EFFICACY OF NEW INSECTICIDES TO CONTROL BEET ARMYWORM IN NORTHEASTERN MEXICO

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Abstract

Newly registered and soon to be registered insecticides for use on cotton were tested in three representative locations in Northeastern Mexico, in order to assess their effectiveness and provide an alternative to commonly used insecticides, mainly chlorpyrifos, due to the lack of effectiveness. All new products were efficacious in controlling beet armyworm (*Spodoptera exigua*), and the major difference among them was their speed of action. Chlorfenapyr, RH-2485 and spinosad were the products that demonstrated a greater speed of control. All new products expressed their maximum effectiveness 5-7 days after their application, and because they offer a different mode-of-action, are a good tool for resistance management.

Introduction

The beet armyworm (*Spodoptera exigua* Hübner) is one of the most important pests on cotton throughout Northern México. Recently, a lack of effectiveness of commonly used insecticides has been detected, levels of resistance have reached up to more than 10,000X for chlorpyrifos and more than 5,000 for thiodicarb (Terán-Vargas 1997). Difficulties in the control of this pest lead us to screen products than have been recently registered for use on cotton and products that are on the review process for their approval by the Mexican Regulatory Office.

Materials and Methods

Plots, consisting of eight (0.92 m) rows by 12 m, repeated four times (except on study 2), were sprayed using a CO_2 backpack sprayer delivering 250 l/ha at 30 psi with a 1.94 m-swath, four hollow cone (x-8) nozzles boom. Two larval density evaluations per plot, where foliage damage was noticed, were performed by beating twelve times, two adjacent rows over a 1.0-m plastic sheet covering the bare ground area.

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Treatments consisted of A) tebufenozide (Confirm® 2F [Rohm and Haas Co.]) at 80 g AI/ha, B) RH-2485 2F or methoxyfenozide (proposed) (Intrepid® [Rohm and Haas Co.]) at 40 g (Study 1 and 2, and 120 g [Study 3]) AI/ha, C) hexaflumuron (Consult® 100 SC [Dow Elanco]) at 25 g AI/ha, D) Spinosad® (DowElanco) at 36g (Study 1), 48 g (Study 2) and 360 g (Study 3) IA/ha, E) chlorfenapyr (Pirate® [American Cyanamid]) at 144 g AI/ha, F) chlorpyrifos (Lorsban 480 EM® [Dow Elanco]) at 720 g AI/ha, G) diflubenzuron (Dimilin 25% PH® [AgrEvo] at 62.5 g AI/ha, and H) *Bacillus thuringiensis* (Dipel 2X® [BASF]) at 2,000 g of product /ha, and I) untreated check.

Beet armyworm larvae were divided as small (L1-L2) and large ($\geq$ L3). Average number of larvae per meter of the two samples per plot were analyzed by Analysis of Variance and mean separations were obtained by Tukeys Studentized Range test at P<0.05 level, using the Pesticide Research Manager 4 program.

Results and Discussion

Study 1 (Ciudad Mante, Tamaulipas)

All new insecticides were effective in controlling the beet armyworm, and except for hexaflumuron, statistical differences with chlorpyrifos were found after 7 days on the mortality of small larvae. In the case of large worms, chlorfenapyr demonstrated its effectiveness 3 days after the application. The rest of the insecticides exhibited statistical differences after the fifth day (Tables 1 and 2).

Study 2 (Ciudad Cuauhtémoc, Tamaulipas)

Due to the establishment of this study with only three replications, statistical differences were not found among the most of the new products and chlorpyrifos. However, the same trend of results obtained on Study 1 can be noticed here. In the case of the average of large larvae, some products were able to reduce the population below the commonly used threshold of 3 worms per meter (Tables 3 and 4).

Study 3 (Ébano, San Luís Potosí)

This study included another two commercial treatments as a comparison. Due to an error in mixing treatments RH-2485 and spinosad received a 3X increase in their doses. A greater and faster response was observed. However, these doses are far greater than what has been recommended by the technical personnel of the respective companies. Again, it can be noticed that all new products, except hexaflumuron, were statistically different to compared to chlorpyrifos and more effective than the other commercially used insecticides.

On this study, we were able to screen some alternatives for the current and future control of this pest with very promising results. These new products present a novel mode-of-action that, if used in appropriate rotation, can control beet armyworm on cotton and would aid growers in delaying insecticide resistance.

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References

Terán-Vargas, A. P. 1997. Response of the beet armyworm from Southern Tamaulipas, Mexico to Insecticides. Proceedings of the Beltwide Cotton Conference, In press.

Table 1. Average number of small (L1-L2) larvae per meter

Number of Small Larvae per meter					
T	0 DAT	3 DAT	5 DAT	7 DAT	11DAT
A	33.3 a	16.3 ab	2.3 b	2.3 bc	0.0 a
B	36.5 a	2.8 b	1.0 b	0.5 c	0.0 a
C	19.0 a	23.3 a	13.5 a	3.8 ab	0.2 a
D	25.8 a	8.0 b	3.5 b	2.0 bc	0.2 a
E	27.3 a	5.8 b	0.3 b	1.0 c	0.0 a
F	25.8 a	9.3 b	5.0 b	5.0 a	0.1 a
I	30.5 a	16.3 ab	11.3 a	4.3 ab	0.0 a

Table 2. Average number of large (≥ L3) larvae per meter

Number of large larvae per meter					
T	0 DAT	3 DAT	5 DAT	7 DAT	11DAT
A	18.3 a	8.3 abc	3.3 cd	0.8 c	0.3 ab
B	15.3 a	7.5 bc	1.3 d	0.3 c	0.0 b
C	14.8 a	10.3 abc	9.8 b	4.3 b	0.5 a
D	14.5 a	15.8 a	6.3 c	5.0 ab	0.2 ab
E	21.3 a	5.8 c	1.3 d	1.0 c	0.0 b
F	19.5 a	14.8 ab	9.8 b	6.0 ab	0.6 a
I	16.5 a	12.3 abc	13.3 a	7.3 a	0.5 a

Table 3. Average number of small (L1-L2) larvae per meter.

Number of SMALL larvae per meter						
T	0 DAT	3 DAT	5 DAT	7 DAT	11 DAT	16 DAT
A	57.5 a	12.5 ab	23.0 ab	12.0 b	9.3 ab	2.6 a
B	31.8 a	20.3 ab	4.8 ab	6.3 b	3.8 b	3.5 a
C	58.1 a	17.0 ab	10.3 ab	10.0 b	10.0 ab	1.6 a
D	59.1 a	3.6 b	5.6 ab	6.6 b	7.3 b	1.8 a
E	50.8 a	4.5 b	3.0 b	2.6 b	0.8 b	5.3 a
F	40.1 a	9.5 ab	28.1 a	3.6 b	2.0 b	1.3 a
I	47.0 a	23.5 a	17.0 ab	34.8 a	18.6 a	4.5 a

Table 4. Average number of large (≥ L3) larvae per meter.

Number of LARGE larvae per meter						
T	0 DAT	3 DAT	5 DAT	7 DAT	11 DAT	16 DAT
A	15.1 a	1.6 ab	4.0 a	1.6 a	6.6 abc	2.3 a
B	13.0 a	3.6 ab	1.6 a	3.1 a	2.8 abc	1.6 a
C	13.5 a	7.6 a	4.8 a	7.8 a	7.8 ab	1.5 a
D	15.0 a	0.3 b	1.5 a	5.5 a	4.5 abc	1.1 a
E	14.8 a	1.3 ab	0.6 a	3.5 a	1.8 bc	1.8 a
F	20.1 a	5.0 ab	5.3 a	12.3 a	8.5 b	1.3 a
I	9.0 a	4.8 ab	2.3 a	12.3 a	8.3 a	3.0 a

Table 5. Average number of small (L1-L2) larvae per meter.

Number of SMALL larvae per meter						
T	0 DAT	3 DAT	5 DAT	7 DAT	11 DAT	16 DAT
A	17.1 c	3.1 c	5.8 d	1.2 d	2.7 cde	0.8 b
B	26.3 bc	2.2 c	1.0 d	0.6 d	0.6 f	0.1 b
C	24.6 bc	18.8 bc	10.3 cd	6.8 cd	4.7 bc	12.2 a
D	52.8 a	1.7 c	0.8 d	0.6 d	0.2 g	0.0 b
E	38.1 ab	2.5 c	0.3 d	0.8 d	2.6 def	0.0 b
F	36.6 abc	24.0 bc	29.3 ab	17.7 bc	1.7 ef	0.6 b
G	35.6 abc	11.1 c	8.7 cd	3.6 d	3.8 bcd	2.0 b
H	36.5 abc	34.6 ab	19.7 bc	30.0 b	5.1 b	4.2 b
I	37.6 ab	45.7 a	34.6 a	51.8 a	11.0 a	12.6 a

Table 6. Average number of large (≥ L3) larvae per meter.

Number of LARGE larvae per meter.						
T	0 DAT	3 DAT	5 DAT	7 DAT	11 DAT	16 DAT
A	17.1 c	2.3 c	2.5 bc	0.8 d	3.7 c	0.1 b
B	26.3 bc	0.3 c	0.1 c	0.0 d	0.5 d	0.0 b
C	24.6 bc	10.8 b	1.8 bc	4.5 c	3.8 c	1.5 b
D	52.8 a	0.8 c	0.3 c	0.1 d	0.2 d	0.2 b
E	38.1 ab	0.5 c	2.2 bc	1.8 cd	3.3 cd	0.1b
F	36.6 abc	4.3 c	6.2 bc	4.2 c	4.7 c	1.8 b
G	35.6 abc	20.6 a	6.7 b	8.2 b	4.2 c	1.5 b
H	36.5 abc	15.5 ab	20.1 a	9.3 b	10.3 b	4.3 a
I	37.6 ab	15.0 b	16.7 a	16.5 a	14.3 a	4.6 a

T=Treatments, A= Tebufenozide, B=RH-2485 2F, C=Hexaflumuron, D=Spinosad, E=Chlorfenapyr, F=Chlorpyrifos, G=Diflubenzuron, H=*Bacillus thuringiensis*, I=Untreated