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MANAGEMENT OF "SECONDARY PESTS" IN TRANSGENIC BT COTTON

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Abstract

The cotton aphid, *Aphis gossypii*, and the banded-winged whitefly, *Trialeurodes abutilonea*, were noteworthy "secondary" pests during 2001, and populations of both pests dramatically increased in transgenic *Bt* cotton (NuCOTN33B). Our trials addressed the effectiveness of several new insecticides when compared with existing materials. Overall, the newer insecticides, acetamiprid (Assail) and thiamethoxam (Centric), provided excellent control of both aphids and whiteflies, while the performance of some existing compounds was inadequate.

Introduction

Since the introduction of cotton containing genetic information from *Bacillus thuringiensis* (*Bt*), producers growing the transgenic crop have been dealing with insect pests that infrequently required attention in the past. Some of these pests were traditionally considered "secondary pests" – secondary to the boll weevil, *Anthonomus grandis*, and the complex of the tobacco budworm, *Heliothis virescens*, and the cotton bollworm, *Helicoverpa zea*. Pests such as aphids and whiteflies have always been "secondary" to major pests, but over the years, there has been much research and debate over population levels needed to justify their control. In *Bt* cotton, aphids and whiteflies continue to receive additional attention because of their destructive potential in the low-spray environment of the crop. When chemical control of these pests is warranted, information about the effectiveness of new and existing products is needed. During 2001, we conducted insecticide efficacy trials for the cotton aphid, *Aphis gossypii*, and the banded-winged whitefly, *Trialeurodes abutilonea*, in southeast Arkansas.

Materials and Methods

Plots of cotton (NuCOTN33B) planted on 4 June 2001 in loam soil at the Southeast Branch Experiment Station near Rohwer, Arkansas, were four rows (38 in) by forty feet. Treatments were randomly assigned to plots and were replicated four times. Standard field preparation, fertilization, and irrigation procedures were followed using Arkansas Recommendations (Chapman et al. 2000).

Insecticides were applied on 6, 10, and 17 July for the aphid trials (I and II) and on 14 and 22 August and on 11 September 2001 for the whitefly trial. Insecticides and field-use rates for the aphid trials were dicrotophos (Bidrin 8, Amvac, Los Angeles, CA, 0.33 and 0.50 lb [AI]/A), bifenthrin (Capture 2, FMC, Philadelphia, PA, 0.05 lb [AI]/A), thiacloprid (Calypso 4, Bayer, Kansas City, MO, 0.036 and 0.047 lb [AI]/A), imidacloprid/cyfluthrin (Leverage 2.7, Bayer, 0.0634 lb [AI]/A), oxamyl (Vydate 3.77, DuPont, Wilmington, DE, 0.33 lb [AI]/A), imidacloprid (Provado 1.6F, Bayer, 0.0125 and 0.047 lb [AI]/A), thiamethoxam (Centric 25WG, Syngenta, Greensboro, NC, 0.0237 and 0.0473 lb [AI]/A), dimethoate (Dimethoate 4EC, Helena, 0.25 lb [AI]/A), and acetamiprid (Assail 70WP, Aventis Crop Science, Research Triangle Park, NC, 0.0374 and 0.05 lb [AI]/A). Insecticides and field-use rates for the whitefly trial were bifenthrin (Capture 2, FMC, 0.05 lb [AI]/A), thiacloprid (Calypso 4, Bayer, 0.036 and 0.047 lb [AI]/A), imidacloprid/cyfluthrin (Leverage 2.7, Bayer, 0.0634 lb [AI]/A), imidacloprid (Provado 1.6F, Bayer, 0.047 lb [AI]/A), thiamethoxam (Centric 25WG, 0.0473 lb [AI]/A), acephate (Orthene 97, Valent, Walnut Creek, CA, 0.75 lb [AI]/A), and acetamiprid (Assail 70WP, 0.05 and 0.075 lb [AI]/A). Insecticides were applied using a 4-row CO_2-powered plot boom attached to a hi-cycle sprayer calibrated to apply 10 GPA at 42 psi. Insect populations were estimated by counting/ approximating all aphids or whitefly adults found on the underside of each of 10 leaves (uppermost large leaf) in each plot. Data were processed using Agriculture Research Manager (ARM) (Gylling Data Management, Inc., Brookings, SD), and means were separated using Least Significant Difference (LSD) procedures following significant F tests and Analysis of Variance (ANOVA).

Results and Discussion

Aphid Trials

On 2 July, pre-treatment counts of aphid populations resulted in an average of 20 aphids per leaf. By 3 days after the first treatment of insecticides (3DAT1), aphid numbers had reached 73 aphids per leaf in the untreated control (UTC) (Fig. 1). All products, except for Dimethoate and Capture, provided significant control of aphids 3DAT1, while both rates of Assail and Centric provided the best control. Kharboutli and Allen (2000) reported similar results with efficacy of Centric on aphids in

trials in southeast Arkansas. During mid-July, the cotton aphid fungus, *Neozygites fresenii*, caused an epidemic, and aphid numbers "crashed". By 3DAT2 (Fig. 2), aphid numbers were less than 8 aphids per leaf in the UTC plots. In the second aphid trial, pre-treatment counts resulted in an average of 41 aphids per leaf. Three days after treatment (3DAT), Centric, Bidrin, and Vydate all significantly reduced aphid numbers (Fig. 3), but only Centric provided extended control at 5DAT (Fig. 4).

Whitefly Trial

On 13 August, pre-treatment counts of banded-winged whitefly populations resulted in an average of 76 adult whiteflies per leaf. By 2 days after the first application of insecticides (2DAT1), whitefly numbers decreased to 46 whitefly adults per leaf in the UTC (Fig. 5). All materials provided significant control of whitefly adults 2DAT1, while the highest rate of Assail provided the best control. A recent comparable trial reported similar positive results with efficacy of Assail on silverleaf whiteflies, *Bemisia argentifolii* (Natwick and Deeter 2001). By 7DAT1, populations of adult whiteflies had rebounded, and no product provided significant extended suppression (Fig. 6). One day after the second treatment (1DAT2), Leverage, Assail, Centric, and Capture all provided significant control of whitefly adults (Fig. 7). By 7DAT2, Assail and Centric were the only materials that provided significant suppression of whiteflies (Fig. 8).

Acknowledgments

We thank the staff at the Southeast Branch Experiment Station, Rohwer Branch, for their assistance. We also thank Syngenta, Bayer, FMC, Valent, AMVAC and Aventis for their support of this research.

Disclaimer

The mention of trade names in this report is for informational purposes only and does not imply an endorsement by the University of Arkansas Cooperative Extension Service.

References

Chapman, S. L. 2000. Soil Test Recommendations Guide. University of Arkansas Division of Agriculture publication: 39.

Kharboutli, M. S. and C. T. Allen. 2000. Comparison of insecticides for cotton aphid control. Arkansas Agriculture Experiment Station, Report 198.128-130.

Natwick, E. T. and B. D. Deeter. 2001. Comparison of neonicotinoid with pyrethroid insecticides for control of whitefly in cotton. *In* Proceedings, 2001 Beltwide Cotton Production Conferences, National Cotton Council of America, Memphis, TN, 2: 906-908.

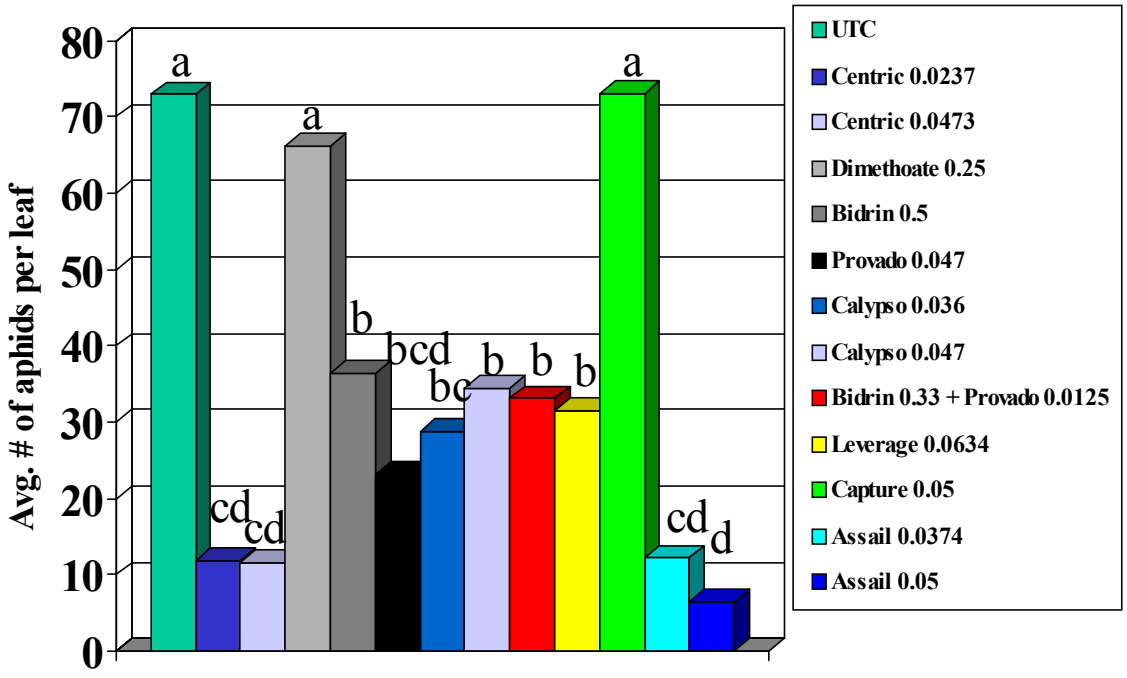

Figure 1. Average numbers of cotton aphids, *Aphis gossypii*, per leaf on 9 July 2001, 3 days after first application/treatment (3DAT1). Bars with a letter in common do not differ significantly, P > 0.05, LSD.

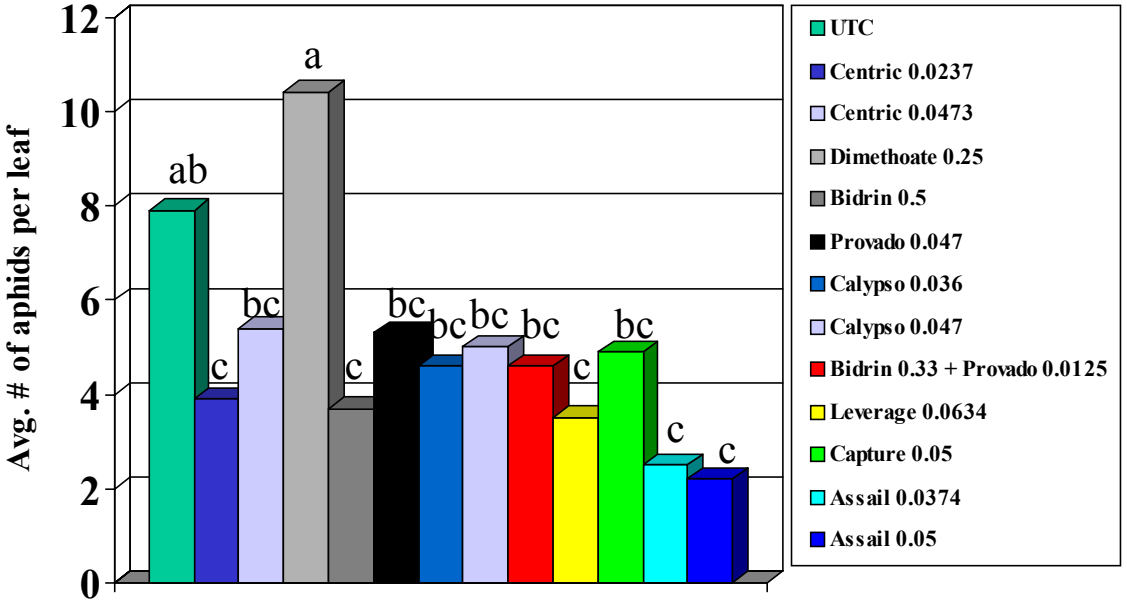

Figure 2. Average numbers of cotton aphids, *Aphis gossypii*, per leaf on 13 July 2001, 3 days after second application/treatment (3DAT2). Bars with a letter in common do not differ significantly, P > 0.05, LSD.

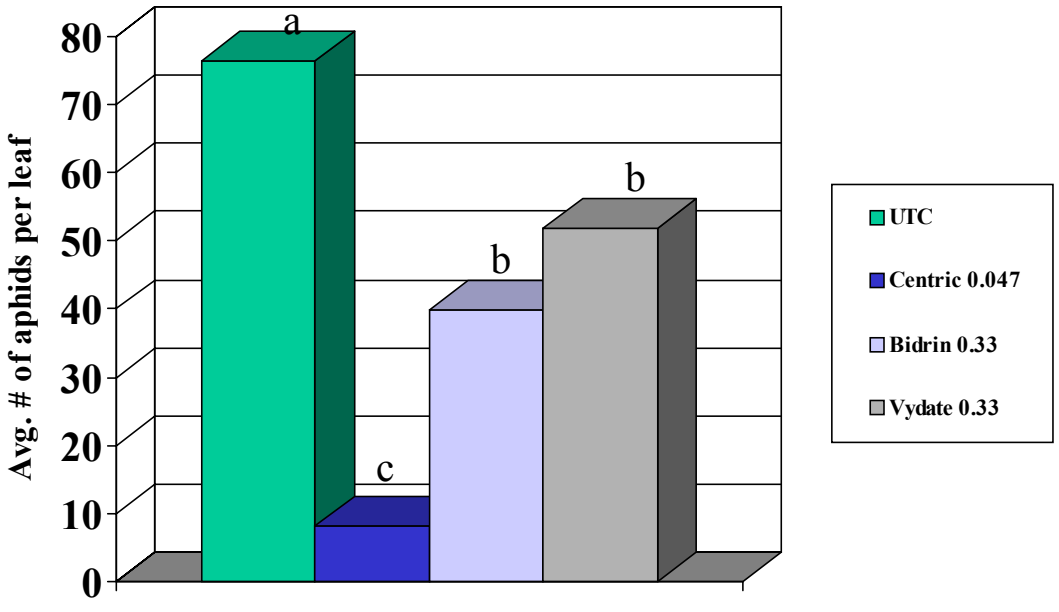

Figure 3. Average numbers of cotton aphids, *Aphis gossypii*, per leaf 3 days after treatment (3DAT). Bars with a letter in common do not differ significantly, P > 0.05, LSD.

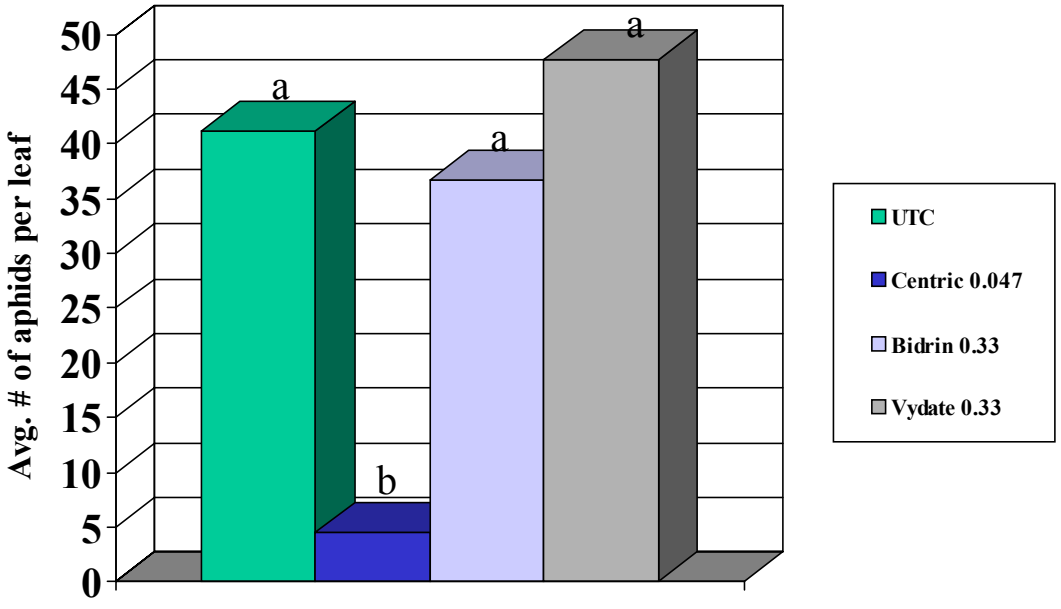

Figure 4. Average numbers of cotton aphids, *Aphis gossypii*, per leaf 5 days after treatment (5DAT). Bars with a letter in common do not differ significantly, P > 0.05, LSD.

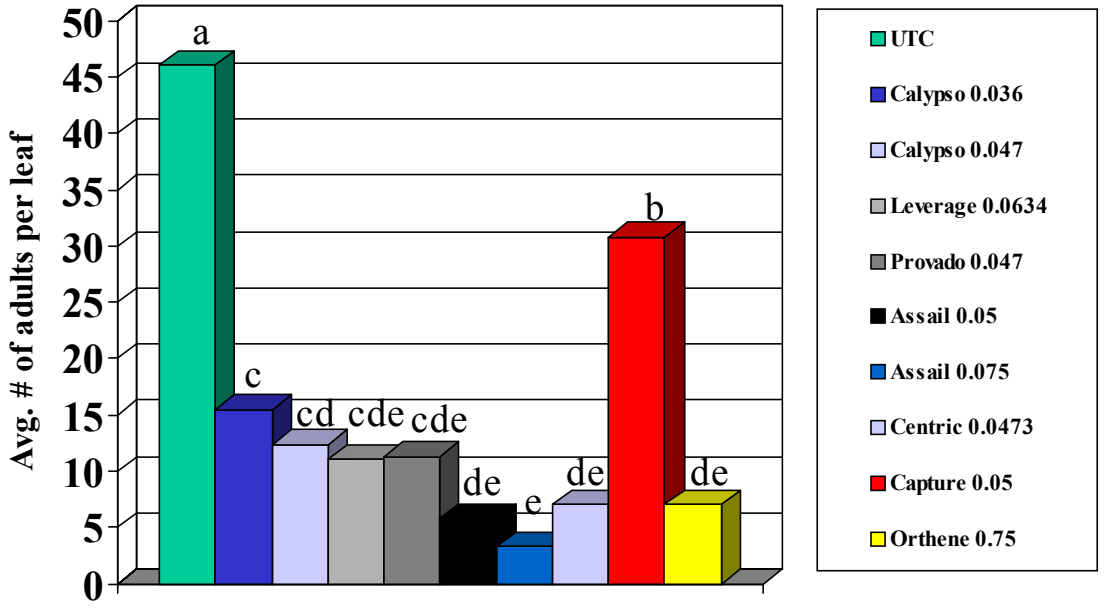

Figure 5. Average numbers of banded-winged whiteflies, *Trialeurodes abutilonea*, per leaf on 16 August 2001, 2 days after first application/treatment (2DAT1). Bars with a letter in common do not differ significantly, P > 0.05, LSD.

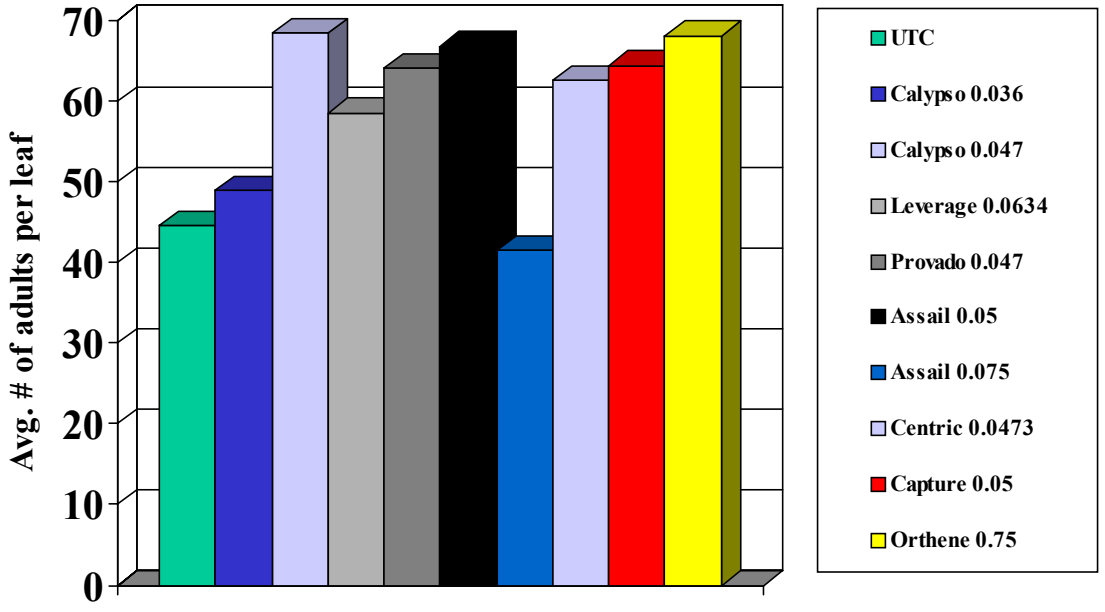

Figure 6. Average numbers of banded-winged whiteflies, *Trialeurodes abutilonea*, per leaf on 21 August 2001, 7 days after first application/treatment (7DAT1). No significant differences, P > 0.05.

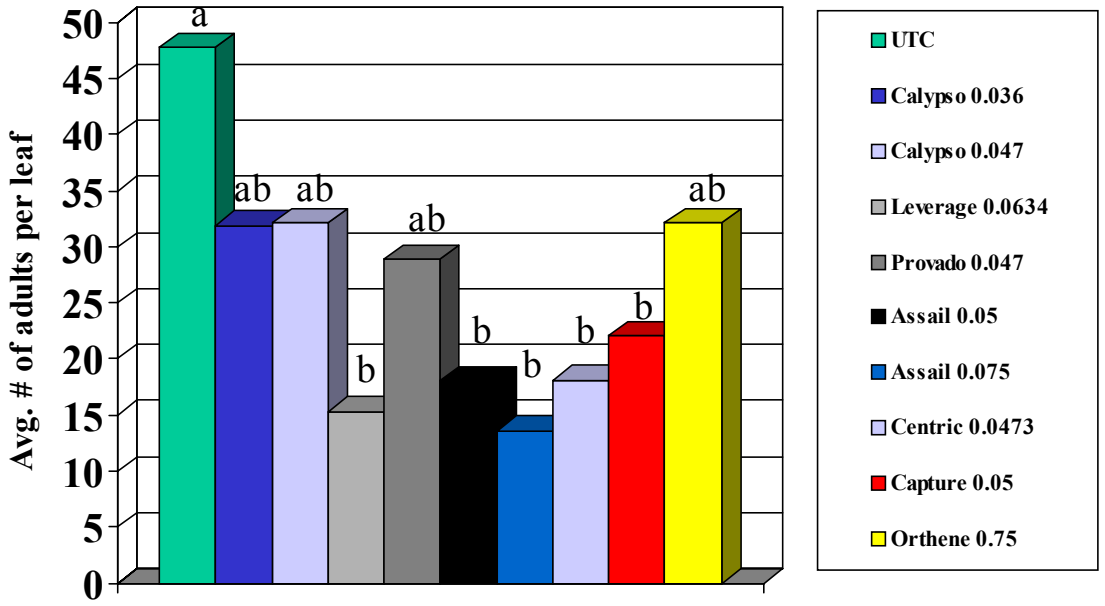

Figure 7. Average numbers of banded-winged whiteflies, *Trialeurodes abutilonea*, per leaf on 23 August 2001, 1 day after second application/treatment (1DAT2). Bars with a letter in common do not differ significantly, P > 0.05, LSD.

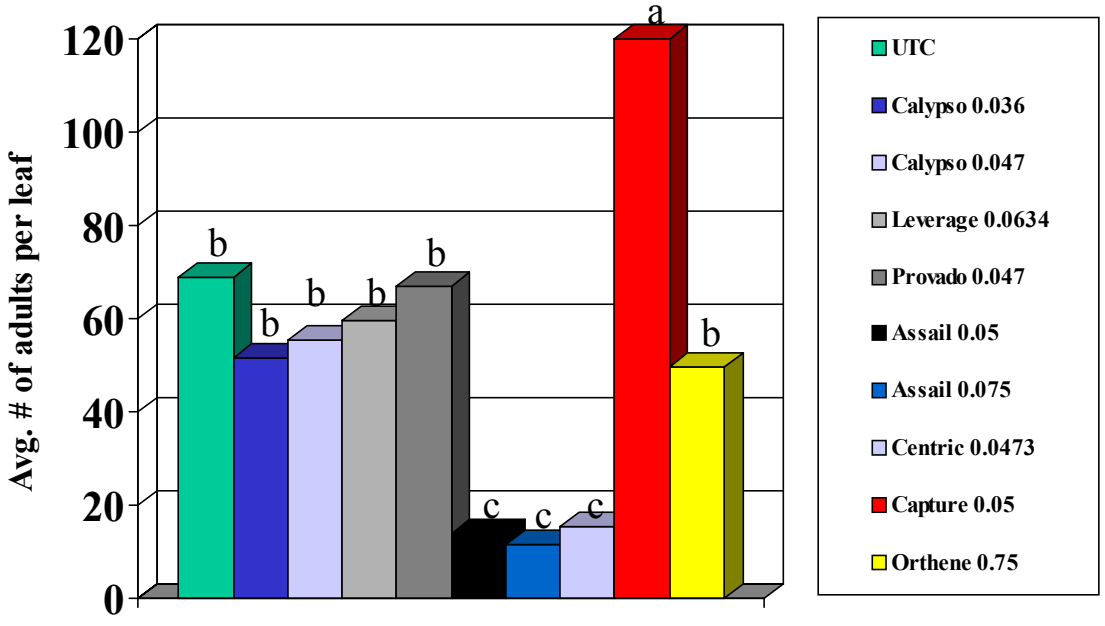

Figure 8. Average numbers of banded-winged whiteflies, *Trialeurodes abutilonea*, per leaf on 29 August 2001, 7 days after second application/treatment (7DAT2). Bars with a letter in common do not differ significantly, P > 0.05, LSD.