Community Entrepreneur Development Institute

Reasons for Rejecting GMO Crops

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Introduction

In order to understand the role of Genetically Modified Organisms in the future of agriculture we need to go back to the origins of industrial agriculture in the so-called "Green Revolution" - a connection that is nominally evidenced by the introduction of GMO technology often being heralded as a "*Second* Green Revolution", or even the "Gene Revolution".

The 'first' Green Revolution, beginning in the 1960s, ushered in the practice of large-scale mono-cropping of newly invented high-yield crop varieties, and the heavy use nitrogen fertilizers, water, chemical herbicides, pesticides, and heavy farm machinery.

The result was an increase in grain production, but that came at the cost of environmental pollution, health problems, the destruction of traditional farming communities, an increase in social inequalities, the concentration of control of the world food system in the hands of large corporations, the loss of agro-biodiversity and traditional farming knowledge.

The list of effects goes on, but what even the promoters of industrial agriculture cannot deny is that the growth in food production is now leveling out – it has plateaued and can no longer be seen as a solution to world hunger.

More seriously the assumptions upon which the Green Revolution was based are today no longer valid.
These assumptions were three:

1. That there would always be abundant and cheap energy (namely oil);
2. That climates would remain stable; and
3. That there will always be plenty of water.

Today, none of these assumptions is valid. There is no longer an abundance of cheap energy – oil is running out. Climates have begun to change, disrupting traditional agricultural cycles; and available water is running out. This all makes industrial agriculture *no longer sustainable.*

The agricultural challenge

Today we are faced then with an agricultural challenge – *how to increase food production on the same land base, while using less energy, less nitrogen, less water, less herbicides and less pesticide.*

There seems to be two choices:

One is **biotechnology** – the production of genetically modified crops that will be more productive with less water, less dependent on herbicides and insecticides, and more amenable to changes in the climate.
The other choice is **agroecology** – the application of the science of ecology to agricultural systems in order to increase biodiversity so that natural biological processes can to work effectively and reduce the need for so much energy, water, artificial fertilizers, pesticides and herbicides.

GENETIC MODIFICATION

The Biology of GM

Genetic modification is the transfer of genes (i.e., sections of DNA) from one species to another, thereby causing the recipient species to express desired traits or characteristics of the donor species.

The process involves several steps: First, the desired gene needs to be identified and isolated. A gene being a section of DNA that carries instructions for the production of a particular protein that set in motion a specific biochemical process with a plant's cells. Once identified and isolated, the gene then needs to be introduced into the target organism by using a bacterium or a gene gun.

Bacteria have the ability to naturally introduce their own genes into a host organism and so are often used as the transmitting medium, or "vector" for the new gene. A gene gun does the same thing but mechanically, by firing micro-particle of gold or tungsten coated with the donor species' DNA directly into the cells of the target species.

The outcome of both processes is unpredictable. Only some of the target species will accept and express the desired genetic characteristics. But once those that do so have been identified, they are then grown and bred conventionally.

The commercial use of GM technology

The two greatest commercial uses of this technology have been to produce crops containing a gene for herbicide tolerance, and crops that are insect resistant.

It might be expected that these two technologies would go a long way toward reducing agricultural reliance on herbicides and pesticides, but whether they do or not is still being argued about. Some studies say they do, and others say they don't.

One thing we need to be aware of, however, is that in the case of herbicide tolerance, the new herbicide tolerant species are being produced by chemical companies to be tolerant of their own patented herbicides. Monsanto, for example, produces genetically modified seeds that are tolerant only to its own "Roundup" herbicide. This means that the farmer who buys Monsanto's herbicide resistant seeds also need to buy Monsanto's "Roundup" herbicide.

The aim of the company is to get the farmers to use its herbicide, which can be sprayed generously over the whole crop to kill unwanted weeds with no danger of damaging the crop itself. Clearly the commercial aim for the chemical company is to sell more of its own herbicide.

There are dangers for the farmer in this sort of relationship. The purchase of the GM seed can lock farmers into a relationship of dependence on the herbicide company, and clearly this is what the company wants. It wants to increase the sale of its own product.

So much for reducing herbicide use …. ***What about insect resistance?***
the promise of increasing food production?

Insect resistance

The second major commercial use of GM technology is in producing crops that are insect-resistant. Insect resistant crops are produced by inserting into them a gene that expresses the toxin of the bacterium Bacillus thuringiensis (Bt). This is used mainly used for maize and cotton.

The Bt toxin is a naturally occurring insecticide, and when the gene that produces it is inserted into a plant, such as corn, then all the cells of that plant produce the Bt toxin; and when insects that are susceptible to the Bt toxin eat any part of the plant they die.

As all biologists know, however, insects, because they breed so rapidly in in such large numbers, quickly develop resistance to pesticides resulting in resurgence in their numbers, creating a need for new more virulent pesticides. It also has the effect of making the natural Bt-pesticide useless for organic farmers, causing them to give up organic farming and start using chemical pesticides.

So much then for the promised reduction in pesticide use…….***What about increases in yield?***

Increased yield

All of the agro-chemical companies raise the specter of world hunger as a way of gaining support for the technology of genetic modification. But do GM crops really help solve the problem of world hunger?

In most cases people are hungry because they are poor. They do not have enough money to buy the food they need. Nor do they have enough land to produce it for themselves. And the modern technologies that are designed to increase crop yields are too expensive for them to buy.

What they need is not more expensive industrial technology, but cheap and readily available means of improving farm productivity. Many such means are available, but they are not being promoted by governments around the world.

Furthermore, since the 1980s when the GM technology was invented, only four GM crops have been widely promoted – soybean, corn, cotton and canola. But these crops are being

grown largely for animal feed and biofuels, and make little or no contribution to the world's food supply.

Lastly, comparative research shows that GM crops do not produce any more than the older more conventional high yield varieties. GM crops therefore are making no contribution whatever to feeding the world's hungry.

What about long-term sustainability of GM crops?

Sustainability

When new genes are inserted into the DNA of target species, the target species will receive this new DNA in different regions of its genome. Some of the new DNA may produce the desired trait (herbicide tolerance or insect resistance); but some of it may unbalance or disrupt the normal functioning of the plant.

It may be several generations before the resulting disruptions are fully realized and the affected species begins to show reduced vigor or some other disability. But because of the rush of biochemical companies to get the new genetically modified species to market as soon as possible, few if any of the genetically modified species are tested for more than one generation to determine whether the gene is acting in the way it is expected to before seed propagation goes into full swing. As a result, the unintended characteristics of plants may only emerge later. The damage or disease may become evident only after several generations.

The reality is that the production of genetically modified crops has proceeded without due consideration for their long-range viability or biological consequences, and for this reason genetically modified organism pose a range of environmental and health risks.

Ecological Risks

These risks are well documented. The most serious ecological risks of GMOs are:
1) To crop diversity – The greater the diversity there is in the environment, the greater the ability there is to adapt to changes; but GM crops encourage mono-cropping, and this destroys biodiversity, thereby leading to greater vulnerability to disease or environmental changes.

2) Super Weeds*:* Genetic herbicide resistance can be transferred from cropping plants to wild plants (through natural gene flow) and this can create herbicide resistant 'super-weeds' that cannot be controlled.

3) Pest Resistance*:* GM crops are engineered to produce their own (Bt) toxin. But insect pest can rapidly develop resistance to this insecticide resulting pest-resurgence. This has the effect of making the natural Bt-pesticide useless for organic farmers, causing them to have to give up organic farming and start buying chemical pesticides.

4) Killing beneficial insects and mico-organisms: Large-scale use of pest resistant Bt crops affects other insects and soil organisms that play important ecological roles in controlling pest and fertilizing the soil.

Socio-cultural and economic risks

There are also a number of socio-cultural and economic risks:
1) Farmers who use GM crops become dependent on credit to buy their GM seeds and associated chemical inputs. This can lead to indebtedness to the seed companies, loss of control over what they plant, and loss of land.

2) Herbicide tolerant crops lock farmers into buying the herbicide produced by the company who sells them the genetically modified seed.

2) Poor farmers who are unable to afford expensive modern technologies become economically marginalized.

3) It has been show that GM seeds do not increase crop yield.

4) The introduction of GM crops can lead to the loss of native plant species and ritual and ceremonies associated with them, and the social practices of seed saving and sharing.

5) Nobody knows yet what the health effects will be of eating GM foods; whether the toxins they produce affect human health?

6) GM crops contribute to the growing consolidation of corporate power over the whole world-wide food system. This contributes to the singular focus in agriculture on new technological solutions at the expense of proven traditional methods.

The scientific debate

There is a large scientific debate over the safely and viability of GM crops, and in it we are confronted with different findings. What is clear, however, is that most of the research results are about potentials - potential benefits and the potential risks.

The potential benefits are said to be increased yields, improved resistance to pests, and tolerance for herbicides. The potential risks are said to be to human health, to biodiversity, and the livelihoods of small farmers. The results are all about potentials, and there is a reason for this.

Because GM crops are a new technology there has not been enough time for conclusive field studies to be made. Studies have, of necessity, been short-term, and short term studies favour the benefits argument because the projected adverse long-term effects have not yet had time to register themselves.

For example, the two main traits present in GM crops are pest resistance and herbicide tolerance. In short-term studies, both traits are said to have increased crop yield. But over the long-term, both traits are also expected to lead to natural resistance among pest and weeds, thereby rendering their GM traits worthless.
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Similarly, it is also only over the long-term that the risks to human health, will become evident. Therefore, those who support GM technology point to the results of short-term studies; while those who oppose GM technology warn about the long-term, but as yet unproven, environmental and health risks.

In this situation there seems to be no conclusive evidence one way or the other. For this reason we need a more secure basis for rejecting GM crops than is provided by short-term scientific studies.

A BASIS FOR REGECTING GM CROPS

One such basis lies in the principle challenge referred to above as facing agriculture today:

How to increase food production on the same land base, while using less energy, less herbicide, less pesticide, less water, and less nitrogen.

There is to my knowledge only one way of doing this – and that is by increasing biodiversity. GM technology, however, does the opposite – it perpetuates the practice of large-scale mono-cropping and destroys biodiversity. This is clear and evident to everyone today.

The Importance of Biodiversity

Biodiversity is the variety of life forms – plants animals and microbes – within an ecosystem and the interactions between them. The more diverse an ecosystem is the more sustainable it is. When ecosystems are diverse, there are many pathways for ecological processes, so if one is damaged or destroyed, and alternative pathway can be used.

Biodiversity also applies to cropping systems. Where there is high agro-biodiversity there is more effective natural pest control, pollination and nutrient cycling and the system is more stable and resilient. The need for external inputs such as chemical fertilizers, insecticides and herbicides is diminished.

In poly-cultures there are many types of diversity: species diversity as in intercropping; genetic diversity (both within and between species); temporal diversity as in seasonal rotations; vertical diversity as in agroforestry; functional diversity where there are complex interactions between species that contribute to pest control, nutrient cycling, and pollination. All of this is put at risk by the mono-cultures promoted by GM technology.

How to increase agro-biodiversity

The question is how do we do increase biodiversity. The answer is by adopting the second of the two choices mentioned earlier – Agroecology.

AGROECOLOGY

Agro-ecology is the application of the science of ecology to agricultural systems and allowing the natural processes that arise from interactions among species to work to work for the benefit of agricultural production. It represents a fundamentally different agricultural paradigm from that of the industrial agriculture that has spawned GMOs, and it is one that is widely recognized in the world today as where the future of agriculture lies. We even find the case for Agroecology being made in World Bank and UN publications.

In their 2008 report titled the “International Assessment of Agricultural Knowledge, Science and Technology (IAASTD)” the above organizations identify the dominant industrial agricultural production system as one that has exhausted resources unsustainably and led to

soil loss and degradation, the over utilization of water, water pollution, habitat and biodiversity loss, global warming and climate change.

They acknowledge that the productive potential of GM technology is "highly variable" and potentially counterproductive to food security and rural poverty alleviation. Instead they point to agro-ecological farming as the key to future food security and equitable development among rural small farmers. Numerous other renowned publications and bodies of scientists are of the same view.

If this is already known, why is there still a persistence of faith in the unsustainable industrial agriculture?

The reason is the economic interest of the agro-chemical companies lies in the continuation of the same industrial agricultural paradigm that has brought them such wealth and power. And they use this wealth and power buy influence over research scientists and national governments in order to get their way in the world.

In this situation, there seems to be only one way of responding: that by organizing rural and urban populations to bring pressure upon their governments to halt the path of industrial agriculture and redirect the efforts of researchers and investors into more sustainable forms of agriculture, such as Agroecology.

The fight against GMOs is not then simply a fight against GMOs; it is also a fight against industrial agriculture and a fight *for* Agroecology. GMOs are just the latest and most extreme practice of the industrial manipulation of Nature - the latest obstacle on the road toward replacing industrial agriculture with a more sustainable ecological alternative.

Opposition to the spread of GMOs is part of the struggle to oppose the spread of industrial agriculture into those zones of the world where smallholder farmers practicing ecological farming still exist, and part of the struggle to extend ecological forms of agriculture into post-industrial zones.

Conclusion

To sum up: GM technologies are part of the same industrial agricultural paradigm that is now recognized as no-longer sustainable. What is needed is an entirely new paradigm. And that paradigm already exists in many forms throughout the world; as ***'Organic Farming', 'Agroecology', Permaculture' and 'Eco-farming'***. The need is to get the resources currently being poured into the unsustainable industrial paradigm redirected toward the new promising ecological paradigm?