Genetically modified soybeans
Blessing or curse for Brazilian agriculture?

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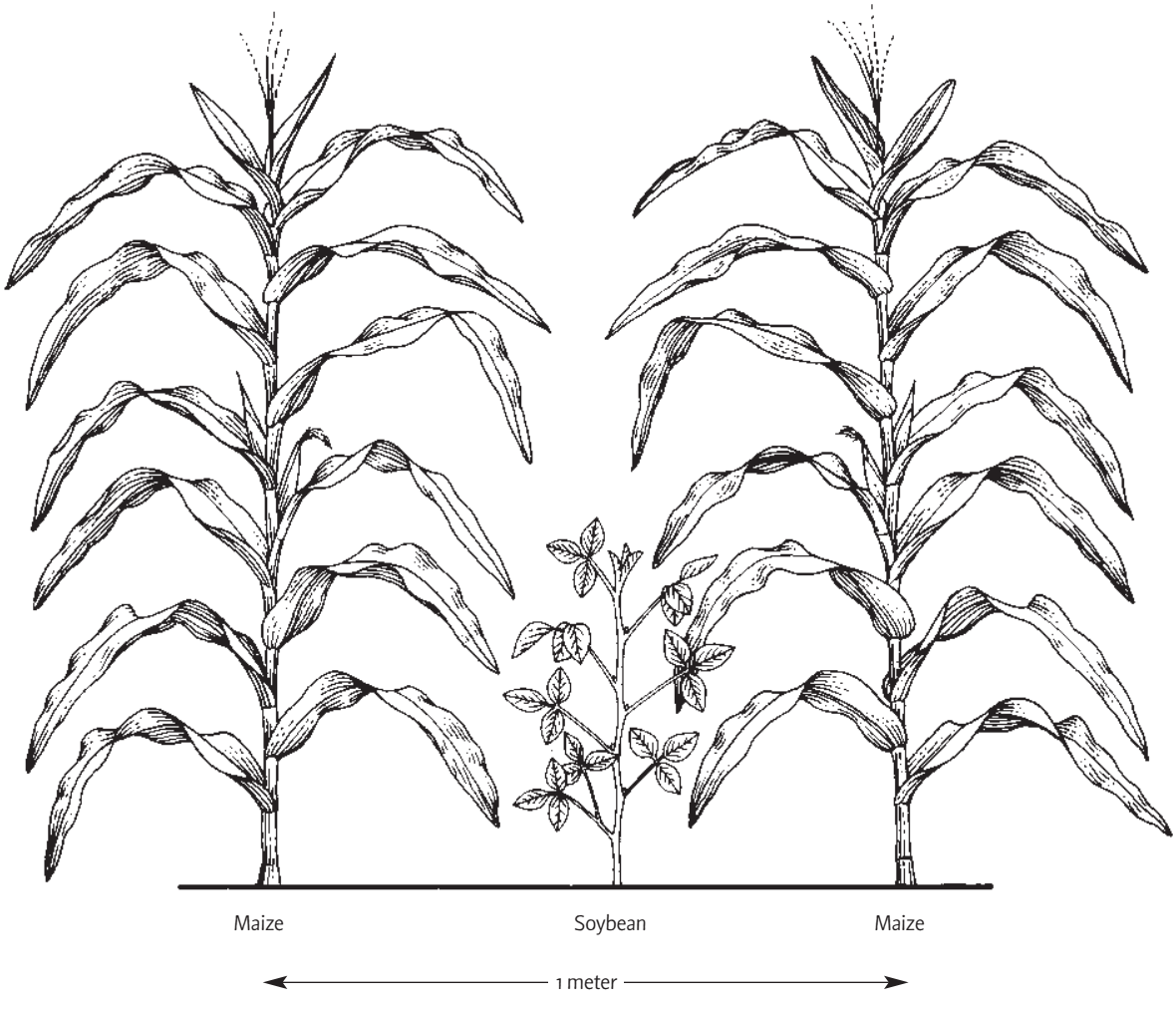
Brazil is the "last of the big dominoes" in the soybean market still resisting the GM onslaught. *"If Brazil legalizes biotech production"*, says Bob Callanan, a spokesman for the American Soybean Association, *"Europe and Asia would have almost nowhere to turn for adequate supplies of non-biotech soybeans"*. The United States, Brazil and Argentina account for about 90% of soybean exports with Brazil occupying 26.4% of grain, 24.8% of soybean meal and 16.2% of soybean oil exports worldwide. The demand for non-biotech soybean has grown to 25% of the EU market, 44% of which is supplied by Brazil (Pelaez and Schimidt, 2001). The Brazilian anti-GM position is therefore decisive for the future of GM agriculture as a whole, for as Callanan says, *"if that (Brazil) goes, it's all gone"*.

Having this picture in mind Brazilians have to decide where their strategic interests lie. According to the Brazilian government, the transnational corporations like Monsanto and Syngenta and the big soybean producers, the country will lose markets if it lags behind in biotechnological improvements in soybean production. Nevertheless, sober assessments of agricultural performances, costs and market opportunities dismiss this position as completely unreal. This article shows that Brazil is doing well without GM soybean, and what's more, that agroecological soybean production is a viable and competitive option for many small-scale farmers in Brazil

Conventional non-GM soybean production

Over the past 30 years soybean production has developed enormously in Brazil, with increases in both yields and area planted. The most spectacular growth has been in the state of Mato Grosso and the Cerrado area of central Brazil. Here soybean yields have more than doubled, whereas harvested areas have increased about tenfold. Given the relatively low cost of land clearing in Brazil, it is likely that soybean production will continue to increase in the years to come.

During this period, soybean production systems have been able to reach this level of high performance with reduced costs



Intercropping - one feature of the agroecological system of soya production (diagram from "A farmer's primer")

because of strong inputs from public research. Conventional genetic improvement has permitted farmers in various ecosystems to choose from around 170 varieties. In addition, the widespread adoption of nitrogen-fixing bacteria (NFB) eliminated the use of expensive nitrogen fertilizers. Moreover, the major pest threat to soybean production in Brazil, the *Anticarsia gemmatalis* worm, is controlled with a cheap biological agent, *Baculovirus anticarsia*.

Considerable reduction of Soybean production costs have also been due to the fact that at least 30% of the seeds used are produced by the farmers themselves. More recently conventional soybean farmers have very rapidly adopted less costly direct sowing, no till methods. In this system herbicides are intensively applied to suppress weed infestation resulting in heavy leaching of residual chemicals.

Comparing GM to non-GM soybean

The question to be answered is a simple one: does GM soybean have enough advantages to compensate for the risks of adverse impacts? If we compare yields of Brazilian non-GM soybean to USA yields (50% planted to GM soybean), the latter attained 2,560 kg/ha in 2000/01, and the former 2,710 kg/ha. In the 5-year period since the introduction of GM soybean in the USA the average yield was 2,520 kg/ha. compared to 2,400 kg/ha. in Brazil (Pelaez and Schimidt, 2001). Even though the USA has increased its acreage of GM soybean drastically in this 5-year period, the figures indicate that the yields of non-GM soybean in Brazil have increased faster than soybean yields in the USA with GM varieties.

Production costs are found to be higher for GM soybeans. In 1998/99 GM soybeans cost 611.70 US$/ha in Illinois, USA, whereas conventional soybeans cost 373.80 US$/ha in Mato Grosso, Brazil – a marked difference to GM soybeans!

Theoretical calculations on what GM soybeans would cost in Brazil also showed a disadvantage against the conventional product. Admitting industry claims of 30% herbicide reduction as true, GM soybeans would still cost 24.75 US$/ha more than conventional soybeans. Costs of GM seeds (76.50 US$/ha) clearly outweigh herbicide costs reduction.

This comparison can be taken further by looking at the export markets to see where Brazilian interests reside. With the increasing demand for non-GM soybeans from Europe, Brazilian exports have soared from 11 million tons in 1999 to 14 million tons in 2000, whilst US exports have stagnated. Moreover, non-GM soybeans have got a premium of 11 US$/ton, whereas prices for biotech products have dropped (Pelaez and Schimidt, 2001).

Apart from economic concerns, there are also environmental concerns. Scientists have warned against the intensive use of herbicides as these chemicals can have harmful effects on soil bacteria. As research in the USA indicates, decreased nitrogen fixation is a likely explanation for the 5-10% yield drag of RR GM soybeans when compared to otherwise similar conventional varieties (Benbrook, 2001). This negative impact will be far more pronounced in Brazil as varietal improvement has been geared to increase response to NFB (Nitrogen Fixing Bacteria). If GM soybean has negative impacts on NFB, then the losses incurred by Brazilian farmers could be substantial, as the gain in terms of reduced nitrogen fertilizers amount to 1.8 billion dollars annually (Franco and Baldani, 1999).

With all these clear advantages for non-GM soybeans why have Brazilian farmers in the southern state of Rio Grande do Sul taken the risk of smuggling GM soybean seeds from Argentina? According to some big soybean producers it is a supposed benefit to farmers of 14.00 US$/ha by using GM soybean seeds. But, in fact, this claim is clearly untrue considering that the Brazilian farmers are getting their smuggled seeds at 16.40 US$ per bag whereas the real cost of a bag is around 57,40 US$. And this is only possible because Monsanto has chosen not to enforce its prohibition on the re-sale of GM soybean seeds on farmers in Argentina, a tactical move to facilitate GM acceptance both in that country and in Brazil.

The agroecological alternative

In southern Brazil, Agroecological soybean production is being developed as part of its family-farmer programme by AS-PTA (a Brazilian NGO) and the Farmers' Forum for the Southern Paraná Regional Development (see LEISA 17.03, 23-25pp). It is based on direct sowing, no-till using green manure varieties as cover crops and weed control based on mechanical/ hand weeding. It is reported to have minimum soil losses, minimal losses from leaching, and no soil, food nor water contamination.

If we compare agroecological soybean production with conventional systems in Brazil the advantages are astounding. Studies made by AS-PTA on the property of the Bischoff family - a family from the southern state of Paraná experimenting with agroecological systems - indicate a yield of 2,677 kg/ha from the soybean plot for the agricultural year 2000/01, whilst production costs were 240.95 US$/ha. Prices for conventional and organic soybeans also differed significantly, 17.20 US$ compared to 24.60 US$ per 60kg bag of grain. The Bischoffs who were testing the new agroecological alternatives for soybean production on a 2.4 ha plot are increasing the acreage by 300% for the 2001/02 season. In the nearby southeastern Paraná region agroecological soybean production is already a major economic alternative for family farmers, with nearly 400 of them involved in this activity since 1995.

How can such extreme cost differences between GM (USA), conventional (Mato Grosso, Brazil) and agroecological (Bischoff) soybean productions be explained?

The Bischoffs noticed that weed infestations have dropped by 50% in 4 years with continuous agroecological practices in their bean and maize plots. They expect this to be the case also in their soybean plots, further reducing their production costs in comparison to chemical systems. The Bishoffs do not use any chemicals in their system, adopting crop rotations, green manuring and biofertilizers produced on the farm. No pesticides or fungicides are used and the Bischoffs attribute this to crop rotations and the conservation of natural vegetation on the borders of the plots, which harbour predators of pests. They also use low doses of lime to correct soil acidity.

Around 10,000 family farmers in this region are involved in intensive experimentation on various agroecologial practices, particularly in soil management, traditional seed improvement and agroforestry. The Bishoffs, like all participants in this programme, have small holdings with diversified cropping systems, including beans, maize, soybeans, potatoes, erva mate (a kind of Brazilian tea) etc.

In the light of the figures presented above, we can conclude, beyond any doubt, that agroecological soybean production is competitive with both conventional and GM cropping systems, without the harmful impacts of the former and the apparent risks of the latter. Wider application of these experiments depends more on enabling public policies, mostly related to credit, rural extension and participatory research.

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