EFFECTS OF FOLIAR APPLICATIONS OF ARY-0469-001 ON FIRST-POSITION BOLL PRODUCTION COMPONENTS OF FLEX AND LIBERTY LINK CULTIVARS: BOLL RETENTION AND AVERAGE BOLL MASS

Carlos J. Fernandez
Juan Carlos Correa
Texas AgriLife Research and Extension Center
Corpus Christi, TX

Abstract

Growth of individual bolls is initiated over several weeks; therefore, a one-time foliar application of a growth-enhancing agrochemical would unlikely affect the whole population of bolls equally. A study was conducted in 2008 at the Texas AgriLife Research and Extension Center at Corpus Christi to investigate whether the cultivars FM9063 B2F and FM832 LL responded differently to foliar applications of Arysta LifeScience North America Corporation's ARY-0469-001. These cultivars were subjected to two application rates of this agrochemical late in the season. Results from this study showed significant although only minor effects of the foliar application of ARY 0469-001 on boll retention and average boll mass, but supports the initial concept the these two cultivars respond differently to this agrochemical. These results also indicate that this agrochemical may alleviate stress conditions during boll growth and that this effect may be limited to fruits at early stages of development at the time of application.

Introduction

Growth of individual bolls is initiated over several weeks; therefore, a one-time foliar application of a growth-enhancing agrochemical would unlikely affect the whole population of bolls equally.

A study conducted in 2005 showed significant effects of a nitro-phenolate based-agrochemical on yield components of bolls growing on a limited number of intermediate sympodia (Fernandez and Correa, 2007a,b). The cotton cultivar used in this 2005 study was FM832 LL. The study was repeated in 2006 using the cultivar FM9063 B2F, but no significant effects were detected (unpublished data). The question arose whether these two cultivars exhibited a different response to the growth-enhancing agrochemical tested.

In 2008, a study was conducted to investigate whether these two cultivars responded differently to foliar applications of Arysta LifeScience North America Corporation's ARY-0469-001. This paper presents data on two primary yield components of first-position bolls, namely boll retention and average boll seed cotton mass per sympodium.

Materials and Methods

The study was conducted at the Texas AgriLife Research and Extension Center at Corpus Christi, Nueces Co. Soil type at the experimental site is a Victoria Clay (VcA). The upland cotton cultivars FM9063 B2F and FM832 LL were planted to a plant population of 50,000/A on 38" row spacing with a 4-row Monosem NG+ vacuum precision planter on March 19, 2008. General production management practices followed recommendations from the Texas AgriLife Extension Service. Fertilizer and a selective herbicide for pre-emergence control of annual grasses and broadleaf weeds were applied broadcast and incorporated in the topsoil before planting. Fertilization rate was 44 lbs ac^{-1} of P_2O_5 and 110 lbs ac^{-1} of N.

Due to lack of adequate rainfall, supplemental irrigation was applied during the growing season using an above-ground drip system. No rainfall events occurred from planting to first-square. Cumulative rainfall from first-square to first open boll in all studies was 2.5 inches (89% of normal). Cumulative rainfall from first-bloom to first-open boll was 2.7 inches in all studies (60% of normal). Irrigation was applied on April 22 (1.24 inches), May 29 (1.91 inches), June 9 (1.44 inches), and June 19, (1.5 inches).

Primary phenological dates for FM9063 B2F were: emergence on March 26, first square on April 22, first bloom on May 28, and first open boll on July 9, while those for FM832LL were: emergence on March 26, first square on April 30, first bloom on June 2, and first open boll on July 13.

Experimental treatments consisted of two cultivars (FM9063 B2R and FM832 LL) treated at mid-to-late bloom with

two rates of the agrochemical ARY 0469-001 (5 and 10 oz/A). Experimental treatments also included an untreated check (UTC) for each cultivar.

Foliar treatments of ARY 0469-001 were applied on June 17, 2008. At the time of treatment application, FM9063 B2F plants had 19.5 main stem nodes, were 26.8, first sympodia was at mainstem node 7.0, and bloom was at main stem node 16.8, while FM832 LL plants had 19.3 main stem nodes, were 30 inches tall, first sympodia was at main stem node 6.0, and bloom was at main stem node 17.0. Treatments were applied at a volume rate (water plus product) of 20 gallons $acre^{-1}$ with a four-row plot sprayer (Model 3220-GC 2wd Lee Spider Spray-Trac, Lee Company, Inc., Idalou, TX). Treatments, including untreated checks (UTC), were arranged in a split-plot design with four replications, where cultivars were randomly assigned to main plots and ARY 0469-001 treatments were randomly assigned to sub-plots. Experimental plots were four rows wide and 75 ft long.

At the time of treatment application, 20 plants per plot (including the UTC plots) were tagged at the sympodium exhibiting a first-position bloom. This procedure would allow for the comparison of first-position bolls of same age across all treatments.

Upon plant defoliation, first-position bolls in 10 sympodia (the one with the tag and nine below the tag) of the 20 tagged plants were individually harvested and grouped per sympodia. Data collected at harvest included the number of bolls and seed cotton per sympodium, and number of tagged plants harvested. Seed cotton per sympodium was ginned and lint and ginned seeds weighed. Ginned seeds were then acid-delinted for separating, counting, and weighing mature and immature seeds. With these data, first-position boll retention and average seed cotton mass, as well as total number of seeds and number of mature seeds per boll and average lint mass per seed were calculated.

Experimental data was organized and processed using Microsoft Excel X for Mac® software (1985-2001 Microsoft Corporation). Statistical analyses of data, including analysis of variance, Fisher's Protected Least Significant Difference (LSD) at 1, 5, and 10% levels of probability, and contrast of means to test the probability (P) of wrongly rejecting the null hypothesis of the difference between a treatment and the untreated check, were performed using SuperANOVA® software version 1.11 (1989-1991 Abacus Corporation, Inc., Berkeley, CA).

Results and Discussion

The untreated check of FM9063 B2F exhibited better first-position boll retention (11%) than the untreated check of FM832 LL across sympodia, although differences in retention were only significant in sympodia 4 6, 7, and 9 (Table 1). While FM9063 B2F had higher retentions (25, 23, and 43%) in sympodia 4, 6, and 7, FM832 LL showed higher retention (33%) in sympodium 9. The increasing water deficits between the last two irrigations (June 9 and June 19), decreased boll retention in both cultivars, but their responses were clearly different. FM9063 B2F was able to maintain higher retention levels (82-85%) in sympodia 6, 7, and 8, retention decreased greatly to about 10% in sympodium 9. FM832 LL, on the other hand, showed an earlier decline in retention in sympodia 6 and 7, but was able to maintain intermediate levels of retention (about 40 -47%) in sympodia 7, 8, and 9. Retention in sympodium 10 was high in both cultivars (85-87%) in response to the last irrigation on June 19.

The effect of ARY 0469-001 on boll retention was minimum and limited to sympodia 9 and 10 of cultivar FM9063 B2F, and only with the 5 oz/A rate (Table 1). This lower rate appeared to have alleviated the severe negative effect of water deficit on boll retention in sympodium 9 (from 10% to 40%), but, on the contrary, it decreased retention in sympodium 10 from 87 to 67%. The reason for this effect is unclear, but on a speculative basis, it may be related to an indirect effect of an increased sink for photosynthates in sympodium 9.

The untreated check of FM832 LL exhibited larger first-position bolls (0.5 g heavier) than the untreated check of FM9063 B2F across sympodia, although differences in boll mass were only significant in sympodia 8 and 10 (1.4 and 1.0 g, respectively) (Table 2). Boll mass was maintained relatively stable from sympodium 2 through 9 by both cultivars, but the untreated check of FM9063 B2F showed a greater decline in boll mass in sympodia 10 than FM832 LL.

The effect of ARY 0469-001 on average boll mass was also minimum and limited to sympodium 10 of cultivar FM9063 B2F, and only with the 5 oz/A rate (Table 2). This lower rate appears to have alleviated the large decline in boll mass exhibited by this cultivar in sympodium 10, with respect to that in sympodium 9, from 52% to 29%.

Results from this study showed significant although only minor effects of the foliar application of ARY 0469-001 and supports the initial concept that these two cultivars respond differently to this agrochemical. These results also indicate that this agrochemical may alleviate stress conditions during boll growth and that this effect may be limited to fruits at early stages of development at the time of application. More studies are needed to further understand the effects of this agrochemical on cotton.

Table 1. Effects of foliar applications of ARY-0469-001 on first-position boll retention per sympodium in cultivars FM9063 B2F and FM832 LL.

Variable: *First-Position Boll Retention per Sympodium (fraction)*

		Sympodium								
Cultivar	**Treatments**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	(Mean Values)									
FM9063 B2F	ARY-0469-001 5 oz/A	0.49	0.76	0.83	0.86	0.76	0.70	0.73	0.41	0.67
	ARY-0469-001 10 oz/A	0.65	0.78	0.78	0.70	0.87	0.88	0.58	0.26	0.70
	UTC	0.62	0.80	0.90	0.85	0.81	0.82	0.61	0.11	0.87
	(P values of contrasts against UTC)									
	ARY-0469-001 5 oz/A	0.2416	0.7166	0.5952	0.9885	0.6308	0.1887	0.3134	0.0453	0.0647
	ARY-0469-001 10 oz/A	0.8437	0.8603	0.3634	0.1369	0.5903	0.4970	0.8003	0.2830	0.1182
FM832 LL	ARY-0469-001 5 oz/A	0.69	0.57	0.64	0.59	0.62	0.50	0.34	0.39	0.76
	ARY-0469-001 10 oz/A	0.66	0.86	0.82	0.72	0.72	0.41	0.37	0.25	0.93
	UTC	0.68	0.66	0.65	0.70	0.58	0.39	0.47	0.44	0.85
	(P values of contrasts against UTC)									
	ARY-0469-001 5 oz/A	0.9624	0.4373	0.9395	0.2593	0.7337	0.1898	0.2517	0.7496	0.3866
	ARY-0469-001 10 oz/A	0.8593	0.1016	0.1923	0.8404	0.2393	0.8113	0.3906	0.1784	0.457
	(P values of contrasts between cultivars' UTC)									
	FM9063 B2F vs. FM832 LL	0.6017	0.2328	0.0638	0.1295	0.0572	0.0002	0.2111	0.0291	0.8726

Table 2. Effects of foliar applications of ARY-0469-001 on first-position boll mass per sympodium in cultivars FM9063 B2F and FM832 LL.

Variable: *First-Position Boll Mass per Sympodium (g)*

		Sympodium								
Cultivar	**Treatments**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	(Mean Values)									
FM9063 B2F	ARY-0469-001 5 oz/A	4.44	4.73	4.82	4.63	5.37	5.18	4.47	4.64	3.30
	ARY-0469-001 10 oz/A	4.78	4.85	4.73	4.90	4.85	5.56	3.94	3.43	2.84
	UTC	4.99	4.80	4.77	5.02	5.33	5.15	3.89	4.52	2.18
	(P values of contrasts against UTC)									
	ARY-0469-001 5 oz/A	0.2630	0.8729	0.8582	0.4636	0.9345	0.9620	0.3030	0.5811	0.0382
	ARY-0469-001 10 oz/A	0.6589	0.9086	0.8961	0.8155	0.3214	0.5523	0.9254	0.4498	0.1928
FM832 LL	ARY-0469-001 5 oz/A	5.19	5.64	5.45	5.26	5.47	5.22	5.19	4.43	3.48
	ARY-0469-001 10 oz/A	4.95	5.69	5.13	5.83	5.03	4.71	4.39	4.88	2.71
	UTC	5.29	5.51	5.01	5.59	5.74	4.93	5.27	4.46	3.26
	(P values of contrasts against UTC)									
	ARY-0469-001 5 oz/A	0.8391	0.7759	0.1718	0.5296	0.5939	0.6744	0.8949	0.9680	0.6490
	ARY-0469-001 10 oz/A	0.4789	0.6975	0.7006	0.6409	0.8097	0.7530	0.1304	0.6137	0.2750
	(P values of contrasts between cultivars' UTC)									
	FM9063 B2F vs. FM832 LL	0.5333	0.1344	0.4279	0.2879	0.3971	0.7474	0.0259	0.7209	0.0442

References

Fernandez, C.J., and J.C. Correa. 2007a. Effects of Chaperone application timing and rate on first-position boll production components: 1. Boll retention and boll mass. pp 509-513. *In* 2007 Proceedings Beltwide Cotton Conferences. January 9-12. New Orleans, LA. National Cotton Council of America. Memphis, TN.

Fernandez, C.J., and J.C. Correa. 2007b. Effects of Chaperone application timing and rate on first-position boll production components: 2. Number and average mass of seeds. pp 514-518. *In* 2007 Proceedings Beltwide Cotton Conferences. January 9-12. New Orleans, LA. National Cotton Council of America. Memphis, TN.