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EFFICACY OF AZINPHOSMETHYL AND OTHER INSECTICIDES AGAINST THE BOLL WEEVIL IN THE FIELD

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Abstract

Azinphosmethyl was evaluated for control of boll weevils in cotton following season long sprays in 1982, 1983, 1990, 1991, 1992 and 1993 in the Lower Rio Grande Valley (LRGV). Methyl parathion and oxamyl were evaluated for control of the same insect in 1990 as were bifenthrin, deltamethrin and endosulfan in 1992. Eight to 15 applications of aqueous sprays were made each year and mean percentage damaged squares and bolls were used to determine control. Azinphosmethyl treated cotton had significantly fewer percentage damaged squares than the check in 1983 and 1990. Azinphosmethyl had significantly fewer percentage damaged bolls than the check in 1982 and 1990. Seed cotton yields were significantly greater in azinphosmethyl treated cotton in 1982, 1983, 1990 and 1991 than the check. Yields in azinphosmethyl and check cotton were equal in 1992 and 1993. In 1990 methyl parathion and oxamyl at 0.56 and 0.14 kg (AI)/ha, respectively, showed significantly fewer damaged squares than the check. Yields from cotton treated with methyl parathion and oxamyl, at 0.56 and 0.28 kg (AI)/ha, respectively, were significantly greater than the check. In 1992 there was no significant difference in damaged squares and bolls by the boll weevil and yields of cotton treated with deltamethrin and the check.

Introduction

Azinphosmethyl and methyl parathion are recommended and are the most widely used insecticides for control of the boll weevil, *Anthonomus grandis* Boheman, in the LRGV. This is the first report on field control with azinphosmethyl in the LRGV of Texas and Mexico. Methyl parathion was shown to be effective against the boll weevil in cotton from the LRGV (McGarr and Wolfenbarger 1968,1969 and 1970).

Here, azinphosmethyl was evaluated for control of the boll weevil in field tests in 1982, 1983, 1990, 1991, 1992 and 1993. In 1990 field tests were conducted with methyl parathion and oxamyl to determine if they can control damage by the boll weevil. In 1992 deltamethrin was also evaluated for control of this insect. Insecticides were applied on an "as needed" basis season long. Yields of seed cotton were determined each year.

Material and Methods

Azinphosmethyl (as Guthion from Bayer Inc., Kansas City, KS), deltamethrin (as Decis from Aventis, Inc., Research Triangle, NC), and methyl parathion (Dennison Inc., Weslaco, TX), and oxamyl (as Vydate from Dupont Corp., Wilmington, DE) as 240, 240, 180, 360, 480 and 360 g/L emulsifiable concentrate formulations, respectively, were used for the field trials.

In 1982 and 1983, at Brownsville, TX, the short-season cotton cultivars, 'Tamcot SP-37' or 'Rio-875' were planted in early to mid March in pre-plant irrigated plots measuring 0.08 ha (12 rows wide, 1 m apart and 67 m long). Plots were irrigated twice in 1982 and three times in 1983.

In 1990, 1991, 1992 and 1993, at Weslaco, TX, the cotton 'DES-119' was planted in mid-March in plots 0.04 ha (12 rows wide, 1 m apart and 33 m long), irrigated at pre-plant and once at first square.

Treatments were arranged in a randomized complete block design in three or four replicates all six years. At both locations four to 12 m (1 m/row) of corn were grown between rows of cotton and 4 m of corn between plots down the row to isolate each plot all years. This was done to minimize movement of boll weevils from plot to plot. Spraying was initiated when 10% to 15% of the squares were damaged by boll weevil feeding and oviposition as recommended by Norman and Sparks (1997) for the LRGV.

In 1982 and 1983 aqueous sprays of insecticides were applied with a 12-row high clearance sprayer at 47 L/ha at 2.1 kg/cm^{-} through Spraying Systems, Bellview, IL, nozzles (TX3) spaced 50.8 cm apart on the boom. In 1982 azinphosmethyl was applied 10 times at three to six d intervals from calendar d 163 to 199. In 1983 azinphosmethyl was applied 14 times at one to four d intervals from calendar d 165 to 209. In 1990, 1991, 1992 and 1993 aqueous sprays were applied with a 12 row high clearance sprayer at 57 L/ha at the same pressure and nozzle arrangement used in 1982 and 1983. In 1990 azinphosmethyl, methyl parathion and oxamyl were applied 15 times at one to four day intervals from calendar d 156 to 206. In 1991 and 1993

nine and seven applications were made at 2 to 10 d intervals from calendar d 165 to 207 and152 to 204, respectively. In 1992 azinphosmethyl, and deltamethrin were applied 14 times at three to seven d intervals from calendar d 148 to 203.

Undamaged and damaged (eggs and feeding punctured) squares and bolls were counted on 5 to 10 whole plants selected at random in each plot once or twice weekly during the fruiting period. The percentages of damaged squares and bolls were averaged for all sampling days. Plots were sampled nine, 11, 12, 10, eight and seven times during the seasons of 1982, 1983, 1990, 1991, 1992 and 1993, respectively. Sampling was initiated after first application and stopped two to seven d before defoliation.

At Brownsville, seed cotton was harvested once in 1982 and 1983 in early to mid August from a 15.2 m section of two rows in the center of the plots to determine yields. At Weslaco, seed cotton was hand harvested twice in early to mid-August in 1990, 1991, 1992 and 1993 from a 3 m section of four rows in the center of each plot.

Analysis of variance was applied to mean percentage damage to squares and bolls taken season long by boll weevil and yields of seed cotton at the end of each season to determine differences among treatments. Significant differences between treatment means were determined by Fishers protected LSD at $P_{0.05}$.

Results and Discussion

Boll weevil infestations caused a seasonal average of 18% to 32% damaged squares in the check during the six test years (Table 1). Boll weevil infestations caused a seasonal average of 17% to 50% damaged bolls in the same check during the same test years. These seasonal averages of damage by the boll weevil are greater than the 10% to 15% required to initiate spray applications (Norman and Sparks 1997). The first application was made for all insecticides tested each year when 10% to 15% damaged squares were determined in the check.

There were significantly less percentage damaged squares for azinphosmethyl in 1983 at 0.42 kg (AI)/ha and in1990 at 0.14 kg (AI)/ha than for the check. In 1990 methyl parathion and oxamyl, at 0.56 kg (AI)/ha and 0.14 kg (AI)/ha, respectively, showed significantly less damaged squares than the check.

At 0.14 kg (AI)/ha sprays of azinphosmethyl resulted in significantly less boll damage in 1990 compared to the check, but not in 1983 or 1991. This rate was not tested in 1992 or 1993. Azinphosmethyl, at 0.42 in 1982, caused a significant reduction in damaged bolls compared to the check, but not at 0.28 kg (AI)/ha in 1983, 1990 and 1991 or 0.56 kg (AI)/ha in 1990. These results for both squares and bolls suggest that azinphosmethyl should be used at rates >0.28 kg (AI)/ha as aqueous sprays to cause significant reductions in damage by the boll weevil. In 1990 oxamyl and methyl parathion, applied at 0.14 kg and 0.56 (AI)/ha, respectively, resulted in significantly fewer damaged bolls than the check.

There were not significant differences in damaged squares and bolls for azinphosmethyl, deltamethrin and the check in 1992 and for azinphosmethyl and the check in 1993.

Yields of seed cotton in the check were 879, 238, 594, 611, 515 and 1680 kg/ha in 1982, 1983, 1990, 1991, 1992 and 1993, respectively. This is a 1445 kg/ha difference in seed cotton during the six years. In 1990, yields of seed cotton in cotton treated with azinphosmethyl (except at 0.28 kg (AI)/ha in 1990) in 1982, 1983 and 1990 and 1991 were significantly greater than those in the check. In 1990 yields of seed cotton in plots treated with methyl parathion and oxamyl (except at 0.14 kg (AI)/ha) were also significantly greater than those in the check. There was no significant differences in yields of seed cotton in the check and azinphosmethyl and deltamethrin in 1992 and azinphosmethyl in 1993.

Egg and larval populations of bollworm, *Heliocoverpa zea* (Boddie)/tobacco budworm, *Heliothis virescens* (F) were <1000/ha on any sample date any test year. Damage to squares and bolls by these lepidopteran pest did not exceed 3% on any sample date. Population levels of and damage by these pests did not cause any yield damage.

Resistance by boll weevil to organophosphorus insecticides in the LRGV in cotton in one or more cotton fields any one year has not been determined to date. From 1972 to 1991 LD_'s of azinphosmethyl have been the only measure of resistance in the LRGV [Wolfenbarger et al. 1986) [Loera et al. 1997). LD_'s show a reversion of susceptibility from a high (0.74) in 1985 to a low (0.0011) in 1991 in the LRGV. LD_'s of azinphosmethyl determined in 1983, 1990 and 1991 were 0.16, 0.059 to 0.13 and 0.0011 to 0.14, respectively, when significant differences in damaged squares and bolls and yields of cotton treated with azinphosmethyl and the check were determined. All of these LD_'s showed susceptibility to azinphosmethyl.

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Table 1. Effects of insecticides on boll weevil damage and yields of seed cotton in field plots in LRGV at Brownsville, 1982-1983 and Weslaco, 1990-1993[a].

Treatment	Kg(AI)/ha	Damaged (%) Squares
	1982	
Azinphosmethyl[b]	0.42	11a
Check		18a
	1983	
Azinphosmethyl[c]	0.28	14a
Check		29b
	1990	
Azinphosmethyl	0.14	15b
	0.28	22a
	0.56	22a
Methyl parathion	0.56	15b
	1.12	22a
Oxamyl	0.14	15b
	0.28	27a
Check		28a
	1991	
Azinphosmethyl[e]	0.28	28a
Check		19b
Azinphosmethyl[e]	0.28	28a
Check		19b
	1992[f]	
Azinphosmethyl	0.28	54a
Deltamethrin	0.022	46a
Check		48a
	1993	
Azinphosmethyl[g]	0.28	10a
Check		14a

a Means followed by the same letter are statistically similar by Fishers LSD at $P_{0.05}$

b Applied on days 163, 167, 172,178,181,185,192,195 and 199, 1982

c Applied days165, 166, 167, 168, 172, 176, 179, 180, 183, 185, 187, 190, 208 and 209, 1983

d Applied insecticides on days 156, 159, 163, 169, 170, 171, 173, 183, 187, 191, 194, 198, 201, 204 and 206, 1990

e Applied on days 165,168, 170, 16, 196, 200, 204 and 207, 1991

f Applied insecticides on days 148, 157, 161, 168, 171, 175, 178, 182,185,189, 192. 196, 199 and 203, 1992

g Applied on days152, 155, 161, 167, 169, 175, 177, 180, 183, 187, 190, 194, 197, 201 and 204, 1993.

Table 1. Continued

Treatment	Damaged (%) Bolls	Yields seed cotton (kg/ha)
	1982	
Azinphosmethyl[b]	11a	2333a
Check	41b	879b
	1983	
Azinphosmethyl[c]	33a	898a
Check	37a	238b
	1990[d]	
Azinphosmethyl	27b	1090b
	31a	805a
	33a	1223b
Methyl parathion	21b	1228b
	37a	1350b
Oxamyl	27b	783a
	46a	895b
Check	50a	594a
	1991	
Azinphosmethyl[e]	15a	895a
Check	17a	611b
	1992[f]	
Azinphosmethyl	58a	441a
Deltamethrin	48a	586a
Check	32a	471a
	1993	
Azinphosmethyl[g]	14a	1950a
Check	18a	1680a

a Means followed by the same letter are statistically similar by Fishers LSD at $P_{0.05}$

b Applied on days 163, 167, 172,178,181,185,192,195 and 199, 1982

c Applied days165, 166, 167, 168, 172, 176, 179, 180, 183, 185, 187, 190, 208 and 209, 1983

d Applied insecticides on days 156, 159, 163, 169, 170, 171, 173, 183, 187, 191, 194, 198, 201, 204 and 206, 1990

e Applied on days 165,168, 170, 16, 196, 200, 204 and 207, 1991

f Applied insecticides on days 148, 157, 161, 168, 171, 175, 178, 182,185,189, 192. 196, 199 and 203, 1992

g Applied on days152, 155, 161, 167, 169, 175, 177, 180, 183, 187, 190, 194, 197, 201 and 204, 1993.