

Pros and cons of genetic engineering in plants



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Genetic engineering of plants (crops) Pros | Cons Less tillage needed, especially with crops containing herbicide tolerance transgress, therefore conserves fertility through minimizing soil damage through compression. | GE agriculture claims low tillage weed control: this can be achieved by ending the practice of monoculture and instead introducing proper crop rotations designed specifically to combat the weeds of the particular locality. Monoculture creates a weed paradise. | All countries face problems caused by alien species accidentally or deliberately introduced into a new environment (e. Prickly pear in Australia). The main factor permitting this is international travel, but nobody has suggested that this should be banned. The problem of alien species is manageable, as would be the problem of genetic pollution caused by spread of seeds or pollen. As regards pollen contamination from GM varieties and the call for compensation for growers of non-GM or organic varieties whose crops are contaminated, if one is to be fair one might reasonably expect growers of non-GM and organic varieties to compensate growers of GM crops if they are contaminated with non-GM or organic pollen.

Genetic pollution from transgress spreads into other organisms through pollen, seeds and microbial processes. It is fundamentally different from other forms of pollution because once the genes are out, they can't be recalled. The best example of pollen contamination is provided by the canola seed, which was multiplied in Canada. It was officially confirmed in May 2000 that this seed was contaminated with unapproved GM canola seed and accidentally shipped to UK and other countries. By then it had been planted in Europe and large acreages of the young crop had to be destroyed.

According to Advent, the intimidation occurred because of cross-pollination in Canada, where the seed was produced. The nearest source of GM contamination was 4 kilometers away. Organic farming has long accepted accidental contamination from herbicide sprays from neighboring farms. If there is concern about Smog, DNA tests can be carried out. Risks destroying organic farming, which rules out the use of GM organisms. Who will compensate organic farmers for the extra surveillance and analysis, which will be needed to ensure that the organic food chains remain free of Smog? The Starling debacle is indeed a lesson that the GM food producers will learn from. Identity Preservation Systems are being put in place, verified by DNA analysis, to ensure that GM and non-GM supplies are kept separate. The massive contamination in 2000 of the USA corn (maize) crop and human food chain by Starling, a variety that is not approved for human consumption, shows that genetic pollution from transgenic crops to non-transgenic crops and food is inevitable. Starling maize produces the Cry protein, which may be a human allergen.

Two other major contaminations of ordinary seed (maize and canola seed) with GM seed have already occurred leading to emergency recalls of the reduce. Reduces labor costs. Sustainable organic agriculture creates much needed jobs in depressed rural economies. Environmentally relatively benign herbicides are used and less of them. Opposing GM crops forces farmers to use herbicide resistant varieties which have not been made by GM such as those resistant to selenographer herbicides which more readily give rise to herbicide resistant weeds.

Promotes “ agribusiness”, therefore more herbicide use. Herbicides are responsible for much illness in farm workers and contaminate drinking water. I Enhances biodiversity by allowing weeds to intuition growing for longer thus providing nutrition for animals. After weed kill a mulch forms which hosts a thriving population of insects, arthropods etc. I The total herbicides used with herbicide tolerant crops kill all weeds thus reducing biodiversity in the field. L No insecticidal sprays needed on crops that have insecticidal Bacillus thurstiensis (Bt)-toxin genes engineered into them.

Plants with Bt or other insecticidal genes are likely to give rise to lower levels Of nominations in the final food product. Less insect damage means less opportunity for fungi to infect the plant and bring toxic substances. I As with weed control, control of insect damage is achievable with properly designed crop rotation and other forms of good husbandry such as interloping. Healthy plants not imbalanced by chemical fertilizers build up their own defenses against insect attack. I GM plants are carefully tested for environmental and ecological impact, including their effects on earthworms and beneficial insects.

Bt crops target only insects, which attack the crop. Future insect resistance genes will be engineered to express in leaves and stem rather than in pollen and seed. There is already evidence that the Bt Nt is expressed less in Bt corn pollen than in leaves/stems therefore the risk to butterflies (e. G. Monarch) through pollen drift onto their food plants (e. G. Milkweed for Monarch) is diminished. Len relation to population variance, sample sizes in lab and field tests (e. G. Of earthworms) are sometimes too low to detect even large effects.

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Insecticidal crops containing the gene for Bacillus thuringiensis (Bt)-toxin kill beneficial organisms such as bees, ladybirds, lacewings & butterflies (e. G. Through pollen). The Bt plant remains falling to the ground are harmful to earthworms and other members of soil fauna. Bt toxins are secreted into soil from Bt plant roots and are toxic to lepidopterist in the soil (Stocky, et al. Nature 402, 480 (1999)). The specific targeting and elimination of one insect pest has led to other pestiferous insect species moving into the ecological niche created by the disappearance of the first species.

Getting rid of one problem simply created another. If a toxin transgresses spread to wild relatives of crop plants the wild plants may also develop resistance to insect herbivores. This COULD lead to the affected wild plants becoming invasive weeds. The problem of resistance to Bt toxin AND other toxins engineered into crops can be countered by planting suitably sized 'refuges' of a non-GM variety of the crop at suitable intervals within the crop. The interbreeding of the wild population with the Bt-exposed potentially resistant population will dilute out the genetic trait and thus prevent it building up.

Putting the Bt toxin gene in the crop exposes the pest to the toxin for longer, thus allowing natural genetic resistance to the toxin to develop in the pest- So-called refuge systems do not work, partly because breeding cycles in the differing pest populations are not synchronized. Refuges of up to 40% of the acreage are having to be recommended and this is not practical or popular for farmers. The build up of Bt toxin resistance threatens to render ineffective an insecticide long used by organic agriculture.

Increased use of pesticides in transgenic crops deprives the ecosystem of one of its natural pest controls thereby putting at risk its ability to restore equilibrium after being upset by abnormal conditions. | Helps solve the problem of world hunger by creating varieties which will make more efficient utilization of scarce land and give higher yields because of better pest assistance, nutrient utilization etc. World hunger will not be solved by technological means. It is a problem of inequitable distribution Of wealth and corrupt governments.

Reduces yields (e. G. Cotton, soybeans and sugar beet in some areas). | If herbicide resistance spreads to weed populations it can be combated with another herbicide with a different active ingredient. The ecological and agricultural threat of a GM plant is no more than a non-GM invasive (exotic) species such as kudzu or purple loosestrife. Although improved crop yields can be engineered by genetically modifying plants, there s ecological concern over whether these plants are likely to persist in the wild in the event of dispersal from their cultivated habitat.

The results of a long- term study of the performance of transgenic crops in natural habitats on four different crops (canola seed, potato, maize and sugar beet) which were grown in 12 different habitats and monitored over period of 10 years show that in no case were the genetically modified plants found to be more invasive or more persistent than their conventional counterparts. (M. J. CRAWLER, S. L. BROWN, R. S. HAILS, D. D. COHN & M. REESE.

Biotechnology: Transgenic crops in natural habitats Nature 409, 682 - 683 (2001) © Macmillan Publishers Ltd) Enhances spread of herbicide resistance to wild weed populations because the necessary genes are in the pollen, which can then pollinate wild relatives of the crop plant. This could create 'supersedes' especially if gene stacking' of several different transgress occurs. Spread of transgress is also caused by birds, animals & machinery carrying the seed to other locations (e. G. Canola seed on Ails Craig isle, 10 miles from Scottish mainland) Increased weediness of GM crops is already beginning to show.

In 1999, in Alberta, Canada canola seed volunteers (unwanted crop plants coming up the following year) resistant to three different herbicides have been discovered. A series of chemical and DNA tests confirm the weeds in farmer Tony Heather's field near Semtism are resistant to herbicide chemicals. Invasive species of plants can remain relatively unproblematic in a region for many years and then suddenly take a hold so much so that they become an economically significant nuisance. For this reason, the ecological impact of GM crops will be difficult to predict in the long term, I. Over several decades. Most cultivar are unlikely to survive amongst wild plant populations and those with herbicide resistance that escape will have no advantage from the herbicide resistance trait unless that particular herbicide is used. Such volunteers can be controlled with other herbicides. I Transgenic herbicide resistant cultivar could escape into the wild and become problematic 'volunteers' in agriculture. These volunteers will require increased use of more toxic herbicides. L Is a sustainable

agriculture, because it reduces chemical inputs as well as fuel inputs for farm machinery.

Unsustainable based on greed not need. Helps chemical agriculture to proliferate. The only sustainable agriculture for the future is organic (including patronymic & prematurely). I Quicker and more precise than traditional breeding. Breeding takes place outside the proper context, I. E. In the laboratory, therefore the crops are So weakened that they need to have the environment of the laboratory (soil sterilization, artificial fertilizers and pesticides) brought to them in the field. Transgenic lines are unstable and can lead to crop failures (e. G. GM cotton in LISA).

I A greater range of distinct disease-resistant varieties can be created so that the farmer has a wide choice and can plant a mixture of several varieties of the same crop in the same field to insure against disease attack. Disease resistance traits can be rapidly introduced to cultivar, e. G. Rice, thus keeping ahead of the changing pattern of disease in a particular locality. I Because of the huge investment in GM crops, the necessarily increased emphasis on single high-yielding varieties reduces genetic diversity within the crop itself. This can lay the crop open to massive losses when disease strikes.

I Novel drought and salt-tolerant ultimate can be created (important for Third World Countries). Sustainable organic plant breeding can develop novel varieties properly suited to a locality perfectly satisfactorily. I Any royalties or technology fees are more than compensated for by advantages including higher yields and easier, therefore less expensive, husbandry. I No seed

saving by the farmer is permitted. The farmer has to pay royalties to the biotech company. This undermines a traditional agricultural practice and particularly threatens peasant farming in developing countries.

GM crops add to the tendency of modern chemical agriculture to undermine the autonomy of farmers and turn them into tractor drivers or machine minders for large transnational corporations. | New varieties are tested for toxicity more than any crop plants have ever been in the past, therefore they are likely to be safer. Jimmy Clark, a professor of ruminant nutrition in Animal Sciences at the University of Illinois at Urbana- Champaign, reviewed the results from 23 research experiments, which were conducted over the past four years at universities throughout the United States, Germany and France.

In each study, separate groups of chickens, dairy sows, beef cattle and sheep were fed either genetically modified corn or soybeans or traditional corn or soybean as a portion of their diet. Each experiment independently confirmed that there is no significant difference in the animals' ability to digest the genetically modified crops and no significant difference in the weight gain, milk production, milk composition, and overall health of the animals when compared to animals fed the traditional crops.

Clark concluded, " Based on safety analyses required for each crop, human consumption of milk, meat and eggs produced from animals fed genetically modified crops should be as safe as products derived from animals fed conventional crops. " Clark added that approximately 70% of the genetically modified soybeans produced in the world and 80% of the genetically modified corn produced in the United States are used as animal feed. " since

these genetically modified crops were grown beginning in 1996, they have been fed to livestock and no detrimental effects have been reported," Clark said. University of Illinois at Urbana-Champaign, News Release, April 2001). | Increases herbicide residues in the food because the herbicide is applied later in the growing season and closer to harvest The issue of spread of antibiotic resistance from GM crops containing antibiotic resistance marker genes is unproven. If it is a problem at all it is likely to be small compared with the induction of antibiotic resistance through profligate use of antibiotics in animal nutrition, veterinary and medical practice.

Spreads antibiotic resistance to microorganisms in the environment, and then to pathogenic bacteria. | More profit for the farmer, seed producer and biotech company shareholder. | No demonstrable benefit to the consumer. | Crops reducing 'intellectuals' can be engineered, I. E. Food additives that have a nutritional benefit bordering on a pharmaceutical benefit, e. G. Modified edible oils. The vitamin content Of plants can be enhanced by GM. Plants which previously did not contain a particular vitamin can now be made to produce large amounts of it (e. G. Vitamin A 'golden' rice).

The aim of the GM Vitamin A rice project is not to achieve ideal levels of vitamin A intake through this source but to augment the extremely low intakes which lead to blindness and death of hundreds of thousands of people a year (Proof. Dir. Ingot Poetry's, tenement, February 2001). | In 1999, Deutsche Bank issued a report advising investors to avoid investing in GM crop technology (agoraphobic). A balanced diet of fresh fruit & vegetables plus cereals and protein is all that is necessary. 'Intellectuals'

are a sticking plaster (band aid) attempt to remedy fundamentally unhealthy diets.

Existing food sources provide adequate daily intakes of vitamins provided they are eaten in sufficient amounts and the vitamins are not destroyed in the processing or cooking. Vitamin-enhanced GM plants are an unnecessary technical solution to a problem, which does exist. Even with Vitamin A GM rice a normal daily intake of 300 gram of rice would, at best, provide 8% percent of the vitamin A needed daily. | The 'killer genes' of the technology protection system (terminator technology') allows the seed producer's intellectual property (patent) to be protected by a biological rather than litigious method.

No seed saving by the farmer is permitted. The farmer has to pay royalties to the biotech company. This undermines a traditional agricultural practice and particularly threatens peasant farming in developing countries. | The increased choice of modern high-yielding cultivar to farmers allows diversification to keep ahead of economic, climatic and plant disease trends. | The possibility of further globalization of crop varieties that GE offers through the introduction of traits necessary for introduction into new regions of the globe erodes cultural diversity - I. . Traditionally, different crops and varieties are grown by different cultures. Genetic engineering works towards global uniformity, I. E. Globalization of Western/Northern culture. There used to be far greater choice of crop varieties for farmers, sometimes hundreds of varieties of a reticular crop in a given region, but this diversity is falling at an alarming rate because of the industrialization of farming under pressure from the agrochemical industry. This will be accelerated by biotech agribusiness.

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GE allows the creation of plants that produce vaccines, pharmaceuticals or enhanced pharmaceutical raw materials. GE is already used to produce pharmaceuticals in microorganisms in the much safer containment conditions of biotechnology factories. It should not be taken out into the environment thus putting the environment at risk. In any case, much of the hermetically production, which would be created, is designed to treat diseases caused by industrialization and arbitration, which could be better treated not by a genetic fix but by changing lifestyles and environment.

Novel food crops are tested for genetic stability (breeding true), 'substantial equivalence', nutritive properties, toxicity and allergenic. It is well known that conventional breeding can introduce increased levels of natural plant toxins into a new variety or can modify its digestibility or industriousness. Furthermore, certain organic crops have been shown to have higher levels of OIC substances, e. G potatoes. GE introduces unpredictable toxic or allergenic effects into food plants (e. G. Brazil nut gene in transgenic soybeans). Substantial equivalence' is a political-commercial concept rather than a scientific one. GM plants are not genetically stable. For instance, the number of copies of an inserted gene changes through later generations of the GM plant. This technology is completely new to the insurance industry. It is natural that insurers will be cautious about it. However, when they realize that the risks are no worse than with introduced alien species that are dealt with by conventional methods of weed control, the problem of insurance will disappear.

No amount of research under containment conditions will reveal how a GM plant will behave when grown en masses in the open field. As the degree of

escape of genes from GM crops is unpredictable, they can't be recalled once they have escaped and they could multiply in the wild, some insurance underwriters have stated that such risks are insurable. There should be a moratorium on experiments in the open until the safety of the GM plant is fully tested under containment conditions. Plant pathogens should not be used in making GM plants.

The genes can be blasted into plant cells using a 'gene gun', which fires microprojectiles of metal coated with the DNA of interest. Plant pathogens such as *Crematoglyphus tenax* (literally 'cancer causing') are used to shuttle genes into plants and viral gene sequences such as cauliflower mosaic virus promoter are used to make the genes express themselves once in the plant. The pathogens could recombine with their natural equivalents in the plant thus risking unpredictable outbreaks of plant disease. Prospectors have gone on since very ancient times.