Agriculture biotech in China

With hundreds of firms and a large number of ongoing research projects being conducted by academic and research institutions, biotechnology is one of the most current and attractive areas for China. More and more foreign investors have chosen China for conducting research activities, mainly due to government assistance for private enterprises, thereby showing a willingness to build a world-class biotechnology sector.
The creation of biotechnology parks has been fundamental in this transformation: bonded facilities, low-priced lands, tax breaks, logistics supports, a huge pool of low-cost scientific talent, completed by access to cheap raw materials is a major advantage for overseas biotechnology companies when selecting China to conduct biotechnology research.
Shanghai Zhangjiang Hi-Tech Park, Suzhou New Territory Park and Wuxi Life Science Park are just few examples of these types of biotechnology parks.
A reduction in costs, particularly employees' salaries are one of the most important factors when multi-national biotechnology companies select China. An example of the difference in the salary of employees is the case of a typical Chinese chemist with a doctorate who earns not more than US$30,000 in China, while he would earn approximately three to four times as much in the United States.
This is the case with the U.S. based biotech firm DuPont, which set up its second Chinese joint venture in December 2006 with Gansu Dunhuang Seed Co., one of China's largest seed production companies. They will provide top corn seed and high-yield corn hybrids to Chinese farmers (1).

CHINA'S NEEDS

The most pressing issues to be faced in China are food supply, health care and environmental protection. By 2020 China's population is expected to rise to 1.5 billion and with only 7% of the world's arable land, China has to face the problem of feeding vast population (2).
The Chinese government has faith that suitable solutions for these issues can be found in biotechnology. By supporting the basic research, adopting favourable policies for technology innovation, forming an educated labour force and a competitive market environment, the biotechnology sector in China has sped up and constitutes a major prospect for investors. At the same time the Chinese government is pleading for mutual support and the sharing of goals by both the private enterprises and the official institutions. They seek to do this by creating a network among universities, public organizations, industrial companies and financial institutions, as "Innovation relies no longer on companies or institutes alone, but on integrated efforts from both sides (3)".

AGRICULTURE

Even though China is presently going through double-digit growth in the adoption of new agriculture bio-technologies, it was initially diffident regarding biotechnology (4). Only later the situation has changed from being one of the slowest to one of the fastest nations in the implementation of new biotechnologies.
In July 2006 China's Minister of Agriculture Du Qinglin asserted that science and technology should contribute up to 63% of the growth of Chinese agriculture sector by 2020 (5). The minister delineated five sectors on which the management will concentrate in order to improve crop growing and those are:

- Genetically Modified cotton;
- Rice;
- Safe farm products,
- Agricultural equipments;
- Research institutions.

GM CROPS DEVELOPMENT

Globally there is a fierce competition in the research and development of plant transgenic technology.
In 2004, China ranked fifth in the world in terms of genetically modified organism (GMO) cultivated acreage. But, if in 2002 China planted 700,000 hectares of transgenic cotton, in the year 2004 this figure quadruplicated reaching the quantity of 2.8 million hectares, making China the 5th largest grower of transgenic cotton. The major product of transgenic farming in China is transgenic insect-resistant cotton and in 2004 it was estimated that its cultivated extension reached two-thirds of the farmland planted with cotton. However, last year India supplanted China growing more Bt cotton (3.8 million hectares) than China (3.5 million hectares). 2006 data esteeming the extension of the cultivation of biotech crops in the globe present altogether 22 countries, of which 11 are industrial countries while the rest are developing countries. They were, in order of hectarage, USA, Argentina, Brazil, Canada, India, China, Paraguay, South Africa, Uruguay, Philippines, Australia, Romania, Mexico, Spain, Colombia, France, Iran, Honduras, Czech Republic, Portugal, Germany, and Slovakia. The US still well ahead as regard to the others with 54.6 million hectares (53% of global biotech area), followed by Argentina 18.0 million hectares and Brazil 11.5 million hectare (6).
Although the worldwide struggle for elaborating new species, research and industrialization of transgenic cotton in China has already made a series of significant breakthroughs; new varieties with intellectual property rights have been patented, essentially thanks to the governmental support.
Central government and local departments invested altogether 830 million RMB (ca. 80 million Euro), focusing on functional gene cloning, transgenic new materials creation and industrialization, transgenic core technology innovation and safety assessment of GM plants.
Cultivation of new transgenic cotton varieties researched in China has raised the domestic market share of anti-insect cotton from 5 percent in 1998 to 70 percent in 2005, winning the competition of the other international anti-insect cotton in the market (7). The Plant Journal 2002 reports that there has been an improvement in cotton production using GM in China, with Bt cotton yields 54.7% higher in 2000 and 10.9% in 2001 (8).
Apart from cotton, GMO plants developed or used in China include pest resistant crops and tobacco, peanuts, sweet peppers, papayas and vaccine-carrying tomatoes.
To boost the international competitiveness of Chinese rice, China gave start to the cultivation of GM rice in 2004. It has been estimated that each year at least $200 million have been invested on transgenic modified rice in China although the product hasn't been allowed on the market yet (9). Being rice the most important food crop in the world, grown by 250 million farmers, and the principal food of the world's 1.3 billion poorest people, the profits coming from its introduction in the market could be huge.
Though field testing on biotech rice had already been carried on during pre-production trials and the final approval was expected in the year 2005, the bio-safety committee entrusted by the government with the investigation of the safety of genetically modified crops has requested more testing. Likely a large-scale production of the insect resistant rice will be postponed for another year or two (10).
The truth is that China at the state of being can not take the risk to be the world's first to commercialise GMO rice. Chinese scientists as well as industry executive knowing the severity of the Western regulatory system assessing food safety do not want to lay on the line, especially with the European Union.
In the event that China will be able to produce and trade both

GM cotton and rice, the economic profit from GMO adoption will be large. During the 25th International Conference of Agricultural Economists "the welfare gains amount to an additional annual income of about US$5 billion in 2010 (11). Given the importance of rice for agricultural production, employment and food budget shares, the gains from GM rice adoption are orders of magnitude larger than the Bt cotton gains".

HISTORICAL PROGRESS OF BIOTECHS IN CHINA

Since the 1949 declaration of People's Republic of China, biological research in China didn't keep step with Western countries, mainly due to the official adoption of the sovietic anti-Mendelian Lysenkoism, and the opposition towards the scientists still following the Mendel Morgan science.
Furthermore in the year 1957 Mao embracing the ideas of the Anti-Rightist Movement brought practically to an end the study of modern genetics, compromising it irremediably during The Great Leap Forward (1958-1959) and the Cultural Revolution (1966-1976) in which the eradication of the scientific community caused the paralysis of the technology research during that period.
Due to this historical background, it is then remarkable how rapidly the Post-Mao China returned to its scientific and technological potential especially in agricultural biotechnology, major genomic ventures and stem-cell research.
Establishment of medical and agricultural institutes, in which most of the major advancements are today achieved, are mainly due to the efforts of Deng Xiaoping, whose work was fundamental for transmitting the idea that technology is the key factor for generating national prosperity.
It should also be noted that after China entered the World Trade Organization (WTO) on December 11, 2001, this required revisions of the country's patent laws. The laws had to comply with international intellectual property rights norms, providing to be a big incentive for overseas companies interested in business opportunities in China. Moreover there is still concern among foreign firms moving to China, as the country is still the world's leading producer of pirated goods, although many positive steps have been made in this area. If Chinese scientific advances are to be globally accepted and marketed, there is a requirement that bioethical and technical standards should comply with international standards and allow for better quality control both locally and nationally (12).Generally speaking not all the work of scientists in China complies with the precepts of ethical science; internationally accepted standards are often maintained only because violations can prevent publication in prominent Western journals or halt participation in international research projects.

CHINA IMPORTED GM

Quite surprisingly China is a net importer of soybeans. In 2003 alone China imported 20.74 million tons of genetically modified soybeans from the US and Brazil for use in the production of oil and meal (13). Overall China's largest import of GM foodstuffs is a Monsanto developed soybean seed.
At the same time, China is the fourth-largest producer of soybeans, which as officially stated it's not genetically modified, and uses most of its domestic crop – probably 75 percent of it – to make such food items as tofu, soy paste and soy milk. Just about all of the soymeal exported out of China is labelled as organic according to the Chinese standards. As said by Mr Duan Wude, Deputy Director of the Ministry of Agriculture of China's Research and Development Centre, China was originally hesitant about GM soybeans, but because of the high domestic demand not importing soybeans, would have requested to import bean oil, which would have meant giving up the profits of bean processing.
The positive testing on GM products undertaken by the Chinese government, as well as high demand for agriculture products have granted the GM products a large potential market in China. Nevertheless it has to be highlighted that as regulated by the March20, 2002 "Measures on the Administration of Appraisal of Bio-safety of Agricultural GM Food" and the "Measures on the Administration of

Bio-marks on Agricultural GM Food" all imported genetically modified soybeans, corn, rapeseed, cotton seed and tomatoes have to be clearly labelled as GMO and a certificate stating the safety of such imported goods has to be requested from the overseas exporters to the Chinese Ministry of Agriculture

BIOTECHNOLOGY EVOLUTION

During the 5th APEC Biotechnology Conference held in July 2006 in Taipei it was clearly stated that the importance of active cross-industrial collaboration and the sharing of the related experiences and practice of the members in developing biotechnology in the Asia-Pacific region is critical for the future of biotechnology in Asian countries given the lack of big competitors .
The Chinese biotechnology market has many limitations due to poor quality control and lack of good management. However, this suggests an opportunity for foreign investors to co-operate on projects, taking advantage of the low costs. China's receptive attitude towards modern technology, overseas-trained Chinese employees and finally the huge potential market (14). The spending on agricultural biotechnology, that already makes up twenty percent worth of the world's investment into global research, is expect to increase almost five fold by 2010. The target of the Chinese government is to achieve higher food security standards and satisfy increasing demand of population and at the same time lessen its dependency on other countries for food products such as soy beans.
As a direct consequence of the increased budget for research and an estimated 6.8 million farmers already cultivating biotechnology crops in Mainland China, Chinese companies and institutions have increasing power in the Genetically Modified Organism global market. Such a situation poses not only a positive future but also may cause concern to multinational biotech companies such as the American giant Monsanto and Dupont if the "Chinese should stand up" (15).

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