SOURCES AND ANALYSIS OF RISING UNIT COSTS OF PRODUCING COTTON ON THE TEXAS SOUTHERN PLAINS

Marcus S. Bednarz and Don E. Ethridge[1]

ABSTRACT

The cost of producing a pound of cotton on the High Plains of Texas has been rising faster than in other regions of the U.S. These rising costs may occur from two basic forces—yields and/or rising input use and/or costs. This study analyzed these factors for both irrigated and dryland cotton and estimated how much of the increase in cost per pound has been due to each of these factors. It was found that during the 1977-1987 study period, yield declines have been responsible for more of the per pound cost increases in the Southern High Plains than have the input costs per acre.

Key words: Cotton, costs, yields, Texas High Plains.

INTRODUCTION

The Texas Southern High Plains cotton industry is a major cotton producing region in the United States and the world, accounting for approximately 20% of total U.S. cotton production of about 12.5 million bales per year. Consequently, events affecting Texas Southern High Plains cotton production can have substantial economic impacts in the world market.

Over the past 25 years, the region has undergone many changes. Neal and Ethridge (1986) indicated that "cotton yields in the Texas High Plains have declined at a rate of 10 pounds per acre per year since 1965", although the region has experienced large increases in yields in 1987 and 1988. Costs of production have also increased from \$89/planted acre in 1974 to \$244 in 1985 for the Southwest while increasing from \$164 to \$400 for the U.S. over the same period (Andrew and Ethridge, 1987). On the South Plains, variable costs of production per pound in 1985 were 12% above the national average and total costs of production per pound of cotton were 24% above the national average (Ethridge, 1988). This indicates that the South Plains had become a relatively high cost producing area of the U.S. by 1985 from being a relatively low cost area in 1970. This trend shows that this region is gradually becoming less competitive in national and world markets.

With unit costs of production increasing, farmers must have higher prices for their crops to continue to operate. Because the prices for output are determined in international markets, higher prices will not occur in response to rising regional costs. Thus, some South Plains producers have been or could be forced to cease production, causing the region's production to decline. To address problems of competitiveness and efficiency, the sources of the cost increases must be understood. The objective of this study was to determine how much of the higher unit cost of producing cotton in the Texas Southern High Plains cotton industry has been due to increasing input costs and how much has been from declining yields.

ANALYTICAL FRAMEWORK & METHODS

The two major factors involved in the increase in unit costs of producing cotton—the increase in input costs and the declining yields—can be examined with the concept of average costs. Average costs (average total cost, ATC; average variable cost, AVC; and average fixed cost, AFC) are the costs incurred in producing a pound of cotton. Average costs for cotton production may be stated as:

AC per pound=[cost per acre] ÷ [pounds of cotton produced per acre] (1)

AC (average costs) may indicate ATC, AVC, or AFC and cost per acre is total, variable, or fixed.

There are three ways for the average costs to rise: (a) the numerator increases, (b) the denominator decreases and/or (c) both. Manipulation of equation (1) yields the percentage change in the cost of producing a pound of cotton:

$$\% \Delta \text{ cost/lb.} = [\% \Delta \text{ cost/acre}] - [\% \Delta \text{ lbs./acre}] \quad (2)$$

where Δ represents "change in".

The study area included seventeen of the major cotton producing counties in the Texas Southern High Plains (Figure 1). The counties were grouped into four regions. Data on both yields and costs were available for this group of counties/regions over a period of time.

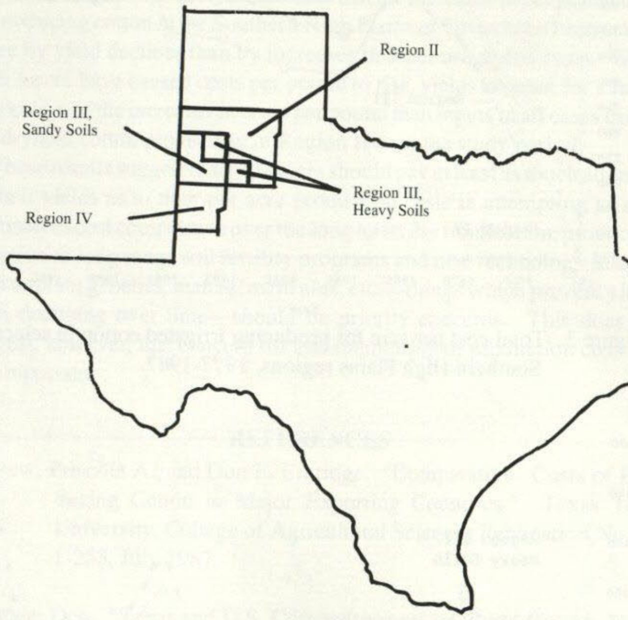

Figure 1. Study area.

The data used in determining the changes in costs per acre over time were from the Texas Agricultural Extension Service (TAEX) Annual Crop Enterprise Budgets (1978 to 1988). These budgets are estimates of yearly production inputs used and their cost per acre for typical cotton farms. Each crop budget corresponds to a particular region for the years 1977 through 1985. The counties considered in this study were assigned to their corresponding budgets. According to economists at TAEX, the budgets are a more accurate measure of prices and practices of the previous year than the year specified on the budgets. In view of this, each budget was assigned to the previous year; e.g., the 1978 crop budgets were used in estimating 1977 per acre costs of production. Total cost per acre for dryland and irrigated cotton are shown in Figures 2 and 3, respectively.

---

[1] Authors are former student and Professor, respectively, Department of Agricultural Economics, Texas Tech University; Marcus Bednarz was also a recipient of a Cotton Foundation scholarship in 1988/89. Appreciation is extended to Terry Ervin, Charles Dodson, Norman Hopper, and Jennifer Stratton for their assistance on the manuscript. Texas Tech University College of Agricultural Sciences Publication No. T-1-310.

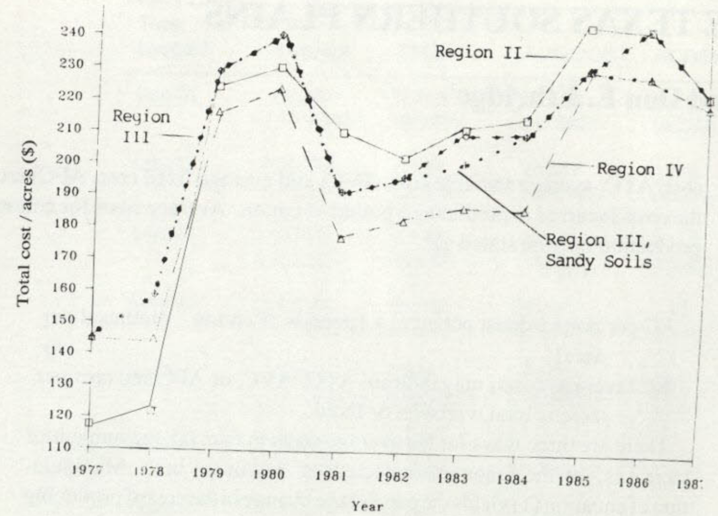

Figure 2. Total cost per acre for producing dryland cotton in specified Southern High Plains regions, 1977-1987.

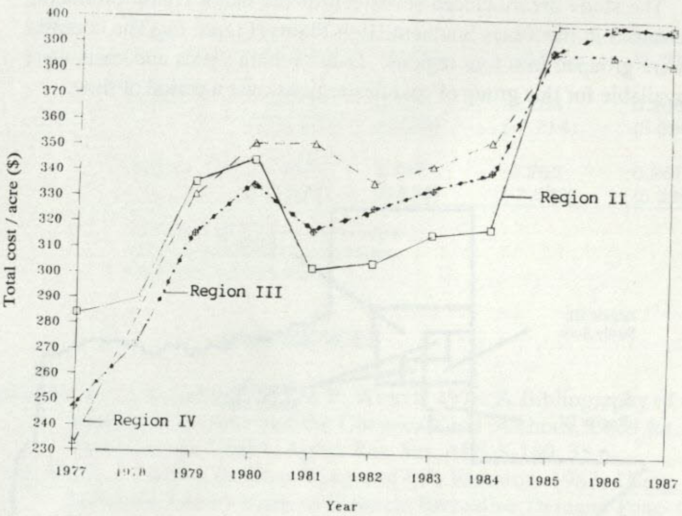

Figure 3. Total cost per acre for producing irrigated cotton in selected Southern High Plains regions, 1977-1987.

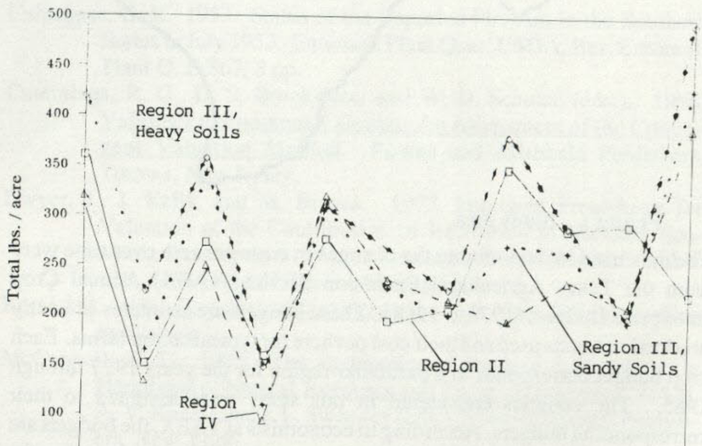

Figure 4. Dryland cotton yields by Southern High Plains region, 1977-1987.

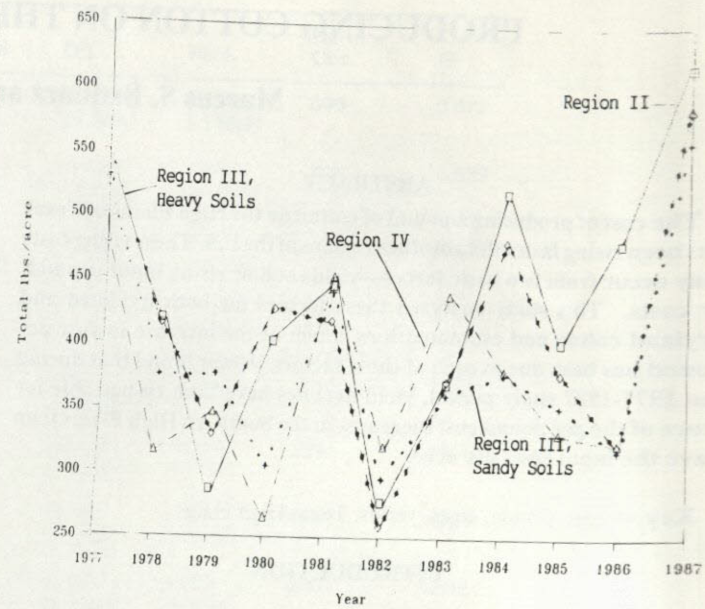

Figure 5. Irrigated cotton yields by Southern High Plains regions, 1977-1987

In analyzing the changes in yields per acre over the ten year period, data from the Texas Agricultural Statistics Service (1977 to 1987) were used. These data provided yields in pounds of irrigated and dryland cotton per harvested acre on a county basis. The weighted average yields (Figures 4 and 5) for each group of counties were incorporated into a spreadsheet for each area for each year. Note that the large increase in yields in 1987 is in sharp contrast to the declining yield trend from 1965 to 1985.

The purpose of the study was to determine how much of the production cost increases have been due to yield effects and how much due to input costs. This involves breaking the change in cost per pound of cotton into the proportion due to changes in yields and the proportion due to changes in cost per acre. Annual costs per pound of lint were calculated, then annual changes and percentage changes were computed. The annual changes in cost per acre and yields were calculated with the following formulas:

% Δ cost/acre = [cost/acre in year 2 - cost/acre in year 1] ÷ [(cost/acre in year 1 + cost/acre in year 2) ÷ 2] (3)

% Δ yield = [pounds/acre in year 2 - pounds/acre in year 1] ÷ [(pounds/acre in year 1 + pounds/acre in year 2) ÷ 2] (4)

The denominator in each relationship indicates that the percentage change is the average over the range of the change. Using this procedure, the percentage changes were calculated for each of the 10 annual changes over the 11 years; the changes were determined for average variable, average fixed, and average total costs for both irrigated and non-irrigated cotton in each of the four designated areas of study.

To estimate the proportion of the changes in the cost per pound of cotton due to yields and input costs, the following relationships were derived from equation (2):

% change due to yield changes = [(% Δ cost/acre) ÷ (% Δ cost/lb.) (5)

% change due to input cost changes = [1 + (% Δ lbs./acre) ÷ - 1] x100 (% Δ cost/lb.)] x 100 (6)

FINDINGS

The results of the analysis are summarized in Table 1. Average annual changes in costs per pound of cotton produced over the 11 year period in each of the four specified regions of the Texas Southern High Plains are shown in the first three columns. The proportion of these changes due to annual yield changes and annual per acre cost changes are shown in the last six columns.

Table 1. Cotton cost per pound changes and proportions due to per acre costs and yields on the Texas Southern High Plains, 1977-1987.

High Plains	Average Annual Percentage Change In Cost Per Pound			Percent of Annual Change in Cost Per Pound Due to Yield Changes			Percent of Annual Change in Cost Per Pound due to Per Acre Input Cost Changes		
Region/Soil	AVC	AFC	ATC	AVC	AFC	ATC	AVC	AFC	ATC
DRYLAND									
Region II	4.3	3.8	4.3	140.7	-279.8	-124.6	-40.7	379.8	224.6
Region III Heavy Soil	3.9	1.0	3.0	103.8	32.1	-124.8	-3.8	67.9	-20.7
Region III Sandy Soil	2.0	-1.2	1.0	94.8	119.5	96.0	5.2	-19.5	4.0
Region IV	1.5	0.3	2.6	72.4	39.5	56.2	17.6	60.5	45.8
IRRIGATED									
Region II	2.2	0.2	1.6	94.1	84.6	88.3	5.9	15.4	11.7
Region III Heavy Soil	4.8	2.4	4.1	98.0	105.6	77.0	2.0	-5.6	23.0
Region III Sandy Soil	4.5	2.5	4.0	79.0	50.0	88.5	21.0	50.0	11.5
Region IV	4.0	1.1	3.2	66.3	-446.8	68.0	33.7	556.8	32.0

Differences between percentage changes in the same column were tested. None of the differences in percentage changes in AVC, AFC, or ATC were statistically different at the .05 level of significance.

Changes in Costs of Producing Cotton

The average annual percentage change in average variable, average fixed, and average total cost per pound of producing cotton varied substantially among regions and between irrigated and non-irrigated over the study period. Variable cost per pound of lint on dryland cotton rose an average of 4.3% per year in Region II while rising only 1.5% per year in Region IV. On dryland cotton, fixed cost per pound of cotton decreased 1.2% per year in the sandy soils areas of Region III, but rose 3.8% per year in Region II. Considering both fixed and variable costs in dryland cotton production, average total cost rose the fastest in Region II (4.3% per year) and the slowest in region III, sandy soils (1.0%).

A different pattern of cost increases occurred in irrigated cotton production. Average total cost increased at the fastest rate in Region II (1.6% per year). Region II had the lowest cost increase with both variable and fixed costs with 2.2 and 0.2% per year, respectively. The low cost increases in Region II in irrigated cotton are due in part to its more abundant underground water supply relative to the other three regions.

Overall, costs tended to rise at a faster rate in irrigated production than in dryland production, with the only exception being in Region II where cotton production is less concentrated (a smaller portion of total farmland) than in the other three regions.

Sources of Cost Increases

The percentage of the average annual cost changes in the first three columns of Table 1 are provided in the last six columns of Table 1. The first column shows the percentage change in AVC per pound; columns four and seven show the percentage of that change in cost per pound which was due to yield changes and input cost changes, respectively. For example, of the 1.6% annual increase in ATC for irrigated cotton in Region II over the study period (column 3), 88.3% (column 6) was a result of yield decreases and 11.7% (column 9) was a result of input cost changes.

In dryland cotton in Region II, yield changes (increases) resulted in a decrease in average total cost per pound of cotton while costs associated with input use and input costs resulted in a larger increase in average total cost per pound. That is, input costs per acre caused a +224.6% increase in cost per pound while yield changes caused a

-124.6% increase (a decrease), and the sum of the two effects was 100%; the two together constitute 100% of the 4.3% average annual increase in total cost per pound in Region II. In Regions III, sandy soil and IV, yield changes and input cost changes both caused ATC to increase; i.e., 96.0% plus 4.0% in Region III, sandy soil and 56.2% plus 45.8% in Region IV. In Region III, heavy soil yield decreases caused a cost increase while input costs resulted in a total cost per pound decline.

In irrigated cotton there is a more stable pattern across regions. With both AVC and ATC, both yield declines and input costs caused cost increases and the proportion of the cost increases due to yields being consistently greater than the proportion due to inputs. The same pattern is evident on dryland cotton with variable costs—cost increases are due much more to yield decreases than to input cost increases over the period studied.

CONCLUSIONS

The findings of this analysis indicate that the increases in per pound costs of producing cotton in the Southern High Plains of Texas have been caused more by yield declines than by increases in input usage and costs. While both forces have caused costs per pound to rise, yields account for a larger proportion of the increases in costs per pound than inputs in all cases except for dryland cotton production in Region II over the study period.

These results suggest that producers should pay at least as much attention to their yields as to their per acre production costs in attempting to keep themselves cost competitive over the long term. By implication, producers' attention to long range soil fertility programs and new technology in areas such as plant genetics, management aids, etc.—things which prevent yields from declining over time—should be priority concerns. This does not suggest, however, that concern for and monitoring of production costs are not important.

REFERENCES

Andrew, Priscilla A., and Don E. Ethridge. "Comparative Costs of Producing Cotton in Major Exporting Countries." Texas Tech University, College of Agricultural Sciences Publication No. T-1-253, July 1987.

Ethridge, Don. "Texas and U.S. Competitiveness in World Cotton Markets." Presentation at a symposium, "The World of Cotton," sponsored by Phi Beta Delta, Texas Tech University, Feb. 18, 1988.

Neal, Tamera J., and Don E. Ethridge. "Analysis of Texas High Plains Cotton Yield Trends." Texas Tech University, College of Agricultural Sciences Publication No. T-1-242, Oct. 1986.

Texas Agricultural Extension Service. "Annual Cotton Crop Enterprise Budgets." 1978 to 1988.

Texas Agricultural Statistics Service. "Texas County Statistics." 1977 to 1987.