Unpacking the Agro Biotech Engines

How the leading seed and agrochemical corporations are driving the biotech agenda

A Polaris Institute report
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About this paper

This paper is one of three background documents to our publication *Galloping Gene Giants; How big corporations are re-organizing their push for a biotech future and what can be done to challenge this agenda* [prepared by Tony Clarke with (Brenda) Kimiko Inouye, February 2002]. The other two papers focus on the biotech activities of: 1) the leading pharmaceutical corporations; and 2) the leading food processing corporations. These papers will be supplemented with other tools such as fact sheets and corporate profiles to help anti-biotech activists develop campaigns that directly target the biotech engines. All of these resources will be available on the Polaris Institute website: www.polarisinstitute.org.

This paper is meant to be a tool for anti-biotech activists. It provides background information on the world's leading agribusiness (seed and agrochemical) corporations and how they are using biotech to advance their overall agenda. These corporations are Monsanto, Bayer, Syngenta, DuPont, Dow and BASF. They are what we refer to as the agro biotech engines. The paper will reveal:

- How the agro biotech engines have reacted to the popular resistance against genetically engineered (GE) crops and foods;
- The agro biotech engines' annual revenues and profitable GE products;
- The influence of the agro biotech engines on governments, universities and industry groups; and
- Resistance struggles of farmers and other activists in the global North and South

The information in these sections is presented critically and is intended to provide a strong rationale for challenging the agro biotech engines.

This paper, as well as the other resources mentioned above, are part of the Polaris Institute's program "Gearing up for the Biotech Century" through which we will be working with various social justice networks concerned about genetic engineering and related issues. We hope that our work will contribute to the larger Biojustice movement – one that will build upon many struggles.

Acknowledgements

I would like to acknowledge the importance of ongoing struggles for indigenous peoples' rights, peasants' rights and farmers' rights in the North and South. I would also like to acknowledge the work of researchers and activists involved with anti-biotech campaigns, and campaigns in support of the struggles mentioned above, which have been essential contributions to my work and this paper.

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Introduction

As we described in *Galloping Gene Giants*, the leading agro biotech engines are Syngenta (created from the merger of the seed and agrochemical units of AstraZeneca and Novartis), Bayer (which bought out Aventis' agribusiness unit in 2002), Monsanto, Dow AgroSciences (owned by Dow), DuPont (includes Pioneer Hi-Bred) and BASF. The agro biotech engines have been investing in biotech research and development since the early 1980s. They control 100 percent of the genetically engineered (GE) seed market, almost one quarter of the entire commercial seed market and 80 percent of the global agrochemicals market.

Many of the agro biotech engines began selling their GE seeds to farmers in the mid to late 1990s. Along with the GE seeds came a new image called the 'Life Sciences.' The life sciences image was mainly used by seed, agrochemical, pharmaceutical and food conglomerates that had been investing in biotech research and development over the years. For corporations like Monsanto, Novartis, AstraZeneca, as well as DuPont to a certain extent, this image was used as part of a larger strategy to promote biotech while getting away from their reputations as dirty chemical corporations. In 1997, for example, Monsanto's slogan became "*Food, Health and Hope*" as it began its spending spree on seed and plant biotech companies and divested its industrial chemicals unit Solutia (note that this did not include its agrochemical operations).

Concerned that the negative publicity of GE crops would harm their more lucrative pharmaceutical operations, the leading life science corporations began distancing seed and agrochemical operations from pharmaceuticals in 1999.

Under the life sciences banner, corporations used biotech to promote messages like biotech will 'feed the world.' As well, they boasted of products like crops genetically engineered to produce drugs -- the so-called 'synergies' between seeds, pharmaceuticals (for humans and animals), vitamins, chemicals and food products using biotech.

Despite these attempts to promote biotech in a spotlight of 'health' and 'hope,' people began to actively oppose the agro biotech engines' attempts to force GE foods and crops on them. Resistance was strong enough to cause market shutdowns – bans and moratoriums on the selling and import of GE products from major GE crop producing countries. This continues to be the most significant threat to the agro biotech engines.

Concerned that the negative publicity of GE crops would harm their more lucrative pharmaceutical operations, the leading life science corporations began distancing seed and agrochemical operations from pharmaceuticals in 1999. Novartis and AstraZeneca divested their agribusiness units, which then merged to create Syngenta. Monsanto, which had merged with pharmaceutical giant Pharmacia, was later divested

as a separate agribusiness corporation. Following the StarLink disaster*, Aventis divested its agribusiness unit, Aventis CropScience, which was bought up by Bayer. Notably, none of these changes actually meant that the agro biotech engines gave up on biotech. Furthermore, there are still close ties that exist between agro biotech engines like Syngenta and Monsanto and their former parent pharmaceutical corporations, also major biotech players.

The agro biotech engines, as well as the large grain processing corporations like Archer Daniels Midland and Cargill, continue to plow ahead. They have been aggressively pushing to keep international markets open for biotech crop commodities. The agro biotech engines have a lot at stake if market shutdowns continue since they have invested billions in the research and development of biotech over the past twenty years.

To fully understand the workings of the agro biotech engines and their attempts to get the public onside of biotech it is worth looking at how one corporation has changed its image within the past few years. The corporation we will look at is Novartis, which has not only been a leading player in the agribusiness sector, but is also one of the world's top pharmaceutical corporations. Novartis was very much active in the life sciences strategy, but it quickly changed its approach as the popular resistance against GE crops and foods grew. Responding very superficially to peoples' concerns, Novartis turned away from its economically questionable GE crops operations, but continued to promote biotech in other ways.

* Because of potential health hazards, StarLink *Bt*-corn has only been approved for use in livestock feed. According to scientists in the U.S. Environmental Protection Agency Scientific Advisory Panel, the Cry9 protein, present in StarLink corn, could potentially cause allergic reactions in humans. After September 2000, there were recalls of 300 processed food products due to the StarLink contamination. (In 2000, some 350,000 acres of this corn was planted in the U.S.). The disaster was exposed as a result of the Genetically Engineered Food Alert campaign, which called for increased testing and labeling of foods containing GE ingredients. Groups involved in the campaign include state Public Interest Research Groups, the National Environmental Trust, the Institute for Agriculture and Trade Policy, Organic Consumers Association, Friends of the Earth, the Center for Food Safety and Pesticide Action Network North America.

Novartis

Novartis began working on its life sciences façade in 1996 when it was created from the merger of two Swiss-based chemical/agribusiness/drug companies Ciba Geigy and Sandoz. The name Novartis was derived from Latin words meaning "new arts." For promotional purposes, CEO (Chief Executive Officer) Daniel Vasella wanted this to appear as a move away from being known as a chemical company, to being perceived as a new life sciences company.

Indeed Vasella was off to a good start with his 'newly transformed' entity. In terms of annual revenues, in 1996, Novartis was the No. 1 agrochemicals company worldwide, No. 2 in seeds and No. 3 in pharmaceuticals, not to mention 9th in animal health care. But just as life science corporations emerged, we began to see waves of resistance. People began to speak out and take action.

People protested at grocery stores, demanding that GE foods be pulled from the shelves. There were groups that destroyed field trials of GE crops, wanting to prevent genetic pollution and further development of these products. Commercial export farmers became concerned that the commodity value for their GE grain would go down. Farmers in the global South protested and burned GE crops. As a consequence, investors began to back off from the biotech sector. Financial consultants began advising clients not to invest in biotech stocks, particularly in the area of agro biotech. "Ag is a drag" became a popular slogan within investors' circles. Vasella's plans for a leading life sciences corporation soon changed.

To keep up a resilient front, Vasella, like most biotech proponents, denies that Novartis' restructuring activities had anything to with peoples' resistance against GE crops and food.

The change can be seen by comparing the company's 1998 and 1999 annual reports. In 1998, under the title *Global Performances in the Life Sciences,* Novartis' annual report boasted that is was a leader in the life sciences. But only one year later, the 'life sciences' term was not to be found in any of the company's propaganda, and Novartis began promoting itself under the new slogan "*Health, Care and Well-being.*" This switch was accompanied by the spin-off of Novartis' agribusiness unit, which was to merge with the agribusiness unit of another life science giant AstraZeneca. The divested units would form a new company called Syngenta, which became the No. 1 agribusiness corporation worldwide, bringing in annual sales of close to $7 billion in 2000. Novartis and AstraZeneca now consider themselves 'pure health care,' or pharmaceutical companies.

To keep up a resilient front, Vasella, like most biotech proponents, denies that Novartis' restructuring activities had anything to with peoples' resistance to GE crops and food. In the Novartis 1999 annual report Vasella states,

Indeed, plant biotechnology did deliver synergies between Seeds and Crop Protection. But, as our experiences grew, so did the realization that the synergies between Agribusiness and our other activities would remain marginal…Our decision (to create Syngenta) was mainly driven by the desire to focus and simplify our business portfolio…it was not influenced by

the hostile stance of certain activists who refused to consider alternate perspectives, spoke only of 'Frankenstein Foods' and went so far as to destroy field tests…[1]

Reality tells a different tale. In August 2000, in reaction to Greenpeace U.S. revealing that Novartis' Gerber baby food product line contained GE ingredients, Novartis announced that it would no longer use GE ingredients in any of its food products developed under its "Consumer Health" division. (Note that though divesting its agribusiness operations, Novartis has not dropped its food business, which operates under Novartis Consumer Health).

Meanwhile, on top of Vasella's denial, and despite attempts to address public concerns by eliminating these GE ingredients, Novartis Consumer Health's North America unit is a member of business lobby groups that fully promote biotech. One of these groups is the Grocery Manufacturer's of America (GMA), whose membership is stacked with food multinationals like Nestle, Coca-Cola, Pepsi and Unilever, as well as pharmaceutical giants like Pharmacia, Johnson & Johnson and Pfizer. Furthermore, the GMA itself is member to the Alliance for Better Foods – another biotech proponent. Gary Kushner, a lawyer who advises the GMA, explains the purpose of the Alliance,

Acting together, food companies, lawmakers, scientists, farmers and regulators must work to ensure that activists with a political agenda do not kill the promise of biotech foods. Acting together, we must speak to the promise of biotech foods in providing more plentiful, healthful and nutritious food for America and for the world.[2]

The Alliance is made up of a number of industry groups and was established in 1999, just as Novartis and AstraZeneca created Syngenta.

The Novartis story is a good example of how it and other biotech corporations are not moving away from GE, but simply want to get rid of the debate in order to create a less controversial and more GE-friendly climate for selling their products. To understand more it is helpful to examine some of the financial strengths of the agro biotech engines.

The Agro Biotech Engines

In 2002, the total seed and agrochemical sales of Syngenta, Bayer, Monsanto, DuPont, Dow, BASF and Dow were just over $24 billion (see table below, which is divided into sales figures for agrochemicals, seeds and then ranking for these categories). Syngenta was the top agro biotech corporation worldwide, with sales of $6.2 billion in 2002. Monsanto came in second with sales of $4.7 billion, then Bayer, with sales of $4.1 billion. DuPont, Dow, and BASF each brought in comparable figures all close to the $3 billion mark.

Top Six Agro Biotech Corporations: 2002 Sales and Rankings
(all dollar figures in billions, USD)

Company	Agrochemical revenues	Seed revenues	Agrochemical revenue ranking (globally)	Seed revenues ranking (amongst top six agro biotech engines)
Syngenta	$5.3	$.937	1	3
Bayer	$3.8	$.294	2	4
Monsanto	$3.1	$1.6	3	2
BASF	$2.8	None	4	Not ranked
Dow	$2.5	$0.190	5	5
DuPont	$1.8	$2.0	6	1
Total	$19.3	$5.02		

Source: Pesticide Action Network North America (www.panna.org) , Annual reports and communication with investor relations' departments.

The top six agro biotech engines control close to 70 percent of the $28 billion agrochemicals market (this figure includes sales of all leading agrochemical corporations, not just the ones listed above). Meanwhile, Monsanto and DuPont alone now control 90 percent of the American corn seed market and 70 percent of the Asian corn seed market. Monsanto, DuPont, Syngenta and Bayer control almost 100 percent of the commercial GE seed market, while Monsanto's GE seed technology makes up 91 percent of the total world area of commercial GE crops.

Importantly, agrochemicals make up a significant portion of the agro biotech engines' sales. As indicated in the table, the top agro biotech engines' total agrochemical sales in 2002 were approximately

$19 billion, compared to $5 billion for seeds. While the agro biotech engines might say otherwise, they have no intention of replacing their agrochemicals with products like pest-resistant *Bt* corn and cotton**. On the contrary, the agro biotech engines want to use GE technologies to increase sales of agrochemicals as well as increase their share of the seed market. Herbicide resistance in major crops is the main GE technology being used by the agro biotech engines to maximize sales. At the same time, the agro biotech engines are hoping to get their *Terminator Technology* (i.e. sterile seeds, see page 9) on the market so they completely stop farmers' seed saving practices and make farmers even more dependent on them year after year.

Following the Money: Profitable GE Technologies

The agro biotech giants want to invest in, and market, GE products that will be the most profitable to them and give them the utmost control over farmers' capital. Herbicide resistant seeds (which are sold as a package with a specific brand-name herbicide) and Terminator Technology fit this requirement, especially when they are applied to major commercial crops like corn, soybeans, wheat, rice and cotton. At the same time, on the horizon are biopharm crops – that is crops (like corn, soybeans, tobacco and rice) that are genetically engineered to produce substances that are not naturally occurring in plants, such as pharmaceuticals and industrial enzymes.

Herbicide Resistance

Herbicide resistant crops are a big money-maker for corporations that have traditionally been based in agrochemicals. What better way to guarantee a market than to trap farmers into buying multiple inputs from one corporation. Herbicide resistance is by far the number one GE crop trait globally. In 2000, herbicide resistant soybeans, corn and cotton made up 74 percent of commercial GE crops worldwide, while GE insect resistant crops made up 19 percent. (See "Major Crop Varieties in 2000" table on page 7). Multi-trait herbicide and insect resistant cotton and corn made up 7 percent of the total area of GE crops. Monsanto and Bayer currently have the biggest market share for herbicide resistant crops.

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Monsanto's Roundup Ready™ and Bayer CropScience's Liberty Link™ herbicide resistant crops are the most widely grown GE crops across the world. Bayer sells Liberty Link canola and corn while it licenses a "Liberty Link gene" to DuPont's Pioneer. Monsanto sells Roundup Ready corn, soybeans and cotton. Monsanto also licenses its Roundup Ready technology to a number of companies including DuPont's Pioneer Hi-Bred, which in turn markets canola and soybeans containing "Roundup Ready genes," and Garst (owned by Advanta), which markets Roundup Ready corn and soybeans.

** *Bt* crops, like corn and cotton, are genetically engineered to be insect resistant. *Bt*, short for *Bacillus thuringiensis*, is a naturally occurring soil bacterium that kills many kinds of caterpillars that eat leaves of crops. *Bt* crops are produced when crops are genetically engineered to contain the *Bt* gene.

Because of its Roundup Ready seeds Monsanto has been able to keep a strong market share of its Roundup herbicide, even though the patent for it expired in 2000. Despite the fact that there are over 50 generic producers of the stuff worldwide, Monsanto controls an 80 percent market share of Roundup globally.[3]

Major GE Crop Varieties in 2000

GE crop variety	Percentage of total area planted with major GE crop varieties (globally)	Corporations that market major GE crop varieties
Herbicide resistant soybeans	59%	Bayer Monsanto
Bt corn	15%	Dow Monsanto Syngenta
Herbicide resistant canola	6%	Bayer Monsanto
Herbicide resistant corn	5%	Bayer Monsanto
Herbicide resistant cotton	5%	Bayer DuPont Monsanto
Bt/herbicide resistant cotton	4%	Bayer Monsanto
Bt cotton	3%	Monsanto
Bt/herbicide resistant corn	3%	Bayer Dow DuPont Monsanto

The agro biotech engines are seeking as many profit opportunities as possible with herbicide resistant technology. This is not surprising when we consider that it took some 15 years to get herbicide resistant products from the research to market stage. This is a substantial amount of time for product development, especially since patent protection itself might only last some 20 years from the research phase on. And, put simply, time does mean money for the agro biotech engines. Calgene (now owned by Monsanto), Ciba-Geigy (merged with Sandoz in 1996 to become Novartis), DuPont, Monsanto, Dekalb AgResearch Inc. (now Dekalb Genetics, owned by Monsanto) and Rhône-Poulenc (merged with Hoescht to form Aventis in 1999, now owned by Bayer) – all had investments in herbicide resistant technologies from 1986 onwards.

In order to maximize its profit from, and influence over farmers, Monsanto enforces a "technology fee" and "Roundup Ready Gene Agreement." When farmers buy the Roundup Ready package, they are forced to pay Monsanto a Roundup Ready "technology fee" of $35 for corn and $5 for soybeans. Furthermore, Monsanto has a "Roundup Ready Gene Agreement" that farmers must sign when using the corporation's Roundup Ready products. This contract requires that the farmer:

- give Monsanto the right to inspect, monitor and test her/his field at any time, without prior notification;
- use only Roundup on the crop;
- not save or replant the patented seed;
- not sell or supply the seed to any person or entity.

Monsanto has actually contracted a private detective firm in the U.S. to investigate violations of the contract, and established toll-free lines, whereby farmers are encouraged to report on neighbours who might be saving Monsanto seeds. By January 1998, Monsanto stated that it had accused 100 farmers of breaking the growers' contract, and by the end of 1999, it initiated over 475 lawsuits for patent infringements and violations of the technology user agreement.[4] In May 2003, Kem Ralph of Covington, Tennessee was sentenced to 8 months in prison after Monsanto took him to court for saving GE cotton and soybean seed. U.S. District Judge Richard Webber also ordered Ralph to repay Monsanto $164,649 for the 41 tons of seed he was found to have saved in violation of the company's technology user agreement.[5]

Some of the agro biotech engines also want to maximize their application of herbicide resistant technologies, and in turn, herbicide sales, by applying them to other major commercial crops such as rice and wheat. Aventis CropScience (now owned by Bayer) grew 5 million pounds of Liberty Link rice in Texas in field trials in early 2001. (All 5 million pounds were destroyed, however, following the StarLink corn disaster). Meanwhile, both Monsanto and Syngenta have plans to release herbicide resistant wheat in the next few years. In a Monsanto press release from July 2001, John Redd, the global director of the company's wheat business, says,

> *Biotechnology has great potential for wheat. We are still several years from the first biotech wheat product, but now is the time to listen to the whole industry and help make sure the technology brings benefits and not concerns.*[6]

Monsanto has already submitted Roundup Ready wheat for government approval in both Canada and the U.S. and is hoping to release it at the same time in both countries. Canadian and U.S. government officials have suggested that Roundup Ready wheat could be approved for full commercial production as early as 2004.

Many export grain farmers in Canada are very concerned about Monsanto's push for GE wheat. Wheat is a major export market crop for Canadian farmers and many of the 70 countries that import Canadian wheat have already stated they will refuse Roundup Ready wheat or any wheat that has been contaminated by GE wheat. According to a study from the University of Saskatchewan (a key institution in the research and development of GE crops in Canada) growing GE wheat could cost Canadian farmers $185 million per year in lost sales.[7]

Sterile Seeds

One of the ultimate goals of the agro biotech engines is to have complete control over the seed purchasing practices of farmers. More specifically, the engines want a way to guarantee that farmers will come to them year after year to buy seed. This is why the agro biotech engines are anxious to get Terminator Technology (a term coined by the ETC group, see www.etcgroup.org) on the market. Terminator Technology makes any seed sterile after the first growing season, thereby making it impossible for farmers to save seed – the very basis of agriculture. Another Terminator type technology that the ETC Group calls *Verminator* or *Traitor* (and the industry refers to as Genetic Use Restriction Technology or GURTs), prevents growth processes such as germination, sprouting, flowering, fruit ripening, etc., unless plants are sprayed with a particular chemical.

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In pursuing Terminator Technology, the agro biotech engines want to further restrict farmers' choices. Farmers are already dependent on seed corporations each year. The agro biotech engines have made sure of this with their numerous patents on seeds. Also, farmers' seed saving has long been restricted because of hybrid seeds. Hybrid seeds were first made commercially available and became widely used in the early 1930s. Hybrid seeds are created through cross-breeding varieties within the same species (e.g. a naturally disease resistant variety of barley with a naturally high yielding variety of barley). Seeds saved from hybrid varieties do not produce offspring 'true-to-type,' that is, wholly consistent with the desirable characteristics (e.g. disease resistance and high yielding) of its parents. Thus it is difficult for growers to save seed from hybrid plants and expect similar characteristics in their offspring.

Martha L. Crouch, Associate Professor of Biology at Indiana University, points out one of the motives for Terminator Technology. According to Crouch,

> *It would be a big boost to seed company profits if people who now grow non-hybrid crops would have to buy new seed every year. This may have been the major incentive for developing the Terminator Technology.*[9]

Crouch says that hybrid seed for wheat, rice, soybeans and cotton, are not generally available. Farmers usually save the seeds from these crops and might not return to the seed company for several years, if at all, to buy a new variety.[8]

Terminator Technology was jointly developed by the United States Department of Agriculture (USDA) and Delta & Pine Land (D&PL) – the largest cotton seed company worldwide, which controls three quarters of the U.S. cotton seed market. A few months after the USDA and D&PL received a patent for their Terminator Technology, Monsanto announced that it would acquire the cotton seed company for $1.8 billion. Monsanto eventually backed out of the deal, however, because of widespread opposition to Terminator Technology. Farmers and non-farmers across the world have voiced strong opposition to the

commercialization and use of Terminator Technology.

In response to peoples' resistance, biotech proponents say that Terminator Technology actually acts as a biosafety mechanism by making GE organisms sterile after one generation, and is therefore a solution to genetic pollution. The reality is, however, that Terminator crops could contaminate non-Terminator crops. If farming systems are polluted with Terminator Technology, it could cause widespread and irreversible damage, especially since 15 to 20 percent of the world's food comes from farm-saved seed that, in turn, feed at least 1.4 billion people.

Soon after the patent was given to the USDA and D&PL for Terminator technology, the intention was made clear – it was about profit. According to Melvin Oliver, one of the USDA scientists who invented Terminator, "*Our system is a way of self-policing the unauthorised use of American technology…It's similar to copyright protection.*"[10] Oliver anticipated that seed companies, given their view that seeds mean profit and seed collecting by farmers is an act of intellectual property theft, would welcome the technology.[11]

While Monsanto and AstraZeneca (now Syngenta) stated that they would not commercialize the technology in 1999 (in response to peoples' opposition), they and other companies and public institutions – including DuPont, BASF, D&PL, as well as the USDA, and Cornell, Purdue and Iowa State universities – continue to develop and hold patents on Terminator Technology.[12]

BioPharm Crops

Right now, in open-air fields, crops that have been genetically engineered to produce things like industrial enzymes, contraceptives, growth hormones, vaccines, blood clotters and blood thinners, are being grown. There are over 400 biopharm products being developed for commercialization. In the U.S., 300 open-air field trials have been conducted, including biopharm plants that produce a chemical that induces abortion, as well as an allergenic enzyme known as trypsin.[12] In Canada, similar experiments are being conducted at government research stations.

The following are examples of the agro biotech engines' biopharm crop activities:

- ProdiGene, Pioneer Hi-Bred (owned by DuPont) and the USDA's Agricultural Research Service have jointly developed Avidin corn by inserting the gene for chicken egg avidin into corn. Avidin is a protein that inhibits growth in insects. Avidin corn was first grown in field trials in 1993. It is now being grown by farmers in the U.S. who are under contract with Stauffer Biotech. The resulting GE avidin is then sold as a research chemical through Sigma Chemical Company.

- Dow AgroSciences has invested $20 million in SemBioSys Genetics Inc. for the development of drugs, vaccines, industrial and feed products from canola. SemBioSys was founded in 1994 as a spin-off company from the University of Calgary, Canada. The current President and CEO of SemBioSys is Andrew Baum, former Director of Business Development for Monsanto. (He is also chairman of the board of BioAlberta, on the board of lobby groups BIOTECanada and the Biotechnology Industry Organization). SemBioSys also had a collaborative agreement with Syngenta's Torrey Mesa Research Institute, which is no longer in operation, to develop food, cosmetic and pharmaceutical products from biopharm crops.

One of the agro biotech engines' main arguments for biopharm crops is that growing drugs and chemicals in GE plants will be cheaper than conventional production methods, and lead to cheaper products for the consumer. Proponents claim that low cost contract farmers will replace high cost production facilities. In reality, however, the purification process for extracting drugs and chemicals from plants, as well as ensuring containment and preventing genetic pollution from biopharm crops, presents major costs and challenges to the industry.

How will the agro biotech engines try to cut their costs? According to some research scientists working on tobacco biopharm crops at Agriculture and Agri-Food Canada (AAFC), cutting regulatory hurdles should play a role,

> *The ability to provide low-cost recombinant biopharmaceuticals free from human pathogens and nearly unlimited scalability are the strengths of plant-based production systems. However, low costs will only be realized if regulatory restrictions are minimized and if recombinant protein accumulation is maximized.*[13]

Meanwhile, the consequences of weakly regulated biopharm crops have already been proven in the U.S. Experimental biopharm corn crops grown by biotech company ProdiGene have already contaminated soybean crops meant for human consumption.

In 2001, ProdiGene planted a field of biopharm corn crops in Nebraska that were engineered to produce a protein not proven safe for human consumption. It was a drug for treating diarrhoea in pigs. The following year soybeans destined for human consumption were planted in that same field. The biopharm corn sprung up in the field with the soybean plants and, in the end, contaminated 500,000 bushels of soybeans. As well, it is suspected that another field of ProdiGene biopharm corn crops grown in Iowa contaminated 155 acres of non-biopharm corn crops. Government inspectors ordered the contaminated crops be uprooted and burned. The USDA had established regulations for cleaning fields of corn seed, but clearly these regulations were not followed.[14]

Biopharm plants present serious threats to the environment (i.e. soil, water and air) and farmers. Farmers face losing entire fields of crops because of contamination from biopharm crops, as well as health risks from inhaling and coming into contact with these drugs and chemicals. They would also have to comply with extremely stringent growing regulations, such as strict on-site inspections, as well as undergo changes in practices and infrastructure that would be expensive and time-consuming. And, while farmers are being offered premiums to grow biopharm crops, the risks involved could cancel out these offers. ProdiGene-Stauffer Seeds, for instance, has already reneged on a 40 percent premium promised to farmers growing biopharm corn because of the problems the company is facing.

Agro Biotech Partners

The agro biotech engines, in their quest to get their products to market with as few barriers as possible, have acquired the support of key decision-makers. Governments have provided public money to the biotech industry and enforced policies that facilitate the testing and commercialization, rather than rigorous regulation of, biotech products. Other policies encourage the research and development of biotech at public institutions, including universities.

The agro biotech engines also have significant influence over key organizations and institutions. In the global North, for example, the agro biotech engines are involved with commodity organizations like the American Soybean Association and the Canola Council of Canada, while in the global South they have worked directly with institutions like the World Bank and the International Service for the Acquisition of Ag-Biotech (ISAAA). The ties between agro biotech engines and such organizations have played a key role in the industrialization of agriculture worldwide, with genetic engineering being the most recent technological contribution to this process. The following section will explore how governments and these organizations play key roles in supporting the agro biotech engines.

Governments

In North America there are very strong links between governments and the biotech industry. National and sub-national governments have demonstrated strong support for the biotech industry. In Canada, the federal government established the *Canadian Biotechnology Strategy* in 1983. Now called the *National Biotechnology Strategy*, it calls for growth in the biotech sector and boasts of job creation and economic growth from the manufacturing and sale of biotech products. It was largely motivated by the boom of biotech on U.S. stock markets in the early 1980s and was devised by several representatives from industry and academia. These kinds of political initiatives have meant that governments: a) promote biotech; b) create regulations that favour industry; and c) provide public money to the biotech industry.

a) Governments promote biotech

In Canada, the federal government has been very active in promoting biotech to the public. Since 1997, the government, through departments like Agriculture and Agri-Food Canada (AAFC), the Canadian Food Inspection Agency, Industry Canada and Health Canada, has spent at least $ (CAD) 12 million on a public relations strategy to promote GE foods. Of that money, $2.5 million was spent on a pamphlet called "*Food Safety and You*" that was distributed to all homes in Canada. BIOTECanada, the country's principal biotech industry lobby group received $25,000 from AAFC and $5.7 million from Industry Canada, while the Food Biotechnology Communications Network (now the University of Guelph's Food Safety Network) and National Institutes of Nutrition (some of whose members are multinational food and pharmaceutical corporations, as well as leading grocery store chains) also received money from the federal government to promote biotech to the public.[15]

While the U.S. government is active in the promotion of biotech to the public, it is also preoccupied with pushing biotech internationally. This is mainly because the U.S. is the largest producer and exporter of GE crops globally and the biggest markets for U.S. crop commodity

exports are countries in Europe and Asia that have restricted imports of biotech crops. The U.S. government is also active in forcing GE crops on farmers in the global South.

Governments also use industry conferences and conventions to promote biotech. These events, usually organized on an annual basis, serve as a meeting ground for corporate heads, employees, corporate-driven scientists, independent consultants, venture capitalists, government officials and media. Some of the main purposes of these industry gatherings are to discuss the latest trends in commercial developments, cultivate a culture of belief in products and technologies, and promote investments in the biotech sector.

The BIO (Biotechnology Industry Organization) international annual conventions are the largest gatherings of biotech proponents. BIO conventions are used to promote investment opportunities in cities like Toronto and Washington D.C., where the BIO International Biotechnology Convention & Exhibition was held in 2002 and 2003, respectively. Toronto and Washington's biotech research institutions and major companies and research parks were highlighted, alongside encouragement for expansion, in all of BIO's public relations materials.

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Governments, alongside corporations, are usually major sponsors of biotech industry conventions. Some of the sponsors for the BIO convention in Toronto, for instance, were the Government of Canada, Government of Ontario, State of Illinois, City of Chicago, and the Canadian Institutes of Health Research. In Washington, sponsors also included the Government of Canada and the Government of Ontario, as well as the State of Delaware, State of Maryland and State of Georgia. Meanwhile, President Bush gave a big public relations boost to biotech and BIO when he gave a speech at the BIO 2003 event, promoting biotech as a solution to "starvation."

Notably, since 1998, most BIO conferences have been met with resistance in the form of counter-conferences, marches and other large gatherings. These events have been effective in raising awareness of the negative impacts of the biotech industry. (See www.biodev.org).

b) Regulations favour industry

Governments in North America create policies and regulations that get biotech products to market as quickly and with as few barriers as possible. In Canada and the U.S., GE crops are approved based on data produced and owned by the very corporations that develop the products. Because this data is private property, it is, by law, not accessible to the public. There is no long-term testing and there is no monitoring once GE products are released onto the market. Essentially, in North America, GE crops and foods are regulated without any precautionary measures to the possible short and/or long-term harm of

growing and consuming them.

GE crops are regulated under the controversial concept of "substantial equivalence," which simply compares GE products to their non-GE counterparts. In Canada, for example, instead of identifying GE crops and foods as genetically engineered, they are classified as "plants with novel traits" and "novel foods," respectively. (See *Regulating Genetic Engineering for Profit; A guide to corporate power and Canada's regulation of genetically engineered foods*, a Polaris Institute report by Lucy Sharratt).

One reason for these regulatory concessions is the close ties between corporations and governments. The following are some examples of specific ties involving corporate executives, mainly from Monsanto:

- Charles W. Burson, Executive Vice President, Secretary and General Counsel at Monsanto (i.e., he leads the corporation's legal activities), has also been Assistant to the U.S. President and Chief of Staff, Counselor to the Vice President and was Attorney General for the State of Tennessee.

- Dr. Robert T. Fraley, Executive Vice President and Chief Technology Officer at Monsanto, has been a technical advisor to the United States Department of Agriculture (USDA), the National Science Foundation, the Office of Technology Assessment, Agency for International Development (USAID) and the National Academy of Science. Fraley has also received the Monsanto Edgar M. Queeny Award in recognition of his contributions to the discovery, development and successful commercialization of Roundup Ready crops.

- Terry Medley, currently Vice President of Global Regulatory Affairs at DuPont Agriculture and Nutrition was a former administrator of the Animal and Plant Health Inspection Service of the USDA, former chair and vice-chair of the USDA Biotechnology Council, and former member of the U.S. Food and Drug Administration food advisory committee.

- U.S. Secretary of Agriculture, Ann Veneman was once on the board of Calgene (now owned by Monsanto), as well as a member of the International Policy Council on Agriculture, a group funded by such corporations as Monsanto, Syngenta, Cargill and ADM. She has also served on the University of California-Davis College of Agricultural and Environmental Sciences Dean's Advisory Council, the Advisory Council for the University of California Berkeley College of Natural Resources and the Joint Policy Council on Agriculture and Higher Education.

c) Public money to the biotech industry

Governments also help the agro biotech engines by providing public money for research and development. The Canadian government for instance has contributed at least $ (CAD) 500,000 for the development of Monsanto's Roundup Ready Wheat at AAFC's Cereal Research Centre on the University of Manitoba campus. Similarly, the development of Terminator Technology was funded by the United States Department of Agriculture (USDA). As well, public money has been used to bail out corporations. For example, the USDA planned to give $20 million to Bayer (then Aventis) to help the company out after its StarLink disaster. This was money that had actually been allocated for disaster relief for U.S. farmers.[16]

Partnerships between industry and government are facilitated by various matching grants programs and specific legislation. In Canada, AAFC operates a Matching Investment Initiative (MII) Program. The MII is designed to increase partnerships between government and corporate research. The MII invites

corporations to invest in government research and promises matched funding in the form of public infrastructure, scientists or money. The Roundup Ready wheat research between the Canadian government and Monsanto occurred under the MII.

Similarly, in the U.S., there are cooperative research and development agreements (CRADAs) that allow corporations to enter into partnerships with government research groups and in turn get first crack at a license to market the resulting technology. Terminator Technology, for instance, was developed under a CRADA. CRADAs were established by the Agricultural Research Service, the main research agency of the USDA, following the passing of the Federal Technology Transfer Act of 1986, which paved the way for public-private partnerships between governments, universities and corporations.

One of the ways these government-industry partnerships benefit the biotech industry is by cutting costs of research and development. Research partnerships between corporations and government have been critical for the survival of the biotech industry, since biotech research and development is too costly for corporations to handle on their own. Partnerships between universities and the biotech industry have been particularly significant for the biotech industry. With the help of governments, the development of the biotech industry has been largely based on public university research.

Universities

Universities have increasingly become sites of corporate investment, and in turn, corporate influence. Securing investments from the private sector, developing commercial and patentable technologies, creating spin-off/start-up companies and training graduates to meet employers' demands have become the main objectives of universities' governing boards and certain departments.

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The agro biotech engines fit right into this agenda. Agro biotech corporations have significant influence at universities. They enter into research 'partnerships' with university labs or departments, contribute to fundraising campaigns, endow chairs, sponsor events, sit on advisory boards and board of governors, award research funds/scholarships to students and provide money for buildings and expansion.

Why universities? Investment costs for the agro biotech engines tend to be lower at universities than when partnering with other companies. Debts are lower and liability can be deflected onto the university rather than taken on by the company. Universities also offer the low cost labour of faculty and graduate students who are willing to put their creativity into biotech research.

All of this, of course, is occurring at the expense of community interests and academic freedom. This is yet another case where public money is subsidizing corporations. Furthermore, farmers, who should have input into the type of research occurring at universities, have very little say unless they are tied to a larger corporate sponsored organization.

a) Agro biotech universities

The agro biotech engines are well-positioned within university science departments. Many research projects, programs and chairs are funded by such corporations as Monsanto and DuPont's Pioneer Hi-Bred. Corporate funding is not given at arm's length. Rather, universities become like a research arm of corporations when they receive funding. The type of research that the agro biotech engines fund varies from basic research to the development of specific GE crops. For example:

- In 1998, the Department of Plant and Microbial Biology (under the Department of Environmental Science, Policy and Management) at the University of California (UC) Berkeley signed a 5-year $25 million deal that grants Syngenta (previously Novartis) access to the department's research, including research funded by the National Institutes of Health, the National Science Foundation and the USDA's Agricultural Research Service. Syngenta can also temporarily delay publication of researchers' findings and make participating professors sign confidentiality agreements, all of which facilitate the patent process. Syngenta representatives sit on an advisory committee that oversees the funded research. In the end, however, the deal was not as successful as Syngenta had hoped. Certain faculty and students protested against the deal, as well, not as many profitable technologies emerged as expected. As a result, the contract will not be renewed.

- Michigan State University is the lead institution for the Agricultural Biotechnology Support Program (ABSP), which involves other universities, corporations such as Monsanto and Pioneer and research institutes in the global South. Its mandate is to provide technical and policy framework support to countries in the global South, i.e. force GE technologies in countries like Kenya and India and create policies for them. ABSP was established in 1991 by the United States Agency for International Development (USAID). One ABSP project is a collaboration between DuPont's Pioneer and the Agricultural Genetic Engineering and Research Institute in Egypt to develop commercial *Bt* corn varieties. In India, Monsanto is working with the Tata Energy Research Institute to develop vitamin A "golden mustard." Another project is a technology donation from Monsanto to the Kenya Agriculture Research Institute (KARI) for a GE virus-resistant sweet potato (see page 21). Monsanto is also doing similar work with the Research Institute for Food Crops Biotechnology in Indonesia. Outside of ABSP, Monsanto has contributed roughly $2 million towards the development of GE virus resistant sweet potato at the University of Missouri, also in collaboration with KARI.

Who benefits from these partnerships? Certainly not farmers. The agro biotech engines stand to benefit the most. They have considerable influence within departments, as well as on university governing boards. This means that there is incredible pressure on faculty and students to accept corporate funding. In some cases, there are researchers who accept the funding because they are strapped for research money (as public money is increasingly cut), and concerned about the intimidation they would face from the university in refusing corporate money. There are others who are simply lured by hefty funds and prestige. These scientists can go as far as blocking truthful research from the public. In some cases, scientists hold shares in the companies funding their research or have interests in starting a biotech company of their own.

b) Spin-off/Start-up companies

A significant event in shaping corporate-university relations in the U.S. was the establishment of the Bayh-Dole Act in 1980, which gave public universities and companies the right to patent discoveries made under federally funded research, as well as become directly involved in the commercialization process. The Act encourages universities to participate in technology transfer – that is the transfer of research results from universities to the marketplace. This has created a widespread ethic that university research should lead to patentable commercial developments. Before the Bayh-Dole Act was passed, less than 250 U.S. patents were issued to universities on an annual basis. Since 1993, the average number of patents per year was more than 1,600. More recently, patents to U.S. universities rose to over 2,000 annually.[17]

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The Bayh-Dole Act also spurred on investments by larger agribusiness corporations in university research. In 1981, a year after the Act was passed, DuPont invested $6 million over five years in the Harvard Medical School for research in genetics, while Monsanto spent $23.5 million in Washington University for research in cell biology. As a result of these kind of 'partnerships,' professors and students work on discoveries for commercial applications. In some cases the researchers in these boutiques split off from their universities and create their own spin-off biotech companies, usually with the help of venture capital funding.

Spin-off companies, or start-up companies as they are referred to in the U.S., along with patents for technologies developed at universities, are often made possible through university "technology transfer offices." Most universities have their own technology transfer office that promotes and facilitates commercial developments on campus. In 1999, 454 companies were created directly from Canadian universities, the majority of which were in biotech. The following are examples of spin-off companies from universities in Canada and the U.S.

- Biotech company Performance Plants was formed by two biology professors from Queen's University in Kingston, Ontario. Dow and Performance Plants have a deal to develop GE varieties of canola, sunflower, peanuts, cotton, and silage corn. The head office of Performance Plants is located in the Biosciences Complex at Queen's, while a research facility is located at Innovation Place in Saskatoon, Saskatchewan.

- Mycogen, fully acquired by Dow in 1998, got its start as an agro biotech spin-off company from the University of California San Diego. Mycogen focuses on a number of different crops, including alfalfa, corn, sorghum, soybean, sunflower, as well as animal feed crops.

- Calgene (now owned by Monsanto) was founded by a UC Davis agronomy professor in 1980, with the help of a $2.5 million grant from the Allied Corporation (then the 6th largest chemical company in the U.S.). Calgene was the company that developed the Flavr Savr™ Tomato and is now developing genetically engineered canola and cotton seed.

c) Governing bodies

The agro biotech engines are not only present within science departments, but also on university governing boards. University governing boards (i.e. Board of Governors, Board of Trustees, Board of Regents, etc.) are led by university Presidents and Vice-Presidents and board members. Most university governing bodies are stacked with representatives from corporations, to a point where it is difficult to distinguish a university board from a corporate one.

Presidents, Vice Presidents and boards have the authority to finalize all major decisions at universities. They can set basic guidelines for degree programs, select chancellors, manage the budget, set tuition fees, decide whether a new research facility should be built and who will fund it, and determine whether a department should be closed down. Corporate executives now make up the largest single group represented on the governing boards of colleges and universities in the U.S.[18]

A corporation's presence on the governing board is often reflected in the various 'partnerships' that exist within a university. The following are some examples:

- Ron Zelonka, Vice President of Technology and Innovation at DuPont Canada is a member of the University of Guelph's board of governors. Meanwhile, DuPont's Pioneer Hi-Bred is one of the funders of an agricultural communications program at the University of Guelph. This program is aimed specifically to train students in communications and journalism to promote the agri-food and agribusiness industries. Another funder of the program is Ontario Pork – the leading pork industry group in Ontario.

- The governing body of Iowa State University*** is lead by President, Owen J. Newlin, a retired senior Vice President and board member of Pioneer. Tightly connected to the seed industry, Newlin also sits on the board of the American Seed Trade Association and the American Seed Research Foundation. Meanwhile, in 1999, former Pioneer research director, Raymond Baker, donated an $80 million bequest to the Agronomy Department, which was the largest ever donation from a single source made to ISU. Rick McConnell, president of Pioneer Hi-Bred sits on the board of the ISU Plant Sciences Institute. Pioneer has also established five research chair positions at ISU. The company donated $100,000 towards ISU's Pioneer Hi-Bred Genomics Laboratory.

- The President of Michigan State University – lead institution of USAID's Agricultural Biotechnology Support Program (see page 16) – is Peter McPherson. McPherson is the Chair of USAID's Board for International Food and Agricultural Development and was also an Administrator (1981-1987) for the Agency's $6 billion per year program. He also has strong ties to banks that handle debt in the global South. He was the Executive Vice President for the Global Debt Restructuring Administration division of the Bank of America (1989-1990) and the Chair for the Overseas Private Investment Corporation (1981-1987).

*** The ISU governing body is the State Board of Regents. It is also the governing body for the University of Iowa, the University of Northern Iowa, the Iowa Braille and Sight Saving School, the Iowa School for the Deaf and the State Sanitarium at Oakdale. The nine members of the Board are appointed to six-year terms by the Governor with the approval of the Senate.

University governing boards are increasingly becoming the hot spot for corporate executives and those who are politically well-connected. Not only do these individuals attract corporate funds, but also make decisions that favour capital growth and so-called innovation over community interests.

Industry Groups

a) In the global North

In North America, where 74 percent (68 percent in the U.S. and 6 percent in Canada) of the world's commercial GE crops are grown, farmers are becoming more and more vulnerable. Increasingly, commodity prices for major crops such as corn, cotton and wheat are falling, subsidies from governments have become less stable and production controls are being removed. This, in turn, enhances a competitiveness amongst farmers that is destructive to farming in general, and favours large-scale over small-scale farms.

Multinational seed and agrochemical corporations, as well as grain processing and distributing corporations like Cargill and Archer Daniels Midland (ADM), reap most of the benefits. Without production controls, farmers end up producing as much as they can and then dumping commodities on the market, pushing down the buying prices and thereby increasing the profits of companies like Cargill and ADM, which buy, process and distribute on the international market.

Farmers' vulnerabilites increase with GE crops. Farmers have faced market shutdowns that have restricted GE crop sales. In Europe and Japan, popular resistance has been strong enough to restrict markets for GE crops, leaving farmers with fewer buyers. Unfortunately many farmers do not always have access to balanced information on the impacts of GE crops. Farmers are constantly bombarded with advertisements from various associations that are largely funded by the agro biotech engines, which falsely promote the benefits of GE crops.

One example of such an association is the American Soybean Association (ASA). ASA is made up of as many as 34,000 U.S. soybean producers, while BASF, DuPont, Monsanto and Syngenta are part of its Corporate Partnership Program. ASA lobbies government and the ASA-Syngenta Crop Protection Leadership Development Program trains members on how to lobby the U.S. Food and Drug Administration on various legislative issues.

In Canada, the Canola Council of Canada, which represents growers' associations, agro biotech and other agribusiness corporations (including exporters and shippers) and governments, helps develop and promote GE canola. It coordinates research on canola varieties across the country through the Canola Production Centre network. There are 11 Canola Production research centres across Canada, mostly in the western region. The major corporate sponsors of these centres include Bayer, Dow, BASF, Syngenta and Monsanto. Pioneer is also a sponsor, but on a smaller scale. Research at these centres has involved the development of GE canola crops and open-air field trials. (Agriculture and Agri-Food Canada provides equipment and labour to the research at these centres). With an annual budget of more than $ (CAD) 4 million, the Canola Council of Canada is the main body for the canola industry in the country, and its agenda is fully set by corporations. The Council's Board consists of representatives from Cargill,

Archer Daniels Midland, Advanta Seeds and Pioneer Hi-Bred. Out of its 15 male board members only about one third represent growers and growers associations, who are also heavily influenced by industry.

b) In the global South

In the global South, industrial agriculture involves a network of the leading agro biotech engines as well as global institutions like the World Bank and the International Service for the Acquisition of Agri-biotech Applications (ISAAA). Notably, the groups active in pushing biotech in the South all have ties to the Green Revolution.

The Green Revolution caused widespread destruction of local farming systems in the global South beginning in the 1960s through the introduction of inappropriate hybrid seed technology and expensive agrochemical inputs. In the Philippines, one of several countries in Asia that was hard hit by the Green Revolution, a mere two varieties of Green Revolution varieties occupied 98 percent of the entire rice growing area by the mid-1980s. Farmers in the Philippines once cultivated thousands of traditional rice varieties.[19] This monoculture has created severe vulnerability to pests that are now able to survive pesticides and wipe out crops.

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The Green Revolution was also led and supported by institutions like the World Bank, governments and corporations like Ciba-Geigy (now Syngenta) and Hoechst (its agribusiness operations now owned by Bayer). These same players have also taken traditional crop resources that have been developed over thousands of years by farmers and indigenous communities in the global South, and transformed them into inaccessible, patented seed. The development of GE crops and forcing of them in the South is merely an extension of these earlier colonial ventures.

The ISAAA, established in 1991, is a key player in forcing GE crops on the South. It is a group established specifically to promote biotechnology and create partnerships between research institutes in the South and corporations of the North. (Like universities, these research institutes do not represent the interests of communities, and are heavily influenced by the agro biotech engines, as well as international bodies like ISAAA, the World Bank and CGIAR). The ISAAA operates in twelve countries: Kenya; Egypt; Zimbabwe; Indonesia; Malaysia; the Philippines; Thailand; Argentina; Brazil; Costa Rica; and Mexico. It is financed by such corporations as Bayer, DuPont, Monsanto, Syngenta, as well as institutions like the World Bank, the Rockefeller Foundation (whose board of trustees include World Bank representatives) and USAID. Some examples of ISAAA's work include setting up the following 'partnerships' between the leading agro biotech corporations and national research institutes:

- In 1991, Monsanto and the Mexican government entered a deal in which Monsanto donated technology and training to scientists from two public research institutes in Mexico for the

development of GE virus-resistant potatoes. Funding for this project came from the Rockefeller Foundation.

- Monsanto, the Kenya Agricultural Research Institute and USAID's Agricultural Biotechnology Support Project (led by Michigan State University) are involved in a joint initiative to develop GE sweet potatoes resistant to the sweet potato feathery mottle virus.

- Syngenta and Vietnam's Institute of Biotechnology and its Agricultural Science Institute are working together to develop *Bt* sweet potatoes. Syngenta has agreed to donate certain resources, including training, to Vietnamese scientists. The Swiss Agency for Development and Cooperation has also contributed funding to this project.

- In 1998, the ISAAA established *The Papaya Biotechnology Network of Southeast Asia*, through the donation of funds and technology from Monsanto, Zeneca (now Syngenta) and Nottingham University, and funding from the Rockefeller Foundation for the development of GE papayas resistant to Papaya Ringspot Virus.

- The ISAAA, through a project funded by the Rockefeller Foundation, is helping corporations and institutions figure out how to distribute the GE vitamin A "Golden Rice" because of the complexity of the many patents associated with the product (see the ETC group's "Golden Rice and Trojan Trade Reps," *Communique*, September/October 2000, Issue #66). Syngenta currently has an exclusive license for the commercial use of Golden Rice in the North, and for medium to large-scale use in the South (when farmers sell over $10,000 worth of Golden Rice).

The ISAAA's founder and chairperson is Clive James, who also once worked under the Consultative Group on International Agricultural Research (CGIAR). CGIAR is governed by the United Nations and the World Bank. It oversees a network of 19 international agricultural research centers (IARCs), which were mostly established with the Green Revolution. The IARCs, operating in various locations in the South, collectively contain the germplasm of more than 3,000 varieties of crops. Over 90 percent of the varieties within the IARCs are collected from countries in Africa, Asia and Latin America, yet only 15 percent of these resources have gone to agricultural development in the global South. Corporations have access to the Group's collection, and in return, they provide either money or technology to the CGIAR. CGIAR's Private Sector Committee includes Novartis, Aventis and Monsanto, as well as the Japan Bioindustry Association and the ISAAA.

Groups like the ISAAA and CGIAR have not only helped the agro biotech engines further the global presence of their GE crops, but also access the germplasm of thousands of varieties of crops. Many financial analysts point out that the agro biotech engines do not actually make a significant profit by selling their seeds in the global South. So, the motivation is less about profit and more about access. Furthermore, a large part of the agro biotech engines' public relations' campaigns has been to promote the message that 'GE crops will feed the world.' This is the very same message that came with the Green Revolution.

Conclusion

The agribusiness industry has been a target of activists over the years for its involvement in the development and marketing of pesticides, particularly in the South. More recently, the industry has been in the spotlight because of its aggressive push of GE seeds. The agro biotech engines have reacted in a way that is typical in the business world. By changing names and mottos and restructuring operations, the agro biotech engines are forging ahead to win.

It is critical that anti-biotech movements continue to move ahead and continue making the ground shakier for the agro biotech engines. In doing so, we must recognize and support the struggles that already exist.

In the global South, farmers, peasant and indigenous peoples have experienced the loss of knowledge systems and varieties locally adapted to their environments and needs as a result of destructive and imperialist initiatives like the Green Revolution. Farmers, peasants and indigenous communities have long experienced the pressures and force of agribusiness corporations and public institutions, and have been actively protesting.

In the Philippines, hundreds of thousands of peasants and farmers, through organizations like *Kilusang Magbubukid ng Pilipinas* (KMP, aka the Philippines Peasant Movement, see www.geocities.com/kmp_ph) and Resistance and Solidarity Against Agrochemical TNCs (see www.geocities.com/resist_agtncs/index.html), have been actively protesting the testing and commercialization of Monsanto and Pioneer's *Bt* corn. They argue that *Bt* corn is not helpful to them since the GE corn is intended for feeding animals for the meat industry and not for direct human consumption. As well, they say that the infestation of corn borers is not a serious problem in the southern Philippines, where field trials occurred, and peasants have been able to manage the pests on their own.

In August 2001, close to 800 farmers, indigenous Lumad people, students and other members of society participated in "Operation Bunot (uproot)" pulled all of the *Bt* corn plants from a 1,700 square meter experimental field owned by Monsanto's Agroseed in Maltana village in southern Philippines.

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In the global North, conventional and organic farmers are struggling with the pressure from the agro biotech engines over farming communities. Conventional farmers who have grown GE crops are losing expected markets, while organic farmers' are losing critical crops, or are in danger of losing crops

to GE contamination.

In 1999, several farmer groups in the U.S. collaborated to work on a campaign to further educate themselves and other farmers on genetic engineering in farming. The campaign came out of an urgent need to provide farmers with information from sources other than the agro biotech engines. The campaign, known as the "Farmer to Farmer Campaign on Genetic Engineering," (see www.nffc.net/bio4.htm) promotes the perspective of family farms and farmers.

In 2000, the Campaign called on Attorney Generals from eight key farm states to create a policy that would place liability on GE seed companies. In 2001, the Campaign launched a major media blitz targeting Minnesota and other Midwestern states urging farmers to consider the declining export markets for GE crops before making planting decisions that year. The Campaign also answers critical questions from farmers on market barriers, develops editorials that can be used by different groups and identifies farmers as spokespeople on the issues, as well as helps facilitate community meetings on genetic engineering and the risks for family farm agriculture.

In Saskatchewan, a class action lawsuit has been filed against Monsanto and Bayer on behalf of over 1,000 of the province's organic canola farmers. The lawsuit is being filed because Monsanto and Bayer' GE canola has polluted organic farmers' fields and they have consequently lost organic canola (see www.saskorganic.com). The farmers are seeking compensation from the two corporations in the tens of millions of dollars. They are also pushing for an injunction that would prevent Monsanto from getting approval in Canada for its GE wheat.

University researchers who are speaking out against corporate influence on campuses risk their reputations and their jobs. Often times, support from their colleagues is limited because other researchers are intimidated and are afraid of the consequences they would face by speaking out or supporting those that do. Most biotech research comes from university labs, therefore confronting corporate-university connections would not only be an act of solidarity with university researchers, but farming communities globally.

Most biotech research comes from university labs, therefore confronting the corporate-university connection can not only be an act of solidarity with university researchers, but farming communities globally.

In 1998, Ignacio Chapela, associate professor in the Department of Environmental Science, Policy and Management at UC Berkeley, spoke out during a campaign that challenged the Syngenta-Berkeley deal. As a result of his opposition, Chapela has faced intimidation from biotech proponents within and outside the university. In April 2002, the journal *Nature* withdrew its support for a study by Chapela and graduate student David Quist. (*Nature* had originally published the study in November 2001). Chapela and Quist's study concluded that GE corn had contaminated native Mexican corn in Oaxaca and Puebla – two remote states in the country. *Nature* was heavily pressured by pro biotech scientists and the biotech industry to withdraw the study.

On and off-campus activists have also been publicly resisting corporate presence on campus. Groups

across North America have destroyed a number of GE crop field trials on university campuses. Other types of actions have been taken. At Yale, students carried out guerrilla theatre to undermine a Monsanto representative's speech on 'sustainable development' in 1999. In 2000, the Earth Liberation Front set fire to offices at Michigan State University in objection to the development of GE technologies to be forced on farmers in the global South. And in 2001, students at the University of Arkansas protested outside of the Arkansas Animal Sciences Building where Monsanto was recruiting students for employment.

In developing strategies that will challenge the agro biotech engines, we must recognize that the structures upon which they are built require the support of certain key players. These players include national and sub-national governments, universities and industry groups. We can support existing struggles by identifying and acting on locally based targets.

We must ask ourselves: How do the agro biotech engines show up in our communities? As head offices, regional offices or in-house labs? As university research labs and technology transfer offices? As partner biotech companies? Inside national or sub-national governments? As corporate sponsored farmer and consumer groups? At industry conferences? As foreign aid agencies or institutions like the World Bank, the ISAAA or CGIAR? As lobby groups or industry front groups? As public relations campaigns? And, what are the main activities of these manifestations of the agro biotech engines? How do they affect local communities? How do they affect communities abroad?

Asking these questions can begin to reveal how groups and individuals could most effectively participate in a global movement against the agro biotech engines. The next step would be to inquire about local groups that might need support, such as farmers in or near your community, or groups working in solidarity with farmers, peasants and indigenous peoples in the global South. The direction, messages and demands of campaigns in support of these groups would need to be determined by them.

Resistance in its many different forms is vital. Not only does it need to be effective, but also needs to be recognized and celebrated. We need to understand others' resistance and create our own. We need this for inspiration, we also need this for survival. There are many opportunities for resistance, it is well-rooted, growing and fertile!

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