A LOOK TO THE FUTURE AND WHAT IT HOLDS FOR NEW COTTON PRODUCTION SYSTEMS

Andrew G. Jordan
National Cotton Council
Memphis, TN

In his opening address, National Cotton Council President Tom Smith outlined the challenges the cotton industry has ahead -- challenges of new competition, challenges of risk management, and challenges of improved production efficiencies. It is the third challenge I want to address this morning. We are reminded that as we discuss the need for improved efficiency that we are likely to generate a response saying it is impossible to reduce unit costs any further and that we are doing everything we can. Indeed, we are doing everything we can with the current technology. But I am one of those who believes that if we continue the research focus that this industry is so well noted for, then we will have new technologies.

Competition is the watchword. Competition traditionally revolves around three factors: First, maintaining a quality that the customer wants; second, maintaining strong marketing programs -- marketing programs such as the promotional efforts led by Cotton Incorporated and the strategies to increase export demand led by Cotton Council International with the Cotton USA Advantage -- and third, that of price, or more importantly, margins. Better margins improve industry profitability. Textile mills are being squeezed to very thin margins, and in turn producer prices also are caught. Fundamentally, the mills must make a profit in order to purchase cotton, and producers must have incentives to supply the raw materials.

These market forces point to the fact that we must continue to maintain our quest toward reducing unit production cost. Unit cost, as we see it, is defined as the cost of producing a pound of cotton. We can affect cost two ways. We can increase yield by keeping the cost the same, or we can decrease cost while maintaining yield. Or more importantly, do both at the same time.

Can we really expect technology to help us reduce cost? I am one of those who believe we can. As we examine new technologies, I think it is appropriate to first look back at some of today's technologies that at one time seemed impossible. Take labor, for example. At the end of World War II, 175 man-hours of labor were required to produce a bale of cotton. This was from the time a farmer began to break land to the time cotton was put in the sack. In 1996, LSU economic statistics for cotton production budgets reported only 3 man-hours labor per bale of cotton -- a tremendous improvement.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:18-19 (1997)
National Cotton Council, Memphis TN

Next, look at harvesting. In 1950 spindle pickers were harvesting only about 5% of the crop. It took 12 years before the industry moved to the 50% level. Remember, it took 150 years from the time the cotton gin was invented to the time we started using mechanical pickers. But one of the points I'm making here is that time is narrowing from the time of testing a new idea to the time of implementation and commercialization.

In 1958 researchers at New Mexico State University were investigating a concept of baling seed cotton. A far-out idea at the time -- baling seed cotton. Researchers could foresee the time that we would have a bottleneck at the cotton gin as mechanical improvements in harvesting evolved. By 1987 modules were used on 50% of the crop and now about 75%.

Insect management control DDT was the first really broad spectrum insecticide. It came on strong around World War II. But by 1972 bollworms were so resistant to DDT that it was no longer effective. Later, along came pyrethroid technology, a tremendous tool which we first began to investigate in the early Seventies. The effectiveness of the pyrethroids and how well they've served us is nearly legend.

Weed control Can you imagine growing cotton without chemical grass control? Prior to the 1960's, cold steel in the form of the sweep and the hoe were the "chemicals" of choice. Treflan was commercially introduced in 1964. What a dramatic breakthrough! By 1996 we have access to over-the-top broadleaf control herbicides. Staple is one of those. The BXN system is another, and soon we'll have Roundup-ready cotton.

Areawide insect management Prior to 1978, areawide boll weevil eradication was a term a lot of people talked about. Most didn't believe it could happen. But it did happen starting with a trial in 1978. Now look at the effect. By 1995 the Southeast acreage had quadrupled to something like 3.4 million acres. Something was going on there and much is to be attributed to boll weevil eradication.

US yields In the early Fifties, beltwide yield averages were something like 350 lbs./acre. By the Nineties we are looking at a 5-year average of almost 650 lbs. We've just heard the reports in 1996, 730-plus per acre, nationwide. Something is going on.

Biotechnology Ten years ago many people thought biotechnology at best was an interesting and curious phenomenon in the laboratory. But in 1996 the US was pushing 2 million acres of transgenic cotton -- Bt, BXN, and various seed increases for other technologies.

So what have we learned from the backward look at visions -- from visions in reverse? I think we can agree that there was no one, single, silver bullet. Furthermore, I don't think we can predict we'll have a silver bullet in the future. There have been many technological improvements and my

previous vignettes just touched on a few. But the industry has enjoyed dozens, perhaps hundreds of technological improvements, most of which were hard to conceive before they were developed. Another factor I think is certain: We will be depending more and more on **integration** of many components. Earlier, Will McCarty used the term integrated crop management, and indeed, I think he's right on target. Our challenge is to integrate new technical components, including genetics, chemistry, engineering, and computer technologies into a well focused, efficient management system.

Let's examine a few of these technologies that will be integrated.

Computer technology We heard a report on precision agriculture at The Cotton Foundation annual meeting back in the spring with computers being more powerful and less costly than ever before, the observation was made that the average automobile from Detroit today has more computing capacity than that of the lunar landing module in 1965. I heard a report last week on NPR that something like 37% of all households in the US today have personal computers, and I would venture to say that among us in this room today the percentage is even greater. I would further guess that you're already using computers on your farms, in your homes for communications, for data collection and manipulation.

Conventional breeding The role of conventional breeding will continue to be extremely important. I believe our industry will insist on strong conventional breeding progress. If we have the proper focus and resources, we should expect varieties to improve something like 1-2% genetic potential in yield increases per year. Conventional breeding is essential to broaden genetic diversity, and breeding with a diverse parentage is the only way we can make sure that all varieties are not first cousins to one another. Breeding for host plant resistance is another area. We heard earlier today in Terry Wheeler's report how important nematode resistance can be. Nematodes -- a growing multi-million dollar problem across the Belt.

Transgenic cottons We've heard about Bt and its toxicity to bollworms. But what about boll weevil, plant bugs, and aphids? My information tells me that those transgenic technologies are available. It is a matter of refining those, making a decision, and putting those into commercially adaptable varieties.

Transgenic resistance to diseases Disease and nematodes are costing the cotton industry something like a half billion dollars a year. Is there potential for cutting those losses? Yes, the potential is there. It is a matter of focus, a matter of putting effort behind it, a matter of delivery.

We talked earlier about herbicide tolerance through transgenics. Then what about yield increases through transgenic technologies? We're hoping to find new 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, earlier fruit setting. What if we could set this fruit earlier, hold it, and be picking in the middle of August rather than in September or October when the weather starts breaking up?

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. (I'm using the term safer insecticides because that is a terminology used in Washington.) These will indeed be softer on beneficial insects.

Fiber quality We have the potential to make quantum leaps in strength. Can we match the strength of polyester? Perhaps we can. For example, at last year's Beltwide Cotton Conferences, one of the technical session papers reported on a polyester-like polymer being included in the cotton fiber itself.

Engineering systems My prediction is that we will begin to remove the bottleneck at the harvester. We can plant the cotton in a week, but sometimes it takes a month to get it out of the field. That is an anomaly. This has been a research need reported in our research focus meetings and there is a high likelihood that equipment manufacturers will address this bottleneck.

Sensors Existing technology can be used to develop recognition systems to determine the difference in the shape of a leaf of a pigweed or a cocklebur from a cotton plant. This will allow targeted spray applications. Consider the savings if 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. Perhaps a modern version of "swords to plowshares."

Precision cultivators Cultivators can be integrated with sensor technology so that unwanted plants can be removed mechanically. Last summer I attended a field demonstration in an Arizona cotton field where morningglory seedlings in the middle of the drill between two cotton plants were removed. This was done 6 rows at the time at 6 mph while the driver was purposely weaving the tractor in the rows.

Precision agriculture The fundamental principle of precision farming is that this technology will provide us with ways to manage within-field variability. This slide screen shows a map of a 100-acre cotton field. Juan Landivar took this data last year. The dark area represents lint yield in the neighborhood of 600-plus pounds per acre. The light area represents less than 300 lbs. per acre. Here

in one field, the variation is more than 100%. From the turnrow, this 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.

There's a similar application with the sorghum field across the road. Less than 2,000 lbs. per acre in one part and more than 4,000 in others. Tying all these things together through computer technology, global positioning, integration of data, and putting that down to the square foot in the field will be a powerful tool.

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 simply swap dollars. If you as a farmer, or as a textile mill, cannot turn a profit, then new technology is not helping. Another requirement is that it should help us in production risk management. New technology should have a natural fit into the whole system. Finally, a very important requirement is that it must be user friendly. Too often new ideas are so complex that they can't be used.

Cost cutting opportunities What are the potentials for precision applications? I don't have time to go into details here, but some of us looked at the budgets for cotton production across the US and selected certain components of the budget to make some assumptions. The assumption was that precision applications could give us some improvements in fertilizer management, weed management, labor and insecticide usage. Based on this, we might be able to find 7-1/2 cents per pound efficiency in precision applications.

Pests are major impediments to efficient cotton production. If we can reduce pest losses simply by one-third, we could find another 7-1/2 cents per pound on-average across the country. This could be done with one or more of several approaches including areawide management programs, new chemistry, new biology, and better information.

Genetic improvements If we can extrapolate recent history, then we could find 1-1/2% annual yield increase. In ten years that represents another 7-1/2 cents per pound. All told in these hypothetical areas, we might identify 20 cents per pound. Again, it's not going to come for free. It is going to cost something. But the net-net may be as much as 10 cents per pound.

How do we realize this potential? Let's learn from the past. Let's look backward and copy past successes. Job One has been for the industry to be together, have a vision with a blueprint backed by a policy and action plan strongly supported by research. Where these criteria were met, the industry has been successful.

Is it optimistic? Yes, highly so! Is it impossible? I don't think so.