long, but not very long, profile of a maximum distance of 100 km to map depth extension and geometry of a series of contact zones. Such a strategy will address both societal and geodynamic problems (including additional inputs) to understand the structure and evolution of an important segment of East Gondwana super-continent – a LEGENDS (Lithospheric Evolution of Gondwana East from Inter-disciplinary Deep Surveys) initiative.

The suggested locales for seismic reflection study and ways of handling the data illustrated in Figure 1 are:

(1) A linear profile across the eastern flank of Cuddapah basin and extending eastwards covering the seismically-active Ongole (AP) belt.
(2) A linear profile from east of Closepet Granite across Chitradurga–Shimoga schist belt.
– For both these profiles reasonably good refraction coverage is available.

(a) 50 km × 50 km grid covering Gurur (Karnataka) and adjoining areas of WDC, as the zone has got thickest crust[4].
(b) 50 km × 50 km grid at the eastern, middle and western segments of Moyar–Bhavani, including the junction where the two shear zones meet and deviate in different directions.
(c) 50 km × 50 km grid or three linear profiles across different segments of Achankovil shear zone.
– For a, b, c velocity information could be taken from both tomographic and adjacent refraction studies.

As NGRI has expertise, experience and infrastructural facilities to conduct seismic reflection studies and as the Department of Science and Technology supports such studies under its deep continental and earthquake hazard studies programmes, this can be effectively launched at the earliest.

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P. R. REDDY

National Geophysical Research Institute, Hyderabad 500 007, India
e-mail: paravata@yahoo.com

The *Bt* cotton story: The ethics of science and its reportage

The paper published recently in *Science* by Qaim and Zilberman[1], purporting to show a dramatic increase in the performance of *Bt* cotton in India has attracted a lot of attention. At the same time, the paper raises serious questions about ethics in the application of science and the societal context of such applications and reportage.

Qaim and Zilberman draw rather sweeping conclusions about the 'Yield Effects of Genetically Modified Crops in Developing Countries' based on meagre and selective data from one single genetically modified crop, cotton, derived from just one country, India. The title is misleading, claiming far more than the scope of the study permits.

On the basis of a single set of trial data of *Bt* cotton from one season in India, the authors project high yields for all GM crops in all developing countries. They base this rather unorthodox prediction, not on any peer-reviewed evidence but on 'crop protection theory'. This amounts to speculative and poor science. Crop yields are known to be multifactorial and have differing dynamics in different countries, based on a number of local factors, which have to be studied for a correct estimation.

The paper of Qaim and Zilberman reports unprecedented yield increase (up to 87%) which strains credibility. Such spectacular performance has not been reported from anywhere else in the world where *Bt* cotton is cultivated. *Bt* cotton does show an advantage in the US and China, but these are in the range of a 10–15% increase in yields reportedly because of better protection against cotton pests found in the region.

Bt cotton, the first GM crop to be grown in India was given approval for commercial cultivation in March 2002, so this is the first GM crop harvested in the country. The sensational data presented in this paper are, however, not based on this harvest, as would be the case in a proper scientific investigation. The data in this paper are derived only from selected field trials plots of Mahyco–Monsanto. No data from farmers' fields or from the All India Coordinated Varietal trials conducted by ICAR (Indian Council of Agricultural Research) have been included in the study. What is really disturbing is that this paper extolling the outstanding performance of *Bt* cotton is based exclusively on data supplied by the company that owns the *Bt* cotton variety in question: Monsanto.

Qaim and Zilberman attribute the 87% yield increase they report as being 'entirely' due to crop losses avoided by the presence of *a single copy of the Bt gene*. Yield in plants is known to be polygenic and there is no known evidence for a single gene being largely responsible for yield. Attributing such large effects on yield to just one copy of the *Bt* gene, is untenable and unscientific.

Actually, to get any real idea about the success or failure of *Bt* cotton in the field, one will need to wait and see the results of at least another two harvests. The authors of this sloppy paper have done a great disservice to science by jumping the gun in this fashion and so have the editors of the journal *Science*, by letting this paper through. These sensational data have led to a spate of media reports about the 'superlative'

performance of *Bt* cotton. Such misleading reports can end up influencing policy makers in a direction that could be ultimately detrimental to farmers.

Publishing a paper only using the data provided by the industry whose product is being studied, is clearly unethical. In fact, the vested interest getting its own experimental data reported in this way, is reminiscent of the old days of the tobacco industry when a spate of 'scientific publications' published in prestigious medical journals reiterated over and over again that nicotine was not harmful, that it was not addictive, that it was not connected to cancer, that there was no correlation to cardiovascular disease.... After a point, leading medical journals took a decision to stop corporate interests from promoting their wares through 'scientific papers' in their journals.

Science journals publishing in the field of food and agriculture would do well to follow this example and place strictures on corporates using a peer-reviewed forum for promoting GM crops. Given the aggressive marketing of GM products by the industry, this would be a timely precaution. GM crops are high profit items and their control is in the hands of big business. These are crops facing great opposition in Europe and now increasingly in the US. The moratorium on cultivating GM crops in Europe continues despite the threat of retaliatory action from the US. Add to this scenario the potentially large markets that an agricultural country like India offers. If India accepts and promotes GM technology, other countries in Asia are likely to accept it too. If GM technology could be accepted and implemented in the vast agricultural markets of Asia, it would neutralize quite a large part of the difficulties the GM industry faces in other parts of the world and turn in a handsome profit. Science must not fall victim to these plans and machinations.

Interestingly, even as the scientific community is debating this controversial paper, results of the first commercial crop of *Bt* cotton have come in. The indifferent performance has been reported at length in the media. The *Bt* crop in Maharashtra and Andhra Pradesh appears to have failed. The state government in Andhra Pradesh has admitted, 'Farmers have not experienced very positive and encouraging results'. Farmers, even the keen supporters of GM technology have recorded their dissatisfaction with *Bt* cotton.

Given the contradiction between the exuberant projections of two foreign scientists publishing from an American university and the ground reality of a failed cotton crop in India, one must question the motivation of scientists in writing up such an unsubstantiated report and a reputed science journal in publishing it. One, of course, could be genuinely bad science on the part of the scientists and uncritical editorial work on the part of the editorial team of *Science*. There are, however, lingering suspicions of other motivations, something along the pattern of what happened with the tobacco industry and medical journals.

There is an overall concern about science and scientific research losing its innocence. Now the talk is about patents, market shares, corporate dominance and keeping the competition out. It is less about putting out the best varieties and about growing food to feed the hungry, rather more about producing high tech commodities for the market and about maximizing profit. Scientists and the public need to be alert to these new developments, in what can be properly called the political economy of food and agriculture and the scientific research associated with it. Science journals have been misused before by vested interests to promote their products in the garb of scientific evidence. The vigilance of the scientific community is needed to make sure that this does not happen in the crucial sector of food and agriculture.

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SUMAN SAHAI

Gene Campaign,
J-235/A Sainik Farms, Khanpur,
New Delhi 110 062, India
e-mail: genecamp@vsnl.com

NEWS

GD Birla Award for Partha Majumdar

Partha Pratim Majumdar has been awarded the 12th GD Birla Award for Scientific Research (2002). He is cited for his outstanding contributions toward understanding Human Genetics and Evolutionary Biology.

Majumdar has been successful in developing innovative paradigms and statistical methodologies applicable to mapping and transmission of complex human traits. He is also noted for his comprehensive study of mitochondrial DNA markers present in the linguistic groups in India.

He currently heads the Anthropology and Human Genetics Unit, Indian Statistical Institute, Kolkata. He also serves on the National Bioethics Committee (Govt. of India), and UNESCO's Working Group on Human Genetics.