RESPONSE TO PLANT DENSITY IN COTTON CULTIVARS, YIELD AND YIELD COMPONENTS. YAQUI VALLEY, SONORA, MÉXICO

Arturo Hernández-Jasso
and Javier Gutiérrez-Zamorán
Instituto Nacional de Investigaciones Forestales y Agropecuarias
and AGREVO Mexicana, S. A. De C. V.
Cd. Obregón, Sonora, MÉXICO

Abstract

Two thinning treatments (plants at 10 and 15 cm) were evaluated in FIBERMAX 963, SURE-GROW 125, and CIANO CÓCORIM-92, in the December new sowing date. These treatments were compared with the regional check (plants at 20 cm) and a treatment without thinning. This experiment was carried out in the Yaqui Valley Sonora, Mexico in 1998-99. The experiment was analyzed under a split plot experimental design with eight replications. Significant yield differences between varieties and treatments were observed. FIBERMAX 963 out yielded CIANO CÓCORIM-92 and SURE-GROW 125. The regional thinned check yielded significantly less that the other treatments. The non-thinning treatment had similar yield potential to the 10 and 15-cm treatments. There were no significant effects of population densities on yield components and fiber quality.

Introduction

Cotton is one of the most important crops in the agricultural system of the Yaqui Valley, Sonora, Mexico. The severe infestation of silver leaf whitefly since 1994 has caused the development of new agricultural practices to deal economically with this pest. One of the new development strategies is a new sowing date in late autumn, December to be precise.

Cotton is a very plastic species due to its perennial nature, and it has the ability to adapt to different population densities. The most important issue is to define the competitive ability of a cultivar in its plant morphology and foliar development. Hernández (1979) reports that genotypes with cluster type, small leaf, and early characteristics, withstand a larger plant population than bushy, large leafed, and intermediate varieties. In Mexico cotton production, 20 –35 seeds are sown/meter and hand thinning is a common, costly, and difficult practice. Hernández and Pérez (1992) reported that in the Yaqui Valley, in March sowing dates, a cluster cultivar, CIANO CÓCORIM-92, showed a higher yield at 120,000 plants/ha (that resulted from sowing 20 seeds/meter and no thinning), in comparison with the regional check DELTAPINE 80, a cultivar with a larger plant development. Hernández (1993) reported that no thinned plant populations of 120,000 plants/ha (20 seeds/meter) of DELTAPINE 5415 had similar yield potential that thinned conventional populations of 50,000 plants/ha. Hernández and Ortíz (1994) when comparing no thinned populations of 130,000 plants/ha of three cultivars, against the conventional thinned population of 50,000 plants/ha, under different irrigation treatments, found similar yield production, confirming the results of Hernández and Pérez (1992) and those of Hernández (1993). Also, some interactions were detected, indicating that non-thinned populations had larger yield when the first water up irrigation was applied at first week of squares. The only available information in regard to sowing dates in December (Hernández-Jasso, 1998) indicates that there are significant differences in yield due to plant populations. Densities of up to 200,000 plants/ha out yielded significantly the conventional population of 50,000 plants (given by hand thinning plants at 20 cm).

The objective of this experiment was to determine the response of cotton cultivars to different plant densities in the new sowing date of December in the Yaqui Valley, Sonora, Mexico.

Materials and Methods

The experiment was established on December 11, 1998, in the Yaqui Valley, Sonora, Mexico. Two thinning treatments (plants at 10 and 15 cm) were evaluated in FIBERMAX 963, SURE-GROW 125, and CIANO CÓCORIM-92, in the new sowing date of December. These treatments were compared with the regional check (plants at 20 cm) and a treatment without thinning (plants approximately at 5 cm). A split plot experimental design, with eight replications, was used. Varieties were placed in major plots while plant densities were established in minor plots. Minor plots consisted of six rows of 10 m in length. Cotton was planted at 100 cm between rows, with a precision planter, which placed 32 seed per meter. Hand thinning was carried out when plants had a height of 15 cm. Experimental yield was estimated on 10 m^2 plots (two central 5m rows). In addition to lint and seed cotton yield, the following variables where estimated: boll size, lint percent, seed index, as well as fiber length and strength and micronaire index. The hypothesis of no significant difference among genotypes was tested at the 0.05 probability level. Afterwards least significant differences were obtained (LSD, 0.05 level) when the analysis so indicated.

Results and Discussion

Cultivar Response

Yield. The analysis of variance detected significant differences in lint and seed cotton yield. FIBERMAX 963, of

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intermediate cycle, presented the highest yield, almost 2,019 kg/ha of cotton lint (more than 9.4 bales/ha), significantly better than, CIANO CÓCORIM-92 and SURE-GROW 125, which occupied the 2nd and 3rd places, respectively (Table 1). It's convenient to address the fact that in the last two cycles, the December sowing date showed the lowest accumulation of Silverleaf Whitefly, in comparison with January and February sowing dates, permitting a much better expression of cultivar yield potential.

Yield Components. Concerning fiber percentage, important differences were observed among cultivars. FIBERMAX 963 and SURE-GROW 125 produced significant higher lint percentages than CIANO CÓCORIM-92 (Table 1). Accordingly, the same cultivars showed significantly lower seed indexes than CIANO CÓCORIM-92. In regard to boll size, FIBERMAX 963 had significantly smaller bolls than SURE-GROW 125 and CIANO CÓCORIM-92. According with plant map data, FIBERMAX 963 had a larger number of bolls/plant than the two other varieties, compensating by this means the smaller size bolls.

Fiber Quality. Significant differences were observed only for fiber strength (Table 2), SURE-GROW 125 had significantly lower strength than CIANO CÓCORIM-92 and FIBERMAX 963.

Plant Density Response

Yield. We did detect significant differences among treatments for lint and seed cotton yield. Yield level ranged from 1,657 to 1,889 kg/ha of cotton lint (7.7 – 8.8 bales/ha, Table 3). The two thinning treatments and the non thinning treatment showed similar yields, and they were 12% better than the check, where plants are thinned at 20 cm between plants, this difference was significant. This results are in agreement with the data analyzed last year (Hernández-Jasso, 1998), confirming the proposal that cotton do not need to be thinned at the emergency population levels obtained in plantings in the Yaqui Valley. This recommendation applies not only for December but also for any other month where cotton is planted in the Yaqui Valley.

Yield Components. Concerning fiber percentage and seed index, very small and not significant differences were detected. A larger difference was observed when it was compared by means of non thinning plots against those of the other three treatments, nevertheless the difference was also not significant, suggesting that these three components show no response, independently of the plant population density (Table 4).

Fiber Quality. No significant differences were observed (Table 4), indicating that there is not plant response to the different population densities tested in this experiment.

Cultivar – Density Interaction

No significant cultivar density interaction was detected, confirming similar last year results (Hernández, 1998).

Summary

FIBERMAX 963 was the highest yielding cultivar. Population densities of up to 200,000 plants/ha produce better yields than the conventional 50,000 plants/ha, implying that no hand thinning is needed when cotton is planted in December in the Yaqui Valley, Sonora, Mexico.

References

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Table 1. Yield and yield components of cotton cultivars. Yaqui Valley, Sonora, Mexico. CEVY-CIRNO-INIFAP. 1998-1999.

	Yield, kg/ha		Boll characteristics		
Cultivar	Lint	Seed-cotton	Lint %	Boll size g	Seed index
FIBERMAX 963	2,019	4,403	45.8	4.6	8.6
C. CÓCORIM-92	1,693	3,975	42.6	5.3	10.1
SURE-GROW 125	1,679	3,738	45.0	5.3	9.6
Mean	1,821	4,099	44.4	5.1	9.5
L. S. D. (0.05)	141	161	0.8	0.3	0.3
C. V. (%)	10.8	10.1	3.1	7.3	5.2

Table 2. Fiber quality of cotton cultivars. Yaqui Valley, Sonora, Mexico. CEVY-CIRNO-INIFAP. 1998-1999.

Cultivar	Length[1]	Strength[2]	Mike[3]
FIBERMAX 963	1 1/32	70,500	5.4
C. CÓCORIM-92	1 1/16	71,625	5.3
SURE-GROW 125	1 1/32	66,125	5.5
Mean	1 1/32	70,075	5.4
L. S. D. (0.05)	NS	3,507	NS
C. V. (%)	3.9	9.9	6.3

[1] inch, [2] pounds/inch^2, [3] micronaire index, N.S. = Non-significant at the 0.05 probability level.

Table 3. Cotton yields and yield components in four plant densities. Yaqui Valley, Sonora, Mexico. CEVY-CIRNO-INIFAP. 1998-1999.

Plant density, Distance between plants (cm)	Yield, kg/ha		Boll characteristics		
	Lint	Seed-cotton	Lint%	Boll size g	Seed index
10	1,889	4,290	44.0	5.2	9.3
~5 (no thinning)	1,881	4,234	44.4	4.8	9.3
15	1,856	4,167	44.4	5.1	9.6
20	1,657	3,707	44.6	5.2	9.7
Mean	1,821	4,099	44.4	5.1	9.5
L. S. D. (0.05)	56	150	NS	NS	NS
C. V. (%)	10.8	10.1	3.1	7.3	5.2

N.S. = Non-significant at the 0.05 probability level.

Table 4. Cotton fiber quality in four plant densities. Yaqui Valley, Sonora, Mexico. CEVY-CIRNO-INIFAP. 1998-1999.

Plant density, Distance between plants (cm)	Length[1]	Strength[2]	Mike[3]
10	1 1/32	68,250	5.4
~5 (no thinning)	1 1/16	72,500	5.4
15	1 1/32	70,650	5.4
20	1 1/32	68,900	5.5
Mean	1 1/32	70,075	5.4
L. S. D. (0.05)	NS	NS	NS
C. V. (%)	3.9	9.9	6.3

[1] inch, [2] pounds/inch^2, [3] micronaire index, N.S. = Non-significant at the 0.05 probability level.