Biological inputs and agricultural policies in South America: between disruptive innovation and continuity

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In South America, public policies take a strong interest in alternative technologies to agricultural chemical inputs (pesticides and fertilisers). Some South American countries support biological inputs, also known as bioinputs, through national incentive programmes and regulatory changes. Argentina, Brazil and Colombia are playing a leading role. However, the intention behind this promotion of bioinputs is not to break with industrial agricultural production models, from which States derive a large part of their tax income through exports. Rather, the goal is to foster coexistence between chemical and biological inputs in the context of a transition towards the bioeconomy. In this sense, the promotion of bioinputs meets the expectations of many South American farmers, as well as those of the agricultural inputs industry, which over the last few decades has diversified into these technologies. But these industrial dynamics are counter to certain farmers' movements that defend on-farm production of biological inputs.

A microbiological and biotechnological turning point

To reduce the use of pesticides, agricultural countries are developing public policies to encourage biocontrol. France, for example, is implementing its *"National biocontrol strategy 2020-2025"*. South American countries, especially the major ones such as Brazil and Argentina, are no exception to this trend, although plans to reduce pesticides are still relatively modest compared to Europe.

Since the mid-2010s, several South American countries, in particular with the support of the Inter-American Institute for Cooperation on Agriculture (IICA), have launched initiatives to that end. Argentina, Brazil, and Colombia are pioneers in these changes. They have organised their action around a category of agricultural inputs that is broader than the definition of biocontrol (see box p. 2): bioinputs *(bioinsumos)*, which include both biocontrol agents and biofertilisers. The latter are epitomised by bioinoculants, which have boomed thanks to growing demand for soy since the late 1990s, and are used as a seed treatment to reduce nitrogen fertiliser inputs. In Argentina and Brazil, a thriving national industry has developed around these technologies, based originally on interactions between small and medium-sized companies and public universities.

This microbiological and biotechnological turning point is also evident in the biocontrol sector, where research and development currently focuses on bacteria and fungi, and often gives less importance to the macrofauna (insects, for example) used against crop pests. The figures for the registration of new products are unequivocal in this respect. In Brazil, between 2000 and 2020, microbial biocontrol agents accounted for, on average, 60% of all new bioinputs registered (only 17.6% for macro-organism products, with the remainder consisting of chemical mediators and other natural substances). But this proportion increased significantly over that period to reach 80% in 2020. In addition, more than half of the products registered over the 20-year period were bioinsecticides.

The innovation frontiers for bioinputs are thus primarily biotechnological, as reflected in Argentina by the fact that the National Advisory Committee on Agricultural Biotechnologies (CONABIA, *Comisión Nacional Asesora de Biotecnología Agropecuaria*) is the institution responsible for them.

From biocontrol to bioinputs: definitions

Biocontrol refers to a set of biological techniques used in plant protection to control plant pests (micro-organisms, insects, mites, nematodes, etc.). Biological control agents are generally divided into four main categories:

> invertebrate beneficial macro-organisms, such as insects and mites;

> micro-organisms (fungi, bacteria, viruses) used to protect crops against pests and diseases or to promote plant vitality;

> chemical mediators, especially including insect pheromones, which help to control insect populations through sexual confusion methods or by attracting pests to traps;

> natural substances from plants, animals or minerals.

Biofertilisers are products of biological origin used to increase soil fertility. They are products containing organic materials (manure, plant residues, compost), or microbial solutions, like bioinoculants.

Bioinoculants are products mainly containing nitrogen-fixing bacteria selected and improved in laboratories. These bacteria live naturally in symbiosis with the roots of legumes (such as soy, chickpeas and beans), capturing the chemical elements in the air and soil and returning then in a form that the plant can assimilate. Bioinoculants are used on legumes and other crops, such as sugarcane.

These **biological inputs** used in agriculture are more generally known as **bioinputs** ***(bioinsumos)*** in South America.

Agrochemicals and bioinputs: alliances and continuity

In South America, as in other continents, the use of biological inputs is an age-old practice. Traditional and subsistence farming systems, or more recently organic agriculture aimed at domestic or export markets, use diverse preparations and technologies, whether to fertilise soils or to ensure crop health.

The expansion of the bioinputs industry is more recent and has taken a specific turn in the last few years. First, it is part of a drive to develop a bioeconomy which, although aimed at the whole agricultural sector, is resolutely turned to the use of biological resources in intensive production systems. Biodiversity is seen as a resource to be explored and exploited in order to enhance the ecological sustainability of the agricultural model inherited from the green revolution. Second, the development of bioinputs is in line with the transformation of the agricultural inputs industry at the South American and also global levels.

Multinational agrochemical companies have invested in the bioinputs sector through numerous buyouts of national companies. They are thereby establishing themselves on this emerging technology frontier, enjoying high growth on the South American markets – in Brazil, sales of biocontrol products increased by 15% between 2018 and 2019 (see box p. 3). In so doing, they are pursuing their diversification into biotechnologies since investments made in the seed sector, but this time applied to plant health and nutrition. This movement is illustrated by the trajectory of the Brazilian Association of Biocontrol Industries (ABC Bio, *Associação Brasileira das Empresas de Controle Biológico*). Initially including small and medium-sized companies in southern Brazil, from the mid-2010s onwards it saw the arrival of large international agrochemical groups investing in biocontrol. In 2020, this shift took a new turn: ABC Bio merged with Brazilian alliances of agrochemical and biotechnological companies to form the association CropLife Brasil.

These industrial alliances show that the radical substitution of biological inputs for chemical inputs is not the objective pursued. Instead, the goal is to ensure industrial diversification and investment in a promising sector. Indeed, biological inputs are attracting large farms and value chains that are increasingly concerned about the health requirements of importing countries. Biological inputs are alternative technologies to chemical inputs, through their nature and their modes of action, but their industrial development places them in a kind of continuity, or at least coexistence, with the dominant chemical model. Moreover, South American public policies promote this vision of a very progressive transition, putting forward biological inputs as a future solution that can complement chemical inputs in the short and medium terms.

Public policies: from adapted regulations to inclusive plans

South American policies on bioinputs are moving into different fields of action. The most important is perhaps that of the adaptation of regulatory frameworks for the assessment and approval of products, which have thus far been designed for chemical inputs. This action is crucial; whether or not a biological input is placed on the market hinges on it. Yet for the most part, these products are still assessed according to the same criteria as chemical products.

This adaptation of regulatory frameworks is nevertheless challenging. The public services that carry out assessments have few biologists working for them, only a small number of laboratories have accreditation, and the reform of existing provisions often encounters red tape. Adaptation is nevertheless essential to stimulate innovation and to ensure the state is able to guarantee the quality and safety of products put on the market. Colombia is the only country with specific legislation on biological inputs, but it lacks an inclusive programme for the promotion of bioinputs, such as the ones Argentina and Brazil recently developed. Indeed, through plans managed by the Ministries of Agriculture, these two countries have introduced instruments that act on several levers to boost the production and use of

biological inputs. These include, for example, schemes to foster innovation in companies, such as programmes to enhance articulation with public laboratories, or reduced costs for registering new products. Other actions concern training in biological control and soil biology for agricultural advisors and, further upstream, for agricultural engineers in universities. Other more modest actions encourage the adoption and use of these technologies through subsidies and information campaigns among farmers' groups.

But these farmers are also at the heart of another dynamic, in which Brazil is a front-runner: the on-farm production of biological inputs.

Bioinput production by large farms is booming In Brazil

The production of biological inputs by farmers is nothing new – it is known as on-farm production. Farmers and non-governmental organisations that promote agroecological practices have been working in this field for a number of years.

The promotion and management of on-farm production are one of the objectives of the Brazilian National Programme on Bioinputs (*Programa Nacional de Bioinsumos*). In some remote regions, or for small family farms, access to commercial inputs remains difficult and costly. Moreover, the production and handling of some microbial products may pose health risks. This programme therefore aims to promote the installation of small local production units in rural areas, known as "biofactories". The plan is for these units to be managed individually or collectively by farmers, potentially with the involvement of private operators or local cooperatives.

But some producers are a step ahead of public action and industries. Since the mid-2010s, a network of large farms, both conventional and organic, has been formed at the federal level to encourage the large-scale on-farm production of micro-organisms for fertilisation or plant health. This network, the Sustainable Agriculture Associate Group (GAAS, *Grupo Asociado de Agricultura Sustentável*), brings together farmers who are investing in material sold by companies whose usual clients are public research laboratories and industries. To improve their practices, these farmers are recruiting microbiologist engineers and are assisted by researchers from the Brazilian Agricultural Research Corporation, EMBRAPA (*Empresa Brasileira de Pesquisa Agropecuária*).

These dynamics pose certain problems for the state and for the booming bioinputs industries. The state, through the National Bioinputs Programme, is striving to develop training, monitoring and control tools to manage the public heath aspects of these innovative practices. Industries are supporting the strictest possible management of these on-farm production practices, in order to guarantee the expansion of a market in which they are investing in research and development. Indeed, they want to guarantee the intellectual property of their microbial strains and are exerting pressure – without yet obtaining any specific measures – to prohibit the on-farm reproduction of micro-organisms derived from their commercial products, a practice they consider to be "biopiracy". This situation clearly recalls the movements and controversies that erupted around seeds in the late 1990s. Bioinputs are thus at the crossroads of industrial interests and farmers' movements defending different or even conflicting approaches to the management and use of living organisms.

In France and Europe, this momentum in the on-farm production of micro-organisms is currently lacking, or almost non-existent. But there is growing interest in biocontrol, for agroecology as well as for the reappropriation by farmers of certain activities in the design and use of technologies. Close attention must therefore be paid to current innovations in South America and to the way in which they are renewing relations between farmers, agricultural research and the inputs industry. ■

A rapidly growing biocontrol market in Brazil

Regional data on biocontrol and bioinput markets are lacking. As regards biocontrol, some figures are provided below for Brazil, the main market in the region, and compared with global figures.

In Brazil, the total market for chemical and biological crop protection products increased from 10.3 billion to 11.6 billion US dollars between the crop years 2017-2018 and 2019-2020. Biocontrol products make up a minority share of this market, which nevertheless increased over this period from 1.5 to 2.6%, in other words almost doubling in value in three years. At the global level, projections suggest that biocontrol will account for 10% of the market for crop protection products by 2025; in Brazil, the projected share is higher, at around 14%. However, these figures only represent sales and do not include biological inputs produced on farms – CropLife Brasil estimates that such inputs are used on around 20% of areas treated with biocontrol products in Brazil.

At the global level, as in Brazil, the biocontrol market is growing by 15% per year. In Brazil, the projected growth rate for 2021 is around 20 to 30%. Between 2020 and 2025, the Brazilian market is thus expected to double in size, in line with projections for the global market, for which sales of biocontrol products could exceed 11 billion US dollars by 2025.

In Brazil, the main crops on which these products are used are soy, sugarcane, coffee and cotton; alone, these account for almost 75% of all biocontrol products consumed.

This market growth in Brazil goes hand in hand with a steady increase in the number of new biocontrol products registered every year, rising from 31 products registered in 2015 to 95 in 2020.

These figures illustrate the market growth and industrial dynamism of biocontrol, both in Brazil and globally. There is still huge potential for growth, especially where use by farmers is concerned. In 2020, most of the Brazilian farmers who apply biocontrol products used on average fewer than two products per crop year, with all other treatments consisting of chemical inputs.

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Between June and August 2020, the dP PP-AL and the Inter-American Institute for Cooperation on Agriculture (IICA) organised a series of conferences on five national experiments to promote agricultural bioinputs – Argentina, Brazil, Colombia, Ecuador, Mexico. The five conferences in this cycle are freely available online at https://www.pp-al.org/en/actualites/politiques-publiques-et-innovation-en-faveur-des-bio-intrants-agricoles.

Some of this research was also conducted in the context of the research project "Institutionalising agroecologies", IDAE, https://www.idae.cnrs.fr/, 2016-2019, French National Research Agency, ANR, France, project 15-CE21-0006-01, https://anr.fr/Project-ANR-15-CE21-0006). The research in Brazil was supported by grants for visiting researchers from the Foundation for Research Support in the State of Rio de Janeiro (*Fundação de Amparo à Pesquisa do Estado do Rio de Janeiro*, FAPERJ, Brazil, PV 201.798/2017) and the National Council for Scientific and Technological Development (*Conselho Nacional de Desenvolvimento Científico e Tecnológico*, CNPq, Brazil, PV 301509/2018-2).

Publications based on this research include:

Goulet F., 2021. Characterizing alignments in sociotechnical transitions. Lessons from agricultural bioinputs in Brazil. *Technology in Society*. https://doi.org/10.1016/j.techsoc.2021.101580

Goulet F., Hubert M., 2020. Making a Place for Alternative Technologies: The Case of Agricultural Bio-Inputs in Argentina. *Review of Policy Research* 37 (4): 535-555. https://doi.org/10.1111/ropr.12384

Goulet F., Aulagnier A., Hubert M., 2020. Del reemplazo tecnológico al desplazamiento de fronteras: las alternativas a los agroquímicos en Argentina, Brasil y Francia. In: Mombello L., Spivak L'Hoste A. (Eds.), *Naturaleza y conocimientos en tensión*. Buenos Aires, TeseoPress, p. 279-299. ISBN 978-987-86-5724-0. https://www.teseopress.com/bienes/

Goulet F., Krotsch T., 15 September 2020. Políticas públicas para los bioinsumos: hacia un espacio de intercambio en América Latina y El Caribe. IICA Blog. https://blog.iica.int/en/blog/politicas-publicas-para-los-bioinsumos-hacia-un-espacio-intercambio-en-america-latina-caribe

Some links

CropLife Brasil, 2019. https://croplifebrasil.org/

Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA). https://www.embrapa.br/

Inter-American Institute for Cooperation on Agriculture, IICA, 2020. https://www.iica.int/en

Ministère de l'agriculture et de l'alimentation (France), 2020. Stratégie nationale de déploiement du biocontrôle 2020-2025. Novembre 2020. 28 p. https://agriculture.gouv.fr/quest-ce-que-le-biocontrole

Grupo Asociado de Agricultura Sustentável (GAAS, Brésil), 2020. http://www.grupoagrisustentavel.com.br

Ministério da Agricultura, Pecuária e Abastecimento (Brésil), 2021. Programa Nacional de Bioinsumos. https://www.gov.br/agricultura/pt-br/assuntos/inovacao/bioinsumos

Ministerio de Agricultura, Ganadería y Pesca (Argentine). Componentes de la Bioeconomía Bioinsumos / Biomateriales. https://www.magyp.gob.ar/sitio/areas/observatorio_bioeconomia/indicadores/04/index.php

A few words about...

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