case 01

Microbial biocontrol agents as an agroecological contribution to food security and sovereignty in Bolivia

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Sustainable Devopment Goals:

OVER THE LAST 25 YEARS, PROBIOMA (PRODUCTIVIDAD BIOSFERA MEDIO AMBIENTE), BASED IN BOLIVIA, HAS BEEN CONTRIBUTING TO THE VALUATION AND SUSTAINABLE USE OF NATURAL RESOURCES AND BIODIVERSITY AS A BASIS FOR SUSTAINABLE DEVELOPMENT. THE ORGANISATION CONDUCTS RESEARCH AND ENVIRONMENTAL REMEDIATION WHILST FOCUSSING ON THE PROMOTION OF AGROECOLOGY AND FOOD SOVEREIGNTY IN BOLIVIA AND ABROAD. AMONG OTHER THINGS, PROBIOMA HAS DEVELOPED A SUCCESSFUL METHOD OF BIOLOGICAL PEST CONTROL THAT CAN BE APPLIED TO BOTH INTENSIVE AND EXTENSIVE CROP PRODUCTION SYSTEMS.

Small green bug (Piezodorus guilldinii) controlled with the Beauveria bassiana fungus in a field of soya bean. (Photo credit PROBIOMA)

THE DESTRUCTIVE IMPACT OF AGRIBUSINESS IN BOLIVIA

Bolivia is among the world's richest countries in biodiversity.[1] But the agro-industrial business model, which relies heavily on the use of agrochemicals (pesticides and synthetic fertilizers) and transgenic seeds, is having serious social, environmental and productive impacts on the country. Export crops such as soybean, sorghum and sugar cane (produced for agrofuel) are increasingly replacing food crops. The production of cereals, vegetables, fruits, tubers and fodder has therefore declined by more than 27 per cent over the last ten years, generating dependency on food imports and hampering food security and sovereignty.[2] The area under soybean cultivation on the other hand has more than doubled since the early 2000s, increasing disproportionately to the increase in total cultivated area (Figure 4). As a consequence, soybean accounted for 36 per cent of the country's total area under cultivation in the 2016-2017 agricultural season.[3]

Bolivia's shift to export crops has also been responsible for significant deforestation, with approximately 3.5 million additional hectares cut down since the turn of the century.[4] It has also contributed to the degradation of soils on 40 per cent of the land, and to climate change, resulting in an increase in droughts and torrential rains. From 2000 to 2017, the import of agrochemicals has increased fivefold in Bolivia – from around 30 to more than 150 million kilograms per year[5] – while at the same time, the area cultivated only went up for around 80 per cent (Figure 4). Taking into consideration that no considerable improvements in yield levels have been achieved for major cash crops during that period – soya yields for example fluctuated between 1.9 and 2.4 tons per hectare, this means that agrochemicals have been excessively used without any justifiable benefit.[6] On the contrary, it has had serious social, health and environmental impacts. The use of the herbicide glyphosate on transgenic soybean has also been linked to serious human health impacts.[7]

HARNESSING THE POWER OF NATURE

PROBIOMA supports the development and transfer of knowledge about biological pest and disease control. In laboratories specially designed by the PROBIOMA team, the organisation has developed a system based on the use of beneficial microorganisms which are present in nature. These microorganisms are natural regulators of insects that are considered pests, as well as of diseases. To be able to manufacture and commercialise such biological pest and disease control, PROBIOMA as a non-profit organisation has created an independent entity called PROBIOTEC SRL.[8] Through working together over the past 15 years, the application of bioregulators based on entomopathogenic and mycoparasitic fungi has reached more than 500,000 hectares in over 60 agricultural crops and a number of livestock throughout Bolivia.[9] Additionally, PROBIOMA has promoted other agroecological practices accompanying biological pest control. The organisation has for example developed different organic foliar fertilizers and engaged in the conservation and recovery of native seeds. Additionally, PROBIOMA has worked on bioremediation of soils to counter soil degradation and helped restoring degraded forest systems through analog forestry. Apart from those practices, PROBIOMA has also introduced an official agroecology label *(Sello de Identidad Agroecológica)* as an alternative to conventional certification, has reached out to media on alternatives to large-scale agribusiness and has given trainings for organisational capacity development.

TACKLING HUNGER AND CLIMATE CHANGE WHILE REDUCING NEGATIVE IMPACTS ON LAND

PROBIOMA's agroecological practices have shown to contribute to several SDGs. On SDG 2 for example, the use of biological control activities has shown to improve yields considerably[10] – a significant contribution towards SDG Target 2.3 of increasing agricultural productivity. Next to increased yields, also the access to safe and nutritious food for people in vulnerable situations (SDG Target 2.1) is addressed, as the organisation arranges weekly agroecological fairs where more than 250 different organic foods are being sold. The agroecological label, which guarantees that agroecological production methods have been used, is popular among consumers and gives farmers the opportunity of value addition (part of SDG Target 2.3). PROBIOMA has also helped to accelerate the implementation of agroecology on a broader scale, as several municipalities of the Chiquitania are incorporating the use of agroecological practices in their policies as a fundamental basis for the sustainable management of their natural resources. Equally, on national level, Bolivia has adopted a law based on agroecological principles, Law 3525 on Ecological Agriculture (SDG 2.4).[11]

Currently, the Bolivian state continues to import agrochemicals in a volume of 150 million kilogram per year, mainly for the production of export crops.

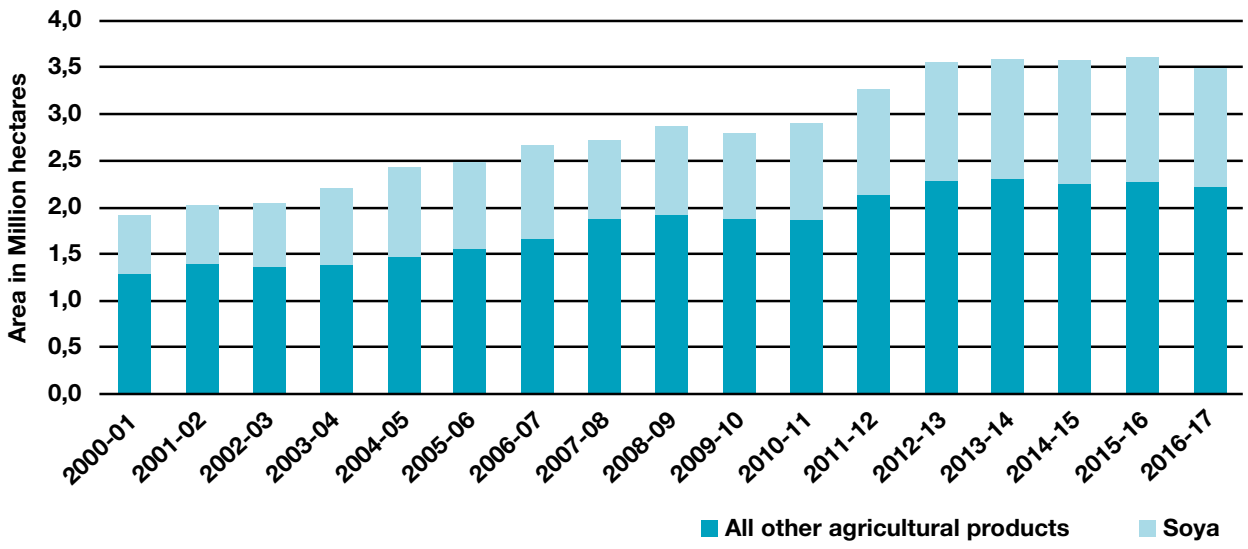
Taking into consideration that through the use of biological pest control, PROBIOMA has contributed to the replacement of more than 420,000 kilogram of pesticides that have not been applied in the fields, the organisation actively works on SDG 3 Target 3.9 of *"substantially reducing the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination"* and SDG Target 6.3 of *"improving water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, thereby avoiding the contamination of waters of rivers and underground aquifers"*. This is especially relevant in Bolivia given that during a recent agricultural census, almost 40 per cent of communities in the country had the perception that their waters are contaminated with agrochemicals.[12]

"PROBIOMA has contributed to the replacement of more than 420,000 kilogram of pesticides that have not been applied in the fields."

By promoting biological pest control and other agroecological practices like analog forestry, PROBIOMA actively resists the expansion of industrial and agriculture in Bolivia. Taking into consideration the enormous environmental and climatic consequences that are associated with such practices – especially considering the deforestation that precedes the creation of large-scale monocultures – the organisation therefore takes action to combat climate change (SDG 13) and help reaching the Paris Agreement. Likewise, PROBIOMA has set up an internationally accredited institute, the Institute of Biodiversity and Biotechnology (INBIOTEC), which, in 18 years, has trained more than 2,000 people from different groups of social, governmental, non-governmental organisations, producer associations and journalists, with the purpose of preventing environmental and climatic disasters.

Finally, Probioma strongly focuses on SDG 15 of preserving life on land. In 2017, Bolivia imported food (especially tubers, cereals, fruits and vegetables) destined for the domestic in a volume of 980 million kilograms, which reflects the current situation of public policies prioritizing the production of export crops at the expense of local and diversified production.[13] As a consequence, the countries cultivated area is covered by a handful of crops (with transgenic soybean being the majority on more than one third of the land), considerably harming Bolivia's (agro)biodiversity. PROBIOMA has therefore decided to contributie to the conservation of native genetic resources by having a stock of 420 types of microorganisms beneficial for agriculture, livestock, soil bioremediation and for the control of vectors of human diseases. It also has a germplasm bank with 82 seed

Figure 4: Proportion of total cultivated area in Bolivia used for soybean production.[2]



varieties of different crops, among which are more than 16 varieties of native corn and four varieties of non-transgenic soybeans, thereby focussing on SDG 15 Target 15.6 of *"promoting the fair and equitable sharing of the benefits arising from the utilisation of genetic resources and promoting appropriate access to such resources"*.

In partnership with other organisations, PROBIOMA also contributes to the consolidation of Forest Management Plans in indigenous territories of the Chiquitania (Lomerio) through the implementation of more than 80 ecological gardens that are in harmony with the forest (SDG 15 Target 15.2). Where areas have been degraded, the organisation conducts bioremediation of soils. This is especially the case in highland arid zones that produce quinoa and in lowland areas of extensive crop and livestock production. Encompassing 50,000 hectares, this work helps combat the process of soil degradation, effectively targeting SDG Target 15.3 of combat desertification and restoring degraded land and soil.

More research and dissemination of knowledge

The use of biological pest and disease control in combination with other practices is key to the growth of agroecology in Bolivia. With its wealth of experience using those control techniques, PROBIOMA serves as a key reference in the country. PROBIOMA promotes biological control via the Agroecological Platform, the Urban Ecological Orchards Network, the Santa Cruz Beekeepers Association, the International Analog Forestry Network (IAFN), the International Seeds of Life Network, the Pantanal Without Limits network and several universities. PROBIOMA believes that further support is needed to deepen and consolidate research, such as field tests of biological pest control agents for new pests that affect crops. Resources are also needed to disseminate such knowledge and to train more producers and their organisations about biological pest control.

NOTES

1 Convention on Biological Diversity (CBD). (n.d.) *Bolivia (Plurinational State of) Biodiversity Facts.* Country Profile. Retrieved from: https://www.cbd.int/countries/profile/default.shtml?country=bo#facts

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3 See 2

4 Ministerio de Medio Ambiente y Agua & Autoridad de Fiscalización y Control Social de Bosques y Tierra. (2018). *Deforestación en el Estado Plurinacional de Bolivia. Periodo 2016-2017.* Informes Anuales. Retrieved from: http://www.abt.gob.bo/images/stories/Transparencia/InformesAnuales/memorias-2016-2017/Memoria_Deforestacion_2016_2017_opt.pdf

5 Salinas, J.C. (2018). *Quintuplican el uso de agroquímicos para evitar nuevas áreas de siembra.* El Deber. Retrieved from: https://www.eldeber.com.bo/economia/Quintuplican-el-uso-de-agroquimicos-para-evitar-nuevas-superficies-20180717-0011.html

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7 Dixon, E. (2019). *Common weed killer glyphosate increases cancer risk by 41%, study says.* CNN. Retrieved from: https://edition.cnn.com/2019/02/14/health/us-glyphosate-cancer-study-scli-intl/index.html

8 For more information, visit: http://www.probiotec.org

9 El Mundo. (2018). *Probioma apoya control biológico en 500.000 ha.* Newspaper article. Retrieved from: http://elmundo.com.bo/web2/index.php/noticias/index?id=probioma-apoya-control-biologico-en-500-000-ha

10 Van Lenteren, J.C. et al. (2018). Biological control using invertebrates and microorganisms: plenty of new opportunities. *BioControl 63* (1), 39-59. DOI: 10.1007/s10526-017-9801-4

11 Presidencia de la Repùplica Bolivia. (2006). *Regulación y Promoción de la Producción Agropecuaria y Forestal No Maderable Ecológica.* Bill. Retrieved from: https://www.ciaorganico.net/legislacion/385_Ley_3525.pdf

12 INE. (2014). *Un pincelazo a las estadísticas con base a datos de censos*. Report. Retrieved from: http://www.fao.org/family-farming/detail/fr/c/317135/

13 INE. (2017). *Estadísticas de Comercio Exterior - Importaciones*. Databank. Retrieved from: https://www.ine.gob.bo/index.php/comercio-exterior/introduccion-3