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Ending Injustices That Cause Hunger and Environmental Destruction

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The Agrofuels Trojan Horse: Biotechnology and the Corporate Domination of Agriculture

by Annie Shattuck

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Biotechnology is poised to strike at our agricultural system on a scale never before imagined. Ten years after the launch of biotech in agriculture, the debate rages on. Consumers, farmer's organizations, social movements and environmental advocates all fiercely oppose biotechnology in agriculture, while the industry has continued to expand its presence in the developing world, often through undemocratic means. But resistance, and effectively all public debate on biotech, may well be put to rest for good by the world's growing dependence on agrofuels. The sunny glow of alternative fuels helps lend biotech the public credibility it has lacked since its market debut. While new traits for agrofuels are already helping corporations amass unprecedented market power, a pipeline of new fuel crops stands waiting in the wings. The new pipeline will have much the same effect as previous biotech offerings: contamination of public genetic resources and even further industry consolidation. Agrofuels are the perfect Trojan Horse, promising not only whole new markets for biotech products, but the irreversible entrenchment of genetically modified crops throughout the world.

Background: The Birth of an Oligopoly

How did we get here? A brief look at the history of consolidation in the biotech industry paints a disturbing picture of what is to come.

Riding the waves of the Green Revolution in the 1960's and '70s, the large agricultural chemical corporations, formerly specialized in chemical weapons, began buying up small seed companies to compliment their nascent agricultural chemicals businesses. In the eighties, when agricultural biotechnology was being developed, these companies were the first to jump on board. Over the last decade, with the global spread of biotechnology, the hybrid seed-chemical-biotechnology industry (from here on biotech) consolidated. In 1998, the top ten seed companies controlled 30% of the global market. Now, that same market share is controlled by only two companies.[i ii] This latest round of consolidation was fueled by biotechnology itself. Genetic modification (GM) has been used to vertically integrate market power, allowing the same companies that sell seed to also sell the herbicides and other inputs these GM crops require.

The pattern of technological development in GM is to develop traits that increase dependence of farmers on the biotech industry. The first and most widely planted products are the "Roundup Ready" or herbicide-tolerant products; crop species like corn, soy, and cotton that are resistant to the herbicide glyphosate. Monsanto, Syngenta, and DuPont all sell glyphosate resistant seeds as well as the herbicide itself, often in a package. This technology has not only dramatically boosted the sales of glyphosate, but it has become so widespread as to undercut farmers' use of non-chemical alternatives and integrated weed management systems, fostering farmers' dependence on both the patented seed and the herbicide.[iii] The much discussed "terminator gene," another early biotech trait, would have served to ensure farmers' dependence on licensed products by physically preventing farmers from saving seed, had the technology gained regulatory approval. (The industry is still pushing for this.) Even Bt corn, a variety that produces a natural pesticide in the stem of corn plants, increases the share of the seed market subject to strong-arm patent laws and licensing fees, while eroding the effectiveness of Bt as part of a more holistic integrated pest management system.[iv] The economic function of these foreign genetic traits is not to decrease chemical use, but to increase market dominance and control over the agro-input industry by the corporations holding the patents.

Integrating agro-chemical sales with patented seed has worked extremely well for big biotech. In 2006, Monsanto alone controlled 20% of the global seed market, worth nearly $4.5 billion annually. The top three

seed companies now control nearly 40% of the global market.[v] All this investment and market dominance has fueled the quest for even more control. In the past ten years the pace of mergers and acquisitions between former chemical companies, smaller biotechnology firms, and the big seed sellers has outstripped all expectations. In a span of eight weeks in 1998, Monsanto absorbed four major agricultural biotechnology firms, including two of the top ten seed sellers in the world at the time.[vi] This pattern of swallowing up smaller biotechnology and seed companies continues apace.

Consumer Rejection Threatens Markets

Biotechnology wasn't always so good to Monsanto however. In 2002 alone, Monsanto lost a staggering $1.7 billion. Monsanto invests 80% of their research and development budget on ag-biotechnology,[vii] producing foods being met with staunch consumer rejection in Europe and parts of North America. After 2002's stunning losses, the company's future, and the future of biotechnology in agriculture itself looked grim. Public campaigns by major environmental groups including Greenpeace labeled GM food as unhealthy and dangerous "Frankenfoods." Prospects for market growth were limited because of the difficulty of gaining regulatory approval for GM plantings outside of the U.S., Canada, and Argentina. In fact, because the controversy generated by GM food was so strong, the Monsanto and the biotech industry it pioneered faced the very serious threat of losing a market for their investments.[viii]

Then miraculously, Monsanto experienced a turnaround. Brazil, once dead set against the cultivation of GM crops within their borders, opened the country to both GM soybeans (for which they are the second largest exporter behind the U. S.) and Monsanto's best selling herbicide, Roundup. GM soy was pushed through the Brazilian legislature as *fait acompli.* Farmers in southern Brazil were already planting Monsanto's Roundup Ready soy, and Monsanto argued Brazil was impeding their legal right to collect royalties on their intellectual property,[ix x] a position that would leave Brazil vulnerable in international trade proceedings. However, according to Terra de Direitos (Land of Rights), a civil society organization based in Curitiba, Brazil, Monsanto was actually encouraging farmers to plant illegally imported Roundup Ready soybeans from Argentina much before this supposed "seed piracy" was used to push through legalization.[xi xii] GM soy was legalized in 2003. In 2004, a congressman from southern Brazil, pushed through a series of federal amendments legalizing the herbicide glyphosate, or Roundup, the necessary partner to Monsanto's soy. The Brazilian government is currently investigating the congressman for corruption after he purchased a large farm from Monsanto at one third the market price.[xiii] Monsanto's sales of Roundup went up 30% after the corrupt Brazilian land deal.[xiv]

The fact that Monsanto was forced to use illegal tactics to enter the Brazilian market illustrates the strength of public resistance to their products. Even in the U. S., where 50% of corn, 90% of soy, and 80% of cotton are genetically modified, consumers are still resistant to GM foods. A 2004 survey done by the Food Policy Institute at Rutgers University indicated that 41% of Americans disapproved of the technology.[xv] The level of awareness of GM foods however is low. The Rutgers study indicates that only 31% of American consumers believe they have ever consumed a GM product (nearly all processed foods sold in the U.S. contain GM ingredients), and 89% said they think GM products should be labeled.[xvi] After labels were required on all food products that contain GM ingredients in Europe, GM food virtually disappeared from European shelves.[xvii] Rejection of GM technology is strongest in the European Union, where, according to a recent WTO ruling, the reticence of EU regulators to approve new GM varieties constitutes an illegal trade barrier.[xviii] From small nations like Sri Lanka, whose government only withdrew plans for a popular GM ban

when threatened with WTO lawsuits,[xix] to powerful social movements like Brazil's Landless Worker's Movement, which demands a ban on all forms of genetic use restriction,[xx] the global tide of public opinion is turning against transgenic food.

Monsanto may have saved their business (and perhaps the biotech industry) in the short run by strong-arming their way into the Brazilian market, but they cannot force consumers to want their products. The biotech industry is constantly faced with the threat of market contraction and consumer rejection. This leaves the industry two options: either quickly recycle their capital, as they did in the 1970's when chemical companies switched from producing warfare-related chemicals like Agent Orange to producing agricultural inputs, or somehow turn global public opinion in their favor. *With the onset of the agrofuels boom, the biotech industry hopes to do both.*

Corn Ethanol: Harbinger of the New Ag-Economy

With the signing of the 2007 Energy Bill, President Bush committed the nation to a Renewable Fuels Standard which will, according to Republican Senator Pete Dominici, "use ethanol and a new generation of advanced biofuels to displace oil."[xxi] The standard pushes an already growing market for liquid biofuels, to 36 billion gallons a year by 2022. While 36 billion gallons represents only a fraction of the U. S.'s total fuel consumption, it opens a bonanza of investment and even further consolidation in the agricultural industry, what many have dubbed the "Agrofuels Boom." The Renewable Fuels Standards in Europe and the U.S. mandate the use of more corn ethanol than is physically possible for either region to produce, driving the transformation of corn for food to GM "dedicated energy crops." While language in both RFS suggest an eventual move to alternate feedstocks, the biotech industry's foray into fuel corn gives us a picture of what future markets for agro-fuel feedstocks might look like.

Both Monsanto and Syngenta have recently come out with genetically modified varieties specifically for processing into ethanol. According to industry, increased processing efficiency and higher yield of ethanol per bushel for these varieties will benefit both the ethanol refiners and farmers. However, farmer's marketing options are much more limited with these newly-patented energy crops. In an indication of what is to come, Monsanto and agribusiness giant Cargill have recently launched a joint venture called Renessen, a whole new corporation with an initial investment of $450 million dollars. Renessen is the sole provider of the first commercially available GM dedicated energy crop, "Mavera High-Value Corn." Mavera corn is stacked with foreign genetic material coding for increased oil content and production of the amino acid lysine, along with Monsanto's standard Bt pesticide and its Roundup Ready gene. The genius of this operation, and the danger to farmers, is that farmers must sell their crop of Mavera corn to a Renessen-owned processing plant to recoup the "higher value" of the crop (for which they paid a premium on the seed). Cargill's agricultural processing division has created a plant that only processes their brand of corn. Further, due to the genetically engineered presence of lysine, an amino acid lacking in the standard feedlot diet, they can sell the waste stream as a high priced cattle feed. Renessen has achieved for Monsanto and Cargill nearly perfect vertical integration. Renessen sets the price of seed, Monsanto sells the chemical inputs, Renessen sets the price at which to buy back the finished crop, Renessen sells the fuel, and farmers are left to absorb the risk. This system robs small farmers of choices and market power, while ensuring maximum monopoly profits for Renessen/Monsanto/Cargill.

Resistance to corn ethanol however, is strong among farmer's movements and environmental groups. Even in official policy circles corn ethanol is seen as a temporary step towards "second generation" fuel crops. U.S. federal subsidies to corn ethanol are politically unsustainable, and numerous studies have questioned its energy efficiency, claiming ethanol yields less energy than it eats up in production.[xxii] [xxiii] [xxiv] Civil society groups have also accused ethanol of robbing food from the mouths of the poor. This food vs. fuel debate has been the most damaging for the image of agrofuels. Agrofuels were blamed as one of the reasons the price of tortillas in Mexico shot up 400%, leading to widespread protests and an eventual government cap on prices.[xxv] The recent spike in global food prices has sparked food revolts in Italy, Morocco, Mauritania, Senegal, Indonesia, Burkina Faso, Cameroon, and Yemen. In Egypt and Haiti over a dozen protesters were killed in food-related protests. While the ethanol industry's champions proudly claim "We drink the best and drive the rest!"[xxvi] for many people burning food in a world with 824 million hungry people is clearly immoral.

While sales of GM corn and soy for agrofuels climb steadily, these crops do little to solve the biotech industry's PR problem. Advanced energy crops, like cellulosic ethanol, promise to open new markets for biotech products and put to bed the issue of consumer rejection once and for all.

Second Generation Energy Crops: Power and Profit Painted Green

The biotech industry promises to develop a "second generation" of new cellulose-based energy crops that can grow on land unusable for modern agriculture, eliminating the food vs. fuel debate currently plaguing the agrofuels industry. They promise to use environmentally friendly native plants like switchgrass, to produce carbon-neutral fuels, and to reduce chemical inputs on these new green energy plantations by engineering plants to grow in resource poor areas. Greater efficiency, opportunities for small farmers, and nothing less than the complete revitalization of rural economies are all supposed to come down the magic biotechnology pipeline in the form of cellulosic energy crops. Cellulosics are inedible but little understood, making all the mythology surrounding them easier for the public to swallow. Perhaps best of all for the biotech industry, second generation ethanol, like cellulosic, promises to open brand new proprietary markets for the biotechnology products being rejected by consumers worldwide.

Cellulosic energy crops can conceivably be produced from any plant material: corn stalks, trees, sugar cane biomass, or grasses. One might ask, with so many possibilities for feedstock, why biotechnology stands to play such a large role. Biotechnology addresses two key factors: processing efficiency and yield. For example, "Energycane," a new product in the pipeline at Ceres, Inc., in which Monsanto is a key equity shareholder, is merely sugarcane with genetic coding for increased biomass and decreased sugar content, i.e. a higher yield of cellulose. Other biotech traits aim at faster growth, shorter time until maturity, increased oil content, and frost or drought tolerance, all traits that attempt to conform nature to an industrial model.

Like first generation biotech traits, many of the energy traits being developed are designed for opening and dominating markets. In fact, many of these traits will create markets from scratch, augment the already lucrative markets for chemical inputs, and deliver the full control of these markets to the tightly packed corporations of the biotech industry. What do these new traits look like?

> *Range expansion, drought/freeze tolerance, growth on marginal land* – Some of the most highly advertised traits being developed allow a plant to escape its own physiological limitations to grow on poor soils, in water scarce regions, and to withstand freezing temperatures. In other words, these

traits aim to make industrial monocrops grow where they otherwise could not. Expanding the range of energy crops will expand the acreage under industrial agriculture worldwide, and with it, a dramatic expansion in the market for seed, fertilizers, pesticides, and other inputs, conveniently sold by the same group developing this technology. Mendel Biotechnology, a privately controlled firm with heavy investments by Monsanto and British Petroleum, has already identified and isolated genes for these new traits.

Increased biomass and faster growth – The biotech industry is working on code for faster growing plants that put more energy into producing biomass, or overall material, than specific products like sugars, nuts, oils, and tubers. What fast growing really means, though, is high nitrogen consuming. Nitrogen, in the form of nitrates and ammonium, is the primary limiting factor in plant growth. Plants that are good at using nitrogen and can use a lot of it quickly, will grow faster, and produce more biomass. This is all well, except that in industrial agriculture the pressure of high-density, high-nitrogen using plants rapidly depletes soil nutrients, making the system more dependent on chemical fertilizers. Increased biomass is also a physiological trade-off. Plants like the GE sorghum being developed by Ceres Incorporated (a small biotech firm with significant equity investment from Monsanto), trade their ability to produce a food product for increased biomass. Farmers growing this crop in the future will have to accept the price offered by the nearest ethanol refinery, instead of having diverse local and international food markets to fall back on when commodity prices inevitably fluctuate.

Reduced lignin content in trees – Lignin is the woody compound in the cell wall that gives trees both their structural integrity and their resistance to pests. Lignin is also what makes it difficult to pulp trees into paper and unlock cellulose in wood to produce ethanol. ArborGen, a biotechnology firm with heavy investments from the industrial forestry industry, is developing trees with 20% reduced lignin content. This development could necessitate the use of pesticides in plantation forests, because some of the natural pest resistance will have been engineered out of the trees. Because genetic modification of tree species is a relatively new field, only a few companies have invested in GM trees. This means that competition in the field will be next to nothing, ensuring a global monopoly. The CEO of Rubicon, an industrial forestry company and one of three owners of ArborGen, notes "the annual unit sales of forestry seedlings are well into the billions, recur every year, and span the globe. ...there are no global competitors to ArborGen."[xxvii]

Proprietary GM Enzymes, Bacteria and Catalysts – Processing cellulose into sugars is the largest hurdle in making cellulosic ethanol practical. At its current stage, processing is vastly inefficient. Much disagreement exists as to when and if cellulosic processing will be efficient. Some reports say it will arrive within the next two years, others claim it will never come. Regardless of doubts about the technology, the engineering of new enzymes and bacteria that can break down cellulose is a multi-million dollar race. Large ag-biotech corporations and oil companies are partnering with smaller start up biotech firms to control the keys to unlocking the potential of cellulosic ethanol. Codexis, one of the leading developers of GE enzymes is partnering with Syngenta and Shell Oil Corporation for its research and development, while Iogen Corporation is funded by the major venture-capital firm Goldman-Sachs as well as Shell. Some enzyme biotechnology firms also own ethanol processing plants, like the Kholsa Ventures funded company, Range Fuels. Patents on this

technology will essentially put a stranglehold on the cellulosic ethanol market. Whoever controls the most efficient catalysts will have a virtual monopoly on processing fuel, meaning that feedstock prices paid at the farm gate will be set by the processor, robbing farmers of market power yet again.

The Cellulosic Halo

After ten years of controversy, the biotech industry is basking in the rosy halo of second generation energy crops. None of these crops are destined for our food supply, a fact which the industry hopes will ease public distaste for biotechnology. Investors have poured untold billions into cellulosic energy crops, counting on them to simultaneously clear up biotech's nasty public image and create whole new markets for its products. The potential value of these new markets is not to be underestimated. Some of the largest venture capital firms in the U.S., Kholsa Ventures, Goldman-Sachs, Warburg-Pincus, and Soros Fund Management, to name a few, have invested hundreds of millions of dollars in dedicated energy crops and cellulase enzymes. With plenty of capital and political clout, competition between industries seems to be minimal, with corporate partnerships the norm. British Petroleum has partnered with Monsanto and Mendel Biotechnology, Royal Dutch Shell with Cargill, and Syngenta, and DuPont with British Petroleum.[xxviii]

But cellulosic ethanol is not just a problem of making an existing technology market-ready. Rather, much like the dream of nuclear fusion, it will depend on major breakthroughs in our understanding and manipulation of plant physiology. Investors claim the second generation agrofuels revolution will be bigger and more lucrative than the IT revolution. Because the stakes are so high (and because the world is experiencing a glut of venture and finance capital), big bets are being placed by big players. In second-generation roulette, whoever cracks the cellulose code will likely win the controlling share in the world's food *and* fuel systems.

But regardless of whether cellulosics are ever commercialized on a grand scale, these investments are already improving the image of both agrofuels and GE. Proponents say that the first generation agrofuels are merely building infrastructure for the second, cleaner round of fuels, and that without corn and sugarcane, switchgrass could never be viable. Belief in cellulosics as a gasoline substitute is blind faith that technology can liberate us from the constraints of finite resources. The very idea that cellulosics will ever be viable gives them a futuristic halo, transforming biotechnology from a very real environmental threat to our collective savior.

Investing in second generation agrofuels politically legitimizes the current astronomical profits and market control being swallowed by the biotech industry. Monsanto posted over $689 million in profits in 2007. Syngenta netted $1.1 billion. Global production of agrofuels has tripled over the past three years, as have Monsanto and Syngenta's stock prices. The link is no coincidence: the companies themselves credit the rise in profits to agrofuels. A recent article in Business Weekly outlined the connection even more explicitly: Monsanto's stock prices are more closely correlated with the price of oil than Exxon Mobil's.[xxix] Over the past year, the price of a barrel of crude tracked Monsanto's stock prices at a correlation of 0.94 (the highest possible correlation value is 1.0). The price of corn, Monsanto's most important product, barely correlates to Monsanto's stock prices at all, coming in at a scant 0.17.[xxx] What we are seeing, between the heavy investment in fuel traits and biotech's soaring profit margins, is a growing dependence on ethanol. With profits this high during a powerful recession, it doesn't matter if cellulosic takes ten or twenty years to reach even a scant percentage of the public. The profits are being made now. The mere *dream* of second generation ethanol is breaking down the gates to biotechnology in agriculture.

If the Horse Enters the Gates...

Once in the field, there is no way to prevent GM fuel crops from contaminating their food-crop cousins. Cases of genetic contamination are commonplace. In the past 2 years alone, there were at least 73 publicly documented cases of genetic contamination.[xxxi] Proving contamination can be difficult, making the actual amount of genetic pollution hard to judge, but likely much higher than reported. GM corn traits were even found in native corn varieties in the mountains of Oaxaca, Mexico, where GM corn was never legally grown.[xxxii] In fact, every commercial fuel crop so far is under consideration or has been approved for human consumption in the U.S. without long term independent testing. This includes Syngenta's fuel corn with traits from a deep sea bacteria that has never come in contact with humans, much less entered our food chain.[xxxiii] [xxxiv] The danger of an agronomically flat, GMO world is that it leaves our food systems vulnerable to climate change events and pest and disease outbreaks. Agrofuels based on GMOs and controlled by a handful of corporate giants does not lessen our vulnerability, it worsens it. Once GM agrofuels have entered the agricultural gates they will soon escape into the wild, contaminating food crops across the globe. Nothing short of a sustained, coordinated (and expensive) international eradication campaign will reign them in.

While big biotech corporations claiming to have the future answer to the energy crisis are raking in profits, the debate on genetic engineering in agriculture rages on. Consumer acceptance of GM food has not grown in the past ten years, but by taking the back door left open by agrofuels, biotechnology in agriculture is about to become the standard.

The Food Bait and Switch Crisis

The fact that agrofuels has exacerbated the vulnerabilities in our food systems, leading to rampant food price inflation and food rebellions across the globe reveals an evil irony. In a sleight of hand that draws our attention away from the fact that they created the crisis in the first place, big grain, seed and chemical companies now claim that in order to solve the crisis we need more GMOs. Their message is clear; "Don't worry about the displacement of food crops by agrofuels, or the contamination of our genetic diversity, just buy more crop-based fuel and more GM seeds and we will consume our way out of the food and fuel crises."

We don't need agro-fuel plantations to solve our energy problems. Neither do we need GMOs to overcome food price inflation or to combat hunger. In the words of many activists, "We need to turn the industrial food system on its head." The vision for a new food system is well reflected in the growing movement for food sovereignty, "the right of all people to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems." This means dismantling the control companies like ADM, Cargill, Bunge, Monsanto, Syngenta and DuPont exercise over our food systems—control that is held in place both by regulations—like the renewable fuel standards—that force us to consume their products, and the GM technologies that limit our options to one: theirs. We need to support movements for food sovereignty that promote policies and technologies for local rather than international markets; for keeping people on the land, rather than driving them off; and for bringing genetic diversity back into agriculture, rather than reducing it to the GMO patents held by a few corporate oligopolies.

The international farmers' movement La Via Campesina sees seeds as the "heritage of mankind for the good of all humanity." The movement offers a drastically different vision of agriculture from the industrial model being pushed through the agrofuels boom, a model based on family agriculture, locally cultivated seeds, and

food sovereignty. Increasingly, they are being joined by movements for community food security and neighborhood food systems throughout the industrial North. As farmers and consumers of the global North and South come together on food sovereignty—in policy and in practice—we will find ways to take back our food systems. Rolling back the industrial onslaught of GMOs is key to establishing food systems that serve the needs of the majority. Stopping the agrofuels boom, with its attendant corporate-owned GMOs, is an essential step in this challenge.

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