Peer review contestations in the era of transgenic crops

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Whoever thought that a harmless professional scientific activity such as peer review to maintain high standards in scientific advancement would become a tool for political activism in the 21st century? However, that is precisely what is happening today in the world of modern biotechnology with respect to transgenic crops, or genetically modified (GM) crops in common parlance. Gone are the days when only scientists were interested in the research work of fellow scientists, and one could evaluate it critically to ensure quality in science. Today, different kinds of stakeholders want to have a say on what happens in science, how it is conducted, funded, and even determine what is permissible in science as it is being played out in a fight between scientists and the anti-GM crop activists at a World Bank sponsored International Assessment of Agricultural Science and Technology for Development (IAASTD)[1]. This IAASTD report was officially released on 15 April 2008 in Johannesburg, by emphatically stating that modern biotechnology and GM crops are not essential for the future of agriculture or for ensuring food security in the developing countries. This is because the anti-GM NGOs used a variety of scientific reports and publications that had been ostensibly 'peer' reviewed. This report will have long-lasting negative impact on future funding of agricultural biotechnology in the developing world for decades to come.

With the advent of GM crops in agriculture, there has been a swirling global controversy about their safety, environmental effects, and socio-economic impacts. In fact, the world has never witnessed anything like the GM crops controversy in the modern history of science and technology. This controversy has seriously hurt the implementation of the goods and services of modern biotechnology in agriculture. Most often, controversies are resolved within the scientific community with the help of experimental evidences and empirical data. However, in the case of GM crops, a new global movement has emerged to 'contest' every scientific datum presented in any peer-reviewed scientific journal with regard to their efficacy, safety, environmental impacts, and socio-economic. In the last few years, editorial decisions of leading research journals like *Science*, *Nature*, *Lancet*, *Proceedings National Academy of Sciences USA* (*PNAS*), *British Food Journal* and *Nature Biotechnology* have attracted severe criticisms. In one instance, groups of anti-GM zealots[2] are demanding that the editor of *British Food Journal*, withdraw one of its award-winning papers on *Bt* maize[3]. A critical examination of many of the published papers on GM crops reveals that there is a great deal left to be desired as far as the peer review standards are concerned, and has led to not-so-admirable editorial decisions[4]. The peer-review system which the scientific community is accustomed to may not be perfect. However, there is nothing better than the peer-reviewed system to ensure quality in science. By and large, the system has acquitted itself ably by ensuring generally high quality in science. No one is suggesting scrapping the system, but there is a definite need to examine it from time to time, to make sure that its faults and drawbacks are rectified for the overall good of scientific progress.

The GM crops scientific controversy in India started with a paper in *Science* by Qaim and Zilberman[5], where they carried out a meta-analysis of selective field data and proclaimed that *Bt* cotton increased the yield by 80%. This paper came in for heavy criticism for its outlandish conclusions on selective meagre data[6,7]. Research papers published in *Current Science*[8,9] on the performance of *Bt* cotton in India have attracted considerable controversy. Sahai[10], using the conclusions of Kranthi *et al.*[9], wrote that there is scientific evidence to prove that *Bt* cotton technology is faulty, and will not protect cotton against the dreaded bollworm. At the time, Shantharam and Rao[11] pointed out a set of methodological flaws in the paper by Kranthi, but concluded that the basic conclusions of the paper were sound. The anti-GM lobby in India, based on the paper by Kranthi *et al.*[9] demanded that authorization of *Bt* cotton commercialization be withdrawn. Fortunately, Kranthi[12] wrote a rebuttal to dismiss the charges of the anti-GM activists, and chided them for misusing the findings of his research paper, a rare instance of a scientist setting the situation right. The strange thing is the double standards of the anti-technology lobby that is always eager to use those peer-reviewed publications that support their beliefs, and denigrate the same peer-review system when such publications do not support their contentions. This is what happened in the case of Bambawale *et al.*[8], where clear empirical field data were produced to show the superior performance of *Bt* cotton. However, this paper has been completely ignored by the anti-biotech activists in India, along with another dozen or so credible research publications and reports on the superior performance of *Bt* cotton in India. Their insidious campaign gives rise to confusion in the minds of the public, the media, and even some scientists, and negative fall-outs creating sensational news. Such controversies circulate throughout the world, and influence the regulatory decision and policy development in the field of agricultural biotechnology[1].

Another paper that set the clock back on GM crops was regarding the *Bt* pollen toxicity to monarch butterfly larvae, by Losey *et al.*[13]. There was a worldwide call for the banning of GM crops due to the findings of this paper. It took three years and millions of dollars of research funding by US-EPA and USDA, and the industry to set the record straight by reinvestigating Losey's findings[14–20]. Peer reviewers allowed the publication of the offending paper without properly checking the methodology and the world of science and technology had to pay dearly for it. The monarch butterfly story rears its ugly head from time to time, even to this day.

Another case in point is a recent paper by Rosi-Marshall[21]. This paper claimed that by-products from genetically engineered *Bt* corn might harm aquatic ecosystems. Pollen and other plant parts from genetically engineered *Bt* corn get into streams near cornfields and harm a type of fly eaten by fish and amphibians. The *Bt* corn in question is engineered by the introduction of a gene from the bacterium, *Bacillus thuringiensis* (*Bt*), which produces a toxin that protects the crop from pests, particularly the European corn borer. This study from the Indiana Uni-

versity School of Public and Environmental Affairs, reported that the consumption of *Bt* corn pollen, leaves, and cobs increased mortality and reduced growth in caddis flies, the aquatic insects related to pests targetted by the toxin in *Bt* corn. According to the study, caddis flies are food for fish and amphibians, and healthy caddis fly larvae are an important part of stream ecosystems. The study concludes that the 'risks associated with widespread planting of *Bt* corn were not fully assessed' before release of *Bt* corn. Rosi-Marshall and coworkers measured inputs of *Bt* corn pollen, leaves and cobs in 12 headstream waters using litter traps. They also found pollen in the gut of caddis flies to show that they were feeding on corn pollen. In laboratory trials, they found that caddis flies fed with leaves or pollen from *Bt* corn had growth rates that were less than half those of the control.

The paper has several drawbacks in methodology, and therefore conclusions drawn were not accurate. Having appeared in a prestigious journal, the paper carried a wrong message to farmers and environmentalists. Parrot[22] and Beachy *et al.*[2] wrote to the editors pointing out the serious flaws in the paper. Rosi-Marshall *et al.*[23] responded to their criticisms, and admitted to the many flaws pointed, but still held onto their general conclusions[24]. The matter is far from resolved; nevertheless, the paper grabbed sensational headlines. Even though *PNAS* carried two commentaries by leading scientists regarding this paper in its on-line edition, anti-technology activists generally ignore such critical evaluations that follow the original publication. The other major fallout is that this offending paper influenced the French President Nicholas Sarkozy to ban further field-testing of GM crops in France, much to the chagrin of the scientific committee appointed to review the paper, and provide advice. The French authorities also ignored a European Food Safety Authority's decision of 18 December 2007 on the paper by Rosi-Marshall *et al.*, which states that conclusions of the paper are not supported by data[24]. In India, the anti-GM lobby is using poor-quality scientific papers, including the above, their own reports and opinions to fight its case against GM crops in the Supreme Court. Activists in Tamil Nadu are using such strategies to advise political parties to seek statewide ban on GM crops. Recently, a group called 'GMO-Free India' resolved to make this an issue in the next general election. This kind of egregious overreach by the activists will hamper the progress of science and technology, and governmental policies in the country.

Scientific literature on GM crops has created a new field of 'contested knowledge'. Global anti-GM movement has become strident in attacking the scientific establishment for research papers that cast GM crops in positive light. Some in the scientific establishment have also challenged the editorial wisdom of journals in publishing controversial papers. The scientific community rarely responds to all this. There is the first, well-known instance of flawed science in which a famous nutritional scientist; Arpad Pusztai, lost his job at the Rowett Institute due to his premature release of flawed research data on the toxicity of GM potatoes[25,26]. Ignacio Chapela, University of California, Berkeley was denied tenure for publishing a faulty paper on *Bt* maize[27,28], which was subsequently withdrawn by the editors due to worldwide condemnation. This paper was clearly faulty as it contained many artefacts. Chapela was eventually granted the tenure under intense global pressure from the activists. These instances have eroded the sanctity of the peer-review process, and have dented the prestige of scientific journals.

The main purpose of this commentary is to remind the scientific fraternity that modern-day science is no longer just the purview of 'peers', but is being closely watched by a variety of stakeholders, who may or may not have the critical scientific training to evaluate science, but will not hesitate to use it for furthering their political agenda. If scientists take their 'review' work seriously and with a renewed sense of responsibility, such politically mischievous use of scientific results could be avoided. Certainly, these are not the times to take scientific peer review lightly, as the future of modern biotechnology is at stake.

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