

The Expanding Soybean Frontier

Argentina's dangerous reliance on genetically engineered soybean

Within the last 10 years, Argentina's agricultural production system has become dominated by one crop: the genetically engineered *Roundup Ready* soybean developed by US agrochemical company Monsanto. The large scale environmental, social, and economic impact of the Argentinian soybean production is unprecedented.

According to a new report by U.S. agronomist, Charles Benbrook, the planting of 14 million hectares of a single, genetically homogenous crop has created a highly vulnerable agricultural production system (1).

One of the direct consequences of the soybean industry is massive forest destruction, and several million hectares of forest been already been destroyed to make room for soybean plantations. The Argentinian government plans further expansion of the soybean industry for export markets (2). To fulfil this ambitious goal, an additional 4 million hectares of land will need to be converted to soybeans by 2010. This means that more forests will be destroyed.

The escalation in forest destruction is driven by the global livestock industry. The vast majority (above 80%) of soybeans are bound for animal feedlots, providing protein for cattle, hogs and poultry. The European Union (EU) is the largest importer of Argentinian soybean meal, with imports to EU agribusinesses accounting for almost 50% of all global trade in soymeal (3).

The consequences of continued soybean expansion will be irreversible. The ancient Argentinian forest, that are home to jaguars, pumas and monkeys, will be replaced with Roundup Ready soybeans; a major loss to global biodiversity. Proposed plans will irrevocably alter the remaining Argentinian wildlands, and encourage degradation of existing agricultural lands.

Of immediate concern are:

- Further forest destruction and loss of biodiversity due to planned increases in soybean production.
- Increased pesticide use and emerging weed resistance to herbicides.
- Less healthy soil and increase of pests and plant deceases.
- Reduced food security: soybeans are for export, not food for the poor.
- Loss of Argentinian competitive edge.

Problem: Over reliance on a single technology

The Argentinian soy production uses genetically engineered (GE) seeds that are resistant to the herbicide glyphosate, marketed under the trade name 'Roundup'. Roundup Ready seeds are planted using 'no-till' farming technologies. Roundup Ready soy relies on repeated herbicide applications to control weeds.

Since 1996, Argentina has increased soybean production by 8 million hectares (twice the size of the Netherlands), transforming many wildlands into agricultural monocultures (1, p.25). By 2002, 99% of Argentinian soybean acres were planted with Roundup Ready seeds (4).

The conversion of forest into industrialized production systems generally triggers decreases in soil fertility, increases in soil erosion, and loss of soil organic matter (5). Argentinian agriculture has traditionally coupled livestock production with diverse crop rotations to maintain soil quality (1, p.20). Monocultures of Roundup Ready soy have destroyed traditional farming systems and drained soil fertility.

There is a growing body of scientific literature to suggest that the adoption of massive monoculture

technology intensifies pests and disease pressure, degrades soil quality, and damages important microbial processes.

Forest destruction and loss of biodiversity

After Roundup Ready technology was introduced in 1996, the pace of land conversion has increased dramatically. The soybean frontier has expanded deeper and deeper into the ecosystems of Argentina, with 5.6 million hectares of new (non-agricultural) land converted for soybean production since 1996 (1, p.25). Compared with conventional soybean production, the technology facilitates rapid expansion because it allows for soybeans to be cultivated in a highly homogenous process that requires less people, less skills and less costly machinery.

Soybean production has led to a forest conversion rate in Northern Argentina that is 3-6 times higher than the world average (1, p.24). The massive destruction of the forests, in particular of the Yungas and Chaco forests, has sparked violence and protests by agrarian families desperate to preserve their land (6). Also, these forests support diverse animal populations, including jaguars, pumas, monkeys, and more than 50% of all bird species of Argentina.

Emergence of Resistant Weeds

Roundup Ready technology leads to complete farmer reliance on herbicides (in this case glyphosate) for weed control. Excessive reliance on a single herbicide results in the spread of weed populations that can tolerate herbicide sprayings (7).

Ecosystem health is also threatened in this process. Continued proliferation of RR technology has forced soybean production from fertile agricultural lands into nutrient poor, marginal lands (1, p.22). This means that ever-increasing chemical inputs are needed to maintain high output

Several weeds species of Argentina have already developed tolerance to glyphosate (7,8,9,10). Tolerant weeds require even higher doses of glyphosate. A vicious cycle develops in which herbicide usage continues to increase. Total glyphosate use on soybeans in Argentina has increased 56-fold in the last six years (1, p.32). Eventually, tolerant weeds will evolve complete

resistance to glyphosate, and require increasing applications of more toxic herbicides.

The economic and environmental consequences of herbicide resistant weeds are evident in the United States where the weed "marestalk" has developed glyphosate-resistance and infested millions of acres (1, p.34). Farmers are now forced to use increasingly toxic herbicides such as 2,4-D and dicamba (1, p. 34). Argentina will face identical challenges given their current reliance on glyphosate and their need for additional rescue-treatment herbicides. Since 2001, the volume of the herbicide dicamba applied in Argentina has increased 157% (1, p32). The situation is potentially harmful for human and animal populations, and is unsustainable also from an economical perspective.

Less healthy soil and increase of pests and plant deceases

Roundup Ready soybeans have irrevocably altered agricultural ecosystems. Heavy herbicide applications and widespread planting of Roundup Ready soybeans has led to increases in pest and disease severity (1, p.2).

Fusarium (a fungi producing toxins which can be damaging to human and animal health) has been shown to increase following glyphosate application on Roundup tolerant wheat (11). Contamination of crops by fusarium can lead to serious reproductive diseases in animals and spell economic disaster (1, p.34).

Soybean rust, another threatening plant disease, is predicted to reduce yields on 3.5 million Argentinian hectares (12). The invasive nature of the disease comes as welcome news for fungicide manufacturers such as BASF, Syngenta, and Bayer, whose aggressive marketing campaigns promote these toxic fungicides (1, p.36).

Roundup Ready soybeans may be even more vulnerable to diseases when plants lack nutrients. In healthy agricultural ecosystems, nutrients (for example nitrogen) can be provided by associations with microbes (such as nitrogen-fixing micro-organisms) that benefit crops. Research has shown that fewer nutrients are provided from these beneficial relationships in Roundup Ready soybean fields (13).

Soybeans for export, not food for the poor

Paradoxically, the rapid expansion of soybean production has reduced Argentina's food security (1, p.26). Hectares once producing subsistence crops and legume forages now produce only soybean monocultures.

From 1996 to 2002 (the period of major soybean production expansion) the number of Argentinians lacking access to basic nutrition grew from 3.7 million to 8.7 million (14). Production of meat, dairy products, and eggs has dropped significantly, to be replaced by soybeans destined for export markets (1, p.26).

In response to the alarming increase in hunger and poverty, the campaign "Soja Solidaria" was launched in 2002 (15). Soybean producers were asked to donate 0.1% of the years harvest to feed the poor. This program met with criticism from doctors stating that soybeans are not an appropriate response to malnutrition (1, p.28). It should also be noted that soy has never been part of the typical diet of Argentinians.

The Argentinian government now acknowledges that soybean industry growth has triggered social problems (16), but economic dependence on this export market continues to deepen. Since 1997, soybean exports have increased 125% (17). Governmental dependence on soybean revenues has fuelled the rapid industrial expansion but accrued little benefit to the people of Argentina. Soybean export taxes accounted for 12.5% of total government revenue in 2003 (1, p.4). The export tax was originally justified as a means of financing the social welfare system but only one-third of collected revenue was actually allocated to the national welfare plan in 2003 (1, p.16).

Loss of Argentinian competitive edge

For a nation suffering from international debt, rising unemployment, and widespread poverty, Roundup Ready soybean production has offered little compensation, and Argentina's economic vulnerability has been worsened by the volatile world soybean market (18).

The financial advantage of Argentina's soybean industry was initially based on access to reduced seed and herbicide prices. Cheap glyphosate and trading of illegal Roundup Ready seeds resulted in production costs that were approximately 25%

lower than in the U.S (19). Recent rises in glyphosate prices in Argentina (20), and announcements that Monsanto intends to collect retroactive royalty payments, and enforce patent laws on the Roundup Ready technology will likely eliminate this Argentinean profit margin (1, p.15).

A recent report by a team of U.S. scientists found that Argentina soybeans contain 5-10% less protein, with lower levels of important amino-acids, than soybeans from competing countries (21). Poor quality soybeans also means less revenue. Buyers of Argentina soybeans will likely seek price concessions.

Soybean exports destined for Europe face additional challenges. In 2006, the EU permit for Roundup Ready soy will expire and a new authorisation will be required (1, p.18). There are unresolved issues regarding the long term consequences of releasing genetically engineered organisms in the environment, and specific irregularities associated with Roundup Ready soy. The discovery of unintentional fragments of DNA inserts in Roundup Ready soy (22) may have resulted in unexpected changes to the protein chemistry of the plant. Differences in phytoestrogen levels between GE soy and non-GE soy have been found (23). These differences were not documented in the original food safety assessment.

There are additional global consequences of growing genetically engineered organisms. As seen in the genetic contamination of traditional Mexican corn varieties with GE corn (24), GE soybeans are a genetic threat to the wild soybean species of China. China is a major importer of Argentinian soybeans (1, p.17) and accidental release during import, transport or processing poses a major risk to related wild soybean species. The dire consequences, both globally and locally, of the GE soybean production need to be considered.

Unacceptable consequences for Argentina

Growth in soybean production has clearly taken an unacceptable economic, social, and environmental toll on Argentina. In the last two years almost 850,000 hectares of forest has been converted to soy (1, p.22), and an even faster rate of wild land conversion is necessary in the next 5 years to meet scheduled governmental goals.

Stagnant yields, escalations in pest and disease pressures, and rapidly diminishing soil fertility have reduced profitability and increased environmental degradation. The introduction of Roundup Ready soybeans has caused an increase, not decrease, in pesticide use in Argentina and accelerated the emergence of resistant weeds. Growing reliance on GE technology packages will exacerbate these problems.

Greenpeace demands

- Not one single hectare of forest or other natural ecosystems should be converted to soy plantations in Argentina. We call on the Argentinian government to take immediate action to protect Argentina's forests and on international institutions and banks to stop financing unsustainable agriculture and forest conversion in the region.
- The use of genetically engineered soy in Argentina should be phased out with a view to implementing a ban on all GMO releases. The Argentinian government must respect consumer opposition to GMOs by providing its citizens the right to reject GMOs through mandatory food and feed labelling and withdraw from the US-led WTO case against the (now historical) *de facto* ban on GMO approvals by the European Union.
- The European Union – a key market for Argentinian GE soy (used for animal feed) – should ban Roundup Ready soy . Greenpeace calls on EU Member States not to re-approve RR soy when Monsanto's approval for use of RR soy expires in 2006. Moreover, the EU must provide its citizens the right to reject GMOs in food production by introducing mandatory GE labelling for eggs, meat and dairy products if GE animal feed has been used.
- In China – another major market for Argentinian GE soy – the risk of genetic contamination of the worlds' center of soy biodiversity through GE soy imports must be acknowledged. Strong measures to avoid such contamination must be taken by the importers of GE soy and the Chinese government, by banning GE soy imports into China.

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