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China's Need for Food and Safety

We have often looked to advances in mechanical technology for the answers to the question how do we feed the world? But these answers from the past are no longer sufficient to meet the world's needs. China is a key example where mechanical technology has not provided all the answers. China has become one of the leading exporting countries in the world, and yet in 2008 China was unable to meet the needs of their citizens and became a net food importer (Wang). Agriculture in China has struggled, with barren deserts in the north and the west, and the rugged Himalayan Mountains and the Plateau of Tibet in the south, only about 16% of China's almost 9.6 million square kilometers can support farming (FAO Statistical Yearbook). Since China is home to 22% of the world's population, this makes this already small amount of arable land seem even smaller. Large scale machinery used on the types of farms we see here in the Midwest United States, are not helpful in increasing productivity. To try to boost yields on this limited land "pesticides and chemical fertilizers are used in excess" according to the Associated Press. It is no wonder that China has seen food safety issues such as: contaminated wheat gluten, contaminated milk, and pesticides found in both peas and dumplings (Associated Press). With approximately 12,000,000 people being added yearly to China's already large population (Knapp), how can China ensure their people an adequate food supply, and still protect its people from more crises such as the current milk scandal? The answer is in biotechnology, and in their subsistence farmers. By focusing research on measures to increase yields and reduce dependence on fertilizers and pesticides it is possible to provide an adequate food supply, improve the environment, and increase the quality of life for subsistence farmers, not only in China, but around the world.

Since 2000, the per capita GDP in China has increased from $3,800 to $5,300 in 2008 (CIA World Factbook). As the Chinese economy has increased, there has been a shift in the diet of the average Chinese citizen. The top source of energy in the Chinese diet remains cereals, making up approximately 63 percent, with smaller amounts of fruits and vegetables, animal products and oils and fats filling out the rest. In 2001-03 the average per capita daily calories consumed increased to 2940 from 2680 in 1991 (FAO 2006 Yearbook). The type of food from which Chinese are getting their calories has shifted. In the early 90s more calories were taken in from proteins, in 2001-2003 more calories were taken in from fats than proteins (FAO 2006 Yearbook).

The increased focus on education in recent years will help China's economy continue to grow. In 1990 the literacy rate in China was 77%. To help eradicate this problem the Chinese instituted a universal system of 9 years of compulsory education. By 2001 the literacy rate had increased to 91.28%. By 2002 over 98% of students were enrolled in primary schools, and 90% of students were enrolled at the junior secondary level. (Basic Education in China)

Farming in China is made up of "about 200 million very small (0.65 ha or less) farms" (The State of Food Insecurity 2006). Before the 1970s agricultural production was more centralized and controlled by the government. However, by 1984 family farming was reestablished and the Household Production Responsibility System (HRS) was implemented. As described by Shenngen Fan in "Is Small Beautiful? "Under the HRS, farmers had freedom of decision making on major production and marketing activities, but were not given ownership of the land allocated to them. Instead, they were granted user rights." After HRS took effect labor productivity increased from $156.9 (1995 US$ per person) to 333.2 in 2000 (Fan 139).

Bryan Lohmar states in “Who Will China Feed?” that “China produces 30 percent of the world’s rice, 20 percent of the world’s corn, a fourth of the world’s cotton, estimated 37 percent of the world’s fruit and vegetables and half of the world’s pork.” However this full-throttle pace of production is starting to strain China’s labor, land, and water resources (Lohmar 12).

Since 2003 wages have been rising at a double digit pace (Lohmar 14) leading to a reduction in more labor intensive agricultural practices, and an increase in mechanization of planting and harvesting (Lohmar 14). People are leaving the Chinese countryside for the large urban centers in eastern China. Guoming Wen expects that urbanization will continue to grow and a pace of 1.5 percent annually, leading to an urbanization level of 50 percent by 2010.

As China continues to industrialize and urbanize, land previously used for agriculture is being converted to meet the needs of this shift (Lohmar 13). According to Guoming Wen over 67,000 square kilometers of arable or cultivated land has been shifted into industrial uses over the past seven years. With only 16 percent of China’s total land able to be used for farming this encroachment increases pressure to boost productivity on the remaining arable land. In order to make use of every possible inch of arable soil, the Chinese cultivate steep hillsides which are related to a number of negative outcomes, such as: significant loss of top soil, and reduced capability for water storage (Lohmar 13).

Water resources for agriculture are also dwindling quickly due to the shift from agriculture to industry. In 1980 only 13 percent of China’s water was used by industry and domestic households. By 2000 the amount of water used had raised to roughly 30 percent (Lohmar 13). Specifically “Who Will China Feed” cites the decline of the North China Plain groundwater table. This led to the Yellow River not flowing all the way to the ocean at a number of times during the 1990s. This was corrected through regulations passed in 2000, but it is an example of the kind of situations that China could face as their water supply continues to be taxed.

Increasing use of fertilizer and pesticides are also straining China’s land and water resources as pollution is becoming a more significant problem (Lohmar 15). In her factsheet, Yang states that about “seven percent of China’s cropland has been polluted due to improper use of pesticides and fertilizers.” This loss of land due to pollution only exacerbates the problem of loss of land due to urbanization. Yang also reports that due to pesticide residue problems China loses about 12 million tons of crops which is the equivalent to $2.5 billion dollars.

Contamination of food stuffs has lead to problems for China with their export partners. Chinese dumplings exported to Japan in late 2007 were contaminated with pesticides leading to Japan opening investigations (Second Pesticide). In 2007 United States rejected shipments from China at a rate of about 200 per month (China’s Food Safety). Wide spread contamination of wheat gluten with melamine in 2007 and infant formula also contaminated with melamine in 2008 have lead to increased concerns about the quality of Chinese products (China’s Food Safety)

China’s awareness of these issues has led them to become one of the leaders in plant biotechnology research. Bt Cotton was China’s first major foray into the field of plant biotechnology. It was approved for commercial use in 1997, and has shown significant cost saving, as well as an increase in farmer health. (Huang) Farmers using Bt Cotton reported an 80 percent reduction in use of toxic pesticides, organophosphates and organocholrines, amounting to a decrease of about 50 kg per season (Huang). Due to these reductions and farmer labor, Huang estimates that the cost of producing a kilogram of cotton has decreased 28 percent since the implementation of Bt Cotton. When asked about their health after use of pesticides Huang found that only 4.7 percent of farmers using Bt cotton reported any ill effects, as compared to 22 percent of those who only grow non-Bt varieties of cotton, and 11 percent of those who planted a combination of Bt and non-Bt cotton (Huang). Huang asserts that “As Bt cotton spreads, the social benefits of this crop will easily pay for all China's past biotech expenditures on all crops."

This success explains why China is a leader in plant biotechnology in the developing world. The number of scientists and professionals employed by the China's plant biotechnology industry has increased to 1,988 in 1999 from only 740 thirteen years earlier (Huang). China allocated 9.2% of their research budget to plant biotechnology. This is less than most developed countries spend, but is significantly larger than the 2 to 5 percent allocated by other developing countries (Huang).

Not only is China's level of spending noteworthy, the areas in which funds are invested are different than the developed world. In the FAO's State of Food and Agriculture report the author states that "(b)arring a few initiatives here and there, there are no major public- or private-sector programmes to tackle the critical problems of the poor or targeting crops and animals that they rely on." China is one of those countries addressing the needs of the poor. Their experiment with Bt cotton has lead to this becoming the world's most wide spread transgenic crop for small farmers (Huang). Most research on food crops world wide has focused on GM maize, however, China is developing trials for rice, wheat, potatoes, and peanuts (Huang), crops which have more significance to farmers in the developing world.

By encouraging China's already burgeoning plant biotechnology industry, it would be possible to increase yields, improve drought and disease resistance, improve the sustainability of the Chinese agricultural system, and increase the standard of living for all those living in rural China. China already has a number of advantages in the plant biotechnology field as listed by Huang: abundant well educated researchers, low cost research environment, and a copious amount of germ plasm. Building on these advantages and their successes, China could then help translate these into successes in other countries around the world. A great return for an investment in a tested and thriving industry.

In the case of Bt cotton, yields remained the same (Huang) when farmers switched from non-Bt cotton. However with 12 million tons of crops being lost due to pesticide residue problems, implementing crops that do not require the high use of pesticides could help China recover portions of the $2.5 billion lost. Bt rice is in field and greenhouse tests in China and is showing promise in reducing rice pests (Toenniessen). If Bt rice lives up to its perceived potential it could increase yields and significantly reduce the need for pesticides not only in China, but throughout the rice producing countries of Asia.

China is facing significant pollution problems due to industrial and agricultural run-off. Yang states that "annual pesticide use in China is about 1.2 million tons on approximately 300 million hectares of farmland and forests." Often times this is greater than what is needed, however farmers have had past experiences which have led them to not trust the pesticides, so they apply more than what is required (Yang). As stated earlier, overuse of pesticides and fertilizers has polluted about 7 percent of cultivated land in China (Yang). Pesticides have also been responsible for the poisoning of 53,300 to 123,000 people per year in China (Yang). This is not sustainable agriculture. Farmers aren't trying to poison the country they are trying to sustain their crops. However, there is hope. Crops such as Bt cotton have demonstrated that pesticide use can be significantly reduced by using transgenic crops. After the implementation of Bt cotton China saw a drop in the use of pesticides by 20,000 tons in 1999 and 78,000 tons in 2001 (Toenniessen). By continuing to implement pest-resistant crops, China can continue to reduce the amount of pesticide use, and protect further land from becoming polluted.

Incorporating more transgenic crops can improve the standard of living for not only subsistence farmers, but all those living in rural China. By focusing on seed based technologies that help farmers reduce costs, the entire rural economy can benefit. By reducing the farmer's costs, prices of the crops can be kept low. This gives the farmer, as well as those who purchase the crops, more income. With the additional income the farmers and those who work on the farms can support those rural non-farm businesses. The State of Food Insecurity describes this, “Agricultural growth generates a virtuous cycle in which agricultural and rural off-farm activities sustain each other.”

In addition to the improvement in the economic status of subsistence farmers, transgenic crops have also shown health benefits by reducing reliance on pesticides. As noted above, farmers using non-Bt cotton reported significantly more instances of poisoning than those planting all Bt cotton (Huang).

Although there is promising research in disease and drought resistance, commercialized crops are not yet available (Toenniessen). Supporting research in this area and ensuring its distribution to subsistence farmers, especially in the water poor areas of China and the world, should be the next step of the Chinese government, private agribusiness, and the world community.

The Chinese plant biotechnology industry is currently one of the largest publicly funded programs in the world. They could eventually account for up to one-third of public money spent on plant biotechnology in the world (Huang). By continuing to make plant biotechnology a priority, especially in the areas of disease and drought resistance, China can continue to be a world leader in agriculture, provide meaningful work for their growing population and encourage growth in their rural areas.

In “Biotechnology and the Seed Industry” Pray states that “Public-private collaboration in biotechnology or plant breeding research is still very unusual in China.” To establish some partnerships, international agribusinesses such as Monsanto and other leaders in transgenic crops could provide assistance to China by helping with funding for their research, establishing crop breeding programs in China or create collaborative research projects (Pray). Since these relationships are just beginning, there is a great deal of potential in this area.

Institutions such as the Food and Agriculture Organization, the International Food Policy Research Institute and the World Trade Organization should be looked to for things such as: assistance in developing research, programs which can educate the public on the benefits of plant biotechnology, disseminating research developed in China to other countries that may benefit, or helping reduce trade barriers to transgenic crops and research.

In conclusion, to help ensure food security in an era of increased demand, the case of China shows us that the use of plant biotechnology and transgenic crops can provide increased yields, drought and disease resistant crops, improved agricultural sustainability, and an increased standard of living of all those in rural areas. It is now up to the Chinese government to continue their already commendable support of plant biotechnology research; to international agribusiness to help boost the research being done in China; and international organizations to ensure that the information is being shared, and barriers to these successful crops and seed technologies are not insurmountable. In this time of global interconnectedness, by improving agricultural techniques, and increasing the standard of living in the poor rural areas of China and the rest of the world, we all will benefit through a growing economy and a safer food supply.

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