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GMOs and hunger – the false link

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In this paper, we introduce key concerns about releasing GMOs into the environment and the food chain, explain how we view the relationship between GMOs and hunger, and provide a vision for what we see as real and sustainable solutions for food security.

The science behind genetic engineering: living on a flat earth?

Fifty years ago the structure of DNA was determined and hailed as the "secret of life". (Watson and Crick 1953) The determination of the structure of DNA made it seem as if the complete understanding of living organisms would someday be possible. Later, in the 1970s and 1980s, the technology to insert genes at random into the genomes of organisms was developed and named genetic engineering (GE). Genetic engineering was hailed as a "life" science, as a technology to shape and design living organisms as required.

In the fifty years since the discovery of the double helix, science has shown that gene expression is not nearly as simple as the genetic engineering industry would like us to believe. The discoveries since 1953, and especially in recent years, are bringing about a paradigm shift – from the concept of DNA as the master molecule that stores information, controls and produces protein, to DNA as an important, but not the only, store of information that is accessed, processed and regulated by other elements that also play central roles.

The publication of the human genome sequence in 2001 deserves special mention. (International Human Genome Sequencing Consortium 2001; Venter 2001) It was heralded as starting a new era in genomics and in our understanding of life – James Watson proclaimed that at last we would know what it meant to be human. However, scientists were startled by a surprising discovery that came along with the elucidation of the genome sequence – the small number of genes in the human genome. There are only 20,000 to 40,000 protein-encoding genes in the human genome, much less than the expected 100,000 – 150,000 genes that would directly correspond to the number of proteins found in human cells. (Gibbs, 2003; Venter 2001)

This finding has severely challenged the current understanding of DNA regulation and control. There are simply too few genes to account for the diversity of proteins that are manufactured by the human genome on a one gene, one protein basis (an important scientific assumption of the gene engineers that move single genes and proclaim that only a single protein has been added to the engineered organism).

Discoveries such as the influence of methylation, the coiling of DNA, gene silencing, differential splicing, reverse transcription and the roles of various types of RNA have changed the picture of gene expression from a simple linear system (where DNA makes RNA makes protein) to one where gene expression is tightly regulated and controlled by many non-DNA elements in a complex hierarchy. (see, for example, Eddy 2001; Felsenfeld and Groudine 2003; Gibbs 2003b; Lee *et al*. 2002; Sorek and Amitai 2001)

Contrary to what the public and our governments are often led to believe, genetic engineering is not a precision tool. DNA is inserted at random into the genome. Insertion of DNA can cause deletions and rearrangements of the original DNA at the insertion site or unintentionally introduce additional, randomly placed copies and fragments of the genetic insert; there is little understanding of what the consequences of these unintended alterations might be. (Svitashev and Somers 2001) Irregularities have been found in the genomes of several commercial GE crops, including Roundup Ready soya and maize (GA21, NK603, MON810) from Monsanto and Syngenta's insect-resistant maize (Bt11 and Bt176). These irregularities were typically found *after* the products had been approved following supposedly rigorous testing and assessment processes.

The new paradigm of DNA being just one, albeit an important, part of the network regulating living cells challenges the fundamental dogma on which the technology of genetic engineering is based. (Ball 2003) The complexity of the regulatory network makes the genetic engineering of higher organisms appear crude and old fashioned – a technology for a flat earth.

Moreover, a reliance on the anachronistic one gene-one protein model has led to misguided decisions by regulatory agencies. For example, in the United States, food safety tests required by the Environmental Protection Agency only examine the toxicity of the engineered protein, and only a form of the protein purified from bacteria. If agency scientists were to take seriously into consideration the new findings about DNA, genes, and imprecise transgenic technology, they would certainly recognize the need to test the protein as it is found in the plant rather than an unrelated organism – the bacterium – and to test for the toxicity of both novel proteins and novel metabolic products that might be the result of the genetic engineering process.

The technical manipulations of genetic engineers are carried out based on flawed assumptions about the role of DNA in the organism. But more significantly, they are derived from an incredible hubris, an arrogant assumption that it is possible to understand the complexity that is life and to manipulate its parts as if it were a set of Leggo toys. However, one of the lessons of the human genome discovery is an old one – that the more we learn, the more we understand we don't know. These genetic engineers are mere technicians tinkering in unknown realms, with little to no understanding of the consequences. The idea that life itself – the human existence – is something divinable through a technical, laboratory knowledge of genes – that is, the declaration of James Watson – is a vivid example of how misguided this scientific enterprise can be.

Genetic engineering won't solve world hunger

Let us turn now to a question that we have dealt with over the course of this study seminar – the question of world hunger. There is no doubt that this is a political, social and ethical question of extreme importance today. There is no need for the millions of hungry people on this planet to exist in such precarious circumstances. This issue is of prime importance to the Church, and indeed should be of deep concern to all of us. We all have a responsibility to our fellow humans to improve the lives of those living on the brink of existence.

Current GE crops are not contributing to solving world hunger. Nobody present here would challenge this assertion. The crisis in Argentina in late 2001 illustrated this frustrating and unjust reality: there is no direct relationship between the amount of food a country produces and the number of hungry people who live there. In 2001, Argentina harvested enough wheat to meet the needs of both China and India. (Parrott and Marsden 2002) Yet Argentina's people were hungry. Argentina's status as the world's second largest producer of GE crops – largely for export – for animals! – did nothing to solve its very real hunger problems at home. (At least 80% of the current GE crops being grown are going to feed animals, not people.)

We specifically challenge the simplistic and inaccurate analysis that hunger is primarily an issue of productivity, that somehow if we just increase yields globally we will increase the availability of food to hungry people. As just noted, there is ample food available in many countries on the planet – unfortunately too many people are too poor to buy food, or lack the land and resources to grow it themselves. (For a more detailed elaboration of this argument see Rosset 2002.)

Political and economic processes over the last several hundred years have created those conditions that lead to poverty and hunger – extreme inequality in access to land, in security of land tenure, and in quality of land farmed.[1] These inequalities underlie equally extreme inequities in wealth, income and living standards. It is a particular irony of current economic conditions, and national emphases on industrial, export agriculture, that food and other farm products flow *from* areas of hunger and need *to* areas where money is more concentrated – due to the shallowness of demand in many poor, developing countries. A further insult – rich country agricultural overproduction continues to put poor developing country farmers out of business.

We cannot deny, however, that low productivity is an important consideration for many poor farmers. But a careful examination of the reasons for low productivity is in order. Peasant farmers, in a globalized economy, producing under conditions of structural adjustment and declining government support are faced with enormous obstacles:

- in the face of cheap imports, the prices of staple foods drop below cost of production;
- under structural adjustment programs, subsidized credit, marketing assistance and price supports, as well as communal land tenure systems, have all been under attack;
- there is a general lack of incentive to produce large quantities of crops in a situation with low prices and few buyers.

These are the conditions leading to declining productivity. Third world food producers have been displaced onto marginal, rain-fed lands, and face structures and macroeconomic policies that are inimical to food production. Peasants demonstrate lagging productivity not because they lack "miracle" seeds; it is because of the difficult economic conditions under which they operate that ***farmers today produce far less than they could with currently available know-how and technology*** because there is no incentive for them to do so. Indeed, why would a farmer buy fertilizer to increase his or her productivity if they know they will be unable to sell their surplus, or if the prices they will receive won't pay for their additional investment? ***Genetic engineering cannot solve these problems.***

Beyond this lack of a demonstrated need for genetically engineered crops, we must also note that there are specific threats of GE crops for poor farmers. Peasant farmers cultivate marginal lands – their agriculture is complex, diverse, risk-prone; their farming systems are complex and

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[1] See the Pontifical Council for Justice and Peace publication *Towards a better distribution of land* for an elaboration of these problems and discussion of the Church's social teaching in relation to ownership of land.

diverse. The risks of GE crops for them are different, and potentially much greater, than those borne by developed country farmers. Let us point out three different ways that GE crops could pose significant risks to peasant farmers:

- First, the risk of widespread crop failure from an untested technology. Large-scale failures have been documented in genetically engineered crops in the US: soy stems cracking in heat (Coghlan 1999); failure of early versions of GE cotton on a large scale (Fox 1997); problems developing with *Fusarium* in Roundup Ready soy (Kremer *et al.* 2000. Peasant farmers operate in much more precarious economic and ecological situations. The economic risks of widespread crop failures for peasants are potentially much more severe than for wealthy farmers.
- Next, the risk of Bt crops. With Bt crops, a pesticide is introduced into the environment in a novel form, with continuous and broad application. Bt crops are antithetical to integrated pest management (IPM), where the first principle is to only spray when necessary, and to delay spraying as long as possible. Bt crops have unknown effects on non-target organisms (think of the myriad environments in Mexico where the Bt gene is now currently being expressed and the diversity of insect life in those environments), and on ecological process upon which peasant farmers greatly depend, such as those contributing to soil fertility. Because peasant farmers absolutely depend on the environment for survival, the disruption of important ecological processes is much more significant to them.
- Finally, the risk of GE crops include introduction into centers of diversity, with more wild and weedy relatives of crop plants than are found in temperate agricultural areas. Again, scientists have no idea what impacts introgression of these transgenes and genetic constructs, and the concomitant genetic disruption, may have on these reservoirs of diversity. However, we know very well that the entire world depends on this crop plant diversity for the stability and sustainability of food supplies around the world. Peasant agriculturalists are particularly dependent on a diversity of traditional varieties for the stability of production in marginal areas and through variable climatic conditions.

Beyond these concerns lies the question of intellectual property protection – patents. Genetically engineered crops are the “inventions” of five major transnational corporations. They are patented. Because they are protected by patents, seeds may not be saved by farmers. This would be akin to patent infringement, as hundreds of farmers in Canada and the United States have found out the hard way, by being sued by Monsanto. Patents confer monopoly rights onto the companies that possess them, and those companies can charge monopoly prices.

In the case of genetically engineered crops, these prices are euphemistically called "technology fees." This year, Monsanto has proposed increasing their technology fees in the US, and is also talking about enforcing patents in Argentina using legal means, where less than 20% of the farmers using RR soy are actually buying seed from Monsanto. (Gillam 2003; SA La Nacion 2004; Smith 2004) This technology is clearly not about soy production – it's about selling seed. There is no indication that the companies in control of this technology – Monsanto sells 90% of the GE crops around the world – are going to give it away for free, not even in a country where there is still a very serious economic crisis, like Argentina.[2]

But what about such inventions as "golden rice," engineered to produce beta-carotene-enriched rice? Vitamin A deficiency is one of several micronutrient deficiencies that have plagued humankind over centuries and which still pose a massive public health problem. Golden rice was designed to address this serious vitamin deficiency.

However, Vitamin A deficiency is not best characterized as a problem, but rather as a ***symptom***, a warning sign. Vitamin A deficiency is in fact part of a broader complex of dietary inadequacies that are associated with poverty and monoculture. People do not present with vitamin A deficiency because rice contains too little vitamin A or beta carotene, but rather because their diet has been reduced to rice and almost nothing else, and they suffer many other dietary illnesses that cannot be addressed by beta carotene, but that ***could*** be addressed, together with vitamin A deficiency, by a more varied diet. A diet rich in Vitamin A and other micronutrients is a luxury for millions of poor, not because such foods are not available in their countries, but because they cannot afford them and/or have no access to them.

To say that the answer to this single deficiency is golden rice is to say that the poor should continue to only be able to afford rice, and that they should continue to suffer from the many other nutrient deficiencies caused by an inadequate diet. This is clearly not a sufficient response, particularly when there are many means being used currently by the international nutrition community to address vitamin A and other nutrient deficiencies. (UN Food and Agriculture Organization 2003)

The parable of the golden snail…

When a group of Filipino farmers were asked recently for their thoughts on genetically engineered rice seeds, a peasant leader responded with what might be called the Parable of the

[2] See the Pontifical Council for Justice and Peace publication *Trade, development and the fight against poverty* for the Church position on patents.

Golden Snail. It seems that rice farmers have long supplemented the protein in their diet with local snails that live in rice paddies. At the time of the Marcos dictatorship, Imelda Marcos had the idea of introducing a snail from South America said to be more productive and, as such, a means to help end hunger and protein malnutrition. But no one liked the taste, and the project was abandoned. The snails, however, escaped, driving the local snail species to the brink of extinction – thus eliminating a key protein source – and forcing peasants to apply toxic pesticides to keep the South American species from eating the young rice plants. "So, when you ask what we think of the new genetically engineered rice seeds, we say that's easy," the leader said. "They are another Golden Snail."

The Real Solutions

The solution to food security being promoted by the United States is oversubsidized industrial agriculture, with surpluses dumped on world markets. The latest component of this industrial system is genetic engineering, with crops that tolerate greater amounts of herbicide and that produce their own insecticide. According to the industrial model, small producers in developing countries are inefficient and ought to be put out of business – the dumped commodities can then be used to feed them. To the United States, self-sufficiency is a trite anachronism.

However real solutions lie not in feeding the world, but in allowing the world to feed itself. Such solutions will not be dependent on patented inputs from transnationals. Instead, real solutions are like the push-pull system in Kenya – a simple technology that is low in cost, effective, not dependent on expensive chemicals or seeds and not patented. (Parrot and Marsden 2002) The push-pull system was developed to deal with the joint problems of a noxious weed and an important pest – the corn borer – in small-scale maize production systems in East Africa. Scientists with the International Center for Insect Physiology and Ecology (ICIPE), under the leadership of World Food Prize winner, Dr. Hans Herren, identified a complex of plants that could be sown in and around maize fields that push the insect out of the field while at the same time attracting it (pulling) towards a more interesting plant outside the field. The plants used happen also to repel the weed, *Striga*, while at the same time increasing the fertility of the field by adding nitrogen.

These locally adapted solutions are the types of initiatives necessary to deal with the diverse array of farming systems around the world, and the diverse conditions under which poor peasant agriculturalists operate. Real hope is coming from initiatives like these that involve farmers in the South directly: A study commissioned jointly by Greenpeace and Bread for the World found more than 200 examples of sustainable, productive agriculture resulting in genuine improvements in people's livelihoods – projects on more than four million farms in 52 countries. (Parrott and Marsden 2002; www.farmingsolutions.org) The examples show how creativity and ecological understanding lead to an agriculture that fosters biological and cultural diversity – alternatives that are productive and adapted to their respective ecosystems. Appropriate solutions are:

- Low cost;
- Rely on ecological processes;
- Developed by understanding and working with local systems;
- Not risky technologies that are threatening to local environments.

These examples carry a strong message for political decision-making both nationally and internationally. Do not delegate the responsibility for 800 million starving and malnourished people to a handful of agribusiness companies. Create the enabling political environment for the poor to feed themselves and support the large number of successful approaches to produce sustainably.

Concluding remarks on the study seminar

Let us in conclusion state some principled concerns we have about this seminar.

Upon being invited, we found it difficult to understand the exact purpose of this study seminar. We could read the programme but what was the agenda behind it? "GMOs: Threat or Hope?" was the title. Threat to whom? Hope for whom? Or what – people or the environment?

As in threat to biodiversity and food sovereignty? Or as in hope for the handful of agribusiness corporations that sell genetically engineered seeds (and the associated chemicals)?

Would the seminar focus on the fact that cultivation of GE crops is creating new forms of chemical-dependent agriculture, and leading to the unavoidable contamination of organic and conventional crops and the development of superweeds and superbugs? Or would the seminar address the loss of export markets due to consumer rejection of GE food or the increasing corporate control over farmers? No?

So, what about the genetic pollution of native maize in Mexico from GE corn dumped there by subsidized US corporations? Was that on the agenda? Where are the representatives of UZACHI, the indigenous group in Mexico that first told the world of their contaminated varieties, and who are deeply troubled by the contamination found in their landraces of maize? Was the seminar to tell how the Yungas rainforest is being cut down in Argentina to make space for new GE soya fields, that are then sprayed with Roundup from aeroplanes and owned – not by farmers – but by banks and corporations?

No. Instead the spurious link between GMOs and solving world hunger was chosen as the focal point. Why? After all, taking departure in a wish to solve world hunger would have resulted in a much different programme, asking questions like how we can eradicate poverty and fight global inequality – how to secure access to land, access to credit, and elimination of harmful subsidies. What does a sustainable world actually mean, for humankind *and* nature? What action is required to take us there?

These issues are unfortunately not tabled for discussion here.

In our view, this seminar adequately addresses *neither* the issue of GMO releases *nor* that of solving world hunger. The question posed in the title of this seminar – *GMOs: Hope or Threat* – would not be answered here.

Conclusion

Hunger and poverty go hand in hand. Technological "solutions" such as genetic engineering overshadow the real social and environmental problems that cause hunger. These issues include who grows our food, how and where it is grown, how it is distributed, and who has access to it.

Genetic scientists are altering life itself. The products of genetic engineering are living organisms that could never have evolved naturally and which do not have a natural habitat. GE organisms can reproduce and interbreed with natural organisms, thereby spreading to new environments and future generations in an unpredictable and uncontrollable way.

Not only do genetically engineered crops not provide the solution, they also pose a threat of irreversible harm to the environment – the real basis of people's food security. GE technology, and the industrial system it maintains, increases dependence on expensive farm chemicals and single food crops, denying people a balanced diet and destroying the environment on which we all depend. It increases dependence on the companies that supply the technology and the countries that supply the loans to pay for it. Far from a solution, GE crops extend all the worst practices of industrial agriculture.

We humbly call upon the Catholic Church and the Vatican to consider its responsibility to serve humankind and not Monsanto. Reject the false promises that genetically engineered crops will "feed the world." Insist instead on real and sustainable solutions that benefit the poor and malnourished.

Thank you very much for your attention!

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