MISSISSIPPI COTTON AND CORN STATISTICS

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Abstract

Historically high prices for corn have persuaded more farmers to plant historic cotton land in Mississippi to corn. The result for the past three years has been an inverse relationship in cotton yield vs. acres planted as the very best land is increasingly used for cotton. Conversely, the corn yields have increased as additional cotton land has been planted to corn. Data from 1866 to the present shows the yield in cotton increased 11.9 times and corn 15.8 times over this time period. The yield increase in corn was exponential in 1982-2002 while the yield of cotton was relatively stable during the same period. Cyclical production has been a characteristic of cotton farming in Mississippi with a high of 4.142 million acres harvested in 1930, almost the same as the current total of all cultivated crops in 2008. The acres of cotton harvested in 2008 were lower than any period since official records started in 1866. Classified satellite imagery demonstrates the crop location changes over the past three years and describes the strong land-use relationship between corn and cotton cultivation in Mississippi.

Introduction

Crop planting decisions can change dramatically from year to year. Reasons for changes include market prices, weather, new crop varieties, production techniques, and Government policies. Decisions of Mississippi farmers impact National crop production with Mississippi ranked 3rd in cotton production in 2005. Cotton and corn are major Mississippi crops that are examined yearly using satellite imagery and the Cropland Data Layer (CDL) process. The purpose of this study is to show that cotton and corn statistics are best examined together to determine possible reasons for statistical trends.

The CDL was developed by USDA-NASS to document crop range and extent using classification of satellite imagery based on ground truth. To date, at least 33 states have been classified at least one year, and many multiple years, using this program. This program adds an independent indicator for acreage estimate of crops and provides a pixel-by-pixel description of crop locations as a supplement to the standard NASS survey programs.

Mississippi agricultural land use has been measured on a state level using satellites since the early 1980's (Allen and Hanuschak, 1988; Ozga and Craig 1995; Muller and Ozga, 2002). In 1999, NASS, the Mississippi Department of Agriculture and Commerce (MDAC), and Mississippi State University (MSU) Extension Service entered into an agreement to produce the Mississippi CDL on a personal computer platform in Mississippi. Results for 1999-2006 have demonstrated the effectiveness of this program in Mississippi for agricultural land use mapping and have performed well against the final NASS county estimates (Shore, Gregory, and Mueller, 2005, 2006). The timing and quality of the images is important. Multi-temporal satellite images comprised of scenes taken in the spring and mid-summer produce improved crop signatures for the maximum classifications (Allen, 1990; Shore, Gregory, and Mueller, 2005). The CDL classifications are useful in maps to show the range and extent of crops (Shore, Gregory, and Mueller, 2006). In 2006 the program was improved by using new software developed using See5® and ERDAS Imagine® following the National Land Cover Data Base (NLCD) described at www.mrlc.gov. The advantage of the See5 system is full state classification in one step from multiple raw images (IRS Resourcesat-1 AWiFS), processed imagery (16-day composite MODIS NDVI), and ancillary layers (NLCD canopy, elevation, and impervious) using improved ground truth data from the USDA-Farm Service Agency. The new See5 process gives faster and better results. Regardless of the method of generation, multiyear comparisons of CDLs gives specific information on land use (Shore, Gregory, and Mueller, 2007a and b; Shore and Gregory, 2008).

Starting in 1866, the Federal Government has estimated crop data, which is current shown on line. This system allows current statistics to be available at a moments notice. Graphing the Mississippi data on cotton and corn reveals changes directly related to local and national events.

- With the Great Depression (1929-1939), after the initial exuberance, cotton harvested acres started a gradual decline to the present day historical low.
- The boll weevil cotton infestation of the south started in the 1920s and hit growers hard in 1930 with production lower than 5 years earlier in spite of farming more acres.
- Corn harvested acres dropped from 1923 to 1931, no doubt helped by increasing cotton planting and prohibition (1920-1933), but picked up again with the start of WWII (1939) with a subsequent decline more rapid than cotton.

Changes in farming practices and results are also evident for the NASS statistics. For example, the harvested corn acres in Mississippi just after the Civil War and today are about equal however the 2008 yield and production are more than 15 times higher. The corn yields started increasing exponentially around 1955. The largest number of harvested acres of corn, at 3,237,000 acres, occurred in 1921. Recently, the planting of corn has increased. We can speculate that this is in part due to potential use of corn for ethanol and the subsequent increase in corn prices. The increase in yield is likely due to the invention of transgenic plant production in the early 1980s and transgenic cotton in the late 80s and corn in the 1990s, with the higher yielding transgenic cotton and corn becoming the predominate varieties planted in Mississippi. With the CDL we can connect corn and cotton statistical changes spatially and suggest reasons for their recent relationships in land use and yields.

Materials and Methods

The USDA-NASS maintains up-to-date crop statistics at http://www.nass.usda.gov/QuickStats/. Annual statistics for the year are initiated in June with the final state-wide crop estimates available June 30. The following year the final county estimates are published from January to June. In addition, census updates are done every 5 years. These data were downloaded into data files suitable for local examination and graphing using Microsoft Excel®. Graphs were prepared for the entire available years and for specific years of interest, examining trends in harvested acres, yield, and production for state-wide Mississippi cotton and corn.

For 1999-2005, the Mississippi Cropland Data Layer was prepared using the public domain software packages Peditor and RSP and multi-temporal 30 meter Landsat imagery. Classification was based on ground truth training fields from the June Agricultural Survey and applying a maximum likelihood classifier to derive a land-use classification. Starting in 2006, the See 5 method was implemented using alternate 56 meter imagery, training data from the USDA-Farm Service Agency, and a decision-tree classifier for the CDL. Generally the crop categories remain the same but non-crop areas have been expanded using categories from the National Land Cover Database. All years of CDL crops can be compared by first resampling the 30 meter pixels to the current 56 meter using ERDAS Imagine®. The published Cropland Data Layer products are available from http://www.mdac.state.ms.us/n_library/programs/gis/index_gis.html, datagateway.nrcs.usda.gov, and http://www.nass.usda.gov/research/Cropland/SARS1a.htm.

Imagine was used to track crop intensity and rotation patterns to allow compilation of multiyear CDL data following the method of Boryan, Willis and Craig, 2008. This method provides a pixel-by-pixel image and summary statistics from the CDL by first using smart eliminate to reduce noise based on pixel size, recoding for crop of interest or for crop/year, and then summing the data.

Results and Discussion

Corn has historically been a good rotation crop for cotton. An examination of the Cropland Data Layer Results for 2006-2008 (Figure 1) shows that much cropland used for cotton has been rotated to corn (and in some cases soybeans), particularly in the southern Delta region near the corn to ethanol plant in Vicksburg. Cropping intensity (Figure 2) and crop rotation (Figure 3) also show the relationship between cotton and corn. Figure 3 also shows the frequency of rotation from cotton of 2006 (82.9% of cotton land use in the 2006-2008 period). Using this spatial information, examination of the recent graph of cotton yield and acres (Figure 4) shows an inverse relationship in cotton yield vs. acres planted suggesting the very best land is increasingly used for cotton. Conversely, as Figure 5 shows, the corn yields have increased as additional historical cotton land has been planted to corn. The spatial information suggests corn yields are increased from use of superior land that was previously reserved for cotton with an additional boost from the rotation effect.

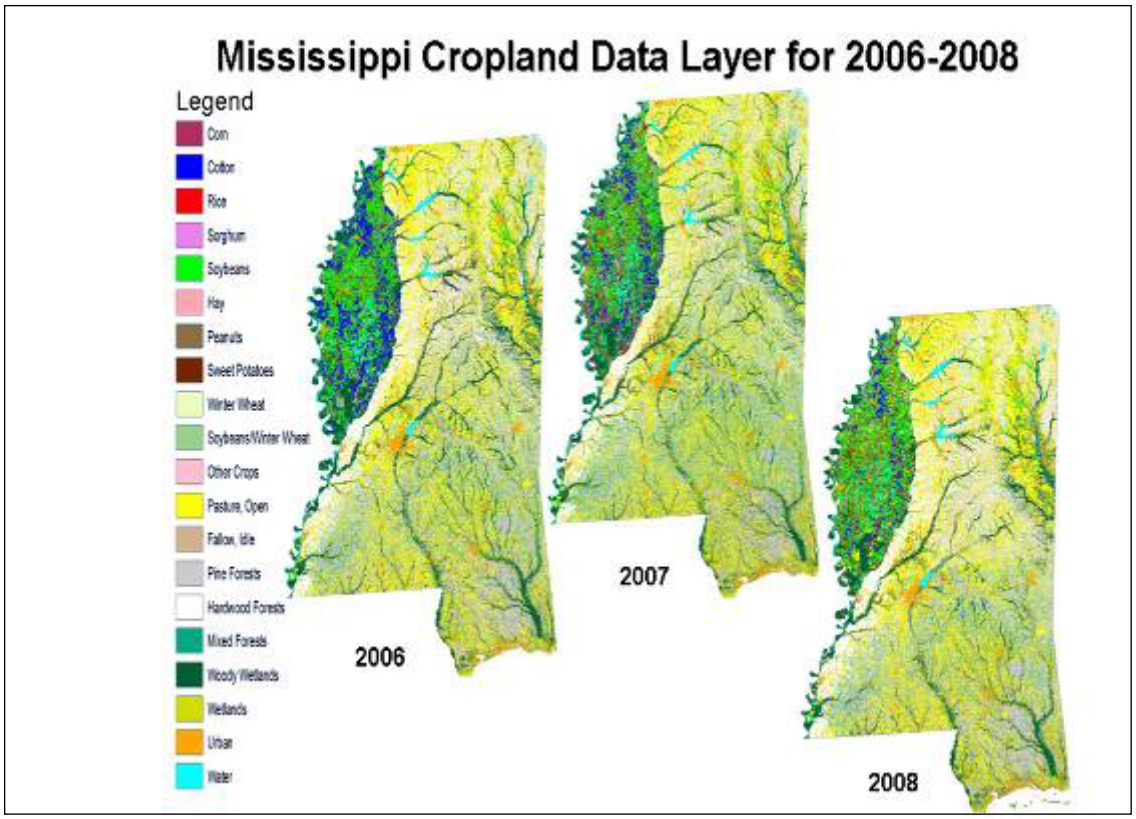

Figure 1. The Cropland Data Layer for Mississippi, 2006-2008.

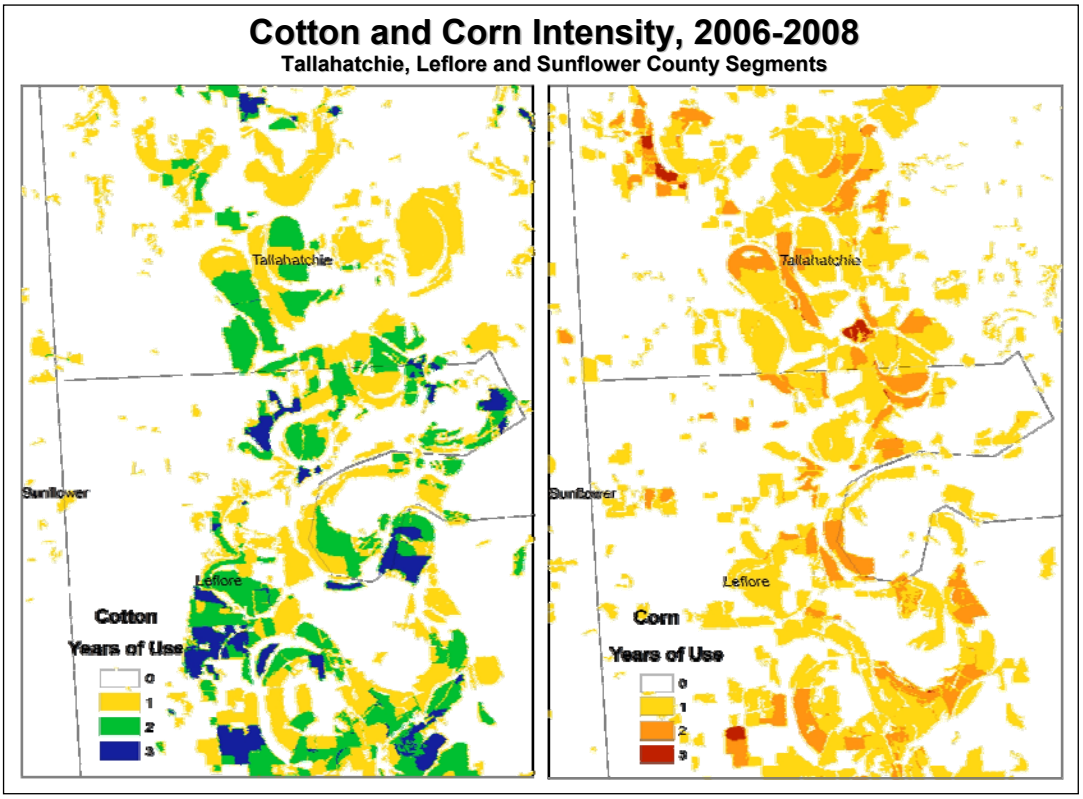

Figure 2. Examining cotton and corn land use for a Mississippi segment, 2006-2008.

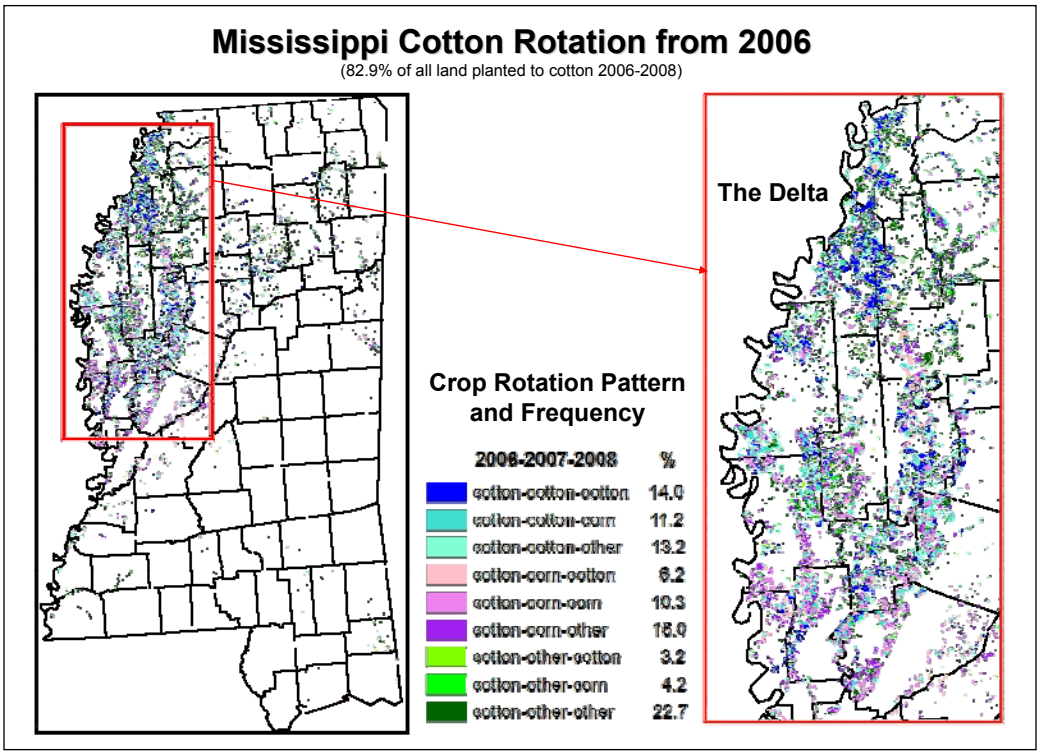

Figure 3. Mississippi cotton rotation patterns and frequency, 2006-2008.

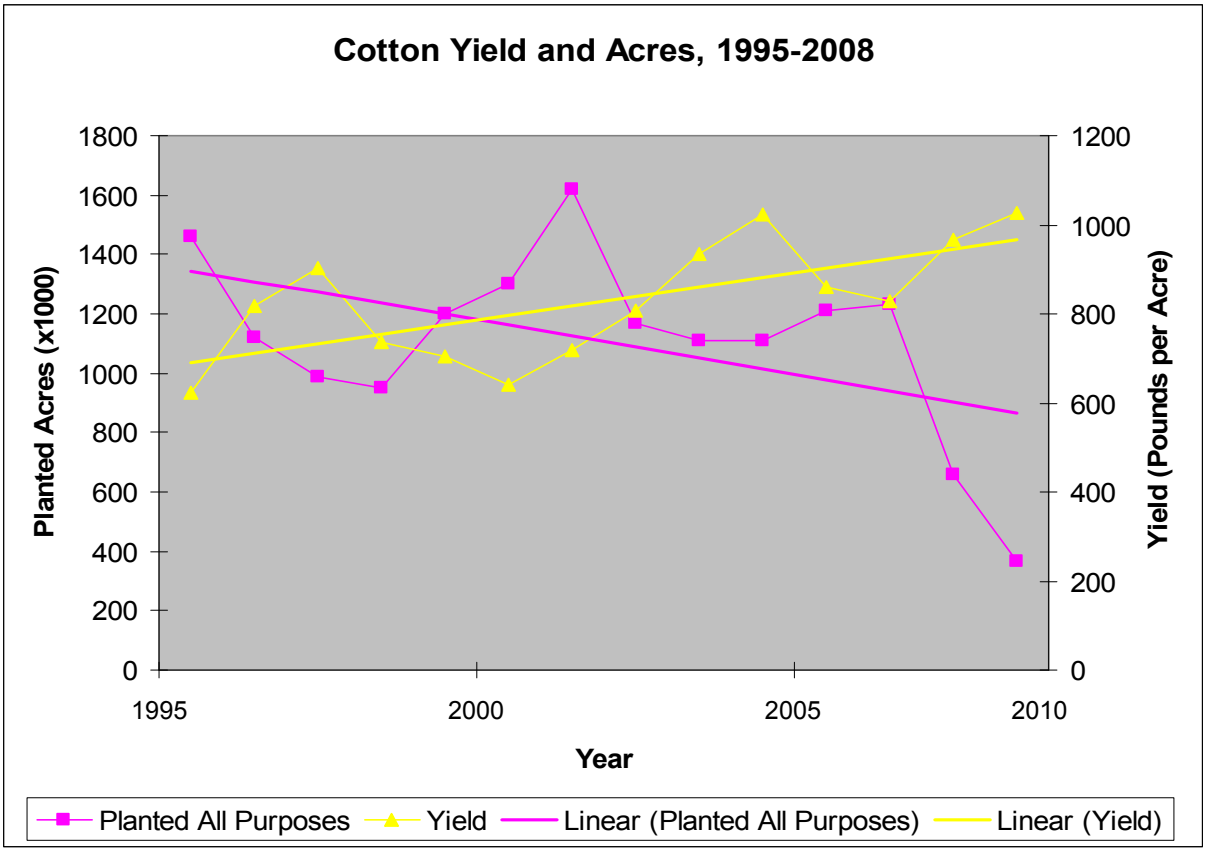

Figure 4. Comparing trends in acres planted and yield for cotton in Mississippi, 1995-2008.

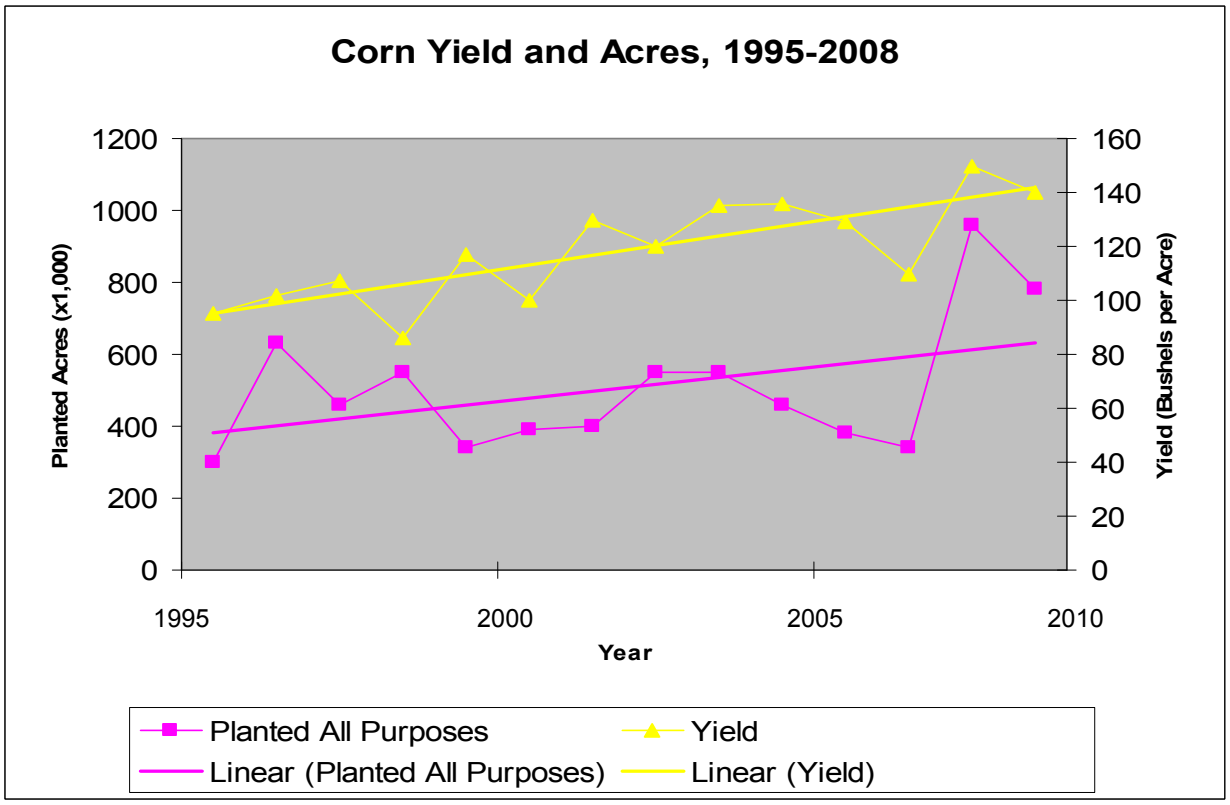

Figure 5. Comparing trends in acres planted and yield for corn in Mississippi, 1995-2008.

Data from 1866 to the present shows the yield in cotton increased 11.9 times (Figure 6) and corn 15.8 times over this time period (Figure 7). The yield increase in corn was exponential in 1982-2002 (Figure 5) while the increase of the yield of cotton was relatively linear during the same period (Figure 6). Cyclical production (Figure 8) has been a characteristic of cotton farming in Mississippi. The high of 4.142 million acres harvested in 1930 is almost the same as the total of all cultivated crops in 2008 while the acres of cotton harvested in 2008 were lower than any period since official records started in 1866 (Figure 9).

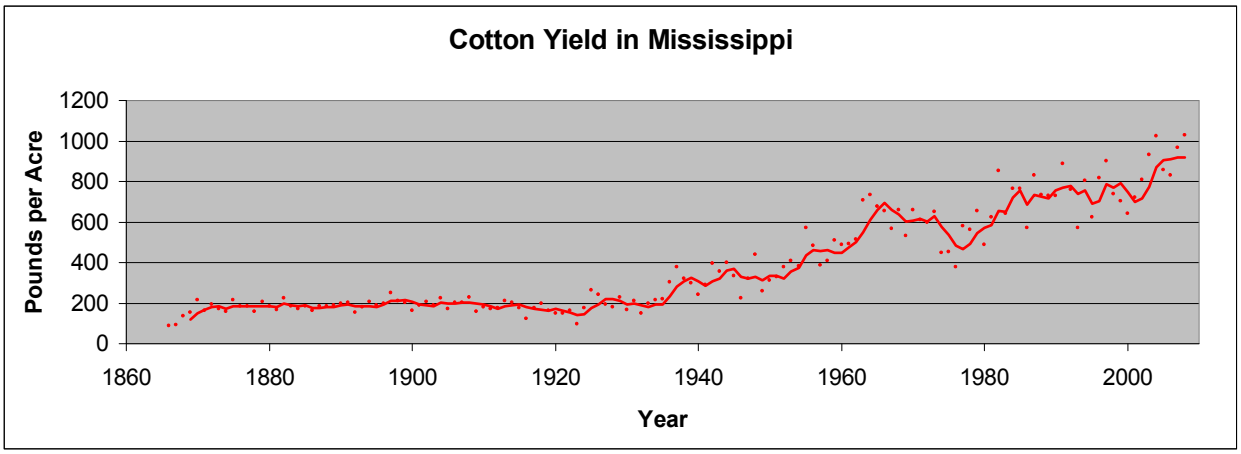

Figure 6. Cotton yield data for Mississippi since 1866. Red line is a rolling average.

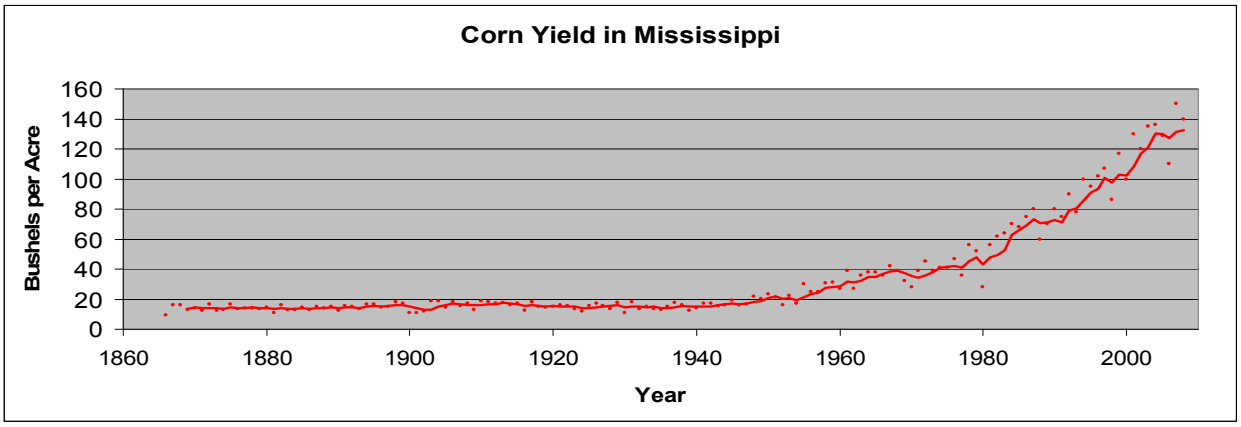

Figure 7. Corn yield data for Mississippi since 1866. Red line is a rolling average.

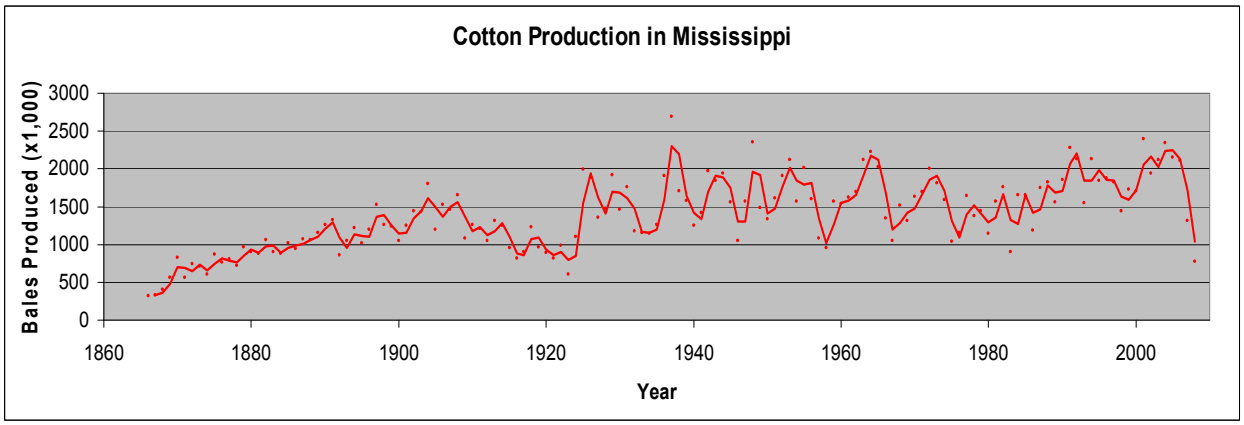

Figure 8. Cotton production data for Mississippi since 1866. Red line is a rolling average.

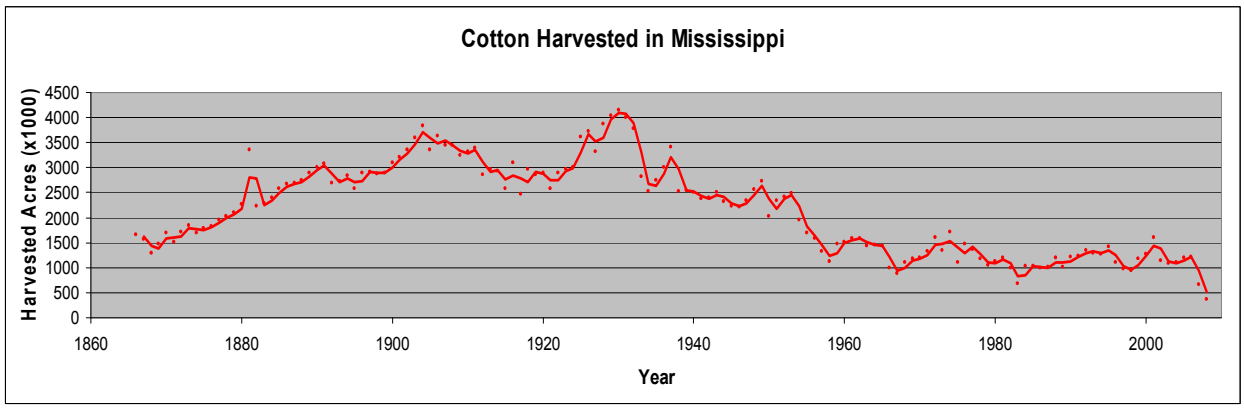

Figure 9. Cotton acres harvested for Mississippi since 1866. Red line is a rolling average.

Conclusions

- Recent legislation, higher prices and the corn to ethanol plant in Vicksburg have favored corn over cotton in Mississippi.
- For land that was planted to cotton in 2006, 38.4% was planted to cotton in 2007, and 14% was planted to cotton in 2007 and 2008. Rotation to cotton was more common in the northern Delta.

- For land that was planted to cotton in 2006, 31.5% was planted to corn in 2007, and 10.3% was planted to corn in 2007 and 2008. Rotation to corn was more common in the southern Delta.
- The reasons for recent greater yields for cotton as the planted acres decreased and greater yields for corn as the acres increased include limiting planting to more fertile soil for each crop and crop rotations.
- Historical swings in cotton production suggest future increases are probable as demand for cotton changes.
- Recent dramatic changes in crop acreage reinforce the need for NASS annual estimates.

Acknowledgements

Commissioner Lester Spell, Jr., D.V.M., Mississippi Department of Agriculture and Commerce, Melissa J. Mixon, Interim Director, Mississippi Cooperative Extension Service, and the USDA Field Enumerators in Mississippi were critical to the success of this project. Also, thank you to Rick Mueller, Claire Boryan, Dave Johnson, and other members of USDA-NASS, Spatial Analysis Research Section, Fairfax, VA for training and assistance.

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