THE ROLE OF PROVADO IN WESTERN COTTON IPM PROGRAMS

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Abstract

During 1995, Provado 1.6 F became registered in California for foliar uses on cotton to control various sucking insects including aphids and lygus bugs. This paper summarizes large scale trials evaluating yield responses as well as effects on beneficial insects. Provado provided 7-10 days of control of lygus bugs and up to 14 days of control of aphids. The most significant yield increases were observed where Provado was used and aphids were the major pest. Where lygus and aphids were present, tank mixes of Provado and Baythroid produced the greatest enhancement of yield.

A significant correlation between the number of aphids at the peak infesta-tion and the reduction in yield was determined. Where the peak infestation ranged between 30 and 150 aphids/leaf, yields dropped approximately four pounds for every one aphid/leaf increase. Provado exhibited little detri-mental effect on big-eyed bugs and minute pirate bugs and a modest effect on damsel bugs. Effectiveness of Provado is optimized when it is applied early in the development of the infestation and by ground.

Introduction

Provado (imidacloprid) belongs to a unique class of insecticides called the chloronicotinyls. It's novel mode of action (Schroeder and Flattum, 1984), effectiveness on several key cotton pests such as whiteflies, aphids and lygus bugs (Almand and Mullins,1991; McNally et al., 1994), and its selectivity to beneficial insects (Stark et al.,1995) position it as an integral component of cotton IPM programs. This paper summarizes trials conducted to evaluate the effects on beneficial insects residing in cotton fields as well as the relationship of the use of Provado and cotton yield responses.

Materials and Methods

Mortality Trials

Two lygus trials and five aphid trials were conducted in California by Bayer representatives and cooperators. One or two foliar applications were made using the labeled rate of .044 lb ai/ac. A randomized complete block was used with four reps per treatment. Each rep was at least four rows by 50 feet. Aphid and lygus mortalities were recorded up to 16 days after treatment.

Yield Trials

Three large scale trials were conducted. The first two trials had four reps/ treatment; each treatment comprised approximately 0.6 acres. These trials evaluated the effect of two applications of Provado 1.6 F at 0.046 lb ai/ac as well as tank mixes of Provado and Baythroid 2 at 0.6 and 0.8 oz ai/ac and a sequential treatment of Provado followed by a soil application of Admire 2 F at 0.125 or 0.1875 lbs ai/ac. In addition several pyrethroids including Baythroid and Capture were evaluated without tankmixing with Provado. The two foliar applications were made at a nine day interval (Madera field) or at a 19 day interval (Reedley). Aphids were the primary pest. Aphids appeared seven days after the second application in the Reedley field and nine days after the second application in the Madera field.

The other trial contained adjacent unreplicated treatments of approximately two acres each. This trial evaluated the effect of Baythroid 2 at 0.6 oz ai/ac and a tank mix of Baythroid 2 at 0.6 oz ai/ac and Provado 1.6 F at 0.046 lb ai/ac on lygus bugs. Two foliar applications (the first applied at 1st square, the second nine days later) of each treatment were made using a commercial sprayer with drop nozzles pumping 16 GPA and 100 PSI. In all trials, the cotton was harvested from four rows using a commercial harvester.

Beneficial Insect Trial

Provado 1.6 F at 0.046 lb ai/ac was compared with Baythroid 2 at 0.05 lb ai/ac to determine the effect on minute pirate bugs, big-eyed bugs and damsel bugs. Two applications were made at a 14-day interval using a CO_2 backpack sprayer pumping 20 GPA and 40 PSI. Each of the four reps/treatment was 25 feet by 75 feet.

Results and Discussion

Mortality Trials

Acceptable control of lygus bugs was achieved after seven days in one trial (Figure 1) and 14 days in the other (Figure 2). The activity of Baythroid was markedly better as excellent activity extended throughout the 16 DAT duration of the trials. Nauen (1995) has shown that Provado causes sublethal antifeeding effects which may go unnoticed until yields are taken. On the average, we would not expect observable mortality to extend beyond 7-10 days after treatment.

Excellent control of cotton aphids was achieved by Provado (Figure 3). The mean control in five trials was over 80% at seven days after treatment and 70% at 14 days after treatment. This is comparable to Furadan and superior to MSR, endosulfan (Phaser), Lorsban and

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:859-862 (1996)
National Cotton Council, Memphis TN

Capture. We would expect field mortality to extend 10-14 days after treatment. Where populations are building, a second application may be necessary. However optimum control can be achieved when Provado is applied at the onset of the developing infestation (Mullins and Christie, 1995).

Yield Trials

In the lygus trial, an increase of approximately 150 lbs lint/acre over the untreated plot was observed in the Baythroid plot and a 250 lb/ac increase in lint was observed in the plots treated with the Provado/Baythroid tank mix (Figure 4).

In the Reedley aphid trial, the highest yielding treatment was the two foliar applications of Provado where an increase of 390 lbs of lint/ac over the un-treated (Figure 5). Combinations of Baythroid and Provado, or Provado and Admire also resulted in large yield increases of approximately 300 lbs of lint per acre. The treatments containing only pyrethroids resulted in no yield increases - aphid populations exceeded those in the untreated plots and were responsible for the detrimental effects on yield.

When the number of aphids at the peak infestation in each treatment in each trial was compared to the yield at the end of the season, a significant correlation was obtained (Figures 6 and 7). Even though the Madera field yielded more than the Reedley field (estimated yields with no aphids present = 1216 lbs lint/ac in the Madera field, 1008 lbs lint/ac in the Reedley field), a similar relationship between aphids and yield existed. Where peak levels of aphids ranged between 30/leaf and 150/leaf a decrease of approximately 4 lb lint/ac resulted from an increase of a peak population of 1 aphid/leaf. This is much higher than the relationship calculated by A. Harris (1995) who analyzed data gathered by Andrews and Kitten (1989). Harris calculated an 0.2 lb decrease in the yield of seed cotton per acre for every increase of one aphid-day infestation during the season. In our California fields aphid peak populations last 10-20 days. Assuming one aphid/leaf at the peak would be roughly equivalent to 10 aphid-days, and assuming a 35% turnout of lint from seed cotton, an increase of one aphid-day in California would be associated with a decrease of 1.1 lb of cotton seed/ac - five times that calculated by Harris. One factor that may account for the difference is that our correlations were calculated from data (treatments) from the same fields while Andrews and Kitten obtained their data from different fields. In addition, poor growing conditions from the cold wet spring in California during 1995 appeared to predispose the cotton plants to more severe damage from insect feeding. Vargas et al (1996) reported that higher than normal square shedding was observed in cotton during 1995 where only modest populations of lygus bugs appeared, resulting in lower economic injury levels. Economic injury levels for aphids based on $20.00/ac loss in yield would be 5 aphids/leaf by our calculations from 1995 California data and approximately 25 aphids/leaf from the 1989 Andrews and Kitten data.

Beneficial Insect Trial

Provado exhibited no effect on minute pirate bugs after seven days (Figure 8). At 14 DAT, minute pirate bug populations were reduced, but that was most likely due to a reduction in their food source. Big-eyed bugs were reduced 50% after seven days, but recovered at 14 DAT (Figure 9). Damsel bugs were reduced by 65% after seven days and remained low at 10 DAT (Figure 10). It is not known if the reduction in Damsel bugs was due to residual activity of Provado or a scarcity of prey.

Conclusion

The introduction of Provado allows growers to utilize a product of an alternative chemistry. This should lend itself to a resistance management program in concert with products of more traditional chemistries such as the organo-phosphates, carbamates and the pyrethroids. When applying Provado, one should address the following considerations. Because of Provado's low volatility and combination systemic/contact activity, applications should be applied early in the development of an infestation and coverage should be maximized. Higher-volume ground applications are more efficacious than lower-volume air applications and should be employed when feasible. Provado's selective nature should reduce the potential of subsequent outbreaks of other pests and its low acute and chronic toxicity makes Provado one of the safest chemicals available to the cotton grower.

References

1. Almand, L., and J. Mullins. 1991. NTN 33893: A New Insecticide for Thrips/Aphid/Whitefly Control. In: Proceedings of the Beltwide Cotton Production Conference: 80-81.

2. Anderews, G. L., and W. F. Kitten. 1989. How Cotton Yields are Affected by Aphid Populstions Which Occur During Boss Set. In: Proceedings of the Beltwide Cotton Production Conference: 291-294.

3. F. A. Harris. 1995. Cotton Aphid Managaement Options: Whether, When, And What to do About Cotton Aphid. In: Proceedings of Cotton Incorporated Crop Management Seminar-Resistance Management in the Mid-South.

4. McNally, P. S., A. C. Scoggan, and J. W. Mullins. 1994. Cotton Aphid Management Using Admire. In: Proceedings of the Beltwide Cotton Production Conference: 1013-1015.

5. Mullins, W., and D. Christie. 1995. Management of Aphids, Whiteflies and Plant Bugs with Foliarly Applied

Imidacloprid. In: Proceedings of the Beltwide Cotton Production Conference: 868-870.

6. Nauen, R. 1995. Behavior Modifying Effects of Low Systemic Concentrations of Imidacloprid on *Myzus persicae* with Special Reference to an Antifeeding Response. Pestic. Sci. 44:145-153.

7. Schroeder, M. and R. Flattum. 1984. The Mode of Action and Neurotoxic Properties of the Nitromethylene Heterocycle Insecticides. Pestic. Biochem. and Physio. 22:148-160.

8. Stark, J. D., P. C. Jepson, and D. F. Mayer. 1995. Limitations to Use of Topical Toxicity Data for Predictions of Pesticide Side Effects in the Field. J. of Econ. Entomol. 88:1081-1088.

9. Vargas, R. L. Godfrey, and P.Goodell. 1996. 1995 Cotton Summary. In: California Cotton Review (Newsletter).

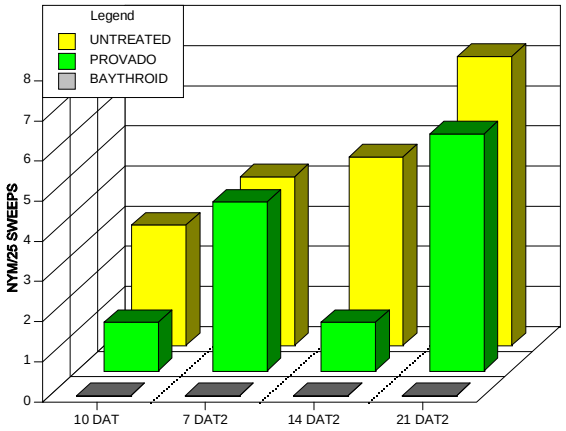

Figure 1. Control of lygus on cotton Woodlake, CA, 1995

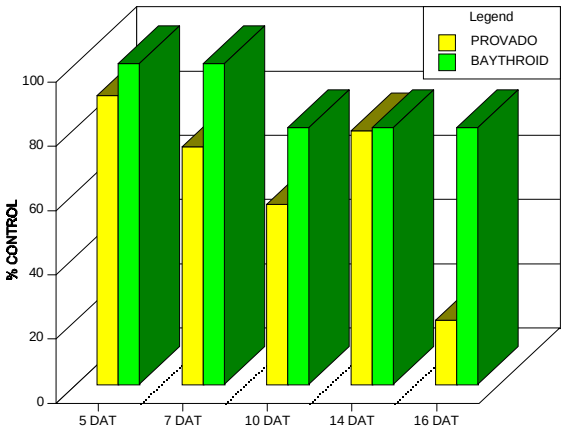

Figure 2. Control of lygus on cotton Reedley, CA, 1995

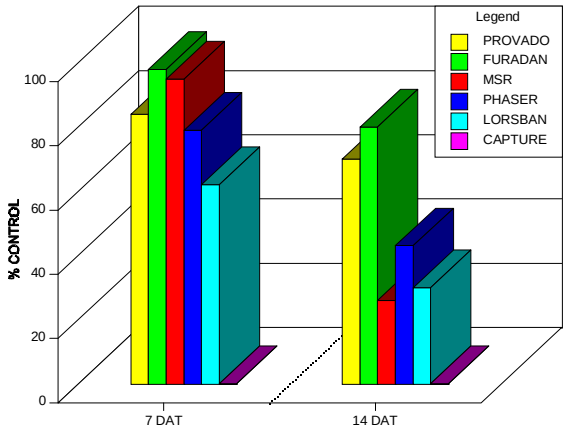

Figure 3. Aphid Control in Cotton Mean of five trials in California (Tracs, Sawtooth Ag., S. Wright, L. Godfrey, P. McNally, 1995)

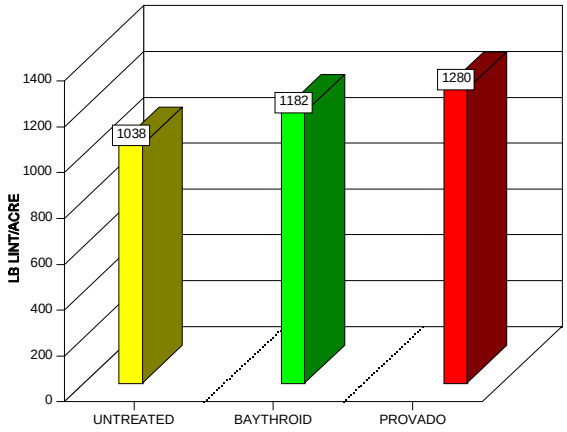

Figure 4. Effect on Yield from Lygus and Aphid Control Madera, CA, 1995

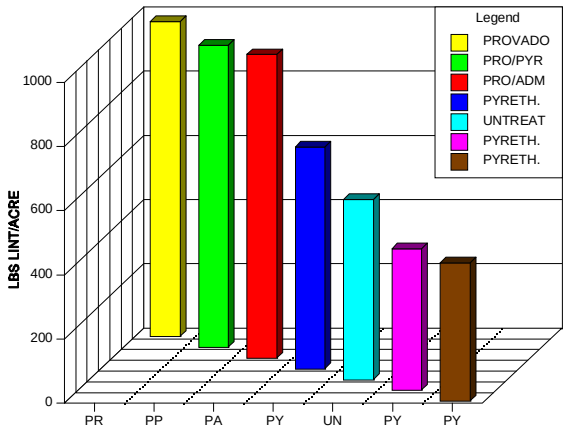

Figure 5. Effect of Provado and Pyrethroids on Yield. Aphids = Major Pest Reedley, CA, 1995

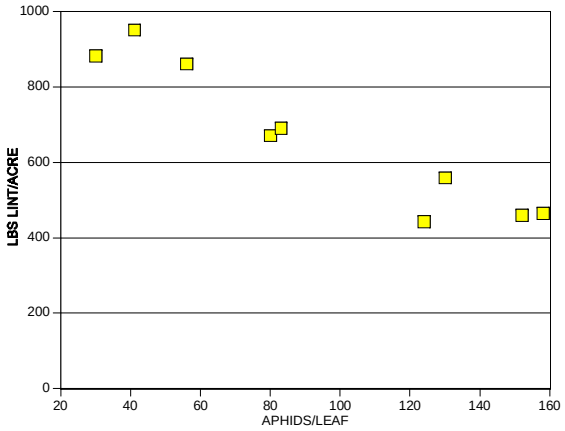

Figure 6. Cotton Aphids and Yields Y = -3.7x + 1008. r2 = 0.90. Reedley, CA, 1995

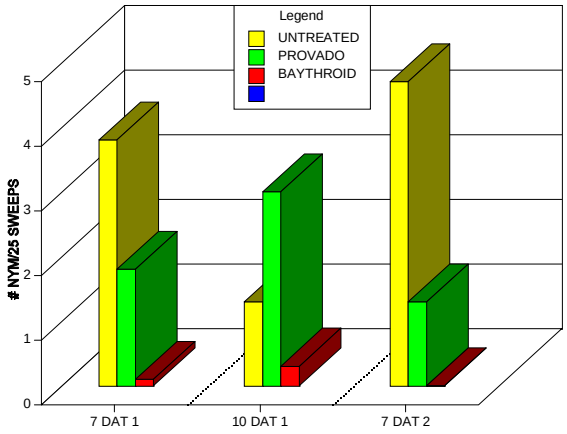

Figure 9. Effect of Provado and Baythroid on Big-Eyed Bug Woodlake, CA, 1995

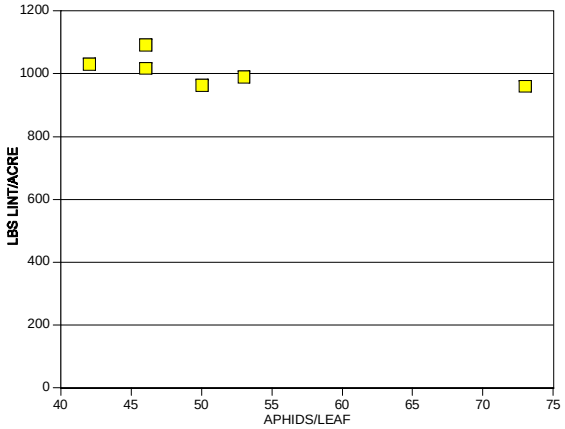

Figure 7. Effect of Aphids on Cotton Yield Y = -3.9x + 1216. r2 = 0.55. Madera CA, 1995

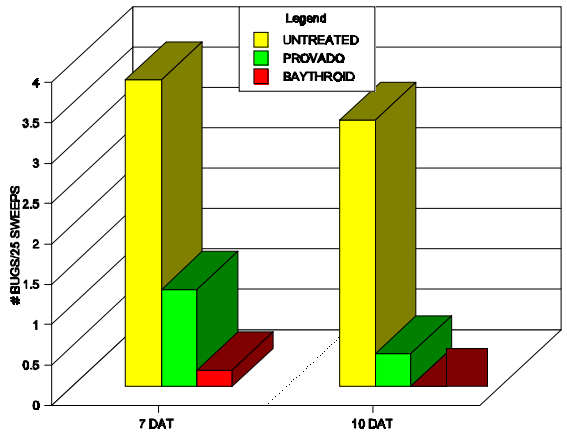

Figure 10. Effect of Provado and Baythroid on Damsel Bug Woodlake, CA, 1995

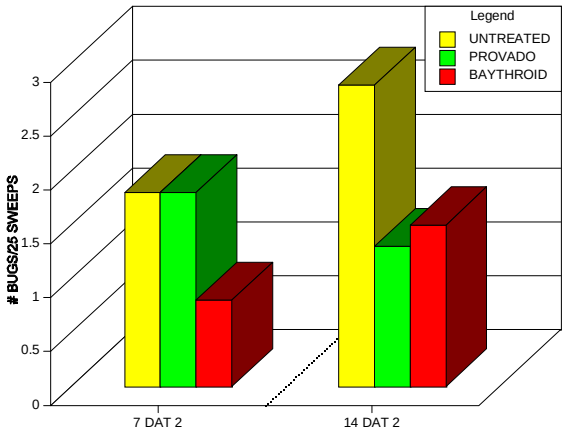

Figure 8. Effect of Provado and Baythroid on Minute Pirate Bug Woodlake, CA, 1995