China's Biotech Policies and Their Impacts on U.S. Agricultural Exports to China

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Baohui Song and Mary A. Marchant

Abstract

China is a key player in global agricultural markets, and the number one importer of U.S. soybeans and cotton, whereby soybeans and cotton are two of the main biotech commodities commercialized in the United States. As of 2005, 87% of soybeans and 79% of cotton planted in the U.S. were biotech. Thus, changes in China's biotech policies may have a significant impact on U.S. biotech commodity exports to China. An understanding of the evolution of China's biotech regulations and factors that may influence China's future biotech policies is crucial for both U.S. producers and policymakers. This article introduces the development of China's biotech regulations in detail. Focusing on soybeans and cotton, the impact of China's biotech policy changes on U.S. trade with China are examined. Results indicate that changes in China's biotech policies in 2001 did cause delay of U.S. soybean exports to China in the short-run, immediately after China's policies were announced. However, no long term impacts on U.S. soybean exports to China were found. For cotton, a non-food commodity and China's dominant commercialized biotech commodity, it appears that U.S. cotton exports to China were not affected by China's biotech policies.

Key Words: biotechnology, China's biotech policy, cotton, international trade, soybeans, U.S. agricultural exports

JEL Classifications: Q13, Q17, Q16, Q18

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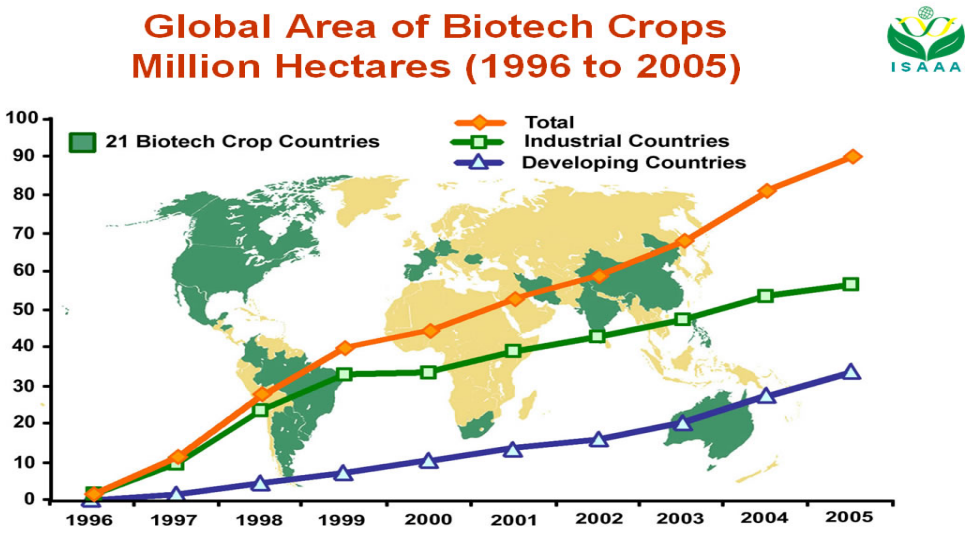
Introduction and Objectives

Agricultural biotechnology has advanced and spread rapidly in both developed and developing countries. Figure 1 shows the global status of biotech commodities by planted hectares (James, 2005). Globally, in 2005 the estimated planted area for biotech varieties reached 222 million acres in 11 developing and 10 industrial countries, whereby the U.S. biotech commodity planted area equaled 122 million acres, accounting for 55% of the global total (James, 2005). China planted eight million acres of biotech varieties, primarily *Bt* cotton, leading the developing countries and ranking fifth in the world. In the U.S., the main biotech varieties include soybeans, corn, and cotton. In 2005, 87% of soybeans, 79% of cotton, and 52% corn of planted in the U.S. were biotech varieties (USDA-ERS, 2005). China, a main U.S. agricultural trading partner, has also invested heavily in agricultural biotech research, ranking second only to the United States.

Figure 1. Global Status of Biotech Commodities by Planted Hectares



Field tests, environmental releases and commercialization as well as imports and consumption of biotech products are regulated in China. Since China is the number one market for U.S biotech soybeans and cotton, any Chinese biotech policy changes are expected to have a significant impact on U.S. agricultural biotech exports to China. In this research, the objectives are 1) to explore U.S. agricultural biotech commodity production and exports to China, 2) to provide an overview of China's biotech policies, 3) to assess the impact of China's biotech policies on U.S. biotech exports to China, and 4) to identify factors affecting China's biotech policies.

Outlook of U.S. Agricultural Biotech Exports to China

The U.S. leads the world in agricultural biotech research, adoption, commercialization, and exports. The main U.S. biotech commodities include soybeans, corn, and cotton. Table 1 shows their growth in planted acreage, which has dramatically increased in recent years (USDA-ERS, 2005). The share of planted acreage for biotech soybeans increased 33% from 2000 to 2005, cotton 18%, and corn 27%. In addition, soybeans, corn, and cotton are among the top U.S. agricultural exports for bulk commodities (USDA-FAS, 2006). In 2005, the export value for U.S. soybeans totaled 8 billion dollars; corn less than 6 billion dollars; and cotton more than 4 billion dollars[*]. The export value for these three commodities accounted for 28% of total U.S. agricultural exports in 2005 (soybeans 13%, corn 9%, and cotton 6%). As such, these U.S. biotech commodities depend highly on international markets. In 2005, U.S. soybean exports accounted for 33% of total domestic production, corn 16%, and cotton 57% (USDA-FAS, 2006).

[*]This soybean export value includes soybeans, soybean oil, and soybean cake and meal. The corn export value includes corn, corn oil, corn oilcake and meal, and corn gluten feed and meal. The cotton export value includes cotton, cotton linters, cottonseed, cottonseed cake and meal, and cottonseed oil.

Table 1. Main U.S. Biotech commodities (Percent of Planted Acreage)

Commodity	2000	2001	2002	2003	2004	2005
Soybeans	54%	68%	75%	81%	85%	87%
Cotton	61	69	71	73	76	79
Corn	25	26	34	40	45	52

Source: USDA-ERS, 2005.

From a marketing perspective, China is one of the most important U.S. agricultural export markets (figure 2), especially for U.S. biotech soybeans and cotton (table 2). Table 2 indicates that China was the number one importer for both U.S. soybeans (53%) and cotton (32%) in 2004. China's soybean imports from the U.S. skyrocketed in the last decade while China's cotton imports from the U.S. increased only in recent years. Additionally, the U.S. is a main soybean and cotton supplier for China. Table 3 shows that U.S. soybean exports to China accounted for 42% of China's total soybean imports in 2004, and U.S. cotton exports to China accounted for 44% of China's total cotton imports.

Figure 2. Top Five U.S. Agricultural Export Markets: Canada, Japan, EU, Mexico, and China

Table 2. Top Markets for Leading U.S. Agricultural Biotech Commodities in 2005

Commodities	Main Exports Markets	Market Share (Percentage of U.S. Total Exports)
Soybeans	China	37%
	The EU (25)	10%
	Mexico	13%
	Japan	11%
	Sum	**71%**
Corn	Japan	33%
	Mexico	13%
	Canada	5%
	Egypt	8%
	Sum	**58%**
Cotton	China	36%
	Turkey	14%
	Mexico	10%
	Sum	**60%**

Source: USDA-FAS, 2006.

Table 3. China's Imports of Soybeans and Cotton

Commodity Imports and Share		1996	1997	1998	1999	2000	2001	2002	2003	2004
Soybeans	China's Total Imports (Million MTs) *	3.80	5.63	5.19	6.67	12.72	16.38	13.85	23.19	22.26
	China's Imports from the U.S. (Million MTs) **	1.49	1.52	1.24	1.88	5.23	5.44	4.86	11.11	9.40
	U.S. Share of China's Market (%)	39%	27%	24%	28%	41%	33%	35%	48%	42%
Cotton	China's Total Imports (Million MTs) *	1.29	1.10	1.16	0.66	0.46	0.54	0.47	0.61	1.34
	China's Imports from the U.S. (Million MTs) **	0.49	0.42	0.37	0.10	0.04	0.06	0.05	0.17	0.58
	U.S. Share of China's Market (%)	38%	38%	32%	14%	8%	12%	11%	27%	44%

* Data from FAO, 2006. **Data from USDA-FAS, 2006.

Agricultural Biotech Research and Development in China

With only about 7% of the world's arable land feeding over 20% of the world's population, China is challenged by its great demand for food. Development of agricultural biotechnology has become an important tool to achieve China's food security. China, one of the world's largest producers of agricultural commodities, produced 31% of world rice, 27% of rapeseed, 27% of cotton, 19% of corn, 16% of wheat, and 9% of soybeans in 2004 (FAO, 2005). China is also a large player in international agricultural markets, exporting 4 million metric tons of corn and importing 22 million metric tons of soybeans in 2004 (USDA-FAS, 2006).

China's biotechnology development began in the mid-1980s (Huang, et al., 2002; Marchant and Tuan, 2002). Agricultural biotechnology has been strongly supported by the Chinese government. More than 100 laboratories were established to integrate biotechnology into conventional Chinese agriculture (Huang, et al., 2002). By the year 2001, more than 130 biotech varieties with more than 100 different traits including insect-resistance, bacterial-, fungus- and virus-resistance, salt-tolerance, drought-resistance, nutrition enrichment, quality improvement, production of edible oral vaccines and recombinant pharmaceuticals, were obtained (Chen and Qu, 2003).

Since 1997, after safety evaluation, the Chinese Minister of Agriculture (MOA) has approved the release of 10 biotech varieties including biotech rice, corn, cotton, soybeans, rapeseeds, and potato. Among these biotech varieties, *Bt* cotton, delayed ripening tomatoes, cucumber mosaic virus (CMV)-resistant sweet peppers, and color-altered petunias have been commercialized (Lu and Zhou, 2004). By far, *Bt* cotton is the dominant biotech commodity in China. China's acreage planted with *Bt* cotton increased by 32% from 2.8 million hectares in

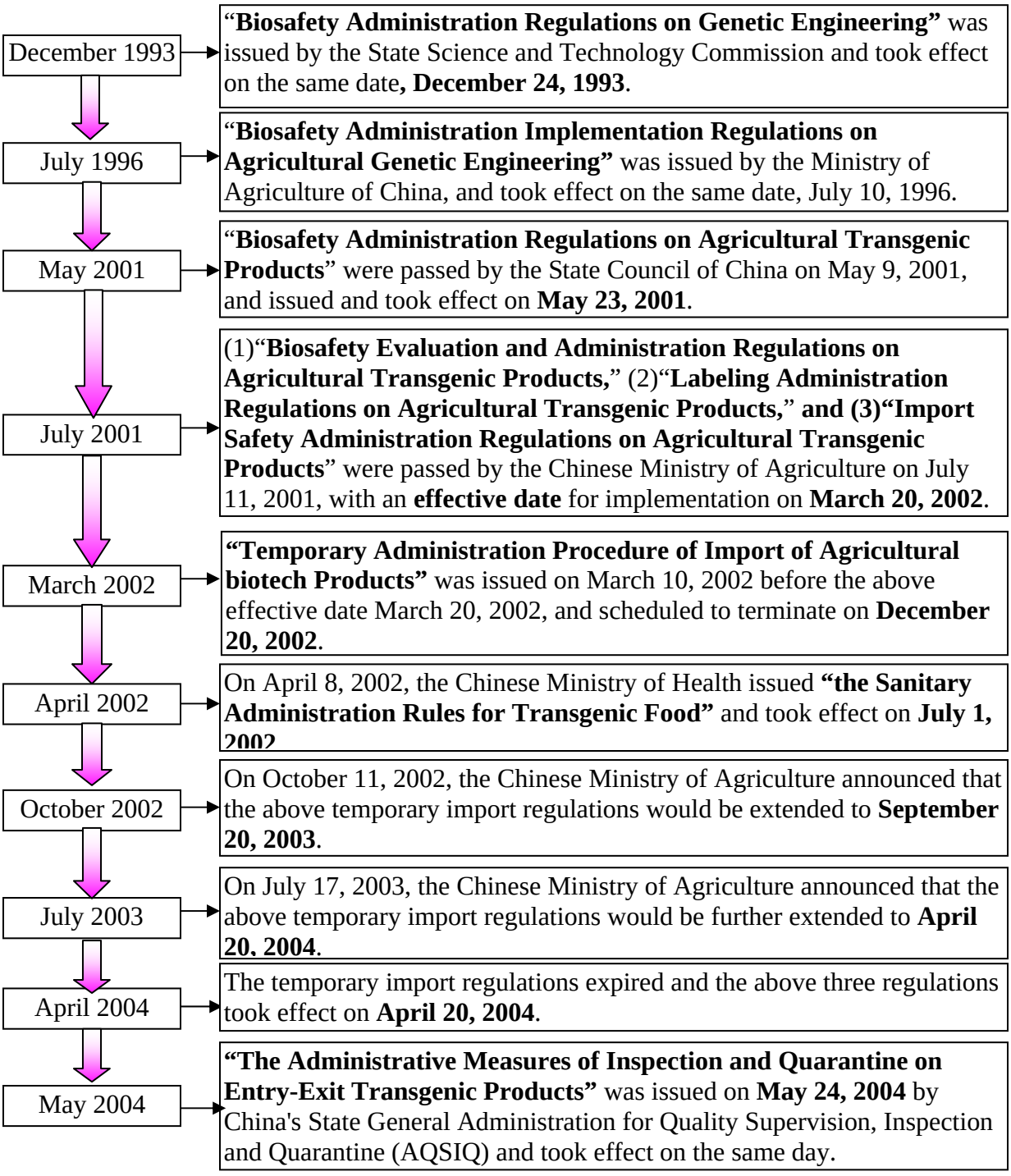
2003 to 3.7 million hectares, which accounted for 66% China's total cotton planted area in 2004 (James, 2004).

Agricultural Biotech Policies in China

Field tests, environmental releases and commercialization of biotech plants are regulated in China as shown in figure 3 (Marchant and Song, 2005). In November 1993, the State Science and Technology Commission of China issued its *"Biosafety Administration Regulations on Genetic Engineering"*, which was China's first law on biosafety (Marchant, Fang, and Song, 2002). Three years later, *"Biosafety Administration Implementation Regulations on Agricultural Genetic Engineering"* was issued by the Ministry of Agriculture (MOA) of China, and took effect on the same date, July 10, 1996 (Chinese MOA, 1996).

Prior to China's accession into the World Trade Organization on December 11, 2001, the Chinese government passed its "*Biosafety Administration Regulations on Agricultural Biotech Products*," which were issued and took effect on May 23, 2001 (Chinese MOA, 2001a). These regulations provided general guidelines for the development, distribution, and use of agricultural biotech products. These regulations required a safety certificate and labeling for any agricultural biotech products from either domestic sources or imports. The Chinese MOA issued three separate implementing regulations for the above guidelines on January 5, 2002: (1) "*Biosafety Evaluation and Administration Regulations on Agricultural Biotech Products*," (2) "*Import Safety Administration Regulations on Agricultural Biotech Products*," and (3) "*Labeling Administration Regulations on Agricultural Biotech Products*" (Chinese MOA, 2001b). These new regulations placed restrictions on Chinese imports of biotech products, including those imported from the United States. The effective date for implementation was originally set for March 20, 2002.

Figure 3. History of China's Biotech Regulations



Specific rules on imports of biotech products from the above regulations included the following: (1) biotech products imported into China required test results or data obtained from in-country field experiments within the exporting country (or a third country) to prove products are safe for human consumption and do not impose biosafety risks to other plants, animals, or the environment, (2) each shipment of biotech products imported into China needs a single or separate safety certificate accompanying each shipment, (3) the Chinese Ministry of Agriculture's approval process can take up to 270 days to grant safety certificates required for imported biotech products, (4) there is a "zero" threshold level (based on qualitative test results) for biotech content in foods, and (5) decision-making should be based on demonstrated risks (bioharzards) from scientific data, whereby the expert panel should play an important role in the decision-making process.

Rules on labeling of biotech products included the following: (1) all products containing biotech content should be labeled correctly, otherwise, products are not allowed to enter unless re-labeled, (2) labeling rules are applied to the following imported biotech products: soybean seeds, soybeans, soybean flour, soymeal, soyoil, corn seeds, corn, corn oil, corn meal, rapeseed seeds, rapeseeds, rapeseed oil, rapeseed meal, cotton seeds, tomato seeds, fresh tomatoes, and tomato ketchup (tomato jam).

Before the effective date to implement these three regulations (March 20, 2002), the Chinese government delayed their implementation (Chinese MOA, 2003). Instead, the Chinese MOA issued a temporary measure, "*Temporary Administration Procedure of Import of Agricultural Biotech Products*", which allowed exporters to ship biotech products, including U.S. biotech soybeans, into China using temporary import certificates through December 20, 2002. Each temporary import certificate granted by the Chinese MOA was good for 10

shipments (Chinese MOA, 2002). After three extensions of this temporary measure, the above three regulations eventually took effect on April 20, 2004 (USDA-FAS, 2004).

Immediately after the effective date of implantation for these three regulations, China's State General Administration for Quality Supervision, Inspection and Quarantine (AQSIQ) announced a new regulation related to the administration of biotech products, "*Administrative Measures of Inspection and Quarantine on Entry-Exit of Biotech Products*", on May 24, 2004 (Chinese AQSIQ, 2004; USDA-FAS, 2004). These measures not only apply to the inspection and quarantine of biotech products via trade, but also apply to processing, research, and production. By these new measures, Chinese importers must declare whether the imported products are biotech or not when they apply for inspection and quarantine. If the products are biotech, the importers shall provide relevant documents including a safety certificate and review and approval documents needed for labeling. For biotech products, labeling is mandatory by the above implementing regulations. In addition, these measures also authorize the AQSIQ to conduct random biotech tests even if products are declared as non-biotech.

Impacts of China's Biotech Policies on U.S. Exports to China

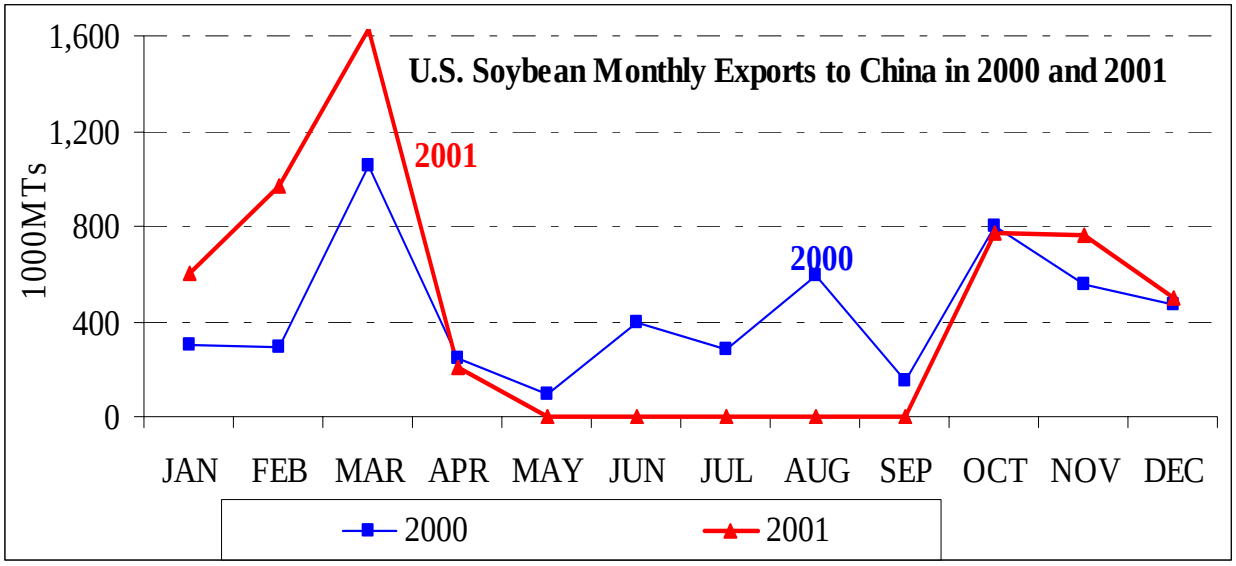
China's biotech regulations and policies did raise concern by U.S. agricultural exporters and policymakers as well as Chinese agricultural importers. Requiring safety certificates incurred additional costs and shipment delays at the initiation of these new regulations in late spring and summer 2001. In addition, these regulations have the potential to be used by the Chinese government as a non-tariff barrier to control soybean imports.

Soybeans

Figure 6 compares U.S. soybean exports to China between 2000 and 2001, pre- and post-announcement of these import regulations. After the Chinese government announced the three

biotech implementing regulations, U.S. soybean exports to China fell, especially from May to September in 2001, whereby U.S. soybean exports to China temporarily ceased. Additionally, U.S. soybean exports to China were also affected by seasonal factors, whereby China typically increases soybean imports from Brazil and Argentina during this period. However, China's soybean imports from the U.S. were zero from May to September in 2001, compared to average monthly imports of 302,000 metric tons from May to September in 2000. Besides these seasonal factors, China's biotech policies may have played an additional role in the cessation of China's soybean imports from the United States in the summer of 2001. Figures 4 implies that China's biotech regulations caused U.S. soybean exports to China to temporarily fall in the short term. However, looking back at China's soybean imports from the U.S. in table 3, it appears that these biotech regulations did not impose significant impacts on U.S. soybean exports to China in the long-run.

Figure 4. U.S. Monthly Soybean Exports to China in 2000 and 2001

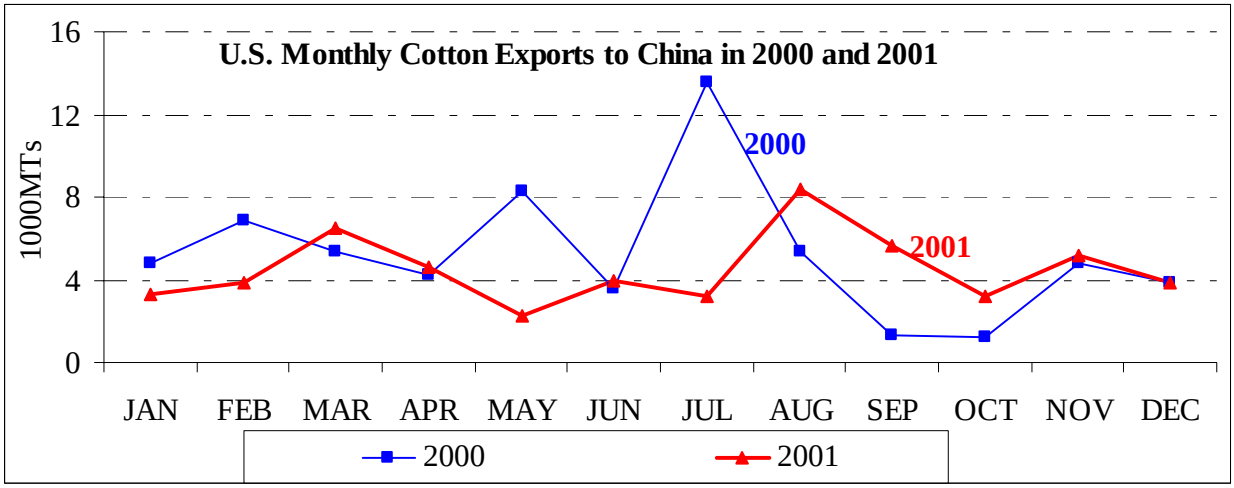


Source: USDA-FAS, 2006.

Cotton

For biotech cotton, the impact of China's biotech policies on U.S. exports differed from that of soybeans. Since cotton is not a food product, food safety issues do not apply. In addition, cotton is the main biotech commodity commercialized for sale in China. Figure 5 shows that after China announced its three implementing biotech regulations in 2001, U.S. cotton exports to China did not dramatically change. Thus, the announcement of China's biotech regulations does not appear to have had a significant impact on U.S. cotton exports to China. Figure 6 indicates that U.S. cotton exports to China dramatically increased in recent years, regardless of China's biotech policies.

Figure 5. U.S. Monthly Cotton Exports to China in 2000 and 2001



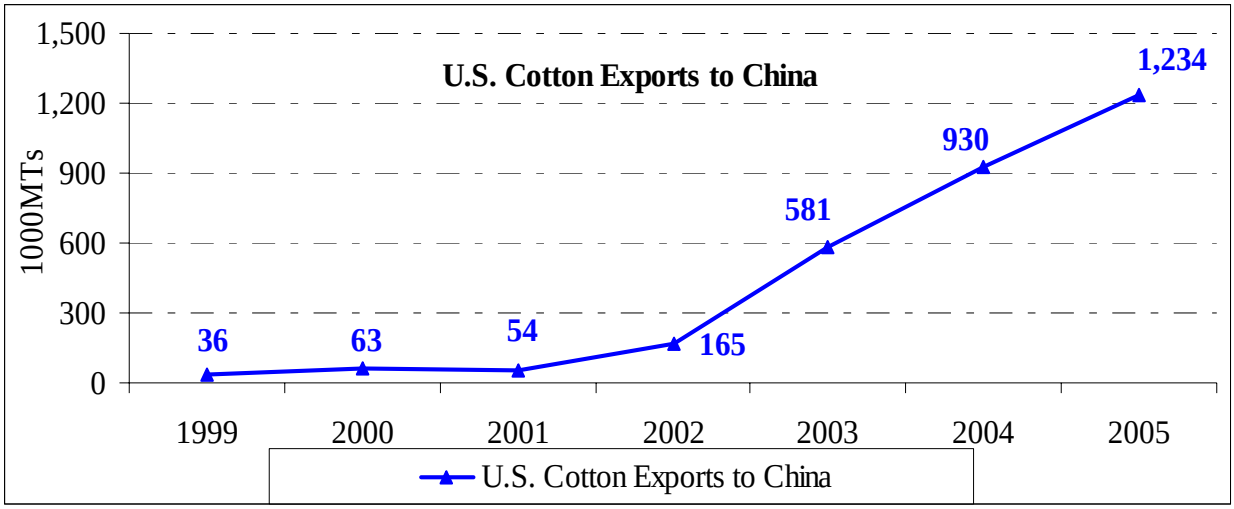
Source: USDA-FAS, 2006.

Additional Factors

To enhance U.S. exports, USDA-FAS provides a series of technical assistance, education, and outreach programs for developing countries, including China. For example, these programs give Chinese officials, policymakers, and researchers a better understanding of agricultural biotechnology in the United States (USDA-FAS, 2003). Upon China's announcement of its

import regulations in 2001, U.S. trade delegations negotiated with the Chinese government. These negotiations along with USDA's educational programs, and mutual visits played an important role in removing obstacles for U.S exports of agricultural biotech products to China.

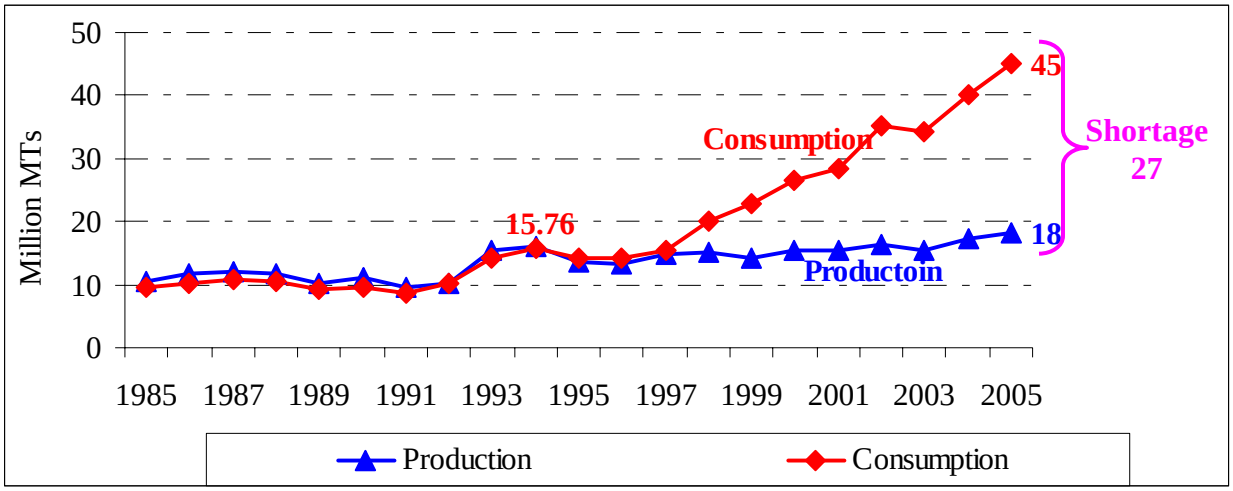
Figure 6. U.S. Cotton Exports to China from 1999 to 2005



Source: USDA-FAS, 2006.

Another key factor affecting China's biotech policies is China's domestic soybean shortage. Figure 7 shows that after 1997, China's domestic soybean demand increased dramatically, while domestic production increased slowly, creating a significant soybean shortage in China. In 2005, the soybean shortage (domestic consumption minus production) reached 27 million metric tons (USDA-FAS, 2006).

Figure 7. China's Soybean Shortage – Domestic Consumption versus Production



Source: USDA-FAS, 2006.

Figure 8. China's Soybean Production Area and Crushing Facilities

From a domestic production viewpoint, China's soybeans are produced mainly in the Northeast region (figure 8). In contrast, large crushing facilities to process soybeans into soyoil and soymeal have been recently built along coastal provinces. Most of these crushing facilities are supplied by imported soybeans. About 45% of domestic soybeans are used directly for food, and the remainder is not enough to supply expanded crushing capacities. With the rapid growth

of both Chinese consumers' income and livestock industry, China's increased demand for soyoil, used for cooking, and soymeal, used for feed, also significantly contributes to China's large soybean shortage. If the Chinese government chooses to control soybean imports through biotech policies, it might dramatically increase China's domestic soybean prices, which could eventually hurt Chinese crushers and consumers. Other factors, including food safety and environment safety considerations, protection of China's domestic producers, crushers and consumers, WTO commitments, and political reasons also play important roles in China's attitude towards biotech products (Zhong, et al., 2002).

Summary and Conclusions

China is one of the world's large producers, importers, and consumers of major agricultural commodities and has been a critical player in the international food market. In addition, China is the leading importer of both soybeans and cotton — globally and for the United States. Soybeans and cotton are among the top biotech varieties commercialized in the United States. The significance of soybean and cotton trade between the U.S. and China and the announcement of China's recent biotech regulations attracted attention from both sides, since 85% of U.S. soybean production and 76% of cotton production are biotech varieties, and China is our top export market for both commodities.

China's biotech development began in the mid-1980s and has become one of a few large countries involved in biotech research throughout the world. China's general "*Biosafety Administration Regulations on Agricultural Transgenic Products*" issued on May 23, 2001, and subsequent implementing regulations issued on January 5, 2002, had the potential to disrupt imports of U.S. biotech products into China, particularly biotech soybeans—a main food and feed product. Through USDA educational and exchange programs along with trade negotiations,

the Chinese government delayed implementing these regulations three times, which ultimately took effect on April 21, 2004. Between 2001 and 2004, the Chinese Ministry of Agriculture issued temporary import regulations allowing biotech imports into China, including U.S. biotech soybeans.

When examining the impacts of these biotech policies on U.S. agricultural exports to China, U.S. soybean export delays did occur immediately after the announcement of these three regulations in April 2001. However, in the long-run, China's biotech policies did not appear to impose a significant impact on U.S. soybean exports to China. Since cotton is not used for food consumption, food safety concerns do not apply. In addition, *Bt* cotton is currently the dominant commercialized biotech commodity in China. Viewing the data on U.S. exports of biotech cotton to China upon announcement of China's biotech regulations, it appears that China's biotech policies did not have an impact on U.S. cotton exports. In regards to China's future biotech policies, several important factors will impact the change of China's biotech regulations: food and environment safety concerns, WTO commitments, and political pressure from foreign governments and traders, as well as changes of biotech policies by other countries.

References:

Chen, Z., and L. Qu. "The Status of Agriculture Biotechnology in China." Paper presented at the 7th International Symposium on the Biosafety of Genetically Modified Organisms, Beijing China, October 2002.

Cheng, J., and Y. Peng. "Biosafety Regulation in China." Paper presented at the 7th International Symposium on the Biosafety of Genetically Modified Organisms, Beijing China, October 2002.

Chinese Ministry of Agriculture (MOA) 1996. *Biosafety Administration Implementation Regulations on Agricultural Genetic Engineering.* Beijing China, Date issued and effective: July 10, 1996. Website: http://www.biosafety.gov.cn/swaq/73192290037792768/20040109/1044833.shtml (Accessed April 2005).

Chinese MOA, (2001a). *Biosafety Administration Regulations on Agricultural Biotech Products.* Beijing China. Date passed: May 9, 2001; dated issued and effective date: May 23, 2001. Website: http://www.biosafety.gov.cn/swaq/73192290037792768/20040109/1044833.shtml (Accessed April 2005).

Chinese MOA, (2001b). *(1) Biosafety Evaluation and Administration Regulations on Agricultural Biotech Products, (2) Import Safety Administration Regulations on Agricultural Biotech Products, and (3) Labeling Administration Regulations on Agricultural Biotech Products.* Beijing China, Date passed: July 11, 2001; Date issued: January 5, 2002; Effective date: March 20, 2002. http://www.biosafety.gov.cn/swaq/73192290037792768/20040109/1044833.shtml (Accessed April 2005).

Chinese Ministry of Agriculture (MOA), 2002. "Temporary Administration Procedure of Import of Agricultural Transgenic Products." Date issued: March 10, 2002. Website: http://www.agri.gov.cn/blgg/t20021016_14351.htm. Accessed on July 2003.

Chinese Ministry of Agriculture (MOA), 2003. "MOA Announced Transgenic Temporary Regulations Extend to April 2004." July 17, 2004. Website: http://www.agri.gov.cn/analysis/asp/info/text.asp?id=11508. Accessed on July 2003.

Chinese State General Administration for Quality Supervision, Inspection and Quarantine (AQSIQ). *The Administrative Measures of Inspection and Quarantine on Entry-Exit of Biotech Products.* Beijing, China, Date issued and effective: May 24, 2004.

Food and Agricultural Organization (FAO) of the United Nations. *FAOSTAT database* (2005). Website: http://apps.fao.org/page/collections (Accessed February 2005).

Huang, J., R. Hu, C. Fan, C.E. Pray, and S. Rozelle. "*Bt* Cotton Benefits, Costs and Impacts in China," *AgBioForum, 5*(4) (2002): 122-135. Webpage: http://www.agbioforum.org (Accessed February 2005).

James, Clive. 2004. "Preview: Global Status of Commercialized Biotech/GM Crops: 2004." *International Service for the Acquisition of Agri-biotech Applications (ISAAA) Briefs No. 32.* Ithaca, NY.

James, Clive. 2005. "Executive Summary: Global Status of Commercialized Biotech/GM Crops: 2005." *International Service for the Acquisition of Agri-biotech Applications (ISAAA) Briefs No. 34.* Ithaca, NY.

Lu, Lingxiao and Zhou Yingheng. "Evaluation of the changes of Chinese Agricultural Biotech Policies." *Agricultural Economics Herald (China),* Volume No. 10, 2004.

Marchant, Mary A., and Baohui Song. "Assessment of Biotechnology Policies and International Trade in Key Markets for U.S. Agriculture." *Journal of Agricultural and Applied Economics.* 37:2(August 2005).

Marchant, M.A., C. Fang, and B. Song. "Issues on Adoption, Import Regulations, and Policies for Biotech Commodities in China with a Focus on Soybeans." *AgBioForum, 5*(4) (2002): 167-174. Website: http://www.agbioforum.org (Accessed February 2005).

Marchant, Mary A., and Francis Tuan, guest editors, *AgBioForum: The Journal of Agrobiotechnology Management and Economics.* "Special Issue: Agricultural Biotechnology in China," 2002 (178 pages).

U.S. Department of Agriculture, Economic Research Service (USDA-ERS). *Data – Adoption of Genetically Engineered Crops in the U.S.*, Washington, DC, July 13, 2005. Webpage: http://www.ers.usda.gov/Data/BiotechCrops/ (Accessed May 2006).

U.S. Department of Agriculture-Foreign Agricultural Service (USDA-FAS), *Online U.S. Trade Internet System.* Washington, DC. Website: http://www.fas.usda.gov/ustrade (Accessed May 2006).

USDA-FAS, (2004), *GAIN Report #CH4017: China, Peoples Republic of FAIRS Product Specific AQSIQ Decree No. 62 Administrative Measures of Inspection and Quarantine on Entry-Exit GM Products*. Washington, DC, June 17, 2004.

USDA-FAS, (2003). *Biotechnology and U.S. Agricultural Trade: Training and Capacity Building*. Washington, DC, November 7, 2003. Website: http://www.fas.usda.gov/itp/biotech/development.html (Accessed February 2005).

Zhong, F., M.A. Marchant, Y. Ding, and K. Lu. "GM Foods: A Nanjing Case Study of Chinese Consumers' Awareness and Potential Attitudes." *AgBioForum.* 5:4(2002):136-144. Website: http://www.agbioforum.org (Accessed February 2005).