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EFFECTS OF PLANT POPULATION ON YIELD OF PHYTOGEN PSC 355 AND OTHER CONVENTIONAL VARIETIES

R. Haygood*, F. Bordelon, D. Anderson and R. McPherson
Phytogen Seed Co., LLC
Leland, MS

Abstract

To determine the optimum population density range of PSC 355 and two experimental PhytoGen varieties PH98M-2983 and PH98M-3196, a study was conducted on a fine sandy loam soil in Leland, MS. Each variety was planted on 40" rows at targeted seeding rates ranging from 10,000 to 70,0000 plants/acre. For each variety, the effect of varying plant populations on lint yield, plant height and maturity were evaluated. Based on the analyses of plant populations closest to 15,000, 25,000, 45,000 and 65,000 plants per acre for each variety, the highest yields were achieved at the 45,000 plant per acre range. The data suggests that the consistent performance of PSC 355 may be partially explained by the ability of the variety to perform well at plant populations ranging from 13,000 to almost 65,000 plants per acre. Yield potential of the two new experimental varieties appear to be equal to or greater than PSC 355. No significant differences were detected in the maturity or height of these varieties at the four plant populations analyzed. Excessive boll rot associated with heavy rains and high humidity in late August and early September may have masked some differences in the results. Additional studies are needed to further define the effect of plant populations on the yield and development of these varieties under different growing locations and seasons.

Introduction

PSC 355 was the highest yielding variety in head-to-head comparisons of available university data obtained from TX to NC from 1998 to 2000 (Haygood et. al., 2000). This early maturing, vigorous, hairy leaf conventional variety is adaptive to most soil types in the southern cotton belt and offers high yield potential in both dryland and irrigated fields. PSC 355 was developed by Phytogen Seed Company, LLC from germplasm licensed from Mississippi State University. This conventional, picker variety is sold and supported by Dow AgroSciences.

The consistent performance of PSC 355 over locations and time in university trials suggests that it adapts well to varying soil types, management systems, environmental influences, etc. More information was needed to determine how it adapted to different population densities.

The objective of this study was to determine the response of PSC 355 to different planting densities in a sandy loam soil in the Mississippi Delta. PH98M-2983 and PH98M-3196, two new varieties being developed by Phytogen, were included for comparison. Yield, height and maturity of these varieties grown at 10 planting densities are presented in this paper.

Materials and Methods

Field studies were conducted at the Phytogen Research Farm in Leland, MS on a fine sandy loam soil. Standard tillage techniques were used to prepare the fields for planting. A fertilizer containing 60-20-90 was incorporated on 4-11-01.

The three varieties were planted on 40" rows using a John Deere 7100 planter with Almaco plot cones on April 27. Each variety was planted at 10 planting densities which ranged from 10,000 up to 70,000 plants per acre. Three reps of each treatment were planted in 48 foot long plots with 4 rows per plot. Each plot was approximately 0.015 acres.

In-furrow applications of Temik (3.5 lbs/acre) and Terraclor Super X 18.8 G (8 lbs/acre) were made. Pre-emergence applications of Prowl (1 qt/acre), Cotoran (1.8 pts/acre) and Staple (0.6 oz/acre) were applied pre-emerge. Plots were side dressed using 60 units of 28-0-0-5s in mid-June. Tillage and irrigation as well as weed and insect control procedures were conducted as needed throughout the growing season.

Two plant stand counts of 3 foot sections were taken on each row on May 22. Plant height determinations and maturity ratings based on percent open bolls were made in mid-September. Lint samples were taken from each plot and submitted for fiber quality determinations. These data will be reported in conjunction with another study. The two center rows of each plot were harvested on September 25.

Results and Discussion

Environmental conditions were favorable for an excellent crop through July. However, rainfall from August 1 to September 6 totaled 11" in the Leland area. Most of the rain occurred over a two week period in late August and early September. These rainy, cloudy, high humidity conditions contributed to the development of excessive boll rot in much of the Mississippi Delta. It was estimated that yield losses approached 25 to 40% in some areas. In the Leland trial, up to 30% of the first and second position bolls on the varieties tested were unharvestable due to the boll rot. The impact of this event must be considered as the data is reviewed.

Yield (lbs lint/acre), maturity (% open bolls) and height are provided for each population for each variety in tables 1, 2 and 3. Plant populations of each variety closest to 15,000, 25,000, 45,000 and 65,000 plants per acre were used to help determine if there were significant interactions between varieties and plant populations with regards to lint yield, maturity and height. Since there were no significant interactions, averages of these parameters are shown for each plant population and variety in tables 4 and 5.

Significant differences were detected between lint yields within each variety (Tables 1, 2 and 3). The numerically highest yields were populations of 45,738 plants, 55,273 plants and 49,006 plants per acre for PSC 355, PH98M-2983 and PH98M-3196, respectively. When the four plant populations were analyzed, highest lint yields occurred in populations closest to 45,000 plants per acre. However, because a great deal of variability occurred among the 10 plant populations of each variety, additional studies are needed prior to identifying an optimum plant population range for each variety. Yields of PH98M-3196 were similar to those of PSC 355 while yields of PH98M-2983 were higher. Both of these developmental varieties appear to have very good yield potential in the Mississippi Delta.

Based on this study, PSC 355 appears to yield well over a broad range of plant populations. This adaptability likely contributed to the yield stability of PSC 355 in many commercial fields and university trials over the past 3 years.

Differences did occur between maturities within each variety, but there was no consistent correlation between maturity and plant population. Also, there were no significant differences between maturities when the four plant populations were analyzed.

The tallest plants for PH98M-2983 were found in the lowest plant populations. However, this was not the case for PSC 355 and PH98M-3196. When the four plant populations were analyzed, no significant differences in plant height were detected between the varieties or plant populations. The excessive boll rot may have resulted in more vegetative growth towards the end of the season, thus masking some height differences which may have normally occurred.

Plant population studies will be repeated at different locations, at different planting times and with additional data collection points in the future so that more conclusive results can be drawn. Lint yield, maturity and height data along with fiber data collected in the trial will be incorporated into more extensive statistical analyses to better understand growth and yield potential of these varieties.

Summary

Under the conditions of this study, indications are that the yield potential of the developmental variety PH98M-2983 is greater than that of PSC 355 or PH98M-3196. Based on the analyses of plant populations closest to 15,000, 25,000, 45,000 and 65,000 plants per acre for each variety, the data indicated that the highest yield was achieved at the 45,000 plant per acre range. At these four populations, no significant differences were detected in the maturity or height of these varieties. However, separate field studies support the trend suggesting that PH98M3196 matures a few days later than PSC 355.

Greater variations and more trends in the lint yield and/or height within each variety at the 10 plant populations tested may have been partly masked by the excessive boll rot associated with the extended rainfall in late summer. Additional studies and data collection points are needed to further define the effect of plant populations on the yield and development of these varieties under different growing locations and seasons.

References

R. Haygood, R. McPherson, and E. Lubbers. 2000. PhytoGen PSC 355 - 2000 update. Proceedings Beltwide Cotton Conferences. Vol. 1, 400 – 402.

Table 1. Lint yield, maturity and height of PSC 355 when grown at varying plant populations.

Plant Populations	Lint (lbs/acre)	Maturity (% open bolls)	Height (inches)
13,265	1,015	75.0	38.3
24,176	1,017	81.7	38.0
29,404	1,132	83.3	36.3
31,364	1,037	85.0	38.0
39,858	952	73.3	43.7
45,738	1,147	76.7	37.3
46,392	1,058	78.3	36.7
52,273	999	88.3	36.0
52,926	936	80.0	38.3
65,994	1,011	83.3	37.0
Average	**1030**	**81**	**38**
LSD .05	**52.1**	**11.7**	**5**

Table 2. Lint yield, maturity and height of PH98M-2983 when grown at varying plant populations.

Plant Populations	Lint (lbs/acre)	Maturity (% open bolls)	Height (inches)
13,918	1,166	70.0	43.3
26,137	1,078	73.3	43.0
31,364	1,147	83.3	39.0
41,818	1,206	85.0	37.7
52,273	1,238	86.7	37.0
52,273	1,207	80.0	37.7
52,273	1,087	80.0	38.3
55,540	1,183	88.3	39.7
67,301	1,136	71.7	39.0
68,608	1,054	85.0	37.3
Average	**1150**	**80**	**39**
LSD .05	**49**	**13.5**	**4.0**

Table 3. Lint yield, maturity and height of PH98M-3196 when grown at varying plant populations.

Plant Populations	Lint (lbs/acre)	Maturity (% open bolls)	Height (inches)
14,375	1,079	70.0	40.3
32,017	1,040	76.7	39.0
36,591	1,045	75.0	36.0
42,472	1,085	71.7	42.7
47,046	1,072	75.0	39.0
49,006	1,119	76.7	36.3
50,966	1,116	66.7	41.7
57,500	1,118	83.3	38.3
62,074	1,017	78.3	39.3
68,608	1,078	70.0	41.0
Average	**1077**	**74**	**39**
LSD .05	**73**	**14.6**	**6.4**

Table 4. Averages of lint yield, maturity and height of PSC 355, PH98M-2983, and PH98M-3196 when grown at 4 plant populations.

Plant Populations (closest of each variety)	Lint lbs/acre and (CV)	Maturity as % open bolls and (CV)	Height in inches and (CV)
15,000	1,087 (7.0)	71.7 (7.0)	40.7 (11.1)
25,000	1,045 (4.2)	77.2 (13.0)	40.0 (14.4)
45,000	1,141 (5.9)	78.9 (9.4)	38.0 (9.9)
65,000	1,055 (6.5)	77.8 (15.1)	38.4 (5.8)
LSD .05	**32.4**	**7.65**	**2.85**

Table 5. Averages of lint yield, maturity and height of PSC 355, PH98M-2983, and PH98M-3196 when grown at approximate plant populations of 15,000, 25,000, 45,000 and 65,000 plants per acre.

Variety	Lint lbs/acre and (CV)	Maturity as % open bolls and (CV)	Height in inches and (CV)
PSC 355	1,047 (6.4)	79.2 (9.3)	39.4 (10.8)
PH98M-2983	1,146 (5.0)	76.0 (15.8)	40.7 (8.7)
PH98M-3196	1,052 (4.6)	75.0 (9.4)	39.4 (12.0)
LSD .05	**28.0**	**6.6**	**2.47**