

# GENETICALLY MODIFIED CROPS: ISSUES FOR INDIA<sup>1</sup>

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Countries like India that have food security concerns and have small and marginal farmers practicing an integrated type of agriculture have specific problems for which they seek solutions. GM technology has been developed for the large land holding, mechanized agriculture of industrialized countries. There is little available in the GM arsenal today that is geared to address the problems of developing country agriculture. India could use a toxin free variety of the *khesari dal* (*Lathyrus sativus*) grown on marginal lands and consumed by the very poor. Consumption over time leads to a form of paralysis because of the poison but sometimes it's the only food available. India could use salt tolerant and drought tolerant crop varieties that could grow on degraded lands or in arid areas where nothing much grows at present. This would help food production and bring money and food to marginal farmers living in difficult areas.

Instead of crop varieties aimed at alleviating hunger, GM technology at present offers just four major crops - soybean, corn (yellow corn used for animal feed and industrial use, not white corn used for food), cotton and canola. The most prevalent characteristic for which the crops are bred is herbicide tolerance followed by insect resistance, as with Bt cotton. There are no crop varieties, which have enhanced nutrition, high protein cereals for example, which would be needed in India and developing countries.

The herbicide tolerance trait in a crop variety bestows the ability to withstand application of herbicides in a field where herbicides are sprayed (often by airplanes) to control weeds. This trait is developed for the several thousand hectare farms in developed countries where aerial spraying is needed since it is not possible to control weeds otherwise. Of what use would an herbicide tolerant crop be in India? It would displace labour that today does the weeding in fields. This would mean loss of income for farm labour, especially women, and it would mean loss of fodder and nutritive leafy greens. What is weed in a rice or wheat crop is valued as vegetable by rural families (the highly nutritious *chaulai* and *bathua saag*). What is not edible goes to feed the livestock. Weeds support rural livelihoods and in our agricultural system we would be mad to introduce herbicide tolerant crops.

Let us take the two crops in question in India, Bt cotton and GM mustard. The economics of Bt cotton is unfavorable since the seed costs about four times as much as the other successful hybrids in the field (Rs. 1600, compared to Rs. 400). With the first Bt crop, the evidence is clear that pesticide savings do not make up the difference in seed price for the farmer. The small land holdings that are the bulk of cotton fields become even more uneconomic if farmers have to divert 20 per cent of their land as an insect refuge, as recommended by the GEAC. If there is no refuge, the insects will quickly develop resistance and the Bt cotton will fail. A fundamental problem with cotton is the crashing prices. Maharashtra, an important cotton area, has a monopoly pricing system because cotton prices have been plummeting these past few years, the situation exacerbated by the government's ad hoc decision to import cotton, causing cotton prices to crash further. So what real life problem facing farmers will Bt cotton solve?

GM mustard is a variety using the barnase –barstar-bar gene complex, an unstable gene construct with possible undesirable effects, to achieve male sterile lines that are used to make hybrid mustard varieties. In India we have good non-GM alternatives for making male sterile lines for hybrid production so the Proagro variety is of little use. Being a food crop, GM mustard will have to be examined very carefully. Even if there were to be benefits, they have to be weighed against the risks posed to human health and the environment. *Sarson ka saag* is a popular vegetable, mustard oil widely used in cooking is extracted by manual crushing which can leave organic (and genetic) matter in the oil and mustard oil cake is used as animal feed. Apart from this, mustard is a cross-pollinating crop and pollen with their foreign genes is bound to reach non-GM mustard and wild relatives. We do not know what impact this will have.

The most worrisome aspect about deciding whether GM crops are good or bad is the complete lack of information about how decisions are being made. Both GM crops belong to MNCs and given their track record, there is apprehension that influence is being 'bought' in scientific and regulatory agencies for favorable verdicts. The GEAC is a secretive insider club taking ad hoc decisions, resolutely refusing to acknowledge the public's right to know. In such a climate, GM crops cannot be good for India.

### **Roundup Ready (Herbicide Tolerant) Maize should not come to India**

Notwithstanding the resounding failure of its Bt cotton, Monsanto has begun the process for introducing another genetically modified crop into India, its proprietary maize variety called Roundup Ready corn. The government's Review Committee on Genetic Manipulation (RCGM) has given permission for Monsanto to bring in breeding material and start its work.

Roundup Ready corn is a herbicide tolerant maize variety which offers no advantages to the Indian farmer with respect to yield, no protection against disease, no ability to tolerate saline soils, no drought tolerance and no improvement in the quality of the grain, to mention a few of the reasons why new varieties are introduced. Monsanto's herbicide tolerant maize is a variety which contains genes that will allow it to tolerate the poisons contained in the herbicide Roundup, which when sprayed, will kill all the other plants, which become weeds in the field. So after spraying Roundup in the field, the Roundup Ready variety will be the only vegetation left standing, everything else will die.

Roundup is an herbicide (a chemical used to kill weeds) which also belongs to Monsanto which until very recently held the patent on it. This means that the farmer has to buy the package, the Roundup Ready variety and its matched herbicide, Roundup, since one is dependent on the other. Herbicide tolerance is a clever strategy developed for the company, not the farmer. It allows Monsanto to make a double killing, first on the seed and then on the herbicide. Monsanto has succeeded in promoting its herbicide tolerant crops to the extent that globally, herbicide tolerance is the single most prevalent trait in the cultivation of GM crops, the other being insect resistance, that is Bt. In 2002, of the total acreage of GM crops, over 80 per cent was devoted to herbicide tolerant crops and the remaining to Bt crops.

Herbicide tolerance was developed as a trait in crops to address the problems of agriculture in industrial countries where landholdings run into a few thousand acres and where practically no labour is available for farm operations. With just two to five per cent of the population in farming, agriculture is largely mechanized. Weed control therefore cannot be done by hand. The preferred way of controlling weeds in these countries is by aerial spraying which is a wasteful and ecologically destructive method.

In developing countries, agricultural holdings are small and densely packed. Fields growing different crops neighbor one another and agricultural fields are set within or border natural ecosystems with natural biodiversity. So, if fields of other crops and even borders of natural vegetation or the forest edge flanked a field growing Monsanto's Roundup Ready maize, then spraying the Roundup herbicide would affect the neighboring crops and natural vegetation (which do not have Monsanto's Roundup resistant gene) and kill them. Surely this leap in GM technology cannot be considered desirable either from the point of view of farmers or the biodiversity.

Herbicide tolerance as a trait should actually not be allowed in India or other developing countries for important economic and health reasons. In these countries weeding is a source of many benefits to the rural community. A weed is only a plant that is growing at the wrong place at that time. It is not a useless plant. Weeding provides wage labor to agricultural labor, which is usually the land-less farmer. In addition, women mostly do the weeding, providing them with a direct, and often only, income source. Using the Roundup Ready approach will kill this source of income. So in India, rather than the chemical route of

herbicide tolerant plants and the double deal for the company with the proprietary herbicide, the socio-economic interest of the community lies in manual weeding.

Even more importantly, the rural household consumes all the plants that are collected as weeds. Many of these are leafy greens like amaranth (the same plant which is contributing the protein gene for the efforts to make a protein rich GM potato), a rich source of vitamins and minerals. This highly nutritious source of food is available for free and goes into the cooking pot of poor rural families, one of the reasons why rural nutrition is far better than urban nutrition. What the family does not consume serves as fodder for the livestock maintained by the family as an additional source of income.

The last thing that rural India needs is Monsanto's herbicide tolerant maize or any other herbicide tolerant crop for that matter. If GM technology is to be used in India, it should be directed at the real needs of Indian farmers, on crops like legumes, oilseeds and fodder and traits like drought tolerance and salinity tolerance.

### **The myth of GM Potato**

The Secretary, Department of Biotechnology has been making statements that a GM potato variety would be available in India within six months. Curiously, the Genetic Engineering Approval committee (GEAC) has not even received an application to consider approval for the GM potato in question.

First, the GM potato is quite far away from commercial release. Its promoters appear to be jumping the gun deliberately, in order to pressure the agencies for its release on a human suffering angle. The emotional button for Bt cotton was the farmer suicides in Andhra Pradesh and the need to give them a cotton variety that would slash the heavy expenditure on pesticides and by inference, stop them killing themselves due to debt burdens. We know now that the Bt cotton practically failed in almost all locations it was grown. The emotional button being pressed for GM potato is malnourished children susceptible to blindness and how this potato will solve all of that and bring smiles to their well fed little faces. What is not explained is how the potato supposedly with enriched protein will cure night blindness, which is brought about by vitamin A deficiency. Curing night blindness has been entrusted to Golden Rice whenever it sees the light of day, not potato.

In fact the premature announcement made a specific reference to the fact that as soon as the potato was cleared, it would be given free to millions of schoolchildren across the country. This is even more worrisome than the fact that at the moment the GM potato is only an experiment, not a product. If the GM potato is improved to the extent that the protein content rises significantly, and it is judged to be safe, we could discuss its merits then. At the moment it will do nothing for schoolchildren except expose them to an untested food, which could have harmful effects. Potatoes belong to the botanical family *Solanacea*, the same family as the poisonous nightshade, a family known to have many plant toxins.

This talk of feeding GM potatoes to schoolchildren is unacceptable adventurism. If there is such an urgent need to save these children, food supplements can be added to their school meals. This will be a safer and more certain path to nutritional enhancement than rushing untested GM potatoes to them. Nutritional enhancement by food supplements is easy to do in schools and has an established tradition. It is difficult to make the case for GM potatoes as a preferred route for enhanced dietary protein, compared for example to pulses or soya blended wheat flour.

As it stands today, even the science done on GM potato is inadequate and we are talking about an incompletely tested product. One thing is clear to everyone that the increase in protein in the GM potato is negligible and will make no real difference nutritionally. Scientists working at the Central Potato Research Institute have emphasized this. What has not been brought out is the fact that this GM potato might not

even pan out, not in 2005, not ever. We do not know yet because the appropriate experiments have not been done to test whether this transgenic potato is stable or not.

All the experiments on the GM potato so far have been done only on the vegetative cycle, which means we do not know how the variety behaves when it is sexually reproduced (flowering and setting seed). At present we cannot say anything about the stability of the transgenic potato in the long run since studies on gene insertion have been done only in one vegetative generation, not in several sexual generations, as it should be.

Potato is mostly vegetatively propagated in India, which means potatoes are cut up into pieces and serve as 'seed' for sowing the next crop. The little pieces grow into bigger potatoes and when they are large enough, the crop is harvested and so it goes from crop to crop. During the potato cultivation process in the plains, no flowering takes place, no seed is set and there is no "next generation" as is, for example, the case with wheat and rice.

Before any judgment can be passed on the value of the GM potato, studies need to be conducted to evaluate the stability of the gene from one generation to the next generation, to ensure that the amaranth protein gene is actually integrated into the genetic material of the potato. If this is not the case and if the gene is only temporarily lodged somewhere, the protein expression in the potato will be unstable; it may vary in amounts from potato to potato and from crop cycle to crop cycle. It may even disappear altogether. Such an unstable variety cannot be given to farmers.

### **Does Bt Basmati make sense?**

Basmati Rice and Darjeeling tea are perhaps India's most easily identifiable premium products in the area of food. Basmati is highly prized rice, its markets are growing and it is a high end, expensive product in the international market. Like Champagne wine and truffles from France, international consumers treat it as a special, luxury food. So does it make any sense at all to breed a genetically modified (GM) Basmati, that too a Bt Basmati, along the lines of Bt Cotton? The Basmati traders would appear to have far more sense than the government of India and its scientific establishment in this respect. RS Sheshadri of United Riceland, the largest Basmati exporter to Europe, has said in the Economic Times that "Anything connected with GM is the kiss of death for Basmati."

Given the fact that there is fearsome resistance to GM foods in Europe and in other pockets of the world, is it an intelligent act to 'taint' your Basmati with the GM label, that too the Bt label? The Bt gene belongs to Monsanto, the company that is the most visible target of the anti-GM lobby and for the GM protestors on the streets, symbolic of all that is wrong with GM crops. Monsanto's Bt approach is not only collapsing in parts of the world, it has also been criticized as unsustainable. And the Indian scientific establishment wants to deliver its much sought after Basmati as a target of protest and rejection, to the anti-GM group that is increasingly determining consumer preference in the European and other selected markets!

Basmati rice is an up market product; eaten largely by that section that is willing and able to spend money on expensive foods. It is precisely this section, which is usually better educated, has surplus money and no food security concerns, that is quite strongly opposed to GM crops. It is this section that is both promoting and consuming organic and natural foods by preference. Not surprisingly, the demand for brown, unpolished Basmati is growing in this elite consumer section of Europe.

So whom is the Bt Basmati targeted at? Who are supposed to be the consumers of this premium rice with the "kiss of death" GM tag? If the argument is that GM is not an issue in the Middle East, the other large market for Basmati, and here Bt rice would be acceptable, then that is an untenable argument. Once India is producing GM basmati rice, the concern in the European market will quite legitimately be whether any

'non-GM basmati' designated for them and that they are buying isn't contaminated by GM basmati? This leads us to the question of labeling and identity preservation of GM and non-GM crops.

Segregation of GM and non-GM basmati (or for that matter any crop) is going to be next to impossible to maintain under Indian agricultural conditions and this will entail large costs. Even if this were to be done, at the first hint of GM and non-GM mixing, which is bound to happen, consignments to Europe and other GM sensitized markets will be rejected and India will lose the assured market she today has for Basmati. Has anyone thought any of this through? Have all those votaries of introducing disease resistance through the patented Bt route (now seen collapsing around our ears in the failure of India's first GM/Bt cotton harvest) thought of what will happen to farmers who grow Basmati and who command assured prices, when their harvests find no buyers?

This idea of Bt Basmati is every bit as crazy as the idea to introduce the Golden Rice technology into Basmati rice. Work on Golden Rice is being done with the goal of increasing the nutritional status of the poor, rice dependent populations of the world who usually have nothing more than plain rice as their only food. Since rice is nutritionally a poor cereal, it is thought that adding iron and vitamin A to it by genetic modification would increase the nutritional quality of rice.

The Golden Rice project may or may not materialize ultimately but to think that people who buy basmati at Rs 40 a kg are likely to be in need of nutritional fortification is about as absurd a theory as any. Are these the people threatened by night blindness that golden basmati rice is supposed to be helping? Should the diminishing agricultural research budget of India be frittered away on nonsensical notions of the golden basmati rice kind? Or should it be targeted at solving problems that real farmers have in real fields?

When will our science planners get it? Basmati rice is an expensive, premium product, which is doing well enough on its own without the scientific establishment trying to queer the pitch every step of the way. Every grain of Basmati rice is likely to find a market today. It will not if we ruin the legend and perception of Basmati in the international market. Can anyone think of GM truffles? Premium wine makers have outright rejected the notion of GM doctored wines that were designed to cut out the hangover and were supposed to be 'healthier'. Premium products like special wines, truffles and Basmati rice need to be handled in a special, premium way. The aura of specialty has to be maintained in order to keep the consumer captivated, and the market vibrant and growing! The approach of Bt Basmati rice and Golden Basmati Rice are about as wrong as you can get to achieve these goals.

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<sup>i</sup> Sahai, S.,(2003), Financing Agriculture, Vol. 35, No.4, pp7-11