Chinese Agricultural Biotechnology in the Field

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China, one of the largest agricultural countries in the world, has made significant achievements in agricultural production. We use about 70% of arable land to feed 20% of our population. However, since 2000, production has been stable, whereas the population continues to increase, therefore we face challenges, as in India. The first is population. We estimate that it will increase to 1.6 billion around the year 2020, therefore we need to increase agricultural production commensurately. And then we have challenges in terms of arable land and water resources.

Imports and Exports

After China joined the World Trade Organization in 2001, importation of agricultural products increased dramatically and the trade deficit climbed to over US$5 billion in 2005. Three major problems characterize US/China trade relations. First is the United States-to-China deficit in agricultural goods. Second is the China-to-United States deficit, which includes textiles and other industrial goods. The second trade issue is the value of Chinese money. The third problem is intellectual property (IP) rights.

In 2005, China imported 27 million tons of soybean from the United States, Brazil and Argentina, almost 40% of the total consumption in China (which produced about 60 million tons). Importation of soy from the United States began in 1995, mostly from Iowa and Wisconsin.

In 2001, China made labeling of GM seed mandatory. US companies were unable to quickly meet the imposed standard, importation dropped precipitously in that year; however, it came back in 2002, 2003 and 2004.

Cotton is the second most important crop imported by China. Although we are one of the largest producers of cotton, involving 200 million farmers, 15% of exports are textiles. In 2005, China's cotton importation increased dramatically; it increased from 3 million to 5 million tons between 2000 and 2005. Corn and rice are also imported.

Investments in Agricultural Biotechnology

The Chinese government has made significant investments in agricultural biotechnology. In an attempt to ensure food security, research funding has been doubling every 5 years. China is second only to the United States in terms of federal funding of plant biotechnology. In contrast to India, in which multinational companies including Monsanto are operating, China has little investment in plant biotechnology from the private sector, possibly due to concerns over IP.

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Thus, plant biotechnology is developing rapidly, with much activity in field trials and the process of commercialization. China is number five in terms of production and commercialization of transgenic crops (*i.e.* cotton) in the world after the United States, Argentina, Brazil and Canada. After the government approves transgenic rice for commercial production, China will quickly occupy the number-two position.

In total, about 700 applications have been approved for field trials and about seventy-five commercialization licenses have been granted. The largest number is of transgenic cotton, which has been released in more than ten provinces. However, about thirty species of transgenic plants being tested in the field, including cotton, rice, wheat, corn, soybean, potato, oilseed rape and tobacco. Also, over 30,000 transgenic poplar trees are under trial in the Beijing area.

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Transgenic cotton was first grown commercially in 1996, and today over 60% of cotton grown in China is genetically engineered. It is close to 100% transgenic in the Yangtze River basin. Transgenics are not used in Xingjian province, although it is a major production area for cotton, because nematode infestation is not a serious problem.

Imported Concerns

As in other Asian countries, public concern over the safety of GMOs is a problem in China. This problem came from Europe; 1998 and 1999 were difficult years. Greenpeace published a magazine, available free of charge, which was sent to officials in China and members of the scientific community. Particular attention was focused on transgenic rice. China is the major rice producer globally. Over 600 million Chinese farmers live on rice and it is also vitally important globally. Research on transgenic rice has been in

progress for over 20 years. Genetically engineered rice is being field-tested for resistance to insects, bacterial blight, and fungal rust, and for salt and herbicide tolerances, and with nutritional improvements including golden rice resulting from collaboration with Ingo Potrykus, and varieties resistant to rice dwarf virus from my laboratory.

We are now in the last phases of preproduction trials of transgenic rice. In November 2004, the final committee of scientists approved transgenic rice for commercialization, and we await approval by the Ministerial Conference, which consists of representatives of seven ministries including Agriculture, Science and Technology Involvement, and Import/Export. We expected approval in May 2005, but Greenpeace acquired seeds and sent them to GeneScan, an analytical laboratory in Germany. A PCR assay revealed a *Bt* gene, which drew press attention globally. Immediately, Japan and Korea, banned importation of rice from China, in response to which the Conference postponed commercialization and we still await approval, despite the fact that our scientific committee again approved *Bt* rice in November, 2005.

In early 2006, Greenpeace announced detection of GM rice in Chinese-made baby food and is publicizing the "scandal of illegal GM rice" on their website. Thus, the situation in China is getting more and more difficult. In contrast, the situation is good in the United States; however, it remains difficult in Europe and increasingly so in China.

A common complaint is that GM food is unsafe, yet *Bt* toxin has been used in China since the 1960s for insect control on vegetables, with no reports of poisoning. Over 2 billion people in the Unites States, Argentina and China have been exposed to transgenic soybean with no reports of toxicity. (We import transgenic soybean, but are not allowed to grow it.)

Environmental safety is also a concern. Greenpeace has attempted to convince the government that genetically engineered crops adversely affect the environment. The fact that many people have been poisoned by ingestion of pesticides is generally ignored. It can be argued that since *Bt* crops save human life, they actually improve the environment. Significantly more insects are present and increased insect diversity exists in fields of transgenic cotton because less pesticide is applied. More people are poisoned and die as a result of exposure to insecticides used on non-transgenic cotton and rice than with *Bt* counterparts.

The issue of beneficiary is another source of complaint. Benefits accrue to farmers and to the production company—often Monsanto is the focus of discontent—rather than to the consumer.

Labeling

Labeling is another contentious issue. In the United States, labeling is voluntary on the part of the producer, therefore the situation becomes complicated where products are being exported. China enacted a law in 2002 enforcing labeling. Soybean oil has to be labeled to indicate its GM source even though it does not contain any transgenic component. This can be confusing for consumers. Furthermore, many people in China are illiterate; the extra cost involved in labeling is, in many cases, of no utility.

Agbiotech and Global Needs

Part of my job is to convince people that this technology is useful, which has become difficult as a result of Europe's influence. If the European Union would be accepting of GMOs, China, India, Thailand and African countries would benefit. In many parts of the world people are hungry, yet their ability to feed themselves is being compromised by others who live in abundance. I hope that more attention will be paid to these poor countries, especially to hungry countries, so that this technology can be made available to help people help themselves and help the environment.

ZHANGLIANG CHEN—A pioneer in genetic engineering of plants—received his PhD in Roger Beachy's laboratory at Washington University, St. Louis, in 1987. He has served as vice president of Peking University and as director of the China National Laboratory of Protein Engineering and Plant Genetic Engineering, one of China's largest centers for R&D in agricultural biotechnology. Actively involved in biosafety issues, he is a member of the China National Agrobiotechnology Biosafety Committee, which approves field trials and commercialization of genetically engineered crops. He has (co)authored seven books and some 200 research papers.

Dr. Chen has been the president of the China Agricultural University since 2003. He also serves as chair of the Plant Biotech Committee of UNESCO, as a consultant for the International Society for Plant Molecular Biology, and as a member of the Sino-Euro Administration Committee for Biotechnology Cooperation. He was recently elected vice chairman of the Council of Scientific Advisers of the International Center for Genetic Engineering and Biotechnology in Italy.