EFFECTS OF CHANGING COTTON TECHNOLOGY
ON U. S. COTTON PRODUCTION

by

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In listening to the report just given on the U.S. and World Cotton Outlook, there is no doubt that there are many challenges for the cotton industry as well as to the rest of agriculture. With world fiber production capacity outstripping demand, we are once again reminded to look at the fundamentals of how we can continue to be the most reliable supplier of high quality cotton for markets around the world. Over the past year the National Cotton Council president has carried the banner for new cost saving technologies. However, we were quickly reminded by our farmers that they already are doing everything possible with existing tools. We also were reminded that margins are getting tighter and tighter. These factors strengthened our resolve to develop and adapt new cost cutting technologies.

I am one of those who believes that there are opportunities for additional efficiencies provided we continue a strong research focus. I believe we can keep the U.S. cotton industry as the premier competitor for fiber markets around the world.

Most are well aware of the promotional efforts led by Cotton Incorporated and strategies to increase export demand led by Cotton Council International. But while we are working collectively to increase market and consumer demand (and, by the way, demand for cotton apparel and home furnishings has never been higher), we are reminded to work on our margins. Textile mills are being squeezed by apparel and home furnishings retailers due to excess retail shelf capacity. In turn, prices paid for raw fiber are low and indeed in many cases barely more than the cost of production. Fundamental economics dictate that textile mills must make a profit in order to purchase cotton, and producers must have incentives to supply the raw materials.

For a farmer, cost can be affected two ways -- increase yield or decrease cost. Better yet, do both at once.

Can we really expect technology to help us reduce cost? I am one of those who believes we can. As we look for new opportunities, I think it is appropriate to first look at some of today’s tools that at one time seemed impossible.

A Backward Look
Take labor, for example. At the end of World War II, 175 man-hours of labor were required to produce a bale of cotton. In 1996, LSU economists reported only 3 man-hours per bale.

In 1950, spindle pickers harvested only about 5% of the U.S. crop. It took 12 years before the industry moved to the 50% level. But interestingly enough, it took 150 years from the time the cotton gin was invented to the time we started using mechanical pickers. The point is that the time of creation of an idea to commercialization is narrowing.

In 1958, researchers at New Mexico State University investigated a concept of baling seed cotton. A far-out idea at the time. Researchers were foreseeing the time that we would have a bottleneck at the cotton gin as mechanical improvements in harvesting evolved. By 1997 modules were used on about 75% of the U.S. crop.

Insect management control  DDT was the first really broad spectrum insecticide, being introduced around World War II. But by 1972 bollworms were so resistant to DDT that the chemical was no longer effective. Later, along came pyrethroid technology, an effective tool which we first began to investigate in the early seventies. The importance of pyrethroids is nearly legend.

Weed control  Prior to the 1960’s, cold steel in the form of the cultivator sweep and the hoe were the “chemicals” of choice. Treflan, one of the first effective grass control herbicides for cotton, was commercially introduced in 1964, and what a dramatic breakthrough! In 1998 we have access to over-the-top broadleaf herbicides and use of cotton plants that have been genetically engineered to make them tolerant to materials such as Roundup. Buctril also will be available once EPA approves a tolerance.

Areawide insect management  Prior to 1978, areawide boll weevil eradication was a term many talked about, but had a hard time believing. But starting with a trial in 1978 the concept was proved, and by 1995 the Southeastern U.S. returned to cotton. Acreage now has nearly quadrupled to over 3.0 million acres. Most of that turnaround can be attributed to boll weevil eradication.

U.S. yields  In the early fifties, beltwide yield averages were about 350 lbs./acre. By the nineties the 5-year average is almost 650 lbs., and in 1997, yields were over 730 lbs. per acre nationwide.

Biotechnology  Ten years ago many people thought biotechnology at best was an interesting and curious phenomenon in the laboratory. But in 1997 the U.S. planted about one-fourth of its crop in transgenic cotton -- Bt, BXN, and Roundup Ready varieties, to be specific.

So what have we learned from this backward look -- from visions in reverse? First, I think we can agree that there was not one single silver bullet. Second, there have been many incremental
improvements and most technologies which we take for granted today were hard to imagine before they were developed. Third, based on our past experience, we will be depending more and more on integration of many components of chemistry, engineering, and computer technologies into a well focused, efficient management system.

Now back to the future! What are the future technologies that we anticipate being major contributors to our industry?

**Computer technology**  We hear a lot about precision agriculture, especially with computers being more powerful and less costly than ever before. One of our technical staff made the observation that the average automobile from Detroit today has more electronic computing capacity than that of the lunar landing module in 1965. We heard a recent report on NPR that something like 37% of all households in the U.S. have personal computers, and I would venture to say that among us in this room today the percentage is much greater. Adaptation of computers on farms for communications, data collection and risk management are accelerating, and in our organization the internet is a major tool of communication. We are now hosting a peer reviewed Scientific Journal available only electronically.

**Conventional plant breeding**  No one should discount the role of conventional plant breeding as it will continue to be extremely important. Our industry will insist on strong conventional breeding programs to serve in concert with new plant biotechnologies. With focus and resources, we should expect varieties to continue to improve from 1-2% genetic yield potential per year, as they have historically. Breeding is essential to genetic diversity to assure that all varieties are not first cousins of one another.

**Transgenic cottons**  We’ve heard about Bt and its toxicity to bollworms. But what about other transgenes for boll weevil, plant bugs, and aphids? Our information tells us that those transgenic technologies could be available. Disease and nematodes are costing the cotton industry nearly a half billion dollars a year. The potential for cutting those losses through genetic engineering exists but may again require public involvement.

**Transgenic yield improvements**  What about yield increases through transgenic technologies? We understand yield is not controlled by a single gene and is complex. Nevertheless, cotton scientists are looking for breakthroughs that will provide significant new levels in yield -- even more so than the 1-2% we should expect from conventional breeding. Additionally, we should expect improvements through better ripening, uniform maturing, and earlier fruit setting. We may need a plant to set fruit earlier and be picked in the middle of August rather than in September or October when harvest conditions begin to deteriorate. The cost of development and return to the seed breeder may be the greatest deterrent to these technologies. There may be a growing role for the public sector in these areas of high risk, low return (to private company).

**Chemical technology**  Chemical technology has been very important to the success of this industry and it will continue to be. Targeted, more selective and safer insecticides are being
developed and tested. Most of the new materials are soft on beneficial insects which is a plus. But, unfortunately, increasing regulations and cost of registration are pushing the cost of new chemistry to the point we can barely afford it.

Fiber quality Fiber quality is more important now than ever as the competition for market heats up. Our recent experience in improving length by more than 15% in the past 15 years is a great success story. Can we do more? Can we match the strength of polyester? Perhaps we can. For example, a technical paper was presented at our conferences last year that scientists have developed a polyester-like polymer which is included in the cotton fiber itself. This is a far-out finding and a long way from commercial use. But it’s an example of the type of value-added traits that genetic engineering offers.

Engineering systems One of cotton’s bottlenecks is with the harvester. We plant cotton in a week, but sometimes it takes a month or longer to harvest. As in Georgia right now, there are fields of 1997 cotton that were never harvested. This research is taking on a new focus and there is good evidence that equipment manufacturers are actively addressing this bottleneck.

Sensors Existing technology can be used to develop electronic recognition systems to determine the difference in the shape of a cotton leaf from that of a weed. This will allow targeted spray applications. Consider the savings when we apply the chemical only on the targeted plant and not the ground and cotton in the vicinity. While this seems to be a far-out idea, it is my understanding that the basic technology exists in weapons and defense systems. While this space-age technology at today’s cost is expensive, it may have opportunities for agricultural applications. Perhaps a modern version of “swords to plowshares.”

Cultivators are being integrated with sensor technology so that unwanted plants are removed mechanically. We have seen demonstrations of weeds between adjacent cotton plants being removed. This can be done 6 rows at a time at 6 mph.

Precision agriculture The fundamental principle of precision farming is that site specific information will provide us with ways to manage within-field variability. Our foundation funded one project last year that showed more than a 100% variation in different parts of the field, even though from the turnrow the field appeared uniform. Precision agriculture is one of the things that will help us understand what is going on in that field and when and how to take action.

What are the requirements or characteristics of new technology? Understanding that technology will cost something, the first requirement is that it must be profitable. We can’t continue to simply swap dollars. Many cotton farmers have reason to believe that commercial developers of new chemistry, genetics or equipment must allow more of the benefits to accrue to the farmer. Finally, a very important requirement is that technology must be user friendly. Too often new ideas are so complex that they can’t be used.
Summary  In conclusion, we know that technology has been good to agriculture and to the public at large. We have a good track record and have a commitment to continue. But it requires that we maintain our focus on the objective -- profitability. With the understanding that new technologies mentioned above could potentially decrease our production costs by as much as 10 cents a pound, we have a target. But it won’t happen without a concerted effort to support the public research community, strengthen our own research and educational programs, and build partnerships with our allied industries.