CHANCHING A PLANTING DATE: A SILVERLEAF WHITEFLY CASE

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Abstract

Cotton had been planted successfully in late winter – early spring before the appearance of the Silverleaf Whitefly. Since 1994, this pest has caused a severe impact in agricultural practices in Northwestern México. Planting dates were the most affected. A new planting date in late fall (December) is being proposed to escape the impact of the Silverleaf Whitefly. December planting date has similar yield potential as the former optimum planting date and also the advantages of avoiding the effect of high temperatures during the critical phase of the fruiting period, and is possible to evade the monsoon rains that cause boll rot and yield losses in rainy years.

Introduction

Cotton is a crop whose center of origin and diversity is located in the tropical regions of Northern México and Mesoamerica (Wendel et al, 1992). In most areas of México it is commercially grown as a Spring-Summer crop. Until 1993 the planting dates for cotton seemed clearly defined for the southern tip of Sonora. February was allowed but not recommended because of the occurrence of low temperatures caused by cold fronts, of polar or maritime origin, that reduce germination and emergence. Besides, cotton could face in this planting date severe rain at boll opening that is conducive to boll rot and yield loss. On the other hand, cotton planted in April is affected by high temperatures in the blooming stage that reduce severely yield potential. On top of that, the levels of insect pests are higher than those observed in early (February) or optimum planting date (first week in March), and pest control is inefficient. In this scenario, the first ten days of March were the optimal planting date to obtain, in a cycle of production of 130 days, the top yields of actual cotton cultivars.

However, the appearance of silver leaf whitefly (SLWF) in 1994 at very severe infestation levels changed the response to the planting pattern already established (Hernández y Ortiz, 1994). It was confirmed in 1995 that the optimum planting date in March wasn't anymore and that yield declined consistently from February through March and April (Fig. 1). This is easily explainable as we correlate the planting date with the population dynamics of SLWF (Fig. 2) where it was detected that the cotton planting date of February was the least affected (Hernández and Pacheco, 1996). As the boll setting peak didn't coincide with the population growth peak of SLWF as in the March and April plantings where both peaks coincided. On the other hand the early varieties especially those of hirsute nature, and obviously those of full season were the most susceptible or preferred. In the planting dates of February, March, and April, CIANO COCORIM-92 was the cultivar that averaged a better yield than Deltapine 5415, and CIANO TAJIMAROA-92 was the one that showed lesser yield. The interaction of the planting dates indicated that CIANO COCORIM-92 was the most productive in three out of the four planting dates. The cultivars showed susceptibility differential to the SLWF; CIANO COCORIM-92 was the least affected by the pest, meanwhile CIANO TAJIMAROA-92 was the most affected. This situation complicated the expectancies of the producers that already were facing the danger of rain during boll opening and at harvest.

The studies on population dynamics of the SLWF were essential for the planning of the research. PACHECO (1997) found in the Yaqui Valley that the exponential phase to the pest occurred for the first time in 1993, when 2162 to 2499 heat units (HU) were accumulated (July 27th to August 27th), the phase presented a slope of 0.089 (r^2=0.95) and a maximum capture of 14 adults/10 cm^2 in 24 hours. By 1994, the exponential phase occurred from 1692 to 2142 HU. The phase presented a slope of 1.28 (r^2= 0.74) and a maximum capture of 441 adults/10 cm^2 in 24 hours. By 1995 the exponential phase occurred from 1505 to 2033 HU (June 27th to August 1st), the phase presented a slope value of 1.008 (r^2= 0.92) and a maximum capture of 212 adults/10 cm^2 in 24 hours. Finally in 1996 the exponential phase occurred from 1540 to 2606 HU (May 21st to July 16th), with a slope of 0.14 (r^2= 0.98) and a maximum capture of 29 adults/10 cm^2 in 24 hours.

In irrigation management, Hernández et al (1996), found that biweekly irrigation intervals, starting at first week of square formation, reduced the incidence of whitefly in comparison with the traditional calendar practiced at the commercial level.

In studies of planting dates, Herrera et al. (1996) for the Mexicali Valley, it was found that the March planting were less affected by the SLWF that those recommended in April and May.

In relation to performance of cultivars, Herrera et al (1994) in the Mexicali Valley found that the early varieties needed a lesser application of insecticides that those of intermediate and full season cycle. To similar results arrived Medina and Herrera (1994) in the Mexicali Valley and López and Grijalva (1997) in the Caborca Region, where the intermediate and early cycle varieties were less susceptible and have better yields than the full season cultivars. On the other hand, Avilés (1996) found that the early variety

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CIANO COCORIM-92 presented the lowest number of eggs and nymphs of the SLWF in comparison to the intermediate and full season varieties.

Hernández and Pacheco (1997) en the Yaqui Valley estimated that the response of new cultivars of cotton and determined that even though there was significant differences in susceptibility to SLWF, this characteristic wasn't directly correlated to the yield.

Knowing the population dynamics of SLWF, the logical approach was to try earlier planting, when the latitude conditions allowed it, as is the case in the Southern part of the Sonora State. Plants from such early sowing dates have the disadvantage that the growing cycle is lengthened and the exposition of the seedlings to lower temperatures in winter and to winter pests is increased. But the probability of loss of yield by the attack of SLWF is lesser than in traditional planting dates, so it is worth while to take the risk.

In the decision to test new sowing dates in fall, climatological data of the southern part of Sonora was taken into consideration. Late fall weather is distinguished for favorable temperatures for germination (18°C) during October, November and part of December (Fig. 3). The minimal temperatures data, points out that January is the coldest month of the year, even though freezing temperatures are rare and of short duration (Fig. 4). Favorable temperatures for germination begin again until the last days of February.

The objective of the new planting date in December is to show that it is possible to get better germination and emergence, and that it is feasible to advance the fruiting cycle, so that the blooming occurs in more favorable conditions. And finally, but of no lesser importance, the advancement of the cycle, permit the plant to escape the period of higher incidence of SLWF and the harvest occurs before the raining season. In this paper the results obtained defining the response to new planting dates are presented, in Southern Sonora with producers and in the Yaqui Valley Experimental Station, that has an area of influence of 300,000 hectares.

Materials and Methods

1995-1996 growing season. Three cultivars (DELTAPINE 5415, DELTAPINE 5409, and CIANO CÓCORIM-92) were evaluated in four planting dates (October 25th, November 10th, November 25th, and December 16th) in a randomized complete block, in the Yaqui Valley Experiment Station. Six cultivars (DELTAPINE 5415, DELTAPINE 5409, SURE-GROW 125, SURE-GROW 404, HARTZ 1215 and CIANO CÓCORIM-92) were evaluated in a strip test, on a farmer's field in one planting date: December 16th.

1996-1997 growing season. Five cultivars (DELTAPINE 5415, DELTAPINE 5432, Deltapine 5461, Deltapine 5690, and CIANO CÓCORIM-92) were evaluated in a strip test, on a farmer's field in one planting date: December 24th.

In the 1995-1996 season, harvesting was carried out on July 10th, in the 1996-1997 season, harvesting was carried out on July 16th, both prior to the onset of the monsoon rains. Insecticide applications were similar in number (three at the experimental station and six in the farmer's field) to those applied in conventional planting dates of late winter or early spring; boll weevils and bud worms were the main insect problem.

Results

In the experimental results of the new planting dates of October, November and December, it was detected that in the December date, cotton showed higher yield potential, being significantly different to the yields observed in those in October and November (Table 1). October and November planting dates yielded less because first fruiting positions (of the first three fruiting branches) tended to show pollen sterility, because their buds were formed under cold conditions in January and February.

In average, C. CÓCORIM-92 (early) and DELTAPINE 5409 (intermediate-early) yielded significantly better that DELTAPINE 5415 (intermediate), because in the October and November planting dates they show superior yield performance, that was not observed in the December planting, where DELTAPINE 5415 easily outyielded the other two varieties. Yield components and fiber quality data was very similar, as that observed in conventional planting dates, with the exception of micronaire index. Micronaire tended to be slightly higher in the December planting date in comparison to the ones observed in February plantings, but similar to those in March or April plantings.

In the strip test Deltapine 5415 was the highest yielder (Table 2), exceeding by more than 2 bales/ha, the rest of the early and intermediate-early varieties, being the difference highly significant. These results are in variance with the hypothesis established that the early cycle varieties would prosper better than the intermediate ones where a crop cycle was elongated, principally because the last ones had slower development in the winter months. However in the 1995-96 cycle, the temperatures in winter and spring tended to be higher than normal, in which the theoretic advantage in early varieties weren't realized.

In the second trial cycle, 1996-1997, the opposite happened, as the early variety CIANO COCORIM-92 or other cultivars of intermediate-early cycle showed a higher yield than the regional check Deltapine 5415 (Table 3). The temperatures observed in the winter months of 1997 were lower than the previous cycle, and more likely with the expected in historical statistics, this condition affected Deltapine 5415 yield performance.

In the combined analysis of the strip tests in the two growing seasons, even though the average of both varieties has the same yield potential, a clear genotypical environment interaction is observed (Fig. 5). CIANO COCORIM-92, the early variety was more stable than the intermediate DELTAPINE 5415 that showed the interaction in the 1996-97 growing season.

Fruiting Cycle in the December Planting

Cotton planted mostly in February present the first squares in mid April, blooming in mid May, and boll opening in mid July, in which the first harvest occurs commonly at the beginning of August when the raining season has already begun. The data obtained in six cotton varieties shows unequivocally that the new December crop present floral buds in the last week of March (Fig. 6) with its peak at the end of April. The first blooms appear in the last week of April (Fig. 7), with a boll peak at the end of May. As boll opening starts around the 10^{th} of June, it is feasible to have the first pick by the 10^{th} of July, with this we gain 15 days that are vital to escape the rain season. Last but not least, as the important phase of the fruiting cycle takes place when the population density of SLWF is low, no insecticide application is necessary to control this pest.

In commercial plantings with farmers that begun in an area of 1,000 ha in 1995-1996 and that grew to 2,500 ha in 1996-1997, the yield results are very satisfactory for the December planting. For the 1997-98 growing season, we have the cooperation of more than 60 cotton growers that do planted over 7,000 ha in December 1997. Experiments will be established with farmers to focus the research on defining the critical values for factors such as: Irrigation, application of growth regulators, economical thresholds of early pests, defoliation timing and plant population density.

Summary

The new December planting date have the following advantages: better temperatures for germination and emergence. Fruiting cycle occurs during April and May under more favorable temperatures, and when Silverleaf whitefly is not a problem yet. Boll opening and harvest occurs prior to the onset of monsoon rains. And last but not least, yield potential is as good or better than the former optimum planting date.

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Table 1. Seedcotton yield (kg/ha) as a function of planting date. Yaqui Valley, Son. México.1995-96.

	Variety			
Planting date	DELTAPINE 5415	CIANO CÓCORIM-92	DELTAPINE 5409	mean
Oct. 25	3,010	3,079	3,316	3,135 c
Nov. 10	3,066	3,629	3,590	3,428 b
Nov. 26	3,152	3,937	3,707	3,598 b
Dic. 16	5,978	5,407	5,524	5,636 a
Mean	3,801 b	4,013 a	4,034 a	

Table 2. Yield response of cotton planted in December 16. Yaqui Valley, Son. México. 1995-96.

	kg/ha		
	Lint	Seedcotton	1st. Pick
DELTAPINE 5415	2,637	6,073	5,293
SURE-GROW 125	2,423	5,613	5,355
SURE-GROW	2,322	5,901	5,470
DELTAPINE 5409	2,207	5,498	5,138
C. CÓCORIM-92	2,163	5,386	5,158
HARTZ 1215	2,004	4,878	4,539
Mean	2292	5558	5159
L. S. D. (0.05)	361	836	NS

Table 3. Yield response of cotton planted in December 24. Yaqui Valley, Son. México. 1996-97.

	kg/ha		
	Lint	Seedcotton	1st. Pick
C. CÓCORIM-92	2,073	5,078	3,519
DELTAPINE 5461	2,046	5,071	3,874
DELTAPINE 5690	2,024	4,876	3,362
DELTAPINE 5432	1,892	4,519	2,640
DELTAPINE 5415	1,833	4,392	1,944
Mean	1,974	4,787	3,068
L. S.D. (0.05)	NS	NS	1,061

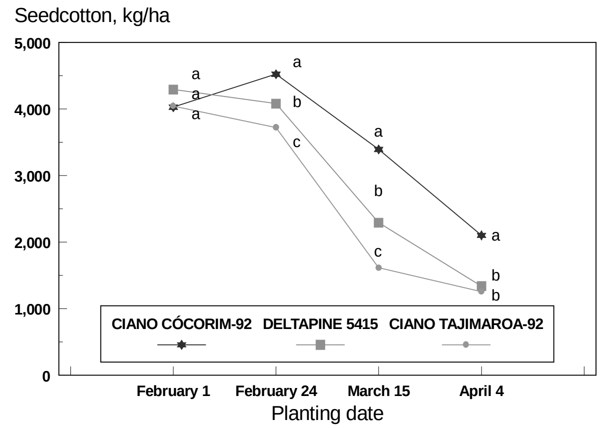

Figure 1. Planting date – variety interaction. Yaqui Valley, Son. México. 1995

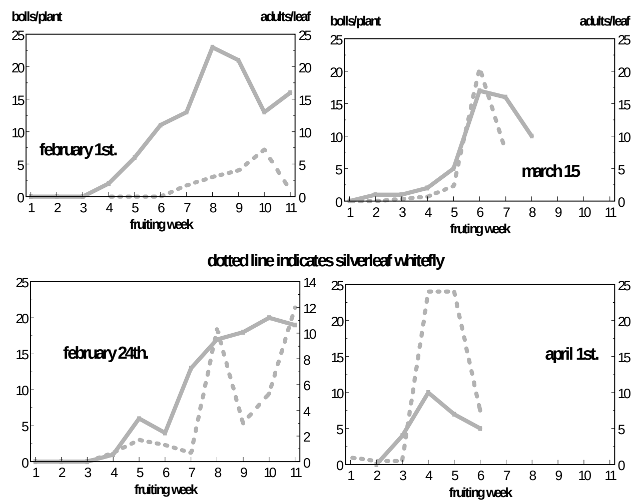

Figure 2. Dynamics of cotton fruiting and silverleaf whitefly, Cv. DELTAPINE 5415, in four planting dates. Yaqui Valley, Son. México. 1995.

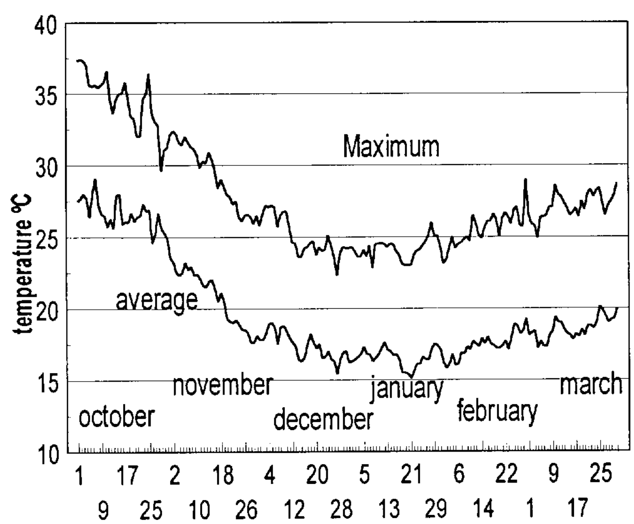

Figure 3. Average maximum and mean temperatures during fall and winter. Yaqui Valley, Son. México. 1978-1994.

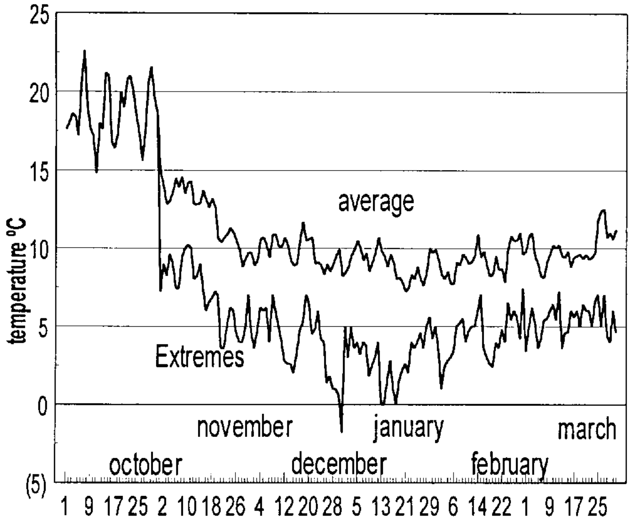

Figure 4. Average and extreme minimum temperatures during fall and winter. Yaqui Valley, Son. México. 1978-94

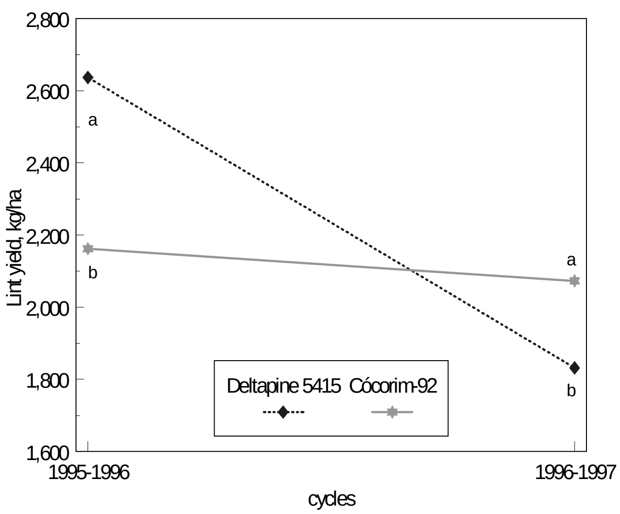

Figure 5. Planting date – variety interaction. Yaqui Valley, Sonora. México. 1995.

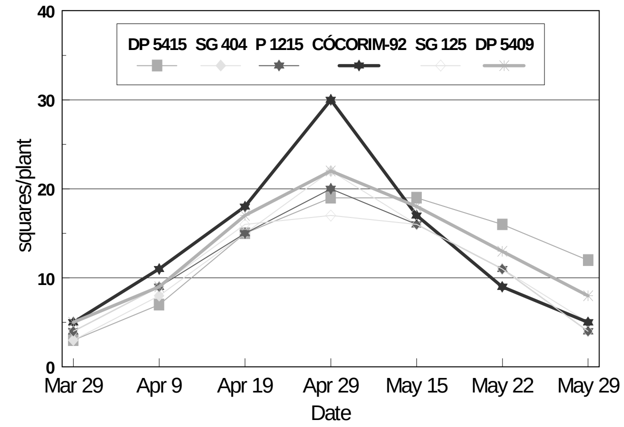

Figure 6. Dynamics of cotton fruiting and Silverleaf whitefly, Cv. DELTAPINE 5415, in four planting dates. Yaqui Valley, Son. México. 1995-1996.

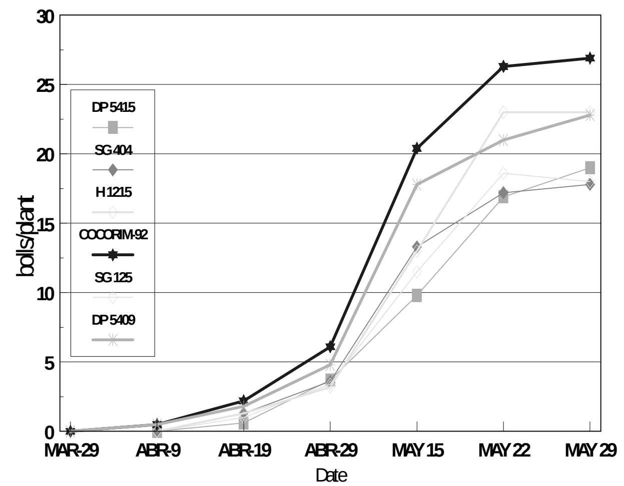

Fig. 7. Fruiting pattern of cotton, planted in late fall. Yaqui Valley, Son. México. 1995-1996