

GMOs Production: New Challenge for the Farmers and Consumers Education

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Abstract

Science education is to enhance the scientific and technological literacy of every person in society. Globally GMOs are increased day by day, also production and use of processed foods are increased. Society should have adequate scientific knowledge upon which to come to a reasonable opinion about the use of GMO food. For imparting education, there must be a focus on two groups more affected by the GMOs, the first one is producer, and the second one is a consumer. The farmer must know the long effect of GMO farming and the cost at which they adopt the GMO seeds and huge production. The consumer should know, what they eat and how they affect their health. Farmers are not properly educated about GMO farming, GMO seeds, their distribution, patent law, can and issues of superweeds and super pests. GM products have been in the food system for decades and their presence is growing day by day, yet consumer knowledge and awareness are not improving. Thus, there is a need to provide scientific education to farmers and consumers about GMOs.

Keywords: GMO, Education, Farmers, Consumers

Introduction

Modern biotechnology has brought several changes in science and technology. As scientific knowledge, modern biotechnology goes to the development of theories and techniques that enable scientists to alter the genetic code of all living organisms practically. Science education is to enhance the scientific and technological literacy in every person (Gelamdin, Alias & Attaran, 2013). The present article is focused on Genetically Modified organisms (GMOs) as increasing feed to the growing world population. Society should get scientific literacy so that even common people have an opinion about the increasing use of GMO food. For imparting education, there must focus two groups who are more affected by the GMOs and their food, the first one is the producer and the second one is the consumer. Because these two groups must be known that what we are growing and what is the effect of GMOs on the health and environment. The farmer must know the long effect of GMOs and at what cost they adopt the GMO seeds and huge production. The consumer should know that what they eat.

Genetic engineering is a technology that alters the genetic material of such living organisms as animals, plants, or microorganisms. Mainly the genetically modified crops grown commercially in the field are soybeans, corn, cotton, and canola. Technologies for genetically modifying foods offer dramatic promise for meeting some areas of the greatest challenge of the 21st century. Most people don't realize that they have been eating genetically engineered foods because more than 60% of all processed food items in the supermarket like pizza, chips, cookies, salad, etc. contain ingredients from genetically modified crops soybean, corn, and canola. Like all new technologies, Genetic Engineering also poses some risks, both known and unknown. Controversies and public concerns surrounding GM foods and crops commonly focus on human and environmental safety, labeling and consumer choice, intellectual property rights, ethics, food security, and environmental conservation. For every risk and benefit of technology, education plays a vital role. Farmers and consumers must get the awareness of the different aspects of GMOs like environmental safety, health risks, consumer choice, ethics, cost-benefit, etc.

Farmers And GMO

As farm economies around the globe become increasingly depressed, farmers are scrambling to find new options for survival. In addition, there is growing concern regarding the degradation of our natural resources and the widespread loss of family farms. Alternatives that increase farm income, facilitate positive land stewardship, and contribute to rural sustainability must be encouraged. Through technology, farmers got an opportunity to increase the economy. While many farmers maintain that they are pleased with GMO varieties, many others are disappointed, finding mixed results or facing new problems in the extremely concentrated and corporate-dominated seed sector. These problematic trends affect all farmers, whether or not they plant GMO seeds.

Privatization is a hurdle to adopt GMOs by farmers, today; just four companies control almost 60% of the seed market. For certain crops, the market is even more concentrated. The "big four" seed companies – Monsanto, DuPont, Syngenta, and Dow – own 80% of the corn and 70% of the soybean market. Other factors are also thought of by the farmers to grow the GM plants. Generally, farmers have not been imparted education of genetic engineering technology and GMO crops and seeds and different laws like a patent. Farmers face problems like contamination and related patent laws also face the problem of superweeds and pests.

Landscape and Patent Laws

GMO landscape is well documented. According to the International Journal of Food, the landscape of almost 400 cases of GMO contamination occurred between 1997 and 2013 in 63 countries. Many plants are pollinated by insects, birds, or wind, allowing pollen from a GM plant to move to neighboring fields or into the wild (Price and Cotter, 2014). This "genetic drift" illustrates the enormous difficulty in containing GMO technology. Not only is genetic drift impossible to prevent, but inadequate regulation also fails to hold seed companies accountable for any resulting damages and ultimately puts the onus on farmers who have been the victims of contamination.

For farmers, the consequences have been severe. Contamination can spark dramatic economic losses for farmers who face rejection from export markets that ban GMOs. Organic farmers suffering contamination can lose their organic certification and the premium they earn for their organic crop.

Farmers who buy GMO seeds must pay licensing fees and sign contracts that dictate how they can grow the crop and even allow seed companies to inspect their farms. GMO seeds are expensive and farmers must buy them each year or else be liable for patent infringement. And while landscape can happen through no fault of their, farmers have been sued for "seed piracy" when unauthorized GMO crops show up in their fields. Crops have been contaminated by GMOs due to improper equipment or facility cleanout, or lack of other necessary precautions.

Farmers who don't know the patent laws, companies are suing for seed piracy. Because the right of replanting from seed is the right of the farmer but this is not allowed to GM seeds. In *David versus Monsanto*, the court observed that great lengths to enrich the Roundup Ready canola plants that originated from his neighbor's land: by treating his crops with Roundup, he ensured that only the resistant strains persisted. In the following seasons, he replanted the seeds without having a licensing agreement with Monsanto. The unusually high prevalence (95-98%) of tolerant plants in Schmeiser's fields demonstrated infringement in the eyes of the court, and Monsanto claimed rightful remedy for its loss of profit (*Monsanto Canada Inc. v. Schmeiser*, (2004) 1 S.C.R. 902, 2004 SCC 34). The US Supreme Court case *Bowman v. Monsanto* introduced a legal doctrine called patent exhaustion, which states that patent rights are applied only to the first sale (*Bowman v. Monsanto Co.* No. 11-796, 569 U.S. 2013). Based on this doctrine, Indiana farmer Vernon Bowman, who replanted the seeds and Monsanto claimed that the right to "use" a patented item did not include reproducing it. The court ruled in favor of Monsanto (<https://geneticliteracyproject.org/gmo-faq/what-are-superweeds/>).

Now, the question is that what the rights of farmers are. They don't know the legality of the patented GMOs but are growing GMO crops. But here they cannot preserve the seeds that mean increased dependency on the big corporate companies. They fail to understand the issues related to GMO farming the issues that affect them. There is a need to educate the farmers holistically regarding GMO farming including the distribution of GM seeds.

Superweeds and Superpests

GM plant agriculture has led to Superweeds and Superpests that are extraordinarily difficult for farmers to manage. The first herbicide-resistant weeds were found in the USA, with herbicide 2,4D but the popular herbicide glyphosate was introduced in 1974 and paired with some GMO crops in 1996. With the Introduction of this herbicide-resistant GMO, production increased but in 1996 this glyphosate weeds was paired with GMO and resistant weeds were produced. Whatever benefits farmers received through herbicide-resistant GMOs went in vain after the introduction of weed-resistant herbicide. Now the farmers are forced to use chemicals to remove the weeds which make farming more expensive. Even consumers fear presence of trace chemicals in the food supply (Wunderlich & Gatto, 2015). Farmers affected by resistant pests must revert to older and more toxic chemicals, more labor, which overshadows the promised benefits of GMO technology. Herbicides, including glyphosate, can also increase plant diseases by altering plants' ability to absorb nutrients and reduce soil health by killing microbes. These chemical-dependent strategies, peddled by major chemical and biotech companies, will keep farmers dependent on increasingly toxic pesticides in a race that nature always wins (Hallmen et al., 2004).

Thus farmers have no idea of GMOs that how they affect nature, the environment, and climate. They do not know about GM plants. Farmers must know about the pros and cons of GMOs. If they don't know about the pros and cons of GMOs then how they will face the various problems related to GMO farming and the side effects of using GMO foods.

Consumer and GMO

The consumer is the one who knows the GMOs because they consume them. But the conscious consumers know about their food. Here, we would discuss the education of GMOs to the consumer. Most of the studies regarding the education of GMOs are from the USA. Genetically modified organisms (GMOs) have been available for commercial purchase since the 1990s, allowing producers to increase crop yields through bioengineering that creates herbicide-resistant and insect-resistant varieties. However, consumers' knowledge about GMOs has not increased at the same rate as the adoption of GMO crops (New Brunswick (NJ): Rutgers, 2004).

Knowledge of GMOs

A survey conducted by the Food Policy Institute at Rutgers University found that US consumers as a whole were not much knowledgeable about GMOs, with just 48% knowing that GMOs were available in supermarkets and only 31% believing that they have most likely consumed a GM product. The majority of participants also self-rated their knowledge to be poor; 48% said that they knew very little about GMOs, whereas 16% felt that they knew nothing at all, compared with 30% knowing a fair amount and just 5% knowing a great deal about GMOs (Pew Initiative on Food and Biotechnology, 2001).

Knowledge of GMOs is an area of interest because it may affect consumer opinions, attitudes, and behaviors. In a 2001 survey of US citizens, only 44% felt that they had at least some information about GMOs, with just 9% receiving a great deal of information. However, 54% had heard not much or even nothing about biotechnology and food. A large amount of indecision accompanied this lack of information, with 46% of consumers not knowing what to think about GM foods and their degree of safety, 29% finding them safe, and 25% feel that they were unsafe. However, attitude toward GMO safety may be a result of limited awareness, because it was not stable for some consumers; after reading that over 50% of foods available in grocery stores contained GM ingredients, 20% of participants who originally found GMOs unsafe changed their answers (Federal Food, Drug, and Cosmetic Act. United States Code, 2006).The consumers know about what they eat and also about their consumer rights of their product, food labeling, and its effect on health.

A recent GMO answers survey reveals that nearly 70% of US adults don't understand what GMOs are and only one-third are comfortable having GMOs in their food. This despite the fact is that the majority (60-70%) of processed grocery store products contain some GM ingredients in the USA.

Labeling of GMO

The debate over foods derived from genetically modified (GM) crops often touches on the subject of labeling. Many consumers argue and insist on their right to know what they are eating and their right to choose. As a result, many governments have begun to heed these suggestions and have

either implemented labeling regulations or are working on them. Before any labeling rules can be implemented, governments would have to set up standards and services to conduct testing of the presence of GM ingredients; certification; and ensure that the quality standards are clear and achievable (European Commission, 2015).

Current regulations are based on the chemical characteristics of the food product and not on the way the product was made. In Canada, special labeling is required for all foods. Manufacturers can choose to label products to provide information regarding the presence or absence of GM ingredients, with safety concerns such as allergen city and compositional or nutritional changes are identified. While, In the US, all foods must be labeled when there are health concerns, In 1992, the FDA published a Statement of Policy announcing that GE foods did not require labeling because they were not materially different from non-modified versions, and under the Federal Food, Drug, and Cosmetic Act, only material information needed to be included on a label (Wunderlich & Gatto, 2015). In January 2001, the Food and Drug Administration provided guidance to manufacturers in the appropriate, truthful and non-misleading labeling of foods and provided examples of acceptable and unacceptable labeling language.

The process for approval of GM foods in the EU is strictly regulated, with all new GM crops having to be presented to the European Food Safety Agency for a thorough risk assessment, after which the European Commission presents the results to the public, brings the resulting comments back to the Food Safety Agency, and then makes a final decision whether or not to grant authorization for the next 10 years. Unlike the United States, the European Union has enforced mandatory labeling and strict traceability of all bioengineered food, including any product, food, or animal feed produced from GMOs, since 1997 (Advances in Nutrition).

Conclusion

The above discussion about the knowledge of GMOs to farmers and consumers is not satisfactory. Farmers have less education about GMOs although, they buy the GMO seeds for farming. There is a need for systematic education about the pros and cons of GMOs. Farmers must be provided adequate education about the growing GMO farming technologies.

GM products have been in the food system for decades and their presence is increasing day by day, yet consumer knowledge and awareness are far from satisfactory. Surveys show that large percentages of consumers are unaware of GMOs or do not fully understand GM products, their traits, and their effects, and they themselves are dissatisfied with their self-rated knowledge, indicating a desire and a need for widespread consumer education.

Although consumers across the globe support mandatory GMO labeling, the limited extent of consumer knowledge regarding GMO characteristics, processing, and effects may present an issue for the actual interpretation of the labels. Experts in the field should consider methods of educating the public more thoroughly so that they can use the information about GM content responsibly and make fully informed judgments about their food choices (Donaven & Chelsea).

Adequate consumer education appears to be the missing puzzle piece. GMO Answers survey found that a majority of consumers want to know more about the impact of GMOs on health and food

safety. But what is the food industry – growers, suppliers, processors, and retailers – to do about this? Consumer education comes at a high cost, and not all supply chain members in the food industry have the resources to fund a widespread educational campaign. At first glance, it appears that the use of product labeling specifically for GMOs would be the answer. However, many consumers already are confused by the variety of labels currently on the food they purchase, making it difficult for families to make decisions at the grocery store.

References

Gelamdin, R. B., Alias, N., Attaran, M. Students' And Teachers' Perspectives On Biotechnology Education: A Review On Publication in selected journals Department of Curriculum and Instructional Technology, Faculty of Education, University of Malaya, Kuala Lumpur, Life Sci J;10(1):1210-1221] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 186

Price, B., Cotter, J. The GM Contamination Register: a review of recorded contamination incidents associated with genetically modified organisms (GMOs), 1997–2013. Food Contamination 1, 5 (2014). <https://doi.org/10.1186/s40550-014-0005-8>

Monsanto Canada Inc. v. Schmeiser (2004) 1 S.C.R. 902, 2004 SCC 34 (Canadian Supreme Court Decision)

Bowman v. Monsanto Co. No. 11-796, 569 U.S. (2013). (U.S. Supreme Court Decision) Wright BD. Plant Genetic Engineering and Intellectual Property Protection. Agricultural Biotechnology in California Series, Publication No. 8186 (2006)

Johal, G.S. and Huber, D.M. (2009) “Glyphosate effects on diseases of plants.” European Journal of Agronomy.

Wunderlich, S., & Gatto, K. A. (2015). Consumer perception of genetically modified organisms and sources of information. Advances in nutrition (Bethesda, Md.), 6(6), 842–851. <https://doi.org/10.3945/an.115.008870>

Hallman W, Hebden W, Cuite C, Aquino H, Lang J. Americans and GM food: knowledge, opinion & interest in 2004.

New Brunswick (NJ): Rutgers, the State University of New Jersey, Food Policy Institute; 2004 Nov Report No. RR-1104–007.

Pew Initiative on Food and Biotechnology. Pew initiative on food and biotechnology finds public opinion about genetically modified foods “up for grabs.” 2001 March 26.

Federal Food, Drug, and Cosmetic Act. United States Code, 2006 Edition, Supplement 3. Subchapter IV: Food. [Internet]. United States Food and Drug Administration; [cited 2014 Dec 4]. Available at: <http://www.fda.gov/RegulatoryInformation/Legislation/FederalFoodDrugandCosmeticActFDCAAct/default.htm>.

[Internet]. Food and feed safety: biotechnology. European Union; c1995–2015 [cited 2015 Feb 4]. Available from: http://ec.europa.eu/food/food/biotechnology/index_en.htm.

Wunderlich, S., & Gatto, K. A. (2015). Consumer perception of genetically modified organisms and sources of information.

Advances in nutrition (Bethesda, Md.), 6(6), 842–851. <https://doi.org/10.3945/an.115.008870>

Donaven, Ken and May,Chelsea. ‘Who Should Be Responsible for Consumer Education on GMOs?’ at <https://martecgroup.com/gmo-consumer-education/>

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