NARRATOR
Genetic modification is a new frontier in science. We have the power to reconstruct the building blocks of life itself. When it comes to food, do genetically modified crops offer the hope of a new Green Revolution?

Or are they poised to contaminate our environment and make farmers dependent on agribusiness bent on maximising profits? Do the risks outweigh the benefits?

And who decides?

Earth Report went to three countries to find out how genetically modified crops are changing the world.

India’s farmers are attracted by claims of higher yields,

Zambia refused desperately needed food aid because it was genetically modified,

Argentina has enthusiastically embraced GM crops, sowing half of its land with GM Soya.

This is Warangal District in Andhra Pradesh - India. Most smallholders here have become dependent on cotton as a cash crop.

But resistance to chemical pesticides has grown and farmers have had to go into debt to buy new, more potent chemicals.

At the same time, prices plummeted.

Seeing no way out of the debt trap, suicides have become common. According to the Indian authorities, in the last decade, up to 10,000 cotton farmers have taken their own lives.

When genetically modified cotton, called BT cotton, was developed by multinational Biotech company, Monsanto, it gave farmers new hope.

P.V. Sateesh Deccan, Development society
BT cotton entered the field with the assurance to farmers, saying if you adopt BT cotton you will increase your yield, reduce the pesticide use and you will get more profits.

The BT cotton plant’s DNA had been manipulated to include the bacillus thuringiensis gene. With this gene, the plant becomes toxic to its most common cotton pest, the bollworm. The crop can resist attack and stays healthy.

One of the seed’s producers, Mahyco, partly owned by Monsanto, had advertised heavily in Andhra Pradesh.

NARRATOR
The BT cottonseed was four times more expensive than the conventional seed but in the hope that the new seed would turn their luck around, many farmers went further into debt and invested in it.
But for many farmers the expected success failed to materialise. Warangal District is a drought prone area. Agriculture is dependent on the rains. In two out of the three years that BT cotton has been grown here, the rains failed.

Devinder Sharma Political Analyst
If you look at the reports of the Department of Biotechnology, BT cotton consumes about 20% more water than hybrid cotton. And scientists knew it, industry knew it.

NARRATOR
The problem appears to be that cotton farmers were not told about this drawback.

Banoth Balu
I was told that BT cotton gives good yields and requires no sprays. I planned to take land on lease for 2-3 years and grow this with a hope that I would be able to repay most of my debts. All my hopes were crushed. The BT crop did not germinate and my wife committed suicide three months ago because of it. She went to the field and drank pesticide.

NARRATOR
According to Warangal authorities, farmer’s suicides have continued at a rate of over 20 a month after the harvest failure in 2004.

The irony was that those who stuck with the conventional, more drought resistant cotton fared better.

P.V. Sateesh
BT cotton could not adapt because it was technologically manipulated and this technological manipulation could not adapt itself to these stressed conditions.

The people who grew non-BT cotton made 6 times more profits than the BT cotton people.

NARRATOR
The BT converted farmers were furious. They rioted in Warangal Town and demonstrated against the seed companies and pressed for the sale of BT cotton to be banned.

Raghuveera Reddy, Minister for Agriculture Andrah Pradesh
We have ordered for a detailed field inspection and once it is found that the company is at fault, he should pay that, if he doesn’t pay also, we’ll put those companies on a blacklist, we don’t hesitate to do that also.

Local TV news archive
According to Mahyco, BT cotton has performed much better in other provinces. Earth Report contacted Mahyco which sent us the following statement about the Andhra Pradesh situation:

“Investigations by an expert government team has found that the performance of BT cotton is satisfactory – it is increasing yields significantly and reducing the number of sprays for bollworm control. The farmers who are not managing the crops for disease and nutrients are getting reduced yields and hence proper practices must be adopted.”
But despite the setback in Andhra Pradesh, countries such as India are pushing ahead with biotechnology. In Hyderabad, the International Crop Research Institute for the Semi-Arid Tropics -ICRISAT – is working on developing crops that they say will help ease poverty.

Part of a publically funded network of seed banks and agricultural research institutes, ICRISAT like many others is seeking private sector partnerships to keep going.

**Dr Kiran Sharma ICRISAT**

We are basically working for the poor farmers - in a country like India where 70% of the people are actually farmers…

If we can help these farmers have a better livelihood and raise above the poverty line,

I think that’s a mission accomplished.

**NARRATOR**

If there is one lesson from the comparative failure of BT cotton in Andhra Pradesh it is that GM crops are no magic bullet.

**Sharma**

The work on the drought is still in early stages. We’ve developed transgenics with a gene that might provide tolerance to drought but I think we still have a long way to go before we have proper answers.

**NARRATOR**

In Zambia, genetically modified crops are controversial for a different reason.

Here, the concern has been about disclosure and transparency.

The issue came to the fore when the country faced starvation in 2002.

**BBC News archive 2002**

All the signs are here around me of an imminent serious famine.

**NARRATOR**

The US government responded fast.

It gave 12,000 metric tons of genetically modified maize. In the USA widespread growing of GM maize is not a matter of controversy.

But to some it was deeply suspect that Zambia was not alerted that the food aid was genetically modified - as it should have been under the food aid convention.

**Mundia Sikatana, Minister of Agriculture**

Zambia took exception to the fact that we were not told. We were not told that the food we were being given was GMO.

You have got to disclose! What is wrong with disclosing? Because they knew we would react.
NARRATOR
There was general astonishment in the international community when the Zambian government rejected the GM food aid.

ZNTV archive 2002
I would like to inform the nation that government has finally decided not to allow GMF into the country, even in our current food deficit situation.

NARRATOR
The race was now on to find alternatives to the imported food aid acceptable to the Zambian government.

David Stevens, Director, World Food Programme
We were in the middle of a drought here in Zambia, a very serious drought, with almost 3 million people in need of emergency food distributions.

Charles Mushitu, Zambian Red Cross
We had to go back to the drawing boards to re-plan our exercise. And what I remember very well, during that period we started distributing beans. From other neighbouring countries like Tanzania. We started delivering those beans, people could live on these beans, they would cook the beans, mash them, eat it as a meal.

David Stevens
With the generous donations of many countries, cash donations, we were able to purchase food in the region and elsewhere. non-gm food for distribution

Charles Mushitu
We didn’t record a single death arising out of hunger.

NARRATOR
Disaster had been averted, but the issue had raised a fierce debate in Zambia and throughout Africa.

ZNTV archive 2002
Please tell the Americans and everybody else to respect the Zambians. We are somebody! We are starving but we must be given a chance as people to make a decision. Yesterday the WFP said that this food is safe?

What the concern is that while it is true, it can be eaten, we may not even have any health effects now but the question is do we know what will happen to our generation to come?

NARRATOR
Zambia had another incentive.

It exports vegetables to Europe.

The Europeans have strict GMO controls. If those given the GM food aid grew crops from it, Zambia’s exports might have been threatened.
**Songowayo Zyambo Zambia National Farmers Union**
The export markets demanded that if there was any activity of GMO in Zambia, then they wouldn’t buy that particular crop. Now that meant loss of a market for farmers, it also meant loss of foreign exchange earnings for Zambia. Eventually it would have translated into reduced employment in Zambia and so many other negative implications.

**NARRATOR**
Farmers were worried about possible GM contamination of their crops.

**Tewani Clarke, Seed producer**
Every time you bring in something that has not been tested you bring in dangers. It has happened when there has been food aid in the past, we imported a pest that didn’t have natural predators in Zambia and it’s still giving us a problem now.

The larger commercial farmers may be able to afford the chemicals to protect their grain but the small-scale farmers may not even be aware about it. So the same thing could happen in a GMO situation.

**ZNBC archive 2002**
We have been assured that all these things will not happen; the problem is there’s no research date that has proven that so our fears persist. I have to say here that lack of proof is not proof - lack of proof is not in itself proof.

**NARRATOR**
Zambia is now considering on its own terms if gm crops may have a place in its future.

**Dr Fastone Goma, University of Zambia**
We want crops that won’t dent the environment. We would want to control cross-pollination. We want to make sure that we still enjoy our organic products. And so with all that in mind, we need to set the agenda for biotechnology.

I think we have open arms towards it but we will not just accept what has gone on everywhere as being good for Zambia.

**NARRATOR**
Impoverished nations such as Zambia have little capacity to make their own scientific assessments of the possible threats posed by GM crops. It is forced to rely on a fair and unbiased international regime.

An issue Norway’s aid minister is aware of.

**Hilda F Johnson, Minister for International Development, Norway**
Very few countries have the capacity necessary even to deal not only with the scientific part of this, but also the regulatory framework that has to go with it.

We as the international community and donor community we have also to strengthen their possibilities to deal with the GMO area.
NARRATOR
Argentina - a world away from Zambia in more than one sense.

Its government does not share the doubts about GM crops.

At the end of the 1990s, GM Soya was introduced.

It proved so profitable that now half of the country’s arable land is planted with a single species – RoundUp Ready Soya, produced by Monsanto.

Frederico Ovejero, Monsanto Argentina
The economic impact has been $9 billion - $9 billion that has been not only generated for the growers but also for the whole country.

NARRATOR
The big agri-businesses are the most enthusiastic growers of GM Soya.

Juan Carlos Mettifogo, Producers’ Association APPRESID
Agricultural producers must participate in the obtainment of their profits. Through biotechnology, producers will get their profits and very large profits.

NARRATOR
But as more and more land was switched to GM Soya cultivation, over 150,000 small farmers and labourers have quit their farms claiming they can no longer compete.

Orchards, greenbelts and dairy farms have gone under the Soya juggernaut. It is good for the country’s export but incredibly, the country now has to import basic foodstuffs such as milk and potatoes.

It is how free trade is meant to work – the problem is that half the country can’t afford the imported food. Recently, the National Institute of Statistics and Consensus estimated that half of Argentina’s population was unable to meet their basic food needs.

The big agro producer association APPRESID started a campaign called Soya Solidarity to help the hungry.

Over one million people received food made from RR Soya donated by APPRESID’s producers.

The Soya products were given out in schools, churches, orphanages, hospitals and soup kitchens.

However some are worried about the safety of eating GM Soya beans. They point to research that has been done on a different gm crop, GM corn.

Prof. Jorge Kaczewer, University of Buenos Aires
We can see that consumption of GM corn leads direct changes in the bowel, changes in the bowel mucous of animals fed with this. And look at the cell growth in animals consuming GM and this is a normal bowel of a rat, which didn’t eat GM corn.
We already know that GM Soya beans were approved without enough long-term experiments to determine that they're safe.

**NARRATOR**
Monsanto’s scientists insist the crop has been properly tested.

**Miguel Azancedo Monsanto Argentina**
You have of course studies to demonstrate that the feeding or eating this new stuff it's not - it's safe enough. And those studies are conducted basically on birds and chicken because chickens are a particular animal with a very very fast grow and with a very very easy way to detect some problems.

**NARRATOR**
RoundUp Ready Soya is genetically modified to withstand the herbicide Glyphosate. After spraying with glyphosate, only weeds die - the Soya plant stays healthy.

The use of glyphosate has gone up.

**Dr Walter Pengue, University of Buenos Aires**
One thing we can link as regards Soya production in Argentina is the very strong, intensive increase in the use of agrochemicals. Particularly in the use of herbicides, mostly glyphosate. Since the beginning of the 90s, we've gone from less than one million litres to more than 150 millions nowadays.

**NARRATOR**
A consortium of US universities funded by the US Department of Agriculture, give glyphosate a clean billing – but medical observers here in Argentina want find out if some of the chemicals used alongside glyphosate in the production of GM soya might be linked to health problems. Endosulfan, often used as an insecticide, is a cause of particular concern. According to the pro-biotech organisation CASAFE, the sales of Endosulfan have gone up by 25% over recent years.

**Dr. Gianfelice**
We have seen with a higher than normal frequency dead babies, babies born with abnormalities and pregnancies without an embryo. Usually this happens to people who produce or spray Soya, or are exposed to Soya fumigation. There are international studies, which demonstrate that the use of persistent organic pollutants to which Roundup-sulfan belongs, produce severe reduction in people’s capacity to reproduce.

That's what the big agrochemical companies, the GM multinationals don't want to be said.

**NARRATOR**
But the government believes the chemicals are not poisonous when used correctly.
Miguel Santiago Campos, Minister for Agriculture
It is specified in the label how you have to do it, when you have to do it and in what condition you have to do it.

And sometimes they don’t know that.

NARRATOR
Critics also point to the environmental impact of the soya expansion. To create new fields for genetically modified crops, forests in the north of the country have been destroyed.

This has limited the ability of the ground to absorb rain water, and increased flooding.

In 2003, a huge flood devastated Santa Fe town.

Over 100,000 people had to be evacuated.

Jorge Carpatto Friends of the Earth/Proteger
Catastrophic floods, which used to happen every 100 years, now happen every five or ten years.

The levels of the river rose twenty times, there were places where water rose by 5 meters in 20 minutes.

We have a saying: “God always forgives, man sometimes, nature never.”

NARRATOR
Although the Santa Fe authorities confirm the link between the deforestation and the floods, the Argentine government continues to support forest clearance for export crops. It is pressing ahead with other gm crops and has recently approved RoundUP Ready maize.

Each of these countries is finding its own way to deal with biotechnology. But on a wider scale, who is determining how biotechnology shapes our future?

Peter Newell University of Sussex
The key decisions about a technology which impacts all of us are being taken elsewhere, by other people, who have their own vested interests in the technology.

We have to find ways of trying to bring people in to the process and allowing them to express whether they want this technology, what type of technology, what safeguards they would want to see.

There is a whole set of issues about the technology and it’s role in society that scientists alone cannot deal with.