Transgenics: Why Their Adoption And Consumption Should Be Approached With Caution In Nigeria

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Abstract: Genetic Engineering which involves the removal of genetic material from one organism and splicing it into the chromosomes of another is today set to revolutionalize agriculture. It has given rise to a new set of organisms known as Genetically Modified Organism (GMOs or transgenics). The major advantage of GMO crops are yield increases as well as reduction in pesticide and herbicide use. According to a report by an industry group GMO crops are today flourishing across the globe accounting for about US$44 billion in crops in five leading countries including the US, Argentina, China, Canada and Brazil. Worldwide, 53 million hectares were planted with GMO crops in 2002 with the US accounting for 68% of that average. About 15% of all corn, 30% of all cotton and more than 50% of soyabean grown across the world today are genetically engineered. In spite of their high potential however, there is need to exercise caution in the adoption and consumption GMO crops in Nigeria. Their health and environmental implications are yet to be subjected to long term scientific investigations. Fallouts from past scientific discoveries give credence to this call. For instance, nobody new at the time DDT was discovered that DDT sprayed over a broad area would be bio-magnified through the food chain and concentrated hundreds of thousands of times in the human body. As well, when CFCs were created, they were hailed as a great discovery-inert compounds, great carriers for aerosol sprays. Only when millions of tons of CFCs were liberated into air many years later did we discover their scavenging effect on ozone in the upper atmosphere.
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Introduction

Geneticists have for some time been able to transfer a gene from one DNA of one organism into the DNA of another within the same species through conventional breeding programmes that usually involved hand-pollination of plants. Today, however, geneticists can go much further. It is now possible to break through natural species barriers, systematically moving genes from one species to another that do not combine in nature. Thus, a new agricultural revolution is taking place: the **GENETIC ENGINEERING REVOLUTION.** Such new technological fit and its product- the **GENETICALLY MODIFIED ORGANISMS (GMOS)** are today however subjects, of intese debate.

Indeed, much has been said both for and against genetic engineering and its products. Proponents of genetic engineering (GE) believe it will provide new plants and animals that would lead to a more environmentally sound agricultural production with crops that produce their own pesticides. It also promise crops that produce medicine, plants tolerant to salt and drought and enriched food to restore micronutrient deficiencies. There is also the argument that plants that produce their own pesticides might reduce the need for toxic chemicals; while engineering for improved protein or vitamin content could make our food more nutritious.

Opponents on the other hand express concern over the safety of genetically modifies plants especially in their use for human consumption. They also express fear that GMOs themselves might escape and become pests or they might interbreed with wild relatives. In either case it may lead to the creation of super weeds or in reduction in native biodiversity. Critics also warn that transgenic crops with built in insecticides or leave toxic residues in soils or our food.

Indeed, a raging controversy has been going on in different parts of the world regarding whether to adopt or not adopt this new technology. While some countries like the united States and Argentina have embraced it, many others are still skeptical about it. For instance, a defector moratorium on releasing GM organisms has been in place in European Union since 1998 (www.ictsd.org/weekly).

This paper takes a look at this new technology, its scientific bases, its role in agriculture and points out some of the reasons why its adoption and consumption in Nigeria should be approached with caution.

The Science behind Genetic Modification

The science behind G.M food is called food biotechnology, that is the use of scientific techniques to develop more more productive crops, and livestocks. Biotechnology ishowever, a very inclusive term ranging from natural fermentation to safe and relatively cheap practices like *in vitro* propagation to genetic engineering.

Genetic engineering (GE) also termed genetic modification or manipulation is radically different from other technologies because it allow gene transfer between completely unrelated organisms allowing for combinations unlikely to occur by conventional means. In specific terms, genetic modification or GE concerns the transfer of genetic information in the form of DNA sequences across sexual barriers between species, which under normal condition would not exchange DNA. It uses a technique called gene splicing in which the desired gene is isolated, extracted and then inserted into specific cells of the targeted crop or livestock species. These genetically transformed cells are induced to grow into individual plants or animals that carry the desired trait. (marsh and Grosser 1996, Visser, 2001). The resulting organisms are called **GENETICALLY MODIFIED ORGANISMS (GMOs) or TRANSGENICS.** GM is currently used only to introduce a single new trait, which might be based on the activity of a single gene, or a small number of genes.

Genetic Modification in Agriculture

In agriculture, genetic modification has been applied in a number of major crops. Majority of these applications involved the introduction of resistant traits, particularly to herbicides, and insects, both of which accounting for more than 60% of the GM crops grown world wide 9Ismael *et al*, 2001). A smaller number of applications involve the quality of the resulting products, example the shelf life of tomatoes (Rossett, 2001). For instance, pest resistant genes from the bacterium, *Bacilus thuringensis* (Bt) have been transferred to tobacco, tomatoes, maize, potatoes and cotton (Gasser and Fraley, 1999). Crops such as bananas and potatoes have been altered to contain oral vaccines that can be grown in developing countries where refrigeration and sterile needles are unavailable. Plants have also been engineered to make industrial poils and plastics (Cunningham *et al*, 2005*)*. Growth hormones, veterinary drugs, and vaccines have been developed that have enhanced livestock production while human genes for medically useful proteins have been successfully sliced into sheep, cows and goats thereby making these genetically altered animals to produce a steady supply of milk used for drug manufacture. Also, varieties of fruits and vegetables have been genetically engineered to resist spoilage while efforts are underway to fashion crops with superior nutritional properties (Marsh and Grossa, 1996). According to Molnar and Kinnucan (1989), a gene responsible for a sulphur rich protein found in the Brazil nut has been isolated, cloned and transferred into tomatoes, tobacco and yeast, while some tomatoes have been modified with a gene taken from a fish, thus making them less sensitive to low temperatures.

Both the number of GMO crops and the worldwide area under commercially grown GMO crops has been rapidly increasing as well. By the end of 1999 for example, an estimated 40 million hectares (ha) were covered with GM crops in commercial cultivation worldwide (Awake, April 22, 2000) while by 2002, 53 million ha (131 million acres) were planted with GMO crops. Accounting for 68% of this acreage is the United State, followed by Argentina with 23%; Canada, Australia, Mexixo, China and South Africa together make up 9% of all transgenic cropland. (Cunningham *et al*, 2005). According to a recent report by an industry group, biotechnology crops currently accounts for about $44 billion in crops in five leading countries namely the U.S, Argentina, China, Canada and Brazil (NAF, undated).

Since the mid-1980s, genetic engineering has been applied to more than fifty crop species, but four major transgenic crops currently dominate world markets. Roundup Ready (RR) Soybean accounts for 58% or 25.8 million ha of the total area under GMO crops, transgenic corn for 10.3 million ha, transgenic cotton for 5.3 million and GM Canola for 2.8 million ha. Argentina and the US lead in GMO crops. In Argentina, 95% of all Soybean is transgenic (Minderhaund-Jones, 2001) while in the US 82% of all soybean, 71% of the cotton and one quarter of all maize (corn) grown are GMOs (Cunmingham, *et al*, 2005). In sub-saharan Africa, Bt cotton was the first commercial release of a GM crop variety. In 199/2000, a total area of 100,000 ha of Bt cotton was grown in south Africa (Ismael *et al*, 2001). The report by a University of Minnesota researcher for the industry's council for Biotechnology information anticipates that growth of these gene-altered crops will soar particularly in Asia, Latin Americ and parts of Africa (NAF, undated).

According to Marsh and Grosser (1996), with the potential for huge profits, much genetic engineering research and development has been done by private corporations in the developed countries. Also, small firms that specialized in biotechnology products as well as a few large American and European firms that manufacture agricultural chemicals have invested heavily in biotechnology. They also claim that the Rockefeller Foundation, which supported development of the Green revolution rice hybrids a generation ago is investing millions of dollars to engineer more nutritious, disease resistant strains of rice.

Possible reasons why Restraint should be Exercised in the Adoption and Consumption of GMOs.

No doubt, GE holds a great prospect not only to feed but also to change the agricultural landscape of the entire world. This notwithstanding, there is a need to exercise caution in the adoption and consumption of GMOs in Nigeria and indeed other African countries. A good number of reasons can be adduced for this stand some of these are enumerated below:

The legal frame work under which GM seeds are being introduced at the moment cannot be favourable to our farming communities. This is because in countries where they are introduced, farmers are required to sign a **Technology Users Agreement** (**TUA**) before obtaining and using the product. Under the terms of TUA, farmers are specifically prohibited from saving or replanting the seeds but must rather return to the company each year for a new supply. This means that farmers will be utterly dependent on the corporation marketing this technology for their seeds. Thus as ever more conventional plant varieties are genetically modified and patented, it will mean that the more corporation holding the patent will exert an ever increasing level of control over the overall seed supply. This implication is that it will be these corporation rather than farmers that will determine the variety of crops grown. Since research and development of GM crops are cost intensive and in order to recoup their investments, these genetic corporations will choose to market only seeds that are commercially viable, rather than allowing farmers to determine the type of crop they wish to grow. This would inevitably result in high seed costs which would ultimately translate into high food prices. As well, the development of herbicide-resistant crops would encourage increasing herbicide use, making farmers even more dependent on costly agricultural chemicals, also resulting to high food prices. For Nigeria and indeed other African countries, this would imply a disaster scenario as high food prices would obviously aggravate the already precarious food security situation in the continent. Moreover, GE is a direct contrast to "bottom-up" approach or participatory farmer led research being advocated for today rather it is a repetition of the very "top down" models that led first generation "GREEN REVOLUTION CROP VARIETIES" to have low adoption rates among poorer farmers across the globe.

Perhaps, the most important reason why GE technology should be approached with cautious optimism has to do with risks of undesired and unknown environmental and health-related side effects of GM crops.

One example from the US tells how genes from one bacterium, *Xanthomonas* were transferred to another soil bacterium, *Kebsielle planticola*. The new organism was meant to ferment stubble into alcohol, thus providing farmers with an extra source of income instead of burning the stubble. However, a test by the authorities found that wheat planted in the soil containing the new organism was killed by it (Ehrenfield, 2001). There is also the problem of Bt crops affecting non target organism and biological processes. Recent evidence shows that the Bt toxin can affect beneficial insect predators that feed on insect pests present on Bt crops while wind blown pollen from Bt crops found in natural vegetation surrounding transgenic fields can kill non target insects. More importantly, it has been discovered that Bt retains its insecticidal properties after crop residues have been plowed into the soil. In a study, such insecticidal properties were said to have persisted for at least 234 days thus protecting the residues from microbial degradation (Rossett, 2001). This situation is of serious concern for poor farmers who cannot purchase expensive chemical fertilizers and who instead rely on local residues, organic matter and soil micro organisms for soil fertility which can be negatively affected by the soil bound toxins. Also, according to Odika (2005), research undertaken in the United Kingdom has shown that cancer that results from the consumption of GM foods in human bodies has no cure at the moment. For reasons such as these therefore, it becomes necessary that we exercise caution in their introduction as well as consumption.

Finally, unanticipated outcomes from past scientific discoveries can be adduced as further reason for the call to exercise restraint in the adoption and consumption of GM foods. This becomes more pertinent as researchers have warned that no long term large scale tests have been conducted to prove the safety of these GM foods. For instance when in 1939, Pan Muller of Geigy Pharmaceuticals in Switzerland discovered the amazing insecticidal

properties of dichloro-diphenul-trichloroethane (DDT), it was then hailed as the great invention of the 20th century. It was indeed effectively used in insect control in large scale commercial agriculture. Nobody knew at the time however that DDT sprayed over a broad area would be bio-magnified through the food chain and concentrated hundreds and thousands of times in the breast of women and in the shell glands of birds. It was only in 1960s that evidence began to accumulate that indiscriminate use of DDT and other persistent industrial toxins were having unexpected wildlife effects. Indeed, biologists only discovered the phenomenon of bio-magnification when eagles, and several other predatory bird species began to disappear from former territories in Eastern North America. Studies revealed that eggs laid by these birds had thin, fragile shells that broke before hatching. DDT and its degradation product, DDE were found responsible (Cunningham *et al*, 2005).

As well, when chloroflorocarbons (CFCs) were invented by Thomas Midgley, Jr. in 1928, they were seen as, miracle chemicals. Being chemically stable, non-toxic and extra ordinarily versatile, they, found uses in such applications as aerosol sprays, refrigeration, packaging, fire retardants computer manufacture and other activities. It took scientists over 40 years to discover that millions of tons of CFCs liberated into the air rose to the upper atmosphere where they are having a scavenging effects on the stratospheric ozone layer responsible for protecting humans from the human effects of the ultraviolet solar radiation. These two examples go far to illustrate the fact that scientific discoveries do have unexpected and unanticipated side effects often far from their site or time of initial applications.

It was for such reasons as these that a panel of biologists and agricultural scientists convened by the US national Academy of Science urged the government to more carefully and more publicly review the potential environmental impacts of genetically modified plants and animals before approving them for commercial use (Cunningham *et al*, 2005).

Conclusion

In consideration of the real and potential problems associated with GM foods and GE technology as enumerated above therefore, there should be no good reason why Nigeria should be in a haste to embrace this new technology. For a biodiversity rich country like Nigeria, unregulated use of GMO's may be catastrophic to our health, environment and our efforts at achieving sustainable development. More importantly, if such countries as the European Union with its advanced and sophisticated technology is not in a hurry to adopt this new technology, Nigeria and indeed other African countries with their rudimentary technologies should take a cue from her. Luckily, the national strategy for biodiversity conservation advocates increased activities in the non transgenic biotechnology processes, use of naturally occurring micro-organisms for industrial processes and to improe agricultural productivity and the intensification of traditional plant breeding technologies, while developing adequate guidelines and protocols for field testing and subsequent release of Genetically Modified Organisms (NBSAP, 2002). This is a step worth taking as the saying goes, it is better to air on the side of caution.

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