



**Policy Brief**

# **HOW TO IMPROVE THE SOCIO- ECONOMIC BENEFIT OF PUBLIC-PRIVATE R&D PARTNERSHIPS IN AGRICULTURAL BIOTECHNOLOGY?**

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IN MERCOSUR**



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**THE CASE OF COTTON  
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## Introduction

Unlike earlier waves of crop innovation, in which the public sector played a key role in innovation, most of the applied research in modern agricultural biotechnology and nearly all its commercial development are undertaken by the private sector, consisting of a handful of multinational firms. This has raised concerns that agricultural biotechnology innovation will not focus on solving the problems experienced by poor farmers, who exert little effective demand.

This policy brief summarises the main findings of a study conducted in Brazil, Argentina and Paraguay to investigate the potential for public-private partnerships in transgenic crop R&D, and whether such partnerships could contribute to the development and commercialisation of biotechnologies that are aimed at solving the production problems of small farmers. The study used the case of cotton, and possible transgenic seed solutions to a pest known as the ‘picudo del algodonoero’ or cotton boll weevil as a lens with which to explore this topic.

The boll weevil pest can be managed using chemical insecticides and management practices, but these are too expensive and/or disruptive for small farmers to adopt. Existing transgenic insect resistant varieties are not effective against the class of insect to which the boll weevil belongs. However, technically, it may be possible to develop transgenic varieties that are resistant to the boll weevil.

The main aims of the study were to:

- understand the strengths and weaknesses of public and private sector R&D and commercialisation capabilities relevant to the development of transgenic cotton varieties
- explore how regulatory frameworks affect innovative activities in transgenic crop development
- analyse the experience of previous public-private partnerships in the seeds sector
- identify synergies and potential points of conflict between the public and private sectors, with the aim of identifying institutional innovations that could promote successful co-operation

## Transgenic cotton and innovation capabilities in the public and private sectors.

Private biotechnology firms have commercialised transgenic cotton varieties in Argentina and Brazil, and are about to do so in Paraguay. Two of the most active firms in this market are: local affiliates of Monsanto (in Brazil, Argentina and Paraguay), and an affiliate of Bayer (in Brazil). Neither firm focuses on the development of novel transgenic events for the region. Instead, they have either backcrossed their proprietary biotechnology events, developed elsewhere, into local germplasm in order to produce new seed varieties, or they have imported transgenic cotton varieties developed originally for other markets.

The local affiliates of Monsanto and Bayer either do not have, or have only small, local R&D programmes in cotton, and little in the way of a local R&D infrastructure. Yet their headquarters overseas have world leading R&D capabilities in agricultural biotechnology which affiliates may be able to draw on. Furthermore, within the host country, local affiliates have access to considerable financial and legal resources, and possess the business models and other commercial ‘know how’, with which to commercialise transgenic seeds. Given absent or weak local R&D capabilities and infrastructure, the affiliates form partnerships with local public agricultural R&D institutions in order to access the

material, logistical and human resources with which to adapt and commercialise their technologies, for example to obtain local germplasm, backcross events into local varieties, and perform field trials.

The main public agricultural research and technology institutions in Argentina and Brazil, INTA and EMBRAPA, have strong capabilities in plant genetic engineering, especially in basic research. Applied research in plant genetic engineering is weaker than basic research, in part because of the academic profile of both institutions, e.g. the high preponderance of doctoral and post doctoral researchers. Both have active research programmes in cotton biotechnology, and these activities are supported by highly qualified human resources, nationwide networks of research laboratories and experimentation sites, well established linkages with other public sector university laboratories, and national germplasm banks. In Paraguay, the public institute, IPTA, has some experience in plant biotechnology (e.g. micro-propagation, plant tissue culture or diagnostics) and in conventional breeding but lacks the human and other resources to be active in plant genetic engineering

INTA and EMBRAPA do not usually attempt to commercialise technology developed by those institutions, at least not on their own since they lack the capacity, resources, and business models to do so. For example, the public institutions do not have the infrastructure to multiply and sell seeds at scale, or the substantial financial resources needed to satisfy regulatory hurdles for commercialising transgenic seeds. Instead technologies (including seeds) developed within those institutions are either transferred to the private sector for commercialisation, or are commercialised in partnership with the public agency. Neither institution has developed or commercialised a transgenic cotton variety on its own.

## Previous experience of public–private agreements

INTA and EMBRAPA both have substantial experience of co-operation agreements with the private sector. These agreements have concerned, for example, the joint conduct of R&D, and final development and commercialisation of technologies developed by the public sector. Both institutions have formed co-operation agreements with respect to transgenic seed innovation and transgenic cotton specifically.

Public-private R&D and technology transfer co-operation agreements involve negotiations over licenses, fees, the sharing of royalties and intellectual property. In general, both INTA and EMBRAPA retain the intellectual property rights over technologies that are developed jointly with the private sector, or that are transferred, under license, from the public to the private sector for commercialisation.

The situation is more complex, however, where the private firm has property rights over material prior to its use in joint R&D or commercialisation projects – such as over the genetic constructs used to produce transgenic seeds. For example, INTA has had two public-private co-operation agreements on transgenic cotton - an R&D agreement to introduce Monsanto's transgenic events into INTA varieties, and a license agreement to allow (by paying royalties) Monsanto to commercialise conventional INTA varieties into which the company had inserted its own genes. Monsanto retained its intellectual property rights over its inserted gene, but it also registered the transgenic seed variety, which contained germplasm developed by INTA, as the firm's property under Argentina's plant variety protection law. In Brazil, that would not be possible since EMBRAPA is not permitted to transfer its own genetic material to other actors. R&D and commercialisation agreements between EMBRAPA and biotechnology firms over transgenic seeds have been organised so that EMBRAPA retains property rights over the new seed varieties.

Several potential benefits of public-private agreements were raised by our interviewees. From the perspective of the public sector institutions (and considering both the seed industry and the private sector more generally) these included:

- additional research funds for the public sector, from the fees and royalties provided by private firms

- a mechanism for commercialising publicly developed technology, including seed varieties, which would not otherwise reach the market
- the exploitation of synergies between capabilities in the public and private sectors, especially over the production of new knowledge
- a way of helping to ensure that publicly-funded knowledge was focused on real production problems

From the perspective of the affiliates of multinational biotechnology firms these benefits included:

- a way of adapting proprietary technologies to the region
- access to basic research in the public sector which was seen as complementary to the more applied research and commercialisation capabilities of the private sector
- a means of promoting the social responsibility of biotechnology firms

Several potential risks of public-private agreements over R&D and technology transfer were also raised by our interviewees. From the perspective of the public sector institutions these included:

- Institutional/cultural impediments to collaborative work. INTA sources argued that this could be and had been problematic; however, EMPRABA sources argued such differences were a positive influence on joint work
- Restricted access to technologies for populations with low purchasing power, if the public sector was unable to influence the price of the technology
- Confidentiality clauses that might prevent public sector researchers publishing findings in a timely manner

Two other types of risk that are sometimes raised in the wider literature were not considered significant by INTA and EMBRAPA. These were (i) that private-public agreements may create a change in the direction of public research agendas, and (ii) that publicly funded knowledge may end up in exclusively private hands.

Some INTA sources noted that the issue of the privatisation of public knowledge was sometimes problematic prior to the early 2000s, but subsequently, the institution had been able to negotiate intellectual property in joint agreements in ways that were not prejudicial to the public interest.

From the perspective of the affiliates of multinational biotechnology firms potential risks of public-private collaboration included:

- Weak standards for, and especially enforcement of, intellectual property rights for seeds.
- Difficulties commercialising technologies that have been developed jointly
- Opportunity costs for seed firms, especially since interviewees saw public agencies as orientated more towards basic research and less interested in launching products that have market potential.
- Stability of political norms over plant biotechnology. This applied to Paraguay where it was unclear whether political decisions to permit commercialisation of plant biotechnology will be stable.

## A collaborative solution to the boll weevil pest?

As we have noted above, the strengths and weaknesses of the local affiliates of biotechnology MNEs, and of INTA and EMPRABA, are to some extent complementary (i.e. infrastructure and human resources for local basic and applied research in the public sector, and stronger commercialisation capabilities –and the ability to draw on the advanced R&D capabilities of the corporations as a whole - in the private sector). This is recognised by both sets of actors. Public-private agreements that have sought to exploit those synergies and complementarities have been routine for many years, especially in Brazil and Argentina.

Yet, public-private agreements to conduct R&D into a transgenic solution to the boll weevil do not exist. The main reason contributing to why that is so, from the perspective of the seed industry, is that the projected market size for a boll weevil resistant seed is too small to be a major commercial interest for the biotechnology firms, at least as global corporations. The boll weevil is not a problem in other important cotton markets, and the area sown to cotton in MERCOSUR in 2009/2010, some 1.3 million hectares, is not sufficiently attractive commercially. The sizeable informal market in all three countries in copied transgenic cotton seed further diminishes the size of the potential market. Local affiliates did argue, however, that although the commercial case of co-operation agreements on R&D might not be persuasive, investment in joint R&D was a feasible prospect under the firms' corporate social responsibility programme. Nevertheless, there are patents on genes that are claimed to be effective against the boll weevil that are held by multinational firms. From the perspective of the public sector, political and strategic reasons may limit the desirability of co-operation agreements with the multinational biotechnology firms, at least from the perspective of host governments. These included tensions between Monsanto and the Argentinean government over soya royalties, and, in Paraguay's case, the impact of anti-transgenic sentiment on the Environment Ministry

To date it is only the public sector in Argentina and Brazil that is financing and conducting R&D to try and develop a transgenic cotton variety effective against the boll weevil. EMPRABA has patented cry genes that are toxic to coleopteran, the class of insect to which the boll weevil belongs, and is investigating strategies to genetically engineer cotton seed varieties using those genetic constructs. INTA, in turn, is performing novel biotechnology research with promising results on a different method to create a transgenic seed resistant to the boll weevil. Although there is limited interest from the private sector in joint R&D projects, sources from both biotechnology firms and public sector research organisations argued that if the public sector's R&D projects were successful and delivered a near working technology, there would be a clear interest from firms at that point in co-operation to commercialise a seed variety.

## Exploiting existing synergies and overcoming barriers

The promotion of co-operative agreements, especially for problems that affect small farmers disproportionately, might include the following:

- Political negotiations to promote biotechnology firms' investment in technologies with low commercial potential. These might include offers from the public sector of resources of interest to the firm, both reputational and material, and that are of wider strategic benefit to the firm and its other lines of business.
- Joint initiatives between public institutions in the region from which to better negotiate collaborative projects with biotechnology firms. Since firms pursue regional and global strategies, public sector innovation policies could do likewise.
- Altering the property rights regime: National regulations covering property rights have a strong influence on the incentives and bargaining power of different actors, with important consequences for development strategy. This area is complex and controversial but options include:

- Stronger and/or better enforcement of intellectual property rules so as to increase the effective size of seed markets. As biotechnology firms claim, stronger property rights could be translated into more R&D to solve more problems. The increased costs of such as proposal for agricultural producers would have to be judged to be compensated for by the benefits arising from R&D collaboration
- Weaker property rights, for example by restricting patent protection granted to inventions to those that are commercialised within a certain period. This could improve the efficiency of the whole system since actors interested in using patented genes (e.g. public institutes) could do so if the patent owners do not develop commercial products.
- Avoiding property rights on modified genes and relying exclusively on seed variety protection. This might better balance current asymmetries between public institutes, which cannot use patented materials for further development, and multinational firms, which can use local germplasm registered by public institutes to create and (co)register new transgenic seeds.
- Policies to promote a more balanced power of negotiation between the public sector and biotechnology firms. For example, negotiating over a full range of products of interest to multinational firms or jointly amongst MERCOSUR countries.
- Improve management of public sector financed projects so as to support teams working on basic research to co-ordinate with researchers taking knowledge through to development stages, where they are more attractive as possible topics of public-private cooperation.

