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SPINDLE PICKER 15-INCH ROW PATTERN INFLUENCE ON LINT YIELD AND PLANT CHARACTERISTICS: ONE YEAR'S PROGRESS

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Abstract

A study was initiated in 2002 on a Marietta silt loam soil (Verona, MS) and a Falaya silt loam soil (Falkner, MS) evaluating cotton response to different row pattern production systems. The row patterns used in the study were 15, 30, and 38-inch row solid cotton, 15-inch rows with a 2 x 1 skip row (2 rows of cotton with a 30-inch skip), 15-inch row 2x2 skip row (2 rows with a 45-inch skip), 30-inch rows with a 1 x 1 skip-row (cotton in 60-inch rows), 30-inch rows with a 2 x 1 skip row (2 rows with a 60-inch skip), and 38-inch rows with a 2 x 1 skip row (2 rows with a 76-inch skip). Due to the wet soil condition through most of May, planting had to be delayed until 5/28/03. The first fruiting branch node located on node 6 was not affected by row patterns at both locations. The study mean lint yield at Verona and Falkner were 978 and 867 lb/acre, respectively. The 15-inch row solid cotton produced the highest yield at both locations with yield of 1196 lb/acre of lint at Verona and 995 lb/acre at Falkner. The 15-inch row 2x1 skip, however, produced yield statistically the same as the 15-inch row solid cotton at both locations and were similar in height and stem diameters. The wider skip row patterns most often had lower yield, more green bolls at harvest, larger stem diameters, and more vegetative branches than 15-inch 2x1 skip or 15-inch row solid. At Verona, the 30 and 38-inch row solid cotton, and the 30 and 38-inch (2x1) skip row patterns and 15-inch 2x2 skip row pattern produced lower yield than 15-inch row solid. However, at the Falkner location, 30-inch row solid and 15-inch row 2x1 skip row pattern produced yield equal to 15-inch row solid. The other treatments produced lower yield than 15-inch row solid cotton. HVI and AFIS analysis indicated no row pattern differences. However, micronaire at Falkner ranged from 3.30 to 3.64 compared to 3.65 to 3.89 for Verona. Boll rot and harvest losses showed no treatment differences at both locations. The trend at Falkner was for the wide rows (30 and 38-inch) and the wide skip row pattern to have more boll rot and harvest loss than 15-inch row solid. The trend at Verona was minor differences in boll rot and higher harvest losses for wide rows and wide skip row pattern than the 15-inch row solid.

Introduction

Efficient cotton production for improved net returns is essential for cotton growers to maintain a competitive advantage in a global market. Ultra narrow row (UNR) cotton and skip-row cotton production systems (Parvin et al. 2000, 2002b) have been used as means for improving profitability. UNR cotton has shown equal or higher yields (Atwell 1996; Buehring et al. 2001; Nichols et al. 2002; Shurley et al. 2002) and net returns (Parvin et al. 2002a; Shurley et al. 2002) than conventional wide rows. However, the 3 to 5¢/lb discount for the fiber's negative spinning quality (neps); the inability to operate the finger strippers under high humidity or dampness in the rain belt; and the increased trash content have offset these advantages. The increased trash content in the material taken to the gin reduces gin processing capacity (Brashears 1968; Mayfield 1999; and Anthony et al. 1999 and 2000). Although HVI fiber quality analysis have shown no differences between spindle picker and finger stripper cotton, finger stripper cotton had increased neps (Anthony et al. 1999 and 2000; Willcutt et al. 2001). However, the recent introduction of a 15-inch row spindle picker offers the potential to offset some of the limitations of the UNR system. The objective of this study was to determine the influence spindle picker harvested UNR and skip row patterns have on lint yield and late season plant characteristics.

Materials and Methods

Studies were initiated in 2003 on a Marietta silt loam and Falaya sandy loam soil at Verona and Falkner, Mississippi, respectively. The studies were conducted as randomized complete block designs with four replications. Plot size was 20 ft by 120 ft with row patterns (treatments) as shown in Figure 1. Deltapine DP449BG/RR cotton cultivar was planted no-till into a spring prepared stale seedbed on 5/28/03 at Falkner and replanted 5/29/03 at Verona. The cotton at Verona, first planted on 5/13/03, had to be replanted due to a stand failure.

Good agronomic production practices at both locations were used to maximize yield. Seeding rates at both locations were 3 seed/ft of row for all 15 and 30-inch rows and 4 seed/ft of row for 38-inch rows. The seed was treated with Centric (thiamethoxam) for early season insect control. Penta (mepiquat chloride) was applied as needed to manage rank cotton growth. Cotton was scouted twice weekly and insecticides were applied when insect pests were above threshold. Insect pest tarnished plant bug (*Lygus lineolaris*), bollworm (*Helcoverpa zea*), and budworm (*Helothis virescens*) infestations were low during the growing season and only one or two applications were made at both locations. The cotton was defoliated on 10/03/03 at Verona with Super Boll (ethephon) + Folex (phosphorotrithioate) at 1.5 + 0.75 lb ai/acre. The cotton at Falkner was defoliated on 10/02/03 with Super Boll + Folex at 1.5 + 0.75 lb ai/acre with a repeated application at 0.75 + 0.28 lb ai/acre on 10/13/03. The cotton was harvested at Verona on 10/22/03 and at Falkner on 10/29/03.

All cotton plots were harvested with a John Deere Pro 12 picker unit equipped with a twin row (15-inch spacing) spindle picker modification mounted on a single row picker using a John Deere 4020 as the power unit. Four rows of the 15-inch solid, 15-inch 2x1 skip row, 15-inch 2x2 skip row (treatments 1, 2, and 3), 1 row of the 60-inch row (treatment 6), 2 rows of 30 and 38-inch solid (treatments 4 and 7); and 2 rows of the 30 and 38-inch 2x1 skip row (treatments 5 and 8) in each plot were harvested for yield.

The seed cotton from the harvested plots was ginned with a mini-gin (state of the art cotton gin, equivalent to a commercial gin) to determine lint yield. Lint moisture determinations were made on all samples after ginning and yield adjusted to 6% moisture for all plots before data analysis. HVI and AFS analysis were used to determine fiber qualities.

Data collected at both locations were nodes above white flower (NAWF) nodes above crack boll (NACB) at defoliation, plant height at harvest, harvestable bolls per plant, plant population at harvest, plant stem diameter at harvest, boll rot at harvest, harvest losses, and lint yield. All data were analyzed with SAS and means were separated using Fisher's Protected LSD calculated at the 5% significance level.

Results and Discussion

The wet soil conditions in May delayed planting at both locations until the last days of May. Above normal rainfall throughout the growing season resulted in above average growing conditions. However, late August cloudy, rainy weather resulted in the top-crop fruit shed at both locations. The cool weather in late September and early October also resulted in a loss of harvestable bolls in the upper most fruiting branches due to a lack of maturity at the time of defoliation. But, yields were above average.

Verona

Seeding rates of 26,000 to 104,000 seed/acre resulted in populations at harvest ranging from 21,100/acre for 60-inch rows to 82,800/acre for 15-inch solid rows (Table 1). Lint yield ranged from 810 to 1196 lb/acre with a mean of 978 lb/acre. The 15-inch row solid was higher in yield than all treatments except the 15-inch 2x1 (treatments 1 and 2). The 15-inch row solid and 15-inch 2x1 skip row pattern (treatments 1 and 2) showed similar yield and both were higher than 30-inch row 2x1 skip and 38-inch row 2x1, 38-inch row solid, and the 60-inch row solid. The 30-inch row solid, 15-inch 2x2 skip row, and 15-inch 2x1 showed no yield differences (treatments 4, 3, and 2). HVI and AFIS analysis indicated no row pattern differences (data not shown).

Harvest losses ranged from 7.0% for 60-inch solid to 3.3% for 15-inch solid row. The 60-inch row had the highest harvest loss of 7.0% and was more than all other treatments. All other treatments losses ranged from 3.3 to 4.6% and were not different. Although harvestable bolls per plant and rotten bolls per acre showed no treatment differences, the trend was for more harvestable bolls per plant with the 30 and 38-inch skip row pattern and 30 and 38-inch solid row pattern. The average first fruit branch node was 6 with no differences between treatments.

The 15-inch solid rows had fewer NAWF at cut-out on 8/25/03 than 15-inch 2x1 skip, 30-inch solid, 30-inch 2x1 skip, 60-inch rows, 38-inch solid and the 38-inch 2x1 skip (Table 2). NACB data also indicated slightly earlier maturity with the 15-inch row solid, which had fewer NACB than the wider row spacings on 9/19/03. However, two weeks later (10/02/03), all treatments had less than 4 NACB. Four NACB is a good indicator that cotton is mature for defoliation without affecting fiber quality. All treatments showed maturity of 3.3 or less NACB on 10/02/03. The 15-inch row solid and 15-inch 2x1 skip had the smallest stem diameter of 0.392 inches with no difference in stem diameter and were less than all other treatments. The 60-inch row had the largest stem diameter of 0.529 inches but was not different from all other row spacings.

Falkner

Lint yield ranged from 715 lb/acre for 60-inch rows to 995 lb/acre for the 15-inch solid with a study mean yield of 867 lb/acre (Table 3). The 15-inch row solid, 15-inch 2x1 skip and 30-inch row solid showed no yield differences. These treatments were higher in yield than 60-inch row, 30-inch 2x1 skip and 38-inch 2x1 skip which had the lowest yield. The 15-row solid and 15-inch 2x1 showed no differences in stem diameter and were less than all other treatments.

Harvestable boll and boll rot data indicated no difference among treatments. Boll rot, however, was more prominent in the 15-inch 2x1 skip, 60-inch row and 38-inch 2 x 1 skip than all other treatments. The number of green bolls per acre (unopened, hard to thumb pressure) was highly variable with no difference between treatments. The number of green bolls, however, was more prominent in the 60-inch row, 30-inch solid, and 38-inch 2 x 1 skip row patterns, and 15-inch 2x1, than 15-inch solid. The 15-inch row solid had 34,000 green bolls/acre compared to 86,000 and 121,400/acre for the 60-inch and the 30 2x1 row skip-row, respectively.

The percent harvest losses ranged from 10 to 15% with no difference between treatments (Table 3). However, the trend was for greater losses with the 15-inch 2x2 skip, and the 60 and 38-inch row. The higher than normal harvest loss is possibly a result of being unable to wait until the cotton lint was fully dried. HVI and AFIS analysis indicated no row pattern differences (data not shown). However, micronaire was in the 3.30 to 3.64 range and was lower than Verona which ranged from 3.65 to 3.89. The lower micronaire is an indication the fibers were immature at the time of defoliation.

The average first fruiting branch node was 6 nodes with no difference between row patterns (Table 4). Vegetative branches were most prominent with the 60-inch row and 38-inch 2x1 skip than all other row patterns. The 15-inch solid had no vegetative branches in comparison to 1.0/plant for 15-inch with 2x1 skip row and 38-inch solid and 1.3/plant for 30-inch and 2x1 skip row pattern. The 15-inch row patterns, 38-inch row solid, and the 30-inch 2x1 skip were similar in height at maturity. The 30-inch, 60-inch, and 38-inch row 2x1 skip row patterns height ranged from 36 to 38 inches and were 4 to 8 inches taller than 15-inch solid and 15-inch 2x1 skip row pattern.

Stem diameter at harvest ranged from 0.439 to 0.666 inches. The 60-inch row had the largest stem diameter of 0.666 inches, which was larger than all other row patterns. The 15-inch 2x2 skip row, 30-inch, and 38-inch row, 30-inch 2x1 skip, and 38-inch 2x1 skip row pattern had similar stem diameter and were less than 60-inch row solid but higher than 15-inch row solid or 15-inch row 2x1 skip row patterns.

NAWF data indicated the 15-inch rows reached cut-out 5 days earlier than wider rows. NAWF data on 8/22/03 indicated the 15-inch row patterns had reached 5 or less NAWF (Table 4). This was in comparison to 60-inch rows and 38-inch 2x1 skip which had 6.1 to 6.2 NAWF. However, five days later (8/27/03) all treatments had reached or past cut-out (5 NAWF). The 60-inch solid and 38-inch row 2x1 skip row pattern had 4.4 to 4.5 NAWF in contrast to 15-inch row solid, 15-inch 2x1 skip row, 30 and 38-inch solid which showed 2.3 to 2.7 NAWF.

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Table 1. Lint yield, harvest losses, plant population, harvestable bolls, and boll rot as influenced by row pattern on a Marietta silt loam soil in 2003, Verona, MS.

Row pattern (in)	Lint lb/acre	% Harv. Loss	Plants/acre x 1000 10/16/03	Planted seed/acre x 1000	H.Bolls/ plant[1] 10/18/03	Rot boll/ acre x 1000 10/18/03
Treatment						
1. 15-in solid	1196	3.3	82.8	104	5.9	7.8
2. 15-in 2x1 skip	1106	3.4	56.7	70	6.7	4.6
3. 15-in 2x2 skip	1039	3.9	40.5	52	6.1	9.6
4. 30-in solid	1038	4.0	38.9	52	6.3	11.3
5. 30-in 2x1 skip	813	4.6	26.2	35	8.0	7.3
6. 60-in solid	902	7.0	21.1	26	8.8	3.9
7. 38-in solid	922	4.1	38.1	55	6.1	5.8
8. 38-in 2x1 skip	810	4.0	26.3	37	9.0	3.9
Mean	978	4.3	41.3	---	9.5	6.8
LSD (0.05)	141	1.6	7.2	---	NS	NS
% CV	10	25.5	11.9	---	25.5	84.0

[1] H.bolls/plant means the number of open bolls that were machine harvestable.

Table 2. Cotton plant characteristic as influenced by row pattern on a Marietta silt loam soil in 2003, Verona, MS.

Row pattern (in)	FFBN[1] 10/02/03	NAWF[2] 8/25/03	NACB[3] 9/19/03	NACB[3] 10/02/03	Stem diam. (in) 10/18/03	Pl. height (in) 10/14/03
Treatment						
1. 15-in solid	6	3.0	3.8	1.7	0.400	31
2. 15-in 2x1 skip	6	3.4	4.3	2.1	0.392	33
3. 15-in 2x2 skip	6	4.3	5.5	2.5	0.472	36
4. 30-in solid	6	3.9	4.5	2.1	0.499	35
5. 30-in 2x1 skip	6	4.4	6.3	2.9	0.526	36
6. 60-in solid	6	4.9	6.5	3.3	0.529	37
7. 38-in solid	6	3.8	5.3	1.9	0.495	35
8. 38-in 2x1 skip	6	4.3	5.3	2.7	0.488	35
Mean	6	4.0	5.2	2.4	0.480	35
LSD (0.05)	NS	0.5	1.6	0.8	0.051	NS
% CV	6	8.1	20.5	21.7	7.34	7

[1] FFBN means first fruiting branch node.
[2] NAWF means nodes above white flower.
[3] NACB means nodes above cracked boll.

Table 3. Lint yield, harvest losses, plant population, harvestable bolls, boll rot and green bolls as influenced by row pattern on a Falaya silt loam soil in 2003, Falkner, MS.

Row pattern (in)	Lint lb/acre	% Harv. loss	Pl/acre 10/22/03 x 1000	Harv. boll/pl 10/22/03[1]	Rot boll/acre x 1000	Green boll/ acre x 1000[2]
Treatment						
1. 15-in solid	995	11	76.7	5.3	0.9	34.0
2. 15-in 2x1 skip	932	10	49.7	7.8	6.9	53.7
3. 15-in 2x2 skip	885	14	36.6	7.3	2.2	68.4
4. 30-in solid	949	12	36.2	9.0	3.5	67.5
5. 30-in 2x1 skip	801	11	24.8	8.3	2.0	121.4
6. 60-in solid	715	15	18.1	8.5	4.4	86.0
7. 38-in solid	907	13	31.4	8.3	1.4	56.1
8. 38-in 2x1 skip	751	12	20.6	10.3	4.1	93.9
Mean	867	12	36.7	8.1	6.1	72.6
LSD (0.05)	76	NS	9.8	2.0	NS	NS
% CV	6	32	18.1	16.9	132	50.7

[1] Harv. Boll/pl means open bolls that were machine harvestable per plant.
[2] Grn boll/acre mean green harvestable bolls (hard to thumb pressure) per plant.

Table 4. Cotton plant characteristics as influenced by row pattern on a Falaya silt loam soil in 2003, Falkner, MS.

Row pattern	FFBN[2] 10/22/03	NAWF[1] 8/22/03	NAWF[1] 8/27/03	Stem diam. (in) 10/22/03	Plant ht. (in) 10/22/03	VB[3]/PL 10/22/03
Treatment						
1. 15-in solid	6.0	3.5	2.3	0.439	32	0.0
2. 15-in 2x1 skip	6.0	3.5	2.4	0.487	32	0.3
3. 15-in 2x2 skip	6.8	5.0	3.2	0.542	35	1.0
4. 30-in solid	6.3	5.1	2.7	0.585	36	1.3
5. 30-in 2x1 skip	6.3	5.7	3.6	0.584	35	1.3
6. 60-in solid	6.3	6.2	4.5	0.666	38	1.7
7. 38-in solid	6.3	5.4	2.7	0.529	35	1.0
8. 38-in 2x1 skip	6.5	6.1	4.4	0.593	36	1.7
Mean	6.3	5.1	3.2	0.550	35	1.0
LSD (0.05)	NS	3.2	0.7	0.070	3	0.8
% CV	8.8	14.0	13.9	8.620	7	46.3

[1] NAWF means nodes above white flower.
[2] FFBN means first fruiting branch node.
[3] VB means vegetative branches/plant.

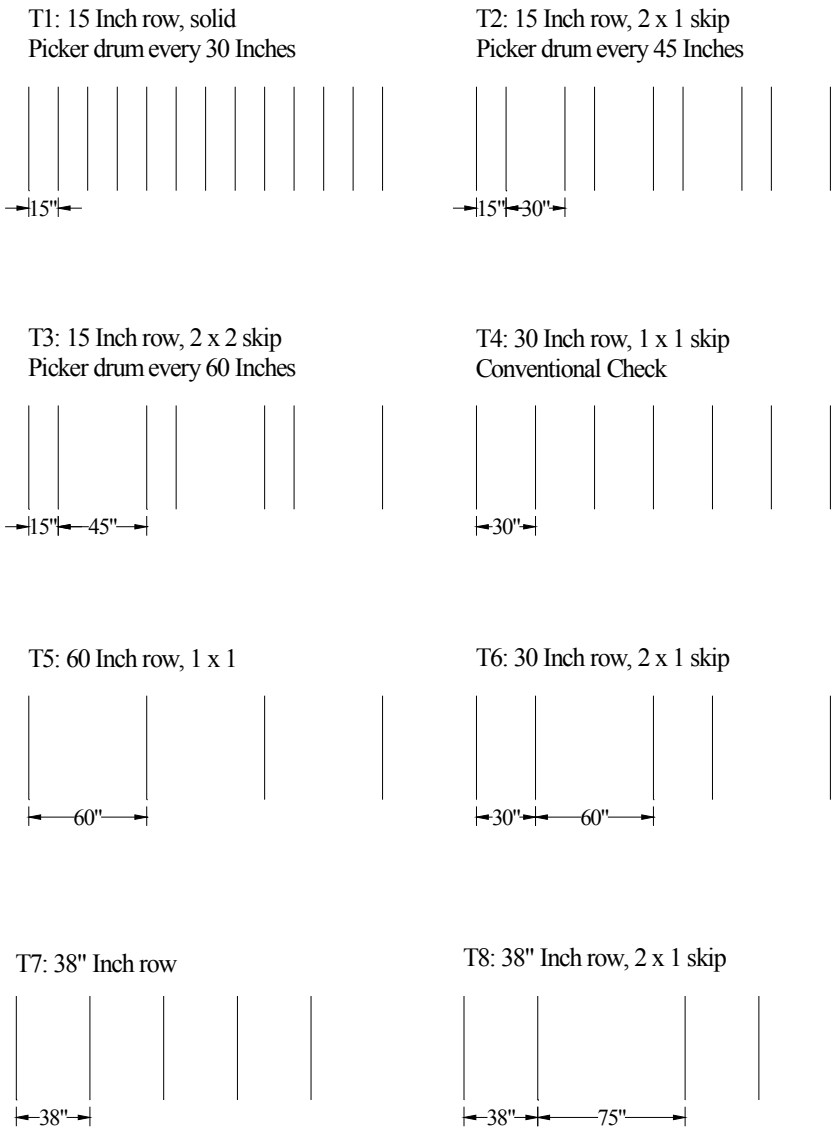

Figure 1. Row patterns tested.