Preliminary Field Evaluation of an Insect Growth Regulator, Buprofezin, for Control of the Sweetpotato Whitefly, *Bemisia tabaci*

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Abstract

Two rates of buprofezin and a combination, buprofezin+endosulfan, were compared against Ovasyn® and the standard pyrethroid combination Danitol®+Orthene®. Targeted pests were all stages of the sweetpotato whitefly (SPWF). Danitol+Orthene was the most effective treatment against all SPWF stages. All buprofezin treatments, including the buprofezin+endosulfan combination, were moderately effective against all SPWF stages relative to the untreated check, while Ovasyn had control levels similar to the untreated check. Danitol+Orthene had the highest yield at 4030.2 lbs seed cotton/A, and buprofezin+endosulfan had the second highest yield, 2172 lbs /A. All other treatments yielded amounts similar to the untreated check, 863.0 lbs /A. Effects of these control practices on beneficial and other non-target arthropods have not yet been analyzed. Lygus *populations were extreme in this test and favored the Danitol+Orthene treatment over the SPWF-specific buprofezin treatments.*

Introduction

Insect growth regulators (IGRs) may provide new alternatives to current sweetpotato whitefly (SPWF) management systems. Their mode of action prevents pest insects from achieving maturity or completing their life cycle. In this manner, subsequent cycles of reproduction and population increase are interrupted, and problematic pest cycles are broken. These newer chemistries also offer much hope in the management of such complex pest problems as resistance development. Use of IGRs may provide respites in the usage of existing insecticides while removing in-field populations which may be resistant to conventional compounds. Respites may also allow the effectiveness of many present insecticides to be prolonged. Another benefit in the use of IGRs is their specificity against pest insects which limits any negative impact on beneficial species. Because IGRs are highly selective against target species and have several modes of activity, IPM systems can be more effective in using undisturbed populations of beneficial species. Buprofezin, marketed as Applaud®, is currently used in some European and Southeast Asian countries for greenhouse and sweetpotato whitefly and rice planthopper control. It is not yet registered in this country and is being considered as a potential management tool for SPWFs. This study is one field evaluation of the ability of buprofezin to control SPWF. Our objective was to compare buprofezin to standard commercial insecticides for efficacy on SPWFs and impact on off-target species. Buprofezin lacks lethal activity on adult sweetpotato whiteflies, and for this reason, a combination of the IGR with an insecticide (endosulfan added as needed) was included. Results presented here are preliminary and do not include information from the extensive sampling of non-target species.

Methods and Materials

Deltapine 5415 was planted 6 April at the Maricopa Agricultural Center in plots, 24 rows (40") x 60 feet (4800 sq.ft.). Experimental design was a randomized completed block using three replications. Plots were separated by 35' of bare ground, while reps were separated by 40' bare-ground areas. Five insecticidal entries and an untreated check were used. Entries were: two rates of buprofezin, Lo (0.25 lb ai/A) & Hi (0.38 lb ai/A); the combination buprofezin (0.38) plus endosulfan (0.75); another combination, Danitol (0.20) plus Orthene (0.50); and Ovasyn (0.25) alone. Insecticides were applied by ground, broadcast, over-the-top using TwinJet® 8003 nozzles at 20 GPA. First date of treatment occurred on 7 July; however, on this date buprofezin was the sole treatment applied. Six subsequent applications used all materials and combinations. These were made ca. weekly. Three methods of sampling were used: leaf turns and sweeps for adults, and leaf counts for immature numbers. Leaf turns began 26 May and continued weekly for ca. 13 weeks. All adult whiteflies found on the underside of fully expanded leaves, second to fifth node below the main terminal, were counted. Leaf counts began 28 June and continued weekly for a total of 8 sample dates. Five leaves per plot from the the fourth or fifth node position below main terminals were collected and microscopically examined in the laboratory. A one inch square area located at the petiole base and between the major lateral veins was tallied for eggs and nymphs. Sweep samples were taken weekly. Collected insects were bagged in-field and transported to the laboratory for tallying by species and numbers. Data were analyzed using JMP® software (SAS Institute) and transformed as needed prior to analysis. Dunnett's comparison was used for treatment comparison to the untreated check. Defoliation was completed September 13 and harvest began November 3. A modified two row picker was used to obtain seed cotton yields per plot from 4 center rows of each plot.

Results and Conclusions

Adults: Early counts of adults (prior to treatment initiation) were low (<1 adult/leaf). No differences among treatment or replications were observed before the first application. Buprofezin treatments were started on 7 July (at 2.4 adults / leaf), and the rest began on 15 July (at ca. 6.7 adults / leaf). Significant differences (P=0.001) in adult numbers due to treatment were not observed until 19 July. Danitol+Orthene and buprofezin+endosulfan were consistent in their effect on adult numbers (Fig. 1). The two buprofezin alone treatments did have an impact on adult whiteflies, but their activity was not consistently significant over all dates. The two rates of buprofezin were not significantly different in adult numbers. Efficacies of the entries overall, in a descending order of efficacy, were: Danitol+Orthene ≥ buprofezin+endosulfan > buprofezin-Hi = buprofezin-Lo > Ovasyn = untreated.

Immatures: Prespray counts of both immature stages, eggs and nymphs, revealed no significant differences in treatments or in replications.

Eggs: Significant differences (P=0.002) in egg numbers were not observed until 26 July, after two or three applications. ANOVA of egg numbers on each of the dates thereafter ranged from significant to highly significant (P≤ 0.05–0.000). For each sample date, Danitol+Orthene was the only treatment which was consistently effective in reducing whitefly egg populations (Fig. 2). Buprofezin+endosulfan was also effective but not as consistent as Danitol+Orthene. Buprofezin alone, at both rates, did reduce egg numbers relative to the untreated check but not always significantly. Egg numbers in both the Ovasyn and untreated plots were similar through the season until 24 August when eggs within Ovasyn treatments suddenly decreased significantly compared to the check (Fig. 2). Efficacies of the entries against eggs, in a descending order of efficacy, were: Danitol+Orthene ≥ buprofezin+endosulfan > buprofezin-Hi = buprofezin-Lo > Ovasyn ≥ untreated.

Nymphs: Treatment effects on nymphal populations were similar to egg populations in that no significant effects were observed until 26 July (Fig. 3). Danitol+Orthene again had the lowest numbers of nymphs relative to the check for most sample dates. Buprofezin treatments did reduce nymphal populations in comparison with the untreated check, but not significantly nor at a level comparable with the Danitol+Orthene treatment. Ovasyn and

untreated plots had similar nymphal numbers throughout the season. Efficacies of the entries against nymphs, in a descending order of efficacy, were: Danitol+Orthene > buprofezin+endosulfan = buprofezin-Hi = buprofezin-Lo > Ovasyn = untreated.

Yields: Yields for the Danitol+Orthene and buprofezin+endosulfan treatments were significantly higher than the check (Table 1). The remaining three treatments did not yield well compared to the untreated check; however, *Lygus* populations were very high (see Ellsworth & Meade, this volume). Neither buprofezin nor Ovasyn have significant activity against *Lygus*.

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Table 1. Rates of test compounds and their respective yields (seed cotton / A).

Trt No.	Compound	Rate (lbs ai/A)	Seedcotton (lbs/A)
1	Buprofezin (Lo)	0.25	943
2	Buprofezin (hi)	0.38	828
3	Buprofezin + endosulfan	0.38 + 0.75	2173
4	Danitol + Orthene	0.20 + 0.50	4030
5	Ovasyn	0.25	913
6	Untreated	—	863

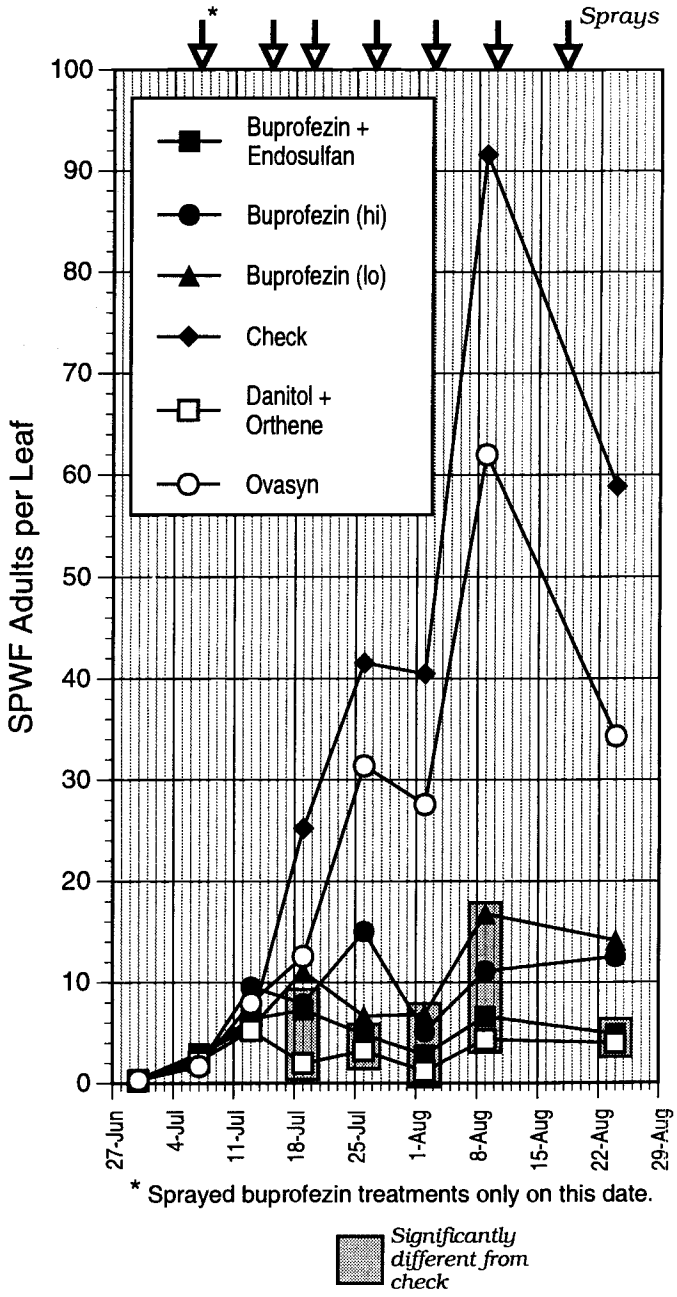

Figure 1. Number of SPWF adults / leaf for each sample date. Arrows indicate spray applications.

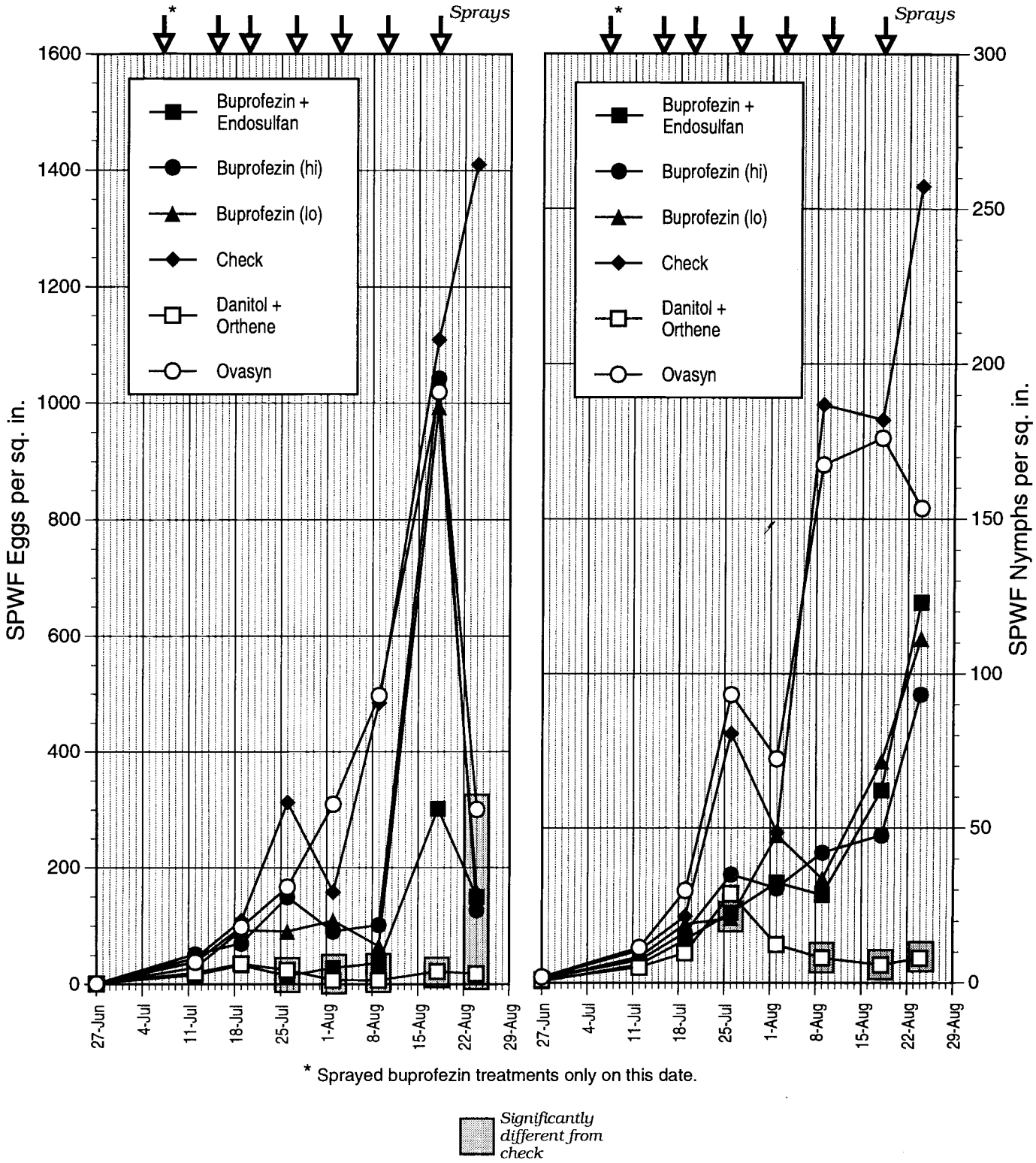

Figure 2. Number of SPWF eggs / sq. in. of leaf for each sample date. Arrows indicate spray applications.

Figure 3. Number of SPWF nymphs / sq. in. of leaf for each sample date. Arrows indicate spray applications.