ECONOMIC FEASIBILITY ANALYSIS OF ULTRA-NARROW-ROW COTTON IN TENNESSEE

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Abstract

Rising costs of picker cotton production technology warrants a reevaluation of ultra-narrow-row cotton (UNR) in West Tennessee. Field studies were conducted at the Milan (TN) Experiment Station in 1994 and 1995 to evaluate UNR systems of no-till cotton production. The objective of this paper is to estimate the net returns to UNR production system and compare those returns with those from the traditional 40" row production system using data from these experiments. In 1994, net revenue was highest for the traditional 40" row system. By contrast, finger stripped cotton in 20" rows produced the highest net revenue in 1995. The differences in net revenues between years were influenced by heat unit accumulation and weather between planting and harvest and their effects on yield and fiber quality.

Introduction

Picker cotton has traditionally been produced using a 38" or 40" row spacing. The rising cost of producing picker cotton and concerns about row-crop cotton production on highly erodible soils in West Tennessee have revived interest in ultra-narrow-row (UNR) cotton technology (Gwathmey and Hayes, 1996). With the UNR system, cotton is planted with a row spacing as narrow as 7.5" and is harvested once using a finger stripper that has a single wide-swath header instead of two harvests with a 4-or 5-row spindle picker. Ultra-narrow-row production was evaluated by Rugh et al. (1973) and Hoskinson et al. (1974) at the University of Tennessee in the early 1970's. They concluded that UNR cotton was not feasible with the production practices available at that time. Since that time, new technologies have become available that may make UNR production feasible in West Tennessee. The new technologies include no-tillage cotton production methods, earlier-maturing cultivars, improved over-the-top herbicide systems, and the development of growth regulators such as mepiquat chloride (Pix). Besides reducing production costs and erosion the UNR system may also enhance weed control. Impeding the potential adoption of UNR technology is the question of whether or not finger stripped cotton may be sold in the traditional marketing channels for cotton in West Tennessee.

Field experiments were conducted at the Milan (TN) Experiment Station in 1994 and 1995 to reevaluate the feasibility of using ultra-narrow-row production technology in Tennessee. The objective of this paper is to estimate the net returns to UNR production system and compare those returns with returns from the traditional 40" row production system using data from these experiments.

Materials and Methods

Field experiments were conducted at the Milan (TN) experiment station in 1994 and 1995. No tillage production practices evaluated in the study included row spacing and harvest method. The cotton cultivar, ‘Deltapine 20', was planted in 10", 20", and 40" rows using a Kinze Tandem planter. The soil type was a Loring Silt Loam, 0 to 2% slopes. The planting date in 1994 was 10 May, but was replanted on 2 June due to poor stands. Cotton was also planted on 10 May in 1995. The seeding rates were 29 lb/ac for 10" rows, 22 lb/ac for 20" rows, and 15 lb/ac for 40" rows. University of Tennessee recommended practices for no tillage cotton were followed during the growing season in both years (Shelby and Bradley, 1995). Row-spacing-by-harvest-method included 10" and 20" rows harvested with an Allis Chalmers 760 finger stripper equipped with a bur extractor, and 40" rows harvested with a John Deere 9930 spindle picker. These treatments were arranged in a randomized complete block design with 4 replications in each year. In 1994, the plots were harvested once on 9 November, after application of the harvest aids ethephon followed by sodium chlorate to all plots. In 1995, the plots were harvested once on 7 October, after application of the harvest aids thidiazuron and ethephon followed by paraquat and sodium chlorate to all plots.

Each year, samples of harvested seed cotton were air-dried and ginned (Continental 20-saw gin with two lint cleaners) to determine lint percentages and obtain lint samples. Lint fiber from each treatment were used to determine fiber characteristics using High Volume Instrument (HVI) testing (Agricultural Marketing Service Staff, 1993). Lint samples were classed at the USDA-AMS Cotton classing Office in Memphis. HVI data for characteristics currently valued in the marketing of cotton--color, trash, staple, strength, and micronaire--were used to determine price differences by treatment.

Row spacing and harvest method can impact lint quality and effective lint price received by farmers, which is the price of base quality lint (base quality price) plus the price discount or premium for variations from base quality lint (quality price difference). While the base quality price reflects general cotton supply and demand conditions, the quality

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:315-317 (1997)
National Cotton Council, Memphis TN

price difference depends on the mix of fiber characteristics for grade [color and leaf (trash)], staple (fiber length), micronaire, fiber strength, and extraneous matter.

Currently, a market specializing in finger stripped cotton does not exist in Tennessee. The only published source of cotton price data that reports premiums and discounts from a base quality are quotations collected by the U.S. Department of Agriculture, Agricultural Marketing Service. These spot price quotations are compiled daily using information gathered by market reporters for seven major market areas in the U.S. Cotton Belt (Larson and Meyer, 1996). The reported base quality price is for color 41, leaf 4, staple 34, micronaire 35-36 or 43-49, and strength 23.5-25.4 cotton (Strict Low Middling). Leaf grade was not included in the UNR data set, but was estimated by regression from 4-year averages of HVI trash correlated with leaf grade (Larson et al., 1996). Monthly spot price data for November 1993 through May 1995 were used to estimate regression equations to predict quality price differences from information about leaf grade and base quality price (Larson et al. 1996).

The average base quality price for November 1993 through May 1995 of $0.75/lb and the discounts associated with it were used to determine net revenue for each row spacing and harvest method treatment. For example, for color 31, staple 36 cotton, the leaf grade discounts were approximately $0.03/lb for leaf 5, $0.10/lb for leaf 6, and $0.13/lb for leaf 7. Average quality price differences for that period for micronaire and fiber strength were assumed in determining the effective price received by farmers because the discount relationship for those attributes did not change with the base quality price. Average discounts for level 1 extraneous matter were also used to calculate price difference for the finger stripped cotton. The estimated percentage of finger stripped bales that would incur a level 1 extraneous matter discount of $0.045/lb is 50 percent (Gwathmey, 1996, unpublished data). Consequently, an average extraneous matter discount of $0.0225/lb was applied to the finger stripped data along with the estimated discounts for leaf grade and micronaire.

Enterprise budgets were constructed for each treatment to reflect the cultural practices specific to the Milan experimental treatments. Yields and estimated effective lint prices were entered into the Agricultural Policy Analysis Center Budgeting System (Slinsky et al., 1996) to generate net revenues (over variable costs, fixed equipment costs, and overhead) for each treatment. The factors that influence net revenues for each treatment are seeding rate, harvested lint yield, estimated effective lint price, and harvest method variable and overhead costs. Currently, a modern finger stripper for harvesting UNR is not available for purchase new by farmers. Several assumptions were made to estimate the ownership and operating costs of a finger stripper. The first assumption is that the cost of a finger stripper would be approximately one-half the cost of a new 4--row spindle picker because of the greatly simplified harvesting head on the unit. The estimated purchase cost for a modern finger stripper with a burr extractor was assumed to be $100,000. The second assumption is that the finger stripper can harvest 50% faster than a 4-row spindle picker. The field speed of a finger picker was assumed to be 6 mph compared with 4 mph for a spindle picker. The expected useful life of a finger picker was assumed to be 20 years compared with 12 years for a spindle picker. And finally, the width of the header on finger stripper is approximately 12', the same as a 4-row spindle picker. In addition, because of increased trash and extraneous matter in the seed cotton that is ginned, we assumed that the ginner would charge more for ginning finger stripped cotton. The assumed charge for ginning finger stripped cotton was $0.10/lb compared with $0.06/lb for picked cotton (Glade et al., 1995).

Results and Discussion

Lint yields by row spacing and harvest method in 1994 and 1995 are presented in Figure 1. Yields in the finger stripped 20" rows were higher than those in finger stripped 10"rows and the picked 40" rows in both years. In 1995, finger stripped yields in 10 and 20" row spacings were significantly higher than the picker yield. Differences in heat unit accumulation and weather between planting and harvest account for most of the yield differences between the 1994 and 1995 results.

Net revenues for UNR and picker cotton production systems are also influenced by fiber quality. High trash content in lint may receive significant price discounts. The visual estimate by the cotton classer of cotton plant leaf particles in the lint sample (trash) is called leaf grade which has whole number designations from 1 to 7 with 7 associated with the highest HVI trash content. Cotton with a high leaf grade typically receives the largest price discount. HVI trash percentages were higher for lint from the finger stripped plots than from the picked plots. In 1994, the HVI trash percentage in 10" and 20" finger stripped rows were 1.5% and 1.6% respectively, compared with 0.5% for the picked cotton in 40" rows. In 1995, the finger stripped HVI trash percentage was 1.0% for both stripper systems compared with 0.6% for the picked cotton. The harvest aid treatment of thidiazuron and ethephon followed by paraquat and sodium chlorate used in 1995 was more effective in reducing trash than the ethephon followed by sodium chlorate regime used in 1994.

Discounts for micronaire can also impact net revenues. In 1994, micronaire in 10" and 20" finger stripped rows were 31 and 35 respectively, compared with 36 for the picked cotton in 40" rows. Micronaire was either 40 or 41 for all treatments in 1995. Color grade Rd and +b values, fiber length, and fiber strength did not differ among treatments. Yellowness of fiber (+b) in 1995 was slightly higher in lint from stripped plots

The estimated effective lint prices by row spacing and harvest method in 1994 and 1995 are presented in Figure 2. The estimated effective lint in both years was highest for picker cotton in 40" rows ($0.74/lb and $0.70/lb, respectively). The finger stripper systems incurred higher discounts for trash content in lint, extraneous matter, and low micronaire. In 1994, the grade discount was −$0.12/lb in 10" and 20" finger stripped rows compared with −$0.01/lb for picked cotton in 40" rows. Finger stripped cotton in 10" rows also incurred a micronaire discount of −$0.05/lb in 1994. Effective lint prices for finger stripped cotton in 10" rows was $0.55/lb and $0.60/lb in 20" rows. By contrast, the grade discount was −$0.10/lb in 10" and 20" finger stripped rows compared with −$0.05/lb for picked cotton in 1995. Price discounts for micronaire were not assessed for any treatment in 1995. Effective lint prices for finger stripped cotton in 10" rows was $0.63/lb and $0.62/lb in 20" rows. Several treatments also received very small price premiums for fiber strength in both years.

Net revenues by row spacing and harvest method in 1994 and 1995 are presented in Figure 3. In 1994, net revenue was highest for the traditional 40" row system. Picker net revenue was $291/acre compare with $222 /acre for the finger stripped 20" rows and $93/acre for the finger stripped 10" rows. By contrast, finger stripped cotton in 20" rows produced the highest net revenue in 1995, $321/acre compared with $295/acre for the picker system. Several factors influenced net returns. Seeding costs were much higher for the narrow row system. Seed cost for one planting was $11.40/ acre for the 10" rows compared with $ 22.04/acre. The estimated operating and ownership cost for the finger stripping system was $64.61/acre compared with $74.81/acre for picker system. Effective lint prices for 20" stripper cotton in 1995 were higher relative to 1994 because of the use of a more effective harvest aid. Besides seeding rate costs, machinery costs, and effectiveness of the harvest-aid, the differences in net revenues between years were primarily influenced by heat unit accumulation and weather between planting and harvest and their effects on yield and fiber quality. Higher lint yields in 1995 offset lower fiber quality and effective lint prices for UNR cotton when compared with traditional picker cotton.

Conclusions

Analysis of net revenues for picker and UNR cotton production systems indicate that UNR cotton can produce net revenues similar to the traditional system. This analysis assumes that farmers can sell UNR cotton in the same marketing channels as picker cotton. The price discounts may be much higher and the effective price received for lint with this system may be much lower than assumed in this analysis thus negatively impacting net revenues for UNR cotton. Future economic analysis should evaluate the impact of growth regulators and weed control on yield, quality, and net revenue. Additional analysis is also needed to evaluate the potential markets for UNR cotton in West Tennessee.

Acknowledgments

The field research portion of this study was supported in part by a grant from BASF Corporation.

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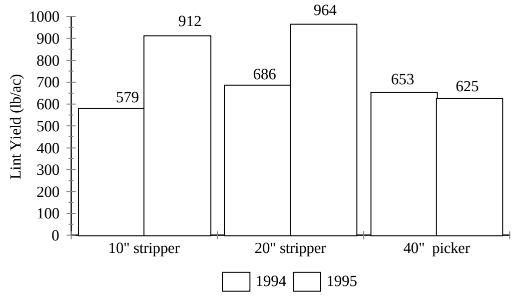

Figure 1. Lint Yeilds by Row spacing and harvest method

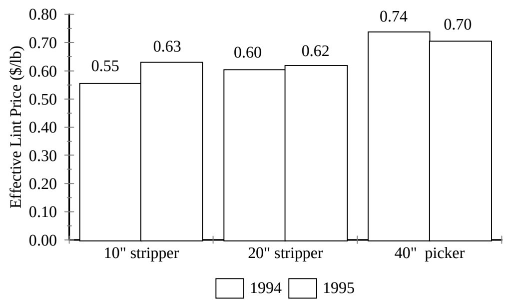

Figure 2. Estimated effaective lint price by row spacing and harvest method.

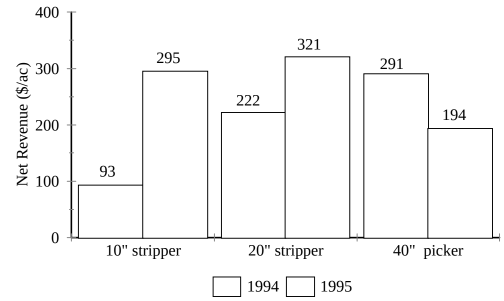

Figure 3. Estimated net revenues by row spacing and harvest method.