes out new varieties, multiplies them and markets the seeds through its sales channels, distributors or cooperatives.

Currently, the company is constructing a biotechnology laboratory to accelerate the seed genetical research processes. Don Mario offers counterseason multiplication services to genetic soy seed companies in the United Status and Canada, and also produces for them. In Brazil the company has a subsidiary named BrasMax, where they are doing research and developing soy seed varieties adapted to the south of Brazil (it is expected that these products will be commercialized within one or two years).

Asociados Don Mario S.A.
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6740 Chacabuco, Buenos Aires
Argentina
E-mail: donmario@rcc.com.ar
Tel: +54 (0352) 430762
Fax: +54 (0352) 430418
Web site: http://www2.donmario.com

4.2.2.6 KWS Argentina

KWS is one of the world's leading plant breeding (seeds for maize, sunflower, sorghum and pastures) companies, with subsidiaries, associated companies and distributors in all the main markets. Its products are agricultural plants for temperate climates. The wide range of species and varieties KWS produce are inevitably based on traditional plant-breeding techniques, but KWS is also making increasing use of the latest innovations in biotechnology.

KWS aims to develop new high-yield varieties suited to local conditions and with increased pest and disease resistance, to make more efficient use of fertilisers and to find alternative uses of plants.

KWS specializes in sugar beets, maize, and cereals. The company generates over 70% of its revenue outside Germany. It is the 4th largest maize breeder in the US with annual sales of US$622 million in 2004, and the fifth largest seed company in the world.

The company uses various techniques for crossing and selection; such as, cell biology, molecular markers, genetic engineering and genomics research.

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B7620- Balcarce -Pcia. de Buenos Aires
ARGENTINA
Tel.: (+54) 2266 - 4 201 14
(+54) 2266 - 4 255 43
Fax.: (+54) 2266 - 4 21811
E-mail: kws@kws.com.ar

4.2.2.7 Syngenta Seeds

Syngenta is a world-leading agribusiness committed to sustainable agriculture through innovative research and technology. The company is a leader in crop protection, and ranks third in the high-value commercial seeds market. Sales in 2005 were approximately $8.1 billion. Syngenta employs more than 19,000 people in over 90 countries. In Argentina, Syngenta operates two business divisions - Seeds and Crop Protection.

Research and Development:

Syngenta focuses on the following dominating issues:
- Developing new chemical products to control parasites, diseases and weeds
- Supplying technical support and realizing trials in the country
- Developing products for higher yields; crops tolerant to diseases and drought and higher nutritional value, as well as the improvement of crop characteristics for their industrialization
- Applying integrated solutions based on the use of agro-chemicals and biotechnology.

Syngenta Agro
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(B1638BGE) Vicente Lopez
Buenos Aires Argentina
Tel: 00-54-11-4837-6500
Fax: 00-54-11-4837-6501
agro.soluciones@syngenta.com
www.syngenta.com.ar

Syngenta Seeds
Av. Libertador 1855
(B1638BGE) Vicente Lopez
Buenos Aires Argentina
Tel: 00-54-11-4837-6500

4.2.2.8 Pioneer Argentina SA

Pioneer Argentina S.A., is a branch of Pioneer Hi-Bred International, Inc., with headquarters in Des Moines, Iowa, United States of America, founded in 1926. The Company is a leader in the development, production and commercialization of seeds, operating in more than 70 countries around the world. For more than 75 years, Pioneer Hi-Bred has improved crops and increased the productivity of farmers through genetic modification of plants. By modifying genetic attributes of plants, Pioneer continually improves the characteristics of corn, soybeans, sunflower, alfalfa, sorghum, wheat and canola.

Pioneer started its operations in Argentina in 1988, where it produces and commercializes corn, sunflower and sorghum hybrid seeds, Pioneer® brand; as well as varieties of soybean and alfalfa.

These products are distributed through a highly qualified dealers network and through them Pioneer establishes a relationship with Argentine farmers.

Pioneer Argentina S.A.
Hipólito Yrigoyen 2020 - 1er. Piso
(B1640HFP) Martínez
Buenos Aires
Tel: (54) 11 4717-9100
Fax: (54) 11 4717-9195

4.2.2.9 Nidera

Nidera is an international trading and agribusiness company with strong traditional roots in Europe and Argentina. Its main activities include the trading of grains, oilseeds, vegetable oils and meals; feedstuffs, rice and ocean transport. Other related activities include the operation of elevators, processing plants, and vegetable oil refining and bottling.

In Argentina, Nidera is also engaged in the R&D of agronomic seeds and in the handling of a wide range of agricultural inputs. Due to long-standing research agreements with Monsanto, *Nidera* first succeeded to cross the gene construct into its own germplasm and, hence, release transgenic varieties tailored to the local agro-ecological circumstances. Nidera presently accounts for 67 percent of the annual Argentine soybean seed market.

Since the beginning of 2006 Nidera is actively supplying feedstock, and trading, supplying and investing in Bio-Energy products, such as biofuels and biomass.

Its main product-lines include:
- Grains: wheat, corn and sorghum;
- Oilseeds: soybean seed, sunflower seed and canola (rape) seed;
- Vegetable oils: soybean oil, sunflower seed oil, canola oil, cottonseed oil, maize oil, groundnut oil, safflower oil, and specialty oils;
- Oilseed meals: soybean meal and sunflower meal;
- Agronomic seeds: proprietary germplasm and corn, sunflower, wheat, soybeans and sorghum seeds;
- Crop nutrients: nitrogen, phosphates, potash, compounds, blends and micro nutrients;
- Crop protection: proprietary ZAMBA product line in herbicides, insecticides and fungicides.

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Fax: +54-(11)4346-8001
info@nidera.com.ar

4.2.3 BIOTECHNOLOGY

In this paragraph, local private plant biotechnology companies are presented. These companies do not belong to the (multi)-national traditional seed crop companies mentioned in the previous paragraphs.

4.2.3.1 Bio Sidus S.A.

Bio Sidus SA is Argentine's premier commercial organization dedicated to biotechnology research for human health and agricultural development. Bio Sidus was created with Argentine capital during the early 80's by Sidus (http://www.sidus.com.ar), an Argentine pharmaceutical company that, at that time, had been active for more than forty years.

The main idea of the company was to diversify the traditional production of chemical -pharmaceutical medicines by starting with biotechnology, which, during those years, was a complete new discipline.

Mr. Argüelles is the President of Grupo de Empresas Farmacéuticas Sidus and President of BioSidus. Bio Sidus develops its products by applying recombinant DNA technology. Its first success within this field had been in 1990 with "Eritropoyetina", the first recombinant protein fully produced in Argentina.

Bio Sidus is a leading company in biotechnology in Argentina. It includes Sidus, a very well known pharmaceutical company, as its principal business unit.

As a pioneer in Latin American biotechnology research, Lic. Argüelles also directs the Argentinean Biotechnology Forum (FAB) and serves as the Vice President of the Funprecit Foundation.

Biosidus promotes the integration-between-science-and-industry concept, which is reflected in its strategy. The link between science and business is the adequate mechanism for Biosidus to reach success. It's a difficult road, mainly due to the different lengths of time where these actors expect to perform. Still, they are highly convinced that this is the model of pharmaceutical industry that is needed for Argentina.

Another demonstration of this integration is the investment and work that Bio Sidus is carrying out at the INDEAR Project, the newest public-private agro-biotechnology research project in Rosario. It will be the first Functional Genomic Center in Argentina, fully equipped with the latest generation technology (for more information on INDEAR refer to paragraph 4.3.3.4.3).

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Capital Federal
Tel: (54 11) 4909-8000
Fax: (54 11) 4909-8055
post@biosidus.com.ar
www.biosidus.com.ar

4.2.3.2 Bio Sidus AG – Business Unit Bio Sidus S.A.

Bio Sidus A.G. is a business unit of Bio Sidus SA that develops plants and its derivative products for agriculture, industry and human health applications. It is currently developing two types of potatoes , which are resistant to the economically most important pathogen affecting potato production in Argentina: the "Y Potato Virus" (PVY) and the "Potato Leaf Rol Virus" (PLRV). This work is now under testing, with the idea of introducing them into market by 2008. By then, those potatoes will become the first genetically modified organisms (GMO) produced in Argentina.

Production facilities Biosidus AG:

- Production capacity is 3,000 to 10,000 plantlets a day
- In their growth chambers Biosidus can produce up to 1,000,000 plantlets

Other Projects:

- Virus resistant potato
- Glyphosate resistant sugarcane
- Gluphosinate resistant potato
- Molecular farming
- Nutraceuticals (potato)

Bio Sidus AG SA
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(1254) Buenos Aires
Tel: (54 11) 4909 8045
Fax: (54 11) 4909 8042

4.2.3.3 Genésica

Genésica is a company dedicated to the promotion, study and formulation of scientific projects and/or developments in biotechnology that can, potentially, improve the productive and commercial activity through an effective technological transference.

Genésica was created in October of 2001. The company establishes a bond of communication and effective association between the scientific world and the one of the businesses. Genésica has developed a unique work party in its type for its region, made up of professionals of excellence in the Scientific and Technological Management activities.

Genésica has been awarded with the first prize in the competition NAVES 2001 of the IAE, School of Businesses of the Austral University between more than 150 projects. Designated to participate next to the most prestigious Schools of Businesses of Latin America in the competition of plans of businesses Latin American Moot Coorp 2002 (Getulio Foundation Vargas in San Pablo, Brazil) Genésica obtained the first prize again, and was distinguished with an invitation to participate in the world-wide competition Moot Corp 2002.

During 2003, Genesica has signed a collaboration agreement with Conicet. This agreement allows Genesica to analyze projects and to present proposals to manage Intellectual Property of selected projects and to market or license them.

Genesica is working with research groups of the National University of Quilmes (UNQ), the Leloir Foundation, the National Institute of Agricultural Technology (INTA), the University of San Martín) (UNSM), the Austral University and the University of Buenos Aires (UBA).

Genesica and UNQ have applied for a production project of transgenic plants with high nutraceutical values at the National Agency of Science and Technique (Bilateral Ideas Project together with Brazil) in September 2002.

Genésica manages intellectual property protection (national and international patents), intellectual property valuation, business plans and funds consecution. Its legal staff is specialized in intellectual property protection of scientific-technological developments, while the companies' business team evaluates the economic feasibility and develops the proper business proposal.

Genésica's investor portfolio allows them to find funds for projects in different degrees of development or invest in new ideas and projects.

Genésica
Salta 1007
(1074) Buenos Aires
Tel: (54 11) 4304-6633
www.genésica.com.ar
info@genesica.com.ar

4.2.3.4 Chacra Experimental Agrícola AC – La Chacra

La Chacra is the first and only private sugar cane improvement program in Argentina and has as main objective to obtain sugar cane varieties that are adapted to the ecological conditions of the Northern Argentina. Therefore Chacra Experimental SA is developing a traditional Genetical Improvement Program.

http://www.chacraexperimental.org

4.2.4 BACTERIAL INOCULANTS

The potential market of inoculants is close to US$ 18 million supplied by more than 30 companies. Hereafter a description of some of the main bacterial inoculants suppliers is presented.

4.2.4.1 Laboratorios López

Laboratorios López S.R.L. is a company dedicated to bioproduction of inoculants at large scale with ultimate technology. Laboratorio Lopez started with a project and consulting agreement with the Faculty of Agricultural Sciences (U.N.C. Facultad de Ciencias Agropecuarias) resulting in an enterprise producing and fractionating biological fertilizers to be used in the no-till sowing of important agricultural crops.

The laboratory counts actually on first level professionals dedicated full time to the task of presenting the products according to the requirements of the national legislation (SENASA), Therefore, Laboratorio López SRL has acquired specific equipment for the manipulation of microorganisms, and applies internal and external controls of its production. The insertion of inoculants is supported by offering soil analysis, pulverised water, germination powder, etcetera. At the moment, each specific formulated and embottled inoculant for a determined crop (soy, wheat, maize, etc.) is evaluated at field by national recognized institutions, these data are published periodically.

Products:
1) Inoculants for Maize
2) Inoculants for Soy
3) Inoculants for Wheat

Research:
- Relation with the Facultad de Cs. Agropecuarias U.N.C. with an umbrella agreement with Laboratorios López S.R.L.(Ing. Omar Bachmeier)
- Technological relation with INTA Jesús María to realice field trials in the zone of Jesús María, Sinsacate, San José de la Dormida, etc. (Ing. León Murúa)
- Relation with INTA de Marcos Juarez to realise certified field trials (Ing. Fraschina)
- Relation with the University of Río IV, Microbiology Area for the realization of field trials in the area of Río IV (Biólogo Oscar Masciarelli)
- Relation, with agreement in transfer, with the Faculty of Chemical Science U.N.C. for the support in complex analytical resolutions (Dra. Virginia Sosa)
- Agreement Project with INTA Río I for the realization of field trials (Ing. Carlos López)
- INTA Castelar: agreement establish with INTA Castelar for the acquisition of certified strains and periodical evaluation of the inoculants at field
- Agreement Letter with the Institute of Plant Fytopathology (IFFIVE-INTA), for the evaluation of pre-inoculation for soy C-511(Ing. Roberto Racca)
- Agreement with the University of Rio Cuarto – Cordoba about the evaluation of seed inoculation with Azospirillum inoculant (Ing.Carmen Olmedo e Ing. Cholaky Sobary).
- Agreement with the Faculty of Chemical Sciences, UNC for the technical assistance of different analytical trials. Besides a technological relation for the development of various products (Vice-Decana Dra. Virginia Sosa).
- Cooperation agreement, signed by the University of Río IV, that involves the presentation at FONTAR (Argentine Technological Fund) of an ANR project designed together with Laboratorios Lopez SRL and the Laboratory of Plant Physiology, Area of Research and Development about the theme: reformulation of bacterial inoculants applied and horticultural species with the objective to raise the productive capacity of the species
- Participation in the Project INOCULAR 2004 of INTA CASTELAR (Ing. Perticari).

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Doménico Zípoli 169 – Jesús María
(5220) Córdoba
Tel: (54) 421726 – 400901
www.laboratorioslopez.com.ar

4.2.4.2 Rizobacter Argentina S.A.

Rizobacter is an Argentine company created in Pergamino, which successfully operates in the agricultural sector. The company has four main product lines: inoculants for leguminous seeds, liquid seed treatment for direct application on the seeds adjuvants for agricultural use, toxic strains for plague control and service of seed pelleting.

Rizobacter product portfolio contains inoculants, micronutrients packs, fungicides, adjuvants, plague strains, insecticides, biofertilizers and pellets.

During the last years the company has realized the following field trials:
- Inoculation of wheat seeds with Rizofos
- Treatment and sowing of wheat seeds with Rizofos
- Development of the application of phosphate pseudomones solubilization
- Determination of the percentage of plant knots in soy
- Biological determination of nitrogen in soy crop at field
- Trials Season 2001- 2002
- Trial for Pill Bug control with experimental toxic bait Clartex BB
- Determination of nodulated plants percentage in soybean
- Clartex +R Slug Control in Sunflower
- Clartex +R Slug Control in Sunflower
- Clartex Slugs Control in Sunflower
- Clartex Slugs Control in Soybean
- Clartex Slugs Control in Corn
- Rizofos Trials in Pergamino and Chivilcoy
- Clartex Slugs Control in Wheat
- Clartex Slugs Control in Soybean
- Clartex Slugs Control in Corn
- Clartex Slugs Control in Sunflower crop in no-till sowing
- Field trial of pre-inoculants of soy seeds with a seed inoculant machine
- Productive answers at the inoculation and its interaction with the chemical fertility of the soy
- Wheat: what to discover before sowing
- Rizofos Liq Maize, Bacteria inoculant for maize crop

Rizobacter Argentina S.A.
Ruta 32 km 1,5 - Parque Industrial
(2700) Pergamino
Tel: (54) 2477 - 432044
Fax: (54) 2477 - 432893
www.rizobacter.com.ar

4.2.4.3 CKC Argentina

Laboratorios CKC Argentina S.A. is a company located in the city of Buenos Aire. Its products line is based on the production and sales of inoculants for grass, legumes and liquid seed treatment of direct application.

The company Crawford Keen & Company originates in the United States; it started in Argentina in 1970 with the development of soy crops. CKC was leader at that moment thanks to the incorporation in the agricultural seed market of the soy types Hood, Hood-75, Forrest, Essex, Williams, Agripro, and Stuart.

Since 2001, the company has restructured with national capital and this led to the new Laboratorios CKC Argentina S.A., that is consolidated by two agreements signed with INTA; the first one concerning the installation of a facility within the INTA Castelar Technological Innovation Park and the second one on a Technological Relation with the Institute for Microbiology and Agricultural Zoology; which offers assistance and realizes follow-up and control of production of inoculants for elaborated soy before its commercialization.

Furthermore Laboratorios CKC established various contacts with Research Centers and Universities world-wide:

- ISTC (International Science and Technology Center) - Moscow, Russia.
- Parco Tecnológico Padano - Milán, Italy
- Department of Primary Industries and Fisheries - Queensland, Australia.
- Universidad Nacional Autónoma de México - Cuernavaca, México.

The incorporation of new technologies gave the start to the company's internationalization. Field works have been initiated and products are registered in various countries in Latin America and Europe.

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Tel: (54 11) 4941-5777
Email: ckc@ckc.com.ar

4.2.4.4 Nitragin Argentina SA

Since 1975, Nitragin Argentina SA the company is not only participating actively in the development, production and sales of inoculants, but also, more recently the company has converted into a leader of legume seeds treatment.

As a member of the Merck Group (corporative of the Chemical and Pharmaceutical Branch) the company possesses all the technological information and structure that is required for the development of its products.

Nitragin is a company that utilizes the last advances in chemistry and biology to attend the problems related to agricultural productivity and the quality of life of people.

Nitragin is the first company in the world to certify under ISO 9002 Quality Assurance and ISO 14001 Environment Management System norms.

From the model factory located in the Industrial Park of Pilar (Argentina) Nitragin produces, distributes and sells its products to all the countries of South America.

Products: Growth Promoters and Legume Inoculants (Soybeans, Peanuts, Pulse Crops, Forage Crops)

Nitragin Argentina SA
Parque Industrial Pilar
Telephone: (02322) 496100
E-mail: clientesntg@nitragin.com.ar
http://www.nitragin.com.ar

4.2.4.5 Sintesis Quimica S.A.I.C.

Sintesis Quimica is an Argentine company with private capital, devoted to manufacturing special chemicals and biological products for the industry and agriculture. It was founded in 1951 by a group of Chemical Sciences graduates with the purpose of reaching a leading position among Argentine chemical companies, both for the variety of products and for technical support services to its customers.

The company is renown in the local market due to the quality of its products and the responsibility of its undertakings. This image was projected to other countries where numerous customers supported its objectives. Síntesis Química exports to the United Status, Canada, Brazil and Bolivia and invoices US$15 million a year.

The Biological Products Unit
Carlos Bonfiglio is the Director of the Biological Products Unit of the company that consists out of 50 persons and dedicates to the production of biological fertilizers based on atmospheric nitrogen fixation.

The inclusion of industrial fermentation technology at Síntesis Química began 20 years ago, when the company signed an agreement on technological transfer with CINDEFI. Since then, this production area grew very rapidly in quality, quantity and capacity of the fermenters, as well as in all the peripheral equipment needed to turn the plant into a modern unit with sufficient capacity to supply the domestic market and to export its high-level quality biological products.

In recognition of this serious and systematic work, the company was awarded First Prize in the Banco Frances Techno Competition (1998) for its development of a continuous fermentation process.

At this time, the company's main activity is centered on inoculants for leguminous plants but others, such as Bacillus Thuringiensis and Azoperillom, are being added. New products are in the field test stage (inoculants for fodder) or in the development phase. (Trichoderma).

This Unit handles relations with similar centers, institutes and companies abroad and is also in charge of the export business and technical support to various countries.

The Chemical Plant
This Plant concentrates the company's 50 years of experience in manufacturing chemical products. Currently devoted to producing biocides, fatty acid methyl esters and agrochemicals, the chemical plant has equipment made of glassed, stainless steel, suitable for carrying out a wide range of operations and procedures.

The Agrochemical Formulation Plant
In general, active drugs require a prior formulation for their use as agrochemicals. In this field, throughout the years and particularly on the basis of its own manufactured products, Síntesis Química knowledge in formulation processes and experience in their application to different crops. Increases in the volume of these formulations and the need to assure their quality, led to the installation of a special plant for this purpose; this plant includes an important set of reactors, automatic packaging machines and storage facilities for raw materials and finished products. It is totally suited to cover the Company's needs and to offer its services to third parties.

In Argentina the company has a patent submitted for approval "Aqueous based inoculant composition" (pre-awarded patent).

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http://www.sintesisquimica.com.ar

4.2.5 MICROPROPAGATION

4.2.5.1 Tecnoplant S.A.

Technoplant S.A. (a division of Biosidus SA) focuses in the production of plants with high genetic quality. It produces raspberries, hybrid blackberries, loganberries and, most specially, blueberries by micro propagation of sanitary controlled clone plants. This company seeks to open new markets throughout the world for vegetable-based bio-products of high quality.

Tecnoplant S.A. counts on laboratories equipped with positive and negative pressure sterile areas and growth chambers with 15,000 crop flasks, which represents a total productive capacity of 1,000,000 in vitro plantlets.

Furthermore the company has 1.250 m2 surface of rooting greenhouse and 22.000 m2 of climatization shadehouse, with a productive capacity of one million plants per year. Its rustication capacity is approximately 900,000 plants. Also it has installations on 4.600 m2 in the industrial park of Pilar.

Tecnoplant owns its own blueberry plantation in the Province of San Luis, with 115 acres and is still working to complete a total of 170 acres. It is the largest blueberry plantation in Latin America.

Tecnoplant is integrated with two other companies (Berries de Argentina and Tecnovital) being leaders in blueberry exportations to the US, Canada, Japan, England, the Netherlands, Italy, Spain and Germany.

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(1254) Capital Federal
Tel.: (54 11) 4909 8138
Fax.: (54 11) 4909 8055

4.2.5.2 Agrogenética SA

Since 1987 Agrogenética is dedicated to the production of high quality potato seeds. The company is about to inaugurate its new laboratory for the in-vitro production of plantlets. In the surroundings of Mar del Plata it produces mini-tubers under controlled conditions and in the mountain range of the Andes (at 2,000 meters height in the Calingasta Valley in San Juan) the company produced the first two multiplications of basic seed. Agrogenética has the following varieties available: Spunta, Kennebec, Shepody, Atlantic, Russet Burbank, Ranger Russet, Asterix and Innovator.

The potato production center of Agrongenética is located in the Sierra de la Ventana zone in Buenos Aires where the third generation of potatoes seeds are obtained that are for sale each year. Its entire production is inspected by INASE and supervised by its agronomist.

Agrogenética provides the basic seeds to various seed producers and is the supplier of industrial seed varieties of companies such as Mc Cain and Farm Frites. Furthermore, many consumption potato producers are client of the company.

Its seeds are produced in high zones, isolated with excellent agro-ecological conditions for its cultivation. The seeds come from in-vitro plantlets of selected clones regarding its type and behaviour in the field. They are commercialized under the brand names Sierra de la Ventana (certified) and Cerro Mercedario (basic).

Agrogenética
Av Luro 8123
(7600) Mar del Plata

4.2.5.3 Bioext SA

Bioext SA is a company that has close ties with the University of Quilmes (agricultural division – plant biotechnology). The University owns a small part of the shares of the company participates actively in the majority of the activities and helps the company with specific technical support.

One of the main tasks of Bioext is the generation of Elite plantlets for micro-propagation. Currently, Bioext possesses a huge stock of in vitro blueberries, with various varieties that are adapted to the northern, southern and central zone of Argentina.

Bioext also provides blueberry plantlets:
• Micropropagated under strict process norms
• Guaranteed Sanitary status
• Variety and Molecular Biologic Guarantee
• Optimal Radicular /Foliar development
• Certificación UNQ (Universidad Nacional de Quilmes).

Furthermore, Bioext advises producers about the advantages and disadvantages of biological inoculants and transgenic plants with resistance to herbicides. When the producer decides to implement one of them, Bioext also informs about the correct application.

BioExt is working with agricultural biological inoculant developing companies in the following aspects:

A) Evaluation of the formula of the inoculant and its warehousing conditions
B) Comparison of the nodulative potential with other brands through biological trial in the plant
C) Trials of the nitrogenase activity of the formed knots
D) Factorial field trials (comparing different treatments such as the use of different inoculants, different inoculation protocols, different agrochemical concentrations, etc.).

Bioext S.A.
Av. Calchaquí 5800
(1888) Florencia Varela
Buenos Aires
Tel.: (54 11) 4275 7716
www.bioext.com

4.3 RESEARCH INSTITUTIONS, LABORATORIES, UNIVERSITIES AND NGO'S

In general, biotechnology research in Argentina is performed at national research institutes, universities, and a few private local companies. According to Burachik and Traynor, there are strong interactions between scientists at INTA and universities, particularly in Buenos Aires.[66]

There are more than 60 centers, institutes and groups of research, focused on Biotechnology. In the field of plant biotechnology, the following institutes can be mentioned[67,68:] various CONICET research Institutes, Institute of Genetic Engineering and Molecular Biology (INGEBI), Centre for Studies on Photosynthesis and Biochemistry (CEFOBI), INTA´s Castelar Biotechnology Institute and public universities such as the Universities of Buenos Aires, Córdoba, La Plata, Mendoza and Rosario, San Martin and Tucumán. INDEAR and the agricultural division of Bio Sidus are references in the private sector. For detailed information on institutions and laboratories refer to paragraph 4.3.3.

Representatives of the institutions indicated that one of the main weaknesses of the Argentine research system is related to difficulties in developing and transferring technologies to private local companies.

4.3.1 Research Capacity in Argentina

Argentina[69] has a relatively well-established research tradition, particularly in the biological sciences, as three Nobel prizes confirm—Bernardo Alberto Houssay, medicine, 1947; Luis Federico Leloir, chemistry, 1970; and César Milstein, medicine, 1984.

Argentina has some 20 public research institutes with strong scientific and technical expertise in biotechnology, a successful regulatory system, and the second largest area planted with GM crops in the world. Most current research is at the greenhouse stage.

According to Moises Burachik, financing of field trials is always difficult. Research institutes are short of money; therefore, they are looking for private partners. The combination of the relatively low government R&D budget and the interest of multinational companies leads to an increase in the interaction between the public and private sector.

According to an ISNAR Survey on plant biotechnology (in 2000) Argentina has got a total of 17 research organizations. Compared to the other Latin American countries included in the study, Argentina together with Brazil count on the highest amount of Public University Laboratories and Public R&D Centers, while Colombia has more private firms.

Table 11 Number of Research Organizations[70]

Country	Public R&D Center Lab	Public University Lab	Private University Lab	Private Firm	International Center	Total (*)
Argentina	5	10	-	2	-	17 (41)
Brazil	4	13	-	1	-	18 (68)
Colombia	3	4	4	10	1	21 (45)
Other Latin American Countries (10)	10	10	1	4	3	28 (138)
Total	**22**	**37**	**5**	**17**	**4**	**85 (292)**

Source: ISNAR (2000)
Notes: (*) figures in parentheses indicate the number of questionnaires sent to Argentina

[66] Burachik and Traynor (2002), p. 9.
[67] www.genomicsforum.ac.uk/documents/fabianaLecture.ppt Professor Fabiana Azuaga University of Buenos Aires
[68] Cohen et al, 2001
[69] NYU Project on International GMO Regulatory Conflicts. Argentina, GM nation Chances and choices in uncertain times by Ana María Vara Centro de Estudios de Historia de la Ciencia José Babini Escuela de Humanidades, Universidad Nacional de General San Martín (UNSAM) September, 2005
[70] http://www.rlc.fao.org/redes/redbio/pdf/rur.pdf#search=%22Argentina%20Biotechnology%20Loan%22

Table 12 GMO Field Trials by type of Institution in Three Large Latin American Countries

Year 2000	Argentina		Brazil		Mexico		Total	
	No.	%	No.	%	No.	%	No.	%
U.S. / Europe Agricultural Input Firms	247	78	77	52	193	87	517	75
L.A. Agricultural Input Firms	55	17	34	23	0	0	89	13
Food / Paper Companies	0	0	7	5		4	16	2
Government Institutes or Universities	14	4	29	20	20	9	63	9

Source: FAO

Table 13: Biotechnology Research Focus in Latin American Countries (2000)

Country	Crop / Livestock Breed Involved * Times (*)									Total
	WH	*PO*	*HO*	*FF*	*MP*	*IC*	*CA*	*OL*	*OA*	
Argentina	25	10	16	13	6	3	27	18	5	**123**
Brazil	13	10	37	14	6	5	13	19	7	**124**
Chile	11	6	18	29	8	1	6	2	2	**83**
Colombia	14	23	31	39	13	42	15	12	9	**198**
Costa Rica	-	7	3	9	8	5	-	-	3	**35**
Ecuador	1	13	-	2	2	-	-	-	9	**27**
Guatemala	1	-	5	-	2	1	-	-	3	**12**
Jamaica	-	-	-	-	-	-	-	-	-	**-**
Paraguay	-	-							-	**3**
Peru	-	11	9	12	-	1	-	-	-	**33**
Trinidad & Tobago	-	-	-	-	-	-	-	-	-	**-**
Uruguay	-	-	-	-	-	-	-		-	**-**
Venezuela	7	9	4	18	14	14	-	-	-	**66**
Total	**72**	**89**	**123**	**139**	**59**	**72**	**61**	**51**	**38**	**704**

Source: ISNAR (2000)

Note: (*) WH = Wheat, Barley, Maize and other Cereals (incl. grasses); PO = Potato, Roots and Tubers; HO = Horticultural, Oilseeds, Legumes, Berries and Ornamental plants; FF = Fruit trees and Forestry Species; MP = Medicinal, Tropical and Native plants; IC = Industrial Crops (Coffee, Sugarcane, Tobacco, Palm, etc.); CA = Cattle (Bovine, beef, dairy); OL = Other Livestock species (Swine, Goats, Sheep; also Horses and Poultry); OA = Other Animals and Microorganisms (Aquatic Animals, Dogs, Birds, Insects, etc.)

Table 14 Financial and Human Resources Invested in Biotechnology R&D in Selected Countries of Latin America (1999)

Country (number of responses)	Financial Resources (US$)[a]		Number of Scientists			
	Country total	Institute Average	PhD	M.Sc.	B.Sc.	Total
Argentina (13)	2,945,000	226,538	56	57	144	257
Brazil (16)	3,363,255	210,203	150	102	183	435
Chile (7)	2,154,716	307,817	35	22	36	93
Colombia [b] (17)	5,808,614	263,038	44	55	152	251
Costa Rica (4)	435,245	113,311	8	9	12	26
Ecuador (2)	160,000	80,000	1	2	6	9
Guatemala (2)	55,600	27,800	1	3	6	10
Mexico[c]	n.a.	n.a.	127	49	62	238
Peru[d] (3)	1,496,338	13,169	10	5	19	34
Venezuela (6)	214,475	35,746	18	11	13	42
Total	**16,651,243**		**323**	**268**	**571**	**1,398**

Source: ISNAR (2000) and Falconi (1999)

Note: (a) echange rates of December 1999, (b) financial resources of each country includes, CIAT 1999 investments while institute average excludes CIAT; (c) Mexico data are for 1997; financial resources for country total includes CIP 1999 investments while institute average excludes CIP

Table 15 Biotechnology Tools Applied in Selected Latin American and Caribbean Countries

No	Technique involved	Country – Year 2000													Total
		AR	BR	CH	CO	CR	EC	GU	JA	PR	PE	TT	UR	VE	
Cell Biology Techniques															**259**
1	Micropropagation	13	9	13	39	8	5	3	-	2	11	-	-	11	114
2	Anther Culture	3	2	3	9	-	1	-	-	-	1	-	-	2	21
3	Embryo Rescue	4	1	4	6	1	-	-	-	-	-	-	-	3	19
4	Protoplast fusion	-	1	-	2	-	-	-	-	-	-	-	-	-	3
5	In Vitro germplasm conservation & exchange	5	3	3	14	4	2	-	-	-	1	-	-	10	42
6	In vitro insemination	-	2	-	1	-	-	-	-	-	-	-	-	-	3
7	Embryo manipulation & exchange	3	5	-	1	-	-	-	-	-	-	-	-	2	11
8	Animal cell cloning	-	3	-	1	-	-	-	-	-	-	-	-		4
9	Other-cell biology	3	3	5	21	3	1	-	-	-	-	-	-	6	42
Genetic Engineering Techniques															**124**
10	Agro bacterium mediated	11	12	6	7	4	-	-	-	-	7	-	-	4	51
11	Micro-projectile bombardment	4	11	7	6	3	1	-	-	-	-	-	-	5	37
12	Electroporation	-	7	1	1	-	1	-	-	-	-	-	-	4	14
13	Microinjection	-	4	-	1	-	-	-	-	-	-	-	-	-	5
14	Other genetic engineering	7	5	2	2	1	-	-	-	-	-	-	-	-	17
Genetic Marker Techniques															**239**
15	RFLP	7	9	3	10	-	2	-	-	-	2	-	-	4	35
16	RAPD	15	24	11	14	2	6	-	-	-	4	-	-	5	81
17	Micro satellite markers	13	10	8	12	3	1	-	-	-	4	-	-	4	51
18	AFLP	13	6	7	8	1	1	-	-	-	4	-	-	-	40
19	Others	6	9	10	4	-	1	-	-	-	-	-	-	-	32
Diagnostic Techniques															**176**
20	ELISA	6	12	3	13	-	2	-	-	2	2	-	-	3	43
21	Monoclonal antibodies	1	5	2	4	-	1	-	-	2	1	-	-	1	17
22	Nucleic acid probes	1	5	1	1	-	-	-	-	-	1	-	-	4	13
23	PCR	10	29	12	11	-	1	-	-	-	1	-	-	4	68
24	Others	-	5	5	20	2	2	-	-	-	-	-	-	1	35
Microbial Techniques															**90**
25	Design-delivery biocontrol agents	1	3	2	7	-	-	5	-	-	-	-	-	-	18
26	Design-delivery biofertilizers	2	2	-	2	-	-	-	-	-	-	-	-	1	7
27	Fermentation, food processing	2	4	-	17	-	1	-	-	-	-	-	-		24
28	Animal growth hormones	2	2	-		-	-	-	-	-	-	-	-		4
29	Rumen manipulation	-	1	-	-	-	-	-	-	-	-	-	-		1
30	Design-delivery-vaccines	5	-	-	-	-	-	-	-	-	-	-	-		6
31	Other – microbiology	6	1	2	17	2	1	-	-	-	-	-	-	1	9
Total		**143**	**195**	**110**	**252**	**34**	**30**	**8**	**-**	**6**	**39**	**-**	**-**	**71**	**888**

Source: Agrivalue SA based on ISNAR (2000) data

Table 16 Production Constraints Addressed by Biotechnology Research Institutions in Latin American and Caribbean Countries

Country									Total
	PP	PH	AP	AH	GR	FP	GE	OT	
Argentina	26	20	10	23	22	-	1	-	**102**
Brazil	16	30	15	2	23	8	2	3	**99**
Chile	20	15	3	4	24	1	-	4	**71**
Colombia	39	35	4	14	21	10	-	4	**127**
Costa Rica	12	-	-	-	14	2	-	-	**28**
Ecuador	2	3	3	2	9	-	-	1	**20**
Guatemala	2	5	-	-	-	2	-	-	**9**
Jamaica	-	-	-	-	-	-	-	-	**-**
Paraguay	2	1	-	-	-	-	-	-	**3**
Peru	7	8	-	-	2	1	-	-	**18**
Trinidad & Tobago	-	-	-	-	-	-	-	-	**-**
Uruguay	-	-	-	-	-	-	-	-	**-**
Venezuela	12	9	-	-	9	-	-	-	**30**
Total	**138**	**126**	**35**	**45**	**124**	**24**	**3**	**12**	**507**

Source: Agrivalue SA based on ISNAR (2000) data

Note: (*) PP = Plant Production (plant breeding, cloning, productivity, abiotic stress, other); PH = Plant Health (protection, diseases, diagnostics, other); AP = Animal Production (reproduction, productivity, other); AH = Animal Health (protection, diseases, vaccines, diagnostics, other); Genetic Resources (Characterization, variability, selection, conservation); FP – Food and Pharmaceutical Needs (nutritional quality, functional foods, drugs, enzymes); GE = Genomics; OT = Other (industrial/energy purposes, other)

4.3.2 Research and development efforts

A study[71] of the scientific magazine *Nature* places Argentine among one of the 18 countries in the world that invest most in science and technology, although the investment is qualified as moderate. In the last 3 years, Argentina almost tripled the budget assigned by the Secretariat of Science, Technology and Innovation. It grew from 30 million dollars in 2003 to 78 million dollars in 2006. According to Tulio Del Bono, the state investment in scientific and technological activities represented 0.35% of the Gross Domestic Product (GDP) during 2006, but when private investment is taken into account, the percentage increases to 0.6% of the GDP.

Public (and private) resources allocated to research and development in Argentine in all fields and in agriculture -especially in the area of biotechnology- are scarce as compared to corresponding efforts at the international level[72].

Expenditure in scientific and technological activities in Argentina increased from 0.33 per cent of GDP in the early 1990s to 0.52 percent in 1999. During the years of recession and crisis it decreased to only 0.44 in 2002 to rise to 0.46 in 2003. Agriculture accounted for 18 per cent of the expenditures in R&D and for a similar percentage as a field of application of R&D project.

While the financial resources are scarce, it is important to bear in mind that the country has a sizable human capital force - 27,367 full time researchers in 2003, most of them working in public universities and institutes.

According to the ISNAR survey on biotechnology performed on 18 research organizations (out of 41 contacted ones), the country had about twelve organizations with major capabilities in molecular biology and genetic engineering, which employed approximately 300 researchers. The resources

[71] http://weblog.educ.ar/noticias/archives/006983.php Miércoles 15 de Febrero de 2006 - (Ciencia, Lo que pasa..., Números) Argentina, entre los 18 países del mundo que más invierten en ciencia

[72] Daniel Chudnovsky, "The diffusion of biotech crops in the Argentine agriculture sector" Agricultural Biotechnology for Development – socioeconomic issues and institutional challenges Belfer Center STPP
Kennedy School of Government

devoted to research were U$S 3.5 million excluding researchers salaries. These organizations were mainly located in the public sector and in public universities.

An ongoing survey on biotechnology firms in Argentina indicates that in 2002-03, the seventy-one surveyed firms devoted 0.9 per cent of their sales to R&D. In agriculture biotech, seed firms assigned 0.52 of their sales to R&D (Bisang et al, forthcoming).

The low figures that both public and private institutions devote to R&D in biotechnology represent a dramatic contrast with the resources assigned not only in the United States but also in developing countries such as China and Brazil.

In spite of the low resources, there is a great diversity in research focus. According to the ISNAR survey, agriculture-related applications include the diagnosis of phytopathogens in several crops, the development of biological control agents and the use of micropropagation techniques, molecular markers and genetic engineering of different crops such as garlic, onion, potatoes, sunflower, corn, wheat alfalfa, strawberry, tomatoes, rye, citrus, cranberries, sugar cane and yerba mate (Cohen et al, 2001).

In the recently approved Strategic Plan 2005-2015 for the development of agriculture biotechnology (Ministry of Economy, 2004), it is pointed out that although the country has a good research capacity in life sciences, it can improve the effort in modern biotechnology.

In view of the relatively few biotech plants and industrial developments in the country, the demand for professionals in this area has been limited. Training of more human resources is required in biotechnology. However, it is noted that the Argentine biotech industry has important capabilities regarding access to information, lab techniques, modern equipment and participation in international networks. Argentina is a tool-user in agricultural biotech and has excellent facilities for improving and adapting new plant varieties.

Nonetheless, beyond their meaningful contribution to R&D activities on some crops (such as alfalfa and potato) and into the sphere of veterinary science, institutes devoted to agricultural biotechnology research in Argentina have hardly participated in the events approved by the CONABIA.

There have been transnational corporations (TNC's) that in Argentina -as well as in many other countries- have taken the lead in the process of field trials into the environment. They have mostly focused their field trials on corn and soybean. Given that the Argentine crop growing areas are analogous to those in the northern hemisphere for which the technologies were originally developed, transnational firms have to bear only the costs of backcrossing the new genes into already existing varieties well adapted - a process which is much simpler than the actual development of a GMO variety.

As already mentioned there is a number of local private breeders that have been able to keep their businesses through partnerships with TNC's affiliates; which provide the transgenic genes that are combined with varieties well adapted to local conditions that are owned by local breeders (Bisang, 2003).

4.3.3 Research Institutes

4.3.3.1 CONICET Research Institutes[73]

The National Scientific and Technical Research Council, CONICET, is an Argentine government agency which directs and co-ordinates most of the scientific and technical research done in public universities and institutes.

CONICET is the main institution devoted to research and promotion of science and technology in Argentina. Its activity is developed in four major areas:

- Agricultural Engineering and Materials.
- Biology and Health.
- Exact and Natural Sciences
- Social and Human Sciences.

CONICET
Avda. Rivadavia 1917
CP C1033AAJ
Buenos Aires
Tel: ++54 -11 - 4953-7230/39
www.conicet.gov.ar

CONICET institutes involved in and/or related to plant biotechnology are:

a) Research Institute for Genetic Engineering and Molecular Biology (INGEBI)
Director: Dr. Hector Norberto Torres

INGEBI was created in 1982 as a program and transformed into an institute in 1983 and has the capacity to develop genetic engineering and molecular biology. The institute has a group of researchers in plant biotechnology and signed various agreements with the industry for local developments in the sector.

Lines of research:

- Development of expression systems for the production of heterological proteins in plants: factor of epidermical human increase in tobacco
- Development of resistance against viral, bacterial and fungical diseases in potato, garlic and sugar cane
- Regulation of the signal transduction routes during tuberization of potatoes

INGEBI
Obligado 2490 2º piso
(1428) Capital Federal
C. Bs. As.
Tel./Fax/: ++ 54 (011) 4783-2871 ++ 54 (011)4786-8578
E-mail: ingebi@dna.uba.ar

b) Center for the Study of Photosynthesis and Biochemistry (CEFOBI)
Director: Dr. Carlos Santiago Andreo (interino)

CEFOBI is an institute devoted to basic and applied research in the areas of Photosynthesis, Enzymology and Molecular Biology of Plants. It was created on the base of the Department of Biochemistry of the School of Biochemical and Pharmaceutical Sciences of the National University of Rosario by an agreement among CONICET, UNR and Miguel Lillo Foundation in 1976.

Lines of research:

- Silencing of transgenes in wheat (since 2000)

[73] presentatie bioceres

- Enzimic expression patterns in plants with C4 and CAM metabolism and their relation with the C3 plants ones (since 2000)
- Metabolism of carbo-hydrates in C4 and CAM plants (since 2000)
- Study of the role of the small RNA in the development of grain seeds (since 2002)
- Recognition and reparation of injuries in the DNA of superior plants (since 2004)
- Studies about the effect of the radiation UV-B on maize and Arabidopsis (since 2005)
- Glutelin expression of high-molecular-weight in wheat
- Development of transgenic wheat and maize varieties resistant against herbicides
- Development of transgenic wheat resistant against fungi
- Development of transgenic wheat with improved nutritional quality
- Studies of the bread quality of meal prepared with transgenic wheat.

CEFOBI
Suipacha 531.
(2000) Rosario.
Santa Fé
Teléfono: (54–341) 437–1955.

c) Institute for Physiological and Ecological Agriculture Research (IFEVA)
Director: Dr. Antonio J. Hall

IFEVA is a joint research institute of the Faculty of Agronomy of the University of Buenos Aires (UBA) and the Argentine National Research Council (CONICET). From the beginning in 1965, the research-focus at the institute has been plant physiological and ecological aspects of agriculture and the sustainable use of natural resources.

Current work includes topics ranging from the molecular bases of plant responses to the environment up to regional ecosystem structure and function.

Researchers are working on oat, Arabidopsis and potato, analyzing effects of levels of phytochrome expression in transgenic plants.

IFEVA
Av. San Martín 4453.
(1417) Ciudad Autónoma de Buenos Aires.
Tel.:(54–11) 4524–8070 int. 8129.
Website: www.ifeva.edu.ar

d) Institute of Plant Physiology (INFIVE)
Director: Ing. Agr. Jose Beltrano

In 1982 the program PRINFIVE was created and in 1999 it became an Executive Unit.

Lines of research:

- Physiology and biochemistry of the development and the reactions of plants against biotic and abiotic stress (since 1997)
- Molecular and celular studies of plants and their interaction with micro-organisms (since 1995)
- Ecofysiology of protected crops (since 2001)
- Biochemical, molecular and cellular aspects of the development in plants (since 2004)
- Physiological processes and environmental factors that regulate the synthesis of antioxidants (since 2004).

INFIVE
Diagonal 113 y calles 61 Nº495 - C.C. 327
(1900) La Plata Buenos Aires
Counter part: U.N.L.P. - C. La Plata
Tel./Fax: ++ 54 (0221) 423-6618 ++ 54 (0221)423-3698
E-mail: infive@ceres.agro.unlp.edu.ar

e) IBR - Instituto de Biología Molecular y Celular de Rosario
Director: Dr. Diego de Mendoza

Instituto de Biología Molecular y Celular de Rosario (IBR)
Suipacha 531.
(2000) Rosario.
Teléfonos: (54–341) 435–0661/0596 ó 435–1235.

Other centers and institutes under the umbrella of Conicet are:

CERELA	- Centro de Referencia de Lactobacilos.
CIBIERG	- Centro de Investigaciones Bioenergéticas
CICYTTP	- Centro de Investigación Científica y de Transferencia Tecnológica a la Producción.
CIG	- Centro de Investigaciones Genéticas.
CIHIDECAR	- Programa Centro de Investigaciones en Hidratos de Carbono.
CINDECA	- Centro de Investigación y Desarrollo en Ciencias
CRILAR	- Centro de Investigación Científica y de Transferencia Tecnológica, en la Ciudad de Anillaco, Provincia de La Rioja."
IBYF	- Instituto de Investigaciones Bioquímicas y Fisiológicas
IMBIV	- Instituto Multidisciplinario de Biología Vegetal
IADIZA	- Instituto Argentino de Investigaciones de las Zonas Aridas
IIBBA	- Instituto de Investigaciones Bioquímicas de Bs. As.
INENCO	- Instituto de Investigaciones en Energía No Convencional
INIBIBB	- Instituto de Investigaciones Bioquímicas de Bahía Blanca.
INIBIOLP	- Instituto de Investigaciones Bioquímicas de La Plata
IQUIFIB	- Instituto de Quimica y Fisicoquímica Biológicas

For more detailed information on the above mentioned institutions refer to www.conicet.gov.ar.

4.3.3.2 INTA Research institutes

The following institutes active on biotechnology research belong to INTA:

I Biotechnology Institute INTA Castelar

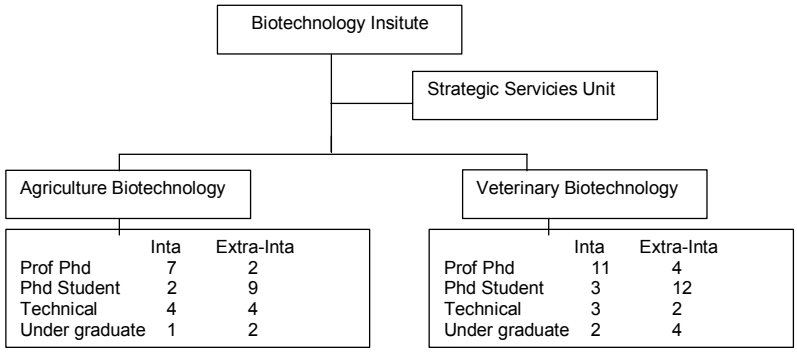
The Biotechnology institute at INTA Castelar consists of three research institutes: Veterinarian Biotechnology, Plant Biotechnology and a Strategic Service Unit.

The Plant Biotechnology area is involved in molecular and genomic studies of agronomically important crops and native species as well as integrated host–pathogen molecular studies involving viral and fungal pathogens.

The Strategical Service Unit offers services such as:

- GMO identification of grains, seeds and processed food based on molecular techniques
- Sequencing and Genotype identification (fingerprinting) at cultivar level for several species.

Figure 5: Biotechnology Institute Structure



Lines of Plant Biotechnology Research at INTA Castelar

- Virus of the disease of Río Cuarto: molecular analysis and host-pathogen interactions
- Development of transgenic sunflower resistant against herbicides, lepidopteras and fungi
- Development of transgenic potato resistant against the Virus PVX, PVY and PLRV and bacterial and fungi infections
- Development of transgenic wheat with tolerance to fungi diseases
- Improvement of the nutritional quality of Festuca (fescue)
- Molecular markers of sunflower, wheat, potato, maize, barley, garlic, soy, native pastures
- Prospection of genes with resistance against fungi and virus in native germplasm
- Mapping and characterization of QTL's of agronomic importance
- Induced mutation methods for plant improvement

II Genetics Institute Ewald A. Favret (IGEAF-INTA)
Lines of Research:

- Research about GMO Alfalfa
- Introduction of insect resistance through Bt technology
- Introduction of antifungal resistance in citrus, wheat and alfalfa
- Transformation of local maize genotypes through biolistics

III Plant Physiology and Phytopathology Institute (IFFIVE-INTA Cordoba)

Lines of Research:

- Development of transgenic tomato and lettuce plants resistant against Tospoviruses
- Identification of induced genes for virus and plants / molecular and immunological instruments for the detection of Tospovirus and Ilarviruses.
- Regeneration and transformation of peanut genetics
- Molecular characterization and sequencing of the Mal del Río Cuarto virus (Fijivirus)
- Epidemiology and molecular diagnosis instruments for Phytoplasm in native plants and commercial crops
- Characterization and production of anti-serum for Potyvirus, Carlavirus and Allexivirus
- Production of garlic seed free from virus / development of transgenic garlic varieties resistant against virus.

IV INTA – Experimental Centers

Lines of Research:

- Development of multi-resistant germplasm in soy through molecular marker assisted improvement
- Frequencing and origin of allele resistant against nematodes in soy
- Identification of potato crops through micro-satellite amplification
- Genetical variability in proteins of candela wheat reserves

V INTA Balcarce

The research and experimentation activities of INTA Balcarce are focused on these areas: Agronomy; Animal Production; Economy and Rural Sociology.

Within the agronomy area the work areas are: Biotechnology, Quality of Agri-food production, Ecophysiology of Crops and Agricultural Products, Sunflower, Agricultural Machinery, Potato, Phyto-genetic resources, Genetics and Plant Improvement, Natural Resources and Environmental Management, Soil and Plant Health.

Research projects of the potato group and associates of INTA Balcarce:
Coordinator: Dr Marcelo Huarte

Potato

- Production of seed potatoes of interest for the industry and plant health service PROPAPA FONTAR (M. Huarte).
- Enrichment of potato breeding programmes in Latin America and Europe with resistance to late blight ECOPAPA European Union (M. Huarte).
- Integrated control of late blight and improvement for resistance of virus in potatoes FCA 15/A111 (M. Huarte).
- Potato improvement plan INTA 0046 (M. Huarte).
- Selection and use of potato varieties with resistance against diseases for industrial processing in Latin America FONTAGRO BID (M. Huarte).
- Use of molecular markers for the identification of crops and a heterosis study of potato FONCYT (S. Feingold/M. Huarte).
- Conservation and use of native genetic resources of potato crops FONCYT (A. Clausen/M. Huarte).
- Evaluation of the culinary and industrial quality of potato INTA 0048 (E. Cacace).
- Obtaining, maintaining and multiplying high sanitary status potatoes through in-vitro tissue culture INTA 0051 (S. Rigato).
- Resistant wild potatoes as source for novel genes mediating resistance against fungal, viral and nematode diseases. Union Europea (E. Hopp, CICV INTA Castelar/S. Feingold).
- Relation between virus PRVD and PVP of potato (S.Feingold/M.Colavita)
- Molecular identification of PVY NTN to determine its presence in Argentina (M.Colavita/S.Feingold).
- Sensorial profiles in potato products and its relation with the quality of the raw material – FCA (M. Huarte/J. Trinchero).
- Management of viruses of potato INTA 0119 (I. Butzonitch).

VID
- Marker assisted selection for table grape Project INCO European Union (Ulanovsky, EEA INTA Rama Caída/ S. Feingold).

Plant Protection
- Distribution and characterisation of the nematodes with quarantine importance in the province of Buenos Aires INTA 0173 (E. Chaves).

Ornamentals
- In vitro introduction and development of methods of fast propagation of ornamental species of zonal interest in Vivero La Colina (S. Rigato).

Wheat
- Increase of the protein content of argentine wheat through molecular-marker assisted improvement (R. Rodríguez/S. Feingold).

Soil
- Transport and persistence of herbicides in the soil and contamination of sub terrain waters in the agricultural sectors of Balcarce and Tres Arroyos – financed by FONCYT (J. L. Costa).
- Transport and persistence of herbicides in the soil in the agricultural sectors of Balcarce and Tres Arroyos FCA AGR 107/00 (F. Bedmar).

Genetics, Genetic Improvement and Genetic Resources
Coordinator: Andrea Clausen

This group is dedicated to the recollection, conservation, documentation and interchange of potato/carrot/forage species germplasm. Besides, it realizes the morphologic, genetic or molecular characterization of wild germplasm and potato crops, asparagus, carrot and forage species.

INTA Balcarce also realizes genetic improvement of wheat, searching for higher yields, good sanitary status and adequate industrial quality; of soy, for oil and protein content increase and absence of lipoxigenasas enzymes and Kuntiz tripsine inhibitor; and of asparagus, for yields and commercial export quality, among others.

The group uses, among other techniques, in vivo and in vitro (controlled crossing, ploid manipulation burning light microscope and UV light for the study of pollen-pistilo compatibility relations and development of the embryo and endosperm in intra and inter-ploid crossings and intra and interspecifics, electrophoresis of isoenzimes and DNA (RAPD, AFLP), molecular marker assisted selection, in-vitro manipulations (micropropagation, somatic embryogenesis, in vitro selection of plants and callusfor behaviour against fungus) and agronomic evaluations.

Sunflower
Coordinator: Alberto Escande

The activity of this group has as focus the promotion of the crop in the region and the entire country. An important part is concentrated on the development of tools for sustainable management of sunflower diseases. This is realized through the diagnosis and monitoring of diseases, epidemiological and pathogenical studies, identification and characterization of genetic resistance, evaluation of fungicides and development of predictive models. For more information refer to the following website: http://www.inta.gov.ar/balcarce/agronomia/girasol.htm.

EEA INTA Balcarce
Ruta Nac. 226, km 73,5
(7620) Balcarce, Argentina
TE 54 2266 439100 Int 279
FAX 54 2266 439101
www.inta.gov.ar
Email: intaba@balcarce.inta.gov.ar

4.3.3.3 National Universities

a) Pilot Plant for Industrial and Microbiological Processes (PROIMI-CONICET) and the National University of Tucuman

Director: Dr. Faustino Siñeriz

Lines of research:

- Studies about microbiological physiology for improvement processes
- Fermentations for the industry at pilot plant level
- Exploration of the biodiversity as a source of new activities
- Characterization of yeast and lactic bacteria
- Biological control of plagues in agriculture

PROMI
Pasaje Caseros y Av. Belgrano.
(4000) San Miguel de Tucumán.
Tel.: (54–381) 434–4888
Website: www.proimi.org.ar

b) Food Cryotechnology Research and Development Center (CIDCA, CONICET) and the University of La Plata

Lines of research:

- Studies about the expression and regulation of genes involved in the ripening of strawberry
- Studies about genetical expression and hydrolytic activities associated with the degradation of the cellular wall in strawberry
- Development of systems for the increase of the anti-body accumulation levels and other recombinant proteins in
- Expression of transcription factors (development of the vascular system in plants)
- Amaranthus proteins: structural, biological and functional aspects

CIDCA
Calles 47 y 116 – C.C. 553.
(1900) La Plata.
Tel: (54–221) 424–9287

c) Botanical Institute of the Northeast (IBONE, CONICET) and University of the Northeast

IBONE has the most important group in the country in tissue culture and micropropagation of timber and fruit species and alfalfa among others.

Lines of research:

- Micropropagation of wood species (Ilex paraguaiensis, Melia azedarach, native species)
- Micropropagation of native orchids
- Generation of rice varieties for anther breeding
- Plant regeneration of cassava (Manihot esculenta) via somatic embryogenesis and peanut (Arachis hipogaea)
- In-vitro tuberization of cassava (Manihot esculenta)
- Rhizogen in vitro of wood species
- Isolation of genes involved in the process of apomixes in Paspalum type
- Collection of in-vitro native germplasm (Arachis spp., Melia spp., Ilex spp.).

IBONE
Sargento Cabral 2131. C.C. 209.
(3400) Ciudad de Corrientes.
Teléfonos: (54–3783) 42–2006/7589, interno 148.

d) Biochemistry and Molecular Biology Institute – National University of La Plata

Lines of research:

- Creation of the Baculovirus to be used as bio-insect ices and expression vectors
- Diagnostics of the psorosis virus in citrus and the construction of resistant transgenic plants
- Characterization of the bacterial population associated with tomato roots
- Biodiversity and rhizobacterial population of beans in the North-East of Argentina
- Role of the Bacterial Polysaccharide in the infection of leguminous roots by rhizobacteria
- Physiological and molecular studies about the associations between rhizobacteria and leguminous plants

e) Institute for Biological Research – National University of Mar del Plata

Lines of research

- Role of nitric oxides against environmental stress in plants
- Molecular biology and the defensive answers of potato against fungi micro-organisms
- Biology and biotechnology of proteolytic systems in archeabacteria Haloalcalofílicas
- Participation of the bacterial chemotaxis in the bio-degradation of contaminants (hydrocarburants and pentachlorophenols).

f) Biotechnology Institute (IBB - INTECH)– National University of San Martin / Biotechnology Institute of Chascomus
Director: Dr. Alberto Carlos C. Frasch

In 1994 INTECH was created and in 1999 IIB-INTECH.

Lines of research:

- Identification of virulence genes in Brucella abortus
- Genes resistant against wheat scab
- Transport of Na+ and K+ in plant cells
- Expression of industrial proteins in heterological systems

- Development of new diagnostic systems for animal and plant diseases
- Studies about the symbiotic interaction of Rhizobium loti-Lotus spp.
- Biochemical aspects of the ripening of fruits
- Studies about the bio-diversity and the breeding of edible fungi
- Studies about the biochemical basis of the ripening of tomato fruit

IIB–INTECH
C.C. 164.
(7130) Chascomús.
Tel.: (54–2241) 424–045 ó 430–323.
www.iib.unsam.edu.ar

g) Instituto Superior de Investigaciones Biológicas (INSIBIO CONICET) – Tucuman Universita
Director: Dr. Ricardo Ferias

Lines of research:
- RADP techniques of high resolution for the molecular characterization of genotypes in sugar cane
- Systematic defensive response in strawberry unleashed by pathogens
- Anti-fungi genes in strawberry

INSIBIO
Chacabuco 461.
(4000) San Miguel de Tucumán.
Teléfonos: (54–381) 424–8921 ó 424–7752, interno: 354

h) Faculty of Agricultural Sciences – National University of Cuyo (UNCU)

Lines of research:
- Use of molecular markers for the evaluation of genetic diversity of onion

UNCU
Centro Universitario
(5502) Mendoza
Tel. (54) 261 - 413 5000
Fax. (54) 261 - 4494022

i) Agronomy Department – University of the South (Universidad del Sur)

Lines of research:
- Mapping of the genes with high protein content in wheat grains
- Selection of wheat genotypes with better tolerance to Fusarium ear blight
- Biotechnological contribution to the grass species area
- Biotechnological contribution to the improvement of wheat

j) Facultad de Agronomía – Universidad de Buenos Aires

Lines of research:
- Obtaining transgenic plants in species of the Paspalum type (resistant against fungi pathogens)
- Over-expression of phytocromes, regulation of the crop density

k) Facultad de Farmacia y Bioquímica – Universidad de Buenos Aires

Lines of research:
- Use of plant roots for phytoremediation research

l) Universidad Nacional de Quilmes

Lines of research:

- Use of the Agrobacterium system for the transformation of various ectomicorrhizal fungi

4.3.3.4 Private Research Institutes

4.3.3.4.1 Foundation for Applied Biological Research (FIBA)

Lines of research

- Abiotic stress in plants: mechanisms of reaction to low temperatures, drought and saltiness
- Regulation of metabolic and biotechnological applications of cyanobacteria
- Use of molecular markets for the determination of the diversity of the pathogen fungus Pyricularia grisea.
- Biological control of insects for fungi and bacteria and isolation of new genes of the Bacillus thuringiensis.
- Molecular markers applied to plant improvement (soy, rice, forestalll species) and the prospection of biodiversity (cyanobacteria, Pyricularia grisea, forestall species).

University del Salvador (USAL)
Viamonte 1856 (1056) - Capital Federal
Tel: (54 11) 4813-1408/9630
Fax: (54 11) 4812-4625
E-mail: uds-rect@salvador.edu.ar

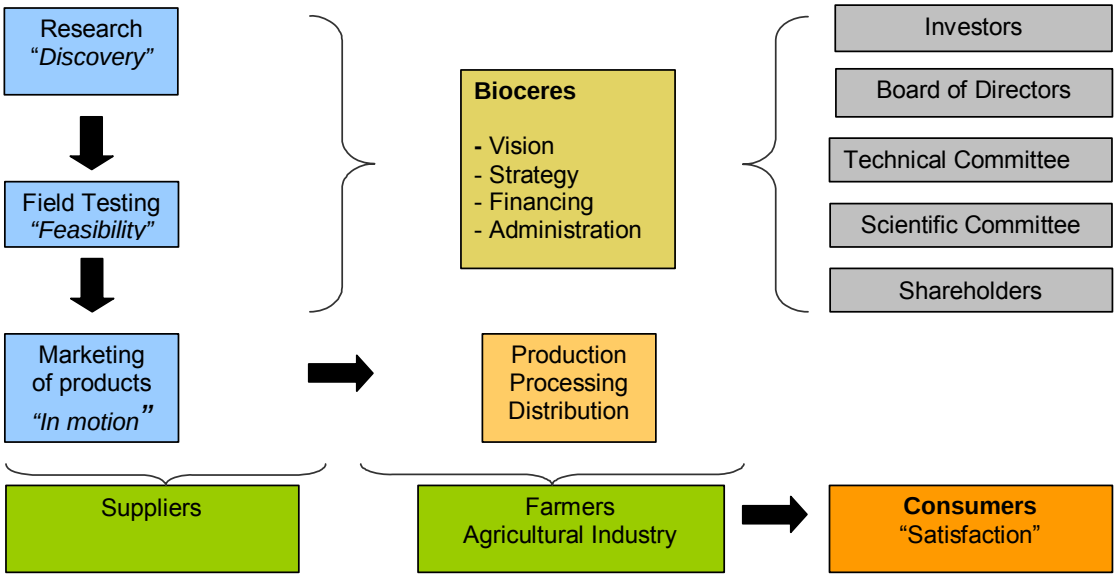
4.3.3.4.2 Bioceres SA

Bioceres[74] was created in 2002 by a group of 23 farmers from AAPRESID (for further information on AAPRESID refer to paragraph 4.4.4). With an initial capital of U$S 240,000, Bioceres was created to establish agreements with research centers, in order to look for and develop new plant varieties.

The mission of Bioceres is to develop and carry out (research) projects in agrobiotechnology as well as in other science fields towards enhancing know how in the production of elaborate goods for agricultural, pharmacy, chemical and power industries. Bioceres aims at facilitating the connections between the public and private sector, leading and managing research and development projects.

Bioceres has managed to constitute an association based on "trust" -an indispensable social capital for growth. This trust becomes bigger with the incorporation of new investors and shareholders. Actually Bioceres is integrated by 111 Shareholders.

Figure 6 Bioceres: Synergy between R & D and agribusiness entrepreneurs



Source: Bioceres

[74] http://www.bioceres.com.ar

The company's main activities are:
- Genetic design for the introduction in model plants
- Characterization of phenotypes in model systems.
- Introduction of the genetic construction in plants of agronomic value.
- Phenotypic evaluation (greenhouse and field) of the GM plants
- Introduction in commercial varieties.
- Regulatory steps (CONABIA and SENASA)
- Intellectual properties (Patents, licenses, agreements)
- Trade of the project
- Distribution of utilities

Bioceres has collaborative agreements with the:
- National Council for Scientific and Technical Research (CONICET)
- Agro-industrial Experiment Station "Obispo Colombres"
- National University of Rosario
- National University of Litoral
- National University of Buenos Aires
- National Institute of Agricultural Technology (INTA)

The first Bioceres project, conducted by researchers of the Faculty of Exact and Natural Sciences (UBA) was intended to develop a fungus-resistant soybean variety.

A recent key development backed by Bioceres was the identification of a gene linked to drought resistance by a team of researchers from Universidad del Litoral research carried out by a team directed by Dr. Raquel Chan, within the framework of the Agreement signed between BIOCERES, the National University of the Litoral and CONICET. During 2004, they studied the expression of a gene that, when introduced in a model Arabidopsis thaliana plant, produces a marked tolerance to drought and salinity. There are plans to introduce this gene into corn, soybean, and wheat, to create drought-resistant GM varieties[75].

Table 17 Current Bioceres SA projects

Project	Institutions involved	Project Duration
Creation, Multiplication and Trading of Wheat Varieties	INTA - Bioceres S.A. Technological Relation Agreement	10 years
Transformation of Soybean with Antifungal Genes	Foundation of the Faculty of Exact and Natural Sciences of Buenos Aires. UBA	3 years
Obtaining transgenic plants of maize that express regions derived from the genome of the Mal de Río Cuarto virus (MRCV)	Agreement signed between Bioceres S.A. and INTA	5 years
Abiotic Stress Resistant Gene (Soybean, Maize, Wheat, alfalfa and rice)	Universidad Nacional del Litoral / CONICET	N.A.
Design of artificial promoters. Development of tools for the transformation of plants with biotechnological breeding purposes	Bioceres, the National University of the Litoral and CONICET	N.A.

Source: Agrivalue SA based on Bioceres data

Bioceres S.A.
Córdoba 1452 Floor 3 Of E
(2000) Rosario
Santa Fe Province
Tel/fax: (+54) 0341-4472520

[75] Mira, Cristian (2005c), "Buscan inversores para un projecto de biotecnología," *La Nación*, Economía & Negocios section, August 13, p. 8.

4.3.3.4.3 Agro-Biotechnology Institute Rosario (INDEAR)

Bioceres S.A. in association with Bio Sidus S.A. began the construction of a 4,000m2 laboratory in Rosario in early 2005. Indear is aimed to be a research center on informatics, molecular biology and biotechnology, to be located in Rosario, Santa Fe province—one key area devoted to soybean and other agricultural products—and funded by the private and the public sector.[76] Indear, a U$S 10 million project, is expected to host around 150 scientists and technicians—most of them from CONICET.[77]

INDEAR S.A.[78] will be located in the CERIDER[79].In this Project the public sector will contribute human resources through the Program of Researchers in Companies, while the private sector will take charge o fan important investment in the infrastructure, equipment, wages of scientific and technical personnel, etcetera.

The already determined areas of research include the search for resistance against biotic and antibiotic stress in plants, molecular farming (factory of medicines in plants) genomic projects and food fortification and in the future researchs related to the forestry sector and animal biology.

In December 2006 the Spanish and Argentine governments signed an agreement on a bi-national plant genomics research center (CEBIVEGE) to be located in Rosario. Both governments participate actively in the construction and maintenance of the new center, focused on food production (the inauguration is planned for the second semester of 2007).

The integration of CEBIVEGE and INDEAR, together with the CONICET Institutes in related themes (Centro de Estudios Fotosintéticos y Bioquímicos -CEFOBI- and the Instituto de Biología Molecular y Celular de Rosario –IBR-) implies the concentration of 400 people dedicated to the research and development of plant biotechnology. Cerider will be the most important biotechnology development pool of Latin America.

4.3.3.4.4 Obispo Colombres (EEAOC)

The Agro-industrial Experimental “Obispo Colombres”, founded in 1909 in San Miguel de Tucumán, is one of the oldest ones in Argentina and the only one linked to a provincial government. Don Alfredo Guzmán dedicated his efforts to give solution to severe sanitary crisis the main industry in the province, sugarcane, was suffering. The original tasks of the center were: implementation and acclimatization of new species, research on prevention and encountering plagues, improvement of crops and all studies related to agricultural work.

EEAOC counts on a headquarters of 86 hectares, with various installations; offices, laboratories, greenhouses, library, crossing-cameras, special structures and experimental fields. Besides the center has four experimental sub-centers in different agro-ecological zones in Tucuman.

Facility	Description	Surface
Central	Offices, laboratories, and experimental field.	(86 ha.)
Santa Ana	Research and transfer activities in Sugar Cane.	(50 ha.)
La Invernada	Destinated to Tobacco Burley.	(15 ha.)
Monte Redondo	For grain activities (Soy, Maize, Bean) and pastures.	(86 ha.)
Tafí del Valle	Destinated to potato seeds and strawberry	

OC - Estación Experimental Agroindustrial Obispo Colombres
Av. William Cross 3150
(T4101XAC) Las Talitas Tucumán
Tel/fax: (54 - 381) 427 6561
http://www.eeaoc.org.ar/

[76] Gasparetti, Walter (2003), “Impulsan en Rosario un polo biotecnológico,” *La Nación*, July 12. Available at: http://www.lanacion.acom.ar/suples/campo/0328/db_510573.asp.
[77] Mira (2005c), p. 8.
[78] http://www.secyt.gov.ar/noti_rosario.htm
[79] Interview Agrivalue SA with Fernando Lopez director of INDEAR

4.3.4 Research Projects Pipeline

4.3.4.1 Public Research Projects

The main research projects in biotechnology currently under way or projected in public research institutes:[80]

Table 18 Public Research Projects

Institute	Abbreviation	Research Project
Institute for Genetic Engineering and Molecular Biology	INGEBI	Researchers are working on potato and tobacco, to obtain fungal and virus resistance. They plan to work on garlic, too.
National Institute of Agricultural Technology	INTA	Researchers are working on sunflower (fungal resistance, development of molecular markers for identification, marker-assisted breeding, genomics); potato (fungal and virus resistance, basic research to screen germplasm for new and better fungal resistance genes); alfalfa (vaccine for FMD and Newcastle viruses, introduction of antigens to several bovine viral diseases); corn (resistance to Mal de Río Cuarto virus); wheat, barley (fungal resistance, development of molecular markers for identification, marker assisted breeding, organelle mutational breeding); tomato (virus resistance); tobacco (model system for research); and chimeric virus vaccines, and vaccines for livestock. INTA researchers are also trying to transform rice and citrus plants.
Institute for Physiological and Ecological Agriculture-related Research at the Faculty of Agronomy, Universidad de Buenos Aires (UBA)	IFEVA	IFEVA is a joint research institute of the Faculty of Agronomy, University of Buenos Aires, and CONICET. From the outset (1965) [81], the research focus at the Institute has been plant physiological and ecological aspects of agriculture and the sustainable use of natural resources. Current work includes topics ranging from the molecular bases of plant responses to the environment up to regional ecosystem structure and function. Researchers are working on oat, Arabidopsis and potato, analyzing effects of levels of phytochrome expression in transgenic plants.
Institute of Biological Research at the National University of Tucumán	INSIBIO	Currently, doing research on strawberry (resistance to fungal disease), tobacco (model system for research).
Faculty of Agricultural Sciences, National University of Cuyo		Currently, doing research on grape (resistance to fungal diseases).
Faculty of Agricultural Sciences, National University of Río Cuarto		Doing research on tomato (peroxidases)
Faculty of Agricultural Sciences, National University of the South		Currently, doing research on pasture grasses (resistance to fungal diseases); onion (resistance to fungal diseases).
Center for Photosynthetic and Biochemistry Research	CEFOBI	Currently, doing research on wheat and corn (herbicide resistance).

[80] Idem, pp. 10-11.
[81] Agrivalue SA Interview with Jorge Casal Dr. Casal, Jorge J. (Associate Professor, Principal Research Scientist) September 6 2006

Cellular and Molecular Research Institute of Rosario at the National University of Rosario	IBR	Currently, doing research on tobacco, Arabidopsis, and tomato (basic research on plant physiology), tobacco (resistance to abiotic stress).
Faculty of Agricultural Sciences, at the National University of the North-East		Researchers plan to do research on characterization of *Paspalum* apoximis genes.
University of Santa Fe		Researchers plan to do research on characterization of sunflower homeotic genes.
Institute for Biochemical Research, Institute Leloir Foundation (former Fundación Campomar) and Agronomy Faculty of the UBA	IBB and IFEVA	Research on Arabidopsis and tobacco (basic research on phytochromes).
Biotechnology Research Institute-Chascomús Institute of Technology	IIB - INTECH	Doing research on tobacco (basic research on mitochondrial genes).
Food Cryotechnology Research and Development Center at the Faculty of Exact Sciences, National University of La Plata	CIDCA	Doing research on tobacco (basic research on gene expression in transgenic plants).

Source: Agrivalue SA based on interviews and Burachik and Traynor (2002)

4.3.4.2 Private Research Projects

An important restriction for the industrial development of biotechnology is the lack of private investment. The high costs related to research and development and large scale production require high levels of investment. At this moment, the biggest part of the investment in research is done by the argentine government. Among private companies, there are a few which perform research in biotechnology. According to Burachik and Traynor, these are the most relevant projects:[82]

- Bio Sidus: presently working on recombinant DNA pharmaceutical proteins, and pharmaceutical expression (human growth hormone) in cow's milk;[83] as well as production of human proteins in tobacco.
- Technoplant (Bio Sidus): researchers are working on potato (virus resistance, herbicide tolerance); and plan to work on improved varieties of yerba mate, berries, garlic, ornamentals, sugar cane, grapes.
- Advanta: researchers are working on sunflower (gene mapping of factors controlling fungal resistance, and virus resistance, among other traits; also marker-assisted selection for international breeding programs).

[82] Burachik and Traynor (2002), pp. 10-11.

[83] Bio Sidus has already obtained a transgenic cow, Pampa Mansa, which produces human growth hormone. See Bär, Nora (2003), "Mansa, una ternera única en el mundo," *La Nación,* October 2. Available at: http://www.lanacion.com.ar/03/10/02/sl_532215.asp; and "Un laboratorio obtuvo leche medicinal de una vaca clon," *Clarín*, October 2, 2003. Available at http://old.clarin.com/diario/2003/10/02/s-02907.htm.

4.4 SECTOR RELATED ORGANIZATIONS

Institutions and associations with strong relations with the plant biotechnology sector in Argentina are presented hereafter.

4.4.1 ARPOV - Argentine Association for the Protection of New Varieties of Plants (ARPOV),

ARPOV, is an non-profit Civil Association that unites the majority of companies that realize research and develop varieties and hybrids. The main objective of ARPOV is to reach a transparent quality seed market, where intellectual property of the inscribed crops is respected and assuring to the producer the best varieties and seed of high quality.

4.4.2 The Argentine Sunflower Association (ASAGIR)[84]

ASAGIR, Argentine Sunflower Association is a non profit organization targeted to increase production efficiency, product and by-products quality and to promote product diversification.

This Association, which was created at the beginning of the 80's, has organized and supported technical and scientific meetings related to sunflower. Nowadays it is working in programs and activities according to the concept of Food Value Chain which is intended to foster the integration of all productive sectors, from seed production to oil and by-products. Main activities include support to scientific research activities and market studies, organization of workshops and scientific or technical events, and participation in international meetings and groups of study, and bulletins and web page edition, to make the results of these studies available.

Asagir promotes scientific technological research orientated to the resolution of sunflower production problems and finances as well together with ANPCyT (National Agency for Scientific and Technological Promotion). In two of them biotechnology is used as a work method; obtaining transgenic sunflower plants that express multiple antifungal genes. For the Project a total subsidy of $117,955 is allocated. Besides, they are realizing the identification of different genetic resistance sources through genomic tools, together with INTA (value $119,738).

Regarding the realized projects, ASAGIR studies the economic impact of the eventual use of transgenic sunflower in Argentina, with the objective to evaluate the advantages and disadvantages of the use of transgenic crops. This work was done between in 2003/2004 and indicated that it is technically feasible to produce transgenic sunflower and that there are no unmanageable risks for the biosecurity. The resistance against gliphosate is what is looked for.

4.4.3 The Argentine Chamber of Agriculture, Livestock and Fertilizer Sanitation (CASAFE)

In Argentina, the agrochemical industry is represented by the Argentina Chamber of Agricultural, Livestock and Fertilizer Sanitation (CASAFE), which has dedicated itself to communicating recommendations for the safe use of chemical crop protection products and proper disposal of empty product containers.

CASAFE is an institution that represents the interests of the plant science industry and its affiliates. It is tightly linked to CropLife Latin America and serves to support the work undertaken in Argentina's neighboring countries. Additionally, it serves as a spokesman for the crop protection product industry and participates in the search for a legal framework that allows the transfer of technology of major benefit for the country. One of the principal objectives of CASAFE is to become a valid participant in the dialogue among agricultural-technical suppliers and to maintain direct contact with governmental entities.

Among others CASAFE has alliances with the Association of Chambers of Agricultural and Livestock Technology (ACTA), the BIO Group, and the Argentina Seed Association.

[84] Biotecnología a la argentina : En el país hay varias iniciativas orientadas a resolver problemas locales. Ramos, Eliana para InfoCampo 2006-03-01

4.4.4 The Argentine Association of No Hill Farmers (AAPRESID)

The leader group in the process of technological innovation in Argentine's agriculture is AAPRESID. The Argentinean No Till Farmers Association is a non-governmental, non profit organization created in 1990 by agricultural producers and agronomists from every part of Argentina performing a National Net of Farmers. In this context Bioceres was founded.

The aim of the founders of AAPRESID was to create a group to exchange knowledge and experiences related to the No-Till system. To do so, they organized different events, which became more and more frequent, such as Field Days, Seminars, Congresses, Technical Exchange Days, Trials, and what is more, they issued publications on each crop with new insights after each campaign.

Today, under the slogan "The Challenge Is To Innovate", AAPRESID is an open network of innovative farmers, receptive to scientific and technological advances, that aims to acquire knowledge and production; integrating research, technical assistance, and production; thus turning the activity into a professional one. The members of AAPRESID are convinced that production methods must respect natural laws and look after the planet.

AAPRESID is an organization of farmers, not a scientific institution; therefore, it does not conduct research. It believes that, as a group of agricultural producers, it needs a solid scientific structure as foundations. That is why it is permanently creating conditions of co-operation with research and technical institutions such as INTA and different universities.

Nevertheless, the Association is aware of the fact that, nowadays, many technological innovations go from the company to the producer almost directly. Therefore, AAPRESID is conducting some trials about relevant topics together with technicians of its associate companies, and with professionals of other institutions such as INTA.

Farmers are the active members of this innovative network regarding highly sustainable and profitable farming production. That is why they believe that the fields of the farmers associated to AAPRESID are the ideal environments to try the latest technologies applied in inputs.

In different regions of the country, the members of AAPRESID have formed groups in order to exchange experiences regarding no-till, and to develop highly productive capabilities in a sustainable way, adapted to the reality of their agro-ecological region.

AAPRESID
Paraguay 777 - Floor 8 Office 4
(2000) Rosario - Santa Fe
Argentina
Telephone/fax: 54 341 4260745/46

4.4.5 Argentine Maize Organisation (MAIZAR)

Maizar is the association of Argentine institutes and companies related to the maize chain. The five links in the maize production chain that Maizar takes into consideration are Research and development, Seeds and farm supplies, Farming, Industry (beef, pork, dairy, poultry) and consumption (wet and dry mill) and Trade and exports. Maizar's associates are the key players of each industry or sector.

MAIZAR - Asociación Maiz Argentino
Argentine Corn Association
Av. Correintes 119, 4th Floor, Office 418
City of Buenos Aires (C1043AAB)
Argentina

4.4.6 Soybean Chain Association (ACSOJA)

The Argentine Soy Chain Association consists of the representatives of the different sectors that integrate the soy chain: Production, Commercialization, Industrialization, Science and Technology, Input Suppliers and Services.

Acsoja organized the third Mercosur Soybean Congress, "Mercosoybean 2006" which was held in the city of Rosario, in June 2006, under the slogan "South American Soybean, Leading the Future". Biotechnology, genetic improvement, ecophysiology and climatology, value added grain, industrial uses such as biodiesel, soybean fungi, quality production, and agrimeteorology were some of the discussed topics.

ACSOJA
Paraguay 777 - 4to. Piso
(S2000CVO) Rosario - Santa Fe - Argentina
Tel: 54-341-4213471 int. 2289
contacto@acsoja.org.ar

4.4.7 Argentine Plant and Environment Protection Association (ASAPROVE)

The Argentine Plant and Environment Protection Association has as main objective to unite all persons and /or institutions that show interest in the know-how of problems affecting plant health, in particular using biological control agents

ASAPROVE
Av. Corrientes Nº 123 piso 4 oficina 410
C1043AAB - Ciudad Autónoma de Buenos Aires
Argentina
Tel: (+54) 011-4311-9540
info@asaprove.org.ar

4.4.8 Argentine Seed Producer Association (ASA)

ASA echoes its partners' needs by promoting the national seed business. In the public sector ASA participates as a member of the Board of Directors of INASE (National Seed Institute), in CONASE (National Seed Commission) and CONABIA (National Advisory Commission on Agricultural Biotechnology) and in SENASA's (National Service of Agricultural Food Health and Quality) Technical Advisory Committee on the use GMOs.

Abroad ASA is a member of the International Seed Federation, ISF, with a permanent representative in its Executive Committee and representatives in several committees and in ASSINSEL, the International Association of Plant Breeders for the Protection of Plant Varieties with active participation in different Committees and Sections. In the Private Sector ASA is a member of A.C.T.A., (Agricultural Technology Chambers Association), a unified voice of the consumables industry before governmental authorities.

Furthermore ASA is part of the Biotechnology Group together with different sectors of the food and agricultural chain such as AAPRESID, (Argentine No-till Farmers Association), Buenos Aires Grain Exchange and COPAL (Coordinator for Food and Beverage Industries) among others. ASA is also related to Chain Associations, being a member of the Board of Directors of the previous mentioned associations: ASAGIR, MAIZAR and ACSOJA.

ASA
Reconquista 661 - 1º Piso
(1003) - Buenos Aires
asa@asa.org.ar
Tel./Fax: 54 11 4516 0070

4.5 PROMOTION INSTITUTIONS

In addition to the previous mentioned government institutions that support scientific activities in general as well as biotechnology, such as SECyT, INTA, CONICET, FONCYT, FONTAR and the Leloir Foundation, the following organizations focus purely on the promotion of biotechnology.

4.5.1 Argentinean Biotechnology Forum (FAB)

The Foro Argentino de Biotecnología (FAB) was established in November 1986 as a non-profitable foundation on the initiative of three pioneer enterprises in the biotechnology area, under the honorary presidency of Dr. Federico Leloir (Nobel Prize in Chemistry, 1970).

The FAB is leaded by a Board of Directors composed by an Executive Committee and an Ordinary Member Board, whose positions are renovated every three years. Besides, the FAB has an Honorary Committee Board integrated by the National Secretariat of Science and Technology, National Secretariat of Agriculture, Food and Fishing, the presidents of the Science and Technology Committees of both Senate and Representatives chambers of the National Congress and the Argentine-Brazilian Biotechnology Centre (CABBIO). FAB activities are implemented and supervised by a General Manager and a Scientific Director.

The Members of the FAB are approximately 30 companies vinculated to biotechnology, universities and national research institutions.

The FAB focuses on:
1) Biotechnology diffusion throughout the country.
2) To foster the national policies in the biotechnological area promoting the public debate.
3) To encourage the public discussion, debate and awareness of the biotechnological impact as well as Argentina's challenge in keeping up with the biotechnology development all over the world.
4) To promote, support and spread the different private and public Argentine biotechnology initiatives.
5) To foster the collaboration between the Argentine scientific and business communities.
6) To represent the private biotechnology sector in front of governmental and other institutions and entities.
7) To act as a linking tool in strategy development between the private, governmental and academic sectors.
8) To establish relations with foreign similar associations.

In order to accomplish the above mentioned goals, the FAB organises lectures, seminars, meetings and courses throughout the country. FAB also publishes a bulletin covering national and international biotechnology news and related general information as well. They have created a data bank on private and national institutions, companies, etc. associated with the biotechnological activity. They maintain a fluent dialogue with governmental and institutional representatives through special working meetings, with the participation of all the biotechnology chore players.

The FAB formed a technical counsel committee to carry out studies and researchs on specific biotechnology topics, and to cooperate with the technical aspects of the different FAB activities. This technical committee is composed of representatives of national R&D institutions, universities and private companies.

The FAB has been involved in the constitution of two national counseling commissions, where FAB representatives actively participate. One is the National Commission of Agricultural Biotechnology (CONABIA), in charge of giving advice to the National Secretariat of Agriculture, Food and Fishing - from which it depends - on all the biotechnological related subjects. The other one, is the National Commission of Biotechnology and Heath (CONBYSA), which depends on the National Secretariat of Health. This Commission started working in 1993, and its purpose is giving advice to this Secretariat on all the subjects related to biotechnology and human health.

4.5.2 "Bio" Group (Grupo BIOtecnologia)

The Grupo Biotecnologia is a group of entities that since its initiation of 2000 has as its main objective the promotion of the introduction of biotechnological innovations in the agri-food sector and the identification and diffusion of biotechnology advances and improve the public perception of biotechnology.

Members of the Grupo Bio are representatives of the different entities related to the production, industrialization and commercialization of agricultural products:

- Asociación Argentina de Consorcios Regionales de Experimentación Agrícola (AACREA)
- Asociación Argentina de Grasas y Aceites (ASAGA)
- Asociación Argentina de Productores de Siembra Directa (AAPRESID)
- Asociación Argentina de Protección de las Obtenciones Vegetales (ARPOV)
- Asociación de Cámaras de Tecnología Agropecuaria (ACTA)
- Asociación de Semilleros Argentinos (ASA)
- Asociación de Productores de Carne Bovina Argentina (APROCABOA)
- Bolsa de Cereales
- Bolsa de Cereales de Córdoba N/D
- Bolsa de Cereales de Entre Ríos
- Bolsa de Cereales, Oleaginosos, Frutos y Productos de Bahía Blanca
- Bolsa de Comercio de Rosario
- Bolsa de Comercio de Santa Fe
- Cámara Arbitral de la Bolsa de Cereales
- Cámara de Industrias Aceiteras de la República Argentina (CIARA)
- Cámara Argentina de la Industria de Productos Veterinarios (CAPROVE)
- Cámara de Puertos Privados Comerciales (CPPC) N/D
- Cámara de Sanidad Agropecuaria y Fertilizantes (CASAFE)
- Cámara de Semilleristas de la Bolsa de Cereales
- Centro de Corredores y Agentes de la Bolsa de Cereales
- Centro de Exportadores de Cereales (CEC)
- Confederaciones Rurales Argentinas (CRA)
- Coordinadora de las Industrias de Productos Alimenticios (COPAL)
- Federación de Centros y Entidades Gremiales de Acopiadores de Cereales
- Foro Argentino de Biotecnología (FAB)
- Fundación REDBIO
- Instituto de Negociaciones Agrícolas Internacionales (INAI)
- REDBIO-FAO Argentina

www.grupobiotecnologia.com.ar

4.5.3 REDBIO-ARGENTINA

REDBIO is the Latin-American and Caribbean Net for Technical Cooperation in Plant Biotechnology:

- Collaboration Net organized by FAO in 1991
- Constituted by more than 630 laboratories publics and privates in Latin-America and the Caribbean
- Organized by National Coordinators
- Approximately 55 laboratories associated in Argentina

Objectives:

- Promote technical cooperation and interchange of materials and experiences between the members laboratories
- Promote exploration and rational use of biodiversity
- Promote the development of regulations and legal frameworks for the introduction of local agri-biotechnology.
- Support the training of human resources in the biotechnology area

In Argentina Diagnosticos Vegetales SRL, Garbi Biotecnologia Vegetal, Laboratorio de Cultivo In Vitro Proarpa S.A., Propagar and Tecnoplant S.A. and others, integrate REDBIO.

4.5.4 Argentinean-Brazilian Biotechnology Center (CABBIO)

Organized in 1986 by a bi-national agreement between Argentina and Brazil with the participation of Chile, Bolivia, Paraguay and Uruguay

- Coordinated by a bi-national committee

Activities:
- Biotechnology schools
- Collaborative research projects
- 161 international courses (1986-2001)
- 76 collaborative projects (1986-2001)

4.5.5 Argenbio: the Argentine Council for Information on and Development of Biotechnology

ArgenBio was created with the mission to diffuse information about biotechnology, contributing to its comprehension through education and stimulating its development.

ArgenBio arises from the commitment its founding members (Bayer S.A., Dow AgroSciences Argentina S.A., Monsanto Argentina S.A.I.C., Nidera Semillas S.A., Pioneer Argentina S.A. and Syngenta Seeds S.A.) made to respond to the demand for clear and transparent information about biotechnology and its applications, its benefits and its safety.

Argenbio is active in: training, extension, education and supplies general information towards its public (professionals, teachers, media, general public) through meetings, seminars, work-shops, documentation (for example: www.porquebiotecnologia.com.ar) and specific publications.

Executive Director of Argenbio is Dra. Gabriela Levitus.

ArgenBio
Reconquista 661 - 1º piso
4516-0070
www.argenbio.org
info@argenbio.org

5 ARGENTINE TRANSGENIC CROPS PRODUCT PIPELINE

The table below shows the transgenic crops, which according to Argenbio and Conabia might be available in Argentina in the years to come:

Table 19 Argentine Transgenic Crops Product Pipeline

Benefits for the Producer	Maize	New generation of RI (Resistance against Insects) crops New generation of TH (Tolerance against Herbicides) crops Combination of RI x TH Combination tolerancies against different herbicides Resistant against fungus Resistant against virus (Mal de Rio Cuarto) Tolerant to drought Efficient use of nitrogen High yields
	Soy	New generation of TH crops Resistance against insects Combination tolerancies against different herbicides Tolerant to drought Resistant against nematodes High yields
	Cotton	New generation of RI crops New generation of TH crops Combination tolerancies against different herbicides Resistant against nematodes Tolerance to drought
	Rice	Resistant against insects
	Potato	Resistant against virus
	Rapeseed	New generation of TH crops High yields
	Sunflower	Resistant against insects Tolerant to herbicides
	Alfalfa	Tolerant to herbicides
	Sugar cane	Tolerant to herbicides
	Wheat	Resistant to virus Resistant to fungus
Benefit for the industry	Maize	Major digestibility / conversion efficiency Major essential amino-acids content Major ethanol production
	Soy	High oil content
Benefit for the consumer	Soy	Higher protein content Higher essential amino-acids content Oil with low linolenic high oleic content Oil with omega-3 Oil with high oleic, high estearic content

Source: Agrivalue Sa based on Argenbio and CONABIA data

6 GOVERNMENT SUPPORT AND PUBLICS FINANCIAL INSTRUMENTS

6.1 Background

Argentina's research system is largely publicly funded. The Ministry of Education, through its Secretariat of Science, Technology, and Industrial Innovation (Secretaría de Ciencia, Tecnología e Innovación Productiva, SETCIP) finances and oversees the most important research systems, integrated by the National Council for Science and Technology (Consejo Nacional de Investigaciones Científicas y Técnicas, CONICET), with more than 50 research institutes; and the system of more than 30 public universities.

A third research system is overseen by the Ministry of Economy. Among these institutes, the National Institute of Agricultural Technology (Instituto Nacional de Tecnología Agropecuaria, INTA) is by far the most important institution regarding agricultural research. Private universities have limited research activities in Argentina[85].

The total public research is approximately 800 million pesos. Before the 2002 devaluation, when the peso was pegged one-to-one to the dollar, this budget was U$S 800/900 million dollars. Currently, the exchange rate is of around 3 pesos to one dollar, so even though the total budget has remained the same in pesos, it has changed in dollars.

As mentioned before the Argentine ratio of research and development expenditures to the GDP is low. Cohen *et al.* consider Argentina's ratio is substantially low compared to developed countries, but above average in Latin America.

According to official reports, in 1999 a total of 1,717 research projects were funded and developed in the agricultural and fisheries sector: 10.6 percent of all the projects, which represented around U$S 140 million.[86]

INTA is certainly a key player in the field of agricultural biotechnology: it had a budget of 157.131 million pesos in 2003; 189.395 in 2004.[87] (It was of about U$S 160 million before devaluation).[88]

Although research currently under way on GMO's in Argentina's public sector is relevant compared to other developing countries, as we shall see, there is clear evidence that agricultural research as a whole does not receive funding proportional to the benefits agriculture offers to Argentina. According to 2004 estimations based on 2001 and 2002 figures, the U$S 80 millions devoted to agricultural research in Argentina represent only 0.5 percent of the primary agricultural products GDP.

The same can be said of scientific production: although Argentina is the third soybean producer with 16 percent of the world production—after the US with 43 percent, and Brazil with 24 percent—it only contributes with 2 percent of the scientific articles on soybean. In comparison, the US contributes with 30 percent of the scientific articles on soybean, Brazil with 10 percent, and India—fifth producer of soybean, with an 8 percent of the world production—contributes with 9 percent.

On the other hand, the Argentine Senate[89] presented in February 2006 a law project for the promotion of the biotechnology industry. The biotechnology law will promote and facilitate the investment in and the development of biotechnology products by national firms, and once approved by Parliament, it will be valid for 15 years. In particular, the law seeks to promote biotech applications aimed at improving agricultural production, such as the development of hybrid seeds.

Senator Jorge Capitanich of the Commission for Treasury and Budgets said that the economic impact of biotechnology is important, as crop production constitutes 52% of the agricultural sector. Currently, 98% of the soybean seeds sown in Argentina are genetically engineered, and the use of biotech maize is increasing. The Biotechnology Law will also promote the development of medicines, diagnostic tools, and enzymes and chemicals for industrial use.

[85] Cohen *et al.* (2001b).
[86] Idem, p. 22.
[87] Stubrin (2003).
[88] Macilwain (1999), A15.
[89] ISAAA, CropBiotech Update http://www.isaaa.org/kc/Bin/cbtupdate/index.htm

6.2 Public Policies[90]:

The Argentine government through the Secretariat of Technology, Science and Productive Innovation (SETCIP) has developed various programs for the stimulation of biotechnology activity in the country

So far in Argentina the following public policies have been applied:

- National Biotechnology Program (1982-1989)
- Priority Biotechnology program (1992-1996)
- Biotechnology Program, National Plan Of Science and Technology (1998-2000)
- National Plan Of Science and Technology (since 2002)

For further information: www.setcip.gov.ar

6.3 Financing Instruments[91]

The financing of activities related to research, development and innovation is in general in charge of the National Agency for Scientific and Technological Promotion (Agencia Nacional de Promoción Científica y Tecnológica ANPCyT). ANPCyT forms part of SETCIP. Its resources originate from contributions from the national budget and credits from the Inter-American Development Bank (IDB).

The agency operates through the Fund for Scientific and Technological Research (FONCIT) and the Argentine Technological Fund (FONTAR).

ANPCyT
Córdoba 831 Piso 1
(1054) Capital Federal
Tel: (54 11) 4311-5424
E-mail: informa@agencia.secyt.gov.ar
Website: www.agencia.secyt.gov.ar

FONCYT Fund for Scientific and Technological Research

FONCYT supports the generation of new knowledge, in basic and applied themes, in public institutions and non-profit organizations. Between 1998 and 2001, it financed 103 biotechnology projects, for a total amount of US $ 12 mln.

FONCYT
Av. Córdoba 831 6th Floor
(1054) Capital Federal
Tel/fax: (54 11) 4312-2666
Website: www.agencia.secyt.gov.ar/foncyt.php

FONTAR – Argentine Technological Fund

FONTAR supports projects aimed at the improvement of productivity within the private sector, through the innovation and development of new alternative technologies. It counts on the following instruments: technological development, fiscal credit and subsidies; technological modernization, under obliged refund modalities and fiscal credits; technological services, under obliged refund modalities, and training and technical assistance, through subsidies, and has responsibility for the application of the Law 23.877 regarding the Promotion of Technological Innovation. Some of the FONTAR financed projects:

[90] Diseño de Projectos Biotecnológicos Curso 2006: “Perspectivas de la agrobiotecnología en el contexto argentino” by Alejandro Mentaberry amenta@dna.uba.ar Departamento de Fisiología, Biología Molecular y Celular Facultad de Ciencias Exactas y Naturales Universidad de Buenos Aires
[91] Interview Agrivalue SA with Dr. Lino Barañao

Table 20: FONTAR Financed Biotechnology Projects:

Company	FONTAR Project Name
Nitrap S.R.L.	Development of bio-inputs for phyto-pathogen control and promotion of plant growth
Establecimiento San Vicente SA	Development of an micorricic inoculant and its pilot implementation in forestal greenhouse in Tucuman
Diagnósticos Vegetales S.R.L.	Subtract for the production of healthy propagation materials in greenhouses: development of an ecological acceptable alternative for Methyl bromide
Diagnósticos Vegetales S.R.L.	Management strategies of in-vitro crop in greenhouse to improve the quality, increasing the production of potato mini tubercles and obtain competitive costs
Bio Ext. S.A.	Development of biotechnological plant production
Sintesis Quimica S.A.I.C.	Production and evaluation of a biological insecticide for the control of the tomato moth and the peach twig borer
Gentos S.A.	Genetic improvement of tempered grass species
BioFruct S.H.	Development of techniques for the industrial benefit of Cichorium intybus, a non-traditional crop, for the production of inulin, fructoside and fructose
Pincen S.A.	Development (on pilot scale) of the production process of biological insecticides for agricultural use
Síntesis Química S.A.	Research and development on pre-inoculation of soy seeds

Source: ANPCyT

FONTAR
Av. Córdoba 831 5th Floor
(1054) Capital Federal
Tel: (54 11) 4311-5690
Fax: int. 530
E-mail: fontar@agencia.secyt.gov.ar
Website: www.agencia.secyt.gov.ar/fontar.php

IADB Loan 2003

In 2003 Argentina received a loan of 20 millions dollars from the Inter-American Development Bank to revive scientific areas affected by the country's severe economic crisis[92]. The loan was aimed at the provision of new equipment and training of scientists and others working in Argentinean universities in the fields of biotechnology, genomics, agroindustry and the protection of genetic resources and environmental management.

The three-year program has been managed by the National Institute of Agricultural Technology (INTA), following an agreement with the Department of Science, Technology and Productive Innovation.

In recent years, scientists from INTA and other Argentinean research institutes have been severely affected by the country's economic crisis. Many have had insufficient funds to continue their work, and some research projects have been delayed or stopped altogether.

For example, an INTA project to develop transgenic alfalfa — which has the potential to be used as an edible vaccine for foot and mouth disease — was cut short last year due to lack of funds. According to Andrés Wigdorovitz, a scientist who worked on the project, the crisis affected them

[92] Valeria Román 13 March 2003 Source: SciDev.Net

profoundly. They had to adapt and use cheaper techniques and, as a consequence, they had been advancing slowly.

Other scientists have only managed to make progress by obtaining grants from abroad or from private companies. According to Esteban Hopp one of the consequences of the crisis has been that young researchers have chosen to go abroad because of the low wages in Argentina.

IADB Loan 2006

In April 2006 the IDB[93] granted Argentina its largest loan for modernization of science and technology. A program to foster innovation and technological development and promote links between research centers and enterprises in priority sectors in Argentina will receive a loan of $ 280 mln from the Inter-American Development Bank.

The loan, approved by the IDB Board of Executive Directors, is the largest one for science and technology in the history of the Bank. It will help build Argentina's science and technology capacity and consolidate previous achievements by financing the third Technological Modernization Program. Two previous loans for Argentina for a total of 235 millions were approved by the Bank in 1993 and 1999.

The new program includes a set of actions to promote, encourage and facilitate the links between enterprises, particularly small and medium-sized companies, with the primary sources of scientific and technological knowledge. The development of a production pattern based on more technology intensive goods and services will contribute to sustainable gains in productive sector competitiveness and productivity.

Main areas expected to be supported include biotechnology and biological sciences; chemical sciences; information technology; agricultural machinery; cattle and crop farming, forestry and fisheries technologies; food processing and medical sciences.

The executing agency will be the Argentine Secretariat of Science, Technology and Productive Innovation, created in 1970 with responsibility for policy-making and coordinating the various scientific and technological institutions. The national and regional innovation systems will now be strengthened through modernization of the science and technology infrastructure and by increasing the associative capacities of their members.

This program reflects the IDB's continued support to science and technology in Argentina since 1966 and follows the Bank's 2004-2008 strategy for the country that includes promoting a more favorable climate of investment and productivity growth to enhance competitiveness.

The loan is for a 20-year term, with a four and a half-year grace period at a variable interest rate. This financing brings total lending by the IDB to Argentina for science and technology and innovation to $626 million. Local counterpart funds for this loan will total $230 million.

Argentine Subsidies 2006

Argentina granted subsidies to 28 scientific institutions. In March 2006, the minister of Education, Science and Technology, Daniel Filmus, announced a program of subsidies for 28 institutes of 4.450.500 pesos (approximately US$ 1,5 million dollars) until the year 2008[94].

Among the recipients of the incentives are: Institute Leloir ($690.000), Bariloche Foundation ($525.000), the Institute for Economical and Social Development ($450.000), the Foundation of Applied Biology Research ($270.000) and the Latin-American Faculty of Social Sciences ($255.000). Besides a program launched by the National Agency for Scientific Promotion for postgraduates for human resources worth US$ 40 million dollars financed by the InterAmerican Development Bank will start during this year.

[93] www.iadb.org/news/articledetail.cfm?language=English&artid=3027&artType=PR
[94] Martín De Ambrosio 10 Marzo 2006 Fuente: SciDev.Net:

6.4 Agricultural Biotechnology Strategy Plan 2005 -2015

Argentina has launched a ten-year plan to increase the value of its agricultural exports through biotechnology[95]. Some 150 scientists from research institutions and private companies contributed to the plan, which the Minister of Economy Roberto Lavagna signed into action on 24 May 2005.

Under the plan, the first of its kind in the country, Argentina will develop genetically modified (GM) crops and livestock, and build stronger links between researchers and the agricultural sector.

Argentina already grows GM soybeans, and has genetically modified cows to produce milk containing human growth hormone. The plan will support research and development in such areas, including the use of GM crops to produce drugs. Further research will focus on developing biological alternatives to chemical fungicides.

Tax-breaks and loans will be introduced to encourage private companies to conduct biotechnology research. Small and medium-sized companies are expected to benefit most from these initiatives.

According to Argentina's Biotechnology Office, the plan will benefit the general public and the environment by creating job opportunities and producing cost-effective, environmentally sound technologies.

The resolution states that biotechnological development is essential because of Argentina's "limited resources, and qualitative and quantitative increases in the international demand for exports of primary products".

Moreover, according to the signer of the resolution, "biotechnology might turn out to be the main source of technological solutions to face that challenge".

Daniel Salamone of Bio Sidus, the company that produced Argentina's first cloned cow in 2002, says the plan will integrate scattered initiatives and "encourage other private investments" in biotechnology. He believes the plan will give Argentinean agricultural productivity a big boost.

[95] Martín De Ambrosio 1 July 2005 (SciDev.Net)

7 CONCLUSIONS

7.1 SWOT

Based on various interviews with key players in the market and referring to the various sources of earlier studies and researchs about the (Plant) Biotechnology Sector in Argentina, the following strengths, weaknesses, opportunities and threats to the Argentina Plant Biotechnology sector can be presented, as shown in table 19:

Table 20 SWOT Argentine Plant Biotechnology Sector

Strengths • Wide availability of environmental resources for the development of plant transgenic events (chapter 2, page 13) • Favorable backgrounds related to GMO use (chapter 2, page 14) • Scarce social opposition against biotechnology in general (chapter 2, page 17) • Existence of a solid regulatory framework (chapter 3, page 22) • Availability of human resources and institutes for the development of agro-biotechnology (chapter 4.3, page 52) • Availability of productive and innovative resources (chapter 4.3, page 54) • Domain of use of biotechnology tools (chapter 4.3, page 54) • Versatility and innovation capacity (chapter 4.3.2 page 56)	**Opportunities** • Favorable macro-economical conditions • Existence of important potential agricultural markets (chapter 1, page 11) • The argentine biotechnology market and its insertion in the international context (chapter 1 page 12) • Bilateral cooperation on field trials (chapter 2, page 20 / chapter 3 page, 26) • Agreement with countries of the European Union (chapter 3.3, page 23) • Argentina can generate own biotechnology (chapter 5, page 76) • Generation of new supplier markets of biotechnology companies (chapter 5, page 76) • Generation of differentiated agricultural products with the consequent access to new and better markets (chapter 5, page 76) • Law on Promotion of Biotechnology (chapter 6.1, page 77)
Weaknesses • Existence of a considerable informal market for the acquisition of biotechnological inputs (chapter 2, page 17) • Little knowledge concerning Intellectual Property and scarce culture of patenting (chapter 3.7 page 27) • Weaknesses in the applied research (chapter 4, page 34) • Concentration of the offer of biotech inputs which will affect on medium term the local innovative capacity (chapter 4.2 page 34/35) • Scarce volume of research and development (chapter 4.3.2, page 55) • Difficulties in developing and transferring technologies to private local companies (chapter 4.3.2, page 56) • Scarce integration of R&D projects in the area of technology transfer and training of specialized human resources (chapter 4.3.2, page 56) • Low level of private research and lack of risk capital investment (chapter 4.3.4.2, page 69)	**Threats** • Competence from organic food in potential sales markets (chapter 1, page 11) • Increasing and improving agricultural production from competitors as Brazil, India and China through a strong impulse of biotechnology in these countries (chapter 1, page 12) • Closure of GMO by export markets (chapter 2, page 14 / chapter 4.2 page 35) • Implementation of biosafety norms of the Cartagena Protocol that Argentine adheres to but did not ratify (chapter 3.1, page 22) • The macro-economic context as a barrier for the incorporation of technology (chapter 6.1, page 77)

(*) between brackets chapter and page reference

7.2 CONCLUSIONS

In a Memorandum signed between the Dutch and Argentine Ministries of Agriculture, the plant biotechnology sector has been selected as one of the key areas for possible future cooperation on both private and public levels. The objective of this report was primarily to screen potential Dutch – Argentine joint-interest in research and commercial priorities in Plant Biotechnology. Therefore a market survey on the Argentine Plant Biotechnology sector has been executed.

For a country like Argentina, whose economy depends largely on agricultural production, the plant biotechnology sector is a critical instrument. During the last decade biotechnological innovations have contributed to increase the countries competitiveness.

To develop biotechnology in Argentina, as well as in any other place in the world, a good human resource basis and a well developed scientific-technological sector are essential. Besides, it requires a productive sector that is able to contribute with risk capital, supported by a firm financial sector and an adequate transparent regulatory framework regarding biohazards and intellectual property.

Biotechnology is becoming a more important item on the political agenda in Argentina. This is shown by the ambitious Strategic Plan 2005-2015 and the law proposal on Biotechnology Promotion that is currently under evaluation in the Congress.

The Argentine biotech industry has important capabilities regarding access to information, laboratorial techniques, modern equipment and participation in international networks. It is a biotechnology tool-user in agriculture and has excellent facilities for improving and adapting new plant varieties.

With several public research institutions and a few private initiatives the country has sufficient availability of human resources and institutes for the development of agro-biotechnology. On the other hand, the main limitations for the sector are the difficulties in financing, which is expressed by some research projects that have been delayed or stopped due to insufficient funds. Another problem, mentioned by stakeholders of the plant biotechnology sector, has been that many young researchers have chosen to go abroad because of the low wages in Argentina.

Although there still is a gap between science and industry, since some years, the relations between private companies and public institutions are intensifying, which appears by many private-public research cooperation. The country still requires reviewing its legislation concerning intellectual property.

Argentina is ready to receive support and impulse in the development of technological pools and parks, company incubators, innovative schools (such as for example INDEAR).

The most sold products of the plant biotechnological industry in Argentina are transgenic seeds, which have been marketed since 1996 in Argentina. The second most sold agricultural biotechnological product are seedlings and seeds of various selected and virus-free crops, obtained through tissue culture techniques and in some cases, molecular markers.

In addition to the two traditional Argentine genetically modified crops, soy and maize, the country has released genetically modified cotton and realized field trials on GMO wheat, sugar cane, rice and potato. The main characteristics introduced are tolerance to herbicides and resistance against insects.

Interviews with both private and public parties in the market have shown that future cooperation opportunities within the area of plant biotechnology between Argentina and the Netherlands are expected in the following areas:

1) Field trials in Argentina (regulatory experience available)
2) Interchange of PhD and Post-doc students
3) Financing of Argentine incubators

Besides, of the traditional crops cultivated in Argentina, the potato is becoming an important biotech product to be taken into account by the Dutch. The knowledge available at both public and private level about field trials and its regulatory framework in Argentina might be of interest for Dutch plant biotechnology companies and research institutions.

Annex I Regulatory Framework on Agricultural Biotechnology

On the website (www.SAGPyA.mecon.gov.ar) of the Argentine Secretariat of Agriculture, Livestock, Fisheries and Food (SAGPyA) a gathering of current regulations on agricultural biotechnology of the Argentine Republic is presented. The material reflects the way in the Argentine government has applied the precautionary and security principles in the development of the agricultural biotechnology from the very beginnings of this activity in our country, covering the process of GMO safety assessment from the first stages of field testing to the commercialization.

National Constitution
Article 41

Laws
19549. Ley de Procedimiento Administrativo
20247. Ley de Semillas y Creaciones Fitogenéticas
22520. Ministries Law
24376. Approval of the International Convenant for the Protection of Plant acquisitions (UPOV)
25845. Re-structurating of INASE
25675. General Law on Environment

Decrees
Reglamentary Decree 2183/91
Reglamentary Decree 438/92
Reglamentary Decree 1283/03
Decree Law 6704/63 Sanitary Defense
Decree 2817/91 Creation of INASE
Decree 373/01 Modification of the 20/99
Decree 1104/00 Dissolution of INASE
Decree 601/02 National Public Administration
Decree 25/03 Organigram of the application of the Public Administration
Decree 1359/04 Organisational structure of the First Level of the Public Administration

Resolutions
Structure
124/91 Creation of CONABIA (modificada por la R. 669/93)
328/97 Membership of CONABIA (modifica a la R. 669/93)
244/04 Creation of the Biotechnology Office

Norms that establish the conditions and requirements to grants liberations permits.
656/92 Norm for Genetically Modified Micro organisms
226/97 Experimental conditions for the distance of isolation for the liberation to the environment of Genetically Modified Plant Organisms
39/03 Norm for the Liberation to the environment of Genetically Modified Plant Organisms (OVGM)
57/03 Norm for experimental projects and or liberation to the environment of Genetically Modified Animals (OAGM)
644/03 Protocol for the evaluation of the biosafety of genetically modified maize seeds production in stage of evaluation
46/04 Register of OVGM operators
Norms that establish the requirements for the evaluation of the food capability (SENASA).
412/02 Requirements for the evaluation of the food capability of Genetically Modified Organisms

Resolutions that grants commercialization permits:
167/96 Soy tolerant to glyphosate, event 40-3-2.
19/98 Maize resistant against Lepidoptera, event 176.
372/98 Maize tolerant to ammonium gluphosinate, events T14 and T25 (modified for 739/99)
428/98 Cotton resistant against Lepidoptera, event MON531
429/98 Maize resistant against Lepidoptera, event MON810.
739/99 Retirement of the commercialization permit of the event T14
32/01 Cotton tolerant to glyphosate, event MON1445.
392/01 Maize resistant against Lepidopteraíz, event Bt11.

640/04 Maize tolerant to glyphosate, event NK603.

Secretariat of Agriculture, Livestock, Fishery and Food (SAGPyA)
Av. Paseo Colón 982 /922
(1063) Buenos Aires - Argentina
Tel: (54-11) 4349-2000

Biotechnology Office
Av. Paseo Colón 922 Piso 2º Oficina Nº 247
(1063) Capital Federal
Tel / Fax: (54 11) 4349-2198/2178
biotecnologia@mecon.gov.ar

ANNEX II GMO Evaluations in Argentina in 2005[96]

	Applicant		Genetic Modification	Type of Release
1	Monsanto Argentina S.A.I.C	Maize	Resistencia a Lepidópteros y Tolerancia a Glufosinato de Amonio (evento TC1507)	Field
2	Monsanto Argentina S.A.I.C	Maize	Alto contenido de Lisina libre en el grano. (evento LY038)	Greenhouse
3	Monsanto Argentina S.A.I.C	Maize	Alto contenido de Lisina libre en el grano y Resistencia a Lepidópteros (eventos LY038 x MON810)	Greenhouse
4	INTA	Potato	Resistencia al Virus del enrollamiento de la hoja de la papa, al virus del mosaico de la lechuga y virus cercanamente relacionados (eventos LR, RY)	Field
5	Syngenta Seeds S.A.	Maize	Tolerancia a Glifosato. (evento GA21)	Greenhouse
6	Syngenta Seeds S.A	Maize	Resistencia a Lepidópteros y Tolerancia a Glifosato (eventos BT11 x GA21)	Greenhouse
7	Monsanto Argentina S.A.I.C.	Maize	Tolerancia a Glifosato y Resistencia a Coleópteros (eventos NK603 x MON863)	Production
8	Monsanto Argentina S.A.I.C	Maize	Resistencia a Coleópteros (evento MON863)	Production
9	Monsanto Argentina S.A.I.C.	Maize	Resistencia a Coleópteros y Lepidópteros (eventos MON863 x MON810)	Production
10	Monsanto Argentina S.A.I.C	Maize	Aumento de Rendimiento (ZM_M19005 y otros)	Production
11	Satus Ager S.A.	Maize	Tolerancia a Glifosato, Resistencia a Lepidópteros y Coleópteros (eventos NK603 x (MON810 x MON863))	Production
12	Monsanto Argentina S.A.I.C.	Maize	Alto contenido de Lisina libre en grano, Resistencia a Lepidópteros y Tolerancia a Glifosato (eventos LY038 x MON810 x NK603)	Field
13	Monsanto Argentina S.A.I.C.	Maize	Alto contenido de Lisina libre en grano y Tolerancia a Glifosato (eventos LY038 x NK603)	Field
14	Satus Ager S.A.	Maize	Resistencia a Coleópteros y Lepidópteros (eventos MON863 x MON810)	Production
15	Satus Ager S.A.	Maize	Resistencia a Coleópteros, Tolerancia a Glifosato y Resistencia a Lepidópteros (eventos (MON863 x NK603) x MON810)	Production
16	Satus Ager S.A.	Maize	Tolerancia a Glifosato y Resistencia a Coleópteros (eventos NK603 x MON863)	Production
17	Satus Ager S.A.	Maize	Resistencia a Coleópteros y Tolerancia a Glifosato (eventos MON863 x NK603)	Production
18	Monsanto Argentina S.A.I.C.	Maize	Resistencia a Coleópteros (evento MON863)	Field
19	Monsanto Argentina S.A.I.C.	Maize	Resistencia a Coleópteros y Lepidópteros (eventos MON863 x MON810)	Field
20	Monsanto Argentina S.A.I.C	Maize	Tolerancia a Glifosato y Resistencia a Lepidópteros (eventos NK603 x MON810)	Field
21	Monsanto Argentina S.A.I.C.	Maize	Tolerancia a Glifosato y Resistencia a Coleópteros (evento MON88017)	Field
22	Monsanto Argentina S.A.I.C	Maize	Tolerancia a Glifosato y Resistencia a Coleópteros y Lepidópteros (eventos MON88017 x MON810)	Field
23	Monsanto Argentina S.A.I.C.	Maize	Tolerancia a Glifosato y Resistante a Coleópteros (eventos NK603 x MON810)	Field
24	Monsanto Argentina S.A.I.C.	Maize	Resistencia a Coleópteros, Lepidópteros y Tolerancia a Glifosato (eventos MON863 x MON810 x NK603)	Field
25	Monsanto Argentina S.A.I.C.	Maize	Tolerancia a Glifosato Resistencia a Coleópteros (eventos NK603 x MON863)	Production
26	Monsanto Argentina S.A.I.C.	Maize	Resistencia a Coleópteros y Lepidópteros (eventos MON863 x MON810).	Production
27	Monsanto Argentina S.A.I.C	Maize	Alto contenido de Lisina libre en el grano (evento LY038)	Field
28	Monsanto Argentina S.A.I.C.	Soy	Aumento del Rendimiento (GM_A41173 y otros)	Field
29	Monsanto Argentina S.A.I.C.	Soy	Aumento del Rendimiento (GM_A70421 y otros)	Field
30	Monsanto Argentina S.A.I.C.	Soy	Incremento de aceite en las semillas. (GM_A50507 y 27 más)	Field
31	INTA	Wheat	Resistencia a hongos fitopatógenos. (derivado de las construcciones UBI-GLUCA, UBI-CHITI, UBI-DEFE, ACT-AP24, PA5-CHITI)	Greenhouse
32	Monsanto Argentina S.A.I.C.	Soy	Modificación en la composición de aceites. (constr. PV-GMPQ1972, PV-GMPQ3322, PV-GMPQ3323)	Field
33	Monsanto Argentina S.A.I.C.	Soy	Modificación en la composición de aceites (constr. PV-GMPQ1972)	Field
34	Monsanto Argentina S.A.I.C.	Soy	Incremento de aceite en las semillas (constr. PV-GMPQ296, PV-GMPQ604)	Field
35	Bayer CropScience S.A.	Rice	Tolerancia a herbicida y alteración en la fertilidad (construcción 1: 850 a 859 eventos, construcción 2: 860 a 899 eventos).	Field

[96] http://www.SAGPyA.mecon.gov.ar/new/0-0/programas/conabia/liberaciones_ogm_2005.php

36	Bayer CropScience S.A.	Rice	Tolerancia a Glufosinato de Amonio y metabolismo de carbohidratos alterado (19 eventos)	Field
37	Monsanto Argentina S.A.I.C.	Maize	Tolerancia a Glifosato y Resistencia a Coleópteros (eventos MON88017)	Field
38	Monsanto Argentina S.A.I.C.	Maize	Tolerancia a Glifosato y Resistencia a Coleópteros y Lepidópteros (eventos MON88017 x MON810)	a campo
39	Monsanto Argentina S.A.I.C.	Maize	Resistencia a Coleópteros y Lepidópteros (eventos MON863 x MON810)	Field
40	Monsanto Argentina S.A.I.C.	Maize	Resistencia a Lepidópteros, Coleópteros y Tolerancia a Glifosato (eventos MON863 x MON810 x NK603)	Field
41	Monsanto Argentina S.A.I.C.	Maize	Resistencia a Coleópteros (evento MON863)	Field
42	Monsanto Argentina S.A.I.C.	Maize	Tolerancia a Glifosato y Resistencia a Coleópteros (eventos NK603 x MON863)	Field
43	Monsanto Argentina S.A.I.C	Maize	Resistencia a Lepidópteros (eventos MON89034, MON89597)	Field
44	Asociados Don Mario S.A.	Soy	Tolerancia a Isoxaflutol y Glifosato (evento FG74)	producción
45	Monsanto ArgentinaS.A.I.C.	Maize	Tolerancia a Glifosato y Resistencia a Coleópteros (evento MON88017)	Field
46	Dow AgroSciences Argentina S.A.	Maize	Resistencia a Lepidópteros, Tolerancia a Glifosato y Glufosinato de Amonio (eventos TC1507 x NK603)	Field
47	Syngenta Seeds S.A.	Maize	Tolerancia a Glifosato (evento GA21)	Production
48	Syngenta Seeds S.A.	Maize	Tolerancia a Glifosato (evento GA21)	Prooduction
49	Monsanto Argentina S.A.I.C.	Maize	Resistencia a Lepidópteros, Coleópteros y Tolerancia a Glifosato (construcción PV-ZMIR245 x MON88017)	Field
50	Monsanto Argentina S.A.I.C.	Maize	Resistencia a Lepidópteros y Tolerancia a Glifosato (eventos MON89034 x NK603, MON89597 x NK603).	Field
51	Monsanto Argentina S.A.I.C.	Maize	Resistencia a Lepidópteros (eventos MON89034, MON89597)	Field
52	Monsanto Argentina S.A.I.C.	Maize	Resistencia a Lepidópteros y Tolerancia a Glifosato (eventos MON89034 x NK603)	Field
53	Monsanto Argentina S.A.I.C.	Maize	Tolerancia a Glifosato y Resistencia a Lepidópteros (eventos NK603 x MON810)	Field
54	Dow AgroSciences Argentina S.A.	Cotton	Algodón con Resistencia a Lepidópteros (281-24-236/3006-210-23)	Field
55	Chacra Experimental Agrícola	Sugar Cane	Tolerancia a herbicida (037-001 y 037-002)	Field
56	Bayer CropScience S.A.	Soy	Resistencia a Glufosinato de Amonio (evento A2704-12)	Field
57	Southern Seeds Production S.A.	Maize	Tolerancia a Glifosato y Resistencia a Lepidópteros(eventos GA21 x BT11)	Production
58	Pioneer Argentina S.A.	Maize	Madurez alterada y Tolerancia a Glufosinato de Amonio (E6326.42.1.15 , E6326.42.1.19, 6326.81.1.1.1, 632681.1.7.1, 6326.53.1.10.1, 6326.53.1.15.1).	Field
59	Pioneer Argentina S.A.	Maize	Tolerancia a Glifosato (E5846.53.9.4 y E5846.49.7.12)	Field
60	Pioneer Argentina S.A.	Soja	Tolerancia a Glifosato (EAFS3559.2.1, EAFS3560.3.2, EAFS3560.4.3, EAFS3561.1.1)	Field
61	Pioneer Argentina S.A.	Maize	Elevado oleico y nivel de ácidos grasos alterados, y eventos con contenido de aceite alterado (FA106.5.12.1, FA088. 1.5 .1, FA088.1.6.1, EA1233. 116.3.35, EA1533.112.4.3, EA1533.112.3.3, EA1533.118.2.19, EA1533.117.3.1, EA1533.118.2.32, EA1533.115.2.47, EA1533.115.2.14)	Field
62	Pioneer Argentina S.A.	Maize	Tolerancia a Glifosato y Resistencia a Lepidópteros (eventos NK603 X MON810)	Field
63	Pioneer Argentina S.A.	Maize	Resistencia a Coleópteros (E4497.59.1.22)	Field
64	Pioneer Argentina S.A.	Maize	Resistencia a Lepidópteros, Tolerancia a Glifosato y a Glufosinato de Amonio (eventos TC1507 x NK603)	Field
65	Pioneer Argentina S.A.	Soy	Elevado contenido de ácido oleico y Tolerancia a Glifosato (eventos EAFS3054.2.3 x MON40-3-2)	Field
66	Pioneer Argentina S.A.	Maize	Tolerancia a Glifosato, Glufosinato de Amonio, Sulfonilureas y Resistencia a Lepidópteros (constr. PHP24269, PHP24273, PHP24279, PHP25119, PHP25121)	Field
67	Pioneer Argentina S.A.	Maize	Tolerancia a Glifosato y Sulfonilureas (constr. PHP24269, PHP24273, PHP24279, PHP25119, PHP25121)	Field
68	Chacra Experimental Agrícola	Sugar Cane	Tolerancia a herbicida (40 eventos)	Greenhouse
69	Semameris Argentina S.A.	Maize	Tolerancia a Glifosato y Resistencia a Coleópteros (eventos NK603 x MON863)	Production
70	Tecnoplant S.A	Potato	Resistencia al virus PVY (eventos SY230 y SY233)	Field
71	Monsanto Argentina S.A.I.C.	Maize	Resistencia a Lepidópteros y Tolerancia a Glifosato (MON810 X NK603)	Field
72	Monsanto Argentina S.A.I.C.	Maize	Alto contenido de Lisina libre en el grano y Resistencia a Lepidópteros (eventos LY038 x MON810)	Field

73	Asociados Don Mario S.A	Soy	Tolerancia a Glufosinato de Amonio (evento A2704-12)	Production
74	Monsanto Argentina S.A.I.C.	Soy	Resistencia a insectos (eventos GM_A19459A, GM_A19478, GM_A19487)	Field
75	Monsanto Argentina S.A.I.C.	Soja	Resistencia a insectos y Tolerancia a Glifosato (eventos GM_A19459A x 40-3-2, GM_A19478 x40-3-2, GM_A19487 x 40-3-2)	Field
76	INTA	Maize	Resistencia al virus del Mal de Río Cuarto (eventos K11, N41)	Field
77	Syngenta Seeds S.A.	Maíz	Resistencia a Lepidópteros y Tolerancia a herbicidas (eventos BT11 + GA21)	Field
78	INTA	Maíz	Resistencia al virus del Mal del Río Cuarto (eventos K11 y N41)	Field
79	Southern Seeds Production S.A.	Maíz	Tolerancia a Glifosato, Resistencia a Lepidópteros y Coleópteros (eventos NK603 x MON810 x MON863)	Production
80	Southern Seeds Production S.A.	Maize	Tolerancia a Glifosato, Resistencia a Lepidópteros y Coleópteros (eventos NK603 x MON810 x MON863)	Production
81	Southern Seeds Production S.A.	Maize	Resistencia a Coleópteros y Tolerancia a Glifosato (eventos MON863 x NK603)	Production
82	Syngenta Seeds S.A.	Maize	Resistencia a Lepidópteros (evento MIR162)	Field
83	Syngenta Seeds S.A.	Maize	Resistencia a Coleópteros (evento MIR604WR)	Field
84	Bayer CropScience S.A.	Soy	Tolerancia a Glifosato (evento A2704-12)	Field
85	Dow AgroSciences Argentina S.A.	Maize	Resistencia a Lepidópteros, Tolerancia a Glufosinato de Amonio y Glifosato (evento TC1507 y NK603)	Field
86	Dow AgroSciences Argentina S.A.	Maize	Resistencia a Coleópteros y Tolerancia a Glufosinato de Amonio (evento E4479.59.1.22)	Field
87	Asociados Don Mario S.A	Maize	Resistencia a Coleópteros y Lepidópteros y Tolerancia a Glifosato (eventos MON863 x MON810 x NK603)	Production
88	Asociados Don Mario S.A	Maize	Resistencia a Lepidópteros y Tolerancia a glifosato (eventos MON810 x NK603)	Production
89	Syngenta Seeds S.A.	Maize	Resistencia a Lepidópteros (eventos BT11 x MIR162)	Field
90	Tecnoplant S.A.	Potato	Resistencia al virus PVY (eventos SY230 y SY233)	Greenhouse
91	Tecnoplant S.A.	Potato	Resistencia al virus PVY (eventos SY230 y SY233)	Field
92	Tecnoplant S.A.	Potato	Resistencia al virus PVY (eventos SY230 y SY233)	Greenhouse
93	Tecnoplant S.A	Potato	Resistencia al virus PVY (eventos SY230 y SY233)	Field
94	Chacra Experimental Agrícola	Sugar Cane	Tolerancia a herbicida (AAB001 y otros)	Field
95	Tecnoplant S.A.	Potato	Resistencia al virus PVY (eventos SY230 y SY233)	Field
96	Pannar RSA (PTY) LTD Sucursal Argentina	Maize	Tolerancia a Glifosato y Resisencia a Lepidópteros (eventos NK603 x MON810)	Field

Note: in the releases of seed production the sign “y” means the sowing of two (2) parentals whose crossing is obtained by accumulated events, while the sign “x” refers to the sowing of parentals that contain the events accumulated.

ANNEX III Identified Biotechnology Companies and Associations in Argentina [97]

1. Companies Associated to the Foro Argentino de Biotecnología (FAB)				
Company	Commercial Address	Teephone	Fax	Website / E-mail
Amersham Bisociences	Montañeses 2820, Capital	4576-3030	4576-3031	
Asociacion De Semilleros Argentinos - Asa	Reconquista 661 –1º Piso - C1003ABM Capital Federal	4516-0070	4516-0070	www.biogenesis.com.ar
Biogénesis S.A.	Ruta Panamericana, Km 38.2 B1619IEA, Garín, Bs. As.	03327-448300	03327-448384	
Bioaxioma S.A.				
Boehringer Ingelheim	Av. Del Libertador 7208 (1429), Capital	4704-8600	4704-8630	www.bai.boehringer-ingelheim.com
Dow Agrosciences	San Vladimiro 3056 (1642) San Isidro	4735-5400	4735-5446	www.dow.com
Gador S.A.	Darwin 429 - Capital Federal	4858-9000/86	4543-8614	www.gador.com.ar
Gold – Berkenwald	Av. del Libertador 6550, 3º piso, Capital	4788-8448	4788-3068	
Laboratorios Bagó	B. de Irigoyen 248 -91 P- Capital Federal	4344-2000	4344-2309	
Laboratorios Beta S.A.	San Juan 2266	84 296-2990	296-2158	
LABORATORIO ELEA S.A.C.I.F. Y A.	Sanabria 2353 (1417)- Capital Federal	4379-4300 4566-8961/6111	4639-5005	Web page: www.lab-elea.com
Laboratorios Rontag S.A.	Arcos 2626 (1428) Capital Federal	4789-8000	4788-1913	
Monsanto Argentina S.A.I.C	Maipú 1210 – 6to. Piso – Capital Federal	4316-2429	4316-2507	www.monsanto.com
PIONEER Argentina Semillas	Hipólito Yrigoyen 2020 1º piso, (1640)Martínez	4717-9100	4717-9100	
Polychaco Saic	Sgo. del Estero 1162 - Capital Federal	4304-2374	4305-0929	
Sintesis Química Saic	Paraná 755 - Capital	4371-6339/4374/3987	4371-6339 int. 104	www.sintesisquimica.com.ar
Syngenta Seeds S..A.	Valentín Vergara 403 (B1638A) Vicente López	4837-6671	44837-6671	www.syngenta.com
TECNOPLANT S.A. - Div. De BIOSIDUS S.A.	Constitución 4234 - Capital Federal	4909-8000	4924-4738	
Vilmax Sa	Sgo. del Estero 366 - Capital Federal	03327-455700/07	03327-455709	
Wiener Laboratorios Saic	Riobamba 2944 (2000) Rosario-Santa Fe	(0341) 432-9191/6	(0341) 432-5555/5454	www.wiener-lab.com.ar

[97] Programa de fortalecimiento institucional de la politica comercial externa Préstamo bid 1206/oc-ar analisis de la biotecnologia en Argentina Juan Carlos Vitagliano, Federico A. Villalpando. Diciembre de 2003

2. Companies Associated to the Argentine Seed Producer Association (ASA)

Seed category / Company	Cereals	Oilseeds	Forrage	Alfalfa Seeds	Vegetable Seeds	Cotton	Flower
Advanta Semillas S.A.	X	X	X	X	X		
Ag Alumni Seed	X						
Agricultores Federados Argentinos	X						
Agroinvest S.A.	X	X	X	X			
Agromania S.A.	X	X					
Agropecuaria Pilar S.H.			X		X		
Agroservicios Sa	X	X					
Agrouranga S.A.	X						
Asociados Don Mario	X	X		X			
Aventis Cropscience Argentina Sabasso Semillas S.A.		X			X		
C.D.M. Mandiyu S.R.L.						X	
Caps S.A.					X		
Centro Agropecuario Modelo	X	X					
Ceres Agropecuaria S.A.	X	X					
Cervecería Y Maltería Quilmes	X						
Ciagro S.R.L.						X	
Criadero Klein S.A.	X	X					
Criadero Sps S.A.	X	X		X			
Criadero Y Semillero El Cencerro		X	X				
Cullen Brokerage			X	X	X		
Do Campo Julio	X						
Estancia La Josefina	X	X			X		
Forrajeras Avanzadas			X				
Franzani S.R.L.			X	X	X		X
Garde Giusti Y Chuchuy S.A.			X		X		X
Gear S.A.	X	X					
Gentos S.A.			X				
Goyaike Saaciyf	X	X					
Semillas Buck S.A.	X	X					
Junarsa S.A.	X	X					
Kws Argentina S.A.	X	X	X	X	X		
La Arrocera Argentina S.A.	X						
La Germinadora S.A.					X		
La Leonor S.C.A.	X	X	X				
Maltería Pampa S.A.	X						
Monsanto Argentina S.A.I.C.	X	X		X		X	
Mycogen S.A.	X	X		X		X	
Nidera S.A.	X	X		X			
Novartis Agrosem S.A.	X	X		X	X		X
Palaversich Y Cía S.A.	X	X	X	X			
Pioneer Argentina S.A.	X	X		X			
Plantar S.A.	X		X				
Produsem S.A.	X	X	X	X			
Q.E.A.C.A. S.A.	X						
Relmó S.A.	X	X					
Roque Lauria					X		X
Satus Ager		X					
Semagra Sa							
Semillas Emilio S.R.L.					X		
Semillas Paulino Martinez			X	X	X		X

Semillas Raffo					X		
Semilla Seminis Sud-America					X		
Semillería Florensa		X			X		X
Semillería Guasch S.R.L.	X	X	X	X	X		X
Semillero Ra – Su**)**	X						
Semillero Sms		X					
Seminor S.R.L.	X	X					
Sonneveldt Arie S.R.L.							X
South Seed					X		
Surcotton S.A.						X	
Sursem S.A.	X	X	X				
Tomas Hnos. Y Cía S.A.	X						
Tsukasa Shoji S.R.L.					X		X
Visscher & Cía		X	X	X	X		X

ANNEX IV: ARGENTINE BIOTECHNOLOGY COMPANIES: INOCULANTS				
Company / Laboratory	**Commercial Address**	**Telephone**	**Website**	**Category**
1-Laboratorios Arbo		(+54 2211) 5407-1906		Legume Inoculants
2-Laboratorios Alquimia	Ayacucho 155 -Venado Tuerto Santa Fé	(+54 3462) 43-7300	www.alquimia.com.ar	Legume Inoculants
3-Laboratorios Biagro SA	Parque Industrial. CC Nº 4. 1741 Gral Las Heras. Pcia.de Buenos Aires.	(+54 11) 4762170 (+54 220) 4761155		Legume Inoculants
4-BPF	Av Rivadavia 772 -Resistencia Chaco	(+54 3722) 434282		Legume Inoculants
5-Campomax	Av Marcelo T de Alvear 832 piso 9 Torre 1 – Córdoba			Legume Inoculants
6-Cergen SRL	Dr Mario Bravo 462 -Hurlingham Planta Bs As	(54 11) 4450-5364		Legume Inoculants
7- Laboratorios CKC	Carlos Calvo 2145 12F Cap.Fed.	(+54 11) 49414621		Legume Inoculants
8-Crinigam	Monasteria 477 Cap.Fed.	(+54 11) 49421648		Legume Inoculants
9-Laboratorios Degser	Ruta 188 y Av Bicentenario Rojas Prov Bs As			Legume Inoculants
10-Ecofertil	Felipe Moré 1475 Rosario	(+54 341) 4583651	www.ecofertil.com	Legume Inoculants
11-FPC	Urquiza y Entre Rios Nueve de Julio	(+ 54 2317) 4333201		Legume Inoculants
12-Fragaria	Calle57 esq 40 Villa Cañas -Sta Fe	(+54 346) 250886		Legume Inoculants
13-Induagro	Derqui 1112 - Cañada de Gomez Santa Fe	(+54 3471) 421830		Legume Inoculants
14-Laboratorios López	Castulo Peña 843 Jesús María - Córdoba	(+54 3525) 421726		Legume Inoculants
15-Masfertil	Belgrano 1442 Reconquista - Santa Fe			Legume Inoculants

16-Nitrap	Ruta 188 Km 307.5 Ameguino Bs As	(+54 3388) 471004		Legume Inoculants
17-Nitrasoil Argentina SA	Perú 345, piso 5-B Cap Fed	(+ 54 11) 43111900		Legume Inoculants
18-Nova	Marconi 42 -Cañada de Gomez Santa Fé	(+54 3471) 422312		Legume Inoculants
19-Palaversich	A.Condarco 612 Pergamino	(+54 2477) 433230		Legume Inoculants
20-Prodinsa	Brigadier Estanislao Lopez N°56 Ruta 14 Km 2.3 -Soldini Sta Fe	(+54) 3414901423		Legume Inoculants
21- Laborat.del Oeste Argentino	Las Cañas 455 Guaymallen-Mendoza	(+54 261) 4314396		Inoculants Biodegradants
22-Rizobacter Argentina	Ruta 32 Km 1.5 Parque Ind Pergamino	(+54 2477) 432044	www.rizobacter.com.ar	Legume Inoculants
23 – BiAgricultura	P.I.Gral. Las Heras - C.C. N° 4 (1741) Gral Las Heras - Pcia. Bs. As.	(+54 220) 4761655		
24-Síntesis Química SAIC	Paraná 755 Piso 4 y 10 Capital Federal	(+54 11) 4375-5349	www.sintesisquimica.com.ar	Bioinsecticides Inoculants

ANNEX V ARGENTINE BIOTECHNOLOGY COMPANIES: AGRICULTURAL AND PLANT SECTOR				
Company / Laboratory	**Commercial Address**	**Telephone**	**Website**	**Category**
1-Relmó SA	Buenos Aires 2415 – Rosario	3414813332		Seeds
2-Sursem SA	Pergamino	2477432556	www.sursem.com.ar	Seeds
3-Asociados Don Mario SA	Ruta 7 Km 208 Chacabuco	2352451171	www.donmario.com	Seeds
4-Bioext SA	Corrientes 1140 - Quilmes	42757716 / 7714	www.bioext.com	Plantlets
5-Bio Grains	Arroyo 880 3-of. 5 Cap.Fed.	43280813	www.biograins.com	Seeds
6-Gentos SA	Corrientes 1099 Olivos	4794-1144	www.gentos.com.ar	Seeds
7-SPS Semillas	Dardo Rocha 3278 Martínez	48360099	www.spsmultisem.com.ar	Seeds
8-Agrogenética	Mar del Plata /San Juan			Plant TissueCulture, Potato
9-Tecnoplant SA	Paraná 3352 – Olivos BsAs Prov.	(54 11) 5128-3100	www.tecnoplant.com.ar	Plant Tissue Culture
10-Diagnósticos Vegetales SA	México 2446 (7600) Mar del Plata	2234729430	www.diagnosticosvegetales.com	Plant Tissue Culture
11-Garbi Biotecnología Vegetal SA	Av San Martín 1425 3-of 37 Mendoza	61-25 0232		Plant Tissue Culture
12-Proarpa SA	Avda.Libertad 5640 Mar del Plata	23-73-3814/2337		Plant Tissue Culture
13-Propagar	Camarones 2514 (1416) Bue	583-8785/750-1378		Plant Tissue Culture
14-ACA	Av E.Madero 942 pisos 4,5 y 6	43101300	www.acacoop.com.ar	Seeds
15-Genética Vegetal (SA)	Avda. del Libertador 1068, Piso 4	5777-8702	www.genetica-vegetal.com.ar	Plant
16-Bioceres SA	Paraguay 777 piso 8 of 4 Rosario	03414260745/46	www.bioceres.com.ar	Agro incubator
17-Ciagro SRL	25 de Mayo 473 Resistencia	3722450006		Cotton
18-Nidera SA	Paseo Colón 505 piso 4 Cap. Fed	43468161	www.nidera.com.ar	Seeds
19-Grupo Biótica (Lab Lemos SRL / Nutripac SA / Polychaco)	Santiago de Estero 1162 Cap. Fed	43042204	www.biotica.com.ar	Potato
20-Cuinex SA	Mercedes Buenos Aires Province	2324432559		Fruit
21 - Chacra Experimental Agrícola AC			/www.chacraexperimental.org	Sugar Cane
22-La Tijereta (Seminium SA)	Paraguay 777 piso 7 of 2 Rosario		www.seminium.com.ar	Seeds, genetics