POTENTIAL OF ULTRA NARROW ROW COTTON IN SOUTHEAST ARKANSAS

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Abstract

Ultra narrow row cotton production shows promise as a way to produce cotton with reduced inputs on marginal cotton land. The primary production challenges are establishing a healthy stand in the optimum plant population range, and making a commitment to reducing inputs.

Introduction

Historically, cotton production in the Mid-South has remained relatively stable (Robinson and Mancill, 1997). In recent years several factors have combined to destabilize Mid-South cotton economics. In 1996 Parsch and Cao showed that cotton production without government programs results in reduced profit and increased risk. Cotton production costs have increased, led by the increasing costs of insect control (Scott, Cooke and Freeland, 1996). The competitive advantage boll weevil eradication has provided for Southeastern U.S. cotton growers (resulting in increases in cotton plantings in those states), and relatively strong prices of competing crops (such as corn, rice and soybeans) have further destabilized Mid-South cotton production (Robinson and Mancill, 1997). The result has been economic concerns among Mid-South cotton producers (and their lenders), and large acreage shifts to other crops. Loss of cotton acreage has serious economic impacts on gins and other cotton infrastructure as well as on the larger community.

Ultra narrow row (UNR) production practices are being investigated primarily for their potential to compete with soybeans, corn and rice on soils previously considered unsuitable for cotton production. The cotton produced could provide stability for gins and other support industries if conventionally grown cotton acreage continues to decline.

Methods

The information presented in this report was obtained from experiments conducted in 1997 on the Southeast Branch Experiment Station, Rohwer AR, and the Tom Gist farm, Marianna, AR. In addition, this report provides grower observations and consensus opinions obtained by interviewing four UNR cotton farmers in Southeast Arkansas.

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UNR Studies at Marianna, AR

The Marianna study was conducted as a minimum tillage study, not as a no-till study. In October 1996 100 lbs/ac. 0-30-60 were applied and disked into the soil Mixed Silt Loam; Loring, Falaya and Memphis series). A chisel was run in April 1997 and a seed was prepared by running a DMI field cultivator on 5-14-97.

The 32-acre field was planted in 7.5 inch rows with 35 lbs of cottonseed per acre on 5-14-97. A John Deere 455, 25 foot grain drill was used to plant the field. The varieties used were Paymaster 1330 Roundup Ready with Gaucho (10 acres), Paymaster 1330 Roundup Ready with Prevail hopper box fungicide (5.1 acres), Paymaster 1215 Roundup Ready with Prevail (1.3 acres) and Paymaster 1220 Roundup Ready with Prevail (15.6 acres).

The herbicide program consisted of 5-27, 6-6 and 6-18 Roundup Ultra 1.5 pts/ac, followed by an application of Staple .6 oz/acre on 6-28-97.

In addition to the fall 1996 P and K fertilizer, 60 units N (130 lbs of urea) were broadcast on 6-6-97, 4.3 units N (2 gallons of 23% liquid) were broadcast on 7-26-97, 21 units N (100 lbs of Ammonium Sulfate) and 3.6 units N (1.7 gallons 23% liquid) were broadcast on 7-31-97. The total N applied was about 89 units/acre.

Insecticide use was as follows. On 6-3-97 and 6-18-97 Bidrin 8 was applied for thrips and overwintered weevil control at 2.56 oz/ac. On 6-28 and 7-17-97 Vydate C-LV was applied for overwintered weevil and plant bug control at 6.4 and 8 oz/acre, respectively. And on 7-31 and 8-14-97 Karate was applied for worm and weevil control at 5.5 oz and 4.3 oz/acre, respectively.

Pix was used for plant growth regulation as follows. On 7-17-97 Pix was used at 4 oz/ acre on the 1220 RR and 1215 RR cotton while a higher 8 oz/acre rates was used on the 1330 RR in a more growthy area of the field. A subsequent Pix application, 8 oz/acre, was made to the whole field on 7-26-97.

For harvest preparation, Finish was applied at 1.56 qt/ac on 9-18-97 for defoliation and Starfire was applied at 1.5 pt/ac on 9-30-97 for desiccation.
Harvest was accomplished on 10-16-97 using an Allis Chalmers stripper fitted with a broadcast stripper header.

Plant Population Study

A plant population study was established in the 1330 Roundup Ready cotton at the Marianna study site. Three replications of 20 foot x 20 foot plots, in a Randomized Block Design, were established. Plant stands of 175,000 plants/acre, 122,000 plants/acre and 70,000 plants/acre were established by hand thinning. Season-long production practices were the same for all plots (as described above). On 10-14-97, 9 ft^2 samples were harvested by hand from each plot. The samples were weighed, ginned and the fiber weighed again so that percent lint turn-out could be calculated. Then the lint yield in lbs lint/acre was calculated for each plot and analyzed using Analysis of Variance and Duncan MRT (P=.05).

Harvest Aid Study

On 9-18-97 a study to compare defoliation products was established on Paymaster 1330 cotton at the Marianna study site. Plots were randomized and replicated 3x (Randomized Complete Block Design) and were 7ft wide by 25 ft long. Borders 7 ft in width separated adjacent plots. The untreated check plots were neither replicated nor randomized into the design. The plots were treated using a CO_2 charged backpack sprayer in 10 gallons of finished spray per acre. The plots were evaluated using a visual rating scale for percent defoliation, percent dessication and percent open at 4, 8 and 12 days posttreatment.

UNR Studies at the SE Branch Experiment Station at Rohwer, AR

At the Rohwer study site, Stoneville 474 cottonseed was planted on a 1.5 acre Herbert silt loam field on 5-16-97. A John Deere 750 All Till Drill was used to place the seed in 7.5 inch drills at a rate of about 3 seeds per foot (42.6 lbs/ac).

Herbicide treatments were applied in the same way to all plots. Prowl was applied preplant at a rate of .75 lb/ac. At planting, Staple .6 oz/ac, and Cotoran .6 lbs/ac were applied. For grass control, Fusilade was applied as a spot treatment on 6-1-97 and Select was broadcast at 8 oz/ac on 7-18-97.

The field was fertilized on 6-4 and on 6-25-97 with 50 units of urea broadcast. An additional 20 units of N were supplied in two foliar sprays. On 7-15 and on 8-12-97 10 unit applications of 23% liquid N were applied.

Insecticide treatments consisted of the treatments applied in the Thrips Control Test and one combination worm and weevil control treatment with Curacron 1 pt/ac + Bidrin .5 pt/ac on 8-12-97.

For defoliation, Def at ½ pt/ac + Boll'd at 1.5 pt/ac + Dropp at .1 lbs/ac were applied on 9-18-97. For dessication, Gramoxone 1 qt/ac was applied on 9-29-97.

Yield data were collected in the Rohwer studies by hand harvesting the seed cotton from 9 ft^2 sections of each plot at maturity on 10-10-97. Yield, lint turn-out and fiber quality were determined from these samples by weighing them, ginning them, then sending the lint to the USDA AMS cotton Division Classing Office, Dumas, AR.

The field was then machine stripped using a John Deere 7455 stripper fitted with a ten foot wide Allis Chalmers broadcast stripper header on 10-20-97. The seed cotton was ginned at the Dumas Cotton Gin, Dumas, AR. The yield figures reported in this paper are the hand harvested seed cotton weights with the machine harvested percent lint turn-out applied.

Thrips Control Test

At planting, a Randomized Block Design of 5 thrips control methods and an untreated check were established in the field. Plots were 10 feet wide by 240 feet long. Two of the six treatments were the seed treatment insecticides, Orthene and Gaucho which had been applied to the seed when it was processed. Another two treatments were the in-furrow insecticides Thimet 20G and Temik 15G. They were dropped in-furrow using the grass seed hopper on the planter at rates of 10 and 11 lbs/ac, respectively. Two treatments were left untreated at planting. One was left untreated to serve as the check, while the other was sprayed with Orthene 90S (foliar) at .25 lbs/ac on 6-12 and 6-16-97.

Thrips samples were taken on 6-12 and 6-25-97 by cutting 10 plants per plot at the soil line and placing the plants in Ziplock plastic bags. The thrips were washed from the plants in the plastic bags using soapy water and then filtered onto 11 cm filter paper. They were then identified and counted under 10 and 20x magnification in the laboratory.

Stand counts were made by counting all plants in 9 ft^2 on 6-5 and 7-9-97. Node counts, height measurements and appearance ratings were taken on
6-16-97. Ten plants/plot were measured and mapped on 7-8, 7-15, 7-22, 7-28, 8-8, and 8-15-97.

Plant Growth Regulator Test

On 7-15-97 Pix applications were made in three rates, 0, 16, and 20 oz/ac, across the thrips control treatments (Factorial Design). A second application of Pix at 10 oz/ac was applied across all plots on 8-12-97. Height and plant mapping data were collected in the plots as described above.

Data in both the Marianna and Rohwer UNR Tests were processed using Analysis of Variance, Duncan's MRT, and in some cases Linear Regression Analysis.

Results and Discussion

Thrips Control

In the Thrips Control Test at Rohwer, differences and non-significant trends in thrips populations, plant height and visual appearance ratings (Table 1) indicate that Thimet, Temik and Gaucho gave good, long term thrips suppression and positive plant responses in growth and appearance. Orthene seed treatment and the foliar Orthene treatment appear to have given briefer periods of thrips suppression based on the thrips counts, plant height measurements and visual ratings data. In fact, the visual ratings data put these treatments at no better than the check on 7-9-97.

Yield data did not follow the thrips count and plant damage patterns observed, however. Lint yields were highest in the Orthene seed treatment plots, the treatment which had numerically the highest thrips counts, among the shortest plant height and one of the poorest visual ratings. Regression Analysis showed no significant relationship between thrips numbers, plant height, fruit per plant or visual ratings and yield. The factor that was significantly negatively correlated with yield was plant population (R^2=.91).

Plant Population Study

The plant population study at Marianna (Table 2) showed no significant yield association with plant population, but a numerical trend indicating higher yields may be associated with UNR cotton plant populations in the range of from 70,000 to 122,000 plants per acre in Southeast Arkansas as compared with plant densities of 175,000 plants per acre. This is in agreement with our observations in the Thrips Test at Rohwer.

Plant Growth Regulation Study

Table 3 shows the data from the Plant Growth Regulation Study conducted at Rohwer. Pix applications in mid July resulted in significantly higher percent square shed, on the dryland Stoneville 474 cotton in this test. Cotton receiving no mid-season Pix retained more fruit, and made higher yields than did the 16 and 20 oz (mid July) treated plots.

The 10 oz late season Pix application was made to help suppress regrowth. Since most of the fruit was in the full grown boll stage, this application is thought to have had little impact on yield or harvestability.

Harvest Aid Study

The results of the UNR Harvest Aid Study at Marianna are shown in Table 4. The Ginstar + Prep combination, though weaker in defoliation than most of the competing treatments, worked quickly to produce a harvest ready crop. Def/Folex + Prep , Def/Folex + Cottonquick, Def/Folex + Prep + Roundup Ultra and Finish 1.5 qt produced quick defoliation. Ginstar + Prep produced significantly superior dessication in comparison with the other treatments. Ginstar + Prep, Cottonquick + Def/Folex, Def/Folex + Prep, Cottonquick + Dropp, and Finish 1.5 qt gave the quickest boll opening. With the possible exception of the Def/Folex + Dropp + Prep combination, all treatments except the Ginstar + Prep needed dessication with Gramoxone, Starfire or sodium chlorate to dessicate them quickly for stripper harvest.

Conclusions

Thrips Control

Data from the Rohwer Thrips Control Test indicate clearly that thrips cause injury and slowed growth in UNR cotton as in conventional cotton. Less clear (confounded by changes in plant populations) is the impact of this damage on yield.

Plant Population

Data from the Marianna study indicate that the optimum plant population range for UNR cotton in Southeast Arkansas is probably in the 70,000 to 122,00 plants per acre range. Regression Analysis of the Rohwer Thrips Control Test supports this optimum range. In the Rohwer study, the highest yields came from the plots with the lowest plant populations (a statistically significant negative correlation, R^2 = .91). Yields from plots with plant populations of about 110,000 plants/acre were higher than yields from plots with plant populations of above 130,000 or 140,000 plants/acre.

Harvest Preparation

Ginstar + Prep could be used alone under 1997 growing conditions to quicky produce harvest ready UNR cotton. The other treatments tested probably needed a desiccant to quickly prepare them for broadcast stripper harvest.

UNR Cotton General Observations and Conclusions

Most Southeast Arkansas cotton producers view UNR cotton, not as an option on conventional, irrigated 38 inch row cotton land, but as a way to produce an economically viable crop on marginal land. The major competitor to UNR cotton on this land is dryland soybeans.

Producers are in agreement that in order to work, UNR cotton must be a low input cotton production system. In the traditionally high inputs, Delta Cotton producing area, what does UNR cotton offer that would allow growers to reduce inputs?

UNR cotton is more vulnerable to damage in the seedling stage than conventional 38 inch row, bedded cotton. Because it is grown on generally more poorly drained soils and has no bed to improve drainage and soil drying, cold wet weather is a bigger threat to UNR cotton. The solution to this problem is later planting. Delaying planting until soils have warmed and the weather is more conducive to quick seedling emergence and development can help us escape the seedling disease problems which commonly develop on earlier plantings. Under many circumstances the more expensive in-furrow fungicides and thrips control products may be left out. (Use of these products on UNR cotton at standard label rates is 5x as expensive as on 38 inch row cotton because there are 5x as many feet of row in 7½ inch row production.) Cheaper hopper box or seed treatment fungicides and scouting and spraying for thrips or use of cheap in-furrow liquid insecticides may lower UNR production costs.

Achieving an adequate stand is more critical in dryland UNR production than in conventional cotton production. If stands are too thick, the cotton will undergo excessive stress and loose yield. If stands are too thin, plants may grow too tall or to bushy to allow the finger stripper to work effectively. In thin stands each plant must produce more bolls, thus some of the advantages of UNR cotton in producing an early crop may be lost. Excessive growth and the prolonging of the production season carry higher price tags in the overall crop production budget as expenses for growth regulators, insecticides and chemical application may increase.

Optimal UNR plant densities allow the plants themselves to regulate growth. This can help growers avoid growthy or bushy cotton in UNR fields. Lower plant density UNR fields may require more Pix to control excessive growth. Poorer soils may require lower plant densities than will be optimal on better soils.

Proper timing of planting and choice of an appropriate plant population allow for quick canopy closure, providing help with weed control.

In comparison with conventional cotton, the 2-4 fold higher plant populations desirable in UNR cotton have some advantages. Obviously, fewer bolls are needed per plant to produce a good crop. Therefore, not as much time is needed to set the crop. This compressed fruiting window allows UNR fields to finish early in spite of their later start. The compressed fruiting window shortens the period of vulnerability to insect pests, thus saving insect control costs.

Another way UNR cotton saves on insect control costs is by spreading the pests over 2-4 fold more plants and relying less on any one cotton plant.

Finally, dryland UNR cotton saves on insect control costs as it becomes water stressed during mid season. Since bollworm and tobacco budworm moths lay their eggs preferentially on succulent cotton, water stressed UNR cotton is less attractive and has fewer eggs laid in it.

Further reductions in inputs are seen in the cost of stripper versus picker harvesters, in elimination of irrigation expenses, and in lower labor and equipment requirements for cultivation and preplant soil preparation.

Low input costs are necessary and possible with UNR cotton production. In order to make this production system profitable, however, growers must scrutinize each cotton production decision and make a commitment to reducing inputs. A tight budget will be necessary for most growers to help them control costs.

Low input costs and good yields in the studies at the Marianna and Rohwer test sites allowed this cotton to compete well with irrigated 38 inch row, conventional cotton in 1997 with respect to break even prices. At Marianna, the break even cost for the UNR cotton was 46.3¢/lb; while at Rohwer, the UNR break even price was an impressive 30.6¢/lb. These break even prices compare well with the 49.1¢/lb break even price needed for irrigated 38 inch row cotton (based on a yield of about 1000 lb/ac and the inputs required to produce a conventional crop under irrigated southeast Arkansas growing conditions) (Bryant and Windham, 1997).

The Staplecotn seasonal advance price average for the cotton produced at the Marianna study site was $0.5550/lb., 9.2¢/lb above the break even price at that site. At that level, $66.05 an acre in returns to land, overhead and management would be realized. Lint quality figures for the Rohwer site were not available at the time of this writing, but assuming similar quality lint was produced at the Rohwer study site, the lint value at Rohwer would be $0.2490 above the break even price. Returns to land, overhead and management for the Rohwer test site in this case come to $231.19/acre.

Summary

Ultra narrow row cotton production practices have promise for better utilizing marginal land in Southeast Arkansas. The keys to success with this system are establishment of plant densities in the optimum range (70,000 to 120,000 plants/acre), setting a quick crop and controlling production costs.

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References

Bryant, K. J., and T. E. Windham. 1997. Estimating 1998 Production Costs in Arkansas - Cotton, Solid Planted, Furrow Irrigation, Loamy Soils, South of I-40, Eastern Arkansas. Publication AG-503-11-97. 4pp.

Parsch, Lucas D., and Ge Cao. 1996. Impact of Government Programs on Risk-Returns of Cotton Production. Proc. Beltwide Cotton Conf. 508-510.

Robinson, R. C., and David Mancill. 1997. The effect of planting flexibility on cotton industry infrastructure in Mississippi. Proc. Beltwide Cotton Conf. 306-309.

Scott, W., F. T. Cooke, Jr., and T. B. Freeland, Jr. 1996. Costs and changes of Cotton Insect Control in Mississippi – 1992-1995. Mississippi Agricultural and Forestry Experiment Station Bulletin 1051.

Table 1. Thrips control, plant response, and lint yield following various treatments for thrips control in ultra narrow row cotton[1]. Rohwer, AR 1997.

Treatmt	Rate lb/ ac	6-19		7-9		10-20
		Thrips/ Plant[2]	1000 plants/ ac	Height (in)	Rating[3]	Lint yield lbs/ac
Orthene St	-	2.5 a	111 a	23 a	4.1 b	1017a
Gaucho St	-	1.1 a	136 a	23 a	5.9 a	988 a
Temik 15G IF	11	0.8 a	136 a	24 a	5.5 a	966 ab
Thimet 20G IF	10	1.3 a	143 a	23 a	6.0 a	889 ab
Orthene 90S F[2]	0.25	0.4 a	146 a	19 b	4.1 b	851 b
Check	-	2.2 a	143 a	22 b	4.1 b	840 b

[1]Means in columns followed by the same letter are not significantly different (P=0.05)
[2]Foliar Orthene applied 6-12 and 6-16-97
[3]1-10 with 10 as perfect plant

Table 2. Ultra narrow row cotton plant population study[1], Tom Gist farm, Marianna, AR. 1997.

Plant Population	Seed Cotton lbs/A	Percent Lint	Lint lbs/A
70,000	2050 a	0.3932 a	808 a
122,000	2146 a	0.3850 a	826 a
175,000	1622 a	0.3927 a	637 a

[1]Means in columns followed by the same letter are not significantly different. (P=0.05)

Table 3. Effects of treating ultra narrow row cotton with Pix plant growth regulator[1]. Rohwer, AR 1997.

	Dates/Rates			7-28		10-20
Treatmt	7-15	8-12	Height	% Square Shed	Fruit per Plant	Lint Yield Lbs/Ac
Pix	0	10	23.8 a	11 b	6.6 a	1014 a
Pix	16	10	22.2 b	17 a	5.6 c	882 b
Pix	20	10	21.4 c	13 ab	6.0 b	880 b

[1]Means in columns followed by the same letter are not significantly different (P=0.05)

Table 4. Activity of harvest aid chemicals on ultra narrow row cotton[1]. Tom Gist Farm, Marianna, AR. 1997.

Product(s)	Rate	9-30-1997 12 days Posttreatment[2]			
		% Def	% Des	% open	Harvest[3] Ready
Ginstar + Prep	6.4 oz + 1.33 pt	78 c	19 a	95 a	1.0 a
Def/Folex + Prep	0.66 pt + 1 qt	92 a	2 c	94 a	1.7 ab
CottonQuick + Def/Folex	1.75 qt + 1 pt	92 a	2 c	95 a	1.7 ab
CottonQuick + Dropp	1.75 qt + .1 lb	83 bc	9 b	94 a	2.0 abc
Def/Folex + Dropp + Prep	0.66 pt + .1 lb + 1.33 pt	82 bc	12 b	90 ab	2.0 abc
Def/Folex + Prep + Roundup Ultra	1 pt + 1.33 pt + 1.5 pt	88 ab	3 c	90 ab	2.3 bc
Finish	1.5 qt	87 ab	2 c	94 a	2.3 bc
Harvade + Dropp + Prep + COC	8 oz + .1 lb + 1.33 pt + 1 pt	80 c	9 b	88 ab	2.7 bc
Cottonquick + Def/Folex	1.75qt + .5 pt	82 bc	4.7 c	86 b	3.0 c
Finish	1 qt	83 bc	2.7 c	90 ab	3.0 c
Check		75	2	90	3.0

[1]Means in columns followed by the same letter are not statistically different (p=.05)
[2]Applied 9-18-97. 20% open, 4 NACB, 25% defoliation, 0% dessication.
[3]Harvest Ready - 1 = harvest ready, 2 = needs time, 3 = much too green or unopen, 4 = need dessication to make harvest ready in a timely manner.