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Introduction

One of the most important factors determining whether or not to plant biotech cotton is the technology fee, particularly relative to potential savings on insecticide costs. A high technology fee can reduce the economic attraction of growing insect resistant biotech cotton. The Technical Information Section collected data on technology fees from various countries. There is a great variation in fees. It is also clear that the method of calculating fees is variable. An article covering Argentina, Australia, Brazil, Burkina Faso, Colombia, India and South Africa was published in the March 2009 issue of the *ICAC RECORDER*. The first article in this issue is a continuation of the same subject and deals with the technology fee for biotech cotton in China (Mainland), Mexico and USA. Time series data from Mexico was not available at the time of publication of this issue. The technology fee in the USA differs by state, and so many biotech genes have been commercialized. The third factor that makes it difficult to estimate the technology fee in the USA, even for one state, is that the fee is determined by the seed-drop rate. Some varieties have smaller seeds while others have bigger seeds, thus the technology fee cannot be the same for these two varieties. The U.S. data are for the Mississippi Delta region.

A lot has been published in the *ICAC RECORDER* on organic cotton. All the organic cotton articles can be accessed free of charge on the ICAC web at: <http://www.icac.org/cotton_info/tis/organic_cotton/documents/english.html>. Most are available in English, French and Spanish. Organic cotton production exceeded 145,000 tons in 2007/08 with India emerging as the largest producer. Seven Asian countries produced 91% of the organic cotton in the world, Africa 5% and North America only 2%. The Organic Exchange estimates that global retail sales of organic cotton products in 2008 were about US$3.2 billion. For the last few years, Organic Exchange has published annual organic cotton market reports that focus relatively little on production and more on labeling, marketing, social implications and prospects for the next two years. The second article incorporates highlights of the report from the Organic Exchange, Organic Cotton Market Report – 2008.

Three staff members from Cotton Incorporated, Cary, NC, USA have contributed the third article. Cotton Incorporated undertook a survey to gather information on cotton production practices in the USA and growers' attitude toward the environment. The questionnaire asked growers about irrigation, tillage practices, pesticide use and other practices that affect natural resources. The results show that less than 50% of cotton area in the USA is grown under irrigated conditions. 81% of the growers that grow cotton on irrigated land have improved irrigation systems. The three reasons given for irrigation improvement are to improve yields, improve water use efficiency and reduce energy use. Of all the cotton growers, 33% use conventional tillage, 82% rotate cotton with other crops, 71% maintain ground cover to reduce soil erosion, 86% use soil analysis recommendations to decide fertilizer application rates and 67% use reduced tillage practices. Similar interesting findings are reported in the field of energy use and habitat and wildlife.

Award – ICAC Cotton Researcher of the Year 2009

The ICAC decided to honor a distinguished cotton researcher each year beginning in 2009. An Award Panel consisting of five recognized experts located in at least four countries was constituted to choose the outstanding cotton researcher of the year. The Panel is anonymous and is known only to the chairman of the Panel. Applications were received from February 1 to March 31, 2009. Twelve candidates from eight countries in three disciplines breeding/production (6), plant protection (5) and biotechnology (1) applied or were nominated for the award. Members of the Award Panel selected Dr. Keshav R. Kranthi of India as the ICAC Cotton Researcher of the Year - 2009. For more details about Dr. Kranthi, see the last article in this issue.

The award will be continued, and the ICAC Secretariat will raise the profile of the award and have it recognized as the most prestigious award in the cotton community, particularly dealing with production research. Researchers will be able to apply again from February 1 to March 31, 2010 and the winner will be announced in early May 2010. For more details, visit the ICAC web page at <http://www.icac.org/tis/researcher_of_the_year/english.html>.

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Biotech Cotton and the Technology Fee

(China, Mexico and the United States)

The article on this topic published in the March 2009 issue of the *ICAC RECORDER* covered the technology fee in Argentina, Australia, Brazil, Burkina Faso, Colombia, India and South Africa. The present article deals with the remaining three countries, i.e., China (Mainland), Mexico and the USA, thus bringing our coverage up to the 10 countries that have commercialized biotech cotton so far. (Indonesia is not included because biotech cotton is no longer approved there.) Many sources, including informal contacts, were used to compile the data. Some of the data is official and much of the rest may have varying degrees of reliability.

The technology fee, varies among states, provinces and regions, but some of the following reasons may also account for diminished reliability of technology fee data:

- There are many seed companies that supply planting seed and each may have its own price.
- Companies try to keep price information confidential; this is usually considered sound business tactics.
- Six out of the ten countries growing biotech cotton commercialized it over 10 years ago, and not all of them have kept track of a series of data lines for all traits.

China (Mainland)

China put Monsanto's Bollgard® cotton into commercial production back in 1997/98. Monsanto, Delta and Pine Land Company and the Singapore Economic Development Authority formed a joint venture with Hebei Provincial Seed Company and, after approval by the Chinese Biosafety Committee, started selling DPL variety 33B in 1997. In China, commercial cotton hybrids as well as straight varieties are planted at the same time. The hybrid seed is sold in 500 gm or 350 gm packets and, on the average, farmers use about 5.25 kg seed/ha obtaining about 30,000 plants/ha. The varieties seed is planted at an average rate of 15 kg/ha, with some farmers using as little as 12.5 kg/ha and others using as much as 17.5 kg/ha, thus introducing a non-trivial difference in the technology fee per hectare.

In 1997, China was also ready with its locally developed insect resistant biotech cotton commonly called "Guokang" (CPTi-Cowpea trypsin inhibitor gene). To market "Guokang" cotton, the Chinese Academy of Agricultural Sciences (owner of the technology) had its Biotechnology Research Center form a joint venture with a real estate company based in Shenzhen (located in southern Guangdong Province) and transferred the "Guokang" cotton to it. The joint venture, called Biocentury Transgene Technology Limited, sub-licensed the technology to over 30 private and provincial seed companies in China. As a major stakeholder in the Biocentury Transgene Technology Company, the Chinese Government had a say in fixing the technology fee. The license fee was collected as a lump sum payment of US$60,000 per annum per company regardless of their sales.

There are conflicting reports about differences in the efficacy of the two types of biotech genes, and having a technology fee that was lower than the one for Bollgard was certainly a factor, but they were not the only factors that attracted farmers to Guokang; cotton producers favored a local product over a foreign one and quickly started replacing Bollgard varieties with Guokang hybrids. There was one more difference in the two types of technologies. Bollgard was sold in the form of varieties while Guokang was mainly sold as commercial cotton hybrids. This explains why hybrids are now more popular in the Yellow River Valley and the Yangtze River Valley. It is estimated that in 2003/04, each event covered almost half of the biotech cotton area in China. Guokang had replaced all Bollgard cotton by 2008/09.

Biotech cotton spread at a practically uniform rate in the Yellow and the Yangtze River Valleys. By 2006/07, most of the cotton planted in Hebei, Shandong, Jiangsu, Shanxi, Henan and Anhui provinces was biotech. Insect-resistant biotech cotton was favored in China because before the introduction of biotech cotton, resistance to insecticides had become a big problem. China was in real need of an alternative control

Price of Biotech Planting Seed in China (Mainland)

Year	Bollgard (In US$/Ha)	Guokang (In US$/Ha)	Seed Rate/Ha (Kg)	Exchange Rate/US$ (Yuan)
1997/98	45.2		15	8.3
1998/99	45.3		15	8.3
1999/00	45.3	3.6	15	8.3
2000/01	45.3	3.6	15	8.3
2001/02	45.3	3.6	15	8.3
2002/03	45.2	3.6	15	8.3
2003/04	45.2	3.6	15	8.3
2004/05	45.2	3.6	15	8.3
2005/06	45.2	3.6	15	8.3
2006/07	46.6	3.7	15	8.1
2007/08	38.6	0.2	12	7.8
2008/09	34.7	0 to 0.21	10	7.2
2009/10	36.5	0 to 0.22	10	6.9

Note: The exchange rates are for February 15 of each year, which is the high season for seed sale.

measure. China had already begun implementing its integrated pest management (IPM) plans to tackle the resistance problem, but if biotech cotton had not been introduced in China when it was, the cotton situation in the country would be very different today. So far, only the insect-resistance trait has been approved in China. There is no mandatory refuge requirement in China because the Chinese Biosafety Committee is of the opinion that thanks to the broad diversity of crops in both Valleys, other crops, like soybean and maize, play the role of refuge crops. Biotech cotton is not approved for the Northwest region.

In the beginning, Monsanto/Deltapine charged almost the same technology fee as in the USA, i.e. $45/ha or US$2.3/kg. In fact, farmers were paying not only for the Bt gene, but also for improved cultivars and seed quality (higher germination). However, because of the small-scale farming system prevalent in China, particularly in the Yellow and the Yangtze River Valleys, it was not possible for Monsanto/Deltapine to sign direct contracts with individual farmers. On the other hand, the Biocentury Transgene Technology Company liberally provided licenses to seed companies. The institution responsible for developing Guokang is also said to receive some kind of royalty payment, but it was all a government system so the situation was quite fluid. Therefore, different sources report the technology fee differently.

The technology fee was also different for official and unofficial seeds sold on the market. Due to the one-time payment of a lump sum royalty per year, the technology fee system in China became fluid affecting the Bollgard type of biotech cotton as well. The upside of the Chinese system appeared in the form of a very low technology fee, quick adoption of biotech cotton on a vast area and a quick switch-over to the local variety of biotech cotton. The table above contains the spread of mean prices as supplied by different sources. While they may not be exact, they may be expected to be close approximations.

Conventional planting seed is sold at the rate of US$7.5-8.75 per kg (60-70 Yuan or RMB per kg) for hybrids and US$.75-1.25 per kg (6-10 Yuan or RMB per kg) for pure varieties.

Mexico

According to Traxler and Godoy-Avila (2004) there are two types of producers in Mexico – *ejidos* and small landholders. The *ejido* producers or *ejidatarios* are very small producers whose holdings were formed during one of Mexico's several land reforms. The average size of *ejido* holdings is 2-10 ha and that of the small landholders, 30-100 ha. Most cotton producers are organized into farmer associations for the purpose of obtaining credit and technical assistance. There is no obligation to be a member of an association, but wherever there is an association, it has centralized accounting, management and technical staff. Within an association, a number of growers may get together to perform their field operations. In most cases, the individual landholders have relatively little involvement in the technical decision-making process, deferring to the judgments of consultants. Because of the link that the associations provide with credit providers, they serve as a very effective conduit for information about new technologies and have undoubtedly served to speed up the adoption of Bt cotton varieties.

In Mexico, the most important insect pests are pink bollworm (*Pectinophora gossypiella*), boll weevil (*Anthonomus grandis*), tobacco budworm (*Heliothis virescens*), and cotton bollworm (*Helicoverpa zea*), but fall armyworm (*Spodoptera exigua*), whitefly (*Bemisia argentifolii*), and conchuela (*Chlorochroa ligata*) also cause crop damage and require treatment in some areas. Biotech cotton was introduced from the USA in 1996/97. The biotech cotton planting seed contracts obligated farmers not only to refrain from saving seed, but also to have seedcotton ginned only at authorized gins. Monsanto contracted entomologists to supervise the farmers' compliance with biosafety standards. The contracts also allowed Monsanto free access to the area planted to cotton. Additionally, Monsanto hired entomologists during the season to make random verification checks. These representatives were equipped with field kits designed to test for the presence of the Bt gene at a minimal cost. The contractually specified penalty for selling illegal seed was 120 times the purchase price, which was high enough to prevent large-scale violations.

Monsanto's contract with ginners was another check on farmers that limited the illegal use of biotech seeds. Monsanto was able to collect seeds from gins, and gins were also obliged to open their facilities and transaction records to Monsanto for inspection. Farmers who were identified as requesting the return of the seeds after ginning were subject to field visits by Monsanto in the following season. The system worked

Price Cotton Planting Seed in Mexico – 2008/09 (US$)
(Price of 250,000 Seed Count)

Seed Type	Seed Price	Technology Fee	Total
Bollgard	85.0	90.0	175.0
Roundup Ready	85.0	110.0	195.0
Bollgard+Roundup Ready	85.0	190.0	275.0
Roundup Ready Flex	85.0	135.0	220.0
Bollgard II+Roundup Ready Flex	85.0	230.0	315.0
Conventional	85.0		85.0

well, and the illegal spread of biotech seed was kept to a minimum.

The technology fee varied greatly by growing regions (Traxler *et al.*, 2000). For example, in South Tamaulipas, the technology fee is more than three times that of South Sonora, where the budworm-bollworm complex problem is the lightest. The differential pricing strategy is based on differences in the marginal value product of Bt cotton seed caused by differences in pest pressure and seed drop rates.

Price for Bt Seed by Growing Region in Mexico – 2000/01

Region	Bt Seed Price (US$/22 kg bag)
Comarca Lagunera	105.45
Tamaulipas	179.26
North Tamaulipas	80.05
South Chihuahua	90.45
North Chihuahua	61.81
South Sonora	50.40
North Sonora	105.45
Sinaloa	59.95
Baja California	85.05

A twenty-two kilogram packet of seed contains about 250,000 seeds. The table from the previous page contains data from the 2008/09 season on the technology fee for a packet with a seed-count of about 250,000 covering various traits. The price of a bag of seed with the Roundup Ready or Roundup Ready Flex traits also included 5 liters of Roundup. The price of the seed was separate. A 250,000-seed packet is enough to plant 1.5 hectares. A bag with the same number of conventional seeds costs about US$85.

USA

In the U.S., many traits have been approved and many companies are involved in the supply of planting seed. Each company has its own technology fee for its proprietary traits, but almost all seed companies offer risk management programs. Different companies have different names for these programs, but the main objective is to provide at least some assurance in case the seed does not germinate properly or there is a heavy loss in yield due to natural disasters. So, when growers buy seed and pay the technology fee, they automatically become entitled to the company's program benefits. The risk/guarantee

programs vary by production area and also carry certain other limitations, but in general, they cover the following two contingencies:

- **Replanting** – Most companies provide free replanting seed of the same variety or of another variety of seed if the same biotech variety is not available, but this facility is exclusively for the first replant. On the other hand, some companies provide full reimbursement of seed and technology fee costs when time limitations do not allow for replanting of the crop. Some times companies will visit farms to verify that conditions actually warrant replanting, and still other companies require a minimum affected area before they will sanction replanting seed or waiver of the fee, whatever the case may be. The companies may commit exclusively to reimbursing the technology fee, but only for some types of biotech seed and not all brands. There is always a certain deadline date (that varies by production area) by which growers have to report to the seed company that they need replanting or that replanting was required but there was no time to replant.
- **Crop loss** – The crop loss options also vary by company, type of biotech variety and production region. Some companies may not offer any crop loss program at all; all of them, however, change their requirements every year. Most companies offer a 100% refund of the technology fee if there is total loss or if the average yield is below 168 kg lint per hectare. Eligibility requirements to opt for the crop loss program are stricter than they are for the replanting program. For example, growers who fail to protect their crop against pest attack are not eligible for crop loss protection.

Seed companies restrict their replanting and total loss benefits solely to their own brand varieties. The programs change from year to year and farmers are advised to be aware of the options before they buy the planting seed. Monsanto/Delta and Pine Land varieties are usually planted on over 40% of the cotton area in the U.S., and the 2009/10 Monsanto program has two options in addition to crop loss.

- **Trait Replant Refund** – If a grower replants an eligible crop containing a Monsanto trait to another eligible Monsanto trait crop, the grower gets replant protection on his initial trait investment through Roundup Rewards®.
- **Seed Replant Protection** – If a grower plants an eligible Deltapine, Asgrow or DEKALB seed and replants to another eligible Deltapine, Asgrow or DEKALB seed, the grower gets replant protection on his second crop's seed investment.

The technology fee structure has changed drastically in the U.S. It used to be based on area, but, in 2004/05 it was pegged to the seed drop rate. The seed drop rate varies by planting method: solid or skip row, rainfed or irrigated, narrow row or ultra narrow row planting, conservation tillage system, etc. Another factor, one that is even more significant, is the geographical variation in price. The price of planting seed and the technology fee in the USA vary greatly from state to state and from trait to trait. This is why this article contains data solely for the Mississippi Delta Region. There are no data available for WideStrike, WideStrike+Roundup Ready, WideStrike+Roundup Ready Flex and Bollgard II+Liberty Link, all of which are also approved for commercial production. The table on the next page indicates that the cost of conventional seed may, in some cases, be unexpectedly high and the reason is that in regions that are intensively biotech, conventional seeds tend to be scarce or even unavailable.

Other Countries

Biotech cotton is still not approved in Pakistan but spurious seeds have been around for quite a few years and occupy a significant area. However, Monsanto entered into an agreement with the Ministry of Food, Agriculture and Livestock to allow it to run official tests of biotech hybrids under Pakistani conditions. Four Bollgard II hybrids of Indian origin were tested at multiple locations during 2008/09. Furthermore, it is reported that Monsanto is currently negotiating with the Ministry to settle the technology fee issue, but despite newspaper accounts indicating that a technology fee of about US$52/ha may be in the works, at the time of publication of this report no firm agreement had been reached. Pakistan is also said to have imported a ton of biotech seed from China (Mainland) for testing at farmers fields.

In Pakistan, an average of US$100/ha are spent to control sucking insects and the target insects controlled by Bollgard II genes. Bollworms have traditionally been a great threat to cotton production in Pakistan, mainly prior to the appearance of the leaf curl virus disease in 1992/93. Currently, all commercial varieties are resistant to the leaf curl virus disease, but in the last few years a modified form of the virus called the "Burewala" strain has wreaked havoc on cotton farming. No variety has been found that is resistant to this virus and, coupled with this problem, the mealy bug has become a major pest. Effective chemical control is not yet available either against the Burewala virus or the mealy bug. The complex pest situation in Pakistan has encumbered and delayed the official introduction of biotech cotton in the country.

A number of other countries are formally testing biotech cotton under confined conditions. The countries that have completed, or are close to completing, most of the requirements for commercialization of biotech cotton are Kenya, Malawi and Uganda. (There are no indications from these countries on the question of the technology fee.) Uganda has designed a protocol to test biotech cotton, but the final decision to authorize commercial adoption has not been made yet. Uganda will undertake its first field trials in 2009/10. However, the fact that a country has initiated trials does not necessarily

Technology Fee for Biotech Cotton in the Mississippi Delta Region, USA

Year	Fee in US$										
	BXN	Bollgard	Bollgard II	RR	RR Flex	BG + RR	BG + RR Flex	BG II + RR	BG II + RR Flex	Liberty Link	Conven. Seed
1995/96		1.87/kg+74.1/ha	-	-	-	-	-		-	-	1.87/kg
1996/97		2.21/kg+79.1/ha	-	-	-	-	-		-	-	1.9/kg
1997/98		2.27/kg+79.1/ha	-	2.25/kg+NA	-		-		-	-	2.03/kg
1998/99		2.38/kg+79.1/ha	-	2.36/kg+NA	-		-		-	-	2.12/kg
1999/00		2.25/kg+79.1/ha	-	2.21/kg+22.2/ha	-		-		-	-	2.07/kg
2000/01	3.29/kg+NA	2.38/kg+79.1/ha	-	2.34/kg+22.2/ha	-	2.71/kg+101.3/ha	-		-	-	2.14/kg
2001/02	3.53/kg+NA	8.47/kg	-	4.23/kg	-	10.3/kg	-		-	-	2.29/kg
2002/03	3.57/kg+NA	8.71/kg	-	4.65/kg	-	10.76/kg	-		-	-	2.78/kg
2003/04	3.75/kg+NA	9.11/kg		5.42/kg	-	11.71/kg	-		-	-	2.98/kg
2004/05		0.87/1,000 seeds	1.01/1,000 seeds	0.63/1,000 seeds	-	1.26/1,000 seeds	-	1.41/1,000 seeds	-	0.56/1,000 seeds	0.30/1,000 seeds
2005/06		NA+0.57/1,000 sd		0.95/1,000 seeds	-	1.39/1,000 seeds	-	1.61/1,000 seeds	-	0.62/1,000 seeds	0.19/1,000 seeds
2006/07		0.28/1,000 sd+NA		0.99/1,000 seeds	1.25/1,000 seeds	1.53/1,000 seeds		NA	NA+1.38/1,000 seeds	0.62/1,000 seeds	0.18/1,000 seeds
2007/08		NA+0.28/1,000 seeds		0.98/1,000 seeds	1.27/1,000 seeds	1.55/1,000 seeds		NA	1.88/1,000 seeds	0.62/1,000 seeds	0.39/1,000 seeds
2008/09		NA		1.1/1,000 seeds	1.36/1,000 seeds	1.53/1,000 seeds	0.51/1,000 sd+NA	NA	1.9/1,000 seeds	0.62/1,000 seeds	NA

Notes:
1. Wherever there are two numbers in a cell, the first is the price of seed and second is the technology fee. One number denotes seed price+technology fee.
2. 2001/02 - maximum technology fee/ha for Bt = US$79.1, BtRR = $101.3, RR = $22.2
3. 2002/03 - maximum technology fee/ha for Bt = US$79.1, BtRR = $101.3, RR = $25.95
4. 2003/04 - maximum technology fee/ha for Bt = US$79.1, BtRR = $101.3, RR = $25.95
5. 2004/05 - maximum technology fee/ha for Bt = US$79.1, BG II =$98.8, BtRR = $106.3, BGIIRR = $126.1, RR = $35.8
6. 2005/06 - maximum technology fee/ha for Bt = US$49.4, BtRR = $121.1, BGIIRR = $135.9, RR = $69.2
7. 2006/07 - maximum technology fee/ha for Bt = US$48.2, BtRR = $121.1, BGIIRR = $138.4, RR = $71.7, RRF = $98.8, BGIIRRF = $158.1
8. 2007/08 - maximum technology fee/ha for Bt = US$48.2, BtRR = $121.1, BGIIRR = $138.4, RR = $71.7, RRF = $98.8, BGIIRRF = $158.1
9. 2008/09 - maximum technology fee/ha for Bt = US$48.2, BtRR = $121.1, BGIIRR = $138.4, RR = $71.7, RRF = $98.8, BGIIRRF = $158.1

Source: John Black, Department of Agricultural Economics, Mississippi State University, MS, USA

mean that it will commercialize biotech cotton. There have been cases where the opposite has also happened. The reasons for such a reversal can be many, but the fact is that there are some countries, such as Zimbabwe, that have their biosafety legislation in place and have completed the testing, but have not commercialized biotech cotton.

Who Reaps the Benefits?

The technology has economic benefits, but that is not the focus of this article. Benefits tend to vary greatly among growers and countries. The three primary beneficiaries of biotech cotton are: a) the technology developers (Monsanto, Dow AgroSciences, Bayer CropScience, etc); b) the seed companies (in various countries that sell biotech genes through their varieties) and c) the growers. Benefits also trickle down to consumers, but only a small proportion of the economic advantage. However, no matter how many benefits there may be along the chain, the broad-spectrum benefit, the one that is most sustainable and uniform in regard to production practices, is the elimination of multiple applications of insecticides.

References

Traxler Greg, Salvador Godoy-Avila, José Falck-Zepeda, and José deJesús Espinoza-Arellano. 2000. Transgenic Cotton in Mexico: Economic and Environmental Impacts. Available at http://infoagro.net/shared/docs/a2/Traxler.pdf.

Organic Cotton Market Report - 2008

The ICAC Secretariat has published a great deal of information on organic cotton since early 1993. Although most ICAC articles published in various issues of the *ICAC RECORDER,* are limited to the production of certified organic cotton, issues such as suitable varieties for organic production, yield loss and cost of production were also covered. Moreover, some critical issues such as agricultural limitations to successful and economical production of organic cotton were also discussed in the many articles in the *ICAC RECORDER,* which also carried continuous updates on certified organic cotton production data by country. All the organic cotton articles published by ICAC may be accessed free of charge on the web at: http://www.icac.org/cotton_info/tis/organic_cotton/documents/english.html. Most are available in English, French and Spanish.

The certified organic cotton produced in the world today still accounts for less than 1% of world cotton production, but organic cotton is nevertheless a huge industry involving everything from field operations and certification to ginning, spinning, finishing, garment production and marketing under different labels. The Organic Exchange estimates that global retail sales of organic cotton products in 2008 were about 3.2 billion US dollars. For the last few years, Organic Exchange (OE) has published yearly organic cotton market reports that focus relatively little on production and a lot more on labeling, marketing, social implications and prospects for the next two years. The present article incorporates high lights of the OE Organic Cotton Market Report – 2008. The report can be obtained, for a price, but additional information is found at http://www.organicexchange.org/

Organic Cotton Production by Country

OE production figures are slightly higher than the corresponding ICAC figures. OE pegged certified organic production in 2007/08 at 145,872 tons, just 4,309 tons more than ICAC calculations. Twenty-one countries produced organic cotton in 2007/08, almost equal numbers of them in Africa and Asia. However, since the adoption of biotech cotton in the USA over ten years ago in 1996/97, it is Asia that has been the production leader in organic cotton.

Organic Cotton Production Share by Continents

Asia	91% (7)
Africa	5% (8)
North America	2% (1)
South America	1% (4)
Europe	< 1% (1)

( ) Refers to number of countries producing organic cotton in the region

Egypt and the USA were the pioneers in the introduction of organic cotton in 1990/91. India and Turkey started producing certified organic cotton in 1992/93, along with Australia and Peru. Many more countries in different continents began producing organic cotton, and by 1995/96 the number of certified organic cotton producing countries had reached 15. In 1995/96, the US produced 64% of the 11,527 tons of organic cotton produced in the world. Since then, production in the US has declined, but in Turkey production increased steadily and ultimately exceeded 23,000 tons in 2006/07. In 2007/08 India produced 73,702 tons emerging as the top organic cotton producing country in the world. Syria produced 26,000 tons of organic cotton in 2007/08. With the exception of two other significant organic cotton producers, i.e. China (Mainland) and the USA, most other countries only produced organic cotton under projects sponsored by NGOs or governments. According to OE, some of the world's largest organic cotton producing projects include Eco Farms, Mahima, Rajeco and Vesudha in India; Mavideniz in Turkey and Syria, and BioRe Tanzania in Tanzania. Many other smaller projects exist around the world, in addition to self-initiatives by growers.

Production in 2007/08 of over 140,000 tons of organic cotton created an over-supply of organic cotton for the 2008/09 season. Some countries and projects encountered difficulties in selling their organic cotton, although most were able to sell their stocks on time. This situation might possibly affect organic production in countries like Syria. The current experience with the marketing of organic cotton has shown that producing it without secure purchase commitments prior to planting may lead to difficulties in selling the lint and getting a good price.

Organic Cotton Production (Tons of Lint)

Country	2003/04	2004/05	2005/06	2006/07	2007/08
Australia				4	
Benin	25	67	115	496	223
Brazil			17	20	82
Burkina Faso		30	150	374	436
China (Mainland)	1,601	1,870	2,532	4,079	7,354
Egypt	122	240	240	250	761
Greece				59	72
India	2,231	6,320	12,483	18,790	73,702
Israel	380	436	600	370	313
Kenya		2	6	3	
Kyrgyzstan		12	60	150	194
Malawi			4		
Mali	34	296	386	614	335
Nicaragua					65
Pakistan	400	600	1,000	271	206
Paraguay	60	34	184	238	105
Peru	404	300	1,603	2,017	1,339
Senegal	6	27	33	65	75
Spain				4	
Syria			2,667	8,185	26,000
Tanzania	600	1,213	1,336	1,662	2,852
Togo			2	1	
Turkey	11,625	10,460	14,360	23,152	21,698
Uganda	740	900	1,000	1,798	2,545
USA	1,041	1,968	2,512	1,826	3,156
Zambia			23	18	50
Total:	19,269	24,775	41,314	64,446	141,563

Source: ICAC and OE

Major Retailers and Brands

Certain companies are more determined to support the organic agriculture movement and more readily commit to adopting and promoting organic products. According to research conducted by OE, in 2008 the five companies with the largest organic cotton programs were Wal-Mart/Sam's Club (USA), C&A (Belgium), Nike (USA), H&M (Sweden) and Zara (Spain). In 2008, the top 10 companies accounted for 67% of the organic fiber produced in the world. The table below shows that there has been a change in the order, with some companies increasing their share of consumption of organic cotton.

Most of the organic cotton produced in countries around the world is not consumed locally. Many companies in different countries spin organic cotton into yarn. Some of the largest producers of organic yarn include Buhler Mills, Indorama, Parkdale Mills, Pratibha Syntex, Remei, Sanko, Shanghai Flying Dragon and Thai Alliance.

In the organic cotton industry, expansion is driven by consumer interest in environmentally friendly products sold under brand names. Thanks to growing consumer awareness about sustainable production and processing methods, interest in environmentally friendly products is increasing. The consequences of sustained use of dangerous plant protection chemicals in farming operations and their impact on the world, as a whole is better understood today than ever before. People have become sensitive to social issues and also prefer to use natural resources, such as land and water, more conservatively. But beyond mere individual awareness, many people are taking action and are ready to convince others to take action as well, and not only in the field of organic cotton production and processing.

The plant protection chemicals were introduced into agriculture after the World War II. Pesticides, in particular insecticides, were aggressively promoted in cotton because insects attack cotton more compared to other field crops. At one stage, insecticides became almost an integral component of cotton production systems. However, consequences of intensive insecticide use were quickly realized and researchers started finding ways and means to control insects with least or no insecticides. Conventional production and processing systems are more sustainable today than they were just a decade ago and, consequently, an important segment of society is steering a course between the two extremes: heavily input-dependent conventional production systems, on the one hand, and organic production systems, on the other. All cotton-producing countries are minimizing the use of insecticides and most have already made a significant progress. Unfortunately, there is some misinformation about use of insecticides on cotton. Unrealistic quantities of insecticides are quoted to be used to grow cotton while the fact is that insecticides use on cotton is on decline worldwide. Insecticides use on cotton will be further reduced in the next decade.

Most companies use special labels or brands to identify and market their organic products. The following are some of the better-known companies and their slogans:

Organic Cotton Use Initiatives by Leading Companies

Company	Slogan
Banana Republic	Look for the Green Elephant
C&A	We Care
JCPenney	Simply Green
Marks & Spencer	Plan A – Because there is no Plan B
Pottery Barn	Earth Friendly
REI	REI ecoSensitive™
Timberland	Green Index™
Woolworth South Africa	Good Business Journey
Anvil	Anvil Organic
Aratex	Aratex Organic
Greenesource (For Kohl's, Macy's, Sam' Club and Wal-Mart)	Re-Gen (recycled generation)
Nordstrom	Stem

All the above labels more or less mean the same thing: that organic cotton has been used in making the product, but the use of organic processing is not guaranteed. The Pesticide Action Network, in their online publication, My Sustainable T Shirt, available at <http://www.ccc-images.com/CATALOGUES%20in%20PDF/Other/My%20Sustainable%20T-shirt%20(English).pdf>, has very clearly defined the difference between: 1) a T-shirt made with organic cotton, and 2) an organic T-shirt. Customers quite often consider both statements to be one and the same thing, but they are actually two very different things. The common characteristic is that they are both made from 100% certified organic cotton, but the "T-shirt made with organic cotton" is not necessarily certified throughout the processing and manufacturing chain. On the other hand "an organic T-shirt" is not only made with certified organic cotton, but every step of its processing, all the way to the retail store, is organic as well.

Top Retailers Using Organic Cotton

2005	2006	2007	2008
1. Nike	1. Wal-Mart/Sam's Club	1. Wal-Mart/Sam's Club	1. Wal-Mart/Sam's Club
2. Coop Switzerland	2. Nike	2. Nike	2. C&A
3. Patagonia	3. Coop Switzerland	3. Coop Switzerland	3. Nike
4. Otto Group	4. Patagonia	4. C&A	4. H&M
5. Wal-Mart/Sam's Club	5. Otto Group	5. Woolworth's South Africa	5. Zara
			6. Anvil
			7. Coop Switzerland
			8. Pottery Barn
			9. Greensource
			10. Hess Nature
Fiber use represented by 5 companies = 39%	Fiber use represented by 5 companies = 50%	Fiber use represented by 5 companies = 48%	Fiber use represented by 10 companies = 67%

Source: OE, *Organic Cotton Market Report 2008*

Factors Affecting the Organic Product Retail Market

Organic production is still a demand-driven initiative and it has proved to be more of a marketing tool than a standalone, economically viable, production system. Farmers will continue producing organic cotton as long as there is a demand for it. Therefore, there is a pressing need to create greater demand through innovation in the retail products sold on the market. Organic products must have a distinct image distinguishing them from conventional retail products. According to OE, organic customers received enhanced offers in retail stores during 2008.

It is not only a question of the variety of products available in retail stores; media campaigns by highly environment-conscious groups have vigorously promoted organic products. The entire organic production chain, from lint production to retail sales, is strongly interlinked and understands the problems it is facing as a group. Thus, all segments of the organic cotton industry joined hands and organized trade shows, seminars and workshops in 2008. The World Congress on Organic Cotton, to be held on September 21-25, 2009 in Switzerland, is another example of a successful campaign. This initiative complements the 2009 OE Global Conference to be held in Seattle, Washington some time during the current year. The object of the conference is to establish a holistic view of the links among relevant global issues such as: the world economic crisis, the food crisis, climate change and the growing need for risk and quality management by companies and governments. One of the key questions before the conference is how to enhance long-term commitments by companies and governments for sustainability in the cotton sector instead of bandying sustainability as a fashionable short-term trend. More information about the congress can be found at <www.fashiontosustainability.org>.

Most of the drive behind the organic production and processing initiative comes from self-motivated growers and businessmen. However, government support is critical to the success of any program, and government support for the organic agriculture movement is increasing. The U.S. Government made special mention of organic agriculture in the 2008 farm bill. The Philippines Government announced on October 29, 2008 that it was launching a nationwide campaign to promote organic farming as a way to improve agricultural productivity and guarantee food security over the medium-term in response to the threat to global farm productivity posed by climate change. The Zurich Police Department in Switzerland is buying organic cotton uniforms for their police officers.

Among many other factors that are supporting the organic retail market, the initiative by retail stores to come up with innovative new models of partnerships with producer organizations and manufacturing partners is pushing the organic cotton retail market to new highs.

New Organic Standards in 2008

A group of certification bodies and other organizations have developed different sets of organic standards for agricultural products. However, they are all based on a limited number of "basic" or "minimum" standards. In Europe, for example, the basic organic standards were provided in a European Union Council Regulation issued back in 1991. In the US, organic standards are set by the US Department of Agriculture as part of the National Organic Program. All organic production standards affecting farming practices are stringent and elaborate but comparatively easy to implement compared to processing standards. The processing and manufacturing of organically produced cotton must be just as organic as the corresponding farming practices, but this is usually not the case. Some essential synthetic chemicals are still being used because economically and technically viable alternative solutions are simply not available or too expensive.

OE developed or revised two standards during 2008: 133 OE Blended Standard and 300 OE 100 Standard. The purpose of the OE Blended Standard is to ensure that organically produced cotton is being used in the percentage claimed for the product in question. However, a product can be certified only if it contains at least 5% organic cotton. If the company chooses to label the finished product as containing a *blend*, it must state: "Made with x% organically grown cotton." The "x" must specify the exact quantity of organic cotton by weight in the finished product. The Blended Standard can also be used to label cotton products "organic-in-conversion" or "transitional". In the latter case, the label would change to: "made with x% organic-in-conversion cotton." The main philosophy behind the blended standard is to enhance the market for organic cotton at little or no cost to the company that is producing the product. The OE 100 Standard was also revised in 2008, but it only certifies products produced with 100% organic cotton. Both standards are available at <http://certification.controlunion.com/certification/program/subprogram/Subprogram.aspx?Subprogram_ID=50&Program_ID=16>.

As stated before, organic cotton means certified organic cotton. Some times it is hard to tally the organic production numbers at the farm gate level with organic cotton products sales at the end use level, indicating that some cotton is falsely claimed as organic. Such practices hurt genuine producers and damage the organic cotton image. Incorrect labeling must be stopped.

Production of organic cotton at the farm level is a one-stage step. When a farmer has decided to produce certified organic cotton, he can produce it and the certifying agency can verify the authenticity of the organic operations. However, the processing of that cotton at the gin, spinning mill, weaving mill, finishing and dyeing stages would be in many hands. Certification of each operation is more complex than the corresponding farming operations. As the market for organic cotton grows, there is greater need to build confidence in the term "organic." If a cotton product has been produced using certified organic cotton and in compliance with certified

organic processing requirements, it can rightly be claimed to be organic production. However, what about a product that has been produced using certified organic cotton but the ensuing processing operations are not organic? That would be in the same category as the example mentioned above in connection with the "T-shirt made with organic cotton" and an "organic T-shirt".

OE has developed a standard to tackle that problem. The "OE 100 Standard" verifies that certified organic cotton was used to make a particular product. The OE 100 Standard allows for the use of up to 5% non-cotton content in the product and the product may still be labeled as meeting the OE 100 Standard. However, the OE 100 Standard can also be applied to various components of a product. Thus, the OE 100 Standard may be used for tracking and documenting the purchase, handling and use of 100% certified organic cotton fiber in yarns, fabrics and finished goods. Like the 133 OE Blended Standard, OE 100 can also be used for cotton in transition or organic-in-conversion.

OE Essential Guide to Certification

OE has developed guidelines that are not limited to OE standards but are useful for all voluntary standards. The primary objective is to ensure the integrity of claims made by producers, processors or retailers. Higher confidence in organic labeling ensures higher income for all segments of the industry and also adds to the viability of the organic cotton industry. According to OE, the three most important considerations about organic certification are the following:

- Ensure that you are meeting the applicable labeling laws of the country of sale;
- Ensure that the fiber has been certified to the appropriate standard – fiber certification is mandatory, but production certification is voluntary; and
- Verify whatever claim you are making about your product.

The first step in the certification process is to understand the requirements of the importing country or the country where the goods are to be sold. Although not true for every country, certain countries, like the US, do have their own certification standards that must be adhered to. In the US, the Department of Agriculture has specific requirements under the National Organic Program to certify a product as organic. The OE Guide to Labeling Organic Textile Products provides information on requirements both for farming standards and labeling laws.

The certification standards followed at the farm or at the mill must be realistic and acknowledged by all producers. Full Product Certification certifies that not only the cotton, but also all processing steps, from the raw cotton to the finished product, are also organic. The Global Organic Textile Standard issued by the International Association Natural Textile Industry in Germany is one example of such standards. The aim of the Global Organic Textile Standards is to define requirements for ensuring the organic status of textiles from harvesting of the raw materials, through environmentally and socially responsible manufacturing, and up to labeling in order to provide credible assurance to the end consumer. This standard for organic textiles covers production, processing, manufacturing, packaging, labeling, exportation, importation and distribution of all natural fibers. The final products may include, but are not limited to, cotton products, yarns, fabrics and clothes. The final products that are produced and manufactured in compliance with all the compulsory criteria defined in these standards may be labeled "Global Organic Textile Standard." Like the OE standard, the Global Organic Textile Standard also permits the use of the in-conversion label.

More details on the Global Organic Textile Standard, including general requirements for chemicals, banned chemicals and restricted inputs at mills, waste water treatment, etc., may be found at <http://www.global-standard.org>. The Fiber Flow Certification ensures that the cotton used in processing originated in a certified organic farming process. OE 100 or OE Blend may apply to the cotton used, depending on the percentage of certified organic cotton used in processing.

Verification has no established standards to be observed, but if the need arises, certified organic cotton production must be traceable all the way back to the farm. It is also important to have similar assurances that each supplier has taken the necessary steps to protect the identity and integrity of the organic cotton. This can be done manually, but it is very complex and time consuming. OE has established an Online Tracking Service that is easy to use and capable of tracking and verifying all processes. Any standard can be used, but there is a possibility that more than one company may be involved in the certification process. This is particularly true in the case of full product certification. If more than one company is involved, each company must demand valid documentation from the preceding company or companies, attesting to the fact that they are accredited to the standard claimed. Proper documentation is another area that should be as strict as certification and verification.

Correct documentation is also a strong confidence-building factor in organic production, processing and sales at the retail level. According to OE, there are two types of certificates: farm or company certificates (also known as scope certificates) and transaction certificates. Some times the supplier of organic cotton or an organic cotton product can only provide

a company certificate showing that the company is certified to a given standard. Such a company certificate would show that the company is qualified to produce products to that standard, but it does not mean that the product or products they are producing are certified organic to that standard.

Many companies may be dealing with organic as well as conventional production. This means that the company certificate only proves its entitlement to produce a given standard of organic production. The transaction certificate, which is issued for each shipment or sale, is the key document needed to ensure that the products being sold or bought were produced adhering to the designated standard. If the organically produced raw material has gone through certain processing stages, for example, if the organic cotton was ginned, spun, woven and sewn, the transaction certificate should be provided by the last seller, whether it is a retailer or one of several possible downstream segments of the industry. The buying party can always contact the certifier, not only to verify that they are authorized to certify, but also to make certain that they did, in fact, certify a particular product or production.

Other Organic Natural Fibers

Organic wool is the second most widely used natural fiber after organic cotton. For wool to be certified organic in the USA, the US Department of Agriculture requires that the animal be fed organic feed and forage from the last third of gestation, and that it be raised without the use of synthetic hormones or chemical dips. Although not a requirement for certification, organic livestock producers ensure that they do not exceed the natural carrying capacity of the land on which the animals graze. A number of companies introduced new organic products in 2008. That same year a Scottish yarn spinner, Todd & Duncan, launched a range of organic cashmere yarns and planned to have 10-15% of their cashmere labeled organic by the end of 2008. The company target is to increase organic cashmere's share to 25% of the overall cashmere business. The company is also taking steps to become certified to the Global Organic Textile Standard.

China (Mainland) is the largest producer of linen that is produced from flax. Belarus, France and Russia produce flax on about 75,000 hectares every year. Many European countries produce flax on some area. However, in 2008, organic flax was grown in Belgium, China, France, Germany, The Netherlands and Turkey. Linen can be spun wet or dry, depending upon the quality of the yarn to be produced. Wet spinning of long fibers produces a yarn that is used in clothing and household linen. Many companies introduced new organic linen products and styles in 2008.

Hemp is mostly grown without chemical inputs. Hemp's quick growth characteristic and planting with ultra-narrow row spacing allows the plant to cover the ground quickly, thus avoiding weed growth. Insecticide and fungicide requirements, if any, are also minimal, as are fertilizer needs. China produced organic hemp for the first time in 2006, although in very limited quantities. Organic hemp products available online would seem to indicate that certified organic hemp has also been produced in Mongolia.

China produced certified organic bamboo in 2008. The Organic Crop Improvement Association (OCIA International) certified the crop.

According to OE, Switzerland-based Alkena gained organic certification for silk production in China, and today it is the only such operation in the world. The company received processing certification in 2007. Alkena doubled its sales in 2007 and 2008. Organic silk underwear, baby and children's wear, basics, women's outer garments, and knitted and woven fabrics are sold by Alkena stores in Europe and Japan. The mulberry silkworm, which is actually a caterpillar, produces the best silk in the form of an enclosed cocoon. The caterpillar has to be killed inside the cocoon to harvest silk; otherwise, it will destroy the cocoon to get out of it.

Production and Market Prospects in 2009 and 2010

OE expects that the major retailers dealing in organic cotton products will continue their plans to enhance the use of organic cotton in spite of the difficult economic situation in the world. It is expected that organic product sales will reach about 4 billion US dollars in 2009 and 5.3 billion US dollars in 2010. OE has developed three possible scenarios for production prospects in 2009 and 2010. Based on previous performance over many years, OE expects production to grow at a rate of 50% over the next two years. This might be possible only if a large number of farmers grow organic cotton without end-of-harvest contracts. However, OE does not support such a move and recommends entering into the relevant contracts before planting organic cotton. OE does not support uncommitted production because organic production is such a small market that even a few thousand extra tons of organic cotton production might lead to an over supply in the market place. Nevertheless, if it did happen, organic production could reach 175,000 tons in 2009 and 193,000 tons in 2010.

In the second scenario, OE estimates that organic production may increase by only 10% per year during the next two years. This scenario assumes that all organic cotton will be produced under contracts signed before the harvest. If this were the situation, organic cotton production would decline to 128,000 tons in 2009, but would recover to the 2008 level in 2010. The third scenario assumes that organic cotton production may decline by 10% from 2007/08 to 105,000 tons in 2009 and then recover to 116,000 tons in 2010.

US Cotton Growers Respond to Natural Resource Survey

Janet N. Reed, Edward M. Barnes and Kater D. Hake, Cotton Incorporated, Cary, NC, USA

Introduction

In late summer and fall of 2008 Cotton Incorporated USA, with assistance from the Cotton Board, National Cotton Council, and OrgWide Services, conducted a Natural Resource Survey to gather information on U.S. production practices and grower attitudes about the environment. The online survey consisted of 77 questions and was divided into two sections. In the first part, the growers were asked to respond to general questions about water and soil management practices (irrigation practices, crop rotation, soil erosion, soil health, fertilizer, tillage practices), pests and weeds, precision agriculture, energy, and wildlife and habitat. In the second part growers answered questions about a specific field that represented their predominant yield and production practice.

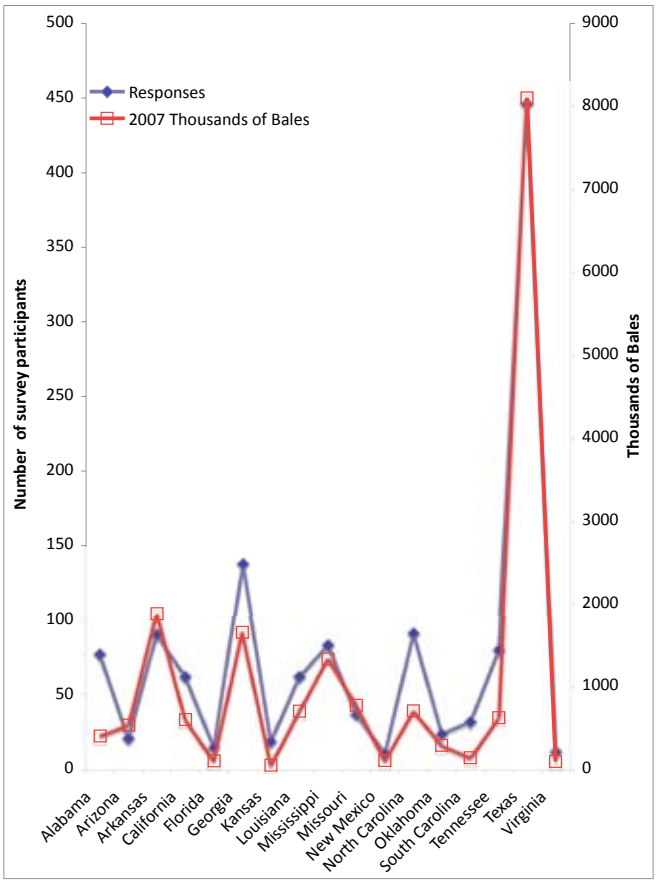
The primary objectives of the survey were to 1) Provide an enhanced data set to capture current successes and provide new information for the global cotton industry; 2) Establish a benchmark to monitor current and future trends in the sustainability of cotton production practices; and 3) Improve U.S. cotton by identifying areas of greatest need for additional research. A secondary objective was to elevate the discussion among producers and other agricultural leaders regarding the long-term sustainability of U.S. cotton and cotton production in general.

Participation in the survey was high with over 1,300 valid responses representing 16% of U.S. cotton area and 0.7 million hectares of rotational crops. The robustness of the survey made it possible to analyze regional production practices as well as those of individual States (Table 1). The geographic distribution of survey participation correlates closely to USDA's 2007 cotton production distribution (Figure 1).

In cotton production, the United States adopts new technologies that drive environmental and economic improvements. U.S.-based cotton research and implementation is a vital catalyst for advancing the global cotton industry. Innovations and technologies that improve cotton production ultimately find their way into the global arena. Biotech plant varieties, integrated pest management (IPM) strategies, conservation tillage, precision farming, and water optimization strategies are examples of some of the technologies with U.S. origins that have contributed to cotton's environmental gains over the last 13 years.

This article highlights the findings of the Natural Resource Survey (NRS) and cotton's progress in reducing its impact on water, soil, energy, and habitat.

Figure 1: Geographic Distribution of Survey Participation and 2007 U.S. Cotton Production



(Source: USDA)

Table 1: Regional Distribution of Natural Resource Survey Respondents and Cotton Area Farmed by Survey Respondents

	Far West	Southwest	Mid-South	Southeast	Total
Valid Responses	106	477	352	370	**1,305**
Cotton Area (1000's)	124	559	428	272	**1,383**

Results

Water

Water consumption for cotton production is often misunderstood. Cotton is a drought-tolerant plant and can prosper in high salt soils. These attributes enable cotton to be grown in areas where it is often not feasible to grow any other crop. And while a harvestable crop of cotton is possible from an annual supply of only 250 millimeters of water, supplemental irrigation as for most crops ensures a consistently high yielding crop. Irrigation water is used in cotton production throughout the world but the amount and distribution varies widely depending on region, climate, available technologies and governmental policies. In the U.S., rainfall supplies most of the water needed to grow a good cotton crop. According to the 2007 USDA Census of Agriculture <http://www.agcensus.usda.gov/>, 64% of U.S. cotton area is grown without irrigation and rely solely on rainfall. The remaining 36% of cotton area under irrigation is grown using the most advanced irrigation systems that growers can afford.

Although abundant yields of high quality cotton are a primary goal of U.S. cotton growers, water-use efficiency -growing more using less water - is a common sense priority for them, as well. The survey shows that 72% of U.S. cotton growers list an adequate water supply as one of their top five concerns. This helps explain why 81% of the cotton growers who do use supplemental irrigation upgraded their irrigation systems within the last 10 years. The survey also showed that growers are moving away from surface irrigation systems (where leaching and non-uniformity of water application are a greater challenge) to the more uniform sprinkler systems. These include highly efficient technologies such as subsurface drip irrigation (SDI), and Low Energy Precision Application (LEPA). SDI is a system, which as the name describes, delivers water via underground tubes where it is not subject to evaporation (the photo below shows drip lines that were recently installed). LEPA is also energy efficient since it requires less pressurization and the water is delivered precisely to the base of the plant where it's needed. These and other irrigation systems are made further efficient by various kinds of sensing or application technologies such as water-saving nozzles, soil moisture probes, or infrared leaf thermometers that detect when a plant is becoming water-stressed, in which case, the plants are only watered on an as-needed basis. Remarkably since 2002, cotton areas being grown under the more efficient drip irrigation methods increased by 400%. The greatest adoption of drip irrigation has been in the western states where water is most limited (Table 2). The Far West still uses a significant amount of surface irrigation; however, in this region the fields have been precisely leveled to increase the uniformity of water applied.

Based on yield, irrigation and rainfall data collected as part of the field specific part of the survey, these improved technologies and practices account for a 20% increase in irrigation water use efficiency since the 1990's.

Figure 3: Type of Irrigation and Percent Adoption by U.S. Cotton Growers

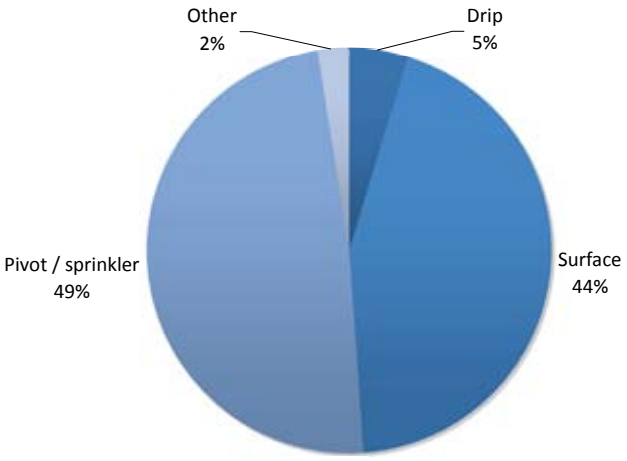


Figure 2. Drip Irrigation Lines Recently Installed in a Texas Cotton Field

(Photo Courtesy of James Bordovsky, Texas A&M)

Figure 4: Conversion to More Efficient Irrigation Systems is Evident from the Steady Decline in Percent of Irrigated Cotton Area that Rely on Surface Irrigation

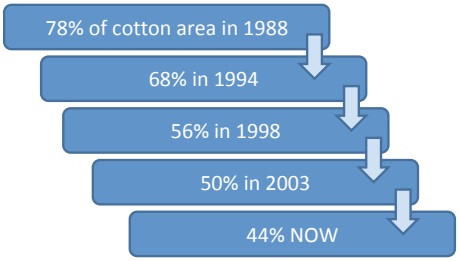


Table 2: Irrigation System by Region and Percentage Use by Growers

	Far West	Southwest	Mid-South	Southeast
Percent irrigated	87	41	56	21
Percent Sprinkler	12	73	42	99
LEPA	2	64	11	19
Percent Drip	8	8	1	0
Manage Tail Water	77	38	36	2

Soil

Topsoil depth and soil quality are integral to cotton producers' livelihoods. U.S. growers recognize that preserving soil resources is paramount as evidenced by the survey responses. One key technique in maintaining soil quality is conservation tillage, a practice that leaves plant residues on the soil surface for erosion control and moisture conservation. Of the U.S. cotton producers responding to the survey, more than two-thirds have adopted some form of conservation tillage with the greatest adoption occurring over the past decade. The survey shows that:

- 67% use reduced tillage practices
- 82% rotate cotton with other crops, which also helps prevent disease buildup.
- 71% maintain ground and surface cover to reduce erosion
- 86% use soil test recommendations to set fertilizer rates and reduce inputs
- Crop rotation is a common practice

Figure 5: Conservation Tillage Field – Cotton Planted Directly into a Wheat Cover Crop

- These management practices are having a positive impact on soil quality (Fig.7)

Wildlife Habitat

Biotech cotton varieties with enhanced pest-resistance are allowing growers in countries like India and China (Mainland) to increase yields, while decreasing pesticide applications and lowering their environmental impact (Brookes and Barfoot 2008). In the U.S. as well, biotech cotton has been responsible for a significant reduction in pesticide usage. According to the survey, 75% of U.S. growers have reduced their use of pesticide by 40% (or more) compared with 10 years ago. And most farms (94%) employ beneficial insects as part of their Integrated Pest Management program (Table 3). When insecticides are used, they are not applied to all cotton area. In fact, the survey found that 44% of U.S. farms did not even require foliar insecticides on some fields and remarkably, 29% of U.S. cotton area were not treated at all.

In addition to a vested interest in the environmental health of their own farms, U.S. cotton growers are also concerned with the effects of cotton farming on local wildlife. The good news is that modern farming practices have contributed to a more robust biodiversity in and around cotton farms. In fact, high percentages of U.S. growers report that the wildlife, beneficial

Figure 6: Percentage of Growers Practicing Crop Rotation and the Top Five Rotational Crops by Region

Far West 91%	Southwest 76%	Mid South 77%	Southeast 90%
•Alfalfa •Wheat •Vegetables •Orchards •corn	•Wheat •Sorghum •Corn •Pasture •Native Vegetation	•Soybeans •Corn •Wheat •Rice •Sorghum	•Soybeans •Corn •Peanuts •Wheat • Native Vegetation

Figure 7: Percentage of U.S. Growers Reporting Improved Soil Characteristics on their Farms

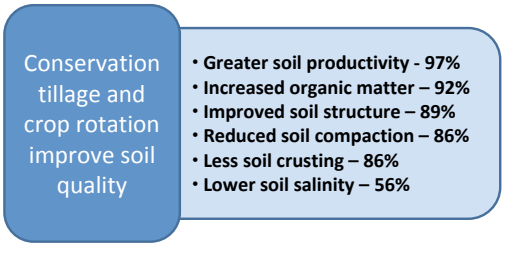


Table 3: Insecticide Use Practices and Percent Adoption by U.S. Cotton Producers

	Far West	Southwest	Mid-South	Southeast
Mode of Action rotation	85	76	92	85
Beneficial insects	98	94	92	91
Avoid sensitive areas	93	84	88	87

Table 4: Wildlife Habitat

Compared to 10 years ago have you noticed any changes to wildlife on and around your farm?

	Agree	Not Sure	Disagree
Bird population increased	61%	26%	13%
Bird diversity increased	48%	41%	12%
Beneficial insects increased	62%	30%	8%
Wildlife increased (deer, beavers, porcupines, frogs, rabbits, foxes)	78%	16%	6%

insects, bird populations and diversity of bird species have increased over the past ten years (Table 4).

Energy

Previous studies show that cottonseed contains twice the amount of energy needed to grow the fiber. Using coefficients from West and Marland (2002), survey results indicated nitrogen fertilizer production and irrigation water pumping are the largest energy consumers in cotton production.

Both water use efficiency (WUE: lbs of fiber per inch of irrigation water) and nitrogen use efficiency (NUE: lbs of fiber per pound of N fertilizer) vary across the U.S. WUE increases from West to East following rainfall gradients, while NUE is more variable likely due to the greater number of variables influencing residual soil nitrogen (Table 5).

Based on these results, Cotton Incorporated will continue its support of research to evaluate every technology available to improve water and nitrogen use efficiency. For example, efforts are underway to refine nitrogen recommendations through a nationally coordinated study started in 2009, and progress is being made to use equipment mounted sensors to detect cotton's nitrogen needs and then apply the fertilizer accordingly. Other examples include studies to screen for more drought tolerant cotton varieties and development of improved crop

Figure 8: Where energy is used in producing cotton

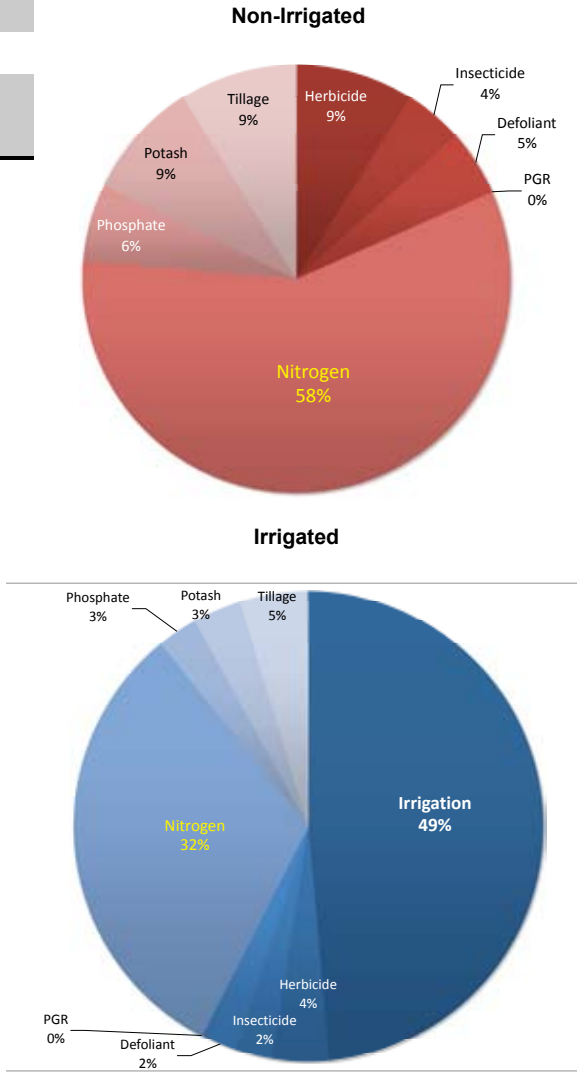


Table 5: Water Use Efficiency and Nitrogen Use Efficiency in Cotton Production Across the U.S.

	Far West	Southwest	Mid-South	Southeast
Water Use Efficiency (pounds of lint per inch water)	46	58	63	68
Nitrogen Use Efficiency (pounds of lint per pound of N applied)*	25	32	23	37

* NUE of this table does not include estimates of residual N in the soil or N from cover crops, as this information was not recorded in the survey.

coefficients that will lead to more accurate predictions of cotton's water needs to improve irrigation scheduling tools.

Grower Concerns

Other needs were identified in the survey by ranking the top grower concerns. The top concern was not a surprise; in recent years a number of weeds have developed herbicide tolerance and have complicated weed management strategies in many parts of the U.S. Cotton Incorporated has been working with weed scientists around the country to develop region-specific best management practices to help address this concern (Burgos *et al*., 2006) and growers are actively engaged in managing herbicide resistance on their farms (Table 6).

Perhaps it is not surprising that producers willing to participate in a natural resource survey are concerned about consumer attitudes, and this may reflect some producers' frustration that the tremendous gains they have made in minimizing their environmental footprint over the last ten years have not been acknowledged by the popular press. It is interesting that the two energy intensive operations identified from analysis of the field specific data were also listed in the top five grower concerns – water and nitrogen. The concern of insecticide resistance may be indirectly related to the top concern of weed resistance. Growers experiencing loss of herbicide efficacy may be reminded that without continued stewardship of integrated pest management strategies, they could face similar issues in preventing insect damage in their fields in the future as well.

Figure 9: Top Five Grower Concerns

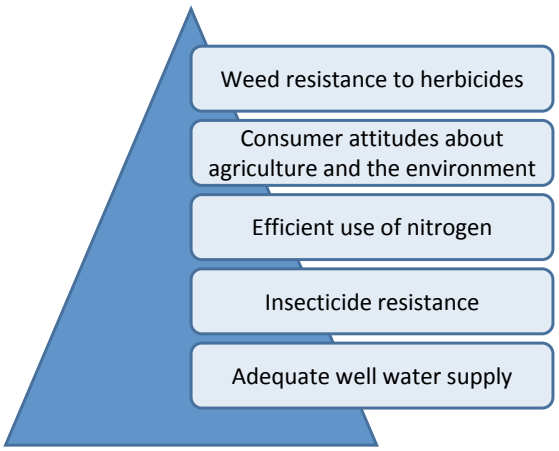


Table 6: Practices to Manage Herbicide Tolerant Weeds and Percent Adoption by U.S. Cotton Producers

	Far West	Southwest	Mid-South	Southeast
Check for escapes	76	69	81	79
Pre-emergent herbicides	63	71	67	74
Rotate herbicides	47	54	65	72
Cover crops	6	21	16	48
Cultivate escapes	67	58	31	27

Summary

The Natural Resource Survey shows that U.S. cotton growers care about the environment and are making responsible investments and decisions regarding use of the world's natural resources. U.S. cotton growers are innovative and dedicated to continually finding ways to increase efficiency and yield. The technological and environmental gains made by cotton growers over the last 10 years are evidence that cotton can effectively meet or exceed the future demands of the world's growing population while also safeguarding precious natural resources. Results from this survey have been useful in identifying issues that will challenge U.S. cotton producers in the future, including the need to maximize water and nitrogen use efficiency.

References

Brookes, G. and Peter Barfoot. 2008. Global impact of biotech crops: socio-economic and environmental effects, 1996-2006. *AgBioForum*, 11(1): 21-38.

Burgos, N., S. Culpepper, P. Dotray, J. Kendig, J. Wilcut and R. Nichols. 2006. Managing Herbicide Resistance in Cotton Cropping Systems. Cotton Incorporated. http://www.cottoninc.com/Agronomy/ManagingHerbicideResistance/ManagingHerbicideResistance.pdf

West, Tristram O. and Gregg Marland. 2002. A synthesis of carbon sequestration, carbon emissions, and net carbon flux in agriculture: comparing tillage practices in the United States. *Agriculture, Ecosystems and Environment* 91:217–232.

ICAC Cotton Researcher of the Year 2009

ICAC is proud to announce the first winner of the ICAC Cotton Research of the Year 2009. Dr. Keshav R. Kranthi of India will be honored with a trophy, certificate and honorarium at teh 68th Plenary Meeting of the ICAC to be held in Cape Town, South Africa from September 7-11, 2009.

Dr. Keshav Raj Kranthi
Central Institute for Cotton Research
PB.No.2, Shankarnagar PO
Nagpur. INDIA 440 010
Tel. No.: 91-7103-275549
Fax No.: 91-7103-275529
E-mail: krkranthi@gmail.com
Date of Birth: 26th February 1963
Education: Ph.D. (Entomology), Indian Agricultural Research Institute, New Delhi

Dr. Keshav R. Kranthi is an entomologist by training and currently works as Acting Director of the Central Institute for Cotton Research, Nagpur, India. The Central Institute for Cotton Research belongs to the Indian Council of Agricultural Research and is the leading institute on cotton research in India. Dr. Kranthi is 46 years old and has been working at the Institute since 1992. He has handled 17 externally funded projects as the principal investigator. He has also worked as a Principal Investigator on one of the CFC/ICAC projects located in China (Mainland), India, Pakistan and the UK.

Dr. Kranthi is recognized for his work in India and has received many national awards. He developed an extensive database on bollworm resistance to insecticides and Bt-toxins; he discovered the mechanisms of resistance; developed stochastic models and insect resistance management strategies (IRM) that benefitted small holders and reduced insecticide use in India. Dr. Kranthi developed several diagnostic kits to detect Bt-cotton, insecticide resistant insects and sub-standard insecticides. He developed easy-to-use field kits to detect Bt-crops. The kits were commercialized and contributed directly to the reduction in spurious Bt-cotton seed in India.

68th Plenary Meeting
of the
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The theme will be:

"*The Role of Cotton in Economic Development and Ensuring Food Security During a Period of Global Economic Crisis*"

Topics during Plenary and Open Sessions will include:

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- **Cotton By-Products and Value Addition**
- **Outlook for Supply, Demand and Prices of Cotton and Inputs**
- **Overcoming Impediments to Progress in Multilateral Trade Negotiations**
- **Technical Seminar: "Biosafety Regulations, Implementation and Consumer Acceptance"**
- **The Impacts of Social and Environmental Standards on Demand for Cotton and Textiles**

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Phone #	**(202) 463 66 60**
Email	**plenaryinformation@icac.org**