COMPARATIVE GROWTH AND YIELD OF COTTON AT VARIOUS PLANTING DENSITIES

Peter McGuill
Texas AgriLife Extension Service
Wharton, TX
Dan D. Fromme
Texas AgriLife Extension Service
Corpus Christi, TX
Gaylon Morgan
Texas AgriLife Extension Service
College Station, TX
Lawrence L. Falconer
Texas AgriLife Extension Service
Corpus Christi, TX
Dale Mott
Texas AgriLife Extension Service
College Station, TX

Abstract

Due to ever increasing prices associated with seed and technology, cotton producers in many regions of the Cotton Belt have reduced seeding rates as a means of controlling input costs. Despite the high cost of seed and technology, many producers along the Texas Gulf Coast have not embraced this cost saving tactic, primarily due to real and perceived problems with seedling establishment on heavy clay soils. The objective of this study was to evaluate the performance of Phytogen 440W at three different planting densities and the subsequent impact on cotton growth, yield and dollar return per acre. This study was conducted in Wharton County located in the Upper Gulf Coast region of Texas. Three seeding rates consisting of 2, 4, and 6 seed per foot of row were evaluated in large field plots in a commercial cotton field. Final number of plants emerged per foot of row for the 2, 4, and 6 seed per foot planted were 1.7, 3.2, and 4.6 plants, respectively. Field plots were 12 rows wide by 1267 feet in length on 40-inch centers and were arranged in randomized complete block design with three replications. No differences in lint yield and loan value were found between the three different planting densities. Dollar return per acre above seed and technology cost was highest for the 4 seed per foot treatment; however, it returned only $2.13/acre more than the 2 seed per foot treatment. Results of this study show that seeding rates of 2 seed per foot did not significantly affect lint yield, loan value, and dollar return per acre.

Introduction

Due to ever increasing prices associated with seed and technology, cotton producers in many regions of the Cotton Belt have reduced seeding rates as a means of controlling input costs. Despite the high cost of seed and technology, many producers along the Texas Gulf Coast have not embraced this cost saving tactic, primarily due to real and perceived problems with seedling establishment on heavy clay soils. The objective of this study was to evaluate the influence of different planting densities on cotton growth, yield and dollar return per acre.

Materials and Methods

This field study was conducted in Wharton County located in the Upper Gulf Coast region of Texas. Three different seeding rates consisting of 2, 4, and 6 seed per foot were planted on April 8, 2009. Soil type in this field was a Lake Charles clay. The three seeding rates were planted on 40-inch centers. Cotton variety utilized in this study was Phytogen 440W. Trial design consisted of a randomized complete block design. Each treatment was replicated three times. Plot sizes were 12 rows by 1267 feet.

Final plant stands were determined on May 13, 2009 by determining the number of plants in 1000^{th} of an acre at three different locations in each of the plots. Beginning at bloom, bi-weekly NAWF counts were taken on ten plants per plot to determine cutout dates (NAWF=5). At harvest, ten plants per plot were plant mapped to compare plant height, number of vegetative, fruiting, and total nodes, internode length, total fruiting sites, percent boll retention, number of bolls per foot, and total number of bolls per plant. Boll weights were compared by hand harvesting ten consecutive plants at three different locations in each plot.

On August 7, 2009 plots were harvested with a commercial cotton picker, seed cotton yields then were determined by weighing each of the plots harvested in a commercial large plot weight wagon. Lint yield and gin turnout were obtained by collecting a grab sample from the seed cotton collected from each of the plots and ginning them on a small plot research gin. Seed index was determined by collecting 100 fuzzy seed ginned from each of the plots. Fiber quality was measured by sending a 50 gram lint sample from each plot to the Fiber and Biopolymer Research Institute in Lubbock, Texas.

Results and Discussion

Total seed and technology cost was $15.60, $29.47, and $42.81 an acre for the 2, 4, and 6 seed per foot treatments (Table 1).

Table 1. Seed, technology, and total cost per acre for the three seeding rates.

Treatment (seed per foot)	Seed cost ($/acre)	Technology cost ($/acre)	Total cost ($/acre)
2	11.60	4.00	15.60
4	21.91	7.56	29.47
6	31.83	10.98	42.81

Final number of plants emerged per foot of row for the 2, 4, and 6 seed per foot planted were 1.7, 3.2, and 4.6 plants, respectively. Significant differences for the final number of plants per foot were observed when comparing the three treatments (Table 2).

Table 2. Number of seeds planted per foot and final number plants per foot.

Number of Seed Per Foot Planted	Final Number of Plants/Foot
2	1.7 a
4	3.2 b
6	4.6 c
CV%	7.06
LSD	.5041
P>F	.0002

Means followed by the same letter do not differ significantly at the .05 level of probability.

Number of days to cutout was significant longer for the 2 seed per foot treatment; however, this was only 1.4 days more than the 4 seed per foot treatment. There were no significant differences in the number of days to cutout between the 4 and 6 seed per foot treatment (Table 3).

Table 3. Number of days to cutout (NAWF=5).

Treatment		Days to cutout (NAWF=5)
No. seed planted/foot	Final number of plants/foot	No.
2	1.7	72.7 a
4	3.2	71.3 b
6	4.6	70.7 b
CV%	---	0.74
LSD	---	1.19
P>F	---	0.0230

Means followed by the same letter do not differ significantly at the .05 level of probability.

At harvest, plant heights ranged from 26.6 to 27.2 inches; however there were no significant differences between the three seeding rates (Table 4).

Table 4. Plant height (inches) at harvest.

Treatment		Plant height
No. seed planted/foot	Final number of plants/foot	inches
2	1.7	26.6 a
4	3.2	27.2 a
6	4.6	26.6 a
CV%	---	2.88
LSD	---	NS
P>F	---	0.6262

Means followed by the same letter do not differ significantly at the .05 level of probability.

Total number of vegetative nodes was not significantly different when comparing the three seeding rates which means earliness of square set was not affected (Table 5).

Table 5. Number of vegetative nodes at harvest.

Treatment		Vegetative nodes
No. seed planted/foot	Final number of plants/foot	No.
2	1.7	5.03 a
4	3.2	5.43 a
6	4.6	5.27 a
CV%	---	3.18
LSD	---	NS
P>F	---	0.0988

Means followed by the same letter do not differ significantly at the .05 level of probability.

At harvest, the 2 seed per foot treatment had more fruiting branches compared to the 4 and 6 seed per foot treatments. No significant differences were observed in number of fruiting branches between the 4 and 6 seed per foot treatments (Table 6).

Table 6. Number of fruiting branches at harvest.

Treatment		Fruiting Branches
No. seed planted/foot	Final number of plants/foot	No.
2	1.7	12.50 a
4	3.2	11.43 b
6	4.6	10.63 b
CV%	---	3.3
LSD	---	0.861
P>F	---	0.0098

Means followed by the same letter do not differ significantly at the .05 level of probability.

Total number of nodes or branches at harvest was significantly higher when comparing the 2 seed per foot treatment to the 6 seed per foot treatment; however there were no significant differences between the 2 and 4 seed per foot treatments. No differences in total number of nodes were found between the 4 and 6 seed per foot treatments (Table 7).

Table 7. Total number of nodes at harvest.

Treatment		Total nodes
No. seed planted/foot	Final number of plants/foot	No.
2	1.7	17.53 a
4	3.2	16.87 ab
6	4.6	15.90 b
CV%	---	2.55
LSD	---	0.971
P>F	---	0.0235

Means followed by the same letter do not differ significantly at the .05 level of probability.

Internode length differences were not significantly different between the three seeding rates (Table 8).

Table 8. Internode Length at harvest (inches).

Treatment		Internode Length
No. seed planted/foot	Final number of plants/foot	inches
2	1.7	1.52 a
4	3.2	1.61 a
6	4.6	1.68 a
CV%	---	3.44
LSD	---	NS
P>F	---	0.0567

Means followed by the same letter do not differ significantly at the .05 level of probability.

Total number of fruiting sites per plant was significantly higher for the 2 seed per treatment when compared to the 4 and 6 seed per foot treatments. Total number of fruiting sites for the 4 seed per foot treatment was significantly higher for the 4 seed per foot treatment when compared to the 6 seed per foot treatment (Table 9).

Table 9. Total number of fruiting sites per plant at harvest.

Treatment		Total fruiting sites/plant
No. seed planted/foot	Final number of plants/foot	No.
2	1.7	27.53 a
4	3.2	22.07 b
6	4.6	16.63 c
CV%	---	4.83
LSD	---	2.42
P>F	---	0.0006

Means followed by the same letter do not differ significantly at the .05 level of probability.

Differences in percent boll retention were not found across the three seeding rates (Table 10).

Table 10. Percent boll retention at harvest.

Treatment		Boll retention
No. seed planted/foot	Final number of plants/foot	%
2	1.7	26.83 a
4	3.2	31.95 a
6	4.6	33.85 a
CV%	---	21.65
LSD	---	NS
P>F	---	0.4801

Means followed by the same letter do not differ significantly at the .05 level of probability.

Total number of bolls per plant at harvest was significantly higher for the 2 seed per foot treatment when compared to the 4 and 6 seed per foot treatments. Total number of bolls per plant for the 4 seed per foot treatment was significantly higher compared to the 6 seed per foot treatment (Table 11).

Table 11. Total number of bolls per plant at harvest.

Treatment		Total bolls per plant
No. seed planted/foot	Final number of plants/foot	No.
2	1.7	7.33 a
4	3.2	5.47 b
6	4.6	3.53 c
CV%	---	8.27
LSD	---	1.021
P>F	---	0.0013

Means followed by the same letter do not differ significantly at the .05 level of probability.

Differences in number of bolls per foot at harvest were not found when comparing the three treatments (Table 12).

Table 12. Number of bolls per foot at harvest.

Treatment		Bolls per foot
No. seed planted/foot	Final number of plants/foot	No.
2	1.7	12.31 a
4	3.2	17.31 a
6	4.6	16.36 a
CV%	---	11.50
LSD	---	NS
P>F	---	0.0513

Means followed by the same letter do not differ significantly at the .05 level of probability.

Differences in boll weight at harvest were not found when comparing the three treatments (Table 13).

Table 13. Boll weight (g).

Treatment		Boll weight
No. seed planted/foot	Final number of plants/foot	grams
2	1.7	3.97 a
4	3.2	3.73 a
6	4.6	3.75 a
CV%	---	3.23
LSD	---	NS
P>F	---	0.1320

Means followed by the same letter do not differ significantly at the .05 level of probability.

Differences in lint yield per acre were not found across the three treatments (Table 14).

Table 14. Lint yield per acre (lb)

Treatment		Lint yield
No. seed planted/foot	Final number of plants/foot	Lb/acre
2	1.7	629 a
4	3.2	677 a
6	4.6	666 a
CV%	---	2.79
LSD	---	NS
P>F	---	0.0699

Means followed by the same letter do not differ significantly at the .05 level of probability.

Differences in seed index were not found across the three treatments (Table 15).

Table 15. Seed index (g).

Treatment		Seed index
No. seed planted/foot	Final number of plants/foot	Grams/100 seed
2	1.7	8.70 a
4	3.2	8.47 a
6	4.6	8.37 a
CV%	---	2.33
LSD	---	NS
P>F	---	0.2241

Means followed by the same letter do not differ significantly at the .05 level of probability.

Differences in total dollar value per acre were not found across the three treatments (Table 16).

Table 16. Dollar value per acre.

Treatment		Dollar value
No. seed planted/foot	Final number of plants/foot	$/acre
2	1.7	334.30 a
4	3.2	350.30 a
6	4.6	348.70 a
CV%	---	3.52
LSD	---	NS
P>F	---	0.3128

Means followed by the same letter do not differ significantly at the .05 level of probability.

Dollar return per acre above seed and technology cost was highest for the 4 seed per foot treatment; however, it returned only $2.13/acre more than the 2 seed per foot treatment. Dollar return for the 6 seed per foot treatment was $14.94 and $12.81 an acre less compared to the 4 and 2 seed per foot treatments, respectively (Table 17).

Table 17. Dollar return per acre above seed and technology cost.

Treatment		Dollar return
No. seed planted/foot	Final number of plants/foot	$/acre
2	1.7	318.70
4	3.2	320.83
6	4.6	305.89

No differences in gin turnout, micronaire, length, uniformity, strength, or loan value were found when comparing the three different planting densities (Tables not shown).

Summary

Number of days to cutout was significantly longer for the 2 seed per foot treatment compared to the 4 and 6 seed treatments. However, it was only 1.4 and 2 days longer than the 4 and 6 seed treatments, respectively. There were no differences in the number of days to cutout between the 4 and 6 seed per foot treatments. Plant height, number of vegetative nodes, internode length, percent boll retention, number of bolls per foot, and boll weight were not significant when comparing the 2, 4, and 6 seed per foot treatments. However, the 2 seed per foot treatment had significantly more fruiting branches, fruiting sites, and bolls per plant than the two higher seed densities. There were significantly more total number of nodes or branches per plant for the 2 seed per foot treatment when compared to the 6 seed per foot treatment; however there were no differences in total number of nodes or branches between the 2 and 4 seed per foot treatments. Differences in lint yield, boll weight, and seed index were not found when comparing the three different planting densities. No differences in gin turnout, micronaire, length, uniformity, strength, or loan value were found when comparing the three different planting densities. Dollar return per acre above seed and technology cost was highest for the 4 seed per foot treatment; however, it returned only $2.13/acre more than the 2 seed per foot treatment.

Acknowledgements

Appreciation is express to Duane Lutringer for providing the land and equipment for this study and to Cotton Incorporated for their financial support.