

PROFITABILITY AND COST OF PRODUCTION OF ROUNDUP READY VERSUS CONVENTIONAL COTTON VARIETIES IN THE SOUTHERN HIGH PLAINS OF TEXAS

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Introduction

Technological advances have provided cotton producers opportunities to increase productivity and efficiency in their operations. One technology that has been widely adopted by cotton producers in the Southern High Plains (SHP) of Texas is Roundup Ready cotton varieties. The introduction of Roundup Ready cotton varieties along with Roundup Ultra has provided cotton producers in the SHP with an effective tool to help control troublesome weed infestations throughout the growing season (White, Jones, and Johnson, 2000).

According to Monsanto, there are several key advantages in selecting Roundup Ready cotton varieties. First, producers have the ability to reduce a number of expensive and repeated chemical applications and mechanical operations resulting in alternative weed management options. Second, producers may be able to incorporate reduced tillage practices into their operations easier with Roundup Ready varieties compared to conventional cotton production systems. Alternative weed management options and the opportunity to replace traditional tillage costs with Roundup herbicide applications has the potential to lower overall production costs, while providing potential environmental advantages compared to conventional systems utilizing traditional herbicides and tillage practices (Monsanto, 2001).

Substantial research has been conducted evaluating the agronomic and environmental impacts of Roundup Ready cotton varieties. However, there has been little research evaluating costs of production, profitability, and economic advantages of planting Roundup Ready cotton varieties. A study by White, Jones, and Johnson (2000) evaluated the profitability and production costs of Roundup Ready versus conventional cotton varieties in the SHP of Texas for 1998. Their results indicated Roundup Ready cotton varieties produced higher net returns to operator labor, management, and risk of \$72.55 per acre compared to \$58.93 per acre for conventional cotton varieties. However, the authors acknowledged the limitations of having only one year of data and emphasized the need for further research with a multi-year database. A study by Slinsky et al. (1998) evaluated cost and returns for Roundup Ready cotton varieties in Tennessee for the 1996 crop year. Their results indicated that conventional weed-control practices produced higher lint yields, lint prices, and total revenues compared to Roundup Ready treatments. In addition, their study revealed that Roundup Ready treatments had lower production costs compared to the conventional weed-control practices. The results of these two studies are limited by data constraints associated with one year of data.

Producers in the SHP of Texas need reliable information evaluating the profitability and production costs of Roundup Ready versus conventional cotton varieties over a longer time horizon. Therefore, the objective of this study was to evaluate the costs of production and profitability of Roundup Ready cotton compared to conventional cotton varieties in the SHP of Texas from 1998 to 2000.

Methods and Procedures

The methods utilized in this study included a combination of the Standardized Performance Analysis-Multiple Enterprises (SPA-ME) computer program and Standardized Performance Analysis (SPA) database. The SPA-ME computer program was utilized to complete all individual analyses used in this study. SPA-ME is an analytical program that allows for individual enterprise and whole farm financial analysis (McGrann, Michalke, and Stone, 1996). The SPA-ME program starts by identifying all enterprises and farming units within a specific farming operation. Additionally, whole farm financial statements (Balance Sheets, Accrual Adjusted Income Statement, Statement of Cash Flows, and Statement of Owner Equity) are developed for the operation according to recommendations from the Farm Financial Standards Council. Upon completion of the financial statements, the SPA-ME program allows for specific enterprise revenues, expenses, assets, and liabilities to be allocated from the whole farm financial statements to the individual enterprises and farming units. The end result for the producer was an assessment of actual production costs and profitability of each enterprise and farming unit. Individual SPA analyses were entered into a database, which compiled aggregated enterprise profitability and production cost data for Roundup Ready and conventional cotton enterprises within the SHP.

The data utilized in this study were collected for irrigated cotton production under crop share rental agreements in the SHP from 1998 to 2000. The data included detailed production, financial, and marketing information for each individual producer. It is important to note that all results are reported on an aggregate basis to protect the confidentiality of individual producers.

Empirical Results

Standardized Performance Analyses of individual farming operations provided 27, 12, and 21 observations for Roundup Ready cotton varieties, and 38, 22, and 15 observations for conventional cotton varieties from 1998 to 2000, respectively. Aggregated results are given in Tables 1 and 2 on a per acre basis and Tables 3 and 4 on a per pound basis for Roundup Ready and conventional cotton varieties, respectively.

Gross enterprise accrual revenues for Roundup Ready cotton averaged \$285.74 per acre compared to \$263.41 per acre for conventional cotton varieties. This was primarily the result of higher primary product income and government payments for Roundup Ready cotton varieties. Crop share yields for Roundup Ready cotton were 39 pounds per acre higher on average compared to conventional cotton varieties, which contributed to the higher primary product income. Crop share yields were 411, 317, and 363 pounds per acre for Roundup Ready varieties, and 350, 317, and 308 pounds per acre for conventional varieties from 1998 to 2000, respectively.

Producers received an average cotton lint price of \$0.58 per pound for both varieties in 1998. However, the results indicate that cotton lint prices were higher for conventional cotton varieties in 1999 and 2000. Producers received cotton lint prices of \$0.53 and \$0.52 per pound for conventional varieties compared to \$0.48 and \$0.46 per pound for Roundup Ready varieties in 1999 and 2000, respectively. Furthermore, the higher level of government payments for Roundup Ready cotton was the result of higher payments of \$25.02 and \$18.63 per acre in 1999 and 2000, respectively. However, there is no significant explanation for the higher government payments other than the possible variability resulting from the random selection of producers across the SHP.

Total cash operating expenses were higher for Roundup Ready cotton varieties in 1998 at \$216.89 per acre compared to \$191.95 per acre for conventional cotton varieties. However, the results indicated that total cash operating expenses were lower for Roundup Ready varieties at \$158.33 and \$196.76 per acre compared to \$167.25 and \$202.14 per acre for conventional varieties in 1999 and 2000, respectively. Herbicide expenses were \$10.42 per acre higher for Roundup Ready varieties compared to conventional varieties. The higher herbicide expense is primarily the result of increased Roundup herbicide applications. Insecticide expenses were relatively constant across both varieties with the exception of 2000. In 2000, there was a significant increase in insecticide expense for the conventional cotton varieties. This increase is the result of several producers in the study who incurred higher insecticide expenses to control boll weevils without the assistance of a Boll Weevil Eradication program. There was no apparent reason to expect that increased insecticide applications would only affect conventional cotton varieties.

Producers also incurred higher seed costs per acre for Roundup Ready varieties of \$15.74 per acre compared to \$9.03 for conventional varieties. This is consistent with expectations given the technology fee associated with Roundup Ready varieties. Further, producers incurred hired labor and management expenses that were \$5.22 per acre lower for Roundup Ready varieties. This decrease was primarily due to decreased hoe labor with respect to Roundup Ready varieties. Producers also incurred other cash operating expenses (custom hire, insurance, rent, supplies, and other miscellaneous expenses) that were \$11.28 per acre higher for conventional varieties. However, there is no apparent explanation for the increased expenditures other than the variability associated with the random selection of producers.

Total overhead expenses were consistent for both varieties at \$35.95 and \$37.17 per acre for Roundup Ready and conventional cotton varieties, respectively. It is important to note that overhead expenses only included interest and depreciation expenses. Family living withdrawals were not included in the overhead expenses due to the significant variation in this expense across producers. The total enterprise cost was \$30.30 per acre higher for Roundup Ready varieties compared to conventional varieties in 1998, however, total enterprise costs were lower for Roundup Ready varieties at \$186.86 and \$232.54 per acre compared to \$199.62 and \$243.10 per acre for conventional varieties in 1999 and 2000, respectively.

Further analysis suggests that producers faced a total average breakeven cost of \$0.62 and \$0.69 per pound from 1998 to 2000 for Roundup Ready and conventional varieties, respectively. Total breakeven costs represent the total primary product income, government payments, crop insurance, and other income necessary to cover total costs of production. The unit cost of production (breakeven price) averaged \$0.34 and \$0.42 per pound from 1998 to 2000 for Roundup Ready and conventional varieties, respectively. The unit cost of production represents the cotton lint price necessary to cover all costs after accounting for all non-primary product income.

Producers in the SHP received, on an aggregate basis, higher net incomes for Roundup Ready varieties compared to conventional varieties. Producers received net incomes of \$64.70, \$65.49, and \$47.22 per acre for Roundup Ready varieties compared to \$45.77, \$43.70, and \$27.91 per acre for conventional varieties from 1998 to 2000, respectively. However, it should be noted that net incomes would have been much closer in 2000 without the increased insecticide expense incurred by several conventional cotton producers.

Concluding Remarks

The results of this study indicated that Roundup Ready cotton varieties produced higher net returns compared to conventional cotton varieties under crop share rental agreements from 1998 to 2000 in the SHP of Texas. This was primarily the result of higher yields and lower production costs for Roundup Ready varieties from 1998 to 2000. Producers planting Roundup Ready varieties produced higher cotton lint yields in 1998 and 2000, with no difference in yields between the two varieties in 1999. This result was consistent with the results from White, Jones, and Johnson (2000) and Monsanto (2001). Further, Roundup Ready varieties incurred lower total costs of production with the exception of 1998. This lower production cost was consistent with the result of studies by Slinky et al. (1996) and Monsanto (2001). Hence, the lower total cost of production combined with increased yields provided the opportunity for cotton producers of Roundup Ready varieties to increase their profitability.

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Table 1. Roundup Ready Cotton Results Per Acre

| | 1998 | 1999 | 2000 | Average |
|----------------------------------|--------|--------|------------|---------|
| | | | (lbs/acre) | |
| Total Yield | 548 | 423 | 484 | 485 |
| Crop Share Yield | 411 | 317 | 363 | 364 |
| | | | (\$/acre) | |
| Gross Cash Income | | | | |
| Cotton Lint* | 236.82 | 153.04 | 166.72 | 185.53 |
| Agricultural Program Payments | 47.66 | 79.65 | 59.51 | 62.27 |
| Crop Insurance Proceeds | 4.32 | 0.00 | 21.34 | 8.55 |
| Other Income** | 36.32 | 19.66 | 32.19 | 29.39 |
| Gross Enterprise Accrual Revenue | 325.12 | 252.35 | 279.76 | 285.74 |
| Cash Operating Expenses | | | | |
| Chemicals | | | | |
| Herbicide | 22.48 | 29.43 | 21.36 | 24.42 |
| Insecticide | 4.53 | 3.84 | 6.41 | 4.93 |
| Harvest Aide | 5.81 | 3.77 | 3.63 | 4.40 |
| Growth Regulator | 2.70 | 2.26 | 1.52 | 2.16 |
| Fertilizer & Lime | 14.25 | 14.94 | 15.19 | 14.79 |
| Gasoline, Fuel, & Oil | 13.53 | 9.87 | 12.85 | 12.08 |
| Seeds & Plants | 15.47 | 14.85 | 16.89 | 15.74 |
| Repairs & Maintenance | 15.75 | 13.82 | 25.80 | 18.46 |
| Hired Labor & Management | 28.10 | 21.32 | 24.09 | 24.50 |
| Irrigation | 46.61 | 33.19 | 43.79 | 41.20 |
| Other Operating Expenses*** | 47.66 | 11.04 | 25.23 | 27.98 |
| Total Cash Operating Expenses | 216.89 | 158.33 | 196.76 | 190.66 |
| Total Interest Expense | 14.33 | 14.69 | 10.56 | 13.19 |
| Depreciation Expense | 29.20 | 13.84 | 25.22 | 22.75 |
| Total Overhead Expenses | 43.53 | 28.53 | 35.78 | 35.95 |
| Total Enterprise Cost | 260.42 | 186.86 | 232.54 | 226.61 |
| Net Income**** | 64.70 | 65.49 | 47.22 | 59.14 |

* Cotton revenue was accrual adjusted to account for the entire 1998, 1999 & 2000 crop share yield.

** Other income includes coop distributions, custom hire earnings, and miscellaneous income.

*** Other expenses include custom hire, insurance, rent, supplies, and miscellaneous expenses.

**** Net income is before family living withdrawals.

Table 2. Conventional Cotton Results Per Acre

| | 1998 | 1999 | 2000 | Average |
|----------------------------------|--------|--------|------------|---------|
| | | | (lbs/acre) | |
| Total Yield | 467 | 423 | 411 | 433 |
| Crop Share Yield | 350 | 317 | 308 | 325 |
| | | | (\$/acre) | |
| Gross Cash Income | | | | |
| Cotton Lint* | 202.28 | 166.92 | 160.16 | 176.45 |
| Agricultural Program Payments | 47.74 | 54.63 | 40.88 | 47.75 |
| Crop Insurance Proceeds | 0.65 | 10.88 | 21.50 | 11.01 |
| Other Income** | 25.22 | 10.89 | 48.47 | 28.19 |
| Gross Enterprise Accrual Revenue | 275.89 | 243.32 | 271.01 | 263.41 |
| Cash Operating Expenses | | | | |
| Chemicals | | | | |
| Herbicide | 14.61 | 13.55 | 13.84 | 14.00 |
| Insecticide | 5.31 | 3.97 | 20.22 | 9.83 |
| Harvest Aide | 4.96 | 4.62 | 6.73 | 5.44 |
| Growth Regulator | 1.44 | 3.54 | 2.31 | 2.43 |
| Fertilizer & Lime | 17.57 | 15.08 | 14.71 | 15.79 |
| Gasoline, Fuel, & Oil | 9.37 | 7.25 | 11.23 | 9.28 |
| Seeds & Plants | 9.55 | 7.14 | 10.40 | 9.03 |
| Repairs & Maintenance | 17.70 | 16.21 | 10.62 | 14.84 |
| Hired Labor & Management | 28.12 | 30.17 | 30.86 | 29.72 |
| Irrigation | 42.66 | 31.12 | 38.71 | 37.50 |
| Other Operating Expenses*** | 40.66 | 34.60 | 42.51 | 39.26 |
| Total Cash Operating Expenses | 191.95 | 167.25 | 202.14 | 187.11 |
| Total Interest Expense | 9.22 | 8.59 | 9.47 | 9.09 |
| Depreciation Expense | 28.95 | 23.78 | 31.49 | 28.07 |
| Total Overhead Expenses | 38.17 | 32.37 | 40.96 | 37.17 |
| Total Enterprise Cost | 230.12 | 199.62 | 243.10 | 224.28 |
| Net Income**** | 45.77 | 43.70 | 27.91 | 39.13 |

* Cotton revenue was accrual adjusted to account for the entire 1998, 1999 & 2000 crop share yield.

** Other income includes coop distributions, custom hire earnings, and miscellaneous income.

*** Other expenses include custom hire, insurance, rent, supplies, and miscellaneous expenses.

**** Net income is before family living withdrawals.

Table 3. Roundup Ready Cotton Results Per Pound

| | 1998 | 1999 | 2000 | Average |
|---|------|------|------------|---------|
| | | | (lbs/acre) | |
| Total Yield | 548 | 423 | 484 | 485 |
| Crop Share Yield | 411 | 317 | 363 | 364 |
| | | | (\$/pound) | |
| Gross Cash Income | | | | |
| Cotton Lint* | 0.58 | 0.48 | 0.46 | 0.51 |
| Agricultural Program Payments | 0.12 | 0.25 | 0.16 | 0.18 |
| Crop Insurance Proceeds | 0.01 | 0.00 | 0.06 | 0.02 |
| Other Income** | 0.09 | 0.06 | 0.09 | 0.08 |
| Gross Enterprise Accrual Revenue | 0.79 | 0.80 | 0.77 | 0.79 |
| Cash Operating Expenses | | | | |
| Chemicals | | | | |
| Herbicide | 0.05 | 0.09 | 0.06 | 0.07 |
| Insecticide | 0.01 | 0.01 | 0.02 | 0.01 |
| Harvest Aide | 0.01 | 0.01 | 0.01 | 0.01 |
| Growth Regulator | 0.01 | 0.01 | 0.00 | 0.01 |
| Fertilizer & Lime | 0.03 | 0.05 | 0.04 | 0.04 |
| Gasoline, Fuel, & Oil | 0.03 | 0.03 | 0.04 | 0.03 |
| Seeds & Plants | 0.04 | 0.05 | 0.05 | 0.04 |
| Repairs & Maintenance | 0.04 | 0.04 | 0.07 | 0.05 |
| Hired Labor & Management | 0.07 | 0.07 | 0.07 | 0.07 |
| Irrigation | 0.11 | 0.10 | 0.12 | 0.11 |
| Other Operating Expenses*** | 0.12 | 0.03 | 0.07 | 0.07 |
| Total Cash Operating Expenses | 0.53 | 0.50 | 0.54 | 0.52 |
| Total Interest Expense | 0.03 | 0.05 | 0.03 | 0.04 |
| Depreciation Expense | 0.07 | 0.04 | 0.07 | 0.06 |
| Total Overhead Expenses | 0.11 | 0.09 | 0.10 | 0.10 |
| Total Enterprise Cost | 0.63 | 0.59 | 0.64 | 0.62 |
| Net Income**** | 0.16 | 0.21 | 0.13 | 0.16 |
| Unit Cost of Production (Breakeven Price) | 0.42 | 0.28 | 0.33 | 0.34 |

* Cotton revenue was accrual adjusted to account for the entire 1998, 1999 & 2000 crop share yield.

** Other income includes coop distributions, custom hire earnings, and miscellaneous income.

*** Other expenses include custom hire, insurance, rent, supplies, and miscellaneous expenses.

**** Net income is before family living withdrawals.

Table 4. Conventional Cotton Results Per Pound

| | 1998 | 1999 | 2000 | Average |
|---|------|------|------------|---------|
| | | | (lbs/acre) | |
| Total Yield | 467 | 423 | 411 | 433 |
| Crop Share Yield | 350 | 317 | 308 | 325 |
| | | | (\$/pound) | |
| Gross Cash Income | | | | |
| Cotton Lint* | 0.58 | 0.53 | 0.52 | 0.54 |
| Agricultural Program Payments | 0.14 | 0.17 | 0.13 | 0.15 |
| Crop Insurance Proceeds | 0.00 | 0.03 | 0.07 | 0.04 |
| Other Income** | 0.07 | 0.03 | 0.16 | 0.09 |
| Gross Enterprise Accrual Revenue | 0.79 | 0.77 | 0.88 | 0.81 |
| Cash Operating Expenses | | | | |
| Chemicals | | | | |
| Herbicide | 0.04 | 0.04 | 0.04 | 0.04 |
| Insecticide | 0.02 | 0.01 | 0.07 | 0.03 |
| Harvest Aide | 0.01 | 0.01 | 0.02 | 0.02 |
| Growth Regulator | 0.00 | 0.01 | 0.01 | 0.01 |
| Fertilizer & Lime | 0.05 | 0.05 | 0.05 | 0.05 |
| Gasoline, Fuel, & Oil | 0.03 | 0.02 | 0.04 | 0.03 |
| Seeds & Plants | 0.03 | 0.02 | 0.03 | 0.03 |
| Repairs & Maintenance | 0.05 | 0.05 | 0.03 | 0.05 |
| Hired Labor & Management | 0.08 | 0.10 | 0.10 | 0.09 |
| Irrigation | 0.12 | 0.10 | 0.13 | 0.12 |
| Other Operating Expenses*** | 0.12 | 0.11 | 0.14 | 0.12 |
| Total Cash Operating Expenses | 0.55 | 0.53 | 0.66 | 0.58 |
| Total Interest Expense | 0.03 | 0.03 | 0.03 | 0.03 |
| Depreciation Expense | 0.08 | 0.08 | 0.10 | 0.09 |
| Total Overhead Expenses | 0.11 | 0.10 | 0.13 | 0.11 |
| Total Enterprise Cost | 0.66 | 0.63 | 0.79 | 0.69 |
| Net Income**** | 0.13 | 0.14 | 0.09 | 0.12 |
| Unit Cost of Production (Breakeven Price) | 0.45 | 0.39 | 0.43 | 0.42 |

* Cotton revenue was accrual adjusted to account for the entire 1998, 1999 & 2000 crop share yield.

** Other income includes coop distributions, custom hire earnings, and miscellaneous income.

*** Other expenses include custom hire, insurance, rent, supplies, and miscellaneous expenses.

**** Net income is before family living withdrawals.