EFFECTS OF COTTON VARIETY SELECTION AND IRRIGATION LEVEL ON ECONOMIC RETURNS: TEXAS SOUTHERN HIGH PLAINS

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Abstract

As technology increases and new varieties are released for cotton production, producers have more options when choosing inputs and input levels. Studies have been conducted at the Agricultural Complex for Advanced Research and Extension Systems (AG-CARES) research facilities at Lamesa, Texas to determine the agronomic impacts of variety selection and applied irrigation level on cotton production. This study analyzes the effects of variety selection and irrigation level and allocation of limited irrigation water for irrigated cotton producers in the Texas Southern High Plains. For this study, the authors considered three varieties with three irrigation levels. The results show that newer indeterminate picker type varieties yielded higher, had greater response to irrigation, and produced larger profit margins than traditional determinate stripper type varieties.

Introduction

As technology is rapidly increasing and new cotton varieties are released, producers have many options when choosing inputs and application rates. Proper management of these inputs is critical for producers to remain profitable and competitive. Additionally, the proper management of inputs is critical to managing production risk associated with growing cotton. Due the production risk associated with cotton production, it is not only important for producers to look at the expected return but also the associated risk involved. The objective of this study was to show the profitability and associated risk of variety selection and the allocation of limited irrigation water.

Methods and Procedures

Trials were conducted in 2003, 2004, 2005, and 2006 at the Agricultural Complex for Advanced Research and Extension Systems (AG-CARES) farm in Lamesa, Texas. These trials compared effects of three irrigation levels on lint yield and economic returns per acre for three cotton varieties. Two longer season, indeterminate "picker" varieties FiberMax® 989BR (FM 989BR) and Stoneville™ 5599BR (ST 5599BR) were compared to a determinate "stripper" variety, Paymaster™ 2280BR (PM 2280BR). Each year during the study, cotton was planted in early May, fertilized according to soil test recommendations and harvested in October. Irrigation treatments included a base irrigation, 1.00BI, which reflected the irrigation capacity available at AG-CARES and was targeted to approximately 80% of evapotranspiration demand in a year assuming average rain fall. Low, 0.75BI, and high, 1.25BI, water treatments were -25% and +25% of the base, respectively.

Production or response functions were estimated to determine the environmental effects and the effects of water on each of the varieties. A comparison of the effects on each variety can be seen by comparing the estimated production functions. Production functions were estimated as follows:

$$Y_{it}^{V} = \beta_0 + \beta_1 DY04 + \beta_2 DY05 + \beta_3 DY06 + \beta_4 wat + \beta_5 wat^2 \quad (1)$$

$$Y_{mt}^{V} = \beta_0 + \beta_1 DY04 + \beta_2 DY05 + \beta_3 DY06 + \beta_4 wat \quad (2)$$

where Y_n represents yield, micronaire, and strength; Y_m represents Rd, +b, staple length, leaf and uniformity. Rd and +b are measured quality factors used to determine the color grade. The Rd value indicates grayness or how light or dark the sample appears. Yellowness or how much yellow color appears in the sample is indicated by the +b

value. *V* represents the variety: PM 2280BR, FM 989BR, ST 5599BR. *DY04*, *DY05*, and *DY06* are dummy variables representing the environmental effects of each year from 2004 through 2006. *Wat* is the summation of the seasonal rainfall and irrigation applied.

The yield production functions were then substituted into the profit function to determine the economic effects. Additionally, the quality functions were used to determine the price for cotton lint based on the Texas-Oklahoma Producer Cotton Market Summary: 2005/2006 from the Daily Price Estimation System (DPES) at Texas Tech University (Fadiga, Misra and Ethridge, 2006).

Three irrigation scenarios were also considered involving a limited irrigation capacity. The first was the BIL which was the 1.00BI level applied across the entire field. The second was the 1/2IL where one-half of the field was irrigated at the 0.75BI level and the other half at the 1.25BI level. The third scenario, 1/3IL where the field was split into 1/3's with one third watered at the 0.75BI level, another third at the 1.00BI level, and the last at the 1.25BI level, shown in figure 1. Under the three scenarios, ST 5599BR was evaluated for all water levels.

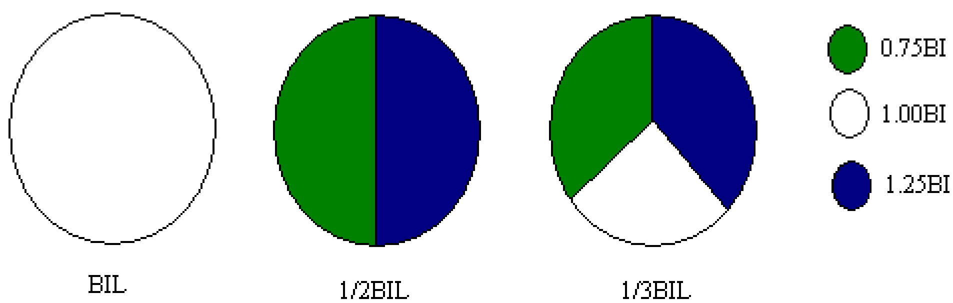

Figure 1. Irrigation Scenarios

Results

When estimated functions were evaluated at average levels of water for all three irrigation levels, ST 5599BR was estimated to have the highest yield and gross margin at all irrigation levels, shown in figures 2 and 3 and tables 1 and 2. Also, FM 989BR was estimated to have a higher yield and gross margin than PM 2280BR at all water levels. In addition, the 1.25BI irrigation level provided the highest yields and gross margins for indeterminate "picker" varieties followed by the 1.00BI and 0.75BI irrigation levels, respectively. The 1.00BI level provided the highest yield and gross margin for the determinate "stripper" variety. Furthermore, the indeterminate "picker" variety, ST 5599BR, demonstrated first-degree stochastic dominance over the determinate "stripper" variety at the 0.75BI irrigation level when analyzed with variance and risk considerations. Additionally, the indeterminate "picker" varieties demonstrated first-degree stochastic dominance over the determinate "stripper" variety at the 1.00BI and 1.25BI irrigation levels.

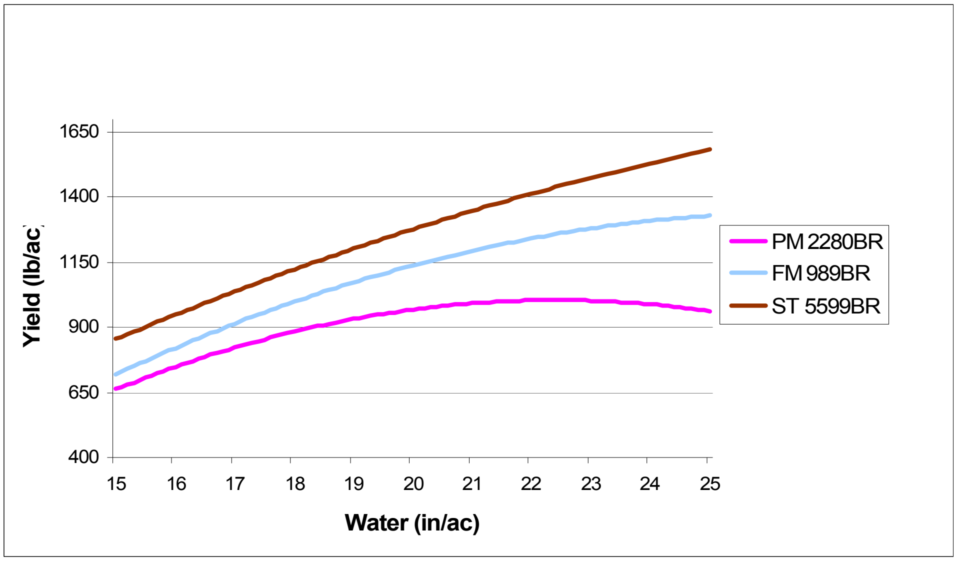

Figure 2. Yields per Acre for Three Cotton Varieties

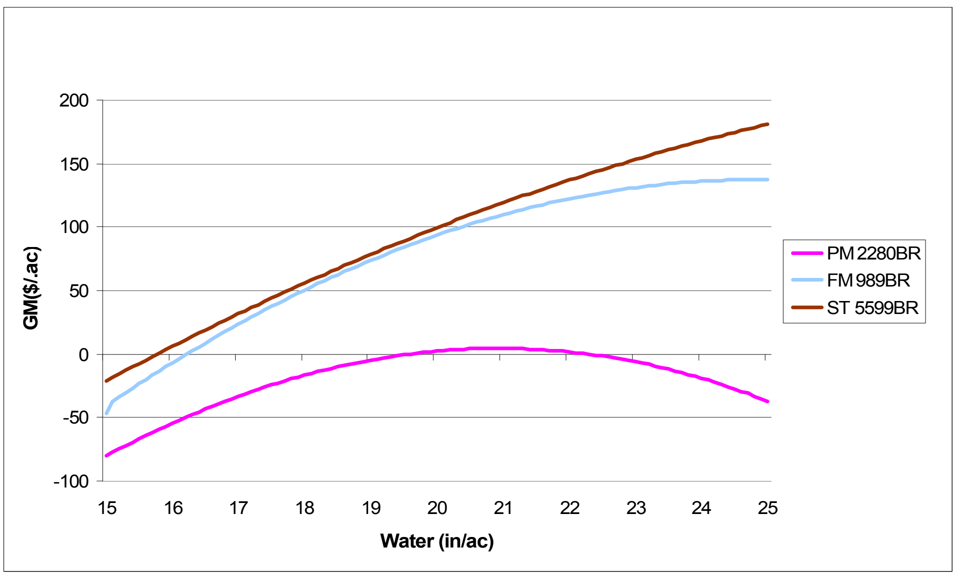

Figure 3. Gross Margin per Acre for Three Cotton Varieties

Table 1. Average Yields: Variety by Irrigation (lbs/ac)

Irrigation	PM 2280BR	FM 989BR	ST 5599BR
0.75BI	820	911	1034
1.00BI	967	1134	1272
1.25BI	1004	1271	1459

Table 2. Gross Margins Variety by Irrigation ($/ac)

Irrigation	PM 2280BR	FM 989BR	ST 5599BR
0.75BI	-33.91	16.24	30.74
1.00BI	1.97	86.20	98.20
1.25BI	-3.62	122.95	149.08

Additionally, FM 989BR displayed the highest price per pound of lint followed by PM 2280BR at all water levels shown in figure 4.

The difference between the yield and net returns of two indeterminate "picker" varieties, ST 5599BR and FM 989BR, may be due partially to the nematode problems that exist at the AG-CARES research farm. ST 5599BR has been shown to be a top yielding variety in the presence of nematodes (Wheeler, et al., 2004).

Additionally, a limited irrigation capacity with only enough water for the entire field at the 1.00BI irrigation level was available. Irrigating at the 1BIL scenario produced the highest gross margin. The 1/3I scenario provided higher gross returns that the 1/2I. The BIL had a gross margin of $98.20 as compared to $92.67 and $89.91 for the 1/3IL and 1/2IL scenarios, respectively.

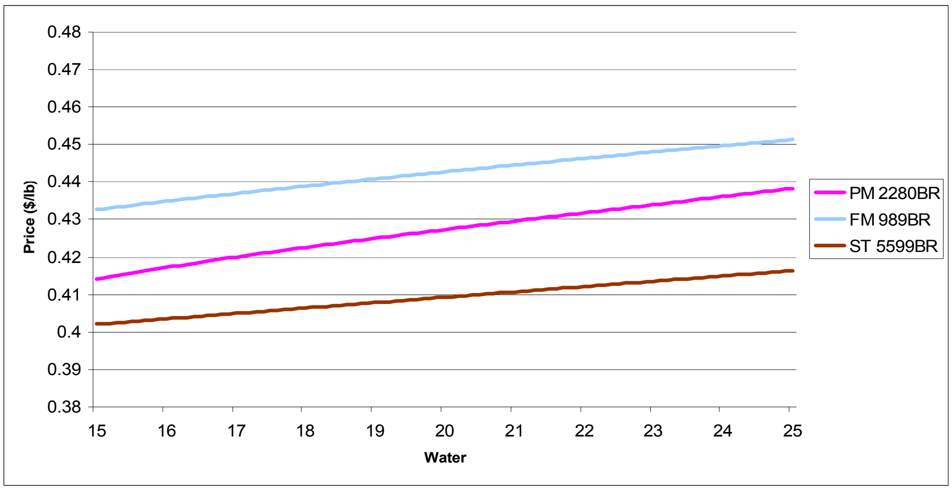

Figure 4. Price per Pound for Three Cotton Varieties

Summary and Conclusion

Cotton producers have an impact on their gross margin based upon varieties selected and irrigation levels and allocation selected for cotton production. With proper knowledge, producers can appropriately select and manage production inputs to maximize gross margins. It is important for producers to realize that economic benefits can be obtained by different management practices between varieties and the selection of a variety that will optimize returns under certain growing practices and environmental conditions.

References

Fadiga, M., S. Misra, and D. Ethridge. 2006. "TEXAS-OKLAHOMA PRODUCER COTTON MARKET SUMMARY: 2005/2006." Cotton Economics Research Institute.

Wheeler, T. A., et al. 2004. "Results of the Irrigated Nematode Variety and Strains Performance Test at AG-CARES, Lamesa, TX, 2004." 2004 AG-CARES Annual Report.