2002 BELTWIDE COTTON CONFERENCES, ATLANTA, GA – JANUARY 8-12

NOVALURON - A BENZOYLPHENYL UREA FOR COTTON INSECT CONTROL

R. Tim Weiland
Uniroyal Chemical Company, a subsidiary of Crompton Corporation
Middlebury, CT
James Whitehead
Makhteshim-Agan of North America, Inc.
Oxford, MS

Abstract

Novaluron is a new generation benzoylphenyl urea active against insects of the orders Lepidoptera, Coleoptera, Hemiptera and Diptera through both larval ingestion and contact. This insect growth regulator has been field tested in cotton across the U.S.A. since 1998. Rates as low as 0.011 to 0.022 lbs. ai per acre are shown to control *Bemesia argentifolii* immatures, equivalent to current standard products. The heliothines, *Heliocoverpa virescens and H. zea*, exhibited a rate response to novaluron and appear to require at least 0.04 lbs. ai per acre to achieve acceptable control. Activity on foliar feeding Lepidoptera is expected. A rate response on *Lygus* (spp.) was also seen in field trials with 0.04 lbs. ai novaluron per acre giving similar nymph control to current standards. Research continues across the cottonbelt to further define rates and insect spectrum.

Introduction

Novaluron is a new generation Insect Growth Regulator (IGR) in the benzoylphenyl urea chemical class. It exhibits broad-spectrum IGR activity against numerous insect species of the orders Lepidoptera, Coleoptera, Hemiptera and Diptera (Ishaaya et al., 1996). The basic manufacturer of novaluron is Makhteshim Agan of North America (Makhteshim Chemical Works) and Uniroyal Chemical Company is a Development and Marketing Partner. During the last quarter of 2001 novaluron was registered in the U.S.A. for use on ornamentals as a reduced risk pesticide. The rationale used to obtain reduced risk designation was satisfied since novaluron has very low acute and chronic toxicities to mammals, low toxicities to birds and fish, low impact on beneficial organisms and it quickly degrades in soil and water. Additionally, it can be used as a replacement for organophosphates, carbamates and pyrethroids.

As was mentioned above, novaluron is a benzoylphenyl urea IGR. It acts on immature stages of numerous insect species of the orders Lepidoptera, Coleoptera, Hemiptera and Diptera by inhibiting chitin biosynthesis causing interference with cuticle formation. Novaluron works primarily by ingestion however, limited contact activity has been observed. High mortality of early instar larvae occurs when treated foliage is ingested. Additionally, novaluron acts as an ovicide in some cases.

Several formulations of novaluron are being developed in the United States. These include the following: 0.83EC for use on field crops and vegetables, 7.5WG for use on pome fruits, and 0.83SC for use on ornamentals.

Novaluron is registered in approximately forty countries around the world for use on cotton, corn, soybeans, orchards, citrus, ornamentals and numerous vegetable crops. It is registered for use against several cotton pests in Argentina, Australia, Bolivia, Brazil, Columbia, Israel, Paraguay, Peru, Uruguay and Turkey. Novaluron development for use in cotton in the U.S.A. was initiated in 1998. Trial work has been targeted against key pests including Lepidopterans, whiteflies, plantbugs and thrips. Usage rates will depend on target species and ranges from 0.02 to 0.09 lbs ai/acre.

Makhteshim Agan of North America plans to proceed with development of novaluron and submission for the cotton registration is planned for the second quarter of 2002. Reduced risk status will be sought for this use.

This paper presents some results that have been generated to date.

Materials and Methods

Bakersfield, CA 1998

Insecticides evaluated on immature nymph populations of *Bemesia argentifolii* were novaluron 0.83EC at 0.011, 0.022 and 0.045 lbs. ai/acre, Applaud 70WP at 0.044 lbs. ai/acre and Knack 0.86EC at 0.054 lbs. ai/acre. Maxxa cotton was planted and test plots were 10 feet wide by 50 feet long. Treatments were arranged in a RCB design with 4 replications. The insecticides were applied on 25 August, leaf samples were taken 7, 10, 14, 17 and 21 days after application and mean number of immatures were determined.

Macon Ridge, LA 2000
In this study, novaluron 0.83EC at 0.02, 0.04 and 0.06 lbs. ai/acre, Steward 1.6SC at 0.1 lbs. ai/acre, Tracer 4SC at 0.067 lbs. ai/acre, and Decis 1.5 EC at 0.025 lbs. ai/acre were tested on non-irrigated BXN 47 cotton for heliothine Lepidoptera control. Plots were 4-row (40 inch centers) wide by 50 feet long. Treatments were arranged in a RCB design with 4 replications. The insecticides were applied on 7, 13 and 19 July. The number of damaged squares and/or bolls per 100 sampled in a plot were determined 5 days after the first application, 4 days after the second application and 5 days after the third application.

Bossier City, LA 2000
Products evaluated for heliothine Lepidoptera control were novaluron 0.83EC at 0.02, 0.04 and 0.06 lbs. ai/acre, Steward 1.6SC at 0.11 lbs. ai/acre, and Tracer 4SC at 0.067 lbs. ai/acre. DPL 429 - Roundup Ready cotton was planted and test plots were 4-row (40 inch centers) wide by 100 feet long. The experimental design was a RCB with 4 replications. Insecticide applications were made on 10, 17, 24 and 31 July. The number of heliothine damaged bolls per 100 sampled in a plot were determined 7, 10 and 14 days after the last application.

Cheneyville, LA 2000
In this study, novaluron 0.83EC at 0.011, 0.022 and 0.045 lbs. ai/acre, Leverage 2.7SC at 0.079 lbs. ai/acre and Orthene 90SC at 0.5 lbs. ai/acre were evaluated on non-irrigated STV 4892 B/R cotton for *Lygus* (spp.) control. Test plots were 4-row (40 inch centers) wide by 40 feet long. A completely randomized study design with 4 replicates was used. The insecticides were applied on 5, 16, and 25 August. The percent nymph infested terminals out of 100 assessed were determined 6 days after the first application, 8 days after the second application and 7 days after the third application by visually examining twenty-five randomly selected terminals in each plot.

Prattville, AL 2000
Insecticides tested for control of *Lygus lineolaris* nymphs were novaluron 0.83EC at 0.011, 0.022 and 0.045 lbs. ai/acre, Leverage 2.7SC at 0.065 lbs. ai/acre and Bidrin 8 Water Miscible Insecticide at 0.025 lbs. ai/acre. ST 125 BRR cotton was planted and test plots were 8 row (40 inch apart) wide by 300 feet long. Applications were made on 5 and 10 July in adjacent strips. One and five days after the first application and 7 days after the second application 6-row feet of cotton was beat over a drop cloth at 4 randomly selected sites in a treatment. Nymph numbers were counted and mean number per 100 row feet was determined.

Results

Bakersfield, 1998
At each of the evaluation dates all of the chemical treatments resulted in immature populations of *Bemesia argentifolii* that were significantly lower than the untreated control (Table 1). There were no differences in control across novaluron rates or across treatments for any evaluation time.

Macon Ridge, LA 2000
Heliothine pressure was relatively light but results showed that the higher novaluron rates (0.04 and 0.06 lbs. ai/acre) performed similarly to the Steward and Tracer standards (Table 2). The lower rate of novaluron (0.02 lbs. ai/acre) and Decis gave weaker control in contrast to the other treatments.

Bossier City, LA 2000
Assessment of damaged bolls several times after four applications of insecticides indicated that 0.04 and 0.06 lbs. ai/acre of novaluron controlled potential damage from heliothines statistically similar to Tracer and Steward (Table 3). The 0.02 lbs. ai/acre rate failed to control heliothines to the extent of the other treatments at the last evaluation time.

Cheneyville, LA 2000
All treatments statistically lessened plantbug nymphal pressure by 6 days after the first of 3 applications (Table 4). The higher rates of novaluron gave equal control to Orthene 8 days after the second application, while populations in the Leverage treatment had increased to a level greater than found in the untreated plots. The lowest rate of novaluron (0.011 lbs. ai/acre) also exhibited populations similar to the untreated at this time. Nymphal populations had drastically lessened in the untreated plots by 7 days after the third application and all treatments had significantly lower plantbug populations in comparison to the untreated.

Prattville, AL 2000
Both Leverage and Bidrin had lowered *Lygus lineolaris* nymphal populations starting 1 day after the first application (Table 5). All novaluron treatments lowered populations starting 5 days after the first application and activity was maintained through 7 days after the second application. The highest novaluron rate (0.045 lbs. ai/acre) exhibited superior control to the lower rates at that time.

Concluding Remarks

Initial cotton trials in the U.S.A. indicate novaluron has activity on *Bemesia argentifolii*, heliothines, and *Lygus* (spp.). A rate of 0.045 lbs. ai/acre or more appears to be needed for heliothine and *Lygus* control. A lower rate will control *Bemesia argentifolii* populations. Preliminary trials on thrips and stinkbugs suggest novaluron is active on the latter. Field research continues on all these insects and future publications will address them, including foliar feeding Lepidoptera and novaluron's minimal activity on the beneficial insect complex.

Acknowledgments

The authors thank those institutes and consultant organizations that helped establish, monitor and provide results presented here.

References

Ishaaya, I., S. Yablonski, Z. Mendelson, Y. Monsour, and A.R. Horowitz. 1996. Novaluron (MCW-275), a novel benzoylphenyl urea, suppressing developing stages of Lepidopteran, whitefly and leafminer pests. *In:* Brighton Crop Protection Conference - Pests & Diseases - 1996, The British Crop Protection Council, Major Print Ltd., Nottingham, Great Britain, pp. 1013-1020.

Table 1. Mean number of *Bemesia argentifolii* immatures per leaf disk at 7, 10 14, 17 and 21 days after application (Bakersfield, CA 1998).

Treatment	Rate lbs. ai./A	Immatures per 10 leaves				
		7 DAA	10 DAA	14 DAA	17 DAA	21 DAA
Untreated		32 a	37 a	35 a	46 a	44 a
Novaluron 0.83EC	0.011	8 e	10 c	15 bc	11 b	16 b
Novaluron 0.83EC	0.022	6 e	10 c	10 bc	10 b	9 b
Novaluron 0.83EC	0.045	6 e	12 bc	10 bc	12 b	8 b
Applaud 70WP	0.044	12 cde	9 c	9 bc	8 b	9 b
Knack 0.86EC	0.054	9 de	9 c	9 bc	8 b	9 b

Means within a column followed by the same letter do not significantly differ (P=0.05, Duncan's New MRT). Additional novaluron formulation results have been omitted from the table for simplicity. Application date: 25 August.

Table 2. Mean percent damaged squares and/or bolls by heliothine Lepidoptera averaged for various evaluation times across 3 applications (Macon Ridge, LA 2000).

Treatment	Rate lbs. ai./A	Mean percent damaged squares/bolls
Untreated		22.9 a
Novaluron 0.83EC	0.02	1.7 bc
Novaluron 0.83EC	0.04	0.8 cde
Novaluron 0.83EC	0.06	0.7 de
Steward 1.6SC	0.1	0.8 cde
Tracer 4SC	0.067	0.3 e
Decis 1.5EC	0.025	1.9 b

Means followed by the same letter do not significantly differ (P=0.05, Duncan's New MRT). Application dates: 7, 13, 19 July.

Table 3. Bolls damaged by heliothine Lepidoptera per 100 sampled at 3 assessment times after the 4th application (Bossier City, LA 2000).

Treatment	Rate lbs. ai./A	Damaged bolls		
		7 DAA	10 DAA	14 DAA
Untreated		4 b	11 b	21 d
Novaluron 0.83EC	0.02	1 a	4 a	14 c
Novaluron 0.83EC	0.04	1 a	2 a	6 ab
Novaluron 0.83EC	0.06	0 a	5 ab	2 a
Tracer 4SC	0.067	0 a	1 a	1 a
Steward 1.6SC	0.11	0 a	1 a	3 a

Means within a column with the same letter do not significantly differ (P=0.05, Duncan's New MRT). Application dates: 10, 17, 24, 31 July.

Table 4. Mean percent *Lygus* (spp.) nymph-infested terminals at various days after each of 3 applications (Cheneyville, LA 2000).

Treatment	Rate lbs. ai./A	Mean percent infested terminals			
		PRE-TREAT	6 DAA#1	8 DAA#2	7 DAA#3
Untreated		15 a	30 a	21 ab	5 a
Novaluron 0.83EC	0.011	16 a	11 b	18 ab	0 b
Novaluron 0.83EC	0.022	16 a	11 b	3 b	0 b
Novaluron 0.83EC	0.045	10 a	8 b	6 b	0 b
Leverage 2.7SC	0.079	12 a	9 b	27 a	1 b
Orthene 90SC	0.5	18 a	5 b	9 ab	1 b

Means within a column followed by the same letter do not significantly differ (P=0.05, Student-Newman-Keuls).
Application dates: 5, 16, 25 August.

Table 5. Mean number of *Lygus lineolaris* nymphs per 100 row feet at various days after each of 2 applications (Prattville, AL 2000).

Treatment	Rate lbs. ai./A	Mean number of *Lygus* per 100 row feet		
		1 DAA#1	5 DAA#1	7 DAA#2
Untreated		53	75	33
Novaluron 0.83EC	0.011	75	25	4
Novaluron 0.83EC	0.022	67	8	8
Novaluron 0.83EC	0.045	36	13	0
Leverage 2.7SC	0.065	17	8	0
Bidrin 8	0.025	20	4	0

Application dates: 5 and 10 July.