The costly benefits of opposing agricultural biotechnology

Andrew Apel

P.O. Box 461, Raymond, IA 50667, United States

Rigorous application of a simple definition of what constitutes opposition to agricultural biotechnology readily encompasses a wide array of key players in national and international systems of food production, distribution, and governance. Even though the sum of political and financial benefits of opposing agricultural biotechnology appears vastly to outweigh the benefits which accrue to providers of agricultural biotechnology, technology providers actually benefit from this opposition. If these barriers to biotechnology were removed, subsistence farmers still would not represent a lucrative market for improved seed. The sum of all interests involved ensures that subsistence farmers are systematically denied access to agricultural biotechnology.

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Definitions
For purposes of this discussion, the phrase, ‘opponent of agricultural biotechnology’ is defined as any individual, group or organization that uses financial or political power to advocate, impose or assist in imposing, severe restrictions or bans on genetically
modified (GM, transgenic, modified, engineered, biotech) crops or foods made from them. In this context, the term, ‘severe’ is defined as impeding or preventing the use of GM crops ‘for food security in the context of development.’

This definition readily encompasses a large number of opponents of agricultural biotechnology – much larger than many have thought to identify, in economic sectors few would normally suspect. This discussion involves the most influential opponents, but by no means all of them.

**Opponents of agricultural biotechnology**

Aside from various ill-informed consumers and fringe elements in the pseudo-scientific community, it is difficult to find persons or organizations who oppose agricultural biotechnology per se [1,2]. However, there are substantial political or financial advantages which can be protected or gained by opposing this technology.

**Chemical companies**

Among the companies hardest hit by the biotech products currently on the market are chemical companies. Crops designed to resist attacks by hungry insects have dramatically reduced sales, and income, for producers of chemical insecticides. Crops designed to tolerate herbicides, such as glyphosate or glufosinate, have had a similar impact on producers of competing herbicides. In India, for instance, the introduction of insect-resistant cotton has been catastrophic for makers of chemical sprays, reducing sales by up to 70% in some regions [3]. India’s chemical companies support opposition to GM cotton, and chemical companies there and elsewhere lobby government to restrict biotech crops [4–6].

Such a situation is far more likely to emerge in developing nations. In the USA, and in other developed nations where numerous biotech crops are legal, the producers of biotech seeds are also producers of chemical crop protection products. This allows the corporations to offset a decrease in chemical sales with an increase in seed sales. In developing nations, there is no such offset. Their chemical companies have no biotech seed technology, and therefore face financial ruin with the adoption of biotech crops.

**Food companies**

Food companies have substantial financial interests in opposing agricultural biotechnology, and support its opposition both in cash, and in kind. In 2006, the world’s seven largest food advertisers spent nearly US$8 billion on advertising [7]. This represents a tremendous outreach effort, by the wealthiest food retailers, to the wealthiest consumers. In some countries, this outreach regularly includes advertising claims that certain food items are ‘GM-free’.

**Supermarkets**

Such advertising behavior is exemplified by the major supermarkets in Britain, which shortly after the introduction of GM crops sought commercial advantage by advertising that their store-branded products contained no GM ingredients. The resulting competition led to a situation where all major British supermarket chains were advertising in 1999 their premium brands as GM-free [8]. In 2008, the eight largest British supermarket chains spent a total of 349 million pounds on advertising [9]. Advertising claims of ‘GM-free’ food necessarily communicate or reinforce anti-biotechnology sentiment.

**Organic food industry**

Producers and retailers of organic food advertise to the public that their foods are not genetically modified. However, they spend almost no money on advertising [10]. That is because most of their advertising is done by others. Direct advertising by producers and retailers of organic food has consistently been found false or misleading by advertising authorities, so non-governmental organizations (NGOs) make false and misleading claims on their behalf [11,12,35–38].

In 2007, the world market for organic food was estimated at US$40 billion, with over 90% of that market concentrated in the European Union (EU) and the USA [13]. Demand for organic food in these economies has outpaced supply, leading to shortages so acute that much or most organic food in wealthy markets is now produced for them in developing nations [14,15].

Paradoxically, this means that the poor in developing nations are themselves often too poor to be able to buy the organic crops they produce for Europeans and Americans [16]. Because organic standards prohibit the use of most modern agricultural technologies, including engineered seed, this is nothing more than paying farmers in the developing countries to not develop. Indeed, many of them are organic ‘by default’, that is, they practice organic farming methods because they cannot afford anything else [17].

This paradox has a wider impact. The organic food industry has by far the greatest financial interest in opposing agricultural biotechnology (Table 1). This makes the organic food industry, which has captured elements in nearly all financial and political interests opposed to modern biotechnology, the world’s most profitable oppressor of agricultural development in developing nations.

**Supply-chain services**

Companies which provide services to those in commodities and food distribution benefit substantially from opposition to agricultural biotechnology.

**GM testing**

The more stringent and widespread the regulations of GM content in food and feed become, the more revenue is diverted to companies which offer tests to detect the presence of GM content. A wide variety of tests is available, with costs ranging from US$6 to US$600 per test [18,19]. Though expensive, these tests are fairly cheap in comparison to the global industry that emerged simply from the ability to test. In the US, which is comparatively friendly to GM crops and foods, the value of the GMO testing market was estimated at US$106 million in 2007 and forecast to reach US$193 million by 2012 [20]. In India, a developing country where the controversy over GM crops has reached epic proportions, the value of the GM testing market is estimated to be twice as large [21].

**Segregation/traceability**

The ability to test for GM content enables segregation and traceability of commodities, facilitating middlemen in the commodities pipeline who charge a premium for non-GM commodity grains and oilseeds.

The EU is the world’s largest importer of soybean meal, and the second largest importer of soybeans. In 2008, premiums for non-GM soy were in the range of 60–80 € per metric ton [22]. With estimated EU demand for non-GM soy of 33 million metric tons in
2008, this yields an annual outlay of roughly 2.3 billion € in premiums for non-GM soy ([23], Table 1).

Equally salient are recent major purchases by Japanese trading firms of North American storage and shipping facilities, and contracts with North American farmers, for the production and distribution of non-GM maize and soybeans [24,25]. Such investments are not justified without the prospect of extraordinary profits, and represent the commitment of vested interests in maintaining public fears and regulatory restrictions directed at modified crops.

Politicians
Politicians have a great deal to gain from opposing agricultural biotechnology. Trade protectionism draws the support of domestic financial interests, while appeasement of NGOs gives politicians access to skilled media professionals. This works out differently in developed and developing countries.

Developed countries
In developed countries, notably those of Western Europe, bans and restrictions on the import and use of modified grains and oilseeds act as a trade protectionist price support for growers of grains and oilseeds, even after taking into consideration the productivity which would be gained if farmers were allowed to grow them [26,27]. It need not be explained how conferring commercial advantages on domestic interests translate into political support.

Restrictions on biotechnology also appeal to NGOs and to voters who find NGOs credible or persuasive. Politicians seeking restrictions on GM crops can look forward to political support from many quarters, which can even include NGO advertising on behalf of political candidates, or monetary contributions by NGOs to campaign finances [28–30].

Developing countries
The most prominent features of a developing country are a chronic shortage of food, and widespread poverty. Those in developing countries with food and money naturally wield political power, and in spite of food shortages, political leaders remain concerned with protecting export markets. These export markets supply the power elite with money in stable foreign currencies, an arrangement which they believe would be imperiled if farmers were allowed to grow genetically modified crops [31,32]. To protect their wealth and positions of power, these leaders have every incentive to oppose these crops – even to the point of calling them ‘poisonous’ [33,38].

Taking part in this dynamic requires that leaders in developing countries appease NGOs funded by developed nations. These organizations continually seek opportunities to disrupt export markets wherever genetically modified content can be detected, which could easily be considered to be a form of extortion [34]. NGOs also work to support decisions by corrupt leaders to deny farmers the use of modern biotechnology, by spreading lies among citizens. The lies include claims that modified crops cause homosexuality, impotence, illnesses like HIV/AIDS, baldness, allergies, liver and kidney toxicity, immune disorders, retarded growth, infertility and other things [35–38].

NGOs and the protest industry
The organizations which appear to be most bitterly opposed to agricultural biotechnology are known, sometimes ironically, as NGOs. These tax-exempt, but nonetheless profitable organizations are quite adept at portraying themselves as representing ‘civil society’, and the claim, to some extent, is true. In the case of agricultural biotechnology, these organizations derive much of their political influence by claiming to represent the concerns of consumers, farmers and others. However, these concerns are largely creations of the NGOs themselves [35–38]. At the same time, NGO efforts directly support commercial and political interests that rely on anti-biotech sentiment, often quite overtly. As a result of overlapping interests with politics and commerce, and the professional talent their lavish funding is able to attract, the operations of these organizations are coming closely to resemble private enterprise [39].

The sums of money diverted to these organizations are substantial and in Europe consist heavily of public funds. Perhaps the greatest beneficiary in this category is the Friends of the Earth (FOE). In 2006 alone, the FOE, directly and through member/affiliate/partner groups, was earmarked to receive roughly 790 million € from European governments. These governments appear to provide nearly all of its annual income [40]. Members of the European Parliament have called this diversion of public funds ‘grotesque’ and ‘anti-democratic’, and said that it amounts to government ‘paying to have itself lobbied to take actions which, in the main, it would wish to take anyway’ [41,42]. Even so, the sums diverted to the FOE are commensurate with the magnitude of the financial and political interests which benefit from its advocacy, and the influence of the FOE is not restricted to Europe. The organization now claims to be ‘the world’s largest grassroots environmental network, uniting 77 national member groups and some 5,000 local activist groups on every continent’ [43]. The vast majority of the FOE’s affiliate groups are found outside the EU, which means that Member States of the EU are paying the FOE to advertise the anti-biotech message around the world.

While the European Commission provides a good deal of money to the FOE, its main source of funding appears to be the Dutch government. The Netherlands is home to many of the world’s largest agricultural kombinates, making this tiny country one of the world’s three largest exporters of agricultural products [44]. This ensures that kombinates based in the Netherlands have some of the world’s most significant interests in the regulation, testing, segregation and labeling of commodities and foods. At the same time, this helps to ensure political and economic support for Dutch agriculture, which is not well-equipped to compete with streamlined, low-cost, high-volume producers of agricultural products [45]. Such producers are invariably producers of modified crops.

European governments appear largely unaware of the extent to which they subsidize the FOE, and it is probably that there are similar problems with similar organizations. For instance, the European Commission says it paid nearly 520,000 € to the international headquarters of the FOE in 2006, an amount which the EC believed to be about 40% of the FOE’s income. However, the FOE claims income of nearly five times that amount during the same period [46,47]. By way of comparison, European public funds earmarked for the FOE and its affiliates in 2006 are, at current rates of exchange, roughly equivalent to the regulatory compliance costs of 72 new biotech crops [40,55].

The vast sums paid to the FOE by European governments represent only a part of what is often called the ‘international protest industry’. NGOs around the world are funded by governments,
founded, corporations and individual donations. Since opposition to agricultural biotechnology can be rooted in nearly any political or economic motive, it is impossible to precisely determine the allocation of protest funds. In the US, sums paid annually to US NGOs with an anti-biotechnology campaign element are in the range of US$600 million [48–50]. The assets which generate these sums are substantial. For instance, the US-based Council on Foundations boasts an international membership of more than 2100 grantmaking foundations and corporations, whose assets total more than US$282 billion [51]. If the amounts they dedicate to environmentalism alone bear any resemblance to the spending habits of Greenpeace International, assets directed at opposing biotechnology in agriculture will account for roughly 16% of the total, or US$17 billion [52].

**Multinational biotechnology corporations**

With such a vast array of well-funded, influential groups, organizations, political interests and business enterprises engaged in restricting or preventing the use of biotechnology in food production, the position of the developers of biotechnology would appear hopeless. However, after a dozen years of commercialization, biotech crops now account for 125 million ha, or 309 million acres, worldwide. They are grown by 13.3 million farmers in 25 countries [53]. In 2007, the global market value of biotech seed was estimated at roughly 20% of the US$34 billion global commercial seed market [54].

The cost of gaining regulatory permission to commercialize a GM crop is in the range of US$6 million and US$15 million, although there exist higher estimates [55,56]. The costs of regulatory compliance are so high that, with few exceptions, they can be borne by only a select few multinational corporations—perhaps as few as five: BASF, Dow AgroSciences, Monsanto, Pioneer Hi-Bred (DuPont) and Syngenta [57]. It is widely claimed that the consolidation of the seed industry via the control of biotechnology by a select few corporations is because of ‘patents on life’. However, patents are granted for GM and non-GM seeds alike, and all patents expire after a set number of years [58,59]. Rather, it is the regulatory costs imposed on biotechnology which limits the use of that technology. Since the costs of compliance will remain for as long as the regulations persist, this amounts to a perpetual patent in favor of the largest multinational corporations, not on individual inventions or discoveries, but upon an entire branch of crop development [60]. The net result is oligopolistic control of the technology and of the market for GM seed.

**Costs of opposing biotechnology in agriculture**

The costs of opposing biotechnology are in the form of foregone benefits. For instance, if biotech traits currently on the market were incorporated into rice varieties and cultivated in India, Bangladesh, Indonesia and the Philippines, this would generate economic benefits of US$4.3 billion [61]. Annually, hundreds of thousands go blind or die as a result of vitamin A deficiency (VAD). As of November 2009, those who have died from VAD since the availability of Golden Rice total over 17 million, and those who have gone blind from VAD total nearly 4 million [62]. Where rice is the staple food, much of this enormous toll is directly attributable to regulatory restrictions on Golden Rice, which are imposed solely because the rice was developed using modern biotechnology.

Even so, the costs of opposing biotechnology in agriculture are not ‘actual’ costs, but merely, foregone benefits. Foregone benefits, also known as ‘opportunity costs’, do not reduce existing wealth. Such costs are merely profits which might have been [63]. Even the blind and dead do not count as actual costs, per se, as their destinies are merely part of the status quo of poverty and malnutrition.

**Conclusion**

The key players encompassed by the definition of ‘opponent’ of engineered crops reap billions annually from restricting agricultural biotechnology or the food that results. Indeed, more money can be made from restricting agricultural biotechnology than by delivering it. This dynamic ensures that access to the most recent advances in the technology of crop and food production is restricted to farmers in progressive nations with strong political and financial interests in agriculture. Those who most need access to this technology are those who have the least political and financial power, that is, subsistence farmers in the developing world.

In fact, it appears that the greatest money to be made by restricting access to agricultural biotechnology is made by intentionally keeping it out of the hands of those who need it the most—that is, by the organic industry. By linking political and financial interests in environmentalism, GMO testing, segregation and traceability, international trade and threatened disruptions, premiums for functionally identical goods, retailing, advertising, popular media and government subsidies for NGOs, the organic industry is able to monetize restrictions on agricultural biotechnology at nearly every point in the political/financial chain of interests.

The multinational seed developers capitalize on these interests as well, because restrictions on biotechnology prevent competition from smaller entities. In the context of development, however, this is not a meaningful barrier. If regulatory compliance costs were zero, subsistence farmers would still not represent a lucrative seed market. Indeed, the food production methods dictated by the poverty of farmers in developing nations make them an ideal source of organic food for European and North American retailers. Accordingly, the organic industry can monetize these farmers’ poverty in a way that seed developers cannot.

There are no significant financial or political incentives to change this situation to the advantage of subsistence farmers in developing nations. If there were, this situation would not exist. It remains merely to consider the moral and ethical dimensions of this situation, which, upon serious examination, might prompt spontaneous changes based on more fundamental humanitarian concerns.

**TABLE 1**

| Comparison of financial interests in restricting agricultural biotechnology |
|---------------------------------|-------|
| **Organic industry sales, international** | 40,000 |
| **Sales of GM seeds, international** | 6800  |
| **Premiums paid for non-GM soy, EU** | 3409  |
| **Payments to Friends of the Earth (FOE) and affiliates, EU** | 1171  |
| **Payments to US groups opposed to GM** | 600   |
| **Supermarket advertising (eight largest supermarkets in UK)** | 575   |
| **Testing for GM content, US and India (excludes EU market)** | 318   |

Figures are annual, US$ millions.
The case of Bt brinjals

On February 9, 2010, India’s environment minister declared a moratorium on the cultivation of GM brinjals (eggplant, aubergine) [65]. The brinjals were engineered to withstand attack by the fruit and shoot borer, a destructive insect which inflicts ‘opportunity costs’ in the form of brinjal crop losses as high as 70%, even with chemical sprays. Without such sprays, the opportunity cost nears 100% [63,66]. Brinjals are grown on nearly 600,000 ha in India. The cost of crop protection per hectare of brinjals is about US$400 [66]. This means that Bt brinjals directly threaten roughly US$240 million in revenues for India’s crop protection industry. India’s crop protection market differs from most. Globally, because of consolidation in the industry, five multinational corporations control almost 78% of the market. In India, the industry is very fragmented, with about 30–40 large manufacturers and about 400 formulators [67].

Currently, India’s crop protection industry is experiencing a financial crisis. The causes given for this are rising costs of inputs, governmental duties and taxes and the cost of capital [68]. A good part of that crisis is probably the approval in India of Bt cotton. India’s crop protection industry lobbied to prevent the approval of Bt cotton [4–6]. Were it not for the widespread illegal cultivation of Bt cotton that presented the government with a fait accompli, it would probably not have been legalized [69]. In the aftermath of its introduction, India’s crop protection industry was devastated, with revenue losses of up to 70% in some regions [3]. Such an order lesson would necessarily lend urgency to the motives of chemical companies and formulators facing the loss of yet another lucrative market. With US$240 million at stake over the issue, the average company in that sector would see annual revenues decline by roughly US$540,000. With far greater combined political and financial resources than vegetable farmers, and the backing of NGOs (many of which are backed by Europe), and of producers of conventional seed, exporters and organic food interests, these companies and organizations were nearly destined to achieve the success with Bt brinjals that eluded them with Bt cotton [70].

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References

4 Campaign against Bt cotton is motivated, says research scientist. The Hindu Available at (http://www.thehindu.com/2007/04/16/stories/2007041603040102.htm)
8 UK supermarkets to stay GM-free. Food & Drink Europe Available at (http://www.foodanddrinkeurope.com/Retail/UK-supermarkets-to-stay-GM-free)
13 The evolution of organic food and drinks: growth opportunities, NPD and the impact of the economic downturn. Business Insights Available at (http://www.globalbusinessinsights.com/content/rcbg0200m.pdf)
16 Global organic food industry facing supply challenges. Organic Monitor Available at (http://www.organicmonitor.com/r1511.htm)
21 AQUAS to sign joint venture pact with krissat. The Hindu/Business Line Available at (http://www.blinem.com/2004/03/02/stories/2004030201590300.htm)
24 Marubeni to buy U.S. corn, soybeans from farmers. MarketWatch Available at (http://www.marketwatch.com/story/marubeni-said-to-buy-corn-soybeans-directly-from-us-farmers)
REVIEW

WDSContentServer/WDSP/IB/2004/09/14/000009486_20040914111306/Rendered/INDEX.wps/1395 Standards.txt


30 Sheppard, K. (2009, November 3) Green groups digging big cash on independent expenditures for this year’s election. Grist Available at (http://www.grist.org/article/the-enviro-end-zone-rush/)


36 Greenpeace pleads for ban on GM food. The Hindu Available at (http://www.hindu.com/thehindu/holmus/015200912310922.htm)


42 Cox, S. (2007, December 6) EU ‘wasting’ cash on lobby groups. BBC News/Radio 4’s The Investigation Available at (http://news.bbc.co.uk/2/hi/europe/7127182.stm)

43 Friends of the Earth International (web page). Who we are. Available at (http://www.foei.org/en/who-we-are)


47 Results of the Call for the submission of proposals under a Community Action Programme promoting non-governmental organisations primarily active in the field of environmental protection. In Operating Grants European Parliament and Council Available at (http://ec.europa.eu/environment/funding/pdf/ngos2006.pdf)


52 Greenpeace international annual report 2006 (year ending December 31, 2005). Available at (http://www.greenpeace.org/raw/content/international/press/reports/annual-report-2006.pdf)


65 Govt backs down over Bt brinjal. The Financial Express (India) Available at (http://www.financialexpress.com/news/Govt-backs-down-over-Bt-brinjal/577870/)


67 Bt brinjal is healthy, vouches expert. The Hindu Available at (http://www.thehindu.com/2010/01/29/stories/2010012853750600.htm)


70 Bt brinjal is healthy, vouches expert. The Hindu Available at (http://www.thehindu.com/2010/01/29/stories/2010012853750600.htm)