SUSCEPTIBILITY OF UPLAND COTTON CULTIVARS DELTAPINE 5461 AND LOUISIANA 887 TO SILVERLEAF WHITEFLY COLONIZATION

Chang-chi Chu, Eric T. Natwick,
Donald. E. Brushwood,
Thomas J. Henneberry, and Allen C. Cohen
USDA-ARS WCRL and CQR
Phoenix, AZ and Clemson, SC,
University California Coop. Extn
Holtville, CA

Abstract

In the three years study from 1994 to 1996, both Deltapine (DPL) 5461 and Louisiana (LA) 887 were susceptible to silverleaf whitefly colonization. When the insect was not controlled, silverleaf whiteflies infestation were higher on LA 887 leaves as compared to DPL 5461 leaves. Lint yields were low, although DPL 5461 yielded more than LA 887. When whiteflies were controlled with Danitol-Orthene at 4.1 adults per leaf turn, silverleaf whitefly densities were greatly reduced. Lint yields were also significantly increased. However, DPL 5461 requires fewer insecticide applications than LA 887 to optimize yield.

Introduction

The silverleaf whitefly *Bemisia argentifolii* Bellows and Perring (Bellows et al. 1994) has been a major economic pest of cotton since 1991. Natwick et al. (1996) reported that in 1991, dead leaves frozen on Pima and upland cotton plants occurred in mid-July. In addition to lint yield losses, increases in the occurrence of sticky cotton have occurred because of honeydew contamination (Chu et al. 1995). Berlinger (1986) suggested development of whitefly-resistant cotton cultivars as one approach to reduce the cotton stickiness problem. Cottons with pubescent leaves have been reported to support higher whitefly populations than smooth leaf varieties (Norman et al. 1996). The objective of this study was to compare two upland cultivars Deltapine (DPL) 5461 and Louisiana (LA) 887 susceptibility to silverleaf whiteflies in the Imperial Valley of southern California.

Materials and Methods

The study was conducted at the USDA Irrigated Desert Research Station, Brawley, CA, from 1994 to 1996. In the 1994, we compared DPL 5461 and LA 887 in a randomized complete block with 10 replicates. Each plot was 10 ft x 6.7 ft with beds spaced 3.3 ft apart. There were 10 ft fallow areas between blocks. To allow maximum adult migration between the two tested cultivars there were no skip rows designed between plots and no insecticides were applied. Seeds were planted on 14 April and plants emerged about a week later. Whitefly densities were monitored weekly from 17 May to 16 August. Five 5th main stem node leaves (Naranjo and Flint 1994) were sampled from each plot and a 3.8 cm^2 leaf disk was taken from the base of each leaf to count numbers of eggs and nymphs. Seed cotton was hand picked from one of two rows and ginned for lint yields. In the 1995 and 1996, the experimental design was a split-plot with four replicates. Each plot was 40 ft x 13.3 ft with beds spaced 3.3 ft apart. There were 13.3 ft of unplanted area between plots and 30 ft alleys between blocks to partially isolate each plot and reduce whitefly adult migration between plots. Whole plots were untreated or Danitol-Orthene treated. Split plots were the cotton cultivars DPL 5461 and LA 887. Seeds were planted on 14 March in 1995 and 11 March in 1996 and plant emergence occurred about two weeks later. Whitefly densities were monitored weekly from 23 May until 8 August in 1995 and 7 May to 13 August in 1996. Leaf sampling was identical to that in 1994, except the sample size was increased from five to ten leaves. In addition, whitefly adults were counted using the leaf turn methods as described by Naranjo and Flint (1994). Whitefly control was initiated only when adult counts for a specific cultivar were 4.1 adults or more/leaf. The 4.1 adults/leaf was proposed as an action threshold by the authors based on two years study from 1993 to 1994 (unpublished data). The insecticide used was a mixture of Danitol® and Orthene® at 0.2 and 0.5 lb AI/ac, respectively. Seed cotton was hand picked from a 1/1000 acre area from each of the two center rows and ginned for lint yield. In the 1995 and 1996 study, lint was also sampled for total reducing sugar content and thermodetector counts as described by Perkins and Brushwood (1995). All data were analyzed using analysis of variance (ANOVA), and means were separated with Student-Newman and Keul's multiple range test (MSTAT-C 1988).

Results and Discussion

In untreated plots, DPL 5461 leaves had fewer eggs and nymphs than LA 887 leaves in each year of the study (Table 1). In 1996, DPL 5461 also had fewer adults per leaf turn than that found on LA 887 leaves. Lint yields of DPL 5461 were significantly higher than those of LA 887 each year of the three years (Table 2). Nevertheless, yields were low, about a bale of lint per acre for DPL 5461 and half a bale or less for LA 887. When plots were treated with a Danitol-Orthene mixture in 1995 and 1996, numbers of eggs, nymphs and adults on leaves of both cultivars were significantly reduced and lint yields were increased. In 1995, LA 887 also yielded higher than DPL 5461. However, at the 4.1 adults action threshold used in this study, LA 887 plots required one more insecticide treatment than DPL 5461. LA 887 appears more susceptible to silverleaf whitefly colonization than does DPL 5461 under the conditions studied.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1064-1066 (1997)
National Cotton Council, Memphis TN

Leaf surface structure may be related to the susceptibility of cultivars to silverleaf whiteflies. The higher number of eggs and nymphs found on leaves of LA 887 may be in part due to its semi-hairiness characteristics as compared to DPL 5461's smooth leaf characteristics (personal communication, Larry Burdett, Delta and Pine Land Co., Yuma, AZ, 1995). Recent reports showed that hairy leaf cottons attracted more whitefly adults than do smooth leaf cottons (Norman 1996).

Results of total reducing sugars and thermodetector analyses in 1995 and 1996 did not show clear cut differences between the two cultivars and between the insecticide treated and untreated plots. For total reducing sugars, the only significant difference was between the untreated and Danitol-Orthene treated plots in 1 995. Also in 1995, thermodetector counts of Danito-Orthene treated and untreated plots were significantly different for both cultivars. This suggests that the assessment of sticky cotton caused by the whitefly colonization may be complex, requiring either a specific sampling technique or a new lint stickiness index, or both.

Results of this study indicate that cotton cultivars are different in the susceptibility to silverleaf whitefly colonization and selection of less susceptible cultivars may result in savings from reduced insecticide applications.

References Cited

Bellows, T. S., Jr., T. M. Perring, R. J. Gill, and D. H. Headrick. 1994. Description of a species of *Bemisia* (Homoptera: Aleyrodidae). Ann. Entomol. Soc. Amer. 81: 195-206.

Berlinger, M. J. 1986. Host plant resistance to *Bemisia tabaci*. Agric. and Environ. 17: 69-82.

MSTAT-C. 1988. MSTATC-C, a microcomputer program for the design, management, and analysis of agronomic research experiments. Michigan State Univ., East Lansing, MI.

Naranjo, S. E., and H. M. Flint. 1994. Spatial distribution of preimaginal *Bemisia tabaci* (Homopter: Aleyrodidae) in cotton and development of fixed-precision, sequential sampling plans. Environ. Entomol. 23: 254-266.

Norman, J. W., Jr., A. N. Sparks, Jr. 1996. Silverleaf whiteflies and cotton leaf hairs, Lower Rio Grande Valley, 1994-1995. pp. 1026-1027. *In* P. Dugger and D. A. Richter (eds.), Proc. Belt. Cotton Prod. Res. Conf. National Cotton Council, Memphis, TN.

Natwick, E. T., C. C. Chu, and T. J. Henneberry. 1995. Pima and upland cotton susceptibility to *Bemisia argentifolii* under desert conditions. Southwestern Entomol.: 429-438.

Perkins, H. H., and Brushwood. 1995. Interlaboratory evaluation of the thermodetector cotton stickiness test method, pp. 1189-1191. *In* D. J. Herber and D. A. Richter (eds.), Proc. Belt. Cotton Prod. Res. Conf. National Cotton Council, Memphis, TN.

Table 1. Mean numbers of *Bemisia argentifolii* eggs, nymph, and adults on leaves of Deltapine 5461 and Louisiana 887 upland cotton cultivars at Brawley, CA from 1994 to 1996

Year	Cultivar	No. insecticid e applied	No./cm^2 leaf disk Eggs	Nymphs	No. adults / leaf
1994	DPL 5461	0	21.3 b[a]	6.66 b	30.1 a
	LA 887	0	49.4 a	16.62 a	33.1 a
1995	DPL 5461	0	15.8 b	6.66 b	21.6 a
	LA 887	0	33.2 a	15.68 a	25.6 a
	DPL 5461	5	6.7 c	1.36 c	7.7 b
	LA 887	6	13.8 b	3.80 c	8.0 b
1996	DPL 5461	0	23.5 b	11.85 b	14.3 bc
	LA 887	0	45.9 a	27.67 a	25.6 a
	DPL 5461	7	7.3 c	2.36 c	5.2 c
	LA 887	8	11.1 c	4.61 c	9.3 c

[a] Means in a column of a year with different letters differ significantly

(Student-Neuman-Keul's Multiple Range Test *p* ∴ 0.05).

Table 2. Lint yields, percent reducing sugar content and thermodetector counts of Deltapine 5461 and Louisiana 887 upland cotton cultivar lint samples at Brawley, CA from 1994 to 1996

Year	Cultivar	No insecticide applied	Lint lb/ac	% Total reducing sugar	Thermo-detector rating
1994	DPL 5461	0	534 a[a]		
	LA 887	0	55 b		
1995	DPL 5461	0	516 c	1.46 a	42 b
	LA 887	0	263 d	1.73 a	45 a
	DPL 5461	5	1278 b	0.55 b	15 c
	LA 887	6	1626 a	0.42 b	12 c
1996	DPL 5461	0	581 b	1.25 a	29 a
	LA 887	0	257 c	1.75 a	46 a
	DPL 5461	7	1390 a	0.89 a	21 a
	LA 887	8	1270 a	0.75 a	10 a

[a] Means in a column of a year with different letters differ significantly (Student-Neuman-Keul's Multiple Range Test *p* ∴ 0.05).