RESULTS OF DPX-MP062 EFFICACY TRIALS ON COTTON BOLLWORM (*HELICOVERPA ZEA*) AND TOBACCO BUDWORM (*HELIOTHIS VIRESCENS*) IN TEXAS

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Abstract

DPX-MP062 has been given the trademame "STEWARD" (proposed) and is being developed for Lepidoptera (worm) control in cotton and certain vegetables and fruits. This new and novel insecticide will belong to the proposed chemical class, Oxadiazine; the proposed common name is Indoxacarb. "STEWARD" has a low use rate and favorable environmental and toxicological profiles. The primary route of entry is through ingestion and it is also active through contact. In four 1997 Texas trials, "STEWARD" gave excellent control of tobacco budworm (*Heliothis virescens*) and cotton bollworm (*Helicoverpa zea*) at rates of 0.065 to 0.11 lb. ai/A.

Introduction

We in DuPont are excited to be able to announce that we plan to bring a new and novel insecticide to the cotton market. This new product has the experimental code DPX-MP062. The proposed trade names are "STEWARD" for cotton and "AVAUNT" for the fruit and vegetable markets. "STEWARD" is the result of an extensive discovery and development program within DuPont aimed at providing new and useful chemistry for cotton producers. Important criteria are a low use rate and with soft environmental characteristics. Today I will discuss some of these properties and present some 1997 cotton insect control data from Texas.

What is "STEWARD"? It is a new family and belongs to a new insecticide class. We began it's field development in 1993 as DPX-JW062. Then, a process development breakthrough resulted in the production of an enriched isomer and the numerical code was then changed to DPX-MP062 in 1996. Indoxacarb is the proposed common name for the active ingredient and it will belong to a new chemical class with the proposed name of Oxadiazine. "STEWARD" is a broad spectrum Lepidoptera (worm) control agent. The major species controlled include those in the *Heliothis/Helicoverpa, Spodoptera, Plutella, Trichoplusia, Lobesia and Cydia* Genera. In addition, recent data indicate control of certain *Lygus* species in cotton.

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The primary route of entry into the target insects is through ingestion, although it is also active through contact. The "mode of action" is different from any other commercial insecticide because Indoxacarb acts by inhibiting sodium ion entry into nerve cells which results in paralysis and death. Inhibition of feeding by insects is rapid and pest knockdown occurs within 1-2 days.

Indoxacarb has an excellent toxicological and environmental profile. A low use rate will reduce environmental loading, particularly when compared to organo phosphates (OP's) and carbamates. It provides a much safer alternative to pyrethroids from the standpoint of aquatic safety. The relatively low mammalian toxicity provides improved safety to handlers and producers, as well as to terrestrial mammals and birds especially when compared to traditional OP's and carbamates. The acute dermal LD50 for "STEWARD" is >5000 mg/kg in rats and the acute oral LD50 is 3619 mg/kg in male rats and 751 mg/kg in female rats. "STEWARD" will fit well into IPM programs because of it's safety to beneficial insects, spiders and mites; and, also because it's new and different mode of action does not show cross resistance to existing insecticides.

"STEWARD" will be formulated for cotton as a 1.25 lb. /Gallon liquid suspension concentrate.

Materials and Methods

The four 1997 studies to be discussed here were conducted at Uvalde under the direction of Mike Phillips, South Texas Ag Research; at East Bernard with David Wilde, Coastal Ag Research; at Chillocothe by Jack LeClair, DuPont; and, at Hale Center by Jerry Pitts, DuPont. At Uvalde, the cotton variety was Deltapine 5415 RR. The plots were 4 rows by 50 ft. replicated four times. At East Bernard, South Texas MD51 cotton was planted. The plots were 4 rows by 45 ft with four replications. At Chillicothe, the variety was Sphinx and the plots were 3 rows by 25 ft. with 3 replications; and at Hale Center, the cotton variety was Paymaster HS26 with the plots being 10 ft by 50 ft with 3 replications. Applications were made by mounted, hiboy type sprayers at Uvalde and East Bernard, while pressurized back-pack sprayers were used at Chillcothe and Hale Center.

Applications were begun at egg or early instar application threshold levels and continued at approximate 7 day intervals except for Uvalde where both a 7 day and 3-5 day schedule were used. The water spray volume for all sites was from 8 to 10 GPA. All application rates are given in Lb. active ingredient per acre except for Dipel.

Results/Discussion

The first of the four trials I will discuss was at Uvalde in the Winter Garden area of South Texas. For the first three

applications, the application interval was seven days. Due to increasingly high insect pressure, the interval for the next two applications was three and five days. Vydate was oversprayed season long for boll weevil control. Small worms were considered less than ½ inch and large worms over ½ inch. The species estimates were cotton bollworms for applications 1 and 3; and tobacco budworms for applications 2, 4 and 5.

Ratings following applications 4 and 5 illustrate the type of control obtained in this trial. There were only minor differences based on the percentage of terminals with small budworm larva shown in Table 1. The percentage of terminals with large larva is shown in Table 2. Here "STEWARD" completely eliminated large budworm larva. The important square damage rating is shown in Table 3 and is divided between the first three applications, where the interval was 7 days and the pests were bollworm with some budowrm; and applications 4 and 5 when the interval was closed to 3 and 5 days and the species was budworm. These data indicate that the pyrethroids were not as effective on tobacco budworm as were the newer insecticides, "STEWARD" and Tracer. Overall seasonal averages indicated that "STEWARD" at 0.065, 0.09, 0.11 lb. ai/A gave good protection as did Tracer and the two "STEWARD" plus Asana mixtures. The yields are given in Table 4. Yields coincided with damage ratings except the mixtures of "STEWARD" and Asana which could not be explained.

The second trial was located near East Bernard in the Upper Gulf Coast area SW of Houston. This trial had 5 applications and the insect was almost entirely Tobacco budworm. The application interval was 7 days except for one wet period when it was 14 days. Table 5 shows the percentage of larva in terminals. All treatments reduced larva well except Asana. Square damage was excellent for all treatments except the lowest rate of "STEWARD", Dipel and Asana (Table 6). The yields (Table 7) are very indicative of the efficacy results from this trial.

A third trial was located near Chillicothe in the Rolling Plains Region of North Texas. Two applications were made and the species was cotton bollworm. Table 8 shows the seasonal square damage average. All treatments provided good protection under very heavy pressure. There was a notable rate response with "STEWARD". It may also be noted that Asana worked well under this bollworm population as opposed to late season budworm infestations. Table 9 shows boll protection by these insecticides and is an indicator of yield. All treatments worked well with "STEWARD" at 0.09 and 0.11 lb. ai/A giving the best protection.

The last trial was conducted near Hale Center in the High Plains region. One application was made to cotton bollworms. All products reduced worm populations (Table 10) however Asana and Asana plus "STEWARD" were the top performers in this trial in which only one application was made.

To summarize, I have generally divided the data into percent squared damage for tobacco budworms with multiple applications and for cotton bollworms from trials with one or two applications. The Uvalde and East Bernard seasonal averages for square damage were combined. "STEWARD" at rates from 0.065 through 0.11 lb. ai/A, Tracer, and, the Asana/Steward mixtures gave excellent square protection from tobacco budworms (Table 11). Table 12 is the combined seasonal averages of square damage from the other two trials which had cotton bollworms exclusively. The treatments are not separated as much and this is probably due to only 1 and 2 applications per trial. All treatments were effective in reducing square damage from cotton bollworms.

Conclusions

Based on results and conditions of these four trials, "STEWARD" and "STEWARD" plus Asana will provide effective control of tobacco budworm at rates of 0.065-0.11 lb. ai/A. These treatments were also equal to Tracer. The mixtures of "STEWARD" and Asana were actually slightly more effective in control of tobacco budworm. Control of cotton bollworms was provided by all rates of "STEWARD" as well as by Asana and Tracer.

Acknowledgments

Tracer is a registered trademark by DowElanco Company.
Dipel is a registered trademark by Abbott Laboratories.
Asana is a registered trademark by DuPont Agricultural Products.
Vydate is a registered trademark by DuPont Agricultural Products.
Karate is a registered trademark by Zeneca Ag Products.

References

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Table 1. Percentage of small budworm larva in terminals, Uvalde, TX.

Tretament (lb. Ai/A)	Avg.% Apps. 4-5
Steward .055	1.5
Steward .065	0
Steward .09	3.5
Steward .11	1
Tracer .063	1.5
Karate .03	3
Asana .036	1.5
Asana .036 + Steward .055	1
Asana .036 + Steward .065	0.5
U.T.C.	9.5

Table 2. Percentage of large budworm larva in terminals, Uvalde, TX.

Treatment (Lb. ai/A)	Avg. % , Apps. 4-5
Steward .055	0
Steward .065	0
Steward .09	0
Steward .11	0
Tracer .063	1.5
Karate .03	0.5
Asana .036	2
Asana .036 + Steward .055	1.5
Asana .036 + Steward .065	0
U.T.C.	2

Table 3. Percentage of worm damaged squares, Uvalde, TX.

Treatment (lb. Ai/A)	Avg. %	Avg. %	Avg. %
Steward .055	1	14.5	13
Steward .065	9.3	4	7.2
Steward .09	6	10.5	7.8
Steward .11	8.7	8.5	8.6
Tracer .063	8	8.5	8.2
Karate .03	7	15.5	10.4
Asana .036	8.7	17.5	12
Asana .036 + Stwd .055	7.7	6	7
Asana .036 + Stwd .065	5.7	5	5.4
U.T.C.	17	47	29

Table 4. Seedcotton yield and percent of check, Uvalde, TX.

Treatment (lb. Ai/A)	Lb./A	% of Check
Steward .055	2423	90
Steward .065	2845	105
Steward .09	3121	116
Steward .11	2741	101
Tracer .063	2895	107
Karate .03	2722	101
Asana .036	2395	89
Asana .036 + Steward .055	2496	92
Asana .036 + Steward .065	2460	91
U.T.C.	2702	N/A

Table 5. Percentage of budworm larva in terminals, East Bernard, TX.

Treatment (Lb. ai/A)	% Dmg. Term.
Steward .055	6
Steward .065	6
Steward .09	5.5
Steward .11	5.5
Tracer .063	2.5
Dipel 1 Qt.	8.5
Asana .036	14.5
Asana .036 + Steward .055	5
Asana .036 + Steward .065	6
U.T.C.	22.5

Table 6. Season's average of percentage of budworm damaged squares, East Bernard, TX.

Treatment (Lb. ai/A)	% Dmg. Sq.
Steward .055	6
Steward .065	3.5
Steward .09	3
Steward .11	2.5
Tracer .063	2
Dipel 1 Qt.	6
Asana .036	7
Asana .036 + Steward .055	3
Asana .036 + Steward .065	2
U.T.C.	11.5

Table 7. Seedcotton yield and percent of check, East Bernard, TX.

Treatment (Lb. ai/A)	Lb. /A	% of Check
Steward .055	1129	108
Steward .065	1290	123
Steward .09	1311	125
Steward .11	1492	142
Tracer .063	1512	144
Dipel 1 Qt.	1270	121
Asana .036	1189	113
Asana .036 + Steward .055	1331	127
Asana .036 + Steward .065	1391	133
U.T.C.	1048	N/A

Table 8. Percent bollworm damaged squaress, Chillicothe, TX.

Treatment (Lb. ai/A)	% Damaged Squares
Steward .055	16
Steward .065	15
Steward .09	11
Steward .11	9
Tracer .063	13
Asana .036	13
U.T.C.	66

Table 9. Percent bollworm damaged bolls, Chillicothe, TX.

Treatment (Lb. ai/A)	% Damaged Bolls
Steward .055	16.0
Steward .065	13.3
Steward .09	10.7
Steward .11	6.7
Tracer .063	12.0
Asana .036	12.0
U.T.C.	66.7

Table 10. Percentage of bollworn larva per plant, Hale Center, TX.

Treatment (Lb. ai/A)	% Bollworm larva/plant
Steward .055	17
Steward .065	23
Steward .09	17
Steward .11	13
Tracer .063	23
Asana .036	7
Asana .036 + Steward .055	7
Asana .036 + Steward .065	7
U.T.C.	33

Table 11. Budworm summary: Combined % damaged squares, Uvalde and East Bernard, TX.

Treatment (Lb. ai/A)	% Damaged Squares
Steward .055	9.5
Steward .065	5.4
Steward .09	5.4
Steward .11	5.6
Tracer .063	5.1
Standards (Karate, Dipel)	8.2
Asana .036	9.5
Asana .036 + Steward .055	5.0
Asana .036 + Steward .065	3.7
U.T.C.	20.3

Table 12. Bollworm summary: Combined % damaged squares, Chillicothe and Hale Center, TX.

Treatment (Lb. ai/A)	% Damaged Squares
Steward .055	15.5
Steward .065	14.5
Steward .09	13.5
Steward .11	11.5
Tracer .063	14.5
Asana	12.0
U.T.C.	32.2