Lint Yield, Earliness, and Pink Bollworm Resistance of Cottons Treated with Ethephon and Untreated

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ABSTRACT

An early-maturing, nectariless, okra-leaf germplasm line of cotton, Gossypium hirsutum L., designated WC-12NL, was compared with a full-season, nectaried, regular-leaf cultivar, 'Deltapine 61' (DPL-61) over two locations, Maricopa, Arizona (AZ) and Brawley, California (CA), and two seasons, 1986 and 1987. Half of each plot was treated with ethephon (=Prep) when the crop was approximately 60% open. Lint yields were higher in WC-12NL than in DPL-61 at AZ, but not at CA. WC-12NL was earlier maturing than DPL-61, but the difference was greater in untreated than in ethephon-treated plots and at AZ than at CA. From 33 to 67% less insecticide was needed to control pink bollworm, Pectinophora gossypiella (Saunders), on WC-12NL than on DPL-61. Pink bollworm infestations were also significantly lower in bolls of WC-12NL.

INTRODUCTION

Earliness of the cotton crop may be increased and insect populations decreased through the use of early maturing, insect-resistant cultivars and certain growth-regulating chemicals. The objective of the study reported here were to compare 1) lint yield, earliness, and resistance to pink bollworm of an early maturing, nectariless, okra-leaf germplasm line with those of a full-season, nectaried, regular-leaf cultivar; 2) yield and earliness in untreated plots and in those treated with ethephon.

MATERIALS AND METHODS

Plots of WC-12NL and DPL-61 were planted at the Imperial Valley Conservation and Research Center, Brawley, CA, on 31 March 1986 and 31 March 1987, and at the University of Arizona Maricopa Agricultural Center, Maricopa, AZ, on 24 April 1986 and 7 April 1987. Plots were arranged in five randomized complete blocks. Plot size was 48 rows X 189 m (540 ft) [=0.81 ha=2.0 acres]. Rows were spaced 1 m (=40 in) apart. Short-season production systems were used at both locations.

Irrigation was terminated 15 Aug 1986 and 14 Aug 1987 at AZ, and 30 July both years at CA. Ethephon was applied to half of each plot, at the rate of 1.12 kg/ha (=1.0 lb/acre), on 24 Aug both years at AZ, and on 11 Aug 1986 and 17 Aug 1987 at CA. Defoliants were applied 20 Sept 1986 and 16 Sept 1987 at AZ, and 5 Sept 1986 and 31 Aug 1987 at CA. All other cultural practices were standard, except that plots in AZ were irrigated once each week instead of every 2 weeks to preclude water stress. The soil type at CA allowed us to irrigate every 2 weeks without causing stress.

No early-season insecticide was applied because we wanted to measure the differential response of the cottons to thrips and lygus. For pink bollworm control, 50 green bolls per plot were harvested twice weekly and examined for eggs. Insecticide was applied separately to the two cottons when the action thresholds were reached (8% of the bolls with eggs at CA and 17% at AZ). Table 1 lists the number of insecticide treatments applied. Boll samples were also incubated to determine pink bollworm infestations in bolls.

For estimates of agronomic properties and seed damage caused by pink bollworm, two 10-plant plots were established in each ethephon-treated and untreated plot. Seed cotton was harvested weekly as soon as bolls started to open and continuing until all bolls were open. Earliness in this report is defined as the number of days after planting required for a given cotton to reach a 1-, 2-, or 3-bale lint yield. For both seed cotton and lint yield estimates, two rows X 15 m were machine harvested at AZ and one row X 13 m was hand harvested at CA. Seed cotton samples were weighed and ginned; lint and seed samples were weighed. A volumetric (35mL) seed sample was drawn from each 10-plant plot and X-rayed to produce radiographs to estimate seed damage.

RESULTS AND DISCUSSION

From 33 to 67% fewer insecticide applications were required to control pink bollworm on WC-12NL than on DPL-61 (Table 1). Over the two seasons, lint yield was significantly higher for WC-12NL than for DPL-61 at AZ (1,749 vs. 1,557 kg/ha=3.25 vs 2.90 bales/acre), but yields were not significantly different at CA (1,241 vs. 1,312 kg/ha=2.33 vs 2.46 bales/acre; Table 2). Lint yields were not significantly different in ethephon-treated and in untreated plots.

The WC-12NL line reached a 1-bale lint yield 13 days earlier than DPL-61 at AZ and 5 days earlier at CA (Table 3). Also, WC-12NL reached a 2-bale yield 15.5 and 3.7 days earlier at AZ and CA, respectively. Ethephon treatment did not enhance earliness of WC-12NL but it caused DPL-61 to reach a 2-bale yield 3.5 days earlier, and a 3-bale yield 4 days earlier. About 28 fewer days after planting were required for the cottons to reach one-bale yields, and about 33 fewer days after planting were required to reach two-bale yields at AZ than at CA.

In spite of lower insecticide use, numbers of pink bollworms per 100 bolls were significantly lower in bolls of WC-12NL than in those of DPL-61 both seasons and at both locations (Table 4). Percent seed damage was also significantly lower for WC-12NL (data not shown).

Our data show that WC-12NL had a yield potential as high as that of DPL-61 and also enough pink bollworm resistance to allow us to produce a crop with fewer applications of insecticide at both AZ, where pink bollworm populations historically have developed late in the season, and at CA where they have developed much earlier. Our data also show that early maturity was accomplished more effectively with early maturing germplasm than with chemical treatment. It appears that the main value of ethephon, when applied after irrigation termination, is to cause late-season square and boll shed, which will reduce the number of feeding sites for pink bollworm larvae.

Table 1. Number of insecticide applications needed to control pink bollworm on two cottons grown at two locations for 2 seasons.

Cotton	1986 AZ	1986 CA	1987 AZ	1987 CA
WC-12NL	2	6	1	4
DPL-61	3	9	3	7
Reduction %	33	33	67	43

Table 2. Lint yields (kg/ha) of two cottons grown at two locations for 2 years in untreated (U) and ethephon-treated (E) plots.

Cotton	1986 AZ	1986 CA	1987 AZ	1987 CA
WC-12NL-E	1649	1286	1754	1094
WC-12NL-U	1680	1458	1912	1126
DPL-61- E	1064	1466	2035	1224
DPL-61- U	1100	1430	2025	1127
LSD 5%	267	209	219	144

Table 3. Number of days after planting required to reach the designated lint yield, bales/acre, of two cottons (WC-12NL, DPL-61), grown at two locations (AZ, CA), in untreated (U) and ethephon-treated (E) plots (means over 2 seasons).

	Lint yield, bales/acre					
	1		2		3	
Mean	WC-12NL	DPL-61	WC-12NL	DPL-61	*WC-12NL	*DPL-61
	Days after planting					
AZ	95.0	108.0	102.5	118.0	115.0	120.0
CA	127.3	132.3	141.8	145.5	--	--
E	111.8	120.0	123.0	130.0	117.0	118.0
U	110.5	120.3	121.3	133.5	113.0	122.0
Cotton	111.1	120.1	122.1	131.8	115.0	120.0

*Means from AZ 1987 only.

Table 4. Number of pink bollworms per 100 bolls in two cottons grown at two locations for 2 seasons.

	Pink bollworm/100 bolls			
Cotton	1986		1987	
WC-12NL	6*	27*	4*	20*
DPL-61	11	50	7	53

*Difference significant (P=0.05).