CAUSAL FACTORS OF COTTON QUALITY DISCOUNT AND PREMIUMS IN THE MID-SOUTH: 1973 - 1995

Michael Barnes and C.W. "Bill" Herndon, Jr.
Department of Agricultural Economics
Mississippi State University
Mississippi State, MS

Abstract

The quality of cotton produced in the Delta region of Mississippi was analyzed during the 23 crop years of 1973 through 1995. Three quality categories and related discount/premium were reviewed to ascertain how cotton grade, staple length, and micronaire have changed over time. These were then combined to form an aggregate measure of quality. A similar analysis was done to determine how quality changes during the harvest period.. Causal factors were examined in an attempt to explain the fluctuations in these elements.

Introduction

The purpose of this report was to analyze the quality of Mississippi Delta cotton during the 23 crop years, 1973-74 through 1995-96. The classing information used in this report came from the Greenwood or Dumas Classing Office. The three cotton quality categories studied were grade, staple, and micronaire. Each of the three cotton quality categories were reviewed and compared to the price per pound discounts or premiums over the selected years. The data were collected from annual and weekly USDA, AMS, Cotton Division publications (see References for details).

The research consisted of two types of analyses using two different time periods. First, an examination of yearly changes in cotton quality by crop years over the 23 year period was performed to indicate any overall trend in the average quality and the respective discount/premiums. Second, an investigation was made of the weekly changes in cotton quality and discount/premiums during the harvest period for each of the last 17 years of the study period. The weekly review was done to detect if cotton quality and premium/discounts were affected by the timing and length of harvest.

The effect of various factors that affect the quality of the crop were then selected and analyzed. The introduction and retirement of various varieties appeared to have a definite effect on the relationship between the quality of the crop and the discounts received. The biological factor of precipitation was also examined. Overall quality was studied to detect any changes over the 23 crop year period.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:326-330 (1997)
National Cotton Council, Memphis TN

In general, this analysis indicates that cotton quality has exhibited change during the study period.

Yearly Average Quality Discount/Premiums

The analysis demonstrates that the quality of cotton produced in the Mississippi Delta has changed during the past 23 years. Grade quality declined dramatically throughout the first 14 years of the study which was translated into increased discounts for cotton grade. However the rebound in the most recent years served to offset some of the losses in quality sustained in the late seventies and early eighties.

Staple and micronaire quality and related discount/premiums have improved slightly during this period of time. Comparison of the relative size of discount/premiums of the three quality categories indicates that the discounts for grade have been over seven times greater than the discount/premiums associated with staple or micronaire. Therefore, grade quality dominates the discount/premium received for cotton and has caused an increase in total discounts received for Delta-produced cotton during the last 15 crop years.

Quality Discounts and Premiums During the Harvest Period

Cotton quality categories were reviewed for weekly changes in overall quality during the harvest period. The 17 most recent crop years (1979 - 95) were analyzed to determine if the timing of harvest has had an impact on the quality of Mississippi Delta cotton. A review of the weekly data during each of the 17 years indicates that grade quality was significantly affected during the harvest months. The results of the research illustrate that the 17 crop-year weekly average discounts received by producers increased steadily as harvest progressed. A sharp increase in discounts was observed during the last weeks of October and continues to increase throughout the remainder of the harvest period. Clearly, this confirms that cotton grade quality deteriorates dramatically over the course of harvest and that producers' concerns in this area are well-founded. An inference drawn from this historical trend is that production practices promoting early harvest have significant economic value.

The amount of precipitation and its timing during the harvest period were also examined to measure their impacts on discounts and quality. This portion of the project was related directly to the harvest period. Each of these factors proved to have significant affect on the quality of the crop.

Earliness and Cotton Variety Influences

Cotton producers have demanded that seed companies develop germplasms that not only were high yielding but also early maturing varieties. Seed companies have been extremely successful in accomplishing these goals. In reviewing the historical data, cotton varieties adopted and amounts planted by producers were important elements in

determining the level of discount/premiums received by farmers. A detailed description of how cotton producers changed varieties over the 23-year period was completed to provide insights of as to how developments in cotton breeding and the adoption of these new varieties affected the level of cotton quality discount/premiums.

In order to examine the many varieties used throughout the study, certain parameters were set to guide the focus of the research. The percentage of acreage planted in any combination of commercial varieties was gathered and the major varieties comprising at least seventy percent of the crop were then recorded for discussion. The 23 year study was subdivided into four subperiods. These sections were chosen due to the changes in varieties planted during a number of years. In the earlier years of the experiment, there were fewer dominant varieties of cotton being used. The data used in this section of the research was obtained from the AMS. The following sections detail how cotton producers have altered the varieties of cotton planted and classed at the Greenwood/Dumas Classing office.

1973-1979

The first period chosen for discussion was 1973 - 1979. Throughout this time period there were basically three varieties comprising over 90% of the cotton planted: DPL 16, DPL 61, and Stoneville 213. Table 1 shows the percentage of acreage planted in the Mississippi Delta that can be attributed to each of the three major varieties. 1976 saw the introduction of DPL 61 on a substantial basis. This year was also the outlier for the time period with respect to discounts. The total weighted discounts for the period showed a marked improvement in 1976. However, the following year was back to "normal" amounts even with an increase in the amount of DPL 61 planted. This evidence makes it difficult to bestow any of the "better" discounts to the introduction of new variety.

The latter years of the first subperiod was not as dominated by such a few varieties as the earlier years. The "big three" for this era represented only 84% of the acreage in 1978 and only 68% in 1979. The introduction and subsequent use of several varieties on a small scale accounts for this decline in representation. Stoneville 213 was an obvious mainstay of producers during this decade. Never was there a year in which Stoneville 213 made up less than 40% of the acreage planted in Mississippi.

1980 - 1985

In order for the subperiod to continue within the parameters set forth earlier, the number of varieties had to be expanded to meet the seventy percent of the crop planted criteria. Table 2 illustrates the acreage planted in each variety. The decline in the use of DPL 16 caused its retirement in 1979. DPL 61 did not make it into the sextet of seed of the early eighties. These were replaced by new varieties from the DPL line-up. DPL 41 and 55 came onto the scene. After a solid decade of service, Stoneville 213 steadily declined in use throughout this period but was still used in a significant amount in the 1980 and 81 crops. The new item arriving from Stoneville was variety 825. This new seed enjoyed prolific success throughout this time period. DPL 41 saw several years of success although it did not match the popularity of Stoneville 825 in this subperiod. Although, DPL 41 and 55 taken in combination do rival the use of Stoneville 825. There was another newcomer from the Stoneville stable in the last few years of this period. Stoneville 506 began an eight year cycle of use. In the mid eighties, this variety gained acreage steadily. This trend continued throughout this subperiod and into the next. The latter part of this period witnessed the introduction of DES 422. From 1982 to 85 this variety increased in popularity.

The discounts and premiums associated with this period also reflected the variations usually associated with the introduction and demise of new and old varieties respectively. There is a marked relationship between the acreage planted in DPL varieties and the respective discounts. As the amount of acreage of DPL planted increased the discounts decreased. The failure to mention 1984 in its own light would be to pass up an opportunity to observe an unusual occurrence. 1984 was an anomaly in that the yearly average total discounts and premiums associated with grade, staple, and micronaire were up to four times that of other years in this decade. The varieties planted in this year were none different from other years. The amounts of each major variety were more evenly spread in 1984 than in any other year. The reason most likely to be the cause of such an event is biological and will be discussed in more detail later. If the data were observed with a one year lag and 1984 dismissed, there was an relationship between the amount of Stoneville 825 planted and the discounts. However, the lag would seem to discredit the fact that Stoneville 825 accounted for any of this.

1986 - 1991

In this period, DES 422 was replaced by the new 119. This variety continuously increased in use albeit a slow increase. Stoneville remained a key contributor to the industry with their continued influence through the use of the varieties 825 and 506. Both these varieties were prevalent in the previous few years and continued to be used until 1990. Table 3 reflects amounts planted by variety.

However, the rookie of the time was DPL 50. This variety came onto the scene in a major way in 1986 by capturing over 29% of the acreage planted in its first year of substantial use. It continued to increase in use throughout this time period and into the next. Following in the footsteps of DPL 50, DPL 20 also had a successful number of years throughout the late eighties and early nineties. The use of these two varieties represented the closest domination of the industry we have seen since the early seventies.

The discounts of this time period were some of the "best" ever recorded. There was a major decrease from 1986 to 1987 and the average throughout the decade was less than 200 points. 1990 was the exception to this fact with an average of just over 200 points. This was however the largest single acreage planted year for DPL 50. This period finishes on a good note with the average discount being less than 100 points in 1991.

1992 - 1995

The early nineties were somewhat stable concerning the number of varieties planted. For the first four years, there were four major varieties. Some of these were carryovers from the previous time periods and some were newcomers. This period was the first in over a decade not to have a Stoneville variety in the top five varieties planted. The acreage vacated by the Stoneville varieties was picked up by the Suregrow varieties 125 and 501 in 1995. DPL 50 continued to dominate the market by holding over 30% of the acreage until 1995 and the introduction of the Suregrow varieties. The early nineties reflected a slight decline in the use of DES 119. By 1995 this variety represented less than 10% of the acreage planted. 1995 was the year of decline for most of the major varieties. The outstanding variety, DPL 50, dropped from over 35% to less than 20% of the acreage from 1994 to 95. Other than the introduction of the Suregrow varieties there was no increase in acreage for any variety.

The discounts associated with this era were as variable as ever. There has been a steady increase in discounts since 1990. With the introduction of new varieties, it seems the discounts increase. There was a decline in the use of DES 119 over this period. The discounts were at their highest since 1990 in 1995. This coincided with the introduction and use of two Suregrow varieties. Suregrow 125 and 501 came onto the scene in 1995 with a combines use of over 25% of the acreage planted. This market share was forfeited by DPL 50 and 20. DES 119 also lost some ground from 1994 to 1995. This analysis will continue to be interesting to follow with the introduction of the insect resistant varieties hitting the market.

Factors Influencing Cotton Quality Discount/Premiums

Cotton quality and the level of discount/premiums associated with the various characteristics is influenced by several environmental, technological, and institutional factors. The elements which affect cotton quality and the associated discount/premiums were identified through numerous discussions with cotton producers, merchants, USDA personnel, and various cotton experts. Several factors were recognized as having significant influence on cotton quality discount/premiums, such as: (1) cotton varieties; (2) precipitation during harvest; (3) High Volume Instrumentation (HVI); (4) modules and seed cotton handling and storage; and (5) textile mills demand for "less cleaning" of cotton at gins. This study attempts to ascertain the impact of these factors on the yearly average discount/premiums assigned to cotton classed through the Greenwood/Dumas Classing Office for the 1973 through 1995 crop years.

The paper includes an analyses to ascertain whether these factors were statistically related to the level of cotton quality discount/premiums. In the Analysis of Factors section of this paper, simple Ordinary Least Squares (OLS) regression analyses were conducted to determine which, if any, of these five factors were important determinants in the amount of discount/premiums realized by producers for the overall quality of cotton crops over the selected time period.

Precipitation during Harvest

Precipitation during the cotton harvest period will obviously have a significant influence on the overall quality of the crop. The cotton industry recognizes that rain falling on the crop after the cotton has opened dramatically and adversely affects the quality of cotton harvested. In an attempt to analyze how precipitation affects the level of cotton quality discount/premiums, daily and monthly precipitation data were collected from the National Weather Service station located in Stoneville, Mississippi for the selected time period. Monthly rainfall data were examined for the harvest months of September, October, November, and December to ascertain how precipitation influences the level of cotton quality discount/premiums realized by producers.

The amount and timing of rainfall received during harvest has an important influence on cotton discounts/premiums. However, very little is known about the threshold amounts of precipitation that will cause significant changes in discounts/premiums. Several different methods to delineate the amounts and timing of rainfall received during the cotton harvest were analyzed and evaluated in the Analysis of Factors sections found later in this paper.

High Volume Instrumentation (HVI) Classing

There has been an important and fundamental change in the method which cotton is classed by the U.S. Department of Agriculture (USDA). Prior to HVI classing, the primary classification categories were grade, staple, and micronaire; however, HVI classification contains many more cotton quality categories. HVI classing was mandated and fully operational in the Greenwood/Dumas Classing office in 1991 and this institutional change in the cotton classification system may have influenced the level of quality discount/premiums realized by producers. The Analysis of Factors section includes an investigation of how the adoption of HVI classification may have affected the level of cotton quality discounts/premiums over the selected time period.

Modules and Seed Cotton Handling and Storage

Technological developments in the cotton industry have significantly influenced how seed cotton is handled and stored from the field to the gin. Modules have been the

most important element in altering how cotton is transported and stored during harvest and has single-handedly transformed the structure of the cotton ginning industry. Modules have also had an impact on the cotton quality and the related discount/premiums. Modules affect cotton quality in two ways: (1) the quality of cotton stored in modules deteriorates as the module storage time increases; and, (2) modules shorten the harvest period by providing storage for picked cotton rather than waiting for trailers to return from gins. Modules have also had an influence on altering the time required for the cotton to move of the from the field to the gin and then to the classing office. The time required for cotton to move through there stages is no longer consistent with module technology as compared to the cotton trailer harvest system.

During the selected analysis period, the amount of the Mississippi cotton crop that was harvested using modules increased from one percent in 1973 to 80 percent in 1995. In the Analysis of Factors section, the relationship between modules and discounts/premiums was examined to determine if module technology has statistically affected cotton quality.

Textile Mills Demand for Less Ginning

Textile mills have been urging cotton producers and ginners to not clean cotton as much during the ginning process for more than a decade. Textile mills contend that if producers and ginners adopt this practice of "less ginning" that the fiber characteristics of this cotton will be more desirable for cotton spinners because this process preserves staple, strength, and uniformity characteristics. However, this process of "less ginning" generally means that cotton contains more trash in the form of leaves or other materials which will be classed by the USDA as poorer quality cotton with larger price discounts.

This situation is simply caused by the lack of communication. The mills and gins are in touch with what the other needs however the producer was, for a long time, left out of this conversation. The practice of mill direct marketing has been, for several years, becoming more available to selected producers. This is a situation in which the mill deals directly with the producer to buy X amount of XX grade of cotton for XXX price. The gin simply does what the mill wants and the producer receives the price set forth in the contract with the mill. As is stated before, this is a very difficult problem to get reliable information on. The information found is purely speculative as is the analysis of this problem.

Analysis of Factors

An investigation was conducted to determine whether there exists a statistical relationship between the yearly average cotton quality discount/premiums and the five (although no data was available to represent textile mill demands for less ginning) causal factors listed and described previously in this paper. In particular, this analysis attempted to ascertain if variations in the level of discount/premiums could be explained by these five causal factors. Ordinary Least Squares (OLS) regression analysis was utilized to examine these relationships and to construct a explanatory model for cotton quality discount/premiums. The OLS regression routine found in the spreadsheet software program called Quattro Pro was utilized to conduct these regression analyses. The data used in this regression analyses was annual data for the 1973 through 1995 cotton crop years and was either collected or formulated from reports published by the Cotton Division of the Agricultural Marketing Service (AMS) and the Economic Research Service (ERS) of the USDA. Daily and monthly precipitation data was collected for the Stoneville, Mississippi site by the U.S. National Weather Service.

Model Specification

The dependent variable in this regression analyses is specified as cotton quality discount/premiums while the independent variables are identified as the five causal factors described previously in this paper. The OLS linear regression models that were estimated and analyzed in this paper were specified as follows:

$$DISC = f(VAR, PREC, HVI, MOD. MILL)$$

where,

DISC= Annual weighted average discount/premiums, in cents per pound;
VAR= Cotton acreage planted by cotton varieties, in percent;
PREC= Monthly precipitation during harvest period, in inches;
HVI= Dummy variable representing HVI adoption, equals 1, 1991-95; 0, otherwise;
MOD= Amount of Mississippi crop harvested using modules, in percent; and,
MILL= Amount of Mississippi crop sold mill direct, in percent.

These five independent variables (except MILL) were specified in a numerous ways and used in conducting this regression analyses. A number of different regression models were estimated in an attempt to construct various equations to explain what factors influenced the quality and discount/premiums of cotton classed by the Greenwood/Dumas Classing office.

The regression analyses found that of the approximately 15 different independent variables evaluated and of the large number of equations estimated that the most appropriate model included only two independent variables. Both of these independent variables were statistically different from zero at the 95 percent level of significance and this estimated regression equation was able to explain over 62 percent of the variation in cotton quality discount/premiums. The two independent variables represented cotton varieties (where DPL represented the percent of total cotton acreage in the Greenwood/Dumas office area that was planted in Delta and Pine Land varieties) and monthly precipitation (where OCT represented the amount of rainfall in inches recorded at the Stoneville NWS site during the month of October). The estimated regression equation was estimated as follows:

DISC=-4.647+0.076 (DPL)-0.346 (OCT) (4.082)
(-3.248) R^2 = 0.625

where,

DISC=Annual weighted average discount/premiums, in cents per pound of lint;

DPL=Greenwood/Dumas area planted in DPL cotton varieties, in percent; and,

OCT=October monthly precipitation at Stoneville, in inches.

The number in parentheses below the estimated regression coefficients are the t-values for each of the individual estimated parameters.

Conclusions and Summary

The historical review of the quality of cotton produced in the Mississippi Delta and classed in the Greenwood and Dumas Classing Offices found that grade, staple, and micronaire quality have changed during the last 23 crop years. The varieties of cotton planted has a definite impact on the quality of cotton harvested. The research also illustrated that the number of varieties planted in any given year also has an effect on the quality. The study of weekly discount/premiums during the harvest months indicated early harvest production practices have significant economic value to producers and their profitability.

A regression analysis was conducted to ascertain what causal factors have been statistically significant or related to determining the level of discount/premiums. The findings of the regression analyses discovered that about 62 percent of the variation in cotton quality discount/premiums could be explained by the percent of the crop planted in Delta and Pine Land (DPL) cotton varieties and the amount of rainfall or precipitation during October (OCT). None of the other causal factors described in this paper were found to be statistically significant in explaining discount/premiums.

References

U.S. Department of Agriculture, Daily Spot Cotton Quotations, Agricultural Marketing Service, Cotton Division, Market News Branch, various issues, 1973-95.

U.S. Department of Agriculture, Cotton Price Statistics. Annual Summary, Agricultural Marketing Service, Cotton Division, Market News Branch, various issues, 1973-95.

U.S. Department of Agriculture, Quality of the Cotton Crop, Annual Summary, Agricultural Marketing Service, Cotton Division, Market News Branch, various issues, 1973-95.

U.S. Department of Agriculture, Quality of Cotton Classed Under Smith-Doxey Act, Agricultural Marketing Service, Cotton Division, Market News Branch, various issues, 1983-95.

Table 1.

SEASON	DPL 16	DPL 61	S'VILL 213	TOTAL
1973	54	0	42	96
1974	50	0	44	94
1975	52	0	44	96
1976	46	4	45	95
1977	36	8	46	90
1978	21	17	46	84
1979	8	20	40	68

Table 2.

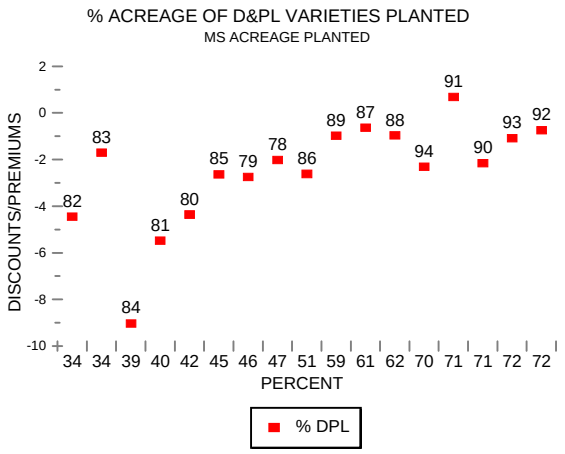
SEASON	DPL 41	DPL 55	S'VILL 213	S'VILL 506	S'VILL 825	DES 422	TOTAL
1980	6	21	16	0	31		74
1981	12	18	15	0	39		84
1982	13	12	7	0	46	1	79
1983	17	8	9	4	39	7	84
1984	20	4	9	5	28	14	80
1985	18	5	4	10	25	12	74

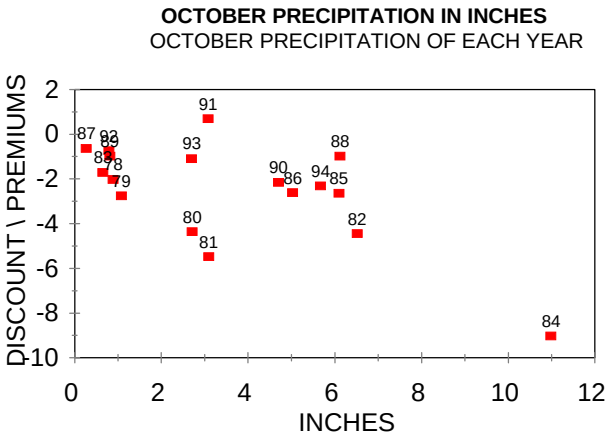
Table 3.

SEASON	DPL 20	DPL 50	S'VILL 506	S'VILL 825	DES119	TOTAL
1986	9	29	7	23	1	69
1987	17	38	7	12	10	84
1988	17.3	40.3	11	9.5	13	91.1
1989	21.4	36.7	8.4	4.4	14.7	85.6
1990	17.9	46.7	3.3	2.5	15.4	85.8
1991	13.6	44.9	3	0.9	17.9	80.3

Table 4.

SEASON	DPL 20	DPL 50	DPL 51	DES 119	SG125	SG501	TOTAL
1992	13.5	35.1	10.2	18.4			77.2
1993	15.1	37.4	10.5	16.2			79.2
1994	16.9	38.4	11.3	13.9			80.5
1995	8.96	19.78	9.86	5.22	11.26	16.76	71.84


% ACREAGE OF D&PL VARIETIES PLANTED
MS ACREAGE PLANTED
DISCOUNTS/PREMIUMS
2
0
-2
-4
-6
-8
-10
82
83
84
81
80
85
79
78
86
89
87
88
94
91
90
93
92
34 34 39 40 42 45 46 47 51 59 61 62 70 71 71 72 72
PERCENT
% DPL


OCTOBER PRECIPITATION IN INCHES
OCTOBER PRECIPITATION OF EACH YEAR
DISCOUNT \ PREMIUMS
2
0
-2
-4
-6
-8
-10
91
87
93
88
90
86
94
85
80
82
81
84
0 2 4 6 8 10 12
INCHES