What's the Bottom Line on Modern Biotechnology?

SAFETY: To the best of our knowledge, GI foods and crops are as safe as conventional ones. Nutritionists and other scientists do not know of any unresolved safety issues.

REGULATION: GI crops and foods are regulated by governments. The approval process requires many tests over many years. Scientists and agricultural biotechnology companies support such regulations.

THE ENVIRONMENT: There is no evidence that GI crops harm the environment or have potential to harm the environment any more than current agricultural farming methods.

ENVIRONMENTAL BENEFITS: Certain GI crops have environmental benefits because they reduce pesticide use and require less tilling of the land (less danger of erosion). GI crops can play an important role in making agriculture more sustainable and more productive.

BETTER NUTRITION: In the near future, GI crops and foods derived from them will have higher levels of vitamins, minerals, biologically active physiochemicals, and other nutrients. Many allergens will be eliminated.

FARMERS: Most farmers want GI crops because they make crop production cheaper. For their own safety, they especially like crops that require less pesticide.

OPPONENTS OF GI CROPS: Groups that oppose modern biotechnology on ideological, philosophical, or economic grounds (such as Greenpeace, Sierra Club, and the Third World Network) have no factual evidence for their claims of negative health consequences or environmental impact.

DEVELOPING COUNTRIES: Plant breeders and farmers want access to modern biotechnology to improve their crops. Everyone knows that this will not solve world hunger, it is simply another tool to increase productivity and reach that goal.

Foods

from Genetically Improved Crops in Africa

From the Editor:

The agricultural scientists and farmers all over the world who improve our crops are the true heroes of our time. They have kept food production ahead of massive population increases. These advances were made possible by the continued genetic improvement of our crops. In addition, our food is safer now than it has been in human history.

Most of us know very little about the way our food plants are grown and are far removed from the factories where they are processed. All we care about is that our food be wholesome, nutritious, and tasty. Critics of crop biotechnology are of the opinion that potential ecological and food safety disasters are looming on the horizon because genetically improved (GI) or genetically modified (GM) crops have entered the food chain. Alarmists have introduced emotionally charged terms into the debate and speak of "frankenfoods" and "genetic pollution." The debate that rages in Europe has now reached Africa. This debate has important consequences for us in Africa where many countries have limited arable soil and extreme climates.

We believe that the issues of food safety and food sufficiency are extremely important. The debate cannot be left to the well-funded efforts of the big multinational agricultural biotechnology companies or to the opponents of GI foods funded by the organic food industry, "green" organisations, and radical "consumer" groups. We take our responsibilities seriously and this brochure is our own small contribution to this debate.

As scientists, we demand facts or evidence. It has been claimed that the risks of genetically improved crops will be "super weeds" and "super bacteria", the appearance of unknown toxins and allergens in our food, paralysing crop losses, and extensive ecological damage. We have not seen any evidence of these scenarios even though we have been testing these GI crops for 20 years and they have been eaten by millions of people on a daily basis since 1996. We believe that agriculture can be less ecologically damaging and more sustainable, and that GI crops can play a positive role in this development. We also believe that GI crops will make food cheaper to produce and more nutritious.

We hope that you will read this brochure and think through the issues raised by the GI food debate. Many scientists and professional scientific societies support the introduction of GI crops in the human food chain but as consumers you have the last word. If the food is good, whether GI or not, you will buy it; if it is not, you won't.

Maarten J. Chrispeels
Director
San Diego Center for Molecular Agriculture
mchrispeels@ucsd.edu

Jocelyn Webster
Executive Director
AfricaBio
africabio@mweb.co.za

TABLE OF CONTENTS

This brochure has been co-produced by the San Diego Center for Molecular Agriculture (see www.sdcma.org for more information) and AfricaBio. AfricaBio is a nonprofit, nonpolitical biotechnology association. This organisation serves as a forum for informed debate on biotechnological issues in Africa. AfricaBio is actively involved in consumer awareness and providing information on biotechnology to all levels of society. To obtain more information on this organisation and its activities visit the website at www.africabio.com and subscribe free of charge to the newsletter, BioLines by emailing biolines@africabio.com

0102-032

GI Foods Affect Your Life

Here are some things you should know...

If you worry about food safety you should know that GI foods are as safe as other foods and that GI foods are grown with fewer pesticide applications than traditional crops.

If you treasure butterflies you need to know that pesticides used in conventional farming are far worse than GI crops for butterflies.

If you have allergies you need to know that modern biotechnology can eliminate food allergens and that all GI crops are extensively tested to make sure that no new allergens are introduced. In addition, GI crops are being created in which the major allergens have been eliminated.

If you are worried about cancer you should take note of the fact that 99.99 percent of the carcinogens in your food supply are natural chemicals that humans have been eating for thousands of years. However, modern biotechnology provides the means of increasing levels of phytoestrogens, isoflavones, carotenoids, and other antioxidants known to prevent cancer.

If you are a woman and worried about getting sufficient iron you should know that modern biotechnology can increase the iron content of cereals and has eliminated chemicals (Phytic acids) that prevent iron absorption.

If you have doubt about the government's approval of GI crops you need to know that extensive testing and a long approval process accompanies every GI crop introduction.

If you care about the environment you may want to know that GI foods are making a significant contribution to alleviating the negative impact that agriculture has on our environment.

If you have religious beliefs you should be aware that ethicists and religious leaders do not object to genetic engineering of crops on ethical or religious grounds.

If you care about developing countries you should take note of the fact that the most eminent plant breeders in those countries want to have access to modern biotechnology to breed more productive and more nutritious crops.

If you don't trust industry spokespersons then listen to independent university scientists. The overwhelming majority agree that modern biotechnology is safe for the consumer and the environment and that it is needed to raise crop productivity. They also support scientific testing and regulation of such crops.

10,000 Years of Manipulating Crops

We are all familiar with the glorious sight of a cob of ripe maize, but what does the cob of the ancestor of the maize plant look like? Some 6,000 to 8,000 years ago Native Americans in Mexico began the slow process of domesticating teosinte, the ancestor of maize. Teosinte still grows wild in Mexico. It produces tiny "ears" with very small seeds, each contained in a tough thick husk, that fall to the ground when they are dry. The plant itself also does not look like a modern maize plant with its single tall stalk, because the species was genetically improved through human intervention. Maize probably has as many as 35,000 different genes and we have no idea how many have been mutated, deleted, rearranged, or duplicated in the past 5,000 years of improvement by man. All these genetic improvements are to our advantage because a hectare of maize yields 1,000 times more food than a hectare of teosinte.

As you travel through maize-growing regions of Kenya, Mexico, or Italy, you seldom see maize growing outside of a field or garden. That's because maize cannot survive without our assistance. It is a natural plant, but it can't survive in nature!

What is true for maize is also true of our other food crops: wheat, rice, beans, and soya beans were all genetically improved by traditional breeding techniques and can't survive on their own. Crop domestication, the process of changing wild plants to crop plants, started in south China and the Middle East about 10,000 years ago and in West Africa and Central Mexico 8,000 years ago.

Plant breeding is systematic genetic improvement

At the beginning of the twentieth century, farmers and plant breeders started improving crops more systematically. First they worked in the field, making simple crosses and producing hybrids from plants of the same species. In about 1950, plant breeders began experimenting with wide hybridisation: crossing different species and rescuing the tiny embryos through laboratory culture. To produce a crop from such a cross requires many generations of plant breeding. A new cereal called triticale was produced in this way by crossing wheat and rye.

Then came radiation breeding. Seeds were irradiated with gamma rays to induce changes in the DNA that might prove to be beneficial to the farmer. Chemicals have also been used to induce mutations. Hundreds of crop varieties are now in use that were produced by these methods. Finally, around 1980 gene cloning was added to the toolbox of the plant breeder.

"We cannot turn back the clock on agriculture and only use methods that were developed to feed a much smaller population. It took some 10,000 years to expand food production to the current level of about 5 billion tons per year. By 2025, we will have to nearly double current production again. This increase cannot be accomplished unless farmers across the world have access to current high-yielding crop production methods as well as new biotechnological breakthroughs that can increase the yields, dependability, and nutritional quality of our basic food crops. We need to bring common sense into the debate on agricultural science and technology and the sooner the better!"

Norman E. Borlaug
Winner of the Nobel Peace Prize, 1970

Twenty Years of Crop Improvement Through Modern Biotechnology

All DNA has the same basic structure. Gene analysis has revealed that in the course of evolution, some organisms have exchanged DNA with each other; one organism passing a few genes to another organism. Plant molecular biologists now use this natural gene exchange mechanism to insert new genes that carry valuable agronomic traits into the genome (the entire set of genes) of crop plants. **This is referred to as genetic modification (GM) or gen-etic engineering (GE) or genetic improvement (GI).**

Presently only a few genes are inserted at a time; in the future researchers will insert segments of DNA carrying multiple genes. Scientists don't know exactly where in the genome a gene lands, but this is usually not important because the genome seems to be constantly rearranging itself anyway. Furthermore, if the DNA lands in an unsuitable place that makes the plant less useful or edible, then those plants will be eliminated in the breeding process.

What about the future of modern biotechnology?

Biotechnology has been used to create many improved crops; for example, insect resistant crops, reducing the need for pesticides or delayed ripening in tomatoes, and virus resistance in potatoes. In the future, scientists will be able to replace an existing copy of a gene with another copy that may be slightly better. New molecular and genetic techniques will make genetic modification or improvement of crops even more precise. Such precision may well make unnecessary the many generations of crop breeding that currently follow standard laboratory procedures.

We are only at the beginning of the applications of modern biotechnology. The study of the plant genome will allow more rational approaches to traditional plant breeding. Furthermore, as genome analysis becomes easier and cheaper, we will be able to tackle African crops, such as cowpeas, sorghum, cassava, and millet, that have not received much attention so far.

Genes that have the potential to allow more food and more nutritious food to be produced on the same amount of arable land are being discovered at an ever-increasing rate. Will we be allowed to use these genes for the benefit of humanity?

"The twenty-first century will be biological and diverse, with biotechnology being the kingpin of the process."

Olusegun Obasanjo, President of Nigeria — Nigeria has committed $26 million per annum to developing biotechnology

Modern Biotechnology Will Help Feed The World

By the year 2050 there will be approximately 9 billion people in the world, an increase of 50 percent over the present day. Most of this increase will occur in the cities of developing countries, primarily in Africa and Asia. If present economic development continues, this population increase will require a doubling of food production. Only a fraction of the food that all these people will need can be produced in the breadbaskets of the world. Most of this food has to be grown locally. The problem of feeding all the people is worsened by the uneven distribution of croplands. For example, China has a quarter of the human population but only 7 percent of the world's farmland.

During the last doubling of the human population from 3 billion in 1960 to 6 billion in 2000, food production increases kept up with population growth because we created and adopted multiple technologies. Better techniques to cultivate the soil, new irrigation technologies, biodegradable pesticides, better genetic strains, machinery that harvests more of the crop, synthetic fertilisers, and green manures that restore the nutrients to the soil all have helped raise food production.

Modern biotechnology is only part of the answer

Genetically improved crops are not the solution that will feed the world. However, they can certainly help because they are an integral part of our continuing quest for crops that can meet our food requirements. We can't afford to reject this technology as some are advocating.

Progress must be made in other technologies as well. We need more durable, longer-lasting, disease and insect resistant crops, irrigation systems that waste less water, agronomic systems with multiple crops that limit erosion on sloping land. We need to find out which types of soil preparation, fertiliser application, and crop rotation systems produce the healthiest soils with the most beneficial microbial activity. We still need to learn so much, and yet financial support for agricultural research has been slowly declining over the last twenty years.

Modern biotechnology cannot eliminate poverty and hunger because these problems are rooted in the socio-political realm. People need jobs to purchase food and with economic demand, food production usually picks up. Although the world does indeed produce enough food to eliminate hunger, we have not yet devised a system that permits the distribution of that food in an equitable way.

In Africa, agriculture is the most important economic activity yet crop production is the lowest in the world. More than 25 percent of the grain needed in Africa is imported, while up to 40 percent of the harvest may be lost due to post-harvest damage.

"Biotech could boost productivity: the average maize yield in Africa is less than half the global average...the African continent, more than any other, urgently needs agricultural biotechnology, including transgenic crops, to improve food production."

Florence Wambugu, Ph.D.
International Service for the Acquisition of Agri-biotech Applications (ISAAA)

Hunger and malnutrition

In Africa, hunger and malnutrition are common. There are an estimated 25 to 30 million malnourished children on the continent today. The World Health Organisation (WHO) estimates that 54 percent of child mortality in developing African countries is associated with malnutrition. As many as one third of the children in sub Saharan Africa are said to be stunted because of poor diet, while every day thousands of people die from hunger. Millions of people across the continent are regularly threatened by food insecurity. A further tragedy is that millions of people are forced to live below their full potential because they lack the energy and good health to function at their best.

Access to existing and new technologies in agriculture is clearly a high priority in Africa. Biotechnology is one of the new technologies that has a significant role to play in improving crop production and reducing waste.

Technologies are not an unmitigated blessing, especially when they are first introduced. Cars pollute the air and people are killed in accidents, but few people want to be without an automobile. Agricultural technologies also have negative effects. To make them better requires our human ingenuity. Former U.S. President Jimmy Carter said it so well: "Responsible biotechnology is not the enemy; starvation is."

Modern biotechnology offers many benefits for agriculture in Africa and these benefits can be packaged in seeds. This means that it is a user-friendly technology that fits with the cultural practices of Africa and is easier to transfer than methods that require elaborate techniques or machines.

"The use of high yielding, disease-resistant, and pest-resistant crops will have a direct bearing on improved food security, poverty alleviation, and environmental conservation in Africa."

John Wafula Ph.D., head of Biotechnology Research
Kenya Agriculture Research Institute (KARI)

"Biotechnology, one of the many tools of agricultural research and development... could contribute to food security by helping promote sustainable agriculture centred on smallholder farmers in developing countries."

Ismail Seragelding, Vice President
World Bank

WHAT ARE GENES?

What is a gene? Genes are the units of inheritance first discovered in the middle of the nineteenth century by Gregor Mendel. He examined thousands of pea plants and discovered that some pea flowers had a purple colour that was inherited when peas were crossed. Now we know that genes are made of DNA and are arranged in long strings on the cell's chromosomes. Bacterial cells have about 2,000 different genes, a flowering plant has some 25,000 genes. Humans may have 30,000 different genes. Every cell has two copies of every gene. Each gene has the information to make a specific protein.

In peas the gene for "purple" specifies a protein that converts a colourless chemical into a purple pigment in a pea flower. When the gene is passed from one generation to the next, so is the capacity to make the purple pigment.

What About the Environment?

For some 5,000 years, crop production has been reshaping our landscape. Forests have been cleared and the natural African countryside has been turned into farmlands. The landscape may still be pleasing to the eye — fynbos rich mountainsides in the Cape, mopani woodlands along the Caprivi Strip, baobab trees in the Kalahari and so on — but the diversity of plants and animals that characterised earlier times has been lost. Not because of GI crops, but because of our need to feed an ever-growing human population coupled with our inability to increase productivity (yield per hectare) fast enough.

This means that ever-increasing amounts of land have had to be put under the plough. The result has been plenty of food for 90 percent of the human population — 100 percent if we could distribute it equitably. This achievement has been at the cost of a loss of species diversity, soil erosion, salt build-up, the spread of weeds and pathogens from one continent to another, and the emergence of new insect pests. None of these problems exist because of GI crops.

We need to do much better! We need to make agriculture more sustainable so that at least some of these problems can be alleviated. Increasing sustainability and raising productivity will tax our ingenuity but most importantly we must be able to assess new technologies and determine their benefit.

Preserving wilderness will require increasing crop productivity

It is odd that environmentalists who rightfully lament the loss of biodiversity are not taking a strong position in favour of technologies that can raise agricultural productivity. Indeed, there is a clear link between crop productivity and the maintenance of biodiversity.

All the good land and much of the marginal land is already being cultivated. What is left is even more marginal, i.e., poorer soils or drier climates, fields higher on the slopes of mountains. If we push production into those areas the damage to the environment will be even greater. So, if we want to preserve wilderness lands and the biodiversity they offer, we have to increase crop productivity on existing agricultural lands. Modern biotechnology can make a real contribution to this goal. The GI crops already being grown require fewer pesticide applications and less tilling of the soil, thereby causing less erosion. Most importantly, we need to increase productivity. If doubling food production will require us to double the cultivated area, there would be no wilderness left. Let's bring all our knowledge and all our technologies — simple and sophisticated — to bear on the important issue of making agriculture more productive and environmental friendly.

There Are More Insects and Greater Insect Diversity in Fields of Bt Crops

Bacillus thuringiensis, Bt for short, is a bacterium that produces a protein called Bt toxin; this protein pokes holes in the guts of insects and insect larvae that ingest these bacteria. Organic farmers use this natural pesticide to keep the population of some insects under control. Scientists have taken the Bt gene and transferred it into cotton, maize, and potatoes, so that every cell of these plants now makes the Bt protein. The lepidopteran (butterfly) larvae that feed on the roots, leaves, or seeds of such crops are doomed. Farmers are happy because they do not have to pay for pesticides. The farm workers are happy because they do not come in contact with pesticides. The consumer is happy, because they do not have to worry about pesticide residues. But most of the all, the beneficial insects are not killed by insecticide sprays. Recent research shows that fields of Bt crops have more insects and a greater diversity in insect species.

"Father, are there genes on my plate?"

"Are there genes on my plate?" a 12-year-old son asked his father. What if your child asked this? An opinion survey showed that 70 percent of the people have the mistaken idea that ordinary foods do not contain genes, whereas GI foods do. After explaining to his son that every bite of food on his plate has billions of genes, the father told him a story.

"In the mountains and valleys of the Lubisi community in the Eastern Cape of South Africa, Madimatsa and Kanakana look after their fields of maize. They are 'organic' farmers because they do not have enough money to buy fertilisers or pesticides. Some years they lose 30 percent of their crop to maize stalk borer (these losses can be even up to 70 percent). Now suppose that the maize was genetically improved with a Bt gene to kill the maize stalk borer, the farmers will be sure of getting a much better harvest without having to spend time on trying to control this pest. Don't you think these farmers would benefit from having some genes on their plates?"

Is Organic Farming the Answer?

Certified organic farming is defined as much by what it does not accept as by what it does accept. For most of its farming practices it turns the clock back to 1950 and disavows the use of all but a few pesticides (such as rotenone, which is actually quite poisonous), and rejects all herbicides and most inorganic (chemical) fertilisers. It prefers organic fertilisers (manure), mechanical removal of weeds (with tractors), and biological pest control. It accepts all methods of producing improved crop plants (including radiation breeding) but rejects plant biotechnology that uses gene transfer. Organic farming can feed about 3 billion people and not the 6 billion we now have, or the 9 billion that we will have.

Why is this so? There are several reasons, according to Professor Tony Trewavas, a well-known and respected British plant biologist and fellow of the Royal Society of Great Britain. First of all, to produce the manure necessary to raise organic crops, a considerable amount of land must be set aside to raise food for the animals. Secondly, crop harvesting and food consumption result in a net transfer of plant nutrients from the soil to the toilets of city dwellers! Replacement of these nutrients through crop rotations with legumes and by utilising rock phosphate is imperfect at best. Also, biological control of insects and diseases is not as efficient as chemical control or control by genetic improvement in large-scale crop production. These factors all conspire to make organic farming less efficient and certified organic produce more expensive than that produced by traditional farming practices.

Farming must be made more sustainable

There are several positive aspects to organic farming that are practised by many farmers. Crop rotations with legumes, the use of crop residues to improve the soil, integrated or biological pest control when appropriate, and use of lime to decrease the acidity of the soil are just a few examples.

The problem is that certified organic farming is driven by ideology, not by sound science or even a "love of the land." Organic farmers reject technologies that other farmers incorporate in their croplands management schemes to achieve a sustainable form of agriculture. Scientists who support GI crops agree that farming must be made more sustainable, but reject the ideology-driven approach of organic farmers. Elements of organic farming combined with modern biotechnology would create a sustainable and environmentally friendly approach to agriculture. Modern biotechnology will move conventional agriculture closer to the sustainable ideals of organic farmers.

Labelling: Mandatory or Voluntary?

Should we have mandatory labelling of all foods that contain even a small amount of a GI crop, as is presently the case in the European Union (EU), or should there be voluntary labelling by companies that want to develop a niche market for "GI-free" foods? Such a niche market now exists for organic produce and organic foods. Who should bear the cost of keeping the GI and non-GI crops separate from the time of planting to the point where processed food is packaged in a labelled box? Several studies show that keeping products separate will add 10 percent to the cost of food because food processing factories will have to maintain separate facilities for each type. The experience in Europe shows that mandatory labelling does not result in more consumer choice. This seems contradictory, but in reality the grocers refuse to carry GI foods even when they are available, for fear of offending any customers. On the other hand, in the U.S.A., the voluntary labelling approach is creating a niche market that caters to those people who are willing to pay just a bit more for their preference. Foods claimed to be free of GI ingredients will undoubtedly be permitted to have a certain level of mixing in of GI foods because zero tolerance is not achievable. To make matters more complicated, many products used in the food industry such as starches and oils contain neither the genes nor the proteins that are responsible for the GI nature of the crop from which they were derived. Are they GI foods?

GLOSSARY

Labelling policies are under development in some countries and still need to be developed in others. Governments need to ensure that labelling meets consumer requirements, that the level of mixing is reasonable (5 percent perhaps), and that the claims can be verified. Most importantly, they should not lead to increases in food prices for the general population.

Modern biotechnology means the application of:

1. Laboratory nucleic acid techniques, including recombinant deoxyribonucleic acid (DNA) and direct injection of nucleic acid into cells or organelles, or

2. Fusion of cells beyond the taxonomic family, that overcome natural physiological reproductive or recombination barriers, and that are not techniques used in traditional breeding and selection.

LMO Living modified organism - means any living organism that contains a novel combination of genetic material obtained through the use of modern biotechnology.

GMO Genetically modified organism - means any organism that contains a new or altered gene.

GI Genetically improved is the same as genetically modified.

GE Genetic engineering is the same as modern biotechnology.

Hybridisation Is the sharing of genes from different parents.

DNA Is the genetic material in most living organisms: plants, animals, and microbes.

Gene Genes are the units of inheritance made up of DNA.

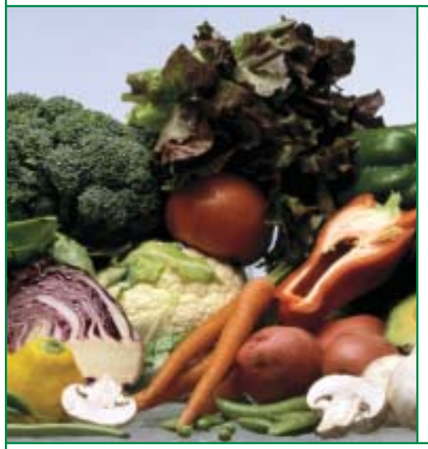
Genome The entire set of genes in an organism.

Biosafety The assessment of the impact and safety of genetically improved organisms.

Bt Bacillus thuringiensis, Bt for short, are bacteria that produce a protein called Bt toxin; this protein kills small insect larvae.

BIOTECHNOLOGY AT WORK

Better Quality and Healthier Foods are in the Pipeline



Modern biotechnology will provide us with foods that have many nutritional benefits. Biotechnology can:

Remove existing allergens
Remove toxicants
Provide us with high-protein root crops
Produce maize with more complete protein
Produce fruits with higher vitamin C levels
Produce vegetables with higher vitamin A and E levels
Provide us with oilseeds with healthier oils

Think about it: In the future, healthcare will be preventative by encouraging the consumption of specialised foods called "nutraceuticals"

New Antibiotic-resistant bacteria because of GI Foods?

The emergence of strains of bacterial pathogens that are resistant to antibiotics has become a major health problem. Antibiotic-resistant bacteria develop when people misuse antibiotics to fight viral infections (like colds) and when they do not use antibiotics long enough to kill all the infecting bacteria. In addition, large doses of antibiotics are fed to animals to stimulate their growth. The emergence of antibiotic-resistant strains as a result of these practices was widely predicted by microbiologists many years ago.

Antibiotics were also used to create the first GI crops in the laboratory. Opponents of GI crops maintain that this will lead to the appearance of new antibiotic-resistant bacteria. Even though there has been no scientific proof to suggest that GI crops with antibiotic markers pose problem to humans, animals, or the environment, most developers of GI crops today have moved away from using antibiotic resistance because of consumer concerns.

"The Newer Biotechnology techniques open up very great possibilities of rapidly improving the quality and quantity of food available. The use of these techniques does not result in food which is inherently less safe than that produced by conventional ones."

World Health Organisation (WHO)

Foods rich in Pro-Vitamin A will help alleviate blindness and infant mortality.

The recent production of "golden rice" is a brilliant application of plant biotechnology. This rice is rich in the precursor of Vitamin A, which the body readily converts into the vitamin itself. Genes that cause the yellow colour of daffodils were isolated and adapted so that they could be expressed in rice seeds and the resulting GI rice looks faintly yellow. Vitamin A deficiency is extremely common in Southeast Asia, Africa, and Latin America among the poor people for whom rice is a major staple and sometimes just about the only food available. This golden rice can make a substantial contribution to their rice needs.

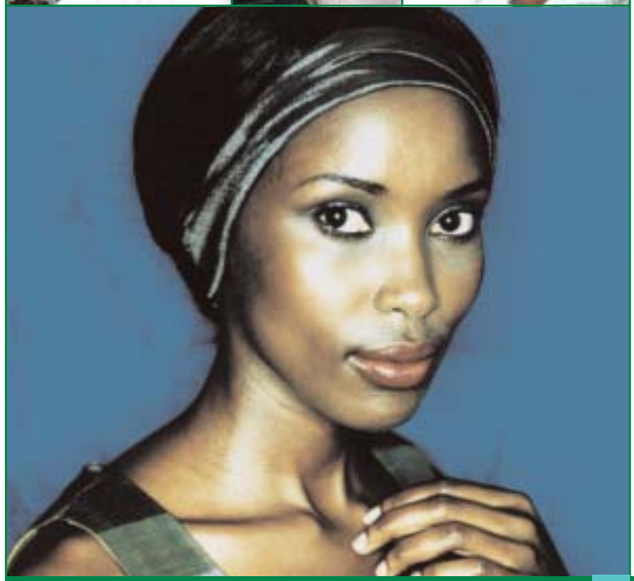
The FAO estimates that 124 million people suffer from vitamin A deficiency and that 250,000 go blind every year because they lack this essential vitamin in their diet. Whilst this breakthrough is not yet been optimised or commercialised, when this rice does come on the market, it will be clearly labelled as "vitamin A-enriched."

Bad Science/Good Science and How Misinformation Is Spread

Phytoestrogens are newly-discovered biologically active chemicals that are particularly abundant in soya beans and soya products. They lower the risk of certain cancers in women that are linked to high serum oestrogen levels.

A group opposed to GI crops measured the levels of phytoestrogens in traditional and genetically improved soya beans and came to the conclusion that the concentration of phytoestrogens was substantially lower in the GI seeds. However, they did not measure phytoestrogens in the seeds of the GI crop line and its parent crop line, harvested from plants grown side by side.

Phytoestrogen levels vary considerably in different soya bean varieties, and vary depending on the conditions of growth (weather, soil, fertiliser, etc.). Levels in GI soya are well within accepted amounts. Thus, no definitive conclusion could be drawn from this poorly controlled experiment. Nevertheless, the group prepared an extensive press release condemning GI crops



Is Your Baby Allergic to Soya Beans?

Many babies are allergic to soya beans. One way to get around this problem is to eliminate the allergenic proteins the soya beans contain. Scientists recently identified the main allergen in soya bean and eliminated it using GI technology. It will take at least five years, probably longer, before these soya bean products are on the market. However, many baby food manufacturers have rejected GI soya beans. Consumers will have to choose between natural allergenic soya beans and GI non-allergenic soya beans!

Many people are allergic to peanuts. The development of non-allergenic peanuts is important for Africa as peanuts are a critical protein source in the diets of many Africans. Scientists are already working on removing allergens from peanuts.

You Can't Taste Those Aflatoxins!

Aflatoxins are potent carcinogens produced by fungi that infect peanuts and maize seeds. These fungi grow when the seeds are in storage. Although we can minimise the problem, there will always be some aflatoxins in your peanut butter. Modern biotechnology offers the prospect of eliminating aflatoxins by equipping the seeds with an enzyme that will break down the aflatoxins. Some of the data collected so far suggests that by using the insect resistant GI maize there is a decrease in the levels of aflatoxins. This is due to the fact that there is less damage to insect resistance maize in the field and therefore less fungal contamination. Consumers will be able to choose between traditional peanuts and aflatoxin-reduced GI peanuts.

Foods From Genetically Improved Crops Are Just as Safe as Those From Other Crops...

No scientific evidence has been found after years of research to prove that foods made from GI crops are any less safe (or more safe) than traditional foods. That is because GI foods are much more extensively tested than traditional foods. Indeed, comprehensive legislation to regulate the safety of GM products to humans, animals, and the environment is being developed. Countries such as Argentina, Australia, Canada, South Africa, and U.S.A. have such legislation in place. The EU is changing aspects of their regulatory requirements. Countries within Africa vary in the extent of development of their legislation and regulatory systems. All recognise the need for comprehensive risk assessments before GI products are commercialised. Furthermore, the Biosafety Protocol, which seeks to regulate the international movement of living modified organisms (LMOs), assures regulatory systems on an international basis. Approval for the release of a GI crop may take up to six years. Crops produced by traditional breeding techniques (including radiation breeding) do not need to be tested in this way.

GI Crops Are Exhaustively Tested

Tests are run to ensure that each GI crop is safe for humans, animals, and the environment. This includes the levels of nutrients and other chemicals found in our food plants. Indeed our crops naturally contain a variety of chemicals that are part of the plant's arsenal to fend off insects, bacteria, viruses, and fungi. When eaten in small quantities they pose no problem; however, several new lines of crops bred by traditional methods had to be recalled because they contained unacceptably high levels of such chemicals. These crops were approved because testing is not required for crops produced by traditional methods. Genetically improved crops are tested in a more rigorous way.

Any additional components present in a GI crop but absent from the traditional crop (usually a few extra genes and a few proteins) are tested for their potential to cause an allergic reaction, and to make sure that they are rapidly broken down by digestive enzymes. The safety tests are the same as those for pesticides and other food additives introduced by the food industry: there must be reasonable certainty that no harm will result from cumulative dietary exposure.

Over 25,000 field trails have been conducted on more than 60 crops in 45 countries and no long-term effects have been detected. Approved GI foods are as safe as their conventional counterparts.

Are GI Crops and GI Foods Properly Regulated in Africa?

At present, South Africa is the only country in Africa to commercialise GI crops. In South Africa, the National Department of Agriculture regulates the process of testing and commercialising a GI crop. The Genetically Modified Organisms Act (Act No.15 of 1997) was developed to ensure that GI crops do not pose a threat to human and animal health or the environment. Permits are required to carry out a field trial before commercialisation. To obtain a general release permit for commercialisation information about all aspects of the new crop must be provided for assessment. This process is called a biosafety assessment.

The biosafety assessment involves a scientific advisory committee as well as input from the public and relevant Government departments. The Department of Health evaluates the safety to consumers and decides whether labelling is required. The Department of Environmental Affairs & Tourism assesses the environmental safety. Especially important is the presence or absence of wild relatives of the crop and the possibility that genes could spread to those wild relatives. The Department of Trade & Industry, Department of Arts, Culture, Science & Technology and Department of Labour determine the socio-economic effects of the new GI crop on their areas of responsibility.

Other African countries have established regulatory processes. For example, Zimbabwe, Egypt, and Kenya are now carrying out field trials on GI crops to determine if they offer benefits to their consumers and farmers. However, most African countries have not established their legislation and regulations to carry out biosafety assessments. No GI crop can be grown in a country until these biosafety structures are in place. Many African countries that wish to test the benefits of using GI crops are being delayed in doing so because they do not yet have biosafety regulations in place.

WHAT'S THE RISK AND WHAT'S THE BENEFIT?

When trains were first invented few people used them because they perceived great risk and little benefit from this mode of travel. The same has happened with aeroplanes. Very few people who now want to go from Kenya to New York think that the risk of air travel overweighs the benefits, even though 'plane crashes occur regularly and planes pollute the air. The British shunned pasteurised milk for decades because the unknown risks from this "unnatural" process of pasteurisation were seen to be greater than the benefits. Ultimately, the consumer decides whether the benefits of a new technology outweigh the risks.