



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.

Contents

Definitions	635
Opponents of agricultural biotechnology	636
Chemical companies	636
Food companies	636
Supermarkets	636
Organic food industry	636
Supply-chain services	636
GM testing	636
Segregation/traceability	636
Politicians	637
Developed countries	637
Developing countries	637
NGOs and the protest industry	637
Multinational biotechnology corporations	638
Costs of opposing biotechnology in agriculture	638
Conclusion	638
Acknowledgements	639
References	639

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 by the domestic adoption of 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 kombines, making this tiny country one of the world’s three largest exporters of agricultural products [44]. This ensures that kombines 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,

foundations, 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.

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.

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.

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 object 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].

Acknowledgements

An earlier version of this paper was presented at: Transgenic Plants for Food Security in the Context of Development, Pontifical Academy of Sciences Study Week, May 19, 2009, Vatican City [64]. The ideas expressed in this manuscript are those of the author alone, and in no way are intended to represent the position of the Holy See, the Pontifical Academy, nor its members, nor the position of any organization of which the author is a member. The author declares no competing interests.

References

- Schilling, B.J. *et al.* (2003) Consumer perceptions of food biotechnology: evidence from a survey of U.S. consumers. *J. Food Dist. Res.* 34 Available at (<http://ideas.repec.org/a/ags/jlofdr/27944.html>)
- Taverne, D. (2005) The new fundamentalism. *Commentary. Nat. Biotechnol.* 23, 415–416
- Kambhampati, U. *et al.* (2005) Perceptions of the impacts of genetically modified cotton varieties: a case study of the cotton industry in Gujarat, India. *AgBioForum* 8, 161–171 Available at (<http://www.agbioforum.missouri.edu/v8n23/v8n23a13-morse.htm>)
- Campaign against Bt cotton is motivated, says research scientist. *The Hindu* Available at (<http://www.hindu.com/2007/04/16/stories/2007041613200300.htm>)
- Paarberg, R. and Pray, C. (2007) Political actors on the landscape. *AgBioForum* 10, 144–153 Available at (<http://www.agbioforum.org/v10n3/v10n3a03-paarberg.htm>)
- Gregory, D. *et al.* (2009) The political economy of agricultural biotechnology policies. *AgBioForum* 12, 34–36 Available at (<http://www.agbioforum.org/v12n1/v12n1a04-graff.htm>)
- Wentz, L. (2007, November 19) Global marketers and global accounts. *Advertising Age* Available at (<http://adage.com/images/random/datacenter/2007/globalmarketing2007.pdf>)
- UK supermarkets to stay GM-free. *Food & Drink Europe* Available at (<http://www.foodanddrinkeurope.com/Retail/UK-supermarkets-to-stay-GM-free>)
- Benady, D. (2009, April 28) The wars of the grocers. *Media Week* Available at (<http://www.mediaweek.co.uk/news/features/901483/wars-grocers/>)
- Chebib, J. and Turner, L. (2000, July 1) Beggars at the organic feast. *Brand Strategy* Available at (<http://www.mad.co.uk/Main/News/Sectors/Retail/Articles/791e858e0f3e4de79f0237043249371e/Beggars-at-the-organic-feast.html>)
- Advertising Standards Authority (Great Britain), (2005, March 2) *Non-broadcast Adjudications – The Soil Association*. Available at (http://www.asa.org.uk/asa/adjudications/non_broadcast/Adjudication+Details.htm?Adjudication_id=39414)
- Powell, D. (2002, July 10) Organic, conventional and genetically engineered foods. *International Food Safety Network* Available at (<http://www.foodsafety.ksu.edu/en/article-details.php?a=3&c=9&sc=62&id=186>)
- 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/rbcg0200m.pdf>)
- Willer, H., (Yusefi-Menzler Minou, Sorensen, N., eds) (2008) *The World of Organic Agriculture – Statistics and Emerging Trends 2008*, Int. Fedn. Organic Agriculture Movements (IFOAM) Available at (<http://orgprints.org/13123/>)
- Greene, C. *et al.* (2009, June) *Emerging Issues in the U.S. Organic Industry*. US Dept. of Agric./Econ. Res. Svc. (EIB-55) Available at (<http://www.ers.usda.gov/publications/eib55/eib55.pdf>)
- Global organic food industry facing supply challenges. *Organic Monitor* Available at (<http://www.organicmonitor.com/r1511.htm>)
- Organic by Default: The Irony of Organic Farming in India*. EcoWorld Available at (<http://www.ecoworld.com/technology/organic-farming-in-india.html>)
- Products: GMO Test Kits. EnviroLogix (web page). Available at (http://www.envirologix.com/artman/publish/cat_index_5.shtml)
- Lauer, J. (2003) Testing grain for transgenic traits. *Wisconsin Crop Manager* 10, 182–184 Available at (<http://corn.agronomy.wisc.edu/WCM/W140.aspx>)
- U.S. market for food safety testing to reach \$2.8 billion by 2012. *Report Buyer* Available at (<http://www.prlog.org/10042422-market-for-food-safety-testing-to-reach-2-8-billion-by-2012.html>)
- AQUAS to sign joint venture pact with Icrisat. *The Hindu/Business Line* Available at (<http://www.blonnet.com/2004/03/02/stories/2004030201590300.htm>)
- Impacts of EU Unauthorised GM's on the feed & livestock sectors. In *Report to European Sherpa Group*. Cardy-Brown Co., Ltd Available at (<http://www.cardy-brown.com/wp-content/uploads/2009/01/impacts-of-eu-unauthorised-gms-on-the-feed-livestock-sectors.pdf>)
- Aramyan, L.H. *et al.* (2009) *EU Policy on GM Soy: Tolerance Threshold and Asynchronous Approval*. Report 2009-052 Wageningen University and Research Centre Available at (<http://edepot.wur.nl/7856>)
- 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>)
- Japan's Kanematsu to Boost Non-GMO Soy*. Reuters Available at (<http://www.flex-news-food.com/pages/19058/GMO/Japan/Soy/japans-kanematsu-boost-non-gmo-soy.html>)
- Anderson, K. and Jackson, LA. (2004) Standards, trade and protection: the case of GMOs. Discussion Paper No. 0411. International Macroeconomics and Finance Program, University of Adelaide (Australia). Available at (<http://www.adelaide.edu.au/cies/papers/0411.pdf>)
- Anderson, K. *et al.* (2004) Trade, standards, and the political economy of genetically modified food. In *World Bank Policy Research Working Paper 3395*. World Bank Available at (<http://www-wds.worldbank.org/external/default/>)

- WDSContentServer/WDSP/IB/2004/09/14/000009486_20040914111306/Rendered/INDEX/wps3395Standards.txt)
- 28 Poll: anti-GMO sentiment could affect German parliamentary votes. *European Biotechnology News* Available at ([http://www.eurobiotechnews.eu/service/start-page/top-news/?no_cache=1&tx_ttnews\[tt_news\]=11325&tx_ttnews\[backPid\]=12&cHash=353dfe0915](http://www.eurobiotechnews.eu/service/start-page/top-news/?no_cache=1&tx_ttnews[tt_news]=11325&tx_ttnews[backPid]=12&cHash=353dfe0915))
- 29 Tribe, D. (2008, September 6) *More on misleading anti-GM advert in the West* *GMO Pundit* a. k. a. *David Tribe* (blog). Available at (<http://gmopundit.blogspot.com/search?q=Anti-GM+advertisement+misleading%3A+academic>)
- 30 Sheppard, K. (2009, November 3) Green groups dropping big cash on independent expenditures for this year's election. *Grist* Available at (<http://www.grist.org/article/the-enviro-end-zone-rush/>)
- 31 Apel, A. and Prakash, C.S. (2002, November 11) The Dead Hand. *Tech Central Station* Available at (http://www.agbioworld.org/newsletter_wm/index.php?caseid=archive&newsid=1671)
- 32 Moss, M. (2009, September 30) Africa 'resistant to GMOs because of relationship with EU'. *The Parliament* Available at (http://www.theparliament.com/no_cache/latestnews/news-article/newsarticle/africa-resistant-to-gmos-because-of-relationship-with-eu/)
- 33 Manda, O. (2003) Controversy rages over 'GM' food aid. *Africa Recovery* 16, 4 Available at (<http://www.un.org/ecosocdev/geninfo/afrec/vol16no4/164food2.htm>)
- 34 GM Contamination Register. Greenpeace, GeneWatch UK, updated September 8, 2009. Available at (<http://www.gmcontaminationregister.org/index.php?content=default>)
- 35 Miller, H.I. (2009, August 12) Fight droughts with science. *Wall Street Journal* Available at (<http://online.wsj.com/article/SB10001424052970203863204574345290928452448.html>)
- 36 Greenpeace pleads for ban on GM food. *The Hindu* Available at (<http://www.hindu.com/thehindu/holnus/015200812310922.htm>)
- 37 GM pose irreversible health risk. Stalling GM experiments in the country need of the hour: Health Experts. *Greenpeace India* (web page) Available at (<http://www.greenpeace.org/india/news/gm-pose-irreversible-health-ri>)
- 38 Bohannon, J. (2002) Food aid: Zambia rejects GM corn on scientists' advice. *Science* 298, 1153a–1154
- 39 Holmen, H. and Jirström, M. (2009) Look who's talking!: Second thoughts about NGOs as representing civil society *J Asian African Stud* 44, 429–448 Available at (http://www.globalpolicy.org/images/pdfs/Look_Whos_Talking.pdf)
- 40 Apel, A. (2008, August 24) Europe's funding of worldwide activism. *GMObelus* Available at (<http://www.gmobelus.com/news.php?viewStory=145>)
- 41 Banks, M. (2007, August 20) EU Commission pays group to lobby Brussels. *The Telegraph (UK)* Available at (<http://www.telegraph.co.uk/news/main.jhtml?xml=/news/2007/08/17/weu217.xml>)
- 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>)
- 44 *Country Profile: Netherlands*. British Foreign & Commonwealth Office Available at (<http://www.fco.gov.uk/en/travel-and-living-abroad/travel-advice-by-country/country-profile/europe/netherlands/?profile=all>)
- 45 de Groot, N.S.P. et al. (1996) Beyond the past: three scenarios for the future of Dutch agribusiness 1990–2015. *Int. Soc. Hort. Sci. – Acta Horticulturae* 429: XIII *International Symposium on Horticultural Economics* Available at (http://www.pubhort.org/acthort/books/429/429_23.htm)
- 46 Friends of the Earth International (2007). Annual Report 2006. Available at (<http://www.foei.org/en/publications/pdfs/annual-report-2006r.pdf>)
- 47 Results of the Call for the submission of proposals under a Community Action Programme promoting nongovernmental 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>)
- 48 Byrne, J. (2003) *Biotechnology, The Media and Public Policy*. American Enterprise Institute reprinted by Princeton University. Available at (<http://www.princeton.edu/morefoodlesscarbon/reading/files/Byrne-Biotechnology-and-Public-Policy.pdf>)
- 49 Fuhrmann, S. Corporate Philanthropy in Unfriendly Times: The Consequences of Social Investing Advocacy. v-Fluence Public Relations, reprinted by Finanza e sviluppo sostenibile. Available at (<http://www.finanzasostenibile.it/finanza/fuhrmann.pdf>)
- 50 Graff, G.D. et al. (2009) The political economy of agricultural biotechnology policies. *AgBioForum* 12, 34–46 Available at (<http://www.agbioforum.org/v12n1/v12n1a04-graff.htm>)
- 51 Council on Foundations (web page). Who we serve. Available at (<http://www.cof.org/whoweserve/index.cfm?navItemNumber=14829>)
- 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>)
- 53 Global Biotech Crop Area Grew to 125 million Hectares in 2008. *Crop Biotech Update*, International Service for the Acquisition of Agri-biotech Applications (ISAAA), February 13, 2008. Available at (<http://www.isaaa.org/Kc/cropbiotechupdate/online/default.asp?Date=2/13/2009#3741>)
- 54 James, C. *Global Status of Commercialized Biotech/GM Crops: 2007*. International Service for the Acquisition of Agri-biotech Applications (ISAAA), ISAAA Brief No. 37. Available at (<http://www.isaaa.org/resources/publications/briefs/37/download/isaaa-brief-37-2007.pdf>)
- 55 Kalaitzandonakes, N., Alston, J.M. and Bradford, K.J. (2007) Compliance costs for regulatory approval of new biotech crops. *Nat. Biotechnol.* 25, 509–511
- 56 Belsie, L. (2001, August 30) No bumper crop of genetically altered plants. *Christian Science Monitor* Available at (<http://www.csmonitor.com/2001/0830/p3s1-usgn.html>)
- 57 *Petitions for Nonregulated Status Granted*. US Dept. of Agriculture/APHIS Available at (http://www.aphis.usda.gov/brs/not_reg.html)
- 58 McEowen, RA. *Developments in GMO Patent Infringement Cases*. Ag Marketing Resource Center/Iowa State University. Available at (http://www.agmrc.org/business_development/operating_a_business/legal/articles/developments_in_gmo_patent_infringement_cases.cfm)
- 59 Krattiger, A. et al. eds (2007) *Intellectual Property Management in Health and Agricultural Innovation: A Handbook of Best Practice*, pp. 1539–1559 ISBN 13: 978-1-4243-2027-1
- 60 Miller, H.I. (1996) Comment: biotechnology giants lobby for overregulation. *Biotech. Law Rep.* 15 949 (6)
- 61 Ammann, K. (2009) *Misconcepts cause High Costs and Huge Delays in Regulation of GM Crops*. Neuchâtel Available at (<http://www.efb-central.org/index.php/forums/viewthread/59/>)
- 62 Apel, A. VAD and Golden Rice. *GMObelus* (web page). Available at (<http://www.gmobelus.com/index.php>)
- 63 Opportunity cost: definition. *InvestorWords.com*. Available at (http://www.investorwords.com/3470/opportunity_cost.html)
- 64 *Transgenic Plants for Food Security in the Context of Development*. Pontifical Academy of Sciences Available at (http://www.vatican.va/roman_curia/pontifical_academies/acdsien/2009/booklet_transgenic_19.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/>)
- 66 Fruit and Shoot Borer Resistant Eggplant. Agricultural Biotechnology Support Project II. Available at (<http://www.sathguru.com/abs2/eggplant.php>)
- 67 *Indian Pesticides Industry*. Bharat Book Bureau Available at (<http://www.bharatbook.com/detail.asp?id=53019>)
- 68 India's pesticide industry: struggling to reach its potential. *New Agriculturist Online* Available at (<http://www.new-ag.info/01-3/develop/dev04.html>)
- 69 Herring, J. (2006) Why did 'Operation Cremate Monsanto' Fail? Science and Class in India's Great Terminator-Technology Hoax. *Crit Asian Stud* 38, 467–493 Available at (<http://www.columbia.edu/~sr793/doc/RHerring.pdf>)
- 70 Bt brinjal is healthy, vouches expert. *The Hindu* Available at (<http://www.thehindu.com/2010/01/28/stories/20100128S3750600.htm>)