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Genetically Modified Crops Seed, Their Implication and Future Prospective

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ABSTRACT

The world presently sits at the cusp of a new agricultural revolution the "Gene Revolution" in which modern biotechnology enables the production of genetically modified (GM) crops that may be tailored to address agricultural problems worldwide. Discharges with agronomic properties (such as drought resistance) jumped from 1,043 in 2005 to 5,190 in 2013. As of September 2013, about 7,800 releases had been approved for corn, more than 2,200 for soybeans, more than 1,100 for cotton, and about 900 for potatoes. Releases were approved for herbicide tolerance (6,772 releases), insect resistance (4,809), product quality such as flavor or nutrition (4,896), agronomic properties like drought resistance (5,190), and virus/fungal resistance (2,616). There are contrasts in the guidelines of GM crops between countries, with some of the most stamped contrasts occurring between the USA and Europe. Regulation varies in a given country depending on the intended use of each product. For example, a crop not intended for food use is generally not reviewed by authorities responsible for food safety. The paper indicated the benefit, implication and future strategy of GM crops.

Keywords: *Genetically modified, plant, biotechnology, benefits, implication*

INTRODUCTION

Genetically modified crops (GMCs, GM crops, or biotech crops) are plants used in agriculture, the DNA of which has been altered using genetic engineering techniques. Much of the time, the aim is to introduce another attribute to the plant which does not occur naturally in the species. Examples in food crops include resistance to certain pests, diseases, or environmental conditions, reduction of deterioration or resistance to chemical treatments (e.g. resistance to herbicide), or improving the nutrient profile of the crop. Models in non-food crops include production of pharmaceutical agents, biofuels, and other industrially useful goods, as well as for bioremediation (ISAAA, 2013).

Genetically-modified (GM) seeds are a significant step forward in the generation of agricultural crops. GM seeds are seeds that have been changed to contain explicit characteristics such as resistance to herbicides (in the case of "Roundup Ready" products) or resistance to pests (in the case of Bt corn). However, the technique of modification used with GM seeds varies from the traditional method in significant regard: the genes have not been modified over generations of cross-fertilization, but rather embedded directly into the DNA of the seed (David, 2001).

The world presently sits at the cusp of a new agricultural revolution the "Gene Revolution" in which modern biotechnology empowers the production of genetically modified (GM) crops that may be custom-made to address agricultural issues worldwide. Somewhere in the range of 1996 and 2015, the complete surface territory of land cultivated with GM crops expanded by a factor of 100, from 17,000 km2 (4.2 million acres) to 1,797,000 km2 (444 million acres) (ISAAA, 2015). The innovation state that GM crops could alter world agriculture, especially in developing countries, in manner that would substantially diminish hunger, improve food security, and increase rural income, and in some cases even reduce ecological contaminations (Felicia and William, 2004).

Some of GM Crops are Alfalfa (Medicago sativa), Apple (Malus x Domestica), Argentine Canola (Brassica napus), Bean (Phaseolus vulgaris), Carnation (Dianthus caryophyllus), Chicory (Cichorium intybus), Cotton (Gossypium hirsutum L.), Creeping Bentgrass (Agrostis stolonifera), Eggplant (Solanum melongena), Eucalyptus (Eucalyptus sp.), Flax (Linum usitatissumum L.), Maize (Zea mays L.), Melon (Cucumis melo), Papaya (Carica papaya), Petunia (Petunia hybrida), Plum (Prunus domestica), Polish canola (Brassica rapa), Poplar (Populus sp.), Potato (Solanum tuberosum L.), Rice (Oryza sativa L.), Rose (Rosa hybrida), Soybean (Glycine max L.), Squash (Cucurbita pepo), Sugar Beet (Beta vulgaris), Sugarcane (Saccharum sp), Sweet pepper (Capsicum annuum), Tobacco (Nicotiana tabacum L.), Tomato (Lycopersicon esculentum), Wheat (Triticum aestivum) (ISAAA, 2016).

Literature Review

History of Genetically Modified Crop Management

Hereditary designing has made a quick section into agriculture. In less than a decade since the commercial introduction of the first genetically modified (GM) crops, in excess of 50 million hectares have been planted to GM crops over the world. Defenders claim that by transferring genes from one organism to another, genetic engineering can conquer the productivity constraints of conventional plant breeding. It is claimed that the new transgenic crops will lessen pesticide use and increase food security in developing countries a promise that these countries urgently need to accept. It is also widely claimed that the 'new' global economy will be built on genetic engineering, and any country that stands on the sidelines will lose its future competitiveness (Clive, 2001). A 2014 meta-analysis reasoned that GM technology adoption had reduced chemical pesticide use by 37%, increased crop yields by 22%, and increased farmer profits by 68% (Klümper and Qaim, 2014). The primary genetically modified crop plant was produced in 1982, an antibiotic-resistant tobacco plant (Fraley *et al*., 1983).

Genetically Modified Crop Research Development

The number of USDA-endorsed field discharges for testing grew from 4 in 1985 to 1,194 in 2002 and averaged around 800 per year from there on. Releases with agronomic properties (such as dry spell obstruction) hopped from 1,043 in 2005 to 5,190 in 2013. As of September 2013, about 7,800 discharges had been affirmed for corn, more than 2,200 for soybeans, more than 1,100 for cotton, and about 900 for potatoes. Discharges were approved for herbicide resilience (6,772 releases), insect obstruction (4,809), product quality such as flavor or nutrition (4,896), agronomic properties like drought obstruction (5,190), and virus/fungal obstruction (2,616). The institutions with the most approved field discharges include Monsanto with 6,782, Pioneer/DuPont with 1,405, Syngenta with 565, and USDA's Agricultural Research Service with 370. As of September 2013 USDA had gotten proposals for releasing GM rice, squash, plum, rose, tobacco, flax and chicory (Fernandez *et al*., 2014).

Mechanisms of Genetically Modified Crop Development

The foreign gene that has been embedded into the cell of a microorganism, a plant or an animal is known as transgene. It is coordinated into the genome of the recipients which are called transgenic. The transgenes are qualities with known traits or changed variants of known genes. Much of the time additionally marker genes are utilized because of distinguishing of transgenic organism.

The combination of transgene into the cell is carried out by various techniques: (a) Transduction with the use of bacteriophages (b) Transgene injection using pronuclear microinjection (Wong *et al*., 2000); (c) Transfer using changed viruses and plasmids (d) Electroporation method by which higher permeability of cell membrane is achieved. For move of foreign gene also artificial chromosomes or fragments of chromosomes can be utilized. Transgenes can be transferred into the egg-cell by spermatozoa containing pieces of chromosomes (Ruttloff *et al*., 1997).

Genetically Modified Crops in Africa

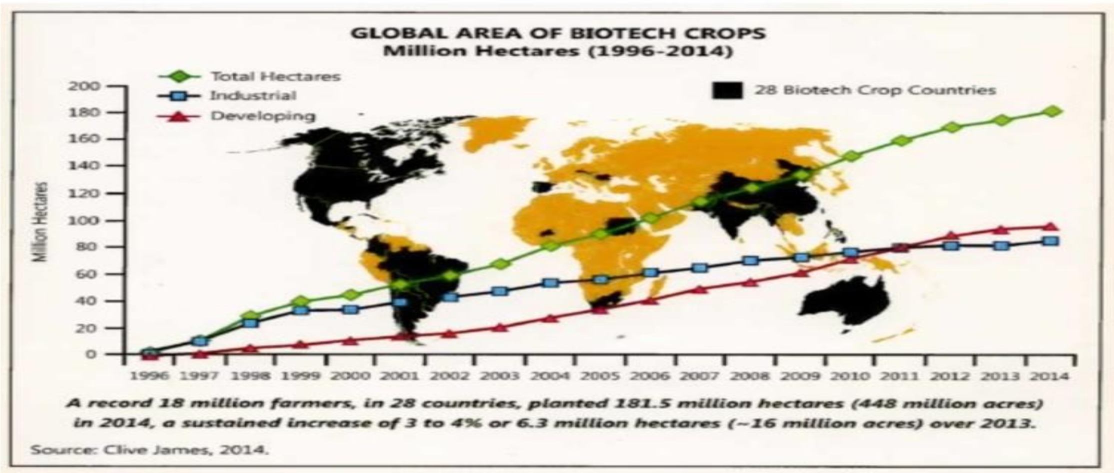
By 2010 around 148 million hectares of land planted by GM crops in 29 countries (of which 19 countries were in the developing world). This 87-crease development makes GM the fastest growing crop technology embraced in modern agriculture. Of 15.4 million farmers that planted GM crops in 2010, over 90 percent (14.4 million) were asset poor farmers in developing countries, including in three African countries: Burkina Faso, South Africa and Egypt. South Africa is the main African country among the five principal GM-producing countries (alongside India, Argentina, Brazil and China), and farmers there planted 63 million hectares of GM crops in 2010 alone. While there are many reported advantages of GM crops, in contrast, there are few barely any recorded instances of potential health effects or economic drawbacks.

Table1. *GM crops seed distribution and position of countries on production area during 2009 and 2010*

Rank	Country	2010 Area (million	2009 Area	Bio tec Crops

		hectares)	(million hectares)	
1	USA	66.8	64	Soybean, Maize, Cotton, Canola, Squash, Payaya, Alfalfa, Sugarbeet
2	Brazil	25.4	21.4	Soybean, Maize, Cotton
3	Argentina	22.9	21.3	Soybean, Maize, Cotton
4	India	9.4	8.4	Cotton
5	Canada	8.8	8.2	Maize, Soybean, Canola, Sugarbeet
6	China	3.5	3.7	Cotton, Tomato, Poplar, Payaya, Sweet Pepper
7	Paraguay	2.6	2.2	Soybean
8	Pakistan	2.4		Cotton
9	South Africa	2.2	2.1	Soybean, Maize, Cotton
10	Uruguay	1.1	0.8	Maize, Soybean
11	Bolivia	0.9	0.8	Soybean
12	Australia	0.7	0.3	Cotton, Canola
13	Philippines	0.5	0.5	Maize
14	Myanmar	0.3		Cotton
15	Burkina Faso	0.3	0.1	Cotton
16	Spain	0.1	0.1	Maize
17	Mexico	0.1	0.1	Cotton, Soybean
18	Chile	0.1	0.1	Maize, Soybean, Canola
19	Colombia	0.1	0.1	Cotton
20	Honduras	0.1	0.1	Maize
21	Czech Republic	0.1	0.1	Maize, Potato
22	Portugal	0.1	0.1	Maize
23	Romania	0.1	0.1	Maize
24	Poland	0.1	0.1	Maize
25	Costa Rica	0.1	0.1	Cotton, Soybean
26	Egypt	0.1	0.1	Maize
27	Slovakia	0.1	0.1	Maize
28	Sweden	0.1		Potato
29	Germany	0.1		Potato

Source: *LCGLRC, 2014*



Source: *Jennifer, 2015*

Over the period of time that economically accessible GM nourishments have been produced, no studies have shown that GM foods are less protected than traditional counterparts. In addition, the World Health Organization and the Food and Agriculture Organization of the United Nations have reported that there is no logical proof that the application of GM technology has resulted in substantial human health effects or environmental problems. Numerous policymakers and organizations in Africa subsequently consider GM innovation as something that should be avoided.

To some extent, this can be ascribed to absence of mindfulness and instruction on the utilization of modern biotechnology. The public needs to be educated on both the potential economic benefits of GM crops and the general lack of scientific evidence of health-related issues when GM crops are consumed in Africa (*Adenle, 2011).*

The Implication of Genetically Modified Crop Seed

GM crop species will collaborate with the other segment types of the agro-ecosystem and surrounding environments, conceivably influencing their fitness, population dynamics, ecological roles and interactions, promoting local extinctions, population explosions, and changes in community structure and function inside and outside agro-ecosystems. Occasions that directly or indirectly may result on effects have been investigated by many authors (Altieri, 2000; Garcia, 2001; Gildings, 2000; Kendall *et al*., 1997; Rissler & Mellon, 1996; Snow & Moran, 1997 cited from Maria and Miguel, 2005).

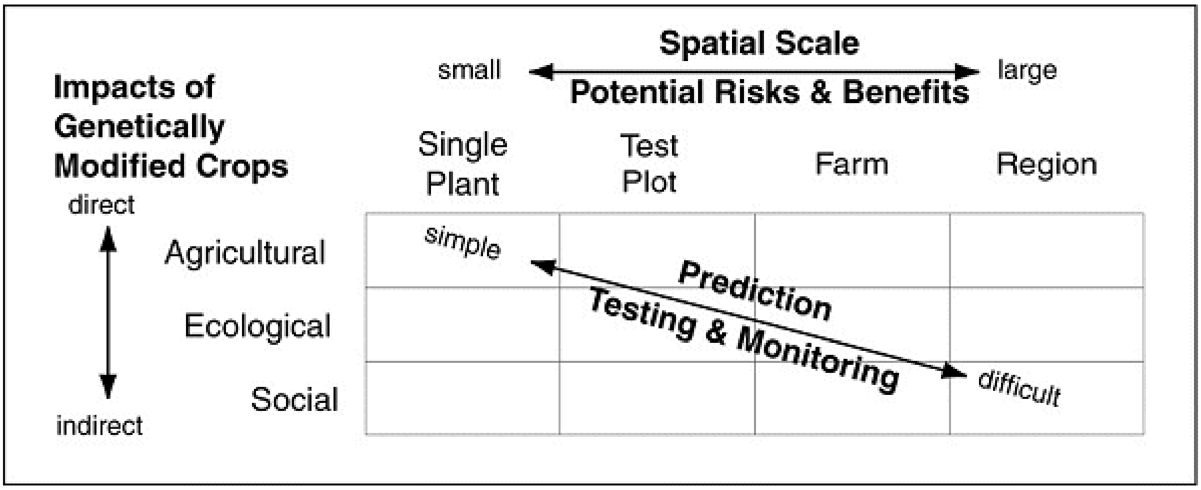


Figure1. *Effects of GMCs on Agriculture, Ecological and Social*

Source: *Maria and Miguel, 2005*

Socio-Economic Implication of Genetically Modified Crops Seed

A 2010 study found that Bt corn gave financial benefits of $6.9 billion over the previous 14 years in five Midwestern states. The majority ($4.3 billion) collected to farmers producing non-Bt corn.

This was credited to European corn borer populations decreased by exposure to Bt corn, leaving less to attack conventional corn nearby (Karnowski,010).

Agriculture economists calculated that "world surplus [increased by] $240.3 million for 1996. Of this aggregate, the biggest offer (59%) went to U.S. farmers. Seed organization Monsanto got the following largest share (21%), followed by US consumers (9%), the rest of the world (6%), and the germplasm supplier, Delta & Pine Land Company of Mississippi (5%) (*Falck et al.,2000).* Right around 100,000 farmers in Burkina Faso cultivated GM cotton on 260,000 hectares in 2010 (representing a 126 percent increase from 2009), and GM crops are assessed to have benefited Burkina Faso's economy by over US$100 million per year. So also, in South Africa, the first and biggest producer of GM crops in Africa, GM innovation is reported to have enhanced farm income by US$156 million in the period 1998 to 2006.

Agricultural Implication of Genetically Modified Crops Seed by Herbicide Resistance

Best management practices (BMPs) to control weeds may help defer opposition. BMPs incorporate applying various herbicides with different methods of activity, rotating crops, planting weed-free seed, scouting fields routinely, cleaning equipment to reduce the transmission of weeds to other fields, and maintaining field borders (Fernandez *et al*., 2014).

Benefits of Genetically Modified Crops Seed

Increased Crop Yields

There is desire broadly held by those in agriculture that GM seeds will build the yields of farmers that adopt the technology. In spite of the fact that there isn't yet a huge volume of research in regards to the effect of biotechnology on crop yields and returns, the research that is accessible supports this expectation. In a study using 1997 data, the Economic Research Service (ERS) found measurably noteworthy relationship between increased crop yields and increased adoption of herbicide and pesticide-tolerant crop seeds. The ERS study found that crop yields "essentially expanded" when farmers adopted herbicide-tolerant cotton and Bt-cotton.

The utilization of herbicide-tolerant soybeans brought about a "little increment" in crop yields. Another examination performed by Iowa State University found that Bt crops out-yielded non-Bt crops. The university studied 377 fields and evaluated those crops grown from GM seeds yielded 160.4 bushels of Bt corn per field, while crops grown from non-GM seeds yielded 147.7 per field.

Fewer Applications of Pesticides and Herbicides

Similarly, farmers anticipate that, as adoption of GM seeds increases, the use of chemical pesticides and herbicides (and the costs associated with their application) will diminish. Once more, the research that is available generally underpins this expectation. The study by ERS found diminishes of pesticide and herbicide use when farmers adopted GM seeds. The decline in pesticide use was significant. This decrease in herbicide use was also significant (except for the herbicide glyphosate, for which the research revealed a huge increment). Different studies have not discovered a clear connection between the use of GM seeds and decreased chemical use. For instance, the Iowa State University study examined above found that farmers' use of pesticides on GM crops remained "shockingly enormous" Farmers applied pesticides on 18% of non-GM crops and 12% of GM crops.

Increased Profits

In general, studies indicate that farmers' profits increase as they adopt GM seeds. The ERS study found that in most cases there is a measurably huge relationship between increases in the use of GM seeds and expand in net returns from farming operations. For example, the service found that, on average, GM soybean crops produced a net estimation of $208.42 per planted acre, while other crops produced a value of $191.56 per planted acre. The service likewise found a "significant increase" in net returns for herbicide-tolerant cotton crops and Bt cotton crops. Other studies have reported similar results. Studies in Tennessee and Mississippi discovered higher returns from herbicide-resistant soybeans than from conventional soybeans. A North Carolina study demonstrated that GM soybeans yielded $6 more per acre than conventional varieties (David, 2001).

Disease Resistance

There are many viruses, fungi and bacteria that reason plant diseases. Plant biologists are working to create plants with genetically-engineered resistance to these ailments (Dahleen *et al*., 2001).

Cold Tolerance

An antifreeze gene from cold water fish has been brought into plants such as tobacco and potato. With this antifreeze gene, these plants can endure cold temperatures that normally would execute unmodified seedlings (Kenward *et al*., 1999).

Drought Tolerance/Salinity Tolerance

As the world population grows and more land is used for housing instead of food production, farmers will want to produce crops in locations previously unsuited for plant cultivation. Creating plants that can tolerate long periods of drought or high salt content in soil and groundwater will support people to grow crops in formerly impossible places (Tang, 2000).

Nutrition

Hunger is common in third world countries where impoverished peoples rely on a single crop like rice for the main staple of their diet. But, rice does not contain adequate amounts of all important nutrients to prevent malnutrition. If rice could be genetically modified to contain additional vitamins and minerals, nutrient deficiencies could be solved. For instance, blindness due to vitamin A deficiency is a common issue in third world countries. Researchers at the Swiss Federal Institute of Technology Institute for Plant Sciences have invented a strain of "golden" rice containing an unusually high content of beta-carotene (vitamin A) (Chaggar *et al., 2005).* Plans were underway to develop golden rice that also has enhanced iron content.

Pharmaceuticals Medicines and Vaccines

Pharmaceuticals Medicines and vaccines often are costly to produce and sometimes require special storage conditions. Researchers are working to develop edible vaccines in tomatoes and potatoes (Daniell, 2001). These vaccines will be much easier to ship, store and administer than traditional inject able vaccines.

Phytoremediation

Plants such as poplar trees have been genetically engineered to clean up heavy metal pollution from contaminated soil (Ahmed and Focht, 2000).

Impacts of Genetically Modified Crops Seed

Environmental Impacts

Most genetically modified (GM) crops awaiting EU authorization for cultivation are either herbicide tolerant or pesticide-producing (or both). The environmental impacts of these crops are increasingly well reported, often from experience in North and South America, where they are majorly grown.

GM Pesticide Producing Crops

GM pesticide-producing crops execute specific pests, by secreting toxins known as Bt, which originate from a bacterium.

Toxic to Harmless Non-Target Species

Long-term exposure to pollen from GM insect resistant maize causes adverse effects on the behavior and survival of the monarch butterfly, America's most famous butterfly. Few studies on European butterflies have been conducted, but those that have report they would suffer from pesticide-producing GM crops. These studies are all depend on one type of toxin, Cry1Ab, present in GM maize varieties Bt and MON. Much less is known about the toxicity of other types of Bt toxin (e.g. Cry1F, present in the GM maize 1507). Cry1F is highly likely to also be toxic to non-target Organisms, but requires separate study.

Toxic to Beneficial Insects

GM Bt crops seriously affect beneficial insects important to controlling maize pests, such as green lacewings. The toxin Cry1Ab has been shown to affect the learning performance of honeybees. The environmental risk assessment under which current GM Bt crops have been assessed (in the EU and elsewhere) considers direct acute toxicity alone and not effects on organisms higher up the food chain. The toxic effects to beneficial lacewings came through the prey they ate. The single-tier risk assessment has been widely criticized by scientists who call for a more holistic assessment.

Threat to Soil Ecosystems

Numerous Bt crops secrete their toxin from their roots into the soil. Residues left in the field contain the active Bt toxin. The long-term, cumulative effects of growing Bt maize are of concern. EU risk assessments so far fail to foresee at least two other impacts of Bt maize.

Risk for Aquatic Life

Leaves or grain from Bt maize can enter water courses where the toxin can accumulate in organisms and possibly exert a toxic effect. This demonstrates the complexity of interactions in the natural environment and underlines the shortcomings of the current risk assessment.

Swapping One Pest for Another

Several scientific researches show that new pests are filling the void left by the absence of rivals initially controlled by Bt crops. Plant-insect interactions are complex, are hard to predict and are not adequately risk assessed.

GM Herbicide Tolerant (HT) Crops

GM herbicide tolerant (HT) crops are generally coordinated with one of two herbicides: glyphosate (the active ingredient of Monsanto's herbicide Roundup used with Roundup Ready GM crops, also sold by Monsanto), or glufosinate, used with Bayer's Liberty Link GM crops. Both herbicides raise concerns, but many recent environmental studies have focused on glyphosate.

Toxic Effects of Herbicides on Ecosystem

Several new studies suggest that Roundup is far less benign than previously thought. For example, it is toxic to aquatic organisms such as frog larvae and there are concerns that it could affect plants essential for farmland birds. Glyphosate is associated with nutrient (nitrogen and manganese) deficiencies in GM Roundup Ready soya, thought to be induced by its effects on soil microorganisms.

Increased Weed Tolerance to Herbicide

Weed resistance to Roundup is now a serious issue in the US and South America where Roundup Ready crops are grown on a large scale. Increasing amounts of glyphosate or additional herbicides are needed to control these 'super weeds', adding to the toxicity of food and the environment. Independent researchers complain about the lack of seed material made available for tests on environmental effects and are seriously concerned because those finding adverse.

Human Health Implication of Genetically Modified Crops Seed

Allergenicity Many kids in the US and Europe have created life-threatening allergies to peanuts and other foods. There is a possibility that introducing a gene into a plant may create a new allergen or cause an allergic reaction in susceptible individuals. A proposal to fuse a gene from Brazil nuts into soybeans was surrendered because of the fear of causing unexpected allergic reactions (Nordlee *et al*., 1996).

Food Allergy

Food Allergy influences roughly 5% of children and 2% of adults in the U.S. and is a significant public health threat. Allergic reactions in humans occur when a ordinarily innocuous protein enters the body and stimulates an immune response. In the event that the novel protein in a GM food comes from a source that is known to cause allergies in humans or a source that has never been devoured as human food, the worry that the protein could evoke an immune response in human increases. Although no allergic reactions to GM food by consumers have been confirmed, in vitro evidence suggesting that some GM products could cause an allergic reaction has motivated biotechnology companies to discontinue their advancement (Verma *et al.,* 2011).

Increased Toxicity

Most plants produce substances that are dangerous to humans. Most of the plants that humans expend produce poisons at levels low enough that they do not deliver any adverse health effects. There is concern that inserting an exotic gene into a plant could cause it to produce toxins at higher levels that could be risky to humans. This could happen through the process of inserting the gene into the plant. If other genes in the plant become damaged during the insertion process it could cause the plant to alter its production of toxins. Alternatively, the new gene could interfere with a metabolic pathway causing a stressed plant to produce more toxins in response. Although these effects have not been observed in GM plants, they have been observed through conventional breeding methods creating a safety concern for GM plants.

For example, potatoes conventionally bred for increased diseased resistance have produced higher levels of glycoalkaloids (GEO-PIE website).

Decreased Nutritional Value

A genetically modified plant could theoretically have lower nutritional quality than its traditional counterpart by making nutrients unavailable or indigestible to humans. For instance, phytate is a compound common in seeds and grains that binds with minerals and makes them unavailable to humans. An inserted gene could cause a plant to produce higher levels of phytate decreasing the mineral nutritional value of the plant. Another example comes from a study showing that a strain of genetically modified soybean produced lower levels of phytoestrogen compounds, believed to protect against heart disease and cancer, than traditional soybeans (Verma *et al.,* 2011).

Antibiotic Resistance

In recent years health professionals have become alarmed by the increasing number of bacterial strains that are showing resistance to antibiotics. Bacteria develop resistance to antibiotics by creating antibiotic resistance genes through natural mutation.

Biotechnologists use antibiotic resistance genes as selectable markers when inserting new genes into plants. In the early stages of the process scientists do not know if the target plant will incorporate the new gene into its genome. By attaching the desired gene to an antibiotic resistance gene the new GM plant can be tested by growing it in a solution containing the corresponding antibiotic. If the plant survives scientists know that it has taken up the antibiotic resistance gene along with the desired gene. There is concern that bacteria living in the guts of humans and animals could pick up an antibiotic resistance gene from a GM plant before the DNA becomes completely digested. It is not clear what sort of risk the possibility of conferring antibiotic resistance to bacteria presents. No one has ever observed bacteria incorporating new DNA from the digestive system under controlled laboratory conditions.

The two types of antibiotic resistance genes used by biotechnologists are ones that already exist in bacteria in nature so the process would not introduce new antibiotic resistance to bacteria. Never the less it is a concern and the FDA is encouraging biotechnologists to phase out the practice of using antibiotic resistance genes (Verma *et al.*, 2011).

Implication of Genetically Modified Crops Seed on Other Organism

Another concern centering on impacts of biotechnology is possible harm of GM seeds and crops to other, beneficial organisms. Very little research exists to support this concern. A study performed at Cornell University received significant publicity. This study indicated that a gene contained within Bt corn can be harmful to the larvae of a monarch butterfly when windblown onto milkweed leaves. But subsequent research has indicated that the actual level of Bt on milkweed plants in a real-life scenario do not reach the levels that produce a toxic results in the larvae. In fact, this later research suggests that the impact of Bt corn when genetically placed in the corn is far less damaging to non-target insect populations than spraying pesticides.

The Future of Genetically Modified Crop Seed

Regulation

The regulation of genetic engineering concerns the approaches taken by governments to assess and manage the risks associated with the development and release of genetically modified crops. There are differences in the regulation of GM crops between countries, with some of the most marked differences occurring between the USA and Europe. Regulation varies in a given country depending on the intended use of each product. For example, a crop not intended for food use is generally not reviewed by authorities responsible for food safety (Wesseler and Kalaitzandonakes, 2011).

Future Strategy

Some challenges for the immediate future might include: Securing fungal resistance in adult plants by "switching on" resistance genes that are active in the seed, but not currently in adult plants. This seems to be an elegant and safe use of biotechnology which could lead to significant reductions in fungicide use. Achieving insect resistance by altering physical characteristics of plants, perhaps by increasing hairiness or thickening the plant cuticle. This could reduce insecticide use, without using in-plant toxins. Altering the growing characteristics of crops (for example, shortening the growing season or changing the timing of harvests), offers the prospect of allowing more fallow land and less autumn planting. The recent discovery of dwarfing genes by the John Innes Institute in the U.K. could be a significant step towards the production of higher yielding and more reliable spring-sown cereals. Developing crops (including trees) that can tolerate high levels of natural herbivory yet remain viable. Preventing out-crossing by engineering pollen incompatibility and other mechanisms into crops. This could significantly reduce the risk of spread of GM traits into native species. Many of these new traits could be simply transferred from one crop variety into another or be accomplished by switching on or off genes already present in the plant. Such transformations are likely to be more acceptable to the public than moving genes between phyla. The consequences of short-circuiting genetic distance between species, which has been maintained over long periods of time and geographic isolation, are simply not well enough understood to be able to assess the risks (Brain, 2000).

Summary and Conclusion

The technology affirms that GM crops could revolutionize world agriculture, particularly in developing countries, in ways that would substantially diminish malnutrition, improve food security and increase rural income and in some cases even reduce environmental pollutants.

Accomplishing insect resistance by changing physical attributes of plants, perhaps by increasing hairiness or thickening the plant cuticle. This could reduce insecticide use, without using in-plant toxins. Preventing out-crossing by engineering pollen incompatibility and other mechanisms into crops the risk of spread of GM traits into native species will significantly reduced. Generally World Health Organization and the Food and Agriculture Organization of the United Nations have concluded that there is no scientific evidence that the application of GM technology has resulted in substantial human health effects or environmental problems.

References

[1] *Adenle AA*, 2011. *Response to issues on GM agriculture in Africa: Are transgenic crops safe? BMC Research Notes, Vol. 4:388.*

[2] Ahmed M and Focht DD, 2000. Phytodetoxification of hazardous organomercurials

[3] Brian J, 2000. Genetically Modified Crops and Other Organisms: Implications for Agricultural Sustainability and Biodiversity by genetically engineered plants. Nat Biotechnol;18(2): 213-217.

[4] Chaggar S, Paine JA, Shipton CA, 2005. Improving the nutritional value of Golden Rice through increased pro-vitamin A content. Nat Biotechnol; 23: 482-487.

[5] Clive James, 2001 .Global Status of Commercialized Transgenic Crops: *ISAAA Briefs*, No./24/

[6] Dahleen LS, Okubara PA, Blechl AE, 2001. Transgenic approaches to combat fusarium head blight in wheat and barley. Crop Sci; 41(3): 628-637.

[7] Daniell H, Streatfield SJ, Wycoff K, 2001. Medical molecular farming: production of

antibodies, biopharmaceuticals and edible vaccines in plants. Trends Plant Sci; 6(5):219-226.

[8] David K, 2001. Impacts of Genetically-Modified Crops and Seeds on Farmers, *Legal Research Assistant*

[9] *Falck ZJB; Traxler G; Nelson RG, 2000. "Surplus Distribution from the Introduction of a Biotechnology Innovation". American Journal of Agricultural Economics. 82 (2): 360-369*

[10] Felicia W and William B, 2004.The Future of Genetically Modified Crops. Rand Science and Technology, *Lessons from the Green Revolution*

[11] Fernandez CJ; Wechsler S; Livingston M; Mitchell L, 2014. Genetically Engineered Crops in the United States (summary. *Economic Research Service USDA*. United States Department of Agriculture. p2.

[12] Green P, 2011. Environmental and health impacts of GM crops - the science ,this briefing gives an overview of scientific evidence regarding the environmental and health risks of genetically modified crops.

[13] ISAAA, 2016. Annual Report Executive Summary, Global Status of Commercialized Biotech/GM Crops: 201.

[14] ISAAA, 2013. Annual Report Executive Summary, Global Status of Commercialized Biotech/GM Crops: 2013 ISAAA Brief 46-2013, Retrieved 6 August 2014.

[15] ISAAA,2015. Annual Report Executive Summary, 20th Anniversary (1996 to 2015) of the Global Commercialization of Biotech Crops and Biotech Crop Highlights in 2015 ISAAA Brief 51-2015, Retrieved 19 August 2016.

[16] James C, 2014. Global Status of Commercialized Biotech/GM Crops: 2014 ISAAA Brief No. 49

[17] Jennifer AT, 2015. **Why genetically modified crops have been slow to take hold in Africa**

[18] Karnowski, 2010. Steve High-Tech Corn Fights Pests at Home and Nearby Sci-Tech today, 8 October 2010.

[19] Kenward KD, Brandle J, Mc Pherson J, Davies PL, 1999. Type II fish antifreeze protein accumulation in transgenic tobacco does not confer frost resistance. Transgenic Res; 8(2):105-117.

[20] Klümper W and Qaim M, 2014. A Meta-Analysis of the Impacts of Genetically Modified Crops. *PLoS ONE*. 9 (11):

[21] LCGLRC (The Law Library of Congress, Global Legal Research Center), 2014. Restrictions on Genetically Modified Organisms.

[22] Maria AG and Miguel AA, 2005. Transgenic Crops Implications for Biodiversity and Sustainable Agriculture, Instituto de Biologia, Universidade Estadual de Campinas University of California, Berkeley .Bulletin of Science, Technology & Society

[23] Nordlee JA, Taylor SL, Townsend JA, 1996. Identification of a Brazil-nut allergen in transgenic soybeans. N Engl J Med; 334(11): 688-692.

[24] Ruttloff H, Proll J., Leuchtenberger A., 1997. Lebensmittel Biotechnologie and Ernährung. Berlin, Springer-Verlag pp121-30.

[25] Tang W, 2000. Peroxidase activity of desiccation-tolerant loblolly pine somatic embryos. *In Vitro* Cell Dev Biol Plant; 36(6): 488-491.

[26] Verma Charu, Surabhi Nanda, R.K. Singh, R.B. Singh and Sanjay Mishra, 2011. A Review on Impacts of Genetically Modified Food on Human Health, *The Open Nutraceuticals Journal.*

[27] Wesseler J and Kalaitzandonakes N, 2011. Present and Future EU GMO policy. In Arie Oskam, Gerrit Meesters and Huib Silvis (eds.), EU Policy for Agriculture, Food and Rural Areas. Second Edition, pp. 23-323&23-332.

[28] Wong RWC, Sham MH, Lau YL, Chan SY, 2000. An efficient method of generating transgenic mice. Mol Biotechnol; 15:155-159.

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