PERFORMANCE OF INTREPID® 80 WSP UNDER SECTION 18 EXCEPTION IN COTTON IN TEXAS

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Abstract

Intrepid® (Methoxyfenozide) mimics the action of the ecdysone hormone, strongly binding to its receptor site in Lepidoptera species. This insecticide must be ingested by the target larvae and cessation of feeding begins within a few hours. Mortality occurs between 1-7 days, depending on species and growth stage. Intrepid® is not systemic, but exhibits limited translaminar movement. Intrepid® does not have vapor activity. It is highly effective against common cotton foliage feeders at rates that range from 0.05 to 0.15 pounds of active ingredient per acre (1 to 3 ounces of product per acre). Due to its specificity for Lepidoptera, Intrepid® does not cause mortality of beneficial arthropods, making it ideal for IPM programs.

In 2000 Intrepid® insecticide was granted a Section 18 and numerous demonstration trials were carried out throughout the Northwestern part of Texas and the Brazos Valley, corroborating the effectiveness of Intrepid for the control of beet armyworm and the cabbage looper.

Introduction

Growth and development in insects, which are punctuated by periods of molting, are regulated by the steroid 20-hydroxyecdysone (20E; molting hormone; ecdysterone) and the sesquiterpenoid Juvenile Hormones (JHs). In the adult stage, both of these hormones are also involved in the regulation of reproductive maturation.

The molting process is initiated by an increase in the titer of the 20E and is completed following the decline of 20E titers and the release of the eclosion hormone. As a larva prepares to undergo larval molt, it stops feeding. With the increasing 20E titer, the epidermis separates from the old cuticle (apolysis), and the ecdysial space is filled by molting fluid. Once 20E titer begins to decline, enzymes in the molting fluid are activated to start the digestion of the procuticle. When the 20E titer has declined to the basal level, escape of the old cuticle (ecdysis) is initiated by the release of peptides and hormones. Feeding then resumes and endocuticular deposition continues during the intermolt period (Chapman, 1969, and Dhadialla et al., 1998).

Mode-of Action

Methoxyfenozide (RH-2485, Intrepid®) Diacylhydrazine insecticide has a binding coefficient 30 to > 670 times higher than 20E in inducing molts on certain Lepidoptera species studied. Field and laboratory studies done with common lepidopteran insects of cotton show that larvae generally stop feeding within 4-16 h after ingestion of toxic doses of this insecticide. By this time the molting process is initiated, and by 24 h, intoxicated larvae prematurely slip their old head capsules in an attempt to ecdyse. However, they are unable to do so, probably because of sustained effective levels of Intrepid® in the hemolymph and the epidermis. The presence of the effective titers of ecdysteroid agonist (Methoxyfenozide) in the hemolymph results in the lack of eclosion hormone release, which, during a normal molt occurs only after a decline in 20E titer to near basal level.

Methoxyfenozide was classified as reduced risk pesticide by the US EPA. This classification is based on its low toxicity found on mammalian, avian, terrestrial and aquatic toxicological studies, as well as lack of impact on pollinators and beneficial arthropods. Degradation of Intrepid® is primarily by microbial action.

Methodology

A small-plot trial (Tables 1-6) was established to compare several rates of Intrepid 2F to other commonly used insecticides for the control of defoliators in Texas in 2000. In this trial treatments were replicated 4 times in a randomized block design consisting of plots of 5 rows (16.6 feet) by 40 feet treating with insecticide only 4 rows. Treatments were applied with a carbon dioxide backpack sprayer delivering 12 gallons per acre at 32 psi, and adjuvant (Latron CS-7 @ 0.05% V/V). Data were collected from the middle 2 treated rows by shaken the foliage into a 3-feet drop cloth on 2 sites per plot were insect activity was noticed.

Large plot demonstrations ($\geq$ 20.0 acres) were conducted in Northwestern Texas and the Brazos River Valley, using a single block per treatment and the grower's equipment or commercial aerial applicators.

Eight evaluations in selected areas of the field where insect activity occurred (not at random) were made with a 3-feet long beating cloth. Visual ratings of defoliation were taken from the same sites. Data presented here, number of larvae per species on 6 feet of row and defoliation, per specified dates, have the goal to show the effectiveness of the insecticides and their comparative speed of kill.

In one trial (Table 9) 200 feet of row, repeated 2 times per treatment, were sampled with a vacuum-blower device (as described on Sparks and Norman, 1998) with the goal of obtaining beneficial arthropods and assess the impact of the insecticides on them.

Results and Discussion

Effective and commercially acceptable rates to control beet armyworm and cabbage looper on cotton with Methoxyfenozide were found to range between 0.05 - 0.12 pounds of active ingredient per acre.
Tables 1-6 show the comparative efficacy of Intrepid® 2F (the formulation to be available in the market in 2001 in the US). Rates of 0.06 and 0.12 lb. ai per acre provided similar control when compared to other insecticides registered for their use on cotton in terms of number of worms per row. Numbers of larvae greatly exceeded the economic threshold at the moment of the application (66.5 per 6 feet of row [local economic threshold being estimated at $\geq$ 18.3]) but declined throughout the course of the trial. However, a very useful parameter to estimate the impact of the worm injury to the plants can be seen with the defoliation evaluation (Table 6). Here the Methoxyfenozide rate 0.03 separates from 0.06 and 0.12 allowing us to focus our research efforts and commercial promotion on rates close to 0.06 pounds of active ingredient per acre, close to the rate of 1.0 oz. of the 80WSP formulation.

Tables 7-9 are comparisons with the new commercially available insecticide Emamectin benzoate, leaving an untreated area in a corner of the field used as untreated check. Performance of both insecticides was similar, but Intrepid showed its effectiveness faster (see evaluations of 2 DAA and 8 DAA). Another aspect of the performance of Methoxyfenozide was evaluated in this trail in terms of its effect on the beneficial arthropod fauna. Intrepid®, as compared with the untreated check, does not appear to reduce the number of beneficials (no statistical analysis performed) as it was reflected in the total number of arthropods obtained in 200 feet of row collected with the aid of a vacuum-blower device.

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Table 1. Control of the Beet Armyworm (*Spodoptera exigua*) with Methoxyfenozide (Intrepid®) on irrigated cotton. Small-plot trial. Edmonson, Texas.

	Beet Armyworms per 6 feet of row			
Treatment and rate[1]	**-1 DAA**	**7 DAA**	**12 DAA**	**27 DAA**
Intrepid 2F @ 0.03	27.0	4.0	0.2	0.4
Intrepid 2F @ 0.06	27.0	2.0	0.2	0.0
Intrepid 2F @ 0.12	27.0	3.2	0.4	0.2
Untreated check	27.0	12.7	6.49	5.5

[1] Pounds of active ingredient per acre.

Table 2. Control of the Beet Armyworm (*Spodoptera exigua*) with Methoxyfenozide (Intrepid®) vs commercial insecticides on irrigated cotton. Small-plot trial. Edmonson, Texas.

	Beet Armyworms per 6 feet of row			
Treatment and rate[1]	**-1 DAA**	**7 DAA**	**12 DAA**	**27 DAA**
Intrepid 2F @ 0.06	27.0	2.0	0.2	0.0
Tracer @ 0.025	27.0	4.4	2.4	3.5
Denim @ 0.01	27.0	2.4	1.2	3.0
Steward @ 0.09	27.0	1.0	1.0	0.4
Untreated check	27.0	12.7	6.49	5.5

[1] Pounds of active ingredient per acre.

Table 3. Control of Cabbage Looper (*Trichoplusia ni*) with Methoxyfenozide (Intrepid®) on irrigated cotton. Small-plot trial. Edmonson, Texas.

	Cabbage Loopers per 6 feet of row			
Treatment and rate[1]	**-1 DAA**	**7 DAA**	**12 DAA**	**21 DAA**
Intrepid 2F @ 0.03	39.5	7.7	3.4	3.7
Intrepid 2F @ 0.06	39.5	4.7	1.0	0.7
Intrepid 2F @ 0.12	39.5	4.4	2.0	0.7
Untreated check	39.5	28.0	11.2	7.4

[1] Pounds of active ingredient per acre.

Table 4. Control of Cabbage Looper (*Trichoplusia ni*) with Methoxyfenozide (Intrepid®) and commercial insecticides on irrigated cotton. Small-plot trial. Edmonson, Texas.

	Cabbage Loopers per 6 feet of row			
Treatment and rate[1]	**-1 DAA**	**7 DAA**	**12 DAA**	**21 DAA**
Intrepid 2F @ 0.06	39.5	4.7	1.0	0.7
Tracer @ 0.025	39.5	2.2	1.8	0.0
Denim @ 0.01	39.5	4.4	3.2	5.4
Steward @ 0.09	39.5	0.2	0.3	0.0
Untreated check	39.5	28.0	11.2	7.4

[1] Pounds of active ingredient per acre.

Table 5. Control of the Beet Armyworm (*Spodoptera exigua*) and Cabbage Looper (*Trichoplusia ni*) with Methoxyfenozide (Intrepid®) on irrigated cotton. Small-plot trial. Edmonson, Texas.

	Percent defoliation			
Treatment and rate[1]	**-1 DAA**	**7 DAA**	**12 DAA**	**21 DAA**
Intrepid 2F @ 0.03	3.6	4.7	5.8	4.7
Intrepid 2F @ 0.06	3.6	3.2	3.5	2.7
Intrepid 2F @ 0.12	3.6	2.5	3.0	1.7
Untreated check	3.6	7.2	6.8	10.5

[1] Pounds of active ingredient per acre.

Table 6. Control of the Beet Armyworm (*Spodoptera exigua*) and Cabbage Looper (*Trichoplusia ni*) with Methoxyfenozide (Intrepid®) and commercial insecticides on irrigated cotton. Small-plot trial. Edmonson, Texas.

	Percent defoliation			
Treatment and rate[1]	**-1 DAA**	**7 DAA**	**12 DAA**	**21 DAA**
Intrepid 2F @ 0.06	3.6	3.2	3.5	2.7
Confirm 2F @ 0.12	3.6	4.5	4.3	3.5
Tracer @ 0.025	3.6	3.2	3.8	3.0
Denim @ 0.01	3.6	3.7	4.0	5.7
Steward @ 0.09	3.6	2.7	3.5	3.5
Untreated check	3.6	7.2	6.8	10.5

[1] Pounds of active ingredient per acre.

Table 7. Control of the Beet Armyworm (*Spodoptera exigua*) with Methoxyfenozide (Intrepid®) and Emamectin Benzoate (Denim®) on irrigated cotton. Seagraves, Texas.

	Beet Armyworms per 6 feet of row			
Treatment and rate[1]	**-1 DAA**	**2 DAA**	**8 DAA**	**14 DAA**
Intrepid 80 WSP @0.05.	1.5	3.0	0.8	0.1
Denim @0.01	1.5	20.2	5.3	0.3
Untreated check[2]	1.5	28.6	6.6	0.6

[1] Pounds of active ingredient per acre.

[2] Untreated check located in the North corner of the field outside of the reach of the irrigation by the central pivot.

Table 8. Control of the Beet Armyworm (*Spodoptera exigua*) with Methoxyfenozide (Intrepid®) and Emamectin Benzoate (Denim®) on irrigated cotton. Seagraves, Texas.

	Percent defoliation per 6 feet of row			
Treatment and rate[1]	**-1 DAA**	**2 DAA**	**8 DAA**	**14 DAA**
Intrepid 80 WSP @0.05.	5.0	5.0	8.8	5.1
Denim @0.01	5.0	12.0	11.8	5.8
Untreated check[2]	5.0	12.0	6.3	8.2

[1] Pounds of active ingredient per acre.

[2] Untreated check located in the North corner of the field outside of the reach of the irrigation by the central pivot.

Table 9. Control of the Beet Armyworm (*Spodoptera exigua*) with Methoxyfenozide (Intrepid®) and Emamectin Benzoate (Denim®) on irrigated cotton. Seagraves, Texas.

	Beneficial arthropods in 300 feet of row 8 DAA			
Treatment and rate[1]	**LBB**	**BEB**	**Nabids**	**Spiders**
Intrepid 80 WSP @ 0.05.	12	3	5	7
Denim @ 0.01	0	1	0	5
Untreated check[2]	3	1	8	5

LBB= Ladybird beetle Adults and larvae combined, BEB= Big-eyed bug adults.

[1] Pounds of active ingredient per acre.

[2] Untreated check located in the North corner of the field outside of the reach of the irrigation by the central pivot.