

Genetically engineered soya – an industrial wasteland?

Soya (*Glycine max*) is a small component of South Africa's agricultural economy. However, at the global level, soya dominates the world supply of edible vegetable oil and high protein animal feeds. The United States, Brazil, and Argentina account for over 90% of world soybean production. Between 1993 and 2002, world production of soya increased from 115 million tons to 180 million tons. South Africa is a net importer of soybean and its 2002 harvest of around 220 000 tons made up only 0.7 per cent of total agricultural value. In 2001, the first permit was granted to commercially grow genetically engineered (GE) soya in South Africa and GE soya now makes up an estimated 30% of the total crop.

This briefing looks at soybean production in South Africa and at the uptake and impact of GE varieties. It also extracts some lessons from Argentina where soya has been grown for much longer.



Soybean farming in South Africa

Mpumalanga is the main growing area for soybean, followed by KwaZulu-Natal and the Free State. Farmers plant the crop in November and harvest it in April. Soybean production is essentially confined to large-scale commercial farmers, as it is not an appropriate crop for small-scale farmers due to high input costs and low profitability. Soybean has been grown for the past 20 years in South Africa, but only in the past five years has become a major cash crop. The yield for 2004 was 180 000 tons, lower than for previous seasons

Most soybean is used for animal feed and this market is growing due to a shortage in fishmeal. The soybean market is split into oil, whole soybean and soya protein meal. The oil has industrial and edible uses, whole soybeans are used for human consumption and the protein meal is used for human consumption and animal feed. Sasol is planning to bring a bio-diesel plant into operation in the near future and will require 400 000 tons of soya to supply this plant, which is expected to triple soya production in South Africa.



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GE soybeans

Roundup Ready (RR) soya was introduced in South Africa in 2001. The seed is genetically engineered to resist Monsanto's RoundUp, a glyphosate-based broad leaf herbicide, making it possible for farmers to spray with RoundUp to control weeds without harming their crop. Developers and stockists of GE soya seeds include Monsanto, Pannar, Pioneer Hi-Bred International and Link Seeds.

For soya, seed is by far the highest input cost and prices vary from company to company, while the difference between GE and non-GE seed is not as big

differ somewhat from other crops because the seeds do not regress over generations like hybrids and can be saved for up to 10 seasons. Farmers therefore typically save soya seed. The technology agreement accommodates this practice on condition that farmers pay the technology fee each year that they use saved GE seed to plant.

Although some seed companies feel that uptake of GE soya has not been as rapid as they expected others say it has been good. However, no figures are available to



	RR soya seed	Non-GE soya seed
Price per 25kg bag	R 267	R 207
Price/ha	R 801	R 621
Additional price/ha	R 180	

as with cotton and maize.

As with other GE crops, farmers must sign a technology agreement in which they undertake not to distribute the seed or use it for any other purpose apart from planting. The terms of the soybean agreement

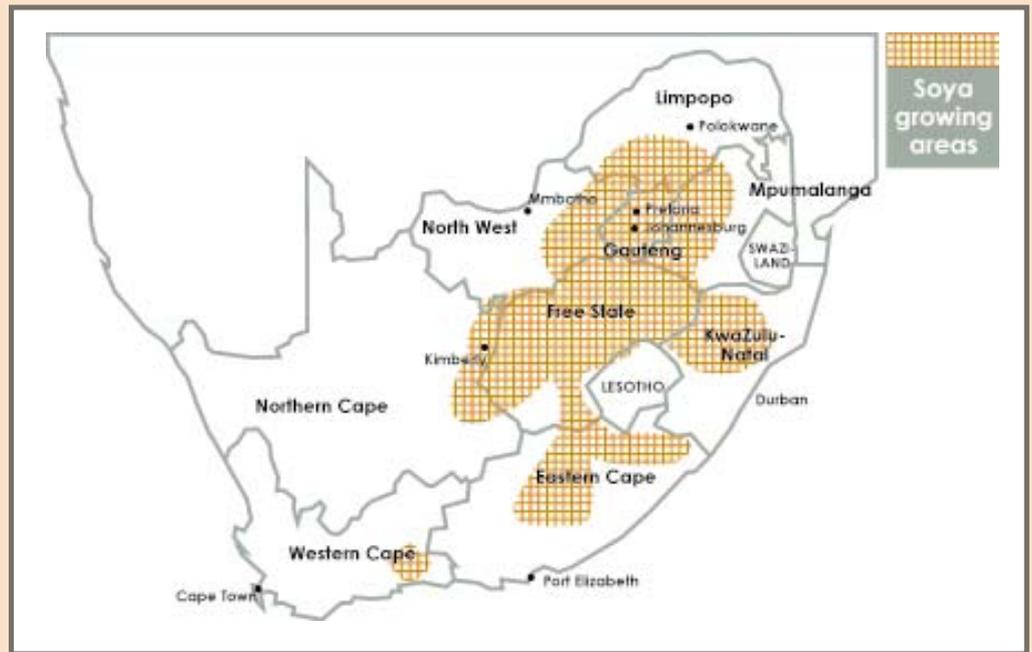
support these perceptions. There appears to be some regional variation with good uptake in some areas, for example south of Middelburg in Mpumalanga province where light soils are prone to weed infestation.



The market for GE soybean

Some farmers have opted to remain GE free partly because they are not convinced that GE soybean offers significant advantages on farm and partly because they believe there is a market for non-GE soybean. However, investigations by Biowatch show that present transport and storage arrangements are not able to ensure that GE and non-GE seed remain separate.

While the public in South Africa is still fairly unaware of the environmental and health issues associated with GE farming and GE products, the manufacturers and processors who are the main buyers of soybean have different attitudes depending on their products and markets. Specialised Protein Products (SPP), a Denel subsidiary producing soybean ingredients for the general foods, dairy and processed meats industries, requires non-GE soybean. Consequently, silos supplying SPP are required to store non-GE soybean separately. However, it was recently found that of the six 'GE-



free' silos, four were contaminated with GE soya. This underlines the concern that not nearly enough is done to ensure that segregation takes place and that farmers and silo-mangers understand the implications of mixing GE and non-GE soya.

The main buyers of GE soybeans are Epol

(Pty) Ltd, Meadow Feeds, Afgri Animal Feed, SPP and other small feed millers. Companies that buy GE-free soya include SPP, Snowflake, Nedan oilmills and other smaller processors. Sasko Milling & Baking, one of the biggest bread manufacturers, does not require GE-free soya from their suppliers.

Impacts of GE soybean

► Environmental impact

The soybean is a self-pollinating crop and cross-pollination is not as significant an issue as with maize. The plant originates in Asia and has wild relatives in Asia and Australia. GE soybean has been planted for a relatively short period of time in South Africa and it is too early to assess possible longer-term impacts on the economy, environment and health. But one only has to look at the case study of Argentina to predict some of the future impacts of GE soya. These include the emergence of resistant weeds, new weed communities, increased pesticide use, health problems, rural poverty and deforestation.

► Farmers

Of farmers interviewed by Biowatch, most who have planted GE soybeans say they will continue to plant them mainly for ease of management. Most growers think it is



too early to notice any environmental changes because the GE soybean has only been around for about two years. In general farmers have little knowledge of, or interest in, what happens to the crop once it leaves the farm. Non-GE farmers have expressed doubts about the advantages of GE seed and are concerned about whether there is a sustainable market for GE soybean. There is no evidence of higher yields and actually the first GE soya varieties had lower yields than conventional varieties.

Farmers rely heavily on seed suppliers for information about cultivation practices and possible environmental or market related risks. However, opinions on these issues vary from one seed company to another. Some are convinced that GE soybeans are very safe with a lot of potential in South Africa, and that they help marginal farm managers to become good managers. Other seed companies are concerned at the lack of information provided to growers and even seed representatives. There is a view in the

industry that research is uncovering negative aspects of GE soybean and maize. One seed company revealed that there have been some problems with the performance of GE soybean in the country with lower yields and another was concerned about the loss of potential export markets.

► Contamination of non-GE soya

Biowatch became aware that a farmer in the Brits district was turned away from the local silo because his soybean crop was contaminated with GE soybean. Upon further investigation, it became clear that this was a case of farmers exchanging seed, a common practice amongst farmers. The big difference here is that this was GE seed, and the farmer did not realise or understand the implications of planting GE seed. What has been shown over and over is that non-GE crops cannot co-exist with GE crops - a choice has to be made.



Argentina: A case study of GE soybean

"It must be pointed out that Monsanto used Argentina like a launching platform for transgenic soy, at a time when the world hadn't determined to accept it, and, in this sense, Argentinean production constituted the critical mass in international trade for defeating the barriers to transgenic products." Dr. Nestor Vittori, president of the Confederation of Rural Associations of Santa Fe.

Little more than a decade ago, Argentina was still famous for its waving pampas and herds of cattle. Today it is known as the "soybean republic" as the production of soya has grown from 9 500 ha in the early 1970s to over 14 million ha in 2003/2004, the majority of which is GE. The country exports some 90-95% of its production, mostly to China and Europe. To a large extent, the livestock feed industry drives the market for soya

products. In 2002, the export of soya and soya products represented 28% of the country's income earned from exports. Argentina has gone the soya export route mainly to service its foreign debt, which stood at US\$198 billion in 2002.

Similar to what has happened in South Africa, GE crops were introduced in Argentina without informing the public or even the

National Congress. The legislative process and administrative procedures have also come under heavy criticism as being inadequate and designed to support companies rather than to ensure biosafety. Companies are also allowed to keep information confidential. All the seed companies have a licence to use Monsanto's RR technology.

Initially Monsanto did not charge a licence fee on RR soya, but once the crop was planted widely, the government was pressurised to allow companies to collect royalties from the producers of RR soya. From Argentina, GE soya seed spread illegally to Brazil, Paraguay and Bolivia. These countries never legalised GE crops but despite this, Monsanto is demanding royalty payments from these countries as well.

The consequences of GE soya in Argentina

The rapid introduction of GE soya in Argentina needs to be seen within the context of:

- ▶ The country's economic collapse, structural adjustment programmes, and huge foreign debts; and
- ▶ the introduction of direct drilling or no-tilling farming methods, introduced to combat soil erosion but leading to a problem with weeds which the RR soya temporarily solved.

Concentration of capital and land

Since the introduction of GE soya, several grain companies and bigger farmers rent land from small farmers to produce RR soya. Small farmers cannot compete, as they cannot afford the big machines used in the no-tilling method nor the aerial spraying programmes. About 150 000 small farmers have lost their land and livelihoods in the process and moved to cities.



New diseases and tolerant weeds

The high use of RoundUp has led to the appearance of weed species that were not previously common, forcing farmers to spray other herbicides to control these and volunteer plants. There has also been an increased incidence of the *Fusarium* fungus, pointing to a relation between glyphosate use and the incidence of *Fusarium*. The fungus *Phakopsora pachyrhizi*, or soybean rust, the most destructive soybean disease, has also for the first time appeared in Argentina, Brazil and Paraguay.

Monsanto charges patent fees, retrospectively

Monsanto introduced RR soya in Argentina without a patent in 1996. Now it is reported that Monsanto is pressurising the government to pay US \$300 million to cover licence fees for RR soya exported since production started to countries where the RR gene is registered. This should sound an ominous tone for Africa where companies are promising to 'transfer' this technology for 'free' for the benefit of Africa.

It would appear that the only way forward for indebted countries such as Argentina is to exploit their natural resources for export, regardless of the needs of their citizens and the threat to the environment in the short, medium and long term. Argentina has fallen into the trap of swapping foreign investment and cash crops for food crops and its citizens now reap the bitter harvest. GE crops have multiplied this effect many times and the GE companies have now returned to reap their profits.

Increased pesticide use

Since GE soya was introduced in Argentina, the volume of glyphosate used has risen from 13.9 million litres in 1997-1998 to 56 million litres in 1998-1999 and has now passed 150 million litres. Glyphosate is being used in combination with 2,4-D, metsulfuron methyl and imazetapir. Bayer CropScience recommends the use of atrazine for soya. A Syngenta advertisement recommends paraquat and atrazine to get rid of volunteer soya plants. RR soya growers in Argentina are using more than twice as much herbicide as conventional soya farmers, largely because of unexpected problems with tolerant weeds.

Replacement of traditional crops and loss of food security

Argentina used to be a country that produced eight times as much food as its population needed. Production of many staples, including milk, rice, maize, potatoes and lentils, has fallen sharply and prices have risen as these products now have to be imported. Dairy farms have decreased by 50% since early 90's and the table below shows the extent to which other grains have been replaced by soya.

Soya is being promoted as a staple food and the use of soya milk for children has caused serious malnutrition problems. This malnutrition is partnered with increased poverty in a country where GE crops have been most successfully adopted. In the 1970s, 5% of households lived below the poverty line. By 2002, this figure had increased to 51%.

Year	Rice	Maize	Sunflower	Wheat	Soya
1996 / 97	226.573	4.153.400	3.119.750	7.366.850	6.669.500
2001 / 02	126.519	3.064.276	2.050.365	7.108.900	11.639.240
Change	- 44,1%	- 26,2%	- 34,2%	- 3,5%	+ 74,5%

Table2: Changes in the production of the most important crops between 1996/1997 and 2001/2002 (in ha)

Source: D. Domínguez, *Up to the neck in soya*, 2003 in Semino et.al (2004)

Health impacts

The New Scientist reports that the increased spraying of herbicides to control persistent weeds has led to reported cases of children breaking out in sores and dying chickens and pigs. Communities all over Argentina report health and environmental impacts as a result of the increased use of pesticides. The planting of glyphosate resistant crops has led an increase in glyphosate use but also an increase in the spraying of other more damaging herbicides to control volunteer plants.



Deforestation and infertile soil

The World Wildlife Fund has released a report stating that the expansion of soya has directly led to massive destruction of forests and savannah in South America. An estimated 22 million hectares, an area roughly the size of Great Britain, will be destroyed by 2020 if the current trend continues. These forests and savannahs are home to many threatened species but also to indigenous peoples. A number of areas with official conservation status have been put under soya cultivation. Soya is very efficient at extracting nutrients from the soil and destroys soil fertility when it replaces the traditional multi-cropping system of farming.



References:

Research in this briefing paper is based on that done by Biowatch researchers. Other key references include:

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Conclusion

The emerging South African experience and well-documented Argentinian experience suggest a number of lessons we would do well to heed. GE soya is not grown as food for Argentina but as animal feed for the EU and other export markets. It is in essence an industrial activity with devastating environmental and human consequences. Soya only benefit big

commercial growers and has therefore little place in a food security strategy for Africa. GE soya has led to a massive increase in the use of pesticides causing irreparable harm to the environment, but also seriously affecting the health of people. Because of the low profit margins for farmers, the technology fee is initially waived or low and farmers easily buy into

this package of GE soybean and RoundUp with the promise of saving cost on labour. However, once the crops have been established and farmers options diminished, this fee is now insisted on. Africa should learn from this experience and protect its own interests and food security.

