RESPONSE OF NUCOTN 33B IN YAQUI VALLEY SONORA, MÉXICO. 1997-98

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Abstract

Transgenic varieties resistant to *Heliothis virescens* are a new tool to reduce production costs due to insecticide application and to diminish environmental contamination. In some areas like Yaqui Valley, infestation levels of this pest do not reach the threshold level most of the time, under this condition, the favorable response of NuCOTN 33B is based in its own overall genetic merit.

Introduction

Yaqui Valley is located in the southeastern corner of Sonora State, México and its Cotton Production dates back to the beginning of this century. It is a privileged zone in Mexico regarding cotton pests, even though almost all known cotton pests can be found in the area, only boll weevil is an ancestral primary pest. In the past five years Silverleaf Whitefly (MBHP) has occupied a prevailing place, classifying itself at the same level as Boll weevil, as a primary plague, in this scenario *Heliothis spp.* are a secondary plague. Being Boll Weevil and MBHP principal plagues, the strategies for their control, include chemical as well as cultural control, getting good results. Their combat implies two to five chemical applications per cycle depending on the sowing date and incidence level of both plagues. Under this pretense *Heliothis spp.* (*zea and virescens)* is controlled when there is an application against boll weevil and MBHP. On the other hand pink bollworm is considered as an almost nonexistent plague in the Valley, because the climate doesn't allow its development.

Heliothis spp. are combated in certain, very defined locations in the valley, and when certain management practices induce its population to explode, usually it is originated when the benefic fauna that keep them in control is eliminated. When cotton is in the vegetative stage secondary pests appear and unnecessary applications are carried out. These applications are dictated by "High Tech" criteria against thrips or aphids that also kills benefic fauna allowing development of dangerous *Heliothis spp.* population.

Actual *Heliothis spp.* population in Southern Sonora can be classified as "sub-threshold", and two specific insecticide applications, usually less, are done to control this insect. Under this scenario, transgenic Bollgard® varieties resistant to *Heliothis virescens* and *Pectinophora gossypiella* were presented in the Cultivar market in Yaqui and Mayo Valleys in 1997. Bollgard® varieties offer to avoid the use of pesticides for *Heliothis virescens* and *Pectinophora gossypiella* control, this is extraordinarily interesting from an economic point of view and above all its ecological perspective. Nevertheless its use implies an extra cost for the seed's price and a technology fee. The present investigation was designed to estimate yield response of NuCOTN 33B in relation to *Heliothis spp.* incidence in Yaqui Valley, Sonora, México.

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Materials and Methods

NuCOTN 33B evaluation was carried out in two cycles, late planting in March 1997 and early planting in January 1998, in comparison with regional check variety: DELTAPINE 5415. Variety evaluation was done in strips of a hectare in size per variety in both cycles. Incidence information of *Heliothis spp.* population was collected by weekly inspections, from first week of squares and until first open boll week. Inspections were carried out in terminals, squares, and bolls to estimate *Heliothis* egg incidence, larvae of different instars, and damage in terminals, squares and bolls. In 1998 fruiting counting was collected weekly with the objective to estimate fruiting rate.

Agronomic management was carried out on the basis of Cotton production guide recommendation for Yaqui Valley, Sonora. Insect management was conditioned by protocols that implied not using pesticide products that promoted bollworm resistance. Nevertheless the mentioned pest was not a problem during both cycles, only cotton boll weevil and silverleaf whitefly presented themselves in important levels that deserved control.

Yield potential estimation was done in two harvests, of 10 random $10m^2$ plots per variety, 10 boll samples were taken in those plots, to estimate boll characteristics and to estimate lint yield. Parameters were estimated also for the following variables: boll size, lint percent, seed index, precocity (first pick yield), and fiber quality (length, strength and micronaire index). The hypothesis of non-significant difference between genotypes was tested at 0.05 probability level.

Results and Discussion

Rational pest management in early cultivar development stage (from emergence until before squaring) in Yaqui Valley, helps benefic fauna action. Secondary pests, as aphids or thrips that are usually found in cotton from seedling stage until sixth leaf, are not controlled chemically, this helps development of benefic fauna, that reduces significantly *Heliothis* complex population. During both years low *Heliothis* populations were observed, as a consequence of this situation, terminal and fruit damage was also low, and we did not have favorable conditions for resistance evaluation of NuCOTN 33[B].

Heliothis egg oviposition was generally very low, at all the squaring stage, not greater than 3% and 1%, in 1997 and 1998, respectively, very far from economical thresholds. This situation is manifested in damaged square percentage, that in general did not reach values superior to 1%. And as a consequence, low larvae levels were observed in terminals and fruiting structures at critical blooming stage, May 23rd to June 26th, where bloom damage was practically 0%. As consequence of the previous situation, bolls damage were lower than 1.5% too, a value very under economical thresholds that define chemical control with pesticides.

On the other hand no pink worm presence was noted, nowadays this pest is practically absent in Yaqui Valley. Because of this, the transgenic variety evaluation stands by it own merit, i.e. its intrinsic capacity or conventional overall genetic potential to adapt itself and prosper under conditions, where only cotton boll weevil (*Anthonomus grandis*), and silverleaf whitefly (*Bemisia argentifolii*) are a problem.

Fruiting Development in 1998

NuCOTN 33[B] variety showed a superiority in each one of the fruiting cycle stages, beginning in squaring (Figure 1), where it superseded Deltapine 5415 in productive capacity, from the beginning to the sixth week. On the other hand blooming began earlier in NuCOTN 33[B] (Figure 2). In the same fashion, NuCOTN 33[B] presented a clear superiority over Deltapine 5415 in boll formation, from the 5th to the 11th fruiting week (Figure 3).

Yield

As a consequence of superior fruiting development of NuCOTN 33[B] over DELTAPINE 5415, highly significant differences were detected between both varieties for lint and seed cotton yield in the two years (Tables 1 and 3). In 1998 NuCOTN 33[B] showed also a superior yield potential at first harvest. As the results of yield evaluation of both years were similar (Table 3), in the absence of *Heliothis spp.* we can conclude that this transgenic variety has an excellent yield stability and production potential. This means that it can be used in conditions when the pest is no problem, when infestation levels are below economical threshold, because the additional costs of technology and extra costs for seed, are amply compensated by a higher yield increase with NuCOTN 33[B]. It is also convenient to stress that NuCOTN 33[B] has an additional advantage, it has a 20% superior emergence to the conventional variety. On the other hand, no notable damage from beet army worm and leaf perforator was observed, the first presented itself in low incidence at blooming stage, affecting foliage and fruits of conventional varieties, and the second one in medium intensity at the final stage of blooming.

Yield Components

Significant differences were detected only in seed index (Table 1), NuCOTN 33[B] variety had a significantly higher seed index than the regional check, the seed is heavier, this explains its higher germination and emergence potential. Percentage values for fiber and boll size were very similar.

Fiber Quality

No significant differences were detected in strength and length (Table 2 and 4). Regarding micronaire index, NuCOTN 33[B] had a significantly better micronaire value than DELTAPINE 5415 that presented a significantly higher value.

Summary

NuCOTN 33[B] resistance to *Heliothis spp.* could not be evaluated, because there was not the necessary incidence of the pest. NuCOTN 33[B] showed better total yield and at first pick than DELTAPINE 5415. NuCOTN 33[B] had a higher emergence than DELTAPINE 5415. And it did not show notable damage from beet army worm or leaf perforator. NuCOTN 33[B] variety has boll and fiber quality characteristics similar to DELTAPINE 5415. NuCOTN 33[B] presents by itself favorable high yield agronomic expectancies and this can be a tool, a very good one, in integrated pest management, even when *H. virescens* specific pressure is at the sub-threshold level.

Table 1. Variety response, yield and yield components. Yaqui Valley, Sonora, México, 1997.

Variety	Yield, kg/ha		Boll Characteristics		
	Lint	Seed-cotton	Lint %	Size	Seed Index
NuCOTN 33[B]	1,091	2,743	39.8	5.4	8.8
Dp 5415	801	1,940	41.2	5.5	8.1
Average	922	2,314	40.5	5.4	8.5
D. M. S. (0.05)	141	336	1.0	NS	0.7

Table 2. Variety response and fiber quality components. Yaqui Valley, Sonora, México, 1997.

Variety	Fiber Quality		
	Length	Strength[1]	Micronaire
NuCOTN 33[B]	1 1/16	86,200	5.2
Dp 5415	1 1/16	89,000	5.3
Average	1 1/16	86,367	5.2
D. M. S.	NS	NS	NS

[1] Pressley, lb/in^2

Table 3. Variety response, yield and yield components. Yaqui Valley, Sonora, México, 1998.

Variety	Yield, kg/ha			Boll Characteristics		
	Lint	Seed-cotton	1st pick	Lint %	Size	Seed Index
NuCOTN 33[B]	1,323	4,462	3,192	41.9	5.7	10.0
Dp 5415	988	3,936	2,371	41.6	5.3	9.4
Average	1,156	4,199	2,781	41.7	5.5	9.7
D. M. S. (0.05)	**	**	**	NS	NS	**

[1] Pressley, lb/in^2

Table 4. Variety response and fiber quality components. Yaqui Valley, Sonora, México, 1998.

	Fiber Quality		
Variety	Length	Strength[1]	Micronaire
NuCOTN 33[B]	1 1/16	83,250	4.7
Dp 5415	1 1/16	82,000	5.1
Average	1 1/16	86,625	4.9
D. M. S. (0.05)	NS	NS	*

[1] Pressley, lb/in^2

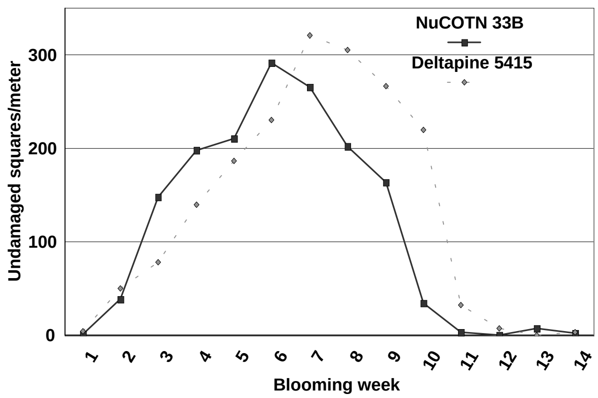

Fig 1. Square formation in two cotton varieties. Yaqui valley, Sonora. México 1998

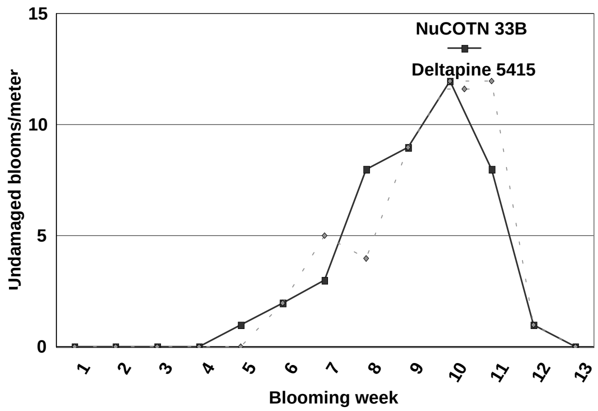

Fig 2. Fruting cycle, blooms, of two cotton varieties. Yaqui Valley, Son. México. 1998

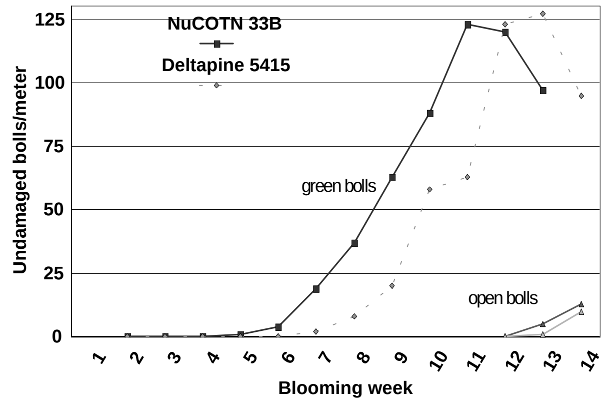

Fig 3. Fruiting cycle, green and open bolls, of two cotton varieties. Yaqui Valley, Sonora. 1998