EVALUATION OF ULTRA NARROW ROW COTTON 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. The field evaluation was carried out in 2000 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 and lint percentage, and fiber properties were determined from these samples. The value of PCH-1 of cotton irrigated once was the highest (86%). The highest lint cotton yield, independently of plant population, was obtained by the treatment with three irrigations. On the other hand, the highest lint cotton yield was obtained with a plant population of 120,000 and 200,000 plants per ha. The lowest value of fiber length (27.2 mm) was obtained when Fiber Max 819 cotton variety was irrigated once. The highest value of fiber resistance (92,000 pounds per square inch) was obtained for Fiber Max cotton variety with one post planting irrigation.

Introduction

Main problems that affect cotton production, the same as that of other products of the region are: the lack of water, which in the last five years have allowed to irrigate only 20 percent of the surface which it is possible to irrigate with water of the dams; diseases such as verticillium wilt, Texan root rot and cotton rust causes important losses to cotton growers with the added difficulty that the infested area 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 to the producer to apply insecticide eight to ten times which is equivalent to 30 percent of production costs (Godoy *et al*., 1998). The use of systems of cotton production of long season have problems such as larger period of chemical protection against insects, larger irrigations number, higher amount of nitrogen and phosphorous, greater exposition of the fiber to the effects of climate (Garcia, 1991) with the consequent decrease in the quality and later realization of post harvest practices causing higher proportions of the population entering in diapause.

In summary, the whole problems of the crop are centered in a decrease of the productivity by effect of the higher costs of production and losses caused by insect pests, diseases, and in less grade for rains at the end of cotton growing season. At "La Laguna" Experiment Station in Mexico was developed the system of cotton production in narrow rows (0.70 m between rows of plants and 0.12 m between plants) as a strategy to solve the problems previously indicated. This system has been totally adopted by the cotton growers at the Comarca Lagunera region and the reported benefits are: The reduction of approximately 30 percent of the production costs, the reduction of three to four applications of insecticide, the 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 lacking of irrigation water and the low prices of cotton in the international market have propitiated the search of methods still more efficient 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 at La Laguna Experiment Station, located southeast Coahuila, Mexico. Cotton variety Fiber Max 819 was established in a late planting in May 3, 2000. The experimental design was a split plot with four replications where number of irrigations and plant population w ere main and sub plots, respectively. Plots were 10 rows wide and two m long. Cotton variety was planted on 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 10 rows of each plot were hand picked and weighted 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 referred to 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. The value of PCH-1 of cotton with only one irrigation was the highest (86%), followed by the values of PCH-1 of cotton irrigated two or three times, respectively.

Lint Yield

The analysis of variance detected significant differences among number of irrigations and plant population but not for the interaction of these two treatments. The highest lint cotton yields, independently 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, highest lint cotton yield was obtained with a plant population of 120,000 and 200,000 plants per ha. When plant population increased to 280,000 and 360,000 plants per ha lint cotton yield significantly decreased. This is 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 (Table 2).

Fiber Length

Table 3 presents the values of fiber length of cotton treated with different irrigation and plant population treatments. It was only found statistically

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significant differences among irrigation treatments. The lowest value of fiber length (27.2 mm) was obtained when Fiber Max 819 cotton variety was irrigated once. This same genotype had similar values of fiber length when water was applied two or three times. 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.

Fiber Strength

The values of fiber strength expressed as pounds per square inch are presented in Table 4. This fiber property was significantly affected only by the irrigation treatments. The highest value (92,000 pounds per square inch) was obtained for Fiber Max 819 cotton variety with one post planting irrigation.

Fiber Fineness

Highly significant differences were detected among the values of micronaire index of Fiber Max cotton variety established with different plant population, Table 5. However, these differences were not important because anyone 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. However, lint cotton yield increased as the number of irrigations increased. On the contrary, cotton yield decreased as plant population increased.

Fiber length and fiber strength were significantly affected when cotton was irrigated only one time. Fiber fineness was affected by the increase in plant population. However, the values of fiber characteristics were in the range to be 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.

Number of irrigations	Plant population (thousand per ha) 120	200	280	360	Average
One	88	88	91	85	86 a*
Two	60	72	64	59	64 b
Three	25	24	22	16	22 c
Average	55	61	59	53	

* 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.

Number of Irrigations	Plant population (thousand per ha) 120	200	280	360	Average
One	1414	1280	1071	1244	1252 c
Two	2017	2069	1951	1876	1978 b
Three	2476	2518	2383	2179	2389 a
Average	1969 a*	1956 a	1801 ab	1766 b	

* 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) 120	200	280	360	Average
One	27.1	26.9	27.2	27.6	27.2 b*
Two	28.3	28.2	28.4	28.3	28.3 a
Three	28.3	28.4	28.3	28.4	28.3 a
Average	27.9	27.8	27.9	28.1	

* 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) 120	200	280	360	Average
One	92	91	92	94	92 a*
Two	90	91	91	87	90 b
Three	89	89	90	90	89 b
Average	90	90	91	90	

* 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) 120	200	280	360	Average
One	3.6	3.8	3.4	3.5	3.6
Two	4.0	4.3	3.9	3.6	3.9
Three	4.0	4.0	4.0	3.7	3.9
Average	3.8 bc*	4.0 a	3.8 bc	3.6 c	

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