Distribution of Benefits

Data in 1999 show that more than 80% of the benefits from *Bt* cotton went primarily to farmers. Seed developers captured at most 17% of the total benefits. *Bt* growers with small farm size and which had lower incomes obtained higher profit than large size farms and those with higher incomes. Thus, small scale farmers tend to gain more from adopting the technology. Rising yields and expanding area have also begun to bring down cotton prices, hence benefiting consumers as well.

_Bt_ cotton has had an important positive impact on Chinese cotton production and the productivity and net income of small farmers. Benefits derived include protected yield, cost savings from input and labor, higher income, and reduced negative impact on the environment and human health.

Suggested Readings

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www.isaaa.org

ISAAA
International Service for the Acquisition of Agri-biotech Applications

ISAAA *Afri*Center
c/o CIP-ILRI Campus
P.O. Box 25171
Nairobi 00603, Kenya
Tel.: +254 2 630743 · Fax: +254 2 631599; 630005
Email: africenter@isaaa.org

ISAAA *Ameri*Center
417 Bradfield Hall
Cornell University
Ithaca, NY 14853 USA
Tel.: +1 607 2551724 · Fax: +1 607 255 1215
Email: americenter@isaaa.org

ISAAA *SEAsia*Center
c/o IRRI, DAPO Box 7777
Metro Manila, Philippines
Tel.: +63 2 845 0563 · Fax: +63 2 845 0606
Email: isaaa-seasia@isaaa.org

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Bt Cotton in China

Background

China is the world's leading producer and consumer of cotton. Hence, it is an important cash crop produced mainly by small scale farmers in all areas of the country.

Cotton bollworm, a major cotton pest, causes heavy damages to cotton areas. In 1991, the China Academy of Agricultural Sciences (CAAS) started research to develop genetically modified (GM) cotton that is protected against major insect pests. This insect protected cotton contains a naturally occurring substance, a *Bacillus thuringiensis* (*Bt*) protein, which has been the active ingredient in safe and effective biological sprays for over 50 years. The first GM cotton was produced in China in 1993.

The Chinese Biosafety Committee approved the commercial use of GM cotton in 1997. To date, 22 new *Bt* cotton varieties have been produced and grown in commercial scale covering approximately 1.5 million hectares. A large share of *Bt* cotton varieties being planted by farmers were developed by public research institutions.

Over four million Chinese farmers have benefited from planting *Bt* cotton. Agricultural economists Carl Pray, Jikun Huang, Ruifa Hu and Scott Rozelle documented the impact of *Bt* cotton on small scale farmers from 1999 to 2001. They surveyed hundreds of farmers in the Yellow River cotton-growing region in northern China.

Benefits of *Bt* Cotton

Lower Pesticide Use

The greatest benefit from *Bt* cotton is reduced pesticide use (Table 1). In 1999, total pesticide reduction was about 20,000 tons of formulated pesticide. In 2001, increased area planted to *Bt* and greater savings per hectare resulted in a pesticide reduction of 78,000 tons. This accounted for about a quarter of all the pesticides sprayed in China in the mid-1990s. Over the years, *Bt* cotton varieties continue to require less pesticide. In the provinces of Henan and Anhui, where *Bt* cotton was recently introduced commercially, the mean application of pesticides was reduced by 24 to 63 kilograms per hectare.

Substantial labor savings were also obtained from reducing the number of sprays by one half to two thirds. In 2001, farmers reduced their sprays from 28 to 14. Although yields and the price of *Bt* and non-*Bt* varieties were almost the same, the savings in pesticide use enjoyed by *Bt* cotton users reduced the cost of producing a kilogram of cotton by 20% to 33%.

The reduction in the use of insecticides also caused a decline in the number of farmers who are poisoned by pesticides each year. About 22-29% of farmers who planted non-*Bt* cotton in 1999 and 2000 said that they became sick from pesticides. In contrast, only 5 to 8% of farmers who used *Bt* cotton reported getting sick from spraying pesticides.

Economic Benefits

The main economic benefit derived from the use of *Bt* cotton is the reduction in the cost of producing the crop. Farmers using *Bt* varieties spent less money on chemical inputs and labor. They saved more per hectare on seed cost because they had to use less seed unlike conventional cotton. Although the cost of seeds was greater for *Bt* varieties, this was offset by a much greater reduction in pesticide use and labor. Despite lower cotton prices in 2001, farmers were still able to obtain increased net incomes of about $500 per hectare by growing *Bt* cotton instead of non-*Bt* cotton.

Table 1. Pesticide application (kg per hectare) on *Bt* and non-Bt cotton, 1999-2001.

Year	Location	*Bt* cotton	Non-*Bt* cotton
1999	All samples	11.8	60.7
	Hebei	5.7	
	Shandong	15.3	60.7
2000	All samples	20.5	48.5
	Hebei	15.5	
	Shandong	24.5	
	Henan	18.0	48.5
2001	All samples	32.9	87.5
	Hebei	19.6	
	Shandong	21.2	
	Henan	15.2	65.9
	Anhui	62.6	119.0
	Jiangsu	41.0	47.9

Source: Carl E. Pray et al., 2002.