ETHICS AND THE LIFE SCIENCES

THE OTHER VALUE IN THE DEBATE OVER GENETICALLY MODIFIED ORGANISMS

J. ROBERT LOFTIS
ST. LAWRENCE UNIVERSITY

ABSTRACT: I claim that differences in the importance attached to economic liberty are more important in debates over the use of genetically modified organisms (GMOs) in agriculture than disagreements about the precautionary principle. I will argue this point by considering a case study: the decision by the U.S. Animal and Plant Health Inspection Service (APHIS) to grant nonregulated status to Roundup Ready soy. I will show that the unregulated release of this herbicide-resistant crop would not be acceptable morally unless one places a very high premium on economic liberty. This is true even if one takes a sound science attitude to unknown risks, rather than a precautionary attitude. I concede that it may not have been within APHIS's legislative mandate to regulate Roundup Ready soy further, but for those of us who do not put a high premium on economic liberty, this only calls for extending regulatory oversight of GMOs.

I. INTRODUCTION

According to Michael Ruse and David Castle, the 'precautionary principle' is "a cornerstone of biotechnology policy" (Ruse and Castle 2002, 250). The precautionary principle is a rule of prudential reasoning designed to compensate for the perceived recklessness of current methods for making decisions when risks are poorly understood, including cost-benefit analysis. It is explicitly written into

European law but has been kept out of U.S. regulation by lawmakers on the right, who prefer the so-called 'sound science' principle. The sound science principle requires that no safety risk be considered in regulation until the causal mechanism that underlies it is thoroughly understood. Because U.S. lawmakers cannot agree on an approach to precautionary issues, regulatory agencies have simply judged genetically modified organisms (GMOs) based on analogies and resemblances to previously known and understood organisms.

The differing approaches to precaution in Europe and the United States have clearly affected the GMO debate. However, I want to highlight the importance of another value at play in this debate, economic liberty. I claim that differences in the importance attached to economic liberty are decisive in deliberations about GMOs. I will argue this point by considering a case study: the decision by the U.S. Animal and Plant Health Inspection Service (APHIS) to grant nonregulated status to Roundup Ready soy. I will show that the unregulated release of this herbicide-resistant crop would not be acceptable morally unless one places a very high premium on economic liberty. This is true even if one takes a sound science attitude to unknown risks, rather than a precautionary attitude. I concede that it may not have been within APHIS's legislative mandate to regulate Roundup Ready soy further, but for those of us who do not put a high premium on economic liberty, this only calls for extending regulatory oversight of GMOs.

Two caveats: First, this is essentially an exercise in rational reconstruction. I am identifying a premise that must be in place to justify a decision. More empirical sociological methods might yield different conclusions about the values in play in the GMO debate. However, the principle of charity in interpretation—the rule that says we should always be kind to our opponents in reconstructing their arguments—guarantees that this sort of analysis must play at least some role in understanding the debate. Second: I am not opposed to all use of GMOs in agriculture. I am only opposed to using the GMOs that worsen the current problems with the global agricultural system. I actually hope this essay will be a contribution to the discussion of the question "What kind of GMOs should there be?"

II. BACKGROUND

The vast majority—81 percent in 2004—of the genetically modified (GM) crops in the environment right now have been modified to tolerate an herbicide (James 2004). Generally the same company that sells the GM seeds makes the herbicide, and the two are sold as a package. The farmer can thus blanket her crops with the herbicide, knowing that it is likely to only affect the weeds. Although many benefits have been cited for herbicide-resistant crops, their only direct benefit is to increase yields relative to cost. They do this by allowing the farmer to kill more weeds with fewer applications of herbicide. Previously farmers would blanket their fields with a wide-spectrum herbicide before the emergence of their crops, followed by many sprayings using targeted herbicides or delivery methods. With herbicide-resistant crops, farmers can simply use a small number of sprayings of a wide-spectrum

herbicide at any point in crop development. It is worth noting, however, that using fewer applications of herbicide is not the same as reducing the overall amount of herbicide pumped into the environment.

Since 1996, APHIS has handled most of the regulation of GMOs.[2] APHIS claims jurisdiction over GMOs because they typically contain genes from *Agrobacterium tumefaciens*, the cauliflower mosaic virus, or other known plant pests (APHIS 1987). This policy leads to a couple of oddities. First, ever since the establishment of the "Coordinated Framework for the Regulation of Biotechnology" (Office of Science and Technology Policy 1986), the major complaint against U.S. biotechnology regulation is that it refused to acknowledge any differences between current genetic technology and traditional selective breeding. Yet APHIS is effectively going back on that refusal by using genetic modification to trigger regulatory review. Second, APHIS's claim of jurisdiction contains a curious piece of genetic essentialism. (Genetic essentialism is the almost superstitious belief that the "true nature" of a thing can be found only in its genes.) Often the genetic material taken from the known pest consists only of promoter or stop sequences, short statements of genetic code that say "start reading here" or "stop reading here." The meaning of such statements, and hence their danger, will have much more to do with the context they are placed in than the context they came from.

In any case, once a GMO falls under APHIS's jurisdiction, the seed company generally asks that APHIS grant the product "nonregulated status," which relieves it of all further oversight. Essentially, APHIS declares that it didn't really have jurisdiction after all. Among other things, this absolves the GMO of all postcommercialization monitoring to see what an organism actually does when it is released into the wild. One of the most pervasive unmonitored GMOs is Monsanto's Roundup Ready soy, which was granted nonregulated status in 1994 (APHIS 1994a, 1994b, 1994c). Roundup Ready soy is the herbicide resistant counterpart to Monsanto's flagship herbicide, Roundup. The farmer buys Roundup and Roundup Ready soy together, knowing that the Roundup will kill all the plants in her field besides the Roundup Ready soy. Roundup is a common weedkiller, available to ordinary consumers in hardware stores. Its active ingredient is glyphosate, which blocks an enzyme used in photosynthesis. Glyphosate is benign by herbicidal standards. It is water soluble, so that it does not lodge itself in animal tissues and accumulate as it works its way up the food chain, the way DDT does. It also disperses quickly, so that no traces can be found in the soil a week after spraying. Nevertheless, there are good reasons why the Roundup in the hardware store carries warning labels. Glyphosate itself can damage the liver of mammals (Chan and Mahler 1992). More important, Roundup contains the surfactant polyoxyethyleneamine (POEA), which helps the herbicide spread more evenly. It also can kill you. The twenty people known to have died from directly ingesting Roundup (all probable suicides) were killed by the POEA (Sawanda et al. 1988; Tominack et al. 1991).

When Monsanto petitioned to have Roundup Ready soy deregulated, they submitted results from nine field trials. Thirty-three letters of public comment were

also solicited by APHIS in the *Federal Register*. In their response to Monsanto's petition (APHIS 1994c), APHIS made five findings: (1) neither the Roundup Ready gene construct nor its products pose a plant pest risk, (2) Roundup Ready soy has "no significant potential to become a weed," (3) Roundup Ready soy will not increase the weediness of plants it can breed with, (4) Roundup Ready soy will not damage processed agricultural products, and (5) Roundup Ready soy will not harm beneficial organisms. Given these five findings, APHIS determined that Roundup Ready soy was not a plant pest, so it did not fall under their jurisdiction and would not be subject to any further regulation.

III. THE COST-BENEFIT ANALYSIS: WHAT BENEFIT?

In their deliberations, APHIS failed to consider many of the environmental risks posed by Roundup Ready soy at all and treated other risks inadequately. All of these risks are compounded by the lack of postcommercialization monitoring. Furthermore, unless you put a premium on economic liberty, the widespread use of Roundup Ready soy has no direct redeeming benefits.

APHIS did not consider any possible risks from the changing patterns in the use of glyphosate, seeming to take for granted the assertion by the petitioners that Roundup Ready soy would decrease herbicide use and that this would be a guaranteed environmental gain. However, as Brian Johnson and Anna Hope point out (Johnson and Hope 2000), the net effect of herbicide use has as much to do with timing and application methods as it does volume of herbicide used. In this regard, Roundup Ready soy looks dangerous. Farmers who use Roundup Ready soy are more likely to set spray nozzles high or even use aerial spraying, increasing pesticide drift (Johnson and Hope 2000; Lappé and Bailey 1998). The environmental impacts of glyphosate itself are still unknown. It is known to disrupt the soil's microflora, but the long-term impact is unknown (Lappé and Bailey 1998, 80). Overall effects on biodiversity in farmed areas are also unknown (Johnson and Hope 2000). And because soy products are used in animal feed, glyphosate can wind up in the human food supply (Lappé and Bailey 1998).

Two other risks not considered at all are the pleiotropic and position effects of gene insertion. It is well known that genes have multiple effects (pleiotropy) and that these effects are determined by the position in the genome (position effects). But when Monsanto asked to have Roundup Ready soy deregulated, they provided no information about where the Roundup Ready gene construct landed. They could show which portions of the construct were incorporated into the soy genome, and that these portions were inherited in a Mendelian fashion, but the information necessary to evaluate pleiotropic and position effects was not available (APHIS 1994c). Thus there was no way to know what else the Roundup Ready construct did to the soybean besides confer Roundup resistance, again entailing unknown risks.

APHIS also did not adequately consider the risk that Roundup Ready genes might find their way into the soybean's wild and weedy relatives, *glycine soya* and *glycine gracilis* (APHIS 1994b, 6). These plants only grow wild in Asia, but APHIS

is required by law to consider the global impact of their decisions. Since many other countries base their regulation in part on U.S. regulation, and the existence of one deregulated market can spur the creation of other black markets, this mandate is well conceived. APHIS made a token effort to consider global effects of their decision in their environmental impact statement by mentioning the existence of international and Asian regulatory agencies and asserting without justification that these agencies could handle any problems that arise (APHIS 1994b). Unfortunately, many Asian governments, especially China, ignore or fail to enforce international intellectual property laws. Pirated seeds could easily become as common as pirated CDs and DVDs and Rolex knockoffs.

Postcommercialization monitoring would help with all of these issues. While many of these risks depend on mechanisms that are well understood—for instance, pollenization—we need large-scale monitoring to measure the effect in this instance. For instance, while there have been plenty of reports of genes from GMOs appearing in wild organisms, there is no general consensus on how likely this is to occur. In 2002 the National Research Council recommended a system for postcommercialization monitoring for GMOs, which have not been implemented (National Research Council 2002). A 2003 report commissioned by the Pew Initiative on Food and Biotechnology argued that none of the agencies involved in biotech regulation were prepared to perform the kind of postcommericalization monitoring needed to achieve the "traditional objectives" of those agencies (Taylor and Tick 2003). Unless we examine the outcome of our actions, we risk repeating mistakes indefinitely.

So there are real environmental risks here; how do they stack up against the benefits? The only *intended* benefit of Roundup Ready soy is to increase yields relative to costs. Other benefits are frequently mentioned by GMO advocates. Half of the letters sent to APHIS during the public comment period suggested that farmers using Roundup Ready could move to no-till agriculture, and several others emphasized the possible decrease in the total amount of pesticides put into the environment (APHIS 1994c). However all of these benefits are speculative at best. The product will not succeed or fail depending on whether it increases no-till agriculture, no efforts have been made to tie the use of this product to no-till agriculture, and indeed we may never know if it increases no-till agriculture. Thus, the focus of our cost-benefit analysis must be on the benefit of increasing yield relative to cost. But here is where the real head scratching begins: Does the world really need cheaper soybeans? While some farmers may try to use the decreased costs to increase their profit margins, competition will quickly force them to drop prices. This effect is positively pernicious in a market where prices are already depressed due to overproduction. According to the Food and Agriculture Organization of the United Nations (FAO), in 1961 the United States produced 18,468,000 metric tons (Mt) of soy. By 2002, that number had more than quadrupled to 85,483,904 Mt (FAO 2005). This is actually less than the total world increase, which is more than sevenfold (FAO 2005). Population growth only puts a dent in the force of this number, since

the world population has merely doubled since the 1960s. There has also been a great deal of increased demand due to increased consumption of heavily processed junk food. Nevertheless, the price of soy has been plummeting: In 2000, the price was about 40 percent of what it was in 1972 (World Bank 2000, 56). As a result of this, soy farmers are now heavily dependent on subsidies. Between 1995 and 2004, the U.S. federal government paid out $13,017,619,420 in soybean subsides (EWG 2005). As Kerschenmann (2003) has pointed out, the economic effects of Roundup Ready soy present the same conflict between individual and group rationality seen in arms races. It is rational for an individual farmer to use Roundup Ready soy, because she will be able to underprice her competitors. However it is not rational for every farmer to adopt Roundup Ready soy, because they will only further reduce prices for a product that already has weak demand. Widespread use of Roundup Ready soy will likely simply increase dependence on subsidies.

What about Third World starvation? Supporters of GMOs love to say that they are necessary to feed the 800 million people who are chronically malnourished worldwide. Superficially, it seems like all these soybeans would help, since each year between 30 and 40 percent of them are exported (EWG 2003). The problem is that starvation is not correlated with the underproduction of food, and is rarely caused by it (Sen 1981, 1999). This is shown most clearly in Amartya Sen's work on famines. Sen has shown that famines occur when food production is at its peak, and food production can drop as much as 70 percent in a poor region without triggering a famine (Sen 1999). Famine is caused not by an absence of food in a region but by difficulty accessing that food, often by a particular economic class. In many of the most notorious famines, a particular group went hungry because of a drop in the value of their product relative to the price of staple grains. For instance, in the Bengali famine of 1943, fishermen starved because of a drop in the price of fish relative to rice (Sen 1981, 1999). Something similar can happen if the price of soy drops precipitously. So, as Nottingham (1998) points out, the use of GMOs by First World farmers is likely to increase starvation by undercutting the incomes of Third World farmers.

The main people who stand to benefit from Roundup Ready soy are the employees, executives, and shareholders of Monsanto. There is one other group that benefits a little, though. Farmers get to exercise their economic liberty by purchasing a product of their own free will, which they will need to keep up with the increased production of their neighbors. Let's look at this value in more depth.

IV. THE ROLE OF ETHICAL PRINCIPLES IN THIS ANALYSIS

People who write about the role of values in the GMO debate tend to focus on the precautionary principle, which is written into law in various forms in Europe, and the alternate sound science principle, which has been adopted by American policymakers. Neither of these principles, however, can make sense of APHIS's decision regarding Roundup Ready soy. I claim that this decision only makes sense if it was motivated by a strong concern for economic liberty. An important factor

here is that the precautionary principle and the sound science principle have been given so many different formulations that it is hard to tell what is really being argued over anymore. In fact, it is hard to even distinguish the principles from one another unless you assume that the partisans are making different assumptions about economic liberty.

The precautionary principle is supposed to provide guidance for decision making under scientific uncertainty and is supposed to mandate more caution than ordinary cost-benefit analysis would require. Beyond this general goal, however, there is no agreement about what the precautionary principle says. Neil Manson, in his analysis of various formulations of the precautionary principle, suggests a general logical structure that they all share (Manson 2002). Every formulation specifies a possible negative outcome, a degree of certainty about that negative outcome occurring, and an action that should be taken to avoid the negative outcome. For instance, one popular version of the precautionary principle is the catastrophe principle, which says that when the negative outcome is catastrophic, and the chance of it occurring is small but cannot be ruled out, then any activity that might lead to the outcome should be stopped. The first test of the atomic bomb would have been a nice place to employ this principle: there was a small risk, which could not be ruled out, that the bomb would ignite the atmosphere and incinerate the Earth. The catastrophe principle would bar the atomic test in these circumstances. Not all versions of the precautionary principle are concerned with catastrophe, however. The version of the precautionary principle in the Rio declaration, for instance, merely talks about damages that are "serious or irreversible."

Because the formulations of the precautionary principle have little in common besides a logical structure, the alternatives to the precautionary principle are hard to specify. While the precautionary principle has been contrasted with the sound science principle and with standard cost-benefit analysis, the logical structure is actually compatible with both of them. For instance, the precautionary principle could say: "If the possible damages are worth x (in dollars), and the probability of those damages is y (on a scale of 0 to 1), subtract $x(y)$ from the benefit of the project." Indeed, many of the more reasonable formulations of the precautionary principle say little more than this. This option is open in part because, although the focus of debate about the precautionary principle has been scientific uncertainty, there is no reason that the probabilities involved in the second condition be epistemic. Even the sound science principle promoted by industry advocates can also be put in the logical form of the precautionary principle. The sound science principle is generally taken to say, "Only act to avoid a risk when the causal mechanism underlying the risk is understood." This is a stricture on the probability portion of the precautionary principle, saying that the chance has to be well characterized.

The sound science principle suffers from the same vagueness as the precautionary principle. Chris Mooney, an activist journalist, traces popularization of the sound science approach to the formation of The Advancement of Sound Science Coalition (TASSC) in 1993 (Mooney 2005). Although TASSC claimed to be a

grassroots organization interested in science policy in general, internal documents from Phillip Morris reveal that TASSC was created by the tobacco company with the help of the public relations firm APCO with the specific goal of discrediting reports of the dangers of secondhand smoke. In the hands of the tobacco industry, sound science was not so much a principle as a strategy. Mooney suggests that the strategy is best summarized in the much earlier notes for an internal presentation at Brown and Williamson, which were made public as a part of tobacco litigation: "Doubt is our product, since it is the best means of competing with the body of fact that exists in the minds of the general public. It is also the means of establishing a controversy." (Brown & Williamson 1969, quoted in Mooney 2005, p. 67)

It would be unfair to leave the rhetoric of sound science as it stood in the hands of the tobacco industry. As I have said, it can be rendered in the same logical structure as the precautionary principle. Phrased this way, it is essentially an attempt to loosen the restrictions of caution by saying that a high level of confidence in the negative outcome must be established before the preventative action may occur. One can already see the value of economic liberty at work in the justification of this principle. A background assumption in this debate is that the "preventative action" is an action by a government to restrict some form of industry. That is certainly the form that the action takes in this debate, since we are considering whether the U.S. government should allow Monsanto to pursue its business plans. But why raise the standard of evidence, across the board, for any government action? The obvious justification, close to the lips of all promoting sound science, is that companies like Monsanto have a strong *prima facie* right to do business as they please. Conversely, those who want to tighten the restrictions of caution assume that Monsanto's economic rights are quite weak.

The problem is that simply adjusting the probability portion of the precautionary principle is not enough to justify APHIS's action in the case of Roundup Ready soy. There are negative outcomes with probabilities greater than zero involving mechanisms like crossbreeding whose workings are well understood. There is no net benefit to the use of these crops. On any formulation of any of the above principles, the use of Roundup Ready soy is an unjustified risk.

To really justify APHIS's decision, you must appeal directly to the principle behind the sound science principle, the principle of economic liberty. A libertarian understanding of economic liberty supports APHIS's decision three ways. First, it implies that deregulation of Roundup Ready soy automatically brings about at least one good result, since economic liberty is itself a good. Second, it blocks my claim that the market for soy is so glutted that further production of soy would not be a good, because the free market is the only legitimate mechanism for determining when too much of a product is being produced. Finally, it blocks considerations of many of the long term potential harms of Roundup Ready soy as illegitimate attempts at social engineering.

The first piece of support for APHIS's decision comes because the economic freedom is now an intrinsic good. The exchange between Monsanto and individual

farmers is, as Robert Nozick would put it, a free act of capitalism between consenting adults (Nozick 1974). Moreover, this free act is no less important to our well being than our freedom of speech or our freedom to choose our romantic partners. Indeed, for some libertarians, economic liberty becomes central to all other liberties: "Economic control is not merely control of a sector of human life which can be separated from the rest; it is the control of the means to all our ends" (Hayek 1944, 92). In the spirit of Mill's *On Liberty* we can say that the state should only interfere with such acts to prevent direct harm to others or the significant risk of such harm. This argument may not be enough to justify APHIS's decision, though, because there Roundup Ready soy does pose potential harm to others. Fortunately for the economic libertarian, there are other factors bolstering APHIS's decision.

The economic libertarian can also claim that a further lowering of prices is also a positive outcome, even though the market for soy seems to be glutted. She can claim this because she believes the only legitimate method for determining how much of a product should be produced is whether sellers can find a market for it. We will know when there is too much soy on the market because farmers won't be able to stay in business selling it. The gap between the individual and collective self-interest of farmers which Kerschenmann described should really be lauded as the source of our affluence, as competition to increase production and lower prices is a part of the genius of modern society. If farmers acted in their collective self-interest to limit production, they would be forming an anticompetitive cartel. A group decision to avoid Roundup Ready soy because increasing production would have no benefit would be similarly anticompetitive. The libertarian would also say that my dismissive description of much of the increased demand as coming from the rise of "junk food" amounts to an elitist sneer at other people's preferences. If the world wants more junk food, then providing it for the world would be a good thing. Concerns that further production of soy would increase famine by undercutting the ability of Third World farmers to sell their product are similarly misplaced. The decline of Third World farming is simply the transfer of production to the regions that can do it most efficiently. There is one problem with the current global soy market the libertarian would acknowledge: the existence of huge subsidies. If there is a glut of soy, it is because subsidies prevent the pricing mechanism from doing its work. But the solution then would be to remove the subsidies, not to block new technology.

Finally, the economic libertarian can dismiss many of the risks I described as illegitimate attempts at social engineering. Many of the risks discussed, such as the risks involved with increased use of Roundup, assume large-scale adoption of Roundup Ready soy. But in considering limiting freedom on the basis of potential harms, one should only look at immediate harms to identifiable individuals. The long-term and large-scale harms and benefits of an action are too complicated for an individual planning agency to predict. It thus must be left to the free market, with its ability to aggregate the values and opinions of the whole society, to decide how to deal with such big picture issues.

Although APHIS did not make an explicit appeal to the value of economic liberty, much of this libertarian style argument is implicit in the APHIS rulings (1994b, 1994c). APHIS made its decision by looking at the immediate circumstances. The benefits considered were all benefits to the individual farmer using Roundup Ready soy. Whether there was a pressing need for cheaper soy was apparently not something they were authorized to consider. Similarly, the only concern considered was the possibility that Roundup Ready soy might be a plant pest. In response to a public comment about the need to change patterns of pesticide use, APHIS claimed that such goals are beyond their jurisdiction. This last point may actually be true. Indeed, the libertarian premises behind APHIS's reasoning may in general be a feature of their legislative mandate, and not ideological. But for those of us opposed to economic libertarianism, this merely points to the need to expand the mandate of regulators.

ENDNOTES

This paper was presented to the Fourteenth North American Interdisciplinary Conference on Environment and Community, Saratoga Springs, NY, February 19–21, 2004, in addition to the Ethics and the Life Sciences conference that this volume represents. I thank audiences at both conferences. Some of the arguments and explication of background facts in this paper are expanded and adapted from Loftis (2005).

1 The Environmental Protection Agency (EPA) does have jurisdiction over plants that produce their own pesticides and has enacted some restrictions. Unfortunately, EPA turns over all enforcement of its regulations to the Food and Drug Administration, which effectively leaves the regulations unenforced (Taylor and Tick 2003).

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