Impacts of Farm Policy and Technological Change on U.S. and California Agriculture

The Cotton Sector

A reprint from the proceedings of the June 1986 symposium sponsored by the University of California Agricultural Issues Center.
This is a selection from the complete proceedings of a symposium sponsored by the University of California Agricultural Issues Center in June, 1986. This excerpt has been printed for the convenience of those who are particularly interested in the cotton sector—one of the three agricultural major industries discussed in depth at the symposium.

The complete volume is available from the Agricultural Issues Center, University of California, Davis, California 95616. (Price: $20) It is titled, *Impacts of Farm Policy and Technological Change on U.S. and California Agriculture*. It covers these topics:

Section I — A Look Ahead at U.S. and World Agriculture  
Section II — Modeling Policy Scenarios  
Section III — Responding to Changes in the Political, Economic and Technological Environment: Three Major California Commodity Groups  
Section IV — Interrelations of Government Programs and California Agriculture  
Section V — Institutional Response to Changes in Agriculture

In addition, a summary report of the symposium is available without charge from the Agricultural Issues Center at the University of California, Davis.
INTRODUCTION

Harold O. Carter

In the past 15 years, U.S. agriculture has experienced unparalleled highs and catastrophic lows. In the early 1970s, as a result of the worldwide vagaries of weather and economic policies, the "food crisis" emerged to replace the "farm problem"; some said the change was permanent. The emphasis of U.S. agricultural policy shifted from supply management to the encouragement of all-out production to meet rapidly expanding export markets. Agricultural prices surged in 1973 and 1974 to new highs, further reinforcing the belief that the "golden years" for farmers had returned. Indeed, aside from some occasional dips, export markets and general farm prices continued strong throughout the decade of the 1970s.

The "ride" crested in the early 1980s as a world recession hit. Export markets seemed to dissolve almost overnight. Farm prices and incomes, as well as land values, tilted downward precipitously. Unfortunately, the 1981 farm bill was enacted on the presumptions that the previous decade of excess demand would continue and that inflation was the only major culprit to hedge against. Target prices were set at unrealistically high levels, giving growers strong incentives to produce more, even as markets were dwindling. Support prices were ratcheted up year by year to offset anticipated inflation growth that didn't materialize.

Entering the second half of the 1980s, agriculture continues to grapple with excess productive capacity, shrinking overseas markets, and a serious financial credit crisis.

The purpose of the Agricultural Issues Center's first symposium, which is in part presented here, was to analyze and discuss the long-term impacts on U.S. and California agriculture of all these economic and structural changes—considered within the policy environment of the recently enacted 1985 Food Security Act and Farm Credit amendment acts. The major participants at the symposium were drawn from government, universities, and agribusiness.
Agricultural Issues Center Director

HAROLD O. CARTER, Director, UC Agricultural Issues Center, and Professor, Department of Agricultural Economics, University of California, Davis.

A faculty member at UC Davis since 1958, Dr. Carter was chair of the department from 1970 to 1976. He has been visiting professor at the Agricultural College of Sweden, the University of Naples, and the University of Sydney, and Senior Scholar at the International Institute of Applied Systems Analysis, Austria. He was elected Fellow of the American Agricultural Economics Association. He has served as chair of the UC World Food Taskforce, as senior staff economist of the President’s Council of Economic Advisers, and as co-director of the Economics project of the UC-Egypt program. His B.S. and M.S. are from Michigan State University; his Ph.D. is from Iowa State University.
The Cotton Sector

M. DEAN ETHRIDGE, Director of Economic Services, National Cotton Council of America, Memphis, Tennessee.

Dr. Ethridge grew up on a cotton and grain-sorghum farm on the Texas High Plains. After receiving his B.S. from Texas Tech University and his M.S. and Ph.D. degrees from the University of California, Berkeley, he held research-teaching positions at the University of Georgia and at Texas A&M and conducted agricultural development work in South America. His professional emphasis has been in the areas of production/marketing efficiency and forecasting. His applied research focus has been on the raw cotton industry. He joined the National Cotton Council in 1981.

ROBERT S. FIRCH, Professor, Department of Agricultural Economics, University of Arizona.

Dr. Firch was born in rural Illinois. He lived and worked on a fruit and dairy farm in central California before enrolling at the University of California, Davis, where he was graduated in agricultural economics. His M.S. is from Purdue University and his Ph.D. from the University of Chicago. He joined the Department of Agricultural Economics in 1962 where his research has focused on the marketing and pricing of cotton. He serves as an advisory member of the Board of Directors of the Arizona Cotton Growers Association. He presents an extension program entitled Futures Markets and Cotton Marketing Strategies.

GRAYDON E. NICHOLS, Farm Operator, Nichols Farms, Inc., Kings and Tulare counties, and Victoria Island Farms, San Joaquin County, California.

On these two family owned and operated business farms, Mr. Nichols has a diversified crop mix, including cotton, beets, alfalfa, grain, almonds, and vegetables. Mr. Nichols is a registered engineer in California with a degree in civil engineering from UC Berkeley; he also has a plant science degree from UC Davis. He is director of the Western Cotton Growers Association, on the executive committee of Ranchers Cotton Oil, president of County Line Cotton Gin, and trustee of the UC Davis Foundation.

LAWRENCE F. PRESTON, Sr. Vice President and General Manager of Conti-Cotton.

Mr. Preston was born and raised in England where he served a three-year apprenticeship with the Liverpool Cotton Association. For four years he served as assistant manager and chief cotton classifier of the Liverpool Uganda Cotton Company in Kampala, Uganda. Then, for Ralli Bros. & Coney Ltd., he was personal assistant to the directors in Liverpool; managing director of Khartoum Cotton Company Ltd., Sudan; area sales manager for South East Asia in Liverpool; director with responsibility for development in Turkey, Afghanistan, the United States, and Central America; deputy managing
director at Liverool; and chair and chief executive officer based in Fresno, California, with responsibilities for the United States, Central and South America. Mr. Preston joined Conti-Cotton in 1981. In addition, Mr. Preston has held the following appointments: director, Ralli Bros., Ltd., London; president, Liverpool Cotton Association; chair of the Committee for International Cooperation between Cotton Associations; president, Western Cotton Shippers Association.

TOM W. SMITH, President, Cal-Cot, Ltd., Bakersfield, California.

Mr. Smith is regarded as a ranking authority on cotton marketing. He joined Cal-Cot in 1957, serving in various capacities, including field representative, sales analyst, operations analyst, corporate secretary, vice president, and executive vice president, becoming president in 1977. A graduate of Texas A&M University in agricultural economics, he also completed advanced studies at Harvard Business School in management and development. Mr. Smith has been active in industry affairs having served as chair of Cotton Council International; he is currently director and vice president of Amcot, vice president of the National Cotton Council, and a member of the Board of Managers of the New York Cotton Exchange.
THE COTTON SECTOR

Tom W. Smith and Kevin L. McDermott

Abstract

U.S. cotton production is more than adequate due in part to record yields. Demand prospects are split between the rebounding domestic textile situation and a complete collapse of export demand. World production fell in 1985-86, but stocks continue to weigh heavily on the market. Among causes of the current situation are the strong dollar, record yields, Chinese incentives, high target prices, the PIK program, and El Nino.

There was no simple, quick solution to the surplus of cotton, but the 1985 Food Security Act dealt with the problem by a gradual lowering of price support loan rates and target prices and by mandating competitiveness on world markets. Thus, while the bill makes a transition to a more market-oriented approach, due to its late passage, the impact will be more noticeable in the future than in the 1986 marketing year. Nearly all U.S. cotton farmers will participate in this program, reducing production by 22 percent. In the long term, the farm bill will reduce farm subsidies in all countries. But it will make prices more volatile. We have had price supports for over 50 years. While the safety net for the producer has been retained, prices will float to market-clearing levels. In 1986-87, both U.S. and world carryovers will be reduced, but stocks will remain sufficient.

Our industry faces both structural and technological change. There is consolidation in all industry sectors except (apparently) farming, for, due to payments limitations, the average farm size is decreasing. Technological changes include new spinning techniques and high volume instrument classing.

Introduction

By now we all are familiar with the advertising campaign by Cotton Incorporated, "Once you get a feel for cotton, you won't feel like anything
else." While for consumers this is true, American farmers were not sure that they felt like growing cotton when they looked at the long-term prospects for the cotton market before the passage of the recent farm bill. However, the Food Security Act of 1985 and changes in monetary policy have contributed to restoring the feeling to cotton growers. With a program that assures we will be competitive in world markets, cotton will continue as a major crop for American farmers.

We will examine the long-term prospect in the cotton sector, including some changes anticipated in our industry. To set the stage, it is important to note where we are today. For cotton producers, this is not a pretty subject, but it is important to know where we are before we determine where we are going. After reviewing our current surpluses, we examine the causes of this surplus. The 1985 farm bill was a major change in farm policy and will alleviate some of the problems in our industry. While not a perfect solution, we think its long-term impact will be to reduce cotton planting worldwide. Having commented on the implications of our new legislation, we look at some trends in the cotton market that will affect our long-term prospects. It is important to examine some of our current assumptions about the structure of our industry because it is likely that technological change may alter some of the relationships that we rely on today. After both a short- and long-run look at the cotton industry we believe that you will agree that cotton will remain a vital part of American agriculture.

Present State of the Industry

U.S. Supply and Demand, 1985-86

In the 1985-86 season we saw acreage decline 4 percent, yet record yields of 630 pounds per harvested acre caused production to increase by 400,000 bales to 13.4 million (Table 1). After remaining stagnant for nearly 20 years, it appears that average yields have broken out, setting records in four of the last six years. With a 4.1-million bale carryover, the total supply of American cotton was up nearly 1.8 million bales over the previous season to 17.5. While this increase would normally account for a fall in prices, it was not the major story this year. Instead it was the extremely weak demand that caught all the attention.

The demand outlook was divided between a rebounding domestic textile situation and a complete collapse of export demand. U.S. mills saw their usage increase to 6.4 million bales—the highest level since 1979. Among the factors contributing to this increase was a steadier U.S. dollar which allowed domestic mills to share in the U.S. economic recovery. Also cotton was able to gain market share against synthetic fibers with attractive prices. Cotton increased from less than 63 percent of the cotton system spindles a year ago
Table 1. U.S. Supply and Demand

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to over 65 percent this season. This alone accounted for a 300,000-bale increase in usage.

While there was a glimmer of optimism about the increased demand domestically, exports fell to their lowest level since 1947. At 2.1 million bales, exports will only reach one-third of last year’s level. While indeed U.S. cotton found itself priced out of competition most of the year, sometimes as much as 25 cents above world prices, it was more a reflection of a reduced foreign production/consumption deficit that caused exports to fall. Typically the United States has been the residual supplier, so exports have been determined by this deficit. Foreign producers tend to sell their crop regardless of price. This season the difference between foreign production and consumption, excluding China, was 2.2 million bales. With the lower expected prices for cotton after August 1, some countries are postponing their purchases. This will cause a reduction in foreign stocks which suggests that U.S. exports will only reach 2.1 million bales. Although shipments have already exceeded 1.9 million, commitments are about 2.2 million.

Total offtake of cotton in the United States fell to 8.5 million bales—the lowest level since 1895. Indeed prices reflected this lack of demand as they traded most of the season at or below the price support loan levels. Carryover stocks increased by nearly 5 million bales to 9.0 million. This was the first time since the 1960s that stocks reached such a level: They were greater than total demand for the season.

World Supply and Demand, 1985-86

Many people have focused on the large world carryover stock levels. Indeed, beginning stocks at over 42 million bales were equivalent to over 7 months of consumption. However, most of the increase in stocks occurred in China (Table 2). Stocks in China increased from about 3 million bales in 1983 to nearly 20 million at the start of the season. At the same time stocks in the rest of the foreign world increased from 14 to 18 million bales. While the
Table 2. World Supply and Demand

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<td>United States</td>
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<td>China</td>
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The psychological impact of the large carryover is undeniable; we must realize that much of the stocks in China were extremely low grades of cotton, in many cases not even able to be spun in textile mills. While the carryover is still more than sufficient, it would not take a large change in production to alleviate the surplus of higher quality cotton.

In examining world production of cotton we need to break the world into two parts. After looking at production prospects in the rest of the foreign world, we will discuss the surge in production by China. Despite acreage reduction programs in the United States and low U.S. cotton prices, production has remained high in most foreign countries. In many cases this was the result of the strong U.S. dollar that provided a subsidy to foreign producers.

An example is Australia where farmers perceived between 1984 and 1985 an 11 percent increase in price compared to a 26 percent decline for U.S. growers (Table 3). As a result, production of Australian cotton went from 450,000 bales in 1980 to over 1.1 million last year. For the current season in the Northern Hemisphere, where plantings occurred before the complete collapse of prices and the correction in the dollar, production rose by nearly 1.5 million bales. However, the Southern Hemisphere, responding to lower prices and weather problems, reduced production nearly 25 percent or 2 million bales. Overall production of foreign countries stayed high at 45.4 million bales.
In China the story began in 1978 when their government adopted a capitalist idea— incentive-based agriculture. They learned something U.S. farmers have known for a long time: Given proper incentives, farmers can produce all the cotton needed. Based upon a contract responsibility system, the grower would contract with the government to produce cotton at a specified price. Not only were peasants allowed to keep any profit but they were paid a bonus for exceeding the established yield, quite a contrast to the U.S. farm program that penalizes growers for higher yields.

This incentive, that in many cases paid the Chinese farmer the equivalent of over $1 per pound, caused a 50 percent increase in acreage and over a doubling of yields. Production increased from 10 million bales in 1979 to nearly 29 million in 1984. Having underestimated the ability of farmers to respond to incentives, the Chinese government, for probably the first time, faced the problem of dealing with surpluses. They lowered the prices paid farmers and put a ceiling on total procurement. When combined with a less perfect growing season, production in China fell in 1985-86 to 19.1 million bales, a 9.6 million bale decline. That is the same decline the United States would experience if all cotton production ceased except for California and Arizona.

Consumption worldwide continued to increase at an annual rate over the last decade of 1.2 million bales per year. This rate of growth has accelerated in the last few years with the lower cotton prices and stronger world economy. In fact during the last five years consumption has grown by 1.7 million bales per year. Besides the continued growth in population, changing consumer preferences are a primary reason for this growth.

China is on the verge of a major increase in consumption based upon the impact of the household responsibility system. As the Chinese peasants saw their incomes rise with this system, their first response was that it would not last. After it was in place several years, housing was their first priority. Now that the system has been in place for a number of years, the Chinese are beginning to increase purchase of consumer items, particularly textiles as evidenced by a major surge in retail sales. Domestic consumption of cotton has shared in this development, with consumption increasing by 2 million bales this past season.
Overall world use of cotton now stands at 72.8 million bales, still about 5 million bales below production this past season. This implies that stocks, already large, continued to grow this year. As a residual supplier most of the increase occurred in the United States.

Causes of the Current Situation

While it is impossible to identify everything that has contributed to the surplus production of cotton, several factors need to be examined to understand how cotton farmers may recover from the current low prices.

USSR embargo. While many people do not include this in their list of causes, we believe that the major impact of the Russian embargo was to raise questions about our reliability as a supplier. In addition, the embargo caused prices for crops that compete for land with cotton to fall. This made cotton more attractive to plant contributing to the surplus production.

Strong Dollar. At a time when American producers saw prices fall to unattractive levels, foreign producers were still increasing their acreage. For example, Australia expanded production dramatically. To American producers the strong dollar had a second negative impact: increased textile imports. The result of the strong dollar was a shift from U.S. to foreign mills. While the American consumer continued to demand cotton, much of that demand was filled by foreign products. Since only 20 percent of the cotton in textile products imported into the United States comes from U.S. cotton, this meant that American growers were losing nearly 80 percent of their market. The strong dollar was the result of a conscious policy by our government to control inflation. We believe that the government has now finally realized that the only long-term solution is to control the federal deficit and that they cannot force farmers and import-sensitive industries to bear the entire burden of solving our country’s fiscal problems. However, we do not look for an instant solution to the additional land and facilities in foreign countries that were brought into production by the strong-dollar policy. At least the correction in the dollar has stopped the expansion in foreign production.

Record Crops. Surpluses in nearly all crops developed as much from the unusual occurrence of several excellent growing seasons in a row as from national policies that stimulated production. With the exception of the Payment-in-Kind (PlK) season, growing conditions worldwide have been extremely favorable in the 1980s.

Recession. When record crops are combined with a recession, the effect is magnified. Agriculture managed to produce the best crop when society had the least ability to absorb it.

Chinese Policy. We have already discussed the adoption by the Chinese of a capitalist tool: incentives. If anyone ever doubted the capitalist system, China has proved it to be alive and well. However this surge in production came when the world already had the ability to meet the anticipated shortfall in China. China went in the space of three seasons from importing over 3 million bales to exporting about 1.5 million. The ability of the other countries
of the world to adjust their production to account for the change in Chinese policy is limited. Once land is brought into production, it does not easily go back out, for with record yields in nearly all crops, there were no attractive alternative crops.

U.S. Target Prices. While the 1981 farm bill followed policies that had worked during the 1970s, a critical error was made in estimating inflation. Target prices were set assuming that inflation would continue, but inflation slowed more than expected. When combined with the strong dollar, the net effect was to establish target prices at a level that encouraged production rather than one that provided a safety net for producers. High target prices may have contributed in part to increased production and lower prices.

The PIK Program. From the government’s viewpoint the 1983 PIK program has to be viewed as a success. While it was expensive, it was less expensive than the program would have been in absence of PIK. It did indeed reduce the government stockpiles. However, it was never intended to be a long-term solution to the surpluses. While it corrected the stock levels, it did not eliminate the stimulus that caused excess production. The PIK program gave us time to correct the problem, but we failed to take advantage of it.

El Nino. When combined with the 1983 PIK program, this weather phenomenon may have caused more long-term problems than short-term benefits. While the reduced production worldwide allowed the stocks to be worked off in a single year, the resulting prices stimulated foreign production at precisely the same time that the dollar was strongest. World production jumped in a single season by 20 million bales, creating the surplus that still exists today.

No matter which of these factors you consider the most important, it was clear that there would be no simple, quick solution. Indeed many factors had to be considered in developing a remedy for our current ills. It appears that the combination of an aggressive farm policy that mandates competitiveness of U.S. products and monetary policy that does not force American industry out of business may offer some hope of a better economic climate for American cotton growers. Before examining the prospects for next season we will review the 1985 farm bill.

**Impact of the 1985 Food Security Act**

**Basic Provisions**

When the President signed the farm bill in December, many people thought it was simply a continuation of past policies. However, this was not the case, for although the legislation continued to support producer income through a combination of price support loans and target prices, it also mandated that the U.S. be competitive in world markets. And the bill attempts to make the transition to a more market-oriented farm policy by gradually lowering
the loan floor and target prices. In order to understand the implications of this new farm bill (as well as subsequent 1986 technical correction bills) I will list some of the basic provisions of the legislation. Too often attention has been focused on the specifics so that many people have failed to understand the major concepts.

A price support loan is maintained although the minimum has been reduced. Cotton had already had a loan formula that was based on market prices and this formula was retained. The minimum loan is being lowered to 50 cents beginning in 1988. In the past this could have resulted in our being uncompetitive at certain times if the safety net is being utilized (as it is at the current time). However, the legislation allows the Secretary of Agriculture to lower the loan repayment level to 80 percent of the original loan level. In this way, U.S. cotton can compete more readily in the world market, but farmers incomes are protected at the full loan amount. If the repayment level is above world prices, then the difference between world prices and the repayment level will be compensated to handlers of cotton in order to sell U.S. cotton abroad.

While loan levels were used to support income at about variable cost levels, the target price concept was kept to stabilize farm income at near full cost levels. The target price remained at 81 cents in 1986 but will be gradually lowered to 72.9 cents by 1990. This provision protects mainly the small and lower yielding growers due to the $50,000 limitation. This is by far the worst provision in the farm bill as it discriminates against those farmers who are more efficient. It is not just large growers who are affected, but rather those with high average yields. Growers with less than 200 acres, hardly a "large" grower, may exceed the payment limit. This provision tends to force efficient growers out of business while encouraging farms to be established at exactly the size necessary to reach the payment limit.

While the program is designed to eventually market incentives to influence production, it permits the secretary to use an acreage reduction program of up to 25 percent to adjust production. A new wrinkle this year was the attempt to eliminate the need to plant cotton in order to receive the target price payments. It seems foolish to provide the incentive to plant as much cotton as allowed in order to receive the full benefit of target price payments while at the same time trying to reduce acreage. This provision, entitled the 50/92 provision, was not only essentially eliminated by the 1986 technical correction bills, but it actually penalizes the growers who exceed the payment limit by causing them to lose some of their base acreage unless they plant all the cotton allowed.

When the farm bill set certain minimums and levels many people thought they knew what to expect. However, Gramm-Rudman causes the government to lower any cash expenditure by 4.3 percent. This meant that deficiency payments will be reduced as will loan support levels. While there is no doubt that a balanced budget will be in the best interest of agriculture, farmers
should not be asked to bear more than their share of the burden. While the farm budget accounts for about 3 percent of the federal budget, it represents about 22 percent of the cuts mandated by Gramm-Rudman. Perhaps even more important is the equity issue raised by the cutbacks. Due to the abnormal accounting system employed by the government that places no cost on giving away assets but considers a loan as a cash expenditure, there will be significant differences in the cutback to individual growers. Congress must allow for full individual bale discretion on the use of the loan or loan deficiency payment in order to alleviate the inequities.

Since full competitiveness is mandated, U.S. prices will fall to world levels for the new crop. This means about a 30 cent reduction in price. Because it would have been a financial disaster for anyone holding stocks, an inventory protection payment will also be made. This allowed continued marketing of the 1985 crop until new crop becomes available.

In order to assure that we are always competitive, a formula had to be designed that calculated world prices. The U.S. Department of Agriculture (USDA) decided to use a landed northern Europe price adjusted back to the U.S. quality, price and location. This formula will keep U.S. prices always among the lowest in the world.

**Short Term Impacts**

In looking at the farm bill the inescapable conclusion is that participation in the acreage reduction program will be widespread in 1986. With producers looking at an 11 cent/pound difference in addition to the deficiency payments, nearly all growers will reduce their acreage by the required amount. While the preliminary indications from the USDA suggest that only 88 percent of the acres are enrolled in the program, this understates actual participation. With the exception of the PIK year in which growers could receive a payment without growing any cotton, this is the highest participation in a government program. Of those growers who did not participate, most are expected to grow no cotton. Even with the market enhancement features of the legislation, it still did not justify growing cotton. In California where growers have traditionally not participated in farm programs, due to payment limits, growers placed over 85 percent of their acreage into the program. Last season large growers stayed out of the program, figuring they were eligible to receive the loan (57.30 cents) on 100 percent of production. This season they had little choice but to participate which only guaranteed them the loan (55.00 cents) on 75 percent of production. Clearly they are worse off than a season ago, but still had no choice but to participate.

A second impact of the farm bill is that U.S. cotton will be offered at competitive prices. The formula established to determine world prices assures not only that we will be competitive but that ours will be among the lowest prices in the world. In the short run this will translate into additional sales of U.S. cotton because U.S. prices are dropping faster than some others are growing. In addition it will require a good volume of sales just to refill the
pipeline. Looking to the longer term we have to realize that total world textile demand is basically inelastic over small price changes. Since the raw material cost is not the primary determinant of textile demand by consumers, a reduction in price will not translate into a significant increase in demand. When we realize that foreign producers are influenced by the need for hard currency and lack of storage facilities, we understand that they will sell their cotton once it has been produced. Even if U.S. prices are competitive, foreign prices will be more so if demand does not exist to use all world stocks. If the U.S. adjusts weekly to world prices, immediately afterwards world prices will adjust to ours. Until we reach a point where substantial new demand is generated prices could snowball. Already we have seen world prices fall by 10 cents to 30 cents since the formula was announced. Additionally, the fact that payments will be made in PIK will tend to increase the size of the snowball. The lower prices fall, the more stocks that will be given back to the market. The more stocks on the market, the lower prices will fall. This impact is particularly significant if the amount of stocks returned to the market exceeds the expected drawdown in stocks. Also, by including U.S. quotations in the world price calculation, it is possible that the world price formula is predatory. We will be adjusting to ourselves, lowering the price each week because we lowered our price the previous one. While we will be competitive, this only means that our prices will be lower than they are today.

One area that will have a significant impact is in domestic consumption of cotton. This past season, cotton has only been available to U.S. mills at U.S. prices. Since these were above those paid for foreign cotton, U.S. mills were at a competitive disadvantage. However, with prices falling to world levels next year, we expect to see a significant improvement for the domestic mills. Not only will cotton prices for U.S. mills fall relative to foreign cotton, but they will also fall relative to synthetic fiber prices. This should lead to a further increase in market share.

A major question about the farm bill’s short term impact is whether it will actually increase exports above normal levels. Since exports are primarily determined by the foreign production/consumption deficit, we would not expect increased exports unless some of the individual components change. With the lateness of the farm bill and many of its administrative decisions, most planting decisions in the Northern Hemisphere had already been made. While the competitive nature of prices may alter the timing of sales in the short run, it does not appear that exports themselves will grow substantially this year due only to this fact. While exports are expected to show a major rebound, there are many factors causing this improvement, and unless some foreign countries increase their stock levels we probably will not experience exports much above the 6 million-bale level.

**Long Term Impacts**

The farm bill passed last year has sent a clear signal to foreign countries that we do not intend to abandon our markets. With the combination of low
prices and the weaker U.S. dollar it will not remain economical for many foreign producers to continue to grow cotton. At a minimum they will be discouraged from planting additional acres. However, for this to happen they must be convinced that the U.S. government is serious about its intentions. There has been much talk about the cost of this program and many people have stated they do not expect this program to last. There is no surer way to defeat the purpose of this program than to convince foreign countries that this is only a one-year program. We believe that when this policy was developed, Congress realized that if it did not follow this path it would end up bailing out farmers through the farm credit systems. While expensive, this program reduces carrying costs of government inventory and converts cash expenditures for loans into PIK payments for loan deficiency payments at about one-fifth the value. This program, by helping domestic textile mills, also tends to reduce other government payments such as for unemployment. Since no cost figures will be generally available until after harvest and Congress is not expected to abandon its efforts immediately before this next election, we believe that this program will last at least two years and anticipate the general concept to survive until the next farm bill in 1991.

Many countries also subsidize their producers. This program makes their subsidies a more expensive proposition, especially in light of the weaker U.S. dollar. This increased expenditure will bring more attention to their subsidies and I expect that we will eventually win the battle of the treasuries. With our gradual reduction in target prices, we anticipate that foreign countries will also reduce their subsidies.

Perhaps though the major long-term impact of the farm bill will be to make prices more volatile. We have operated under a price support loan in the United States for over 50 years. While we retain that support level for the producer, prices to the consumer will float to a market-clearing level. In the past, the government has carried stocks from a year of surplus to a year of shortage through the loan program. With U.S. cotton trading at world prices, there will be dramatic struggles to determine who will finance the world’s excess stocks. It is impossible to state that prices will always be lower under this new program, as some maintain. However, we can be assured that they will be more volatile than any of us can remember.

**Outlook for 1986-87**

*U.S. Supply and Demand*

Starting from an extremely large carryover it appears that we will actually have a larger total supply than in any year since 1967 despite the larger participation in the farm program. Planted acreage will fall about 11 percent nationally, with the largest declines in the far West (Table 4). It is ironic that the only cotton that we have sold into the export market this season, which
Table 4. U.S. Planted Cotton Acreage

<table>
<thead>
<tr>
<th>Region</th>
<th>1985</th>
<th>1986</th>
<th>Percentage change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>acres</td>
<td></td>
<td>percent</td>
</tr>
<tr>
<td>Southeast</td>
<td>828</td>
<td>715</td>
<td>-14</td>
</tr>
<tr>
<td>Delta</td>
<td>2,650</td>
<td>2,475</td>
<td>-7</td>
</tr>
<tr>
<td>Southwest</td>
<td>5,430</td>
<td>4,830</td>
<td>-10</td>
</tr>
<tr>
<td>Far West</td>
<td>1,716</td>
<td>1,410</td>
<td>-18</td>
</tr>
<tr>
<td>Pima*</td>
<td>84</td>
<td>107</td>
<td>+27</td>
</tr>
<tr>
<td>Total United States</td>
<td>10,708</td>
<td>9,537</td>
<td>-11</td>
</tr>
</tbody>
</table>

*Produced in Arizona, New Mexico, and Texas.

The domestic mill outlook is as bright as we can remember. During a recent trip to the mill area no complaints were heard about business: this was the first time that has happened. In some cases mills spoke about rationing their customers since they did not have the capacity to fill all demand. With the lower prices that resulted from the world price formula, we expect an increase in market share. While synthetic fiber prices have tended to follow cotton prices, it appears we may be taking their prices below variable cost. Because most synthetic fibers are extruded on a continuous basis, plants must either operate fully at a loss or shut down completely. It is a long-term decision to shut down these plants instead of following cotton prices to an uneconomical level, for there is a major cost involved in turning off a facility and an additional cost to restart it. Therefore, prices will show more downward rigidity from this point. We would not be surprised to see an additional 2 percent increase in cotton market's share in a single season to 67 percent of the fibers system.
Table 5. U.S. Cotton Acreage, Yield and Production

<table>
<thead>
<tr>
<th>Region</th>
<th>Planted Acres</th>
<th>Harvested Acres</th>
<th>Yield</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>acres</td>
<td>acres</td>
<td>bales/acre</td>
<td>thousand bales</td>
</tr>
<tr>
<td>Southeast</td>
<td>715</td>
<td>690</td>
<td>574</td>
<td>825</td>
</tr>
<tr>
<td>Delta</td>
<td>2,475</td>
<td>2,430</td>
<td>630</td>
<td>3,196</td>
</tr>
<tr>
<td>Southwest</td>
<td>4,830</td>
<td>4,425</td>
<td>354</td>
<td>3,265</td>
</tr>
<tr>
<td>Far West</td>
<td>1,410</td>
<td>1,400</td>
<td>1059</td>
<td>3,090</td>
</tr>
<tr>
<td>Pima*</td>
<td>107</td>
<td>107</td>
<td>763</td>
<td>170</td>
</tr>
</tbody>
</table>

Total 1986 | 9,537 | 9,062 | 558 | 10,540  
Total 1985 | 10,708 | 10,229 | 630 | 13,432  

*Produced in Arizona, New Mexico, and Texas.

Many people have suggested that lower oil prices might hurt cotton's prospects. But the synthetic fiber industry is primarily a high fixed cost industry, so a reduction in raw material costs is not a primary component of their prices. In addition, synthetic fibers are made out of a by-product of oil. If there is a reduced supply of the primary product, it means there is less supply of the byproduct. Besides, energy is a major component of the cost to produce cotton. But perhaps the biggest influence of lower oil prices is to increase disposable income. As oil prices fall, consumers do not proportionately increase their purchase of oil products, i.e., demand is inelastic. Rather they enjoy a windfall benefit and use some of this to purchase discretionary items such as textile products.

We cannot discuss the domestic textile industry without examining the flood of textile imports. The strong U.S. dollar contributed to the widening of the textile trade deficit. In 1980, the raw cotton equivalent of textile imports and exports was almost equal. By last year the deficit stood at over 2.6 million bales. However, with the dollar stopping its advance, we saw imports nearly stabilize last year. This is allowing domestic mills to share in any economic recovery. In addition, with the fall of the dollar there is again the prospect for an increase in U.S. textile exports. Many people have failed to recognize that textile exports had actually been cut in half since 1980 because of the high dollar.

U.S. consumption should exceed 6.9 million bales this season—the highest level since 1975 and over 500,000 more than last season (Table 6). One factor in the recovery in U.S. cotton consumption that cannot be ignored is the contribution made by Cotton, Incorporated. The promotional efforts by this producer-funded organization has definitely helped encourage cotton use. Without its help it is hard to believe that U.S. mills would be using nearly the amount of cotton expected this year.
Table 6. U.S. Cotton Supply and Demand

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Carryover</td>
<td>7.9</td>
<td>2.8</td>
<td>4.1</td>
<td>9.0</td>
<td>6.4</td>
</tr>
<tr>
<td>Production</td>
<td>7.8</td>
<td>13.0</td>
<td>13.4</td>
<td>10.5</td>
<td></td>
</tr>
<tr>
<td>Supply</td>
<td>15.7</td>
<td>15.8</td>
<td>17.5</td>
<td>19.5</td>
<td></td>
</tr>
<tr>
<td>Consumption</td>
<td>5.9</td>
<td>5.5</td>
<td>6.4</td>
<td>6.9</td>
<td></td>
</tr>
<tr>
<td>Exports</td>
<td>6.8</td>
<td>6.2</td>
<td>2.1</td>
<td>6.2</td>
<td></td>
</tr>
<tr>
<td>Offtake</td>
<td>12.7</td>
<td>11.7</td>
<td>8.5</td>
<td>13.1</td>
<td></td>
</tr>
<tr>
<td>Offtake/Supply</td>
<td>.81</td>
<td>.74</td>
<td>.48</td>
<td>.67</td>
<td></td>
</tr>
</tbody>
</table>

We have already discussed the impact that the farm bill’s mandated competitiveness will have on U.S. exports. Our exports will indeed expand next year, due mainly to an increase in the foreign production-consumption deficit. With some reduction in production and continued increases in consumption, this deficit will be about 5.5 million bales next year. The mandated competitiveness feature of the farm bill will cause us to displace some sales by foreign countries so that foreign stocks will increase by nearly 700,000 bales. This suggests that exports will reach a more normal historical level of 6.2 million bales. Already commitments exceed 1 million bales.

Even with the decreased production and increased demand, carryover stocks will remain high. At 6.4 million bales, there will be adequate cotton to prevent any worries about a shortage, but it will be down 2.6 million from the start of the season.

**World Supply and Demand—1986-87**

The effectiveness of the legislative changes made by the farm bill in reducing foreign production was diminished this season by the lateness of its passage. Many producers had already made commitments to plant in the upcoming season. In addition, many people in foreign countries doubt the sincerity of the U.S. government to follow through on this program. It is a common belief that this will only be a one-year program, as was PIK. They reason that they do not need to cut back on production if we are only going to be competitive for a single year. Overall production should fall next year about 2.4 million bales with much of the reduction occurring in Pakistan and India where record yields caused a large increase in supply this year. China appears committed to holding to a crop of about 19 million bales. Procurements will again be limited and drought conditions on the North China Plain raise some concerns.

Consumption prospects appear excellent as cotton will be very competitive with synthetic fibers. Also, the increase in disposable income caused by the
drop in oil prices should keep the annual increase above normal. China's modernization will continue to cause an increase in per capita use in that country which will result in a 1.5 million-bale jump in that country alone. World consumption will reach 75.9 million bales, 3 million bales above last year.

With consumption above world production, carryover stocks will show their first decrease on a world basis since the PIK season (Table 7). While they will remain high at 43.3 million bales, the 3.4 million bale reduction will be the largest decline in world stocks in a single season. It is difficult to label the outlook for the upcoming season as bullish, but it will at least be a step in the right direction. Perhaps there is even some hope in the outlook for high grades of cotton, since much of the world's surplus exists only in the lower grades. We must remember that the difference between a little too much supply and a little too little supply is a whole lot of price. With the new rules our markets will be operating under, due to our new legislation, the safety net below world prices no longer exists. Do not get complacent and expect prices to remain static. If nothing else the 1985 farm bill assures us more volatile prices.

Table 7. World Cotton Supply and Demand

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Carryover</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>7.9</td>
<td>2.8</td>
<td>4.1</td>
<td>9.0</td>
<td>6.4</td>
</tr>
<tr>
<td>China</td>
<td>3.0</td>
<td>7.8</td>
<td>19.8</td>
<td>19.7</td>
<td>18.2</td>
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<tr>
<td>Other Foreign</td>
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<td>14.1</td>
<td>18.7</td>
<td>18.0</td>
<td>18.7</td>
</tr>
<tr>
<td>Total</td>
<td>5.0</td>
<td>24.6</td>
<td>42.6</td>
<td>46.7</td>
<td>43.3</td>
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<tr>
<td>Production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>7.8</td>
<td>13.0</td>
<td>13.4</td>
<td>10.5</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>21.3</td>
<td>28.7</td>
<td>19.1</td>
<td>19.0</td>
<td></td>
</tr>
<tr>
<td>Other Foreign</td>
<td>38.6</td>
<td>45.8</td>
<td>45.4</td>
<td>43.0</td>
<td></td>
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<tr>
<td>Total</td>
<td>67.7</td>
<td>87.5</td>
<td>77.9</td>
<td>72.5</td>
<td></td>
</tr>
<tr>
<td>Consumption</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>5.9</td>
<td>5.5</td>
<td>6.4</td>
<td>6.9</td>
<td></td>
</tr>
<tr>
<td>China</td>
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<td>15.5</td>
<td>17.5</td>
<td>19.0</td>
<td></td>
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<tr>
<td>Other Foreign</td>
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<td>48.4</td>
<td>49.1</td>
<td>50.0</td>
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<tr>
<td>Total</td>
<td>69.0</td>
<td>69.4</td>
<td>72.8</td>
<td>75.9</td>
<td></td>
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</tbody>
</table>
Long-Run Trends in the Cotton Industry

Introduction

One must polish the crystal ball very bright to even project the supply/demand situation for a single season. A long-term outlook predicting precisely the fundamental situation is impossible; however, certain long-term changes in our industry are important to note as they will affect the long-term prospects. A brief review of these may help prepare a long-range strategy regarding cotton marketing. We believe that these trends can be divided into those structural changes that will influence the players and technological changes that will affect the tools those players have to work with.

Structural Changes

When you begin to look at the structure of our industry, a major trend of consolidation seems to prevail for all segments except for the producer. We look first at the backbone of our industry, the farmer, then examine the ginning, marketing and manufacturing sectors.

With the need to compete with low-cost producers in foreign countries, one would have expected that U.S. farms would have shown some trend toward consolidation into “larger, more efficient” units (if those two terms are not mutually exclusive). However, even during the economic stress that our industry has been under for the last several years, the number of farms has actually increased. In the United States, the number of farms with a cotton acreage base has increased from 138,000 in 1982 to 147,000 this year, an increase of 9,000 farms or 6.5 percent (Table 8). At the same time the average size of these farms has declined from 111 acres in 1982 to 106 acres this season.

The tendency for smaller and more farms would suggest that these are more efficient farm units. However, this does not seem to be true, for there

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Base</th>
<th>United States Farms</th>
<th>Average Size</th>
<th>California Total Farms</th>
<th>Average Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>million acres</td>
<td>thousands</td>
<td>acres</td>
<td>thousand acres</td>
<td>number</td>
</tr>
<tr>
<td>1982</td>
<td>15.3</td>
<td>138</td>
<td>111</td>
<td>1,551</td>
<td>6,327</td>
</tr>
<tr>
<td>1983</td>
<td>15.4</td>
<td>137</td>
<td>112</td>
<td>1,560</td>
<td>5,748</td>
</tr>
<tr>
<td>1984</td>
<td>15.5</td>
<td>140</td>
<td>111</td>
<td>1,551</td>
<td>5,413</td>
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<td>1985</td>
<td>15.8</td>
<td>145</td>
<td>109</td>
<td>1,612</td>
<td>5,757</td>
</tr>
<tr>
<td>1986</td>
<td>15.6</td>
<td>147</td>
<td>106</td>
<td>1,497</td>
<td>5,470</td>
</tr>
</tbody>
</table>
is a factor actually encouraging inefficiency in U.S. agriculture at the same time that we claim to be the most efficient farmers in the world. The U.S. farm program, through its use of payment limitations, has promoted the establishment of farms of a size not sufficient to operate on an economic basis. If we maintain this provision, the long-term results will be to force larger growers out of business while at the same time encouraging smaller farms to be established. The long-term costs to the government will be higher as more farms will be eligible to receive full payments. Agriculture will continue to restructure until all farms are eligible to receive the payment limit. In California, this size is about 210 acres this season. If this trend continues, our farmers may find themselves more concerned with lawyers and accountants than with agronomists. So if we are to continue to compete in the world market we must eliminate this payment limit which is tending to make us less efficient. Farmers would prefer to make their own decisions about the appropriate size unit and not have it made for them because of the payment limitation. Simply because there are more official farms, however, does not mean there are more actual farmers. There is still a tendency for more acreage to be managed by one entity. Farmers have restructured only to capture the benefits available to smaller growers.

In the ginning industry there is a continued movement towards fewer and larger gins and the ginning season is being extended over a longer period of time. A major cause of this trend has been the development of improved methods to handle and store seed cotton. The advent of the module has changed our industry tremendously, allowing more efficient use of facilities. Modules also allow the transport of cotton over longer distances which is facilitating further consolidation. This trend has been further encouraged by the use of seed cotton loans which allow growers to receive their money even though the cotton has not yet been ginned. The gin manager is becoming even more important in the industry as a link between the grower and the marketer. With fewer gins, these managers are becoming more informed and knowledgeable about the structure of the entire industry, not just their segment.

In marketing, the number of firms that handle cotton continues to decline. As the trade becomes increasingly international in scope, larger firms have the ability to follow world trends better than smaller firms. This internationalization of our industry will become even more significant with the mandated competitiveness of the farm bill of 1985. As the trend towards larger firms develops, the character of these firms is also changing. A recent trend appears to be for international grain companies to become involved with cotton merchandising. With their international contacts and capital backing, the trend towards larger firms is sure to continue. And the role of the small broker, who had the personal contact with the farmer and bought cotton for the larger marketer, is disappearing rapidly. Farmers are finding that besides the special attention given by a small broker, they also need the expertise of a larger firm. We will see more large companies helping farmers with their planting
decisions by dissemination of information on the market and farm programs. The contact with the grower will not begin and end by selling the cotton. Rather the relationship will become more involved as all segments become more closely coordinated. Marketers will convey the needs of the textile mills more directly to the growers.

Perhaps the major story in the industry this year has been the rapid consolidation of the U.S. textile industry. Many of the larger firms have merged this season. In order to compete effectively with foreign mills, there appears to be a definite trend toward product realignment. Many firms seem to be following the "Kentucky Fried Chicken strategy." They are doing one thing and they are doing it right. Instead of trying to be involved in all segments of the industry many of the companies are, through merger or divestiture, attempting to become a dominant factor in a particular segment of the industry. This type of consolidation is unique in that it is occurring at a time when there is some growth in the industry, rather than as a survival technique when it is declining. There also appears to be a realization by the U.S. mills that they must rely on their strengths in order to compete. They have developed a successful "Made in the USA" campaign that we have all seen with their television ads that remind us that "It matters to me." They are also stressing their ability to respond to customers' needs with a "Quick Response." This campaign emphasizes the need for even more coordination between the mills and the marketers. While the mills will continue to hold inventories at a minimum, they will also need to have a reliable source of supply.

Technological Changes

Among the changes that will shape our industry in the future has been the development of new spinning technology. With the advent of open-end spinning there is the need for more mature but finer fibers. With the consolidation of the industry there will be more coordination between the needs of the mills and the products grown by farmers. Breeders will need to be cognizant not only of the yield aspects but also of the spinning attributes of cotton. I believe that we will see stronger cottons developed with lower micronaire because this type is needed for the new spinning system.

Another development is the use of high volume instrument (HVI) testing equipment. In the past San Joaquin Valley (SJV) cotton has commanded a premium over other cottons in the world because of its strength and uniformity. These traits although important to the spinning of the cotton could not in the past be determined without a lengthy test. This new system gives the ability to identify other cottons that may have some of the desirable traits. Thus, the expansion of HVI may increase the supply of cotton that can meet the needs of mills that rely primarily on SJV cotton now. Unless we continue to improve our cotton through breeding we may lose our premium and find ourselves competing against the bread and butter cotton of the world. We have had an advantage with SJV cotton because of its superior characteristics, but now we may be faced with loss of some of our market. The advent of HVI,
although it is not perfected yet, may also encourage the trend toward consolidation, for as HVI comes into use, there will be an advantage to having a larger pool of cotton from which to select.

Conclusion

We believe that the major conclusion that can be drawn from this cotton outlook is that the U.S. farm bill has changed the rules for the ballgame. U.S. cotton will become competitive in world markets which will mean that over the longer term foreign acreage will drop. Foreign governments cannot afford to subsidize production when competing with the U.S. treasury. Subsidies stimulating production both in foreign countries and in the United States will tend to disappear. With the correction in the value of the dollar and the elimination of subsidies we will find that U.S. cotton can be grown competitively. With the long-term trends indicating continued increases in consumption, we will see production and consumption brought back in line. Although it will not be a quick process, equilibrium will again be achieved and prices will reward cotton producers. Not only will prices increase but they will do it when we least expect them to do so. We believe that the one certainty with this farm bill is that indeed prices will be more volatile than they have ever been before.
PRODUCTION ADJUSTMENT ISSUES

Robert S. Firch

Abstract

The primary objective of the paper is to develop some insight into how cotton production in the western United States is likely to adjust to changing conditions in the future. The first section reviews changes in acreages and production that have occurred in the period 1961-85. The second section takes an intensive look at farmer response to government programs and estimates of costs of production in the 1969-72 period. The third section looks at long-term trends in prices and discusses some implications for the future of cotton production.

Government programs in effect in the 1950s and early 1960s were very important in maintaining cotton production both in the southeastern and southwestern regions of the United States, but were rather neutral on cotton production in the Delta region. The programs definitely curtailed cotton production in the West. Cotton production has continued its long-term shift from east to west.

The data from the 1969-72 period show the San Joaquin Valley is very strongly competitive in cotton production with the Mississippi Delta a close second. The High Plains region of Texas-Oklahoma offsets low yields and low prices of cotton sold, with low per acre production costs, to be fairly competitive in cotton production, while the Imperial Valley-Southwest Arizona region has lost its competitive edge.

Introduction

The objective of this discussion is to develop some insight into how cotton production in the western United States is likely to adjust to changing conditions in the future. The first section will review changes in acreages and production that have occurred in the period 1961-85. The second section takes an intensive look at farmer response to government programs and at estimates
of costs of production in the 1969-72 period. The third section will look at long-term trends in prices and consider some implications for the future of cotton production.

Acres and Bales of Cotton Produced by Regions in 1961-85

The period 1961-85 has seen a wide range of government program involvement in the markets for cotton and farmer decision making. This 25 year period can be divided into five, five-year subperiods with considerable within-period similarity, but substantially different between-period conditions affecting markets and farmer decision making. Tracking acres planted and bales of cotton produced by major regions through the five periods should provide some insight about the ability of cotton to compete as a viable crop in each of several major cotton producing regions. First, the relatively unique conditions of the five subperiods are outlined.

1961-65. This was a period of high price supports for U.S. cotton which also affected prices received by cotton producers in other countries. Non-recourse loans were made to U.S. farmers through the Commodity Credit Corporation of the U.S. Department of Agriculture (USDA). Acreage allotments to individual farmers were to hold down cotton production which was accumulating at an alarming rate in government ownership. It was generally impossible to transfer cotton allotments across state lines, and even transfer across county lines was not allowed in the early years.

1966-70. This was a period of a lower level of price supports and the beginning of direct payments to users of cotton and later to farmers in order to maintain cotton farmer incomes at acceptable levels while reducing huge stocks in government ownership. Government program incentives in 1967 drastically reduced cotton planting and resulted in government payments exceeding gross income from market sales.

1971-75. This was a period of accelerating inflation which caused cotton market prices to rise well above government program prices. By the end of the period government programs had no direct effect on cotton prices or farmer decision making.

1976-80. This was a period of further increases in the rate of inflation, associated with very high nominal interest rates and rapid increases in land values and in costs of producing cotton. Again, government programs for cotton had minimal direct effects.

1981-85. This was a period of decreased rates of inflation, very high inflation-adjusted interest rates, falling land values, and renewed dependence on government programs. The cotton program for 1983 substantially reduced U.S. planting while foreign growers expanded their production. The 1985 support price for cotton was high relative to foreign market prices, and commercial exports of cotton from the United States fell to virtually zero.
Table 1 presents total acres planted to cotton and cotton production in each of several regions during each of these five periods. From the tables it appears not only that California is very competitive with the other regions but also that cotton is very competitive with other potential crops in California. The data show a steady increase in the proportions of both acres and bales in California relative to total U.S. acres and bales. This increase has been achieved in spite of the fact that the Imperial Valley has declined both in acreage and production. The outlook for cotton production in the San Joaquin Valley of California appears to have been very positive. The Arizona cotton industry prospered in the years of relaxed government controls and growing inflation. Arizona’s proportion of total U.S. acres and bales rose at nearly California’s rate through 1976-80. However, cotton acres dropped by about 40 percent from 1981 to 1985, and Arizona’s proportion of total U.S. production declined from 1976-80 to 1981-85. The Imperial Valley has generally followed Arizona’s pattern because both areas were heavily affected with severe insect control problems. Land that came into cotton production during the inflationary 1970s quickly exited since 1981. Large proportions of the increased cotton acreage in Arizona and its subsequent decline was pump-irrigated land that was idle before and is now again idle. This is clearly relatively high production

<table>
<thead>
<tr>
<th>Period</th>
<th>California</th>
<th>Arizona</th>
<th>The Southwest</th>
<th>The Delta</th>
<th>The Southeast</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acreage:</td>
<td>3,911</td>
<td>1,722</td>
<td>36,225</td>
<td>21,608</td>
<td>12,694</td>
<td>76,160</td>
</tr>
<tr>
<td>1961-65</td>
<td>3,292</td>
<td>1,230</td>
<td>25,965</td>
<td>16,073</td>
<td>7,562</td>
<td>54,122</td>
</tr>
<tr>
<td>1966-70</td>
<td>4,728</td>
<td>1,452</td>
<td>28,878</td>
<td>19,535</td>
<td>6,933</td>
<td>61,526</td>
</tr>
<tr>
<td>1971-75</td>
<td>7,210</td>
<td>2,527</td>
<td>37,396</td>
<td>15,931</td>
<td>3,759</td>
<td>66,823</td>
</tr>
<tr>
<td>1976-80</td>
<td>6,640</td>
<td>2,158</td>
<td>30,263</td>
<td>12,610</td>
<td>3,421</td>
<td>55,092</td>
</tr>
<tr>
<td>Production:</td>
<td>8,736</td>
<td>3,920</td>
<td>25,393</td>
<td>25,073</td>
<td>10,759</td>
<td>73,881</td>
</tr>
<tr>
<td>1961-65</td>
<td>6,304</td>
<td>2,641</td>
<td>17,315</td>
<td>16,357</td>
<td>5,095</td>
<td>47,712</td>
</tr>
<tr>
<td>1966-70</td>
<td>9,180</td>
<td>3,248</td>
<td>18,401</td>
<td>19,650</td>
<td>6,933</td>
<td>61,526</td>
</tr>
<tr>
<td>1971-75</td>
<td>13,729</td>
<td>5,606</td>
<td>23,635</td>
<td>15,123</td>
<td>3,002</td>
<td>61,095</td>
</tr>
<tr>
<td>1976-80</td>
<td>14,642</td>
<td>5,413</td>
<td>20,144</td>
<td>16,627</td>
<td>4,513</td>
<td>61,339</td>
</tr>
</tbody>
</table>

aNew Mexico, Oklahoma and Texas.

bArkansas, Louisiana, Mississippi, Missouri, and Tennessee.

cAlabama, Florida, Georgia, North Carolina, South Carolina and Virginia.

cost land that requires inflationary conditions such as those of the 1970s to allow cotton, or any crop, to be profitably grown.

The southwestern region seems to have been more dependent on government programs than California or Arizona. With the exception of the 1976-80 period, acreage and production in this region have generally been below their 1961-65 levels under high price supports and rigid acre controls. A part of this may be attributed to competition from other crops there. The southwestern region is generally characterized as having relatively low yields, low costs of production, and relatively low cotton prices. The acreage and production figures strongly suggest that cotton's position there is definitely inferior to that in the San Joaquin Valley and the gravity-water areas of Arizona, but superior to that of the Imperial Valley and the pump areas of Arizona.

The Delta region held a relatively constant proportion of U.S. total acreage and production through 1975, but then both declined substantially in the 1976-80 and 1981-85 periods. These drops seem to be attributable to a switch to other crops, such as soybeans, and to the resurgence of cotton production in the Southwest. Of the regions that have been defined, the Delta region seems to have been least affected by the government programs of the 1961-65 period. Cotton probably has less of a competitive edge in the Delta primarily because of alternative crops that compete for agricultural production resources. Therefore, cotton production in the Delta seems to have been influenced more by economic conditions and less by government programs than is true for the other regions.

The southeastern region has shown a general decline in acreage and production, except for a slight increase in production stemming from higher yields achieved during the 1981-85 period. The sharp reduction in acreage and as a proportion of U.S. total acreage from 1961-65 to 1966-70 shows the greater dependence of this region on the government programs of 1961-65 to maintain its cotton acreage. The increased yields of recent years suggest that cotton may become more competitive in the Southeast, but the availability of alternative crops will likely prevent cotton from achieving levels found in most of the other regions.

**Acres Planted and Government Programs in 1969-72**

The years 1969-72 provide a somewhat unique opportunity to view competition in cotton production despite the dominance of government programs then. There was a degree of flexibility in the programs then which allowed substantial choices in the amount of cotton to plant on individual farms. Through this period, the programs required farmers to plant 90 percent of their domestic allotments (65 percent of total acreage allotments) in order to earn their maximum direct payments. In 1969 and 1970, farmers were allowed to plant a maximum of 100 percent of their allotments. In 1971 to 1972.
cotton growers had no upper limit on acres they could plant and still receive their maximum payments as long as they satisfied set-aside and conserving base requirements, and there was no upper limit on planting if no payments were received. For this same period (1969-72), the USDA made comprehensive studies of the cost of producing cotton in 20 regions. These data are very useful because regions were defined by aggregating counties into homogeneous groups without regard to state lines. Annual state reports of cotton allotments and cotton planting by counties were used to compute the acres of allotment and acres planted by region. The ratio of acres planted to acres of allotment was used as an indicator of dependence on government programs, and the regions were ranked using these ratios. Table 2 presents the rankings for five of these regions.

Southern California and southwestern Arizona ranked highest in 1969, indicating that it was the least dependent region; by 1970 its rank had dropped to seventh out of the 20 regions where it remained for the next 3 years. This drastic change in rank seems to be related to severe insect control problems that developed at that time. The high plains of Texas-Oklahoma ranked as the least dependent on government programs in 1970, but then its ranking deteriorated in the next two years. The San Joaquin Valley ranked number 1 in 1971 and number 2 in each of the other 3 years. The Mississippi Delta region reached number 1 rank in 1972, showing a steady improvement in its rank throughout the period 1969-72. Central Arizona ranked in the range of 11th to 15th.

While the USDA-defined production regions are a distinct improvement over those defined on state lines, it leaves a mixed group of cotton operations in the Central Arizona region. Large number of farms there have relatively high production costs in pumping water while others irrigate with lower-cost gravity water. These latter farms, if put in a separate region, would probably rank in the top five. Thus, the nonhomogeneity of this region clouds its rank.

<table>
<thead>
<tr>
<th>Year</th>
<th>San Joaquin Valley</th>
<th>Southern California and Southwestern Arizona</th>
<th>Central Arizona</th>
<th>Mississippi Delta</th>
<th>High Plains</th>
</tr>
</thead>
<tbody>
<tr>
<td>1969</td>
<td>2</td>
<td>1</td>
<td>11</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>1970</td>
<td>2</td>
<td>7</td>
<td>15</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>1971</td>
<td>1</td>
<td>9</td>
<td>13</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1972</td>
<td>2</td>
<td>8</td>
<td>14</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

Source: Computed from State Agricultural Stabilization and Conservation Service reports on cotton acreage allotments and acres planted, by counties.
In order to gain further insight into the interregional competition highlighted in Table 2, the estimated costs of production and the average selling price of cotton in each of the 20 regions were also analyzed. Plotting 1971 data on the ratio of planted acres to domestic allotment acres against an index of the selling price relative to the cost of production revealed a definite positive correlation. That is, those regions that had relatively favorable relationships between costs and sales prices planted relatively large acreages relative to the minimum planting required to receive government payments. The advantage of the High Plains' relatively low cost of production is cancelled by its lower average selling price, while San Joaquin Valley's relatively high average selling price is substantially offset by its high costs of irrigation. Each of the five regions in Table 2 are above the average relationship plotted for the 20 regions. It appears to me that this indicates that these regions have relatively poor alternatives to cotton production and that their acreage planting decisions are relatively insensitive to changes in economic conditions.

Some Insights on Cotton Prices and Production Adjustments

In 1978, I stumbled upon a very interesting relationship between the futures prices of cotton, wheat, and soybeans at planting time and harvest time. This is that when December futures prices of cotton are unusually high at planting time the futures price consistently declines from planting to harvest. The reverse was also true. By the spring of 1981 I was very confident that I could consistently forecast whether December futures prices would rise or fall from planting to harvest. But the forecast did not work in 1981; apparently the relationship had changed. With several more years' data it became obvious that the world had indeed changed. With all prices adjusted to the value of the dollar in 1984, the critical value of the December futures price at planting time that separates rising futures prices from falling futures prices was $1.00 in 1973-80. That critical value for 1981-85 was $0.75. The most important difference between 1973-80 and 1981-85 is that in the first period the rate of inflation was generally rising and inflation-adjusted interest rates were very low. In the second period the rate of inflation was falling and inflation-adjusted interest rates were very high. I think that this provides some very powerful insights to the effects of inflation on agriculture. When, and if, the economy stabilizes at low rates of inflation and low real interest rates, the long-run equilibrium price of cotton should be somewhere in that range of $0.75 to $1.00. A "guaranteed" target price of $0.81, because it lacks uncertainty, is surely too high to allow stable conditions in the cotton industry.

For a long while I have felt that agricultural commodity prices have been on a long-term decline. Inflation at various points in our history has prevented this decline from being entirely obvious. I have taken the prices received by farmers for cotton, corn, and wheat from 1900 to 1985, adjusted them to the
value of the dollar in 1984, and then estimated the rate of decline in price. The estimated rates of decline are 0.8 percent per year for cotton, 1.0 percent per year for corn, and 1.2 percent per year for wheat. Each of these estimates comes with a very high level of statistical significance.

The perfectly competitive economic model would hold that the marginal cost of producing cotton, i.e., the cost of producing one additional pound of cotton, has also been falling at the rate of 0.8 percent per year. Thus, farmers who fail to reduce their inflation-adjusted cost per pound of producing cotton by at least 0.8 percent per year will ultimately fail in cotton production.

The Food and Agriculture Act of 1981 was obviously built on an expectation of inflation continuing at a rate of the 1970s, for the target price was supposed to go from 71 cents to 76 cents, to 81 cents, then to 86 cents in the four years of the act. Because the rate of inflation declined substantially beginning in 1981, the act was substantially out of line with reality.
DEVELOPMENT AND TRADE ISSUES

Lawrence R. Preston

Abstract

The presentation discussed three basic development and trade issues: (1) problems with the 1981 farm bill, (2) the development of the 1985 farm bill, and (3) the prospects for trading as a result of the 1985 farm bill.

Introduction

I believe we should divide development and trade issues into three categories:

(1) The problems with the 1981 farm bill,
(2) The development of the 1985 farm bill, and
(3) The prospects for trading as a result of the 1985 farm bill.

Problems with the 1981 Farm Bill

It was apparent to many in 1981 that the cotton section of the farm bill was basically flawed for it would encourage United States and foreign production because of the 55 cent minimum loan concept and the fixed escalation of target prices. The payment-in-kind (PIK) program further escalated the problem as our foreign competitors rushed to fill the void left by our massive acreage reductions. This was further aggravated by record high yields across the globe and, in particular, by China who developed an incentive program which resulted in a production increase from 16,700,000 bales in 1982 to 28,700,000 bales in 1984. By 1984, we were awash in cotton, and 1985 saw world prices collapse as our foreign competitors engaged in a price cutting effort in order to reduce their costly surpluses.

The results were devastating to the U.S. cotton industry from farm to
mill. U.S. producers had no marketing alternative but the loan. U.S. merchants saw their business dry up as exports plummeted from 6 to 2 million bales. Domestic textile mills, restricted to the purchase of U.S. raw cotton, were paying up to $100 per bale more than their foreign competition. We all stood by helpless as lower-priced foreign textiles, made from foreign cotton, invaded our shores in record numbers.

The Development of the 1985 Farm Bill

We were extremely fortunate that two individuals in the Congress knew what was wrong and how the problem should be corrected: Congressman Jerry Huckaby (D-LA), Chair of the House Cotton Subcommittee, and Senator Thad Cochran (R-MS), Chair of the Senate Subcommittee on Agricultural Production, Marketing and Stabilization of Prices. Each knew that the U.S. cotton program encouraged and subsidized foreign acreage. Each of them met our problem head on by developing legislation which protected farm income while allowing the United States to compete through a mechanism which brings U.S. cotton to the world price level. Many people, many trips, many meetings, many hours, and yes, many compromises were made by all industry segments so that we could forge a total industry position which was presented by the National Cotton Council. The end result is that we took the politics out of cotton. We now have a cotton section in the 1985 farm bill which is good for the producer—in fact, much better than we expected—and good for trade as cotton will be available to our U.S. and foreign customers at the world price.

Prospects for Trading as a Result of the 1985 Farm Bill

U.S. producers will be helped by the 1985 farm bill way beyond their expectations of a few months ago. But our farmers need to continue working towards increasing their productivity and not be lulled into complacency by a 55 cent loan and 81 cent target price—because these cannot last forever.

Our domestic industry will purchase U.S. cotton at world market prices with a resulting decrease in cost estimated at $800 million. Because of the easing in the value of the dollar, reduced interest rates, and modern plants and equipment, the U.S. textile industry will be competitive. and textile imports will no longer have an obvious competitive advantage in taking way our markets.

With prices competitive, our exports could increase threefold to our traditional share, but we will continue to have strong competition from foreign producers who are desperate to sell their cotton. Worldwide, prices may well continue their downward spiral.

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As the world acknowledges the determination of the United States to be competitive and to retain its markets, we should see a return to sanity and a reduction in cotton acreage. Within a few years, as we decrease the world surplus, we will move towards a balance between supply and consumption. Prices should then stabilize at a reasonable level.

The dependence on large subsidies by the United States and foreign producers must decrease so that we begin to move towards a free market economy. We must advise our foreign competitors continuously that the U.S. farm program calls for a reduction in cotton acreage of 25 percent. If the other key producers follow this lead, then production will be stabilized and prices will rise. Then efficient farmers worldwide will be able to profit in relation to their efforts. We are now poised to compete and compete we must.
TECHNOLOGY AND RESEARCH ISSUES

M. Dean Ethridge

Abstract

Technological change is occurring at a rapid pace throughout most segments of the cotton fiber industry. In the production sector, results from breeding and genetics, combined with advances in integrated crop management and plant growth regulators, offer the prospect of 10 to 25 percent increases in lint yields during the next five years—along with significantly improved mixes of fiber characteristics. The direction of pest control in cotton is toward integration of chemical, biological, and cultural techniques, involving area-wide monitoring, statistical modeling, and concerted actions by organized groups of farmers.

In the marketing sectors, technological change has become so rapid in textile spinning and weaving that "technological obsolescence" has become a limiting factor in some capital investment decisions. The new technology is typically not neutral with respect to fiber properties, resulting in significant shifts in the demand structure for the various types of cotton and bringing some urgency to developing a classification system that better describes specific fiber properties which are important in the context of different technologies.

The explosion of computer-based technology has made technological change a pressing issue with respect to the facilitating functions of grading, financing, risk-bearing, transferring information, regulating, and developing markets. Whether it is computer-assisted instrument classing of cotton fibers or the electronic transfer of classing results or of information on liens and ownership, the potential exists for substantial improvements in both operational and pricing efficiency.

Regulatory activity is certainly a function of technology, yet it often reveals the limited capability of technology to accurately measure variables such as exposure rates and to establish cause-and-effect relationships. Regulatory action on cotton dust and formaldehyde has undermined market development efforts and hampered domestic competition with foreign textile manufacturers.
Introduction

Cotton is unique among major agricultural crops, being primarily an industrial fiber rather than a food crop. Although cottonseed ranks as one of the world's major oilseeds, space constraints make it necessary to focus on the technology and research issues relevant to fibers. Technological change has accelerated over the last decade throughout the raw cotton industry. This report will present a selective summary of major changes, either occurring or anticipated, within the production and marketing sectors.

Production

Cotton is a genetically unique plant, with great biological diversity and "the most complex morphology of any major field crop grown as an annual" (Mauney, 1984, p. 59). Cotton was originally a woody, perennial shrub, and it simultaneously develops both vegetatively and reproducitively. It consists of numerous wild species but only four domesticated species. Two of the domesticated species are diploids, which evolved in the Old World, and two are allotetraploids, which evolved in the New World and have become dominant in global cotton production (Lee, 1984; Fryxell, 1984).

Breeding and Genetics

Cotton has been the subject of taxonomic studies since the mid-18th Century, resulting in an admirable understanding of its complexity and diversity (Fryxell, 1984). While it is typically more difficult to successfully alter characteristics of the cotton plant, it is feasible to achieve extraordinary alterations in the mix of characteristics. Furthermore, germplasm is available to achieve consistent breakthroughs in yields and qualities—with time and capital being the limiting factors. An example of how the time constraint may be partially overcome is the Winter Cotton Breeding Nursery in Tecoman, Mexico. This has been managed for 35 years by the National Cotton Council. It enables developers of improved cotton varieties to speed the process to commercialization by growing two generations per year—one in the United States and one during winter in the tropics.

It has been proven that major fiber property associations—such as between fiber strength and fiber maturity—can be separated and recombined into favorable combinations; however, achieving this has usually taken 15 to 20 years. While the flower morphology of cotton makes hybrid seed production very difficult, advances in this area offer the prospect of more effectively (i.e., more rapidly) combining maximum yield with improved fiber quality by the end of this decade. Taken in conjunction with other technological advances, yield increases of 10 to 25 percent within the next five years appear possible.

In the longer term, perhaps 25 or 30 years, genetic engineering may
allow selective introduction of specific traits (e.g., salt tolerance, weevil resistance, etc.) with relatively short time lags. If research efforts are not thwarted by economic or regulatory constraints, improvements in yields and fiber characteristics during the first half of the next century could well be amazing.

Pest Control

Cotton has probably benefited more than any other field crop from the use of chemicals, biological controls, and cultural management strategies. Roughly 25 percent of the total dollar value of cotton insecticides is used in the United States (Ridgway, 1984, p. 279). Among the phenomena demonstrated by this use, however, was the development of resistance to insecticides and unbalancing the ecology by destruction of beneficial insects. Analogous lessons have been learned in the use of fumigants and fungicides to combat seed and plant diseases, as well as in the chemical control of weeds.

The term “integrated pest management” was first applied to cotton and was founded upon in-depth knowledge of the physiology of major cotton insect pests, such as the pink bollworm and the boll weevil. Successful “boll weevil eradication” programs in the states of North and South Carolina are really “integrated pest warfare”—directed by the U.S. Department of Agriculture (USDA), state regulatory agencies, and university Extension personnel—followed by continuous pest monitoring and the maintenance of buffer zones between “clean” and “unclean” regions. Analogous “buffer-zone” tactics have been successfully used for years to prevent migration of the boll weevil onto the High Plains of Texas.

The future direction of pest control in cotton is clearly toward the integration of chemical, biological, and cultural techniques that will often involve area-wide monitoring, statistical modeling, and concerted actions by groups of farmers. The complexity of the technology will be mirrored in the application techniques. This will offer competitive advantages to production areas that have informed, organized groups of farmers with access to Extension-type experts on pest control. It also implies the need for increased involvement by government agencies that can facilitate such organization.

Crop Management

Cotton has always been among the most management-intensive field crops, with day-to-day attention being required for consistently profitable operations. Plant varieties and production practices have become so region-specific that, for example, an experienced cotton farmer in California would have much to learn about how to manage a crop in Mississippi.

Computer-Assisted Management. Computerization is already becoming an integral part of the management tools used by cotton farmers. For example, in the desert growing areas of the West, computers are used to control the simultaneous application of water, nutrients, and pesticides through drip irrigation systems. For another example, in the Mid-South, crop simulation technology is being applied as an on-farm decision making tool. A dynamic cotton crop
model (GOSSYM)—driven by input variables such as canopy temperature, solar radiation, soil nutrients, plant density, soil type, moisture, etc.—has been adapted for use on microcomputers and has been used by a handful of producers for two years. They have found the model, along with a companion model for economic optimization (COMAX), helpful in making timely and cost-effective management decisions.

Efforts are now being made to assign a full-time Extension specialist to a three-year project to facilitate the adaptation and transfer of GOSSYM throughout the Cotton Belt. If this management technology is successful, it will inevitably spawn small support industries such as those involved in supplying and servicing the computer-operated, on-farm monitoring stations that furnish critical environmental data used for simulating crop development.

Harvesting and Handling. The harvesting and handling of cotton is unique. Mechanical picking and stripping were commercially introduced in the early 1940s, and hand harvesting had virtually disappeared by the late 1960s. The two basic types of mechanical harvesters are pickers (which remove seed and lint from the bolls) and strippers (which remove the whole boll, including the bracts and some stems).

Improved integration of harvesting technology with cultural practices, cotton varieties, and ginning processes appears to be a prerequisite for achieving a high quality textile fiber. Among the techniques that offer great promise in coming years is the use of plant growth regulators to control plant size, advance maturity, terminate fruiting, and accelerate the opening of mature bolls—all of which affect harvest efficiency (Colwick, Lalor, and Wilkes, 1984).

Rapid harvest is necessary to minimize weather-related loss of yield and quality. This often requires storage of the seed cotton until it can be ginned. Traditional methods of storage include buildings, trailers, baskets, or piles in open areas. Seed cotton storage in specially constructed buildings has generally become economically infeasible. When the ginning rate is not fast enough to allow processing within a few days, the newest innovation in storage is the high density module system, which was developed in Texas during the 1970s. The seed cotton is formed into rectangular stacks of eight to twelve bales, either on pallets or on the ground, which are moved by specially designed transport units. New handling systems in the foreseeable future are likely to be variations on the module system.

Marketing

U. S. cotton marketing encompasses all activities between farmers and consumers, beginning with gins and ending with the retailers of multitudinous end-use products. Major junctures and flows are illustrated in Figure 1, along with several “facilitating functions”—the performance of which depends on service industries, government, trade associations, etc. These facilitating func-
Figure 1
U. S. Cotton Fiber Marketing

MAJOR CHANNELS AND JUNCTURES

Ginter
Warehouses
Mill Buyers
Merchants and Brokers
Commodity Credit Corp.
Warehouses
Shippers
Warehouses
U. S. Textile Mills
U. S. Mfrs.
Whole-salers
Retailers
Foreign Textile Mills
Foreign Mfrs.

MAJOR FACILITATING FUNCTIONS

Grades and Standards
Financing
Risk Bearing
Info. Transfer
Regulation
Market Dev.
tions cannot be left out of a consideration of research and technology issues: in fact, the efficiency and innovativeness with which they are performed may be the U.S. cotton industry’s best hope of maintaining a comparative advantage in the global market.

In this section, specific consideration is given to ginning and to textile spinning and weaving. Then, some technology and research issues related to the facilitating functions will be summarized.

Ginning

In its strictest sense, ginning refers to the separation of cotton fibers from seeds. Gins today are also expected to dry and clean the fibers, package them for storage and shipping, and often facilitate the physical, financial, and ownership transactions necessary to move the cotton into marketing channels (Baker and Griffin, 1984).

The dilemma facing the ginning sector is how to process the raw seed cotton as fast and cost-effective as possible without doing damage to the inherent qualities of the fiber. Much progress has been made, but it has been done by refining technology existing since the early 1900s. Now, as then, there are two basic types of gins: “roller” gins and “saw” gins. While the roller gins are used primarily for extra-long staple cottons in this country, they are the predominant method in other parts of the world. They typically have lower production rates but produce fewer neps (small knots of tangled fibers) and fewer shortened fibers than do saw gins. Limited research on alternative ginning techniques is being done, but it is impossible to foresee commercialization of anything new.

Most changes in gin plants have occurred and probably will continue to occur in auxiliary equipment needed to accommodate the needs of the production sector on one side and the marketing sector on the other. Examples on the side of producers include equipment to clean mechanically harvested cotton; higher capacity plants and automatic sampling to shorten the delay between harvest and marketability of cotton; and alterations to efficiently store and feed cotton modules. Examples on the side of cotton marketing include control of fiber moisture content, fully covering bales to prevent postginning contamination, and pressing bales to a “universal density.”

Textile Spinning and Weaving

A fact not generally known is that there is a continuing technological revolution in every major textile processing category, which has been underway for at least 35 years (Finnie, 1982; Buchanan, 1985). Changes are coming so fast in many cases that “technological obsolescence” has added greatly to the risk associated with making investment decisions. The use of micro processor-controlled monitoring and reporting of production variables has already become commonplace, while robotics will likely be a strong trend by the 1990s.

Spinning. At the beginning of the 1970s, over 95 percent of all spinning of fibers into yarns was done with “ring” spinning frames. Today, probably 15 to 20 percent is done by “open end rotor” spinning frames. Perhaps 35
to 40 percent of the U.S. total will be done with open end rotor frames during the 1990s, due primarily to faster production rates and reduced number of steps involved in processing (Buchanan, 1985; Perkins, Ethridge, and Bragg, 1984; Ethridge, January 1982).

At least two other distinct spinning systems are in developmental stages. "friction" spinning and "air-jet" spinning, with their niches in the market yet to be determined (Derichs, 1983; Ward, 1984). It increasingly appears that friction spinning may have substantial potential because it (like open end spinning) offers a step-saving, economical process for transforming partially oriented fibers into yarns.

All these different spinning technologies require a different mix of fiber characteristics for operational efficiency, and the end-product properties of the yarns they produce are substantially different. For example, open end spinning has been advantageous to cotton in general, and to those varieties with shorter, finer fibers in particular. Thus, the process of adopting open end spinning is related to a process of change in demand for cotton fibers (Deussen, 1983).

*Weaving.* The most widely used process of forming yarns into fabrics is weaving, followed by knitting and then by various nonwoven techniques (which generally use a bonding medium or thermoplastic fusion technique). Weaving is still dominated by "shuttle" looms (which have a missile-shaped holder to carry the yarn back and forth across the loom). But two types of shuttleless looms, "rapier" and "projectile," have become commercially important. Two others, "air-jet" and "water-jet" looms, are also competing to fill niches in the market (Heusser, 1983; Seidel, September 1982 and May 1982). As with the alternative spinning technologies, these weaving technologies are not neutral with respect to either fiber requirements or end-product characteristics.

*Facilitating Functions*  
The six categories of facilitating functions given in Figure 1 are not all-inclusive. Another one that could have been included is agricultural policy (as it relates to the cotton industry); however, the ones listed provide a balance between scope and focus. Thus, they can be generalized to cover all issues and clearly they are *basic* functions; i.e., they cannot be eliminated. They can perhaps be performed more efficiently or by different entities, but they must be performed by *someone* if orderly marketing is to be achieved.

Technological change has become a very relevant, even pressing, issue with respect to several facilitating functions, primarily because computer technology offers the prospect of their faster, more comprehensive, and more cost-effective performance.

*Grades and Standards.* The classification of cotton fiber is fundamental to its utility. This is assured by the facts that (1) cotton is used to make a broad range of end-use products and (2) cotton fiber is subject to a broad range of biological and environmental variations. Official USDA classification
of cotton is comprised of measurements of grade (which is a combination of color, trash content and preparation), staple (which is the predominant length of the fibers), and micronaire (which is a rough indicator of fiber fineness) (USDA, April 1980). These measurements are clearly not sufficient to predict the performance of cotton in textile spinning, weaving, and finishing operations. Three additional measurements which offer large incremental improvements for indicating the use-value of cotton fibers are those on fiber strength, fiber length uniformity (which indicates the length distribution of fibers), and fiber maturity (Deussen, 1983; Ethridge, January 1982; Ethridge, Towery, and Hembree, January 1982; Hembree, Ethridge and Neeper, 1986). While measurement of these characteristics by scientific instruments has been technically feasible for years, it was not commercially feasible because of time and expense involved. However, combining measurement instruments with computer technology has resulted in cost-effective "high volume instrument" (HVI) systems, current versions of which are able to provide separate measurements of grayness, yellowness, average fiber length, fiber length uniformity, micronaire, and fiber strength. Research is being done to add instrument measurement of trash content and eventually a measurement of fiber maturity.

Repeated tests have shown that HVI systems are more reliable than measurements by human classifiers, especially when variability in fiber properties is substantial (USDA, July 1980, and Mimeoograph, 1980). USDA is already operating HVI systems in 15 out of 20 classing offices, and USDA policy is to make HVI classing available to all farmers who request it. The availability of a strength measurement assures that the number of requests for its use will increase as concerns about reliability and calibration of the systems are resolved.

Refinement of this technology and incorporation of it into the market-wide grading system can generate substantial improvements in both operational efficiency (i.e., efficient utilization of expensive inputs by those in the market channel) and pricing efficiency (i.e., efficient communication to the production sector and efficient coordination of marketing functions). These improvements would translate into a U.S. cotton industry that is more competitive with respect both to competing fibers and to foreign-grown cotton.

Financing and Risk Bearing. Baled cotton makes better collateral than most agricultural products because its identity can be preserved as it moves through market channels. A computerized information network linking the Agricultural Stabilization and Conservation Service, warehouses, and banks offers prospects for: a "clearinghouse" to verify the integrity of specific bales as collateral and to determine ownership: speedier transfer and matching of classing results: more reliable information on the quantity of cotton available for certification and delivery on the futures market; etc. It could even provide the basis for electronic transfer of ownership in a shorter time and with a fraction of the expense entailed by current techniques.

Information Transfer. Although all facilitating functions require the transfer of information, a separate category for this function is still needed. Information
on everything from weather to planting intentions to application instructions must be transferred backward and forward through the system. A pilot project is being planned for the 1987-88 crop which will test the feasibility of a "cotton information network." The pilot network will utilize an electronic mail system which will allow participants in selected counties across the Cotton Belt to telecommunicate with each other with the National Cotton Council, and with USDA. In particular, it will provide the producers a direct telecommunications link to their local office of the Agricultural Stabilization and Conservation Service. In addition, it will include an information retrieval capability, allowing users to search for specific data of interest to them. If the pilot network functions satisfactorily, it may be expanded to a Belt-wide network in 1987-88. Over time, such a network could provide part of the samples for surveys done by USDA, greatly reducing the marginal costs of collecting information.

Regulation and Market Development. Regulatory issues are intricately bound with technological advances on one hand and the limits of technology on the other. Regulation is put in conjunction with market development here, because government regulations have been very detrimental to efforts at developing larger markets for cotton fibers.

The two strategic junctures for cotton demand are consumers and the textile mills. Of course consumers give direction to the mills' choice of fibers, but on a fairly general level. It is primarily textile manufacturers that must confront the complex of demand parameters—including price, appearance, comfort, durability, ease of maintenance, etc.—and select the raw materials with which to satisfy the demand.

Since the mid-1970s, threatened and real regulations on cotton dust levels in U.S. textile mills have curtailed cotton consumption by millions of bales and required tens of millions of dollars investment to achieve a high level of air quality within textile plants. They help explain a reluctance by U.S. mills to emphasize cotton until practically forced into it by consumers' revealed preference for cotton in the apparel and home furnishing products imported from other countries. Also, the Occupational Safety and Health Administration is currently deliberating about workplace exposure levels to be required on formaldehyde, which is a fundamental component of chemicals used in achieving the "easycare" characteristics of cotton textiles that are demanded by consumers. One of the issues involved is whether the exposure level will be set below the existing capability to accurately measure workplace concentrations.

The result of such regulatory actions is often a sacrifice of research and promotion that promises a high payoff to the cotton industry, in order to do "defensive research" and public relations. For example, Cotton Incorporated, the research and promotion organization of U.S. cotton producers, has diverted millions of dollars from other projects to fund research efforts aimed at alleviating the cotton dust problem. Another example is in chemical finishing research for textiles, where regulatory constraints on the application and use of new
chemical products, combined with the high cost of toxicological testing, are
discouraging long-range commercial research. This means that chemical finishes
based on new molecular structures, or any totally new finishing concepts,
will probably originate in foreign countries.

Given that adequate risk reduction for both workers and consumers is a
necessary objective, it must be balanced with maintenance of global com-
petitiveness of U.S. industry. Erring too far in either direction results in human
suffering and large social costs.

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Addendum to the List of Participants

KEVIN McDERMOTT. Director, Market Research, Calcot, Ltd., and Chief Economist, Amcot, Inc.

As director, Mr. McDermott analyzes supply and demand factors influencing the cotton market for the 3,300 member regional cotton-marketing cooperative, headquartered in Bakersfield, California. He is known in the industry for his World Outlook presentation to textile executives, farmers, cotton buyers, and gin managers. Joining Calcot in 1977, he served as an internal auditor and sales analyst before becoming director of market research in 1980. He has represented the U.S. industry worldwide as an advisor to the International Cotton Advisory Committee.

Raised in Bakersfield, Mr. McDermott has a B.A. in economics from Stanford University and a Masters in Business Administration from Harvard Business School. He has also been a participant in the California Agricultural Leadership Program.