RESPONSE OF FIBER MAX 819 COTTON VARIETY TO ULTRA NARROW ROWS IN MEXICO

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Abstract

This study was designed to determine the effects of number of irrigations and plant population on earliness, lint yield and fiber properties of Fiber Max 819 cotton variety. Field evaluation was carried out, for the second consecutive year in 2001 at "La Laguna" Experiment Station at Matamoros, Coahuila, Mexico. The experimental design was a split-plot with three irrigation treatments as the main plots and four plant population treatments as the sub-plots. Earliness was measured as the percentage of crop harvested at the first picking (PCH-1). Lint yield (kg/ha) was determined by harvesting two center rows of each plot. A 20-boll sample of seedcotton was hand picked prior to harvest. Lint percentage, and fiber properties were determined from these samples. The value of PCH-1 of cotton irrigated once was the highest (74%). The highest lint cotton yield, independent of plant population; was obtained by the treatment with three irrigations. On the other hand, there were no significant differences in lint cotton yield among plant population treatments. The lowest fiber length value (27.3 mm) was obtained when Fiber Max 819 cotton variety was irrigated once. The highest fiber resistance value (91,000 pounds per square inch) was obtained for Fiber Max cotton variety with a population of 120,000 plants /ha. Fiber fineness was negatively affected when cotton was irrigated only one or two times.

Introduction

Main cotton production problems are, the same as those that affect other products of the region are: the lack of water, which in the last five years have permitted irrigation of only 20 percent of the surface which potentially be irrigated with water of the dams; diseases such as verticillium wilt, Texan root rot, and cotton rust which cause important losses to cotton growers with the added difficulty that infested areas tends to be higher. The attack of insects such as pink bollworm *Pectinophora gossypiella* Saunders, bollworms *Helicoverpa zea* and *Heliothis virescens*, boll weevil *Anthonomus grandis* Boheman, conchuela *Chlorochoa ligata* and white fly *Bemicia argentifloii* obligates the producer to apply insecticide eight to ten times accounting for 30 percent of production costs (Godoy *et al*., 1998). The long cotton production season and longer period requiring chemical protection against insects, greater number of irrigations, higher amount of nitrogen and phosphorous, greater exposure of the fiber to the effects of climate (Garcia, 1991) with the consequent decrease in the quality and later realization of post harvest practices causes higher proportions of the insects population to enter diapause.

In summary, problems are centered on a decreased productivity from higher production and losses caused by insect pests, diseases, and to a lesser extent by rains at the end of the growing season. All the practices needed to produce cotton in the narrow rows system (0.70 m between rows of plants and 0.12 m between plants) as a strategy to solve the problems previously indicated were developed at "La Laguna" Experiment Station in Mexico. This system has been completely adopted by the cotton growers in the Comarca Lagunera region. The reported benefits are: a reduction of approximately 30 percent of production costs; reduction of three to four applications of insecticide; reduction of 0.12 m of irrigation water, and the reduction of 20 percent of the losses produced by the insect pests and diseases. However, the constant rise in production costs, the continuous scarcity of irrigation water and the low cotton prices in the international market have induced the search for more efficient methods to get more benefits from this crop. One of these methods is the system of cotton production in ultra narrow rows (Gwathmey, 1998 and Gerik et al., 1998).

The main objective of this study was to evaluate the system of cotton production in ultra narrow rows to build an economic system to produce plants of short season with high yield and cotton of good quality in different types of soils of the Comarca Lagunera region.

Materials and Methods

The field experiment was planted for a second consecutive, year at La Laguna Experiment Station, located in southeast Coahuila, Mexico. The cotton variety Fiber Max 819 was established in a late planting on May 9, 2001. The experimental design was a split plot with four replications where number of irrigations and plant population were main and sub plots, respectively. Plots were 11 rows wide and eight m long. The cotton variety was planted in 0.20 m rows.

The evaluated irrigation treatments were: one, two and three irrigations. Plant population treatments were: 120,000, 200,000, 280,000 and 360,000 plants per hectare. The cultural practices used during the crop-growing season were those normally recommended for cotton production in the Comarca Lagunera region.

Earliness was measured as the percentage of crop harvested at the first picking (PCH-1). The center four rows of each plot were hand picked and weighed to estimate lint yield (kg/ha). A 20-boll sample of seedcotton was hand picked prior to harvest and lint percentage and fiber properties were determined from these samples. Fiber analysis was done at La Laguna Experiment Station Cotton Fiber Testing Laboratory and included span length in mm, fiber strength in pounds per square inch, and fiber fineness as micronaire index. Data were analyzed using analysis of variance. The means were compared using Duncan test at the 5% level of probability.

Results and Discussion

Percentage of Crop Harvested at First Picking

The first picking of seed cotton was at 129 days after planting. The amount of seed cotton harvested as the first picking is referred to as the total seed cotton produced is presented as percentage of cotton harvested at the first picking in Table 1.

The statistical analysis showed significant differences among number of irrigations and also among plant populations. The value of PCH-1 of cotton with only one irrigation was the highest (74%), followed by the values of PCH-1 of cotton irrigated two or three times, respectively. With respect to plant population treatments, the Percentage of Crop Harvested at the first picking for the lowest number of plants per ha was significantly lower than the other three plant populations.

Lint Yield

The analysis of variance detected significant differences only among number of irrigations. The highest lint cotton yields, independent of plant population, was obtained by the treatment with three irrigations. When cotton was irrigated two times, lint cotton yield was significantly superior to the yield of cotton irrigated only one time (Table 2).

On the other hand, similar lint cotton yields were obtained with all plant population treatments (Table 2). This result is not in agreement with Allen *et al.*, (1998) which concluded that optimum plant population range for ultra narrow row cotton is probably in the 150,000 to 250,000 plants per ha range.

Fiber Length

Table 3 presents the values of fiber length of cotton with different irrigation and plant population treatments. Statistically significant differences were found among irrigation treatments. The lowest value of fiber length (27.3 mm) was obtained when Fiber Max 819 cotton variety was irrigated once. The highest value of fiber length (28.8 mm) was obtained when this same genotype was irrigated twice. This confirms the results reported by Garret and Russell (1954) who pointed out the importance of adequate moisture when fiber is in the process of elongation. Analysis of variance did not detect significant differences among means obtained with the evaluated plant population treatments.

Fiber Strength

The values of fiber strength expressed as pounds per square inch are presented in Table 4. This fiber property was not significantly affected by the irrigation treatments. With respect to plant population treatments, the analysis of variance detected significant differences among their means. However, these differences are not economically important. The largest difference between the values of fiber resistance, between the treatment with 120,000 plants/ha and the treatment with 360,000 cotton plants/ha was only 2,000 pounds per square inch.

Fiber Fineness

Highly significant differences were detected among the values of micronaire index of Fiber Max 819 cotton variety established with different levels of irrigation and plant population, Table 5. However, these differences were not important because any of these values is well accepted by the textile industry.

Conclusions

Fiber Max 819 cotton variety irrigated once was earlier than same variety with two or three irrigations. The same variety with the lowest number of plants per ha had a earliness value significantly inferior to the values of earliness of the other three plant population treatments.

Lint cotton yield increased as the number of irrigations increased.

Fiber length was significantly affected when cotton was irrigated only once. Fiber strength was affected as plant population was increased. Fiber fineness was affected by the reduction in number of irrigation treatments and by the increase in the number of cotton plants per ha. However, the values of fiber characteristics were in the range accepted by the textile industry without any price reduction.

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Table 1. Percentage of crop harvested at the first picking of cotton with different irrigation and plant population treatments.

	Plant population (thousand per ha)				
Number of irrigations	**120**	**200**	**280**	**360**	**Average**
One	64	75	80	79	75 a*
Two	45	56	56	57	54 b
Three	31	36	33	33	33 c
Average	47 b	56 a	56 a	56 a	

* Values followed by the same letter are not significantly different (Duncan, 0.05).

Table 2. Lint yield (kg/ha) of cotton with different irrigation and plant population treatments.

	Plant population (thousand per ha)				
Number of Irrigations	**120**	**200**	**280**	**360**	**Average**
One	1578	1337	1586	1433	1484 c
Two	1745	1768	1955	1640	1777 b
Three	2259	2099	2264	2020	2161 a
Average	1861	1735	1935	1698	

* Values followed by the same letter are not significantly different (Duncan, 0.05).

Table 3. Fiber length (mm) of cotton with different irrigation and plant population treatments.

Number of irrigations	Plant population (thousand per ha)				Average
	120	200	280	360	
One	27.4	27.2	27.4	27.2	27.3 c*
Two	28.7	29.0	29.0	28.7	28.8 a
Three	28.7	28.2	28.2	28.5	28.4 b
Average	28.3	28.1	28.2	28.5	

* Values followed by the same letter are not significantly different (Duncan, 0.05).

Table 4. Fiber strength (thousands of pounds per square inch) of cotton with different irrigation and plant population treatments.

Number of irrigations	Plant population (thousand per ha)				Average
	120	200	280	360	
One	91	87	89	88	89
Two	91	91	87	90	90
Three	90	92	91	89	90
Average	91 a*	90 ab	89 b	89 b	

* Values followed by the same letter are not significantly different (Duncan, 0.05).

Table 5. Micronaire values of cotton with different irrigation and plant population treatments.

Number of irrigations	Plant population (thousand per ha)				Average
	120	200	280	360	
One	4.0	3.7	3.6	3.8	3.8 b
Two	3.8	3.7	3.6	3.4	3.6 b
Three	4.4	4.5	4.3	4.3	4.4 a
Average	4.1 a*	4.0 ab	3.8 bc	3.8 c	

* Values followed by the same letter are not significantly different (Duncan, 0.05).