NATURE AND ECONOMIC IMPLICATION OF SHORT-SEASON COTTON PRODUCTION IN UVALDE COUNTY, TEXAS

by

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Agricultural Economics

Submitted in Partial Fulfillment of the Requirements of the

University Undergraduate Fellows Program

1978-1979

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April 1979

ABSTRACT

NATURE AND ECONOMIC IMPLICATION OF SHORT-SEASON COTTON PRODUCTION IN UVALDE COUNTY, TEXAS

(APRIL, 1979)

Due to rising cost of inputs and chemical resistant insects, cotton farmers in Texas are faced with increasing economic pressure. It is imperative that new cotton production systems be developed, if Texas cotton farmers are to increase net returns and reduce risk.

A short-season cotton production system developed by the United States Department of Agriculture, Texas Agricultural Experiment Station, and the Texas Agricultural Extension Service, has increased net returns and reduced risk for farmers in several regions of Texas. The system implements the use of a determinant cotton variety, one which tends to fruit over a relatively short time period, instead of a conventional indeterminant variety and stresses integrated pest management.

Based on data from a study conducted in Uvalde County, Texas, the economic implications of a short-season cotton production system for the area is evaluated using budgeting and breakeven analysis, a short-season cotton production system is compared to a conventional cotton production system.

ACKNOWLEDGMENTS

I wish to express my appreciation to Dr. Mel Friedman for his unending work with the University Undergraduate Fellows Program. Without his leadership, the University Undergraduate Fellows Program would have been impossible.

My thanks also goes to all of the undergraduate advisors who participated. Their patience and advice was continuous.

I am especially indebted to Dr. Ronald D. Lacewell, my undergraduate advisor. His patience, guidance and friendship were beyond reproach. My most sincere thanks goes to this authority.

He would present papers to the U. S. Senate Committee on Agriculture one day and the next day spend several hours explaining economic principles to me. Dr. Lacewell is an educator and fine man in the true sense.

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DEDICATION

This paper is dedicated to Mom and Dad. Their encouragement, love and friendship has helped me continue my education.

INTRODUCTION

Cotton is the single most important textile fiber in the world. To date, cotton is the only inexpensive fiber with the ability to filter air in and out of a garment, a process commonly called breathing.

The development of the cotton industry in the United States was a slow process. The industry changed from a labor-intensive production system in the Northeast prior to the industrial revolution to a mechanized production system in the South. Today, cotton production extends from North Carolina to California. Texas is the largest cotton producing state in the United States, accounting for approximately one third of all domestic cotton production (Southern Cooerative Series).

Texas farmers have developed a very productive agriculture based on inexpensive energy and a heavy reliance on chemicals for insect and weed control. The system has worked exceptionally well. However; it is becoming apparent that the United States has reached the end of an era of inexpensive energy.

Most industries are structured in a manner such that increased cost of production can readily be passed through

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This Thesis follows the style of the American Journal of Agricultural Economics.

the consumer. This is not true in the case of agricultural production. This uniqueness results from the fact that the number of farmers is sufficiently large that individually they cannot influence the price recieved for their product. This means increases in agricultural input prices must be absorbed out of current income. Thus, as the cost of energy increases, net farm income decreases. Texas producers currently spend approximately $700 million for fuels used on farms. In 1975, Texas net farm income was about $1.3 billion (Knutson, Lacewell, LePort, Hardin, and Hiler).

Texas cotton producers are under severe and increasing economic pressure due to rising cost for all inputs, yield reducing infestation of chemical resistant insects, and are less than optimistic price outlook for cotton lint. To maintain a viable cotton production industry in Texas, improved production systems including new varieties of cotton, improved pest managment strategies and corresponding optimum agronomic inputs are needed. Short-season cotton production systems developed by the United States Department of Agriculture, Texas Agricultural Extension Service, and Texas Agricultural Experiment Station may represent a way to reduce cost per pound of lint produced and increase net returns to farmers. The purpose of this study is to review available material on new cotton production systems and to evaluate the economic implications of a short-season cotton production research program conducted in Uvalde County, Texas.

Short-season cotton is often planted at 1.5 times the seeding rate of conventional cotton (Sprott, Lacewell, Niles, Walker, and Gannaway). The advantages of using 26 inch rows as compared to the conventional 40 inch rows are being investigated. The reduced time from planting to harvest of the short-season cotton reduces irrigation, cultivation, labor, and pesticides needed for the production of a crop and associated cost. A second factor affecting pesticide reduction in the short-season production system is biological control and integrated pest management programs are easier to implement. The producer is able to avoid the increased insect numbers during the late season by already having his crop harvested. Also, short-season cotton allows producers to destroy the stalks before winter. This aids in decreasing the number of boll weevils that can survive the winter in diapause, a state of hibernation of the boll weevil during the winter months, to lay eggs the following spring.

REVIEW OF LITERATURE

There are several cotton producing areas in Texas that differ significantly in growing season, rainfall, temperature, and pest. Because of these dramatic differences, alternative cotton production systems are being developed for each area. There are four major cotton-producing areas in Texas, The High Plains, The Lower Rio Grande Valley, The Trans-Pecos, and The Eastern portion of the state. A separate discussion of the major economic implications and impacts of four regional studies using intergrated cotton production systems follows.

HIGH PLAINS

The largest cotton producing region in Texas is the High Plains. This region is located in the North Central portion of the state and has emphasized boll weevil diapause control as its major objective.

The major application of insecticides to control boll weevils occurs in highly infested areas of the Rolling Plains and emphasizes control of overwintering weevils. Insecticide applications on the High Plains are Primarily for the control of thrips, fleahoppers, spiders, mites, aphids, and boll worms. Through the efforts of this program, economic boll weevil damage has been virtually eliminated on the High Plains. Due to the short growing season, the area relies exclusively on short-season varieties.

If the suppression program were to be discontinued, it was estimated that insecticide use would increase between 8 and 20 million pounds annually, cotton output would decline between 75,000 and 125,000 bales and total production cost would increase between $12 and $20 million over the total area. These results suggest that the suppression program not only is effective in protecting the High Plains from boll weevil infestation but also contributes significantly to an increased cotton output, a reduction of production costs for producers and a reduced quantity of insecticides introduced into the environment (Lacewell, Bottrell, Billingsly, Rummel, and Larson).

LOWER RIO GRANDE VALLEY

The Lower Rio Grande Valley of South Texas has many advantages and disadvantages for cotton production. The climate is favorable for rapidly increasing insect populations. The quantities of insecticides used per acre by cotton producers are among the highest in the nation due to insect pests and their increased tolerance to insecticides.

Insect problems and generally increasing costs of production along the Costal Bend region to decreased cotton acerage from 190,000 in 1972 to 55,000 in 1975. The average yield decreased over this period from 500 to 300 pounds of lint per acre.

Analysis of an integrated pest management (IPM) program for the region indicated a potential to reduce annual insecticide use over one million pounds (40 percent) and increase farmers profit $4.3 million on 275,000 acres of cotton. With the IPM program, farmer profit per acre would be increased $10 on dry land production and $18 with irrigation (Larson, Lacewell, Casey, Namken, Heilman, and Parker).

TEXAS DEPARTMENT OF CORRECTIONS

Because of increasing resistance of the tobacco budworm to phosphate insecticides, the Texas Department of Correction (TDC), located in the Brazos Valley of East Texas, in cooperation with the Texas Agricultural Experiment Station, developed a new pest management strategy for the TDC farms. The new cotton production system was designed to control boll weevils with a fall diapause program, to control the cotton fleahopper with low dosages of insecticides applied in the early fruiting phase of cotton, to terminate fleahopper treatments quickly and allow beneficial insects and spiders to increase in numbers so they can regulate bollworms and tobacco budworms, and to harvest the crop and destroy residues as early as possible to get natural boll weevil diapause control (Southern Cooperative Services).

Over three years of application of the new program, effectiveness was illustrated by a per acre lint yield increase of 60 to 80 pounds, reduction in insecticide use of 6 to 10 pounds of active ingredient, and an increase in per acre farmer profit of $25 to $35. Adoption of the new program on the more than 200,000 acres of cotton throughout the applicable region would result in a reduction of insecticide use of 1.33 million pounds, increse in lint of 27,000 bales, reduce cost of production $129,000 and increase in farmer profit of about $11 million (Casey, Lacewell, and Sterling).

TRANS-PECOS

The Trans-Pecos region of Texas is located in the western portion of the state. The rising cost of natural gas for irrigation and the need to develope an IPM system to control insect-pest prompted the development of a new short-season cotton production system for the region.

With rapidly rising cost of irrigation, energy, and pesticides, cost of production for cotton rose to 70 cents per pound of lint. The strategy of the IPM system involved use of short-season cotton varieties and reduced levels of fertilizer and irrigation with careful management practices. The 1975 test used low levels of inputs which included no insecticides. The new system had a reduced lint yield from 700 pounds per acre with the conventional production system to 489 pounds per acre. However, there was a dramatic reduction in production costs with the IPM strategy, from $546 per acre to $264. This amounted to a reduced cost of production from 70 cents per pound of lint to 46 cents. More important, farmer profit was increased from a negative $68 per acre to a positive $63 per acre (Lindsey, Condra, Neeb, New, Buehring, Foster, and Menzies).

The four cotton production systems provide an overview as to economic implications. The Wintergarden area (Uvalde) relates to the Lower Rio Grande Valley but a detailed analysis of a short-season cotton production system is needed.

STUDY AREA

Uvalde County (Figure 1) is located in Southwest Texas. The area has a semiarid climate with short, mild winters, and long, hot summers. The growing season averages 255 days per year; average annual rainfall is 23.23 inches. The high temperatures are about 100°F in July and August; January, the coldest month, has an average daily minimum temperature of 40°F (Dallas Morning News).

Of the $24 million of agricultural products sold per year, 60 percent comes from the sale of livestock and 40 percent from the valur of cash crops. Cash crops include wheat, oats, corn, soybeans, vegetables, and cotton. There is an abundant supply of groundwater and most of the cash crops are produced with irrigation.

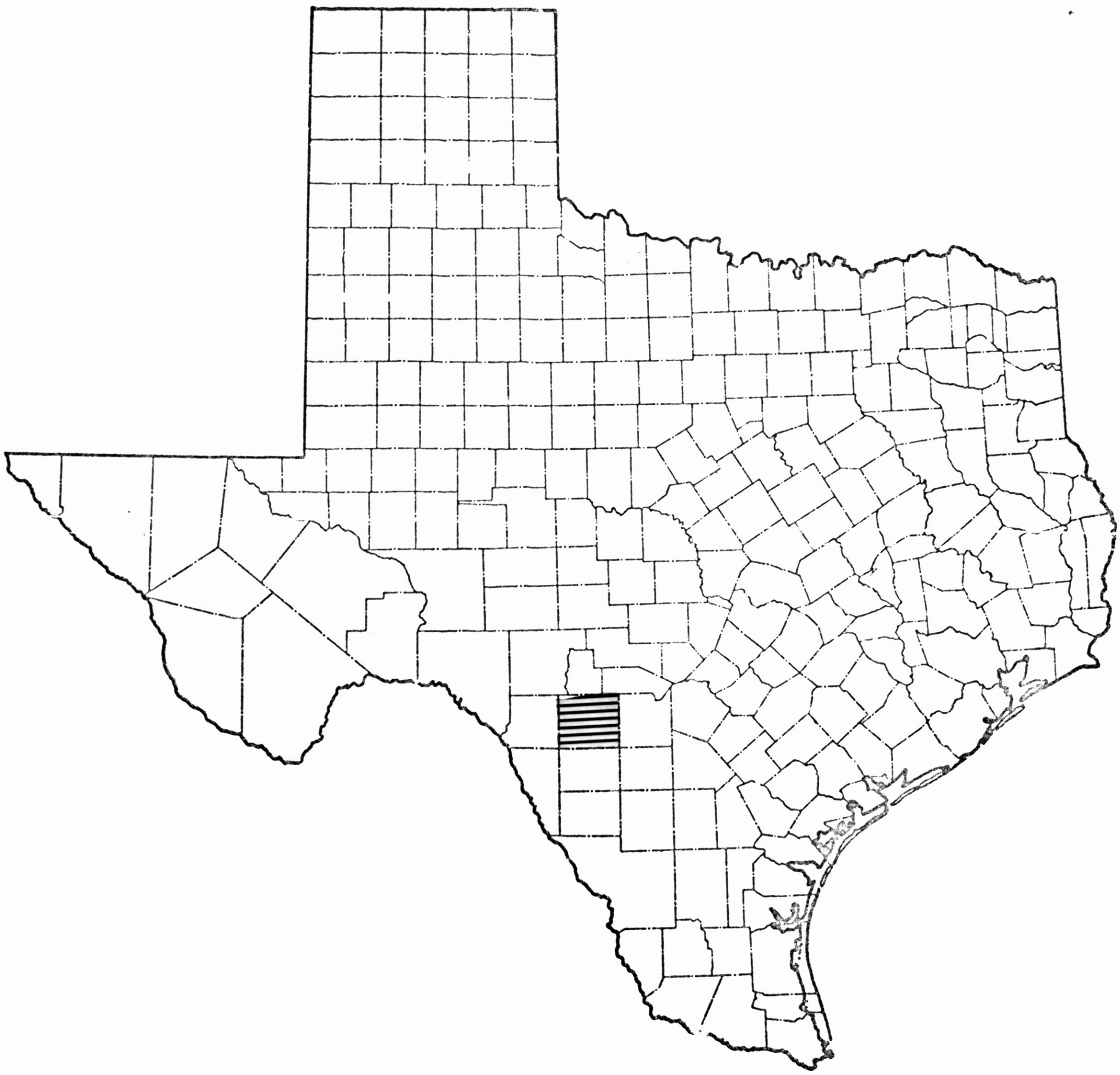

FIGURE 1. STUDY AREA: UVALDE COUNTY, TEXAS

METHODOLOGY

To evaluate a short-season cotton production system for Uvalde County, several methods were employed. Budgeting and breakeven analysis were the principal types of analysis.

The primary data input for this economic analysis was obtained from the Texas Agricultural Experiment Station in Uvalde and results included in a draft of a thesis by Ms. Mandy Armstrong. The variables of particular interest are row width, genotype, and pesticide application. The effect of each of these variables is calculated to see if there is a significant difference among yields in the 180 test plots. Each test using the three row widths, five genotypes, and two pesticide management systems were repeated three times to test statistical significance.

Using the research results and published crop enterprise budgets of the Texas Agricultural Extension Service, a cotton enterprise budget was developed for short-season cotton and conventional cotton production. The short-season cotton variety was Tamcot SP-37 and the conventional cotton variety Stoneville 2B. Tamcot cotton is harvested with a stripper while Stoneville is harvested with a spindle picker. Cost differences between the two harvesting systems were reflected in the respective budgets. The associated input and product prices in the budgets were obtained by interviewing suppliers and producers in the area. Budget analysis involves principally a comparison of the components between the two cotton producing systems. Yields, costs, and net returns are of special interest in this analysis.

Based on the enterprise budgets a breakeven analysis was conducted. The breakeven analysis emphasized breakeven requirements between short-season cotton and conventional cotton production systems. For example, yields of each required to exactly breakeven or cover cost of production where estimated as follows:

$$TR = TC$$
$$TR = P \cdot Y$$
$$TC = H_{ci} Y + C_i$$
$$Y_i = \frac{C_i}{P - H_{ci}}$$

where: TR = TOTAL REVENUE
TC = TOTAL COST

Y_i = Breakeven yield of cotton with production system i.
C_i = Total nonharvest cost with production system i.
P = Price of lint and includes a seed value component.
H_{ci} = Harvest and ginning cost per unit of output with production system i.
Y = Observed yield

Similarly a breakeven price is estimated using the following equation:

$$P = H_{ci} + \frac{C_i}{Y_i}$$

For direct comparisons of short-season and conventional cotton production systems, yields of short-season cotton necessary to provide profit equal to conventional cotton production was calculated as follows:

$$NR_c = NR_s$$

where:
- NR = per acre net returns for cotton
- c = conventional production system
- s = short-season production system

$$NR_j = P(Y_j) - H_j(Y_j) - C_j$$

where:
- P = price of lint and includes a seed value component
- Y_j = yield of cotton with production system j
- H_j = harvesting cost per unit of yield for production system j
- C_j = total non-harvest cost of production for crop production system j.

Thus, the basis for establishing breakeven yields where profit is equal between short-season and conventional production system is represented by:

$$Y_c(P - H_c) - C_c = Y_s(P - H_s) - C_s$$

To calculate breakeven yield of short-season cotton to equate net returns of convention cotton, the equation becomes:

$$Y_s = \frac{Y_c(P_c - H_c) - C_c + C_s}{(P - H_s)}$$

The same concept holds for breakeven yields of conventional cotton production systems compared to short-season cotton production systems.

RESULTS

BUDGETING ANALYSIS

The crop enterprise budgets for conventional cotton production (Table 1) and short-season cotton production (Table 2) illustrate the relationship between total cost, total revenue, and net returns to farmers. The short-season cotton variety is Stoneville 2B.

Table 3 presents the economical implications of budgeting analysis. Although total cost were higher under the short-season system ($350 versus $310 per acre), a higher mean yield (792 versus 532 lbs per acre) associated with the short-season cotton production system more than offset marginal cost. The most important figure in Table 3 is net returns to farmers. The estimated net return or profit to farmers was higher for the short-season cotton ($149 versus $25 per acre). The increased profit above typical is $214 per acre with a short-season production system compared to $90 per acre with a conventional system.

TABLE 1

PER ACRE COST AND RETURNS FOR CONVENTIONAL COTTON PRODUCTION IN UVALDE COUNTY, TEXAS BASED ON 1978 RESEARCH.[a]

ITEM*	UNIT	PRICE OR COST/UNIT	QUANTITY	VALUE OR COST
GROSS RECEIPTS FROM PRODUCTION				$
Cotton Lint	Lbs.	.55	532	292.60
Cottonseed	Ton	100	.426	42.60
TOTAL				$335.20
VARIABLE COSTS				$
PREHARVEST SEED	Lbs.	0.35	20.00	7.00
Herbicide	Acre	9.00	1.00	9.00
Insecticide	Appl	2.18	3.00	5.18
Insect. Appli.	Appl	1.50	3.00	4.50
Machinery	Acre	6.36	1.00	6.36
Tractors	Acre	14.05	1.00	14.05
Irrigation Machinery	Acre	34.80	1.00	34.80
Labor(Tractor & Machinery)	Hour	3.00	4.73	14.19
Labor(Irrigation)	Hour	3.00	0.94	2.82
Interest On Op. Cap.	Dol.	0.08	88.54	7.53
SUBTOTAL, PRE-HARVEST				$105.43
HARVEST COSTS				$
Defoliant	Acre	3.85	1.00	3.85
Defoliant Appli.	Acre	2.00	1.00	2.00
Custom Harvest	CWT.	3.50	15.96	55.86
Gin. Bag. Ties	Bale	45.00	1.064	46.06
SUBTOTAL, HARVEST				$107.77
TOTAL VARIABLE COST				$213.20
INCOME ABOVE VARIABLE COSTS				$122.00
FIXED COSTS				$
Machinery	Acre	12.41	1.00	12.41
Tractors	Acre	20.91	1.00	20.91
Irrigation Machinery	Acre	23.00	1.00	23.00
Land (Net Rent)	Acre	40.00	1.00	40.00
TOTAL FIXED COSTS				$ 96.31
TOTAL COSTS				$309.51
NET RETURNS				$ 25.69

[a] Source: Based on information from Armstrong and Texas Agricultural Extension Service published budgets.

TABLE 2

PER ACRE COST AND RETURNS FOR SHORT-SEASON COTTON PRODUCTION IN UVALDE COUNTY, TEXAS BASED ON 1978 RESEARCH.[a]

ITEM*	UNIT	PRICE OR COST/UNIT	QUANTITY	VALUE OR COST
GROSS RECEIPTS FROM PRODUCTION				$
Cotton Lint	Lbs.	0.55	792	435.60
Cottonseed	Ton	100.00	.634	63.40
TOTAL				$499.00
VARIABLE COSTS				
PREHARVEST SEED	Lbs.	0.35	20.00	$ 7.00
Herbicide	Acre	9.00	1.00	9.00
Insecticide(OW)	Appl	2.18	3.00	5.18
Insect. Appli.	Appl	1.50	3.00	4.50
Machinery	Acre	6.36	1.00	6.36
Tractors	Acre	14.05	1.00	14.05
Irrigation Machinery	Acre	34.80	1.00	34.80
Labor(Tractor & Machinery)	Hour	3.00	4.73	14.19
Labor (Irrigation)	Hour	3.00	0.94	2.82
Interest on Op. Cap.	Dol.	0.08	88.54	7.53
SUBTOTAL, PRE-HARVEST				$105.43
HARVEST COSTS				$
Defoliant	Acre	3.85	1.00	3.85
Defoliant Appli.	Acre	2.00	1.00	2.00
Custom Harvest-SmotHaul	CWT.	1.75	33.26	58.21
Gin.	CWT.	2.00	33.26	66.52
Bag. Ties	Bale	11.30	1.58	17.90
SUBTOTAL, HARVEST				$148.48
TOTAL VARIABLE COST				$253.91
INCOME ABOVE VARIABLE COSTS				$245.09
FIXED COSTS				$
Machinery	Acre	12.41	1.00	12.41
Tractors	Acre	20.91	1.00	20.91
Irrigation Machinery	Acre	23.00	1.00	23.00
Land (Net Rent)	Acre	40.00	1.00	40.00
TOTAL FIXED COSTS				$ 96.31
TOTAL COSTS				$350.22
NET RETURNS				$148.78

[a] Source: Based on information from Armstrong and Texas Agricultural Extension Service published budgets.

TABLE 3

ECONOMIC IMPLICATION OF BUDGETING ANALYSIS

ITEM[a]	STONEVILLE 2B	TAMCOT SP-37
YIELD (LBS.)	532	792
TOTAL COST	310	350
TOTAL REVENUE	335	499
NET RETURNS	25	149
INCREASE ABOVE TYPICAL[b]	90	214

[a]ALL FIGURES ARE ON A PER ACRE BASIS.

[b]BASED ON A TYPICAL NET RETURN OF $-65 PER ACRE.

BREAKEVEN ANALYSIS

Table 4 presents breakeven yield and price associated with short-season and conventional cotton production systems in Uvalde County, Texas. The data show that both breakeven yield and price for short-season cotton production is less than conventional cotton production. The data also indicate that the percent of observed to breakeven for short-season cotton production is lower than that of the conventional cotton production system. This indicates that less risk is associated with short-season cotton production. For example, if conventional cotton yield were reduced 14 percent farmer profit would be zero. On the other hand, the short-season cotton yield could fall 44 percent without the farmer incurring a loss. Also, a short-season cotton production system can take a 37 percent price decline from the observed and still cover cost and a conventional cotton production system farmer can only stand an 11 percent reduction.

TABLE 4

BREAKEVEN YIELD AND PRICE ASSOCIATED WITH SHORT-SEASON AND CONVENTIONAL COTTON PRODUCTION SYSTEMS IN UVALDE COUNTY, TEXAS

ITEM	UNIT	PRODUCTION SYSTEM CONVENTIONAL	PRODUCTION SYSTEM SHORT-SEASON
Breakeven yield			
Observed	lbs/Ac	532	792
Breakeven	lbs/Ac	458	447
Percent of Observed to Breakeven	%	86	56
Breakeven Price			
Observed[a]	¢/lb	55	55
Breakeven[a]	¢/lb	49	35
Percent of Observed to Breakeven	%	89	63

[a] Assumes a fixed price for seed of $100 per ton.

A second method used in the application of breakeven analysis equates the net returns of two alternative systems of production over a certain range. The data equating net returns of a short-season cotton production system with net returns of a conventional cotton production system is presented in Table 5. In each case, yield of short-season cotton production system required to equate net returns with conventional cotton production system is below that of the conventional cotton production system.

For example, for the observed conventional cotton yield of 532 pounds per acre, the short-season system would need to produce only 520 pounds per acre to match net returns of the conventional system. Observed yield of the short-season system was 792 pounds per acre, appreciably higher than the breakeven yield.

These results emphasize the economic advantages of short-season cotton production in Uvalde County, Texas. Emperical results indicate some opportunity to reduce non-harvest costs and the potential for substantially higher yields.

TABLE 5

Short-season cotton production system yield required to Equate with net returns of conventional cotton production system.[A]

Specified Conventional Yield lbs/Ac	Breakeven Short-season Yield lbs/Ac
450	439
500	488
532[B]	520
600	586
650	635
700	684

[A]Based on a lint price of .55 per pound and a seed price of $100 per ton.

[B]Observed conventional cotton production system yield.

CONCLUSIONS

The primary purpose of the study was to evaluate, on a case study basis, the expected affect of a new cotton production system in Uvalde County, Texas.

The results of this study suggest that a total production shift from conventional to short-season cotton production would be advantageous to the farmer by combating rising cost and increasing net returns. However, it should be noted that there are several limiting factors to the study. First, the study is based on results of a single production year (1978) and there could be a significant varience in yield among varieties over several time periods. However, the unpublished results of a study conducted in Uvalde County, in 1975, tend to support the results of this study.

Second, the study assumed a fixed managerial level that is above the typical level of some farmers in the area. Some farmers will obtain different results based on their managerial ability.

Third, the study assumed profit maximization as the primary objective of farmers in future farm planning.

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