Plants protecting other plants
An alternative to pest-resistant GM crops

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One of the justifications for the development of GM crops is to build-in resistance to insects and diseases, which in turn is expected to reduce the negative impact of agrochemicals on health and the environment. Of the total area planted to GM crops worldwide in the year 2000, 19% represent insect-resistant crops and 7% occupy crops combining both herbicide and insect resistance. Herbicide-tolerant crops form the majority as they fit very well in the strategy of large agrochemical companies like Monsanto that sell the seeds with the chemical inputs such as glyphosate in one package.

Research on genetic modification that is taking place in the Andean countries is predominantly focusing on plant health: herbicide-tolerant cotton and soya, resistance to Lepidopteros in cotton, resistance to nematodes in potatoes, resistance to white leaf in rice etc. Significant financial and human resources are being invested in research that will eventually bring benefits only to large-scale industrialised agriculture. The majority of Andean farmers will not benefit from the introduction of these GM varieties.

Biodiversity as a source for plant protection

In agriculture, the fight against harmful organisms is essential, and it is therefore necessary to develop appropriate technologies to regulate and control pests. Environmentally-friendly, biological options that do not make use of Genetic Modification do exist. These options are based on natural crop protection approaches that make use of the diversity found in nature itself. Some institutions are already investigating and promoting these non-chemical and non-GM options, providing excellent and competitive alternatives for pest management.

The challenge in natural crop protection is to have simple and low-cost technologies that are able to regulate pests and diseases and to reduce or completely avoid the problem of contamination by agrochemicals. One such natural crop protection approach is based on the use of plants with biological control properties. Plant types with insecticidal properties that can be used in curative form are equally important. At the moment successful experiences with this type of plant products exist and some of them are even available on the market.

Peru has a great potential of plants that have these properties, but research programmes to validate the technical and ecological benefits of these plants are required. Until now, the research efforts for seeking alternatives to chemical inputs have been very limited. A review of research indicated that over the past 40 years, 90% of research has been related to the management of chemical inputs rather than in finding alternative options.

Preparation of plant-based pesticides on the farm. Photo: Bert Lof

Plants that protect other plants

Within the framework of ecological pest management, an important and promising set of technologies is being provided by making use of plants as biological control agents. An inventory made in Peru indicated the existance of more than 300 plant species - both native and imported - that are useful for the management of populations of harmful insects. 14 possible applications emerge from this inventory, of which the most important are insecticide, repellent, nematicide and fungicide, indicating that ecological pest management has a great potential for further development.

So far, most of the research work has been focused on the rescue and technical validation of a series of these plants. Many plants have demonstrated a certain level of efficiency in regulating pests and diseases, and have been proven on the basis of statistically-sound research. E.g. extracts from a wild forest plant named "cardo santo" (*Argemone sufusiformis*) was found to be an effective regulator of *Spodoptera frugiperda* populations (army worm) in their larvae stage; "cuncuno" (*Vallesia glabra*) and "laurel" (*Nerium oleander*) demonstrated to be efficient fungicides, especially to control *Fusarium solani* and *Rhizoctonia solani*; in some zones of Peru, plants like "cola de caballo" (*Equisetum sp.*) are being used to regulate the presence of "Rancha" (*Phytophthora infestans*) in potatoes. The high silicium content of the plant helps in neutralising the multiplication of the fungus.

Similarly, research is being done on the identification of plants with properties for controlling nematodes such as "crotolaria" (*Crotolaria sp.*) and – again – "cardo santo". Furthermore, the oil of various plants helps to fight pests that cause damage to grain in storage. Research demonstrates that with small investments, the damage of pests in the warehouses can be mitigated.

The use of extracts of the wild coastal plant "tonuz" (*Pluchea chingoyo*) has shown to be of great potential to control "polilla" (*Phthorimaea operculella*) in stored potatoes, a plague that

inflicts great economic damage to Andean farmers. Also the use of eucalyptus (*Eucalipthus sp*.), muña (*Minthostachis spp*.) and lantana (*Lantana camara*) has been reported by the International Potato Centre (CIP) as being capable of controlling pest attacks on stored potatoes.

Many more experiences exist. Although the steps towards more ecological pest management are just being taken, alternative and competitive approaches on the basis of the diversity of plant species will be found in the future.

Plants with a market potential

Large-scale use of plant-based biological control is not yet taking place. The existing experiences are mainly related to the traditional use by farmers, cases that are unfortunately not very well documented. Nevertheless, the existence of four plants widely-known and studied for their biological control properties represent an alternative for pest control. Their characteristics and potential for commercial application are as follows:

a. Kumo (*Lonchocarpaus nicou L*)
Kumo is widely distributed in the forests of Peru where it grows spontaneously as a wild plant. In other zones of the Amazon forest it is also known as *barbasco*. This plant contains in its roots a well-known toxic substance, locally known as *rotenona.* Native farmers use it to for pest control and for fishing. Before the 1950s this plant was harvested and exported, but after the introduction of synthetic pesticides its use has gradually declined.

Plant extracts used in pest control. Photo: Bert Lof

Recently, a private company has again taken up the collection of this plant and has begun exporting it, mainly to the U.S.A. On the local market it is now being sold as a bio-pesticide with the commercial name "Agrosan". At the moment, a small plant for the processing of Kumo is being set-up in the Apurimac valley as part of a United Nations programme to promote alternatives to coca growing. Similarly, another company is offering rotenona in a liquid formula. Kumo controls a good number of pests and therefore has a great potential for agroecological agriculture.

b. Sabadilla *(Schoenocaulon officinale*)
This is a plant with insecticidal properties that is mainly known in Venezuela, Colombia and Mexico. In Peru, it is supposed to have been introduced before the 1950s in order to control skin infections as it kills fleas, lice and mites. After the introduction of DDT in the country, this plant was used less and less, and, today, its insecticidal qualities are hardly known to young farmers and agricultural workers. Farmers indicate that the plant is disappearing because of burning and is only to be found in very degraded and hilly zones.

Sabadilla is a perennial plant belonging to the family of the irises. It is the mature seeds that have the insecticidal properties. The main pests it controls are fleas, fall army worms, corn borers, lice, mites, thrips, leaf bugs and cockroaches (Gaby Stoll, 2000).

c. ***Neem*** (*Azadirachta indica*)
The neem tree, pertaining to the Meliaceae family, originates from Southeast Asia and is very well known world-wide because of its biological control properties. Though the tree was probably brought to Peru a long time ago, it is only recently that a number of institutions like the Network for Action on Alternatives to the use of Agro-chemicals (RAAA), have started distributing seeds on a larger scale. At the moment, around 3.000 seedlings have been planted in various areas.

Neem is cultivated in many regions of Africa, Australia and Latin America, because it adapts very well to the soils and semi-arid climates in tropical and sub-tropical countries. It shows a good tolerance to dry conditions and soil salinity. Its medicinal properties present a potential for treating animals and humans.

The specific use of neem in India for natural crop protection, has extended almost world-wide over the past number of years, including a great number of countries where it is being sold commercially. The production of insecticide from the neem seeds can be done in a relatively simple, artisanal way or else as an industrial process.

Studies indicate that the active substances of the neem seed (Azadirachtin, Salanin, Nimbin, Nimbidin, Meliantrol, etc.) have repellent effects. Upon ingestion, they have a very special effect on the metamorphosis of insects, preventing their growth and development. These substances are not toxic to human beings, mammals, birds, reptiles and fish. Applied in the indicated concentrations they do not affect the beneficial flora or fauna in the cultivated fields.

d. Paradise tree (*Melia azedarach*)
This is a tree that grows in wild form in Peru. It is a close relative of the neem. It contains contact toxins that can serve as an insecticide, repellent, and growth inhibitor. RAAA has made investigations to demonstrate their effectiveness in the control of fall army worms with satisfactory results. In Cuba there is already some experience in making use of the insecticidal properties of the Paradise tree. A commercial product on the basis of melia is available under the name Melitox. The seeds of this tree can also be processed in the same way as neem seeds.

Conclusion

Biological Control represents a concrete alternative to the use of GM crops, because it saves and strengthens the ecological balance that existed before the use of agrochemicals. This control method diminishes the dependency of local farmers on external inputs like pesticides, thus allowing for healthier living and working conditions.

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