

GM crops – China shows the way

While India is yet to take a decision regarding commercialization of *Bt*-cotton, it is of interest to know about the developments in China. Apart from North American countries such as US, Canada and Argentina, China has also been spearheading the commercialization of GM crops. However, it has been difficult to get hard data on the Chinese experience, except for fractured information. Now a detailed article entitled 'Plant Biotechnology in China' has appeared in *Science* (2002, **295**, 674), authored by two Chinese scientists, one from the Centre for Chinese Agricultural Policy, Chinese Academy of Sciences and the other from Biotechnology Research Institute, Chinese Academy of Agricultural Sciences, besides two other US scientists. The data are self-explanatory.

GM crops – ready and in the pipeline

Chinese scientists have generated an impressive array of new technologies. From 353 applications between 1996 and 2000, China's Office of Genetic Engineering Safety Administration (I suppose, equivalent to our Genetic Engineering Advisory Committee (GEAC) with the Department of Environment) approved 251 cases of GM plants, animals, micro-organisms for field trials, environmental releases or commercialization. In this list, 45 GM plant applications were approved for field trials and 31 for commercialization. The crops approved for commercialization are cotton (insect resistance), tomato (virus resistance) and petunia (altered colour). The GM plants waiting for environmental release or commercialization are rice (insect, disease and herbicide resistance and salt tolerance), wheat (virus resistance, quality improvement), maize (insect resistance, quality improvement), besides soybean, potato, rapeseed, peanut, tobacco, cabbage, chilli and papaya, essentially for insect and virus resistance.

Experience with *Bt*-cotton

Chinese scientists have commercialized their own version of *Bt*-cotton (artifi-

cially synthesized gene) and have also permitted a Monsanto joint venture for the same purpose. The article claims that the total benefits from the adoption of *Bt*-cotton in 1999 were \$ 334 million, of which China's public-funded research institute efforts yielded \$ 197 million. It is clear that China is not afraid of the bogey of MNCs and is able to harness the benefits through both approaches. From only 2000 hectares in 1997, *Bt*-cotton was grown in 700,000 hectares in 2000, comprising 20% of total cotton acreage. The average area for cotton was less than 0.5 hectare and the article states, 'currently, *Bt*-cotton in China is the world's most widespread transgenic crop programme for small farmers'. The use of pesticide decreased by an average of 13 sprayings and reduced the costs by \$ 762 per hectare per season. Although the yields as such were more or less the same for *Bt* and non *Bt*-cotton (3371 kg/ha vs 3186 kg/ha), the cost of production decreased by 28%, besides ensuring sustainable production against pest menace. Pesticide toxicity was seen in 4.7% of *Bt*-cotton growers compared to 22% seen with non *Bt*-cotton growers. It is claimed that 'as *Bt*-cotton spreads, the social benefits from this crop will pay for all China's past biotech expenditures on all crops'.

Investment in plant biotechnology

The Ministry of Science and Technology (MOST) has increased plant biotechnology project funding in select institutes from \$ 8 million in 1996 to \$ 48 million in 1999, with a total investment of \$ 112 million in this area. The article states that India spends \$ 25 million in plant biotechnology (\$ 15 million by government and \$ 10 million by private investors). I believe that this figure is an overestimate. China has plans to increase the plant biotechnology budget by 400% before 2005 and this would account for one-third of the world's public plant biotechnology funding. The Chinese plant biotechnology research staff rose from 740 in 1996 to 1988 in 1999.

China is also deeply concerned about consumer safety and acceptance, and is facing conflicting pressures on the use of transgenic crops. Nevertheless, it is able to focus and forge ahead and believes that the plant biotechnology industry will become widespread inside China. It is hoping to become a major exporter of biotechnology research methods, commodities and contract research outputs. The article claims that 'China has several advantages; it has many well-trained scientists, a low-cost research environment, and large collections of germplasm'.

Indian scenario

The above-mentioned statement also holds for the Indian scenario. This could be true, except for one aspect: commitment, which we lack, but which the Chinese have in good measure. China has recently completed the rice genome sequence on its own. Our real investments in modern plant biotechnology would not be more than 10% of the Chinese investment. Our scientists in public-funded institutions have also been working on *Bt*-cotton for a decade, but we are not close to field trials. But, despite minimal investments, there are very promising leads: potato with balanced protein, mustard (low erucic acid: low glucosinilate), *Bt*-cotton, rice and vegetables, virus-resistant tomato, chilli, etc., thanks to support from DBT, which is pushing hard not only for research in the laboratory, but also demonstration trials. The biggest stumbling block is to take laboratory successes to the field. ICAR, with its substantial budget, should take the lead and modern biotechnology should be its major focus. Unfortunately, traditionalists in agricultural research are not yet convinced about the potential of GM technology. Democracy, liberalism and religious moorings have led to a plethora of arm-chair scientists without a background in the methods of science, activists who freely misinterpret science and bioethicists who question any research on genetic make-up. Without producing any product to contribute to the alleviation of human suffering, there

are endless debates, while people continue to die of hunger, disease and poverty. This is not to undermine the importance of environmental and human safety. Let us restate the issues. Tremendous amount of genetic engineering is going on in nature and there is lateral transfer of genes. These, however, take place in the time-frame of decades and centuries. It is not realistic to expect results on environmental impact of GM crops from a few trials. GM crop is a drop in the ocean. Resistance to *Bt*-gene will develop in insects in the field. It is a matter of time. This need not be projected as a Frankenstein monster. After all, we are living with drug-resistant

malaria, tuberculosis and cancer. Alternate strategies are always worked upon and this is true with the *Bt*-gene as well. Realistically, we should utilize *Bt*-cotton and derive maximum benefit during its useful period, while developing strategies to face resistance as and when it develops. Human safety to exposure of new genes is an important consideration. There is ample literature that *Bt*-gene is safe for humans. Any other GM crop can easily undergo human/cattle health safety trial. The so-called single window clearance for regulatory approvals is still not in place. Every new technology has a certain risk and in India, one wants to escape taking

a decision in the garb of abundant caution. Even if large-scale *Bt*-cotton trials in the private sector are approved today, it will take a minimum of two years for commercialization and China would be at least six years ahead of us. All the hype on biotechnology in the country should give place to actual execution on the ground in terms of hard-core research and its exploitation in terms of products for our societal good and/or global leadership.

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The Austrian 'Anschluss' and Science in India

The recent change in sovereignty in Austria has necessitated the immediate emigration of a substantial number of prominent scientists, which include two Nobel Laureates, Professors Hess and Lœwi. These migrations afford an opportunity for other countries, endowed with vision and foresight, to extend their hospitality to these men and enrich the country's scientific talent by 'transfusion of new blood'. England, with its high traditions for intellectual freedom, has always been the first to take advantage of such situations and we know

that the best of the Jewish scientists who had to leave Germany 5 years ago were quickly absorbed by Britain. America too has been equally generous and farsighted; but India at that time lost a great opportunity. Now that a similar situation has arisen, it is suggested that India should take advantage of it.

M.S.

Biology for Senior Schools – Book I.

By M. R. Lambert. (Macmillan & Co., Ltd., London), 1937, pp. 158. Price: Rs 1-10-0 or 2sh. 9d.

With the realization of the fact that the essentials of Biology form an integral part of the training of every child, a large number of books have come to be written for the use and guidance of children. The book under review intended for an eleven-year-old child is the first of a series of three and the portions included in it are expected to be covered in a year. A refreshingly novel method of introducing the subject is used, the child being asked in the first few pages to make the acquaintance of a

familiar plant and an animal. The examples chosen, the dog and the buttercup are essentially those with which the English child is more familiar and the author, instead of plunging directly into technical lore regarding the differences between plants and animals in the first chapter of the book as is common in most books on Biology, gently takes the child through everything that a plant or an animal does and finally reveals to the eager mind the important characters of the two groups of living beings. This essential fact of good teaching – from the familiar to the unfamiliar – is seen throughout the book and is the outcome of the experience of an actual teacher, which the author is. The introduction of a few simple but highly convincing experiments help to sustain the interest of the child throughout. The examples of the plants and animals chosen are such as to make the book useful to English children and it leaves behind a desire for a similar book for use in Indian schools.

B.R.S.