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The Peak Oil Crisis

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From the Editor

The GM Goliath that refuses to fall

Monsanto should have toppled, Goliath-like, years ago, if not for the support of the US and other governments and inter-government agencies; and at least some of that support has been obtained through illegal means. Monsanto was caught spending more than $700,000 on bribes in Indonesia in an unsuccessful bid to bypass control of its GM cotton crops in that country, and duly fined $1.5 million in the US court.

Monsanto remains by far the world's leading producer of GM seeds, which filled 90% of GM hectares worldwide in 2003. But the company has been hard hit by market rejection of GM produce. Innovest Strategic Value Advisors, a financial services firm based in New York, London, Paris and Toronto, has consistently given Monsanto the lowest investment rating for several years now. It says Monsanto is overvalued in the short-term, and its long-term value is at risk. Outside of US, Canada and a few other developed countries, Monsanto has received little revenue from its GM crops.

Although 95% of the soya planted in Argentina is Roundup Ready, Monsanto was forced to shut down its operations there in 2004 because of the lack of revenue. A string of GM products have ceased to be marketed or developed for the same reason: GM wheat, tomatoes, flax seed, rice and sugar beet. Its GM potatoes were withdrawn in 2001 after companies including McDonald's, Burger King, McCain's and Pringles refused to buy them.

North American farmers' concerns over the marketability of GM wheat caused Monsanto to abandon that product in 2004. And worry over contamination liability led Monsanto to give up its pharm-crop R&D in 2003.

Meanwhile, over 58 countries have enacted or announced biosafety laws to restrict import and commercialization of GM products and/or require labelling of food containing GM ingredients. More than 100 regions and 3 500 sub-regions in Europe, the most important market, have declared themselves GMO-free; and are demanding new European laws to protect them from GM contamination.

Last year, the United Nations Food and Agriculture Organization (FAO) published its report, *Agricultural biotechnology: meeting the needs of the poor?* stating that GMOs could be the key to solving world hunger, and pushing for more funding. It was roundly condemned in an open letter signed by 650 civil society organizations worldwide. The letter demanded instead, structural changes in access to land, food and political power, to be combined with support for sustainable technologies in farmer-led research.

Increasing market rejection of GM foods has spread within the US. Several polls have shown that a significant percentage of people - up to 58% - would not eat GM food if it were labelled as such. In the past year, 79 towns in Vermont passed resolutions against GMOs while the State government passed a seed-labelling bill, the first of its kind in the US. In California, Mendocino County passed the first law in the US to ban GMO releases into the environment; and other counties have followed suit.

But beware. Monsanto has just bought Seminis, a fruit and vegetable seed company for $1.4bn, and said it would look into the possibility of genetically modifying the produce. Prof. Joe Cummins warns that Seminis was a major player in transgenic plant virus control. It made transgenic papaya resistant to the papaya ring spot virus, which has been released and marketed in the US and a few other countries. Monsanto had failed to get involved in transgenic virus control, so acquiring Seminis will considerably strengthen its stranglehold on transgenic seeds.

Seminis was a co-patent holder of the papaya ring spot virus transgenes, and has patents for virus control genes in a wide array of vegetable and fruit crops. It also holds a patent on broccoli with anti-sense genes that make broccoli last a long time in the produce stand. "The combined Monsanto-Seminis Corporate Empire may inaugurate a new era of garden spies who rat out their neighbours for saving seeds." Joe says.

All the more reason to reject GM crops now; it is a massive diversion from really feeding the world, especially under global warming.

Before the food bubble bursts

New research just published in the journal *Nature* shows that carbon dioxide and other greenhouse gas emissions could have a more dramatic effect on climate than previously thought, and that average temperature could go up by 11C. But the journal does not tell us that the most immediate catastrophe we face under climate change may be the collapse of food production. Lester Brown of The Earth Policy Institute warns in his new book, that the 'food bubble' is about to burst, unless the urgent problems of water shortage, overpopulation and rising temperatures are tackled right away in "Plan B".

Plan B involves shifting from a carbon-based energy economy to a hydrogen-based one to stabilize climate change; developing wind-generated energy, solar cells, fuel cells and hydrogen generators. It means phasing out motorcars in favour of bicycles, replacing coal-fired power plants by gas-fired plants and wind farms.

Plan B means stabilizing world population at around 7.5 billion; increasing the productivity of water in agriculture, halting soil erosion by replanting trees, adopting minimum-till, no-till and other soil-conservation practices.

Finally, it means restructuring the entire economy by creating an "honest market" that "tells the ecological truth", that includes the indirect costs on the environment.

Another major reason food production is under threat is that fossil fuel, on which industrial monoculture is highly dependent, is fast diminishing.

At the beginning of 2004, Royal Dutch Shell wrote down a quarter of its oil and gas reserves, amounting to some 4.5 billion barrels. It was the latest and most spectacular in a series of write-downs by oil companies. Crude oil price rose above US$50 per barrel in October 2004.

Oil production may be reaching its peak- the crunch point - when roughly half of all the world's reserves have been extracted, and production would decline, driving up the price of oil and eventually failing to meet demand.

It takes roughly 10 calories of energy to produce 1 calorie of food from field to plate, and industrial monocultures need 6 to 10 times more energy than sustainable farming methods. There are thus enormous potential energy savings in shifting to truly sustainable agriculture systems that include minimizing long distance transport, processing and packaging. These energy savings bring a host of other advantages, such as restoring autonomy to small family farmers, social and financial wealth to local rural communities, alleviating poverty, conserving biodiversity and maintaining and revitalizing indigenous cultures.

A mechanism for mobile phone effect at last?

Prof. William Stewart must be tearing his hair out having to repeat his advice that children should not use mobile phones as a Europe-wide study costing more than 3 million euros over 4 years has once again eschewed any suggestion that mobile phones are health risks. In fact, the study was designed to *preclude* implications on health risks, as it involved only *in vitro* investigations on cells and molecules that, the final report on the study said, cannot be extrapolated to whole organisms. And although the study confirmed many biological effects of EMFs far below the current exposure limits deemed to be safe, such as DNA breakages and chromosomal aberrations; it failed, once again, to identify the mechanisms responsible.

There may well have been a minor breakthrough to understanding the mechanism as other scientists found a remarkable tendency of the mobile phone to turn a particular enzyme solution into a gel. And it may have something to do with the collective structure of water. Magical water!

Which stem cells?

Adult stem cells isolated from the patients' bone marrow or blood have proven successful in mending the heart after a heart attack. But new results also suggest they may help patients with chronic heart damage from Chagas' disease; and stem cells harvested from cord blood of the newborn may mend spinal injury.

Meanwhile, insurmountable technical and financial hurdles have piled up on the ethical and safety concerns over the use of embryonic stem cells. Isn't it time to call a halt to 'therapeutic' human cloning and embryonic stem cell research? What purpose does it serve other than indulge the whims of scientists who cannot think of doing anything else?

Mind & body control nano-implants coming

Brain and neuro-implants that can help control pain and restore paralysed people's ability to control their lives and to communicate seem like an unadulterated good. But could this also be the beginning of mind control through virtual reality and Brave New World surveillance through implanted identity tags?

Brain-computer interface is an exciting new area that offers great promises and perils in equal measure. The time to debate this is now.

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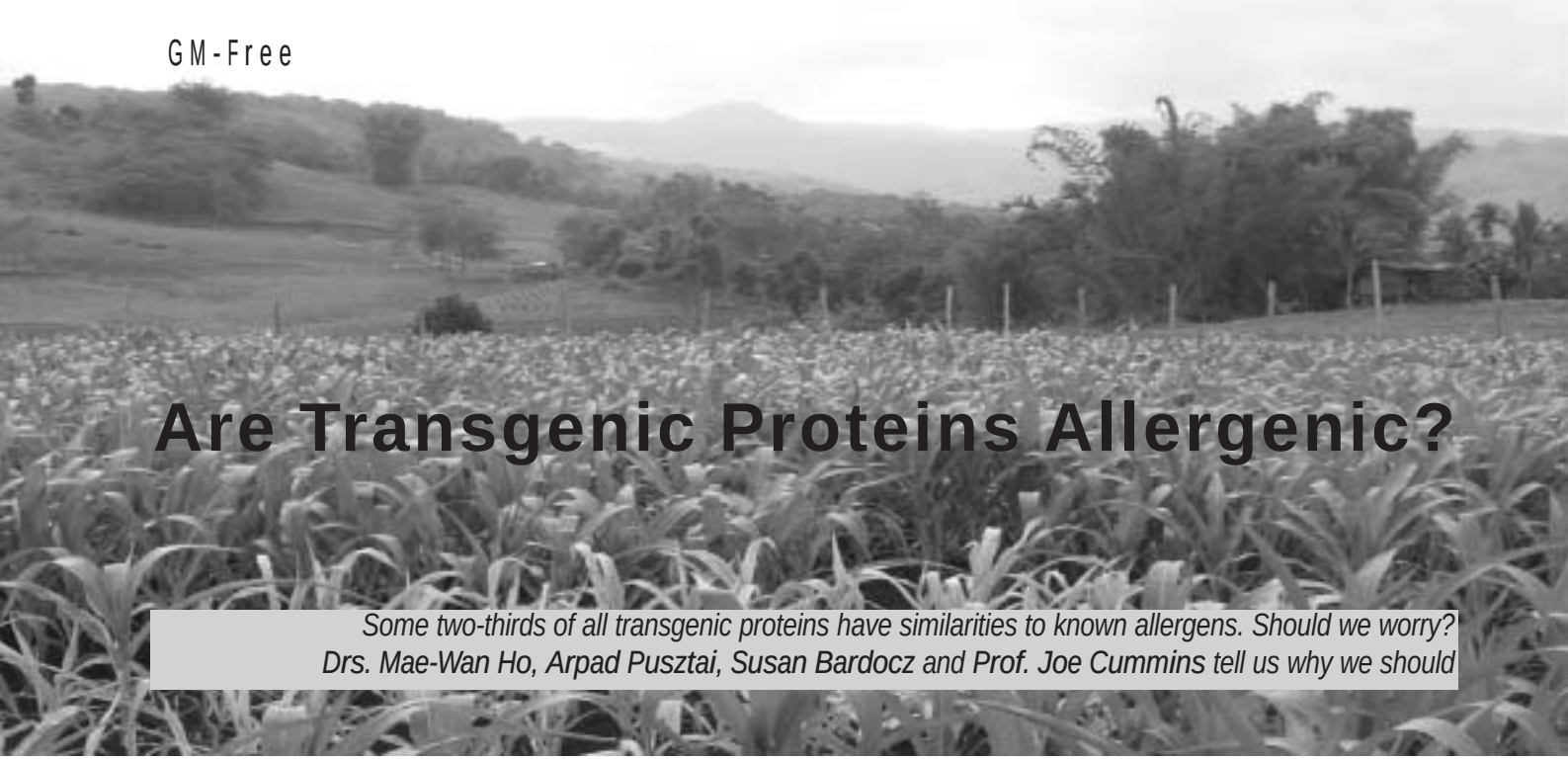
http://www.i-sis.org.uk/isisnews.php



Are Transgenic Proteins Allergenic?

Some two-thirds of all transgenic proteins have similarities to known allergens. Should we worry?
Drs. Mae-Wan Ho, Arpad Pusztai, Susan Bardocz and Prof. Joe Cummins tell us why we should

Similarities to known allergens

A report published in 2002 should raise concerns over the safety of the foreign proteins incorporated into GM crops that are commercially approved.

Researchers at the Institute of Food Safety in Wageningen, The Netherlands, screened transgenic proteins in GM food crops for the presence of short amino acid sequences identical to those in known allergens, and to find out if they are involved in binding IgE, the class of antibodies produced in allergic reactions.

They screened 33 transgenic proteins for continuous runs of at least 6 amino acids identical to known allergenic proteins. Twenty-two of the transgenic proteins showed positive results in runs of 6 or 7 amino acids; these include all the Bt toxins (Cry proteins), the CP4 EPSPS and GOX conferring glyphosate tolerance, the coat protein of the papaya ringspot virus, and even marker proteins such as GUS.

But *on account of the limited data available*, only a small number could be identified as linear epitopes (sites) that might bind to IgE antibodies. Although most identical stretches may be "false positives", the researchers said the results "warrant further clinical testing for potential allergenicity".

How reliable are current tests for potential allergenicity?

Potential allergenicity is one major aspect of safety assessment of GM crops. As many new proteins are introduced into GM food crops, it is important to find reliable methods of assessing their potential to cause allergic reactions, when eaten as food, through contact, or by inhaling (as pollen, for example).

One of the first steps in assessing if a protein is potentially allergenic is to compare its amino acid sequence with those of known allergenic proteins stored in computer databases, using available computer algorithms.

When such comparisons are made, identities of continuous runs of 8 or more amino acids are considered "immunologically relevant". But shorter stretches can also be relevant according to existing findings; for example, small sequences of four and six amino acids can be recognized and bound by IgE antibodies from allergic patients.

Apart from these continuous or linear epitopes, discontinuous epitopes may also be present, consisting of amino acids in different parts of the polypeptide chain that end up next to one-another when the polypeptide chain is folded up in its three-dimensional conformation. Thus, overall amino-acid similarity with an allergenic protein, i.e., 35% identity within a run of 80 amino acids, might be suspect. At the moment, it is difficult to predict which amino acids may form discontinuous epitopes, as we need to know the three-dimensional structure of the protein.

In addition to the linear and conformational peptide epitopes, glycans (carbohydrate chains linked to the protein) have also been shown to be major IgE binding sites in allergenic glycoproteins.

In a follow-up study published September 2004, a new webtool was used to predict potential allergenicity of proteins and peptides according to the current recommendations of the FAO/WHO Expert Consultation, as outlined in the Codex Alimentarius. The Codex Alimentarius Commission was created by the United Nations FAO (Food and Agriculture Organization) and WHO (World Health Organization) to set international food standards.

The amino acid sequence of a protein is compared with all known allergenic proteins retrieved from the protein databases to identify stretches of 80 amino acids with more than 35% similarity, or small identical runs of at least 6 amino acids.

The ability of the procedure to predict allergens is evaluated by screening sets of known allergens and non-allergens. Apart from making correct predictions, both methods generated "false positive" and "false negative" hits. The number of false negatives decreases when a larger database of allergen sequences is used, whereas the number of false positives grows with the size of the database.

"False negatives", "false positives" and the need for precaution

The researchers point out that the number of false positives may be overestimated, because some of the 'non-allergens' used are related to and display similarities with their allergenic counterparts.

But that's precisely why we need to take any positive hits seriously. In fact, at least 5 of the 12 protein sequences used as 'non-allergens' were reported to react with other classes of antibodies, IgG and IgM, and are hence immunogenic, if not allergenic.

Another caveat, pointed out by the researchers, is that a protein belonging to a completely new group of allergens is likely to generate false negative results. This would apply to the majority of transgenic proteins that have never been part of our food chain.

As advised in the earlier publication, and also by the FAO/WHO, the outcomes should therefore be combined with other methods of assessing allergenicity, such as digestibility and binding of antisera from allergic patients, and possibly animal exposure tests. But that too, leaves a lot to be desired.

It is very difficult to assess the allergenicity of GM foods when the gene transferred into the plant is from an organism whose allergenic potential is unknown. Moreover, it is also possible that as a result of the gene transfer or insertion of the transgenic DNA, a new allergen is developed, or the expression of a minor allergen is elevated in the GM crop. The gene product can also have an allergenic adjuvant (helper) effect on a food component previously of low allergenic potential; or conversely, some component in the GM food may have an adjuvant effect on the allergenicity of the transgene product.

Unfortunately, while there are good animal models for nutritional/toxicological testing, no satisfactory animal models have so far been developed to test for allergenicity. For the time being, only indirect methods are available for assessing the allergenic potential of GM foods derived from sources of unknown allergenicity. The screening tests described above are a useful preliminary step.

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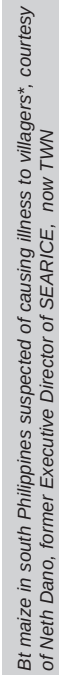

Bt maize in south Philippines suspected of causing illness to villagers, courtesy of Neth Dano, former Executive Director of SEARICE, now TWN*

Beware Monsanto's "Vistive Soybeans"

***Prof. Joe Cummins** lifts the lid on a new wave of genetically engineered products that claim to offer "healthier foods" and "direct consumer benefits"*

Monsanto announced a "Vistive soybean" with reduced linolenic (low linolenic or LL) acid content that will be available for planting in the 2005 season. Although promoted as "produced through conventional breeding" because it includes natural genes reducing the oil content of linolenic acid, Vistive also has transgenes conferring the Roundup Ready trait.

Vistive soybean does not appear to have been approved under the usual procedure for transgenic crops because the reduced linolenic acid content was achieved using traditional selection and breeding. Instead, government regulators have assumed that the Roundup Ready trait acts independently of the LL trait and for that reason the two kinds of traits could be joined by crossing two strains.

Certainly, there is no precedent for reviewing and approving novel crops produced by conventional breeding, but if the LL trait interacts with the Roundup Ready (glyphosate tolerance) trait, Vistive soybeans should be re-evaluated as an alteration to the original Roundup Ready trait. There is a clear indication that the use of glyphosate on the soybean crop will result in an impact on fatty acid metabolism through the breakdown products of the herbicide (see later).

Vistive soybeans with the Roundup Ready trait are claimed to contain less than 3% linolenic oil, in contrast to the 8% linolenic content for conventional soy oil. Low linolenic oil is more stable, with a better flavour and requires less hydrogenation. Trans fatty acids are produced in the hydrogenation process; and trans fatty acids are linked to heart disease because they lower HDL (good) cholesterol while raising LDL (bad) cholesterol. Ironically, trans-fats labelling is to begin in 2006 in the United States, even though industry and regulators there resist labelling of products containing transgenes.

In plants, fatty acids are produced in the chloroplasts. Two molecules are crucial for fatty acid synthesis: acetyl-CoA and malonyl-CoA (acetyl-CoA with an added carbon dioxide molecule). The number of carbon atoms in the long fatty acid chain is always even, and the carbon molecules are added two at a time. The newly synthesized fatty acids may be altered in mitochondria, or the endoplasmic reticulum, or stored in membrane bound lipid vesicles.

Catabolism of the fats occurs in organelles called glyoxysomes where the fatty acids are degraded two carbon atoms at a time, by a process called beta-oxidation. Fatty acids are modified in organelles and the endoplasmic reticulum by the lipoxygenase pathway to produce plant defence and signalling compounds such as jasmonates. Glyoxysomes carry out the glyoxylate cycle - a modification of the tricarboxylic acid cycle found in plants and microbes - as well as beta-oxidation. Fatty acid metabolism is crucial to energy transformation in plants, but also contributes to cell structure and to signalling and defence.

The transgenic parent of Vistive soybean is the soybean line GTS40-3-2 (event MON-04032-6), tolerant to glyphosate. The strain was released commercially in the United States in 1994, then Canada (1995), Japan (1996), Argentina (1996), Uruguay (1997), Mexico (1998), Brazil (1998) and South Africa (2001). The transgenic construct includes a synthetic approximation of the EPSPS gene from *Agrobacterium* for tolerance to glyphosate, adjusted for the codon preference of the crop. The EPSPS gene was driven by the enhanced 35s cauliflower mosaic virus promoter, and the sequence included a chloroplast transit protein from petunia and a nopaline synthesis terminator from *Agrobacterium*.

Six years after Roundup Ready soy was released to the environment, Monsanto acknowledged that an "inactive" 75 base pair fragment and a 250 base pair fragment of the EPSPS gene were inserted outside the open reading frame of the EPSPS protein (those inserts were over 20% the size of the EPSPS gene). The origin of the gene fragments and their possible activity were curtly dismissed without fuller explanation. The evident instability of these and other crop transgenes has been discussed by Mae-Wan Ho, and raises many biosafety concerns (see many articles on ISIS' website).

Possible interactions between the LL and Roundup Ready genes of Vistive soy cannot be dismissed, as the crop will certainly be sprayed with glyphosate. The herbicide will accumulate to levels toxic to animals and humans if it is not broken down in the plant cell. In plants, glyphosate is normally broken down by glyphosate oxidase (GOX) enzyme (presumably an enzyme present to digest natural products). GOX enzyme accelerates the breakdown of the herbicide glyphosate into two compounds, aminomethylphosphonic acid (AMPA) and glyoxylate. Glyoxylate is commonly found in plant cells and is further broken down by the glyoxylic pathway for lipid metabolism. The increased concentration of glyoxylate due to glyphosate breakdown would certainly disturb the metabolism of fatty acids.

Every transgenic crop should be reassessed after it has been crossed with a variety derived from conventional selection, especially one that has a clear metabolic association with the transgene

Glyphosate exposure of herbicide tolerant groundnut was observed to increase glyoxylase enzyme. Presently, it is not possible to predict the nature and extent of disturbance of fatty acid metabolism, or the impact on LL function. The point is that there is a clear link between Roundup Ready and LL traits, which should be explored fully before the Vistive crop reaches general distribution. Every transgenic crop should be reassessed after it has been crossed with a variety derived from conventional selection, especially one that has a clear metabolic association with the transgene, before any release of the crop. There should be a rule to ensure that careful reassessment is done.

The burden of proving that releases such as Vistive are safe rests with the proponent. Experiments must be done to ensure that the Roundup Ready genes and the LL genes are independent of each other, and that any interactions are fully risk assessed. In addition, Roundup Ready soybean itself should be reassessed in light of new scientific evidence raising questions about transgenic instability. SiS

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If the result is positive, then *in vitro* tests for IgE reaction need to be performed, especially as most epitopes are discontinuous. The absence of a positive *in vitro* reaction does not guarantee that the transgenic protein is not an allergen. In a decision-tree type of indirect approach, the next step is to consider the molecular size, glycosylation, stability, solubility and isoelectric point of the transgenic protein compared with known allergens. Unfortunately, in most studies to-date, the all-important ability of the transgenic protein to resist breakdown in the gut is investigated in an *in vitro* simulated gastric/intestinal system; and this is fundamentally flawed. The results are therefore at best misleading and at worst erroneous. Reliance on the concept that most allergens are abundant proteins is probably also misleading because for example, Gadc1, the major allergen in codfish, is not a predominant protein.

In the absence of new and reliable methods for allergenicity testing, particularly the lack of good animal models, it is at present almost impossible to definitely establish whether a new GM crop is allergenic or not in advance of its release into the human/animal food/feed chain.

In our view, with foods consumed by millions, any positive results should be assumed to be significant until fuller testing can definitively rule it out as a false positive. In North America and elsewhere, GM foods are not labelled and this may have led to the spread of allergens not identified as having originating with the GM foods when that may in fact be the case. SiS