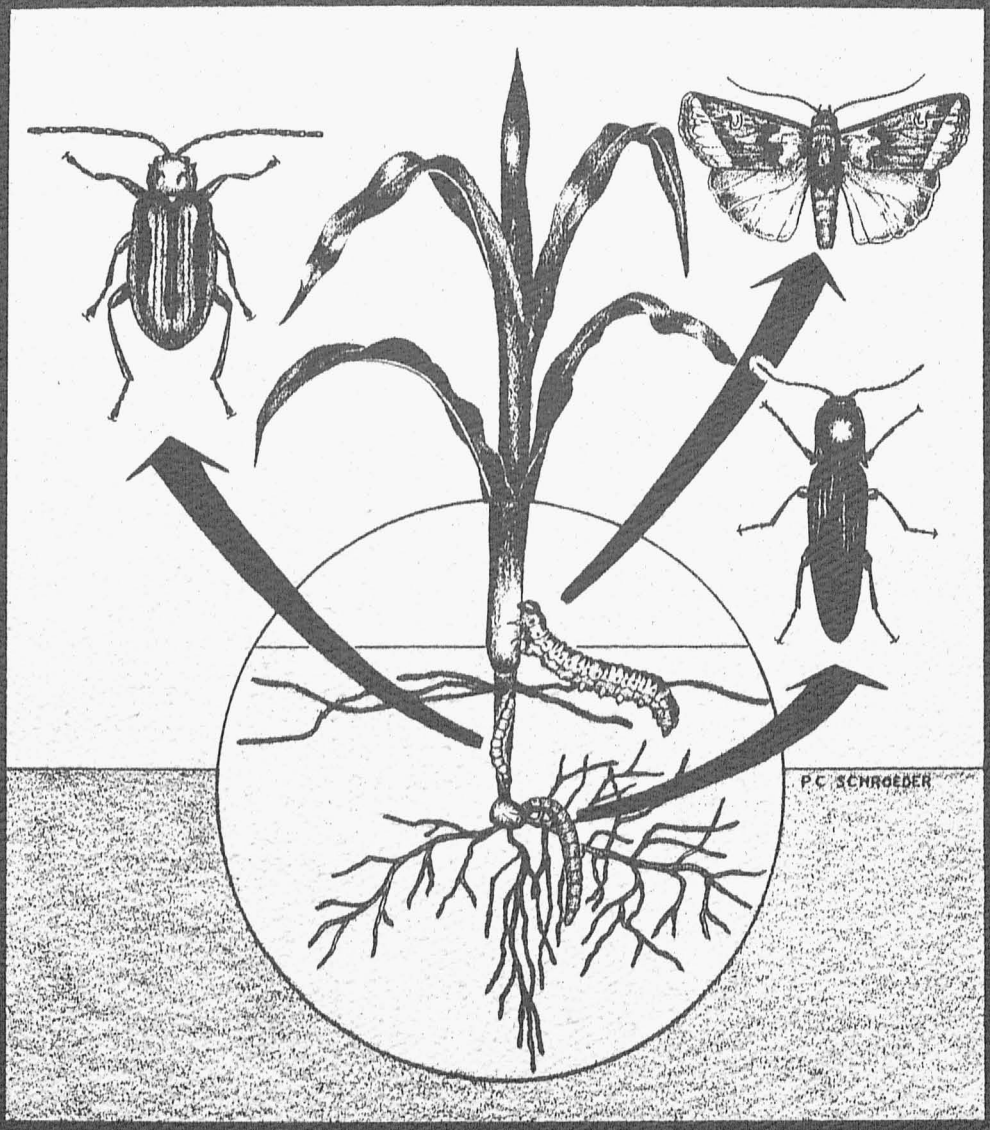
Corn Soil Insects Research

1994 Insecticide Evaluations



Judy A. Grundler

Armon J. Keaster

University of Missouri-Columbia
Agricultural Experiment Station

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CORN SOIL INSECTS RESEARCH
1994 INSECTICIDE EVALUATIONS

Judy A. Grundler, Entomology Senior Research Specialist
Armon J. Keaster, Professor of Entomology
Department of Entomology, University of Missouri-Columbia

Soil insecticide evaluations were conducted to compare the relative efficacy of labeled and experimental compounds for control of corn soil insect pests. This report presents data on the efficacy of compounds for control of western and northern corn rootworms (*Diabrotica virgifera virgifera* LeConte and *D. barberi* [Say]), black cutworm (*Agrotis ipsilon* [Hufnagel]), and wireworms (*Melanotus* spp.).

This report and the data contained within are presented for purposes of information only to agribusiness industries, University of Missouri extension and research personnel, and to interested university extension and research personnel at other Midwestern institutions. The data do not reflect nor constitute a recommendation of specific compounds. The 10-year comparisons of performance for rootworm compounds do, however, provide a basis for comparison of efficacy for control over a period of time. For additional information and specific recommendations for control of corn soil insects, see the current Handbook for the Management of Insects and Plant Diseases (M146), MU Agricultural Guides 4150 (Corn Cutworm Control), 4151 (Corn Rootworm Control), 4154 (Control of Wireworms and Other Corn Soil Insects), and 4906 (Soil Insect Control in Reduced Tillage Cropping Systems).

ROOTWORM INSECTICIDE EVALUATIONS

The insecticide evaluations for rootworm control were conducted at a location near Maitland in Nodaway County. The plot area was located along one side of a corn/soybean production field and was planted to corn in 1993.

A two-row John Deere model 7100 max-emerge planter with a mounted V-belt seeder was used for 7-inch band (7"B) and in-furrow (IF) granular applications. Preweighed insecticide granules were placed uniformly along the V-belt seeder and directed through banders or tubes to obtain the desired placement. The smart box treatments were also applied in a 7-inch band or in-furrow. The insecticide was metered through the computer module, which was calibrated prior to field application. Insecticides were applied to two 35-foot rows and replicated four times according to a randomized complete block design. Seeds at the rate of 22,100 per acre were planted in 30-inch rows at a depth of 1.5 to 2.0 inches during the same operation. A 15-foot alleyway separated each replication. The field was planted under no-till conditions. Conventional tilled treatments were applied after the plot area had been tilled by a TROY-BILT® garden tiller.

Efficacy of treatments within each test was determined by digging 16 plants from each treatment (four per replication). The corn roots were washed free of dirt and evaluated as follows:

A. General Root Rating - The entire root system was taken into consideration when assigned a rating according to the amount of visible rootworm damage. The ratings were assigned as follows: 1) no feeding damage, 2) light feeding damage with pruning, 3) occasional pruning, 4) moderate to severe pruning (one node of roots destroyed), 5) severe pruning (two nodes of roots destroyed), and 6) three nodes of roots destroyed.

B. Damaged Root Rating - The percentage of the roots showing rootworm damage in the second and third nodes below ground level was estimated and assigned to five categories as follows: 1) no injury, 2) 1-25%, 3) 26-50%, 4) 51-75%, and 5) 76-100%.

C. Pruned Root Rating - The same root systems evaluated under A and B were rated where only the percent of the roots pruned in the second and third nodes below ground level were estimated. Ratings were as follows: 1) no pruning, 2) 1-25%, 3)26-50%, 4) 51-75%, and 5) 76-100%.

D. Combined Analysis Rating - The combined analysis rating is the average of the pruned root rating, damaged root rating and general root rating. Only the general root rating and the combined analysis ratings are reported as indicators of insecticide performance.

Table 1. Comparison of Soil Insecticide Efficacy for Control of Western and Northern Corn Rootworm Larvae in No-Till Corn (Test 1), Maitland, Missouri, 1994.

	Rate oz/1000 ft	Placement	General Root Rating Means[1]
Counter 15G	8	7"B	2.57 a
EXP60941A 1.58G	8	7"B	2.75 ab
Aztec 2.1G	6.7	7"B	2.88 abc
EXP60940A 1.17G	8	7"B	2.88 abc
Counter 20CR	6	7"B	2.94 abc
Force 1.5G	8	7"B	2.94 abc
Regent 1.5G	6	7"B	2.94 abc
CRCH 2 2.5G	8	7"B	2.95 abc
EXP60938A 1.5G	8	7"B	3.00 abc
EXP60939A 3.0G	4	7"B	3.00 abc
Aztec 2.1G	6.7	IF	3.06 abcd
Regent 1.5G	7	7"B	3.07 abcd
Regent 1.5G	8	7"B	3.08 abcd
Lorsban NAF-1 15G	8	7"B[2]	3.13 abcde
Lorsban NAF-1 15G	8	7"B	3.13 abcde
EXP60837A 1.5G	8	7"B	3.19 abcde
Lorsban NAF-1 15G	8	IF	3.38 abcde
Lorsban NAF-1 15G	8	IF[2]	3.50 abcde
CRSE 2 2G	8	7"B	3.50 abcde
CRCH 1 1G	8	7"B	3.70 bcdef
CRPR 2 2G	8	7"B	3.88 cdef
CRPR 1 0.5G	8	7"B	4.06 def
Control	-	-	4.13 ef
Control	-	-[2]	4.56 f

[1]Mean separation by DMRT: means followed by the same letter are not significantly different at P=0.05.
[2]Conventional till.

Table 2. Comparison of Soil Insecticide Efficacy for Control of Western and Northern Corn Rootworm Larvae in No-Till Corn (Test 1), Maitland, Missouri, 1994.

	Rate oz/1000 ft	Placement	Combined Rating	Anaylsis Means[1]
Counter 15G	8	7"B	2.77	a
Counter 20CR	6	7"B	3.06	ab
Force 1.5G	8	7"B	3.09	abc
EXP60940A 1.17G	8	7"B	3.10	abc
EXP60941A 1.58G	8	7"B	3.11	abc
Aztec 2.1G	6.7	7"B	3.14	abc
Regent 1.5G	6	7"B	3.15	abc
EXP60938A 1.5G	8	7"B	3.21	abc
EXP60939A 3.0G	4	7"B	3.21	abc
Aztec 2.1G	6.7	IF	3.27	abc
CRCH 2 2.5G	8	7"B	3.31	abcd
Lorsban NAF-1 15G	8	7"B[2]	3.40	abcd
Lorsban NAF-1 15G	8	7"B	3.41	abcd
Regent 1.5G	8	7"B	3.41	abcd
EXP60837A 1.5G	8	7"B	3.44	abcd
Regent 1.5G	7	7"B	3.47	abcd
Lorsban NAF-1 15G	8	IF	3.63	bcde
Lorsban NAF-1 15G	8	IF[2]	3.71	bcde
CRSE 2 2G	8	7"B	3.77	bcde
CRCH 1 1G	8	7"B	3.89	cdef
CRPR 2 2G	8	7"B	4.04	def
CRPR 1 0.5G	8	7"B	4.23	ef
Control	-	-	4.31	ef
Control	-	-[2]	4.61	f

[1]Mean separation by DMRT: means followed by the same letter are not significantly different at P=0.05.
[2]Conventional till.

Table 3. Comparison of Soil Insecticide Efficacy for Control of Western and Northern Corn Rootworm Larvae in No-Till Corn (Test 2), Maitland, Missouri, 1994.

	Rate oz/1000 ft	Placement	General Root Rating Means[1]
Force 1.5G	8	IF	2.00 a
Force 7.5G	1.6	IF Smart Box	2.13 ab
Force 3G	4	IF	2.19 ab
Force 3G	4	IF Smart Box	2.19 ab
Force 7.5G	1.2	IF	2.19 ab
Force 7.5G	1.6	IF	2.25 abc
Fortress 5G	3	7"B	2.25 abc
Force 3G	4	7"B	2.31 abc
Force 3G	3	IF Smart Box	2.31 abc
Force 7.5G	1.6	7"B	2.31 abc
Force 3G	3	7"B	2.38 abc
Force 7.5G	1.2	7"B	2.38 abc
Force 7.5G	1.6	7"B Smart Box	2.38 abc
Force 7.5G	1.2	IF Smart Box	2.38 abc
Fortress 5G	6	7"B Smart Box	2.38 abc
Force 3G	3	IF	2.44 abc
Force 3G	4	7"B Smart Box	2.50 abc
Force 3G	3	7"B Smart Box	2.50 abc
Force 1.5G	8	7"B	2.56 abc
Force 7.5G	1.2	7"B Smart Box	2.56 abc
Fortress 5G	6	7"B	2.63 bc
Fortress 5G	3	7"B Smart Box	2.63 bc
Control	-	-	2.81 cd
Control	-	-	3.19 d

[1]Mean separation by DMRT: means followed by the same letter are not significantly different at P=0.05.

Table 4. Comparison of Soil Insecticide Efficacy for Control of Western and Northern Corn Rootworm Larvae in No-Till Corn (Test 2), Maitland, Missouri, 1994.

	Rate oz/1000 ft	Placement	Combined Rating	Anaylsis Means[1]
Force 1.5G	8	IF	2.02	a
Fortress 5G	3	7"B	2.34	ab
Force 3G	4	IF	2.36	ab
Force 7.5G	1.2	IF	2.36	ab
Force 7.5G	1.6	IF Smart Box	2.38	ab
Force 3G	4	7"B	2.41	ab
Force 3G	4	IF Smart Box	2.44	ab
Force 7.5G	1.6	IF	2.44	ab
Force 3G	3	IF Smart Box	2.46	ab
Force 7.5G	1.6	7"B	2.48	ab
Force 3G	3	IF	2.54	ab
Force 7.5G	1.2	IF Smart Box	2.56	ab
Force 3G	3	7"B Smart Box	2.63	b
Force 7.5G	1.2	7"B	2.63	b
Force 7.5G	1.6	7"B Smart Box	2.63	b
Force 1.5G	8	7"B	2.64	b
Force 3G	3	7"B	2.64	b
Fortress 5G	6	7"B Smart Box	2.65	b
Force 3G	4	7"B Smart Box	2.69	b
Force 7.5G	1.2	7"B Smart Box	2.73	bc
Fortress 5G	6	7"B	2.75	bc
Fortress 5G	3	7"B Smart Box	2.82	bc
Control	-	-	3.21	cd
Control	-	-	3.50	d

[1]Mean separation by DMRT: means followed by the same letter are not significantly different at P=0.05.

Table 5. Ten Year Comparison of Performance[1] for Recommended Corn Rootworm Insecticides Applied at 1 lb. ai/A in a Seven-inch Band at Planting.

Insecticide	A	B	A	C	A	C	A	B	A	B	A	B	B	B	B	B	B	B	B
	1985		1986		1987		1988		1989		1990		1991		1992		1993		1994
carbofuran 10G (Furadan) 15G	3.19	2.31	3.06	3.93	3.12	3.43	2.68	3.81	3.62	3.43			3.25*	4.06*					
chlorpyrifos (Lorsban) 15G	3.13	2.94	3.00	3.00	3.00	2.75	3.12	3.75	3.12	3.00	3.37	2.62	3.00	3.12	2.69*	3.00*	3.13	2.00	3.13
fonofos (Dyfonate) 20G	2.56	2.94	3.25	2.87	2.81	3.56	2.93	3.56	3.06	4.06	3.62	2.68	3.37	3.43	3.06	2.75	2.88	2.00	
phorate 15G (Thimet) 20G	3.13	4.25	3.12	2.87	3.31	3.18	3.00	4.00	3.06	3.56	3.50	2.62	3.25	3.18	3.13	2.88	2.94	1.88	
phorate + flucythrinate (Aastar) 15G	3.00	3.44	2.75	2.93	2.62	3.12	3.06	3.62	3.06	3.50									
tefluthrin[2] (Force) 1.5G									2.75	3.18	3.25	2.50	2.93	3.12	2.88	3.00	2.75	1.75	2.94
terbufos 15G (Counter)	2.63	3.00	2.93	2.93	2.43	2.43	2.75	3.56	2.37	3.25	3.31	2.56	3.00	3.18	2.56	2.50	2.19	1.75	2.57
CONTROL	4.00	5.13	4.50	4.75	4.00	5.00	3.87	5.47	3.50	3.67	4.25	2.93	3.59	4.27	4.44	4.75	5.25	2.69	4.43

[1] Based on general root rating (Iowa method 1-6)
[2] Tefluthrin applied at 0.10 lb. ai/A
[A] Data from field with carbamate history
[B] Data from field with no carbamate history
[C] Data from field with organophosphate history
* Applied in-furrow

WIREWORM INSECTICIDE EVALUATIONS

Wireworm control trials were conducted at two sites - near Kansas City, Missouri (Clay County); and near New Florence, Missouri (Montgomery County). Severely stunted plants and a reduction in stand were first noticed in a corn production field at the Kansas City location in 1989. A significant wireworm population was found and monitored by the UMC Pest Management staff, and wireworm insecticide evaluations were conducted at this site in 1990. Wireworm baits during the spring of 1994 showed an average of 40 wireworms per bait within the 5-acre plot area of the 60-acre field.

The research plots were placed in areas of heaviest wireworm concentrations. Individual plots were two 35-foot rows and replicated four times according to a randomized complete block design. Performance of treatments was evaluated by counting the total number of emerged plants to assess seed protection; and dead and damaged (wilted or stunted) plants were counted to assess seedling protection. The live plant count represents the mean number of plants remaining in the 35-ft row after subtracting the dead and damaged plants from the total number emerged.

Seven-inch band (7"B) and in-furrow (IF) granular applications were made with a V-belt seeder mounted on a two-row John Deere model 7100 max-emerge planter. Preweighed insecticide granules were placed uniformly along the V-belt seeder and directed through banders or tubes to obtain the desired placement. Spray treatments were applied through a tractor-mounted compressed-air sprayer system calibrated to deliver 18 gallons of finished spray at 30 psi. Corn was planted in 30-inch rows at a rate of 24,200 seeds per acre. Seeds pre-treated with seed treatments (ST) were planted through a cone seeder to uniformly distribute a pre-counted number of seeds over the 35-foot rows.

Table 6. Comparison of Registered and Experimental Insecticide Efficacy for Control of Wireworms in Corn, Kansas City, Missouri, 1994.

Insecticide	Rate oz/1000 ft	Placement	Plant Emergence (Standcount) Mean No.[1] Emerged Plants/35 row ft.
Kernel Guard	3.6 oz/cwt	ST	51.19 a
Lorsban NAF-1 15G	8	IF +	
Kernel Guard	3.6 oz/cwt	ST	49.88 ab
Lorsban NAF-1 15G	8	7"B +	
Kernel Guard	3.6 oz/cwt	ST	49.44 abc
Fortress 2.5G	12	IF	49.00 abcd
Counter 15G	8	7"B	48.56 abcde
Lorsban NAF-1 15G	8	IF	48.56 abcde
Kernel Guard	3.6 oz/cwt	ST	48.13 abcde
Fortress 2.5G	6	7"B	48.13 abcde
Counter 20CR	6	7"B	48.13 abcde
Furadan 4F	1.8	IF	47.69 abcde
Fortress 2.5G	12	7"B	47.69 abcde
Dyfonate II 15G	8	7"B	47.69 abcde
Counter 15G	8	IF	47.69 abcde
Force 1.5G	8	7"B	47.25 abcde
Capture 2E	0.11	IF	46.81 abcde
Regent 1.5G	8	7"B	46.38 abcde
Aztec 2.1G	6.7	IF	46.08 abcde
Force 3G	4	IF	45.94 abcde
Regent 1.5G	6	7"B	45.94 abcde
Lorsban NAF-1 15G	8	7"B	45.50 abcde
Regent 1.5G	6	IF	45.50 abcde
EXP60837A 1.5G	8	7"B	45.50 abcde
Counter 20CR	4.5	7"B	45.50 abcde
Thimet 20G	6	7"B	45.50 abcde
Control	-	-	45.06 bcde
Pounce 1.5G	12	IF	45.06 bcde
Regent 1.5G	8	IF	45.06 bcde
Fortress 2.5G	6	IF	44.63 bcde
Pounce 3.2EC	0.46	IF	44.19 bcde
Counter 20CR	6	IF	43.75 cde
Pounce 1.5G	12	7"B	43.31 de
Control	-	-	43.31 de
Thimet 20G	4.5	7"B	42.88 e

[1]Mean separation by DMRT; means followed by the same letter are not significantly different at P=0.05.

Table 7. Comparison of Registered and Experimental Insecticide Efficacy for Control of Wireworms in Corn, Kansas City, Missouri, 1994.

Insecticide	Rate oz/1000 ft	Placement	Mean % Damaged[1] Plants/35 row ft.
Capture 2E	0.11	IF	0.00 a
Kernel Guard	3.6 oz/cwt	ST	0.83 a
Counter 15G	8	7"B	0.89 a
Fortress 2.5G	6	7"B	0.89 a
Thimet 20G	6	7"B	0.96 a
Regent 1.5G	6	IF	1.09 a
Aztec 2.1G	6.7	IF	1.43 a
Lorsban NAF-1 15G	8	7"B +	
Kernel Guard	3.6 oz/cwt	ST	1.73 a
Thimet 20G	4.5	7"B	2.00 a
Lorsban NAF-1 15G	8	IF +	
Kernel Guard	3.6 oz/cwt	ST	2.68 a
Dyfonate II 15G	8	7"B	2.75 a
Kernel Guard	3.6 oz/cwt	ST	2.85 a
Pounce 3.2EC	0.46	IF	3.17 a
Fortress 2.5G	12	IF	3.60 a
Fortress 2.5G	12	7"B	3.64 a
Counter 15G	8	IF	3.67 a
Counter 20CR	6	7"B	3.68 a
Furadan 4F	1.8	IF	3.69 a
Regent 1.5G	6	7"B	3.74 a
Fortress 2.5G	6	IF	4.00 a
EXP60837A 1.5G	8	7"B	4.08 a
Force 1.5G	8	7"B	4.53 a
Regent 1.5G	8	IF	4.67 a
Counter 20CR	6	IF	5.89 a
Pounce 1.5G	12	7"B	6.14 a
Lorsban NAF-1 15G	8	IF	6.25 a
Regent 1.5G	8	7"B	6.55 a
Counter 20CR	4.5	7"B	6.73 a
Pounce 1.5G	12	IF	6.85 a
Lorsban NAF-1 15G	8	7"B	6.90 a
Force 3G	4	IF	6.98 a
Control	-	-	16.38 b
Control	-	-	19.88 b

[1]Mean separation by DMRT; means followed by the same letter are not significantly different at P=0.05.

Table 8. Comparison of Registered and Experimental Insecticide Efficacy for Control of Wireworms in Corn, Kansas City, Missouri, 1994.

Insecticide	Rate oz/1000 ft	Placement	Live Plant Count Mean No.[1] Live Plants/35 row ft.
Kernel Guard	3.6 oz/cwt	ST	50.75 a
Lorsban NAF-1 15G	8	IF +	
Kernel Guard	3.6 oz/cwt	ST	48.56 ab
Lorsban NAF-1 15G	8	7"B +	
Kernel Guard	3.6 oz/cwt	ST	48.56 ab
Counter 15G	8	7"B	48.13 ab
Fortress 2.5G	6	7"B	47.69 abc
Fortress 2.5G	12	IF	47.25 abcd
Kernel Guard	3.6 oz/cwt	ST	46.81 abcd
Capture 2E	0.11	IF	46.81 abcd
Dyfonate II 15G	8	7"B	46.38 abcd
Counter 20CR	6	7"B	46.38 abcd
Furadan 4F	1.8	IF	45.94 abcd
Fortress 2.5G	12	7"B	45.94 abcd
Counter 15G	8	IF	45.94 abcd
Aztec 2.1G	6.7	IF	45.50 abcd
Lorsban NAF-1 15G	8	IF	45.50 abcd
Force 1.5G	8	7"B	45.06 abcd
Regent 1.5G	6	IF	45.06 abcd
Thimet 20G	6	7"B	45.06 abcd
Regent 1.5G	6	7"B	44.19 abcd
EXP60837A 1.5G	8	7"B	43.75 bcde
Regent 1.5G	8	7"B	43.31 bcde
Pounce 3.2EC	0.46	IF	42.88 bcde
Force 3G	4	IF	42.88 bcde
Regent 1.5G	8	IF	42.88 bcde
Fortress 2.5G	6	IF	42.88 bcde
Lorsban NAF-1 15G	8	7"B	42.44 bcde
Counter 20CR	4.5	7"B	42.43 bcde
Pounce 1.5G	12	IF	42.00 bcde
Thimet 20G	4.5	7"B	42.00 bcde
Counter 20CR	6	IF	41.13 cde
Pounce 1.5G	12	7"B	40.69 de
Control	-	-	37.63 ef
Control	-	-	34.56 f

[1]Mean separation by DMRT; means followed by the same letter are not significantly different at P=0.05.

Table 9. Comparison of Registered and Experimental Insecticide Efficacy for Control of Wireworms in Corn, New Florence, Missouri, 1994.

Insecticide	Rate oz/1000 ft	Placement	Plant Emergence (Standcount) Mean No.[1] Emerged Plants/35 row ft.
Lorsban NAF-1 15G	8	7"B +	
Kernel Guard	3.6 oz/cwt	ST	49.00 a
Kernel Guard	3.6 oz/cwt	ST	46.38 ab
Kernel Guard	3.6 oz/cwt	ST	45.94 ab
Capture 2E	0.11	IF	45.94 ab
Furadan 4F	1.8	IF	43.35 abc
Aztec 2.1G	6.7	IF	43.31 abc
Pounce 3.2EC	0.46	IF	43.31 abc
Dyfonate II 15G	8	7"B	42.44 abc
Counter 20CR	4.5	7"B	42.00 abcd
Lorsban NAF-15G	8	IF +	
Kernel Guard	3.6 oz/cwt	ST	41.56 abcd
Force 3G	4	IF	41.56 abcd
Regent 1.5G	8	IF	40.69 abcde
Capture 0.2G	13.8	IF	40.25 abcdef
EXP60837A 1.5G	8	7"B	40.25 abcdef
Force 1.5G	8	7"B	38.94 abcdefg
Fortress 2.5G	6	7"B	38.50 abcdefg
Fortress 2.5G	12	7"B	38.50 abcdefg
AC513,917 15G	8	7"B	38.06 abcdefg
Fortress 2.5G	6	IF	38.06 abcdefg
Counter 15G	8	IF	38.06 abcdefg
Control	-	-	37.19 bcdefg
Pounce 1.5G	12	7"B	36.75 bcdefg
Counter 15G	8	7"B	36.35 bcdefg
AC513,918 15G	8	IF	36.31 bcdefg
Regent 1.5G	6	IF	35.87 bcdefg
Fortress 2.5G	12	IF	35.77 bcdefg
Pounce 1.5G	12	IF	35.44 bcdefg
Counter 20CR	6	7"B	35.44 bcdefg
AC513,918 15G	8	7"B	33.69 cdefg
AC513,919 15G	8	7"B	32.81 cdefg
Thimet 20G	4.5	7"B	32.38 cdefg
Regent 1.5G	8	7"B	32.38 cdefg
Counter 20CR	6	IF	31.06 defg
Lorsban NAF-1 15G	8	IF	31.06 defg
Lorsban NAF-1 15G	8	7"B	31.06 defg
Control	-	-	30.19 efg
AC513,917 15G	8	IF	29.35 efg
Thimet 20G	6	7"B	29.31 fg
Regent 1.5G	6	7"B	29.31 fg
AC513,919 15G	8	IF	28.77 g

[1]Mean separation by DMRT; means followed by the same letter are not significantly different at P=0.05.

Table 10. Comparison of Registered and Experimental Insecticide Efficacy for Control of Wireworms in Corn, New Florence, Missouri, 1994.

Insecticide	Rate oz/1000 ft	Placement	Mean % Damaged[1] Plants/35 row ft.
Lorsban NAF-1 15G	8	7"B +	
Kernel Guard	3.6 oz/cwt	ST	1.67 a
Force 3G	4	IF	1.92 a
Lorsban NAF-1 15G	8	IF +	
Kernel Guard	3.6 oz/cwt	ST	2.47 ab
Capture 2E	0.11	IF	4.01 abc
Pounce 3.2EC	0.46	IF	4.18 abc
Kernel Guard	3.6 oz/cwt	ST	4.93 abc
Aztec 2.1G	6.7	IF	5.14 abc
Fortress 2.5G	12	IF	6.81 abc
Counter 15G	8	7"B	6.89 abc
Regent 1.5G	8	7"B	6.89 abc
Regent 1.5G	6	IF	6.91 abc
Force 1.5G	8	7"B	6.92 abc
EXP60837A 1.5G	8	7"B	7.04 abc
Lorsban NAF-1 15G	8	IF	7.86 abc
Furadan 4F	1.8	IF	8.27 abc
Thimet 20G	6	7"B	9.05 abc
Kernel Guard	3.6 oz/cwt	ST	9.39 abc
Regent 1.5G	8	IF	9.53 abc
Thimet 20G	4.5	7"B	9.89 abc
Lorsban NAF-1 15G	8	7"B	10.02 abc
Pounce 1.5G	12	7"B	10.03 abc
Regent 1.5G	6	7"B	10.05 abc
Capture 0.2G	13.8	IF	10.62 abc
Counter 15G	8	IF	10.97 abc
Counter 20CR	6	IF	11.16 abc
Fortress 2.5G	6	IF	11.42 abc
Counter 20CR	4.5	7"B	11.42 abc
AC513,917 15G	8	7"B	12.51 abc
Counter 20CR	6	7"B	12.91 abc
Fortress 2.5G	12	7"B	13.09 abc
AC513,919 15G	8	7"B	13.31 abc
Pounce 1.5G	12	IF	13.35 abc
AC513,918 15G	8	7"B	13.74 abc
AC512,919 15G	8	IF	14.13 abc
Dyfonate II 15G	8	7"B	14.76 abc
Fortress 2.5G	6	7"B	15.53 bcd
AC513,917 15G	8	IF	16.12 cd
AC513,918 15G	8	IF	16.58 cd
Control	-	-	26.88 de
Control	-	-	31.89 e

[1]Mean separation by DMRT; means followed by the same letter are not significantly different at P=0.05.

Table 11. Comparison of Registered and Experimental Insecticide Efficacy for Control of Wireworms in Corn, New Florence, Missouri, 1994.

Insecticide	Rate oz/1000 ft	Placement	Live Plant Count Mean No.[1] Live Plants/35 row ft.
Lorsban NAF-1 15G	8	7"B +	
Kernel Guard	3.6 oz/cwt	ST	48.13 a
Kernel Guard	3.6 oz/cwt	ST	44.19 ab
Capture 2E	0.11	IF	44.19 ab
Pounce 3.2EC	0.46	IF	41.56 abc
Kernel Guard	3.6 oz/cwt	ST	41.56 abc
Aztec 2.1G	6.7	IF	41.13 abcd
Lorsban NAF-1 15G	8	IF +	
Kernel Guard	3.6 oz/cwt	ST	40.69 abcde
Force 3G	4	IF	40.69 abcde
Furadan 4F	1.8	IF	39.90 abcde
Counter 20CR	4.5	7"B	38.06 abcdef
EXP60837A 1.5G	8	7"B	37.63 abcdef
Regent 1.5G	8	IF	36.75 abcdefg
Dyfonate II 15G	8	7"B	36.31 abcdefg
Force 1.5G	8	7"B	36.31 abcdefg
Capture 0.2G	13.8	IF	35.88 bcdefg
Counter 15G	8	7"B	34.07 bcdefg
Regent 1.5G	6	IF	33.69 bcdefg
Fortress 2.5G	6	IF	33.69 bcdefg
Fortress 2.5G	12	7"B	33.69 bcdefg
Counter 15G	8	IF	33.69 bcdefg
Fortress 2.5G	12	IF	33.48 bcdefg
AC513,917 15G	8	7"B	33.25 bcdefg
Pounce 1.5G	12	7"B	32.81 bcdefg
Fortress 2.5G	6	7"B	32.38 bcdefgh
Pounce 1.5G	12	IF	31.94 bcdefgh
Counter 20CR	6	7"B	31.06 cdefgh
AC513,918 15G	8	IF	30.63 cdefgh
Regent 1.5G	8	7"B	30.19 cdefgh
Thimet 20G	4.5	7"B	29.75 cdefgh
Lorsban NAF-1 15G	8	IF	29.31 cdefgh
AC513,918 15G	8	7"B	28.88 defgh
Lorsban NAF-1 15G	8	7"B	28.44 efgh
AC513,919 15G	8	7"B	28.44 efgh
Counter 20CR	6	IF	27.56 fgh
Control	-	-	27.13 fgh
Regent 1.5G	6	7"B	26.69 fgh
Thimet 20G	6	7"B	26.69 fgh
AC513,917 15G	8	IF	24.73 gh
AC513,919 15G	8	IF	24.73 gh
Control	-	-	20.56 h

[1]Mean separation by DMRT; means followed by the same letter are not significantly different at P=0.05.

CUTWORM INSECTICIDE EVALUATIONS

Planting time insecticide evaluations (Tests 1 and 2) for control of black cutworm, *Agrotis ipsilon* (Hufn.), were conducted in barrier plots on the University of Missouri-Columbia South Farms near Columbia, Boone County. Granular row band treatments were applied with a V-belt seeder mounted on a two-row John Deere model 7100 max-emerge planter. Preweighed insecticide granules were placed uniformly along the V-belt seeder and directed for either 7-inch band (7"B) or in-furrow (IF)placement. Corn was planted at a seeding rate of 24,200 seeds per acre in 30-inch rows during the same operation. Broadcast (BD) and banded (7"B) sprays were applied through a tractor-mounted compressed air sprayer system calibrated to 20 gallons of finished spray at 30 psi. The pre-plant treatment was applied as a broadcast spray 25 days before planting.

Individual plots were two rows 35 feet in length, with 30-inch spacing. Treatments were replicated three times according to a randomized complete block design. Following planting, metal barriers (8 inches in height) were driven approximately 3 inches into the soil to enclose portions of the 35-foot plots (6 feet x 2 rows). Barriers were infested at seedling emergence with ten 3rd- to 5th-instar laboratory-reared black cutworm larvae. Test 2 compared one insecticide in two different tillages, conventional till (cn-till) and no-till. In Test 2, the cutworm infestation rate was increased to 15 because of the heavy cover present in the no-till conditions. Efficacy of the treatments was evaluated by counting the number of plants cut on three dates following larval infestation.

Table 12. Comparison of Registered and Experimental Insecticide Efficacy for Black Cutworm Planting Time Treatments in Corn (Test 1), Columbia, Missouri, 1994.

Insecticide	Rate oz/ 1000 ft	Placement	Mean % Cut Plants Days Post-Infestation 1	3	8	Total[1]
Furadan 4F	1.8	IF	0.00	0.00	0.00	0.00 a
Pounce 3.2EC	4 oz/A	Pre-plant	2.22	2.22	0.00	4.44 ab
Capture 2EC	0.11	7"B	2.78	4.63	0.00	7.41 ab
Pounce 3.2EC	4 oz/A	Bd	7.22	3.51	0.00	10.72 ab
Pounce 1.5G	9.2	7"B	5.47	8.42	6.14	20.04 ab
Capture 0.2G	13.8	7"B	16.44	7.69	0.00	24.13 ab
Pounce 1.5G	9.2	IF	17.78	9.86	0.00	27.64 b
Control	-	-	26.55	22.57	9.71	58.83 c

[1]Mean separation by DMRT; means followed by the same letter are not significantly different at P=0.05.

Table 13. Comparison of Registered and Experimental Insecticide Efficacy for Black Cutworm Planting Time Treatments in No-till versus Conventional-Till Corn (Test 2), Columbia, Missouri, 1994.

Insecticide	Rate oz/ 1000 ft	Placement	Mean % Cut Plants Days Post-Infestation 1	4	6	Total[1]
Lorsban 15G	8	7"B cn-till	8.36	6.04	0.00	14.40 a
Lorsban 15G	8	7"B no-till	4.65	11.25	4.52	20.43 a
Lorsban 15G	8	IF cn-till	2.08	15.07	4.17	21.32 a
Lorsban 15G	8	IF no-till	0.00	12.71	9.10	21.81 a
Control	-	- cn-till	4.76	16.11	4.46	25.33 a
Control	-	- no-till	17.14	14.15	2.56	33.86 a

[1]Mean separation by DMRT; means followed by the same letter are not significantly different at P=0.05.

APPENDIX

Agronomic and Entomological Information for Insecticide Efficacy Plots, Missouri, 1994.

	ROOTWORM	CUTWORM		WIREWORM	
Location	Maitland	Columbia		Kansas City	New Florence
	Nodaway County	Boone County		Clay County	Montgomery County
Planting Date	Test 1 May 11 Test 2 May 23	Test 1 June 27	Test 2 October 7	April 23	May 17
Corn Hybrid	Pioneer 3377	Pioneer 3162	Pioneer 3162	Pioneer 3245	Pioneer 3245
Evaluation Date	July 19	July 3, 5, 11	October 21, 24, 26	May 19	June 13
Insect Population	98% Western 2% Northern	Infested with laboratory reared black cutworm larvae		Ave. 40 wireworms/ bait trap	Ave. 5 wireworms/ bait trap

1994 Soil Test Results for Evaluation Sites

Location	pHs	N.A. meq/ 100 g	O.M. %	P lbs/A	Ca lbs/A	Mg lbs/A	K lbs/A	% Sand	% Silt	% Clay	Texture
Kansas City	7.0	0.0	1.3	47	2697	455	385	64	18	18	Sandy Loam
Maitland	5.9	2.5	3.5	164	4497	454	905	10	56	34	Silty Clay Loam
New Florence	6.0	1.5	2.1	32	2774	138	192	14	60	26	Slit Loam
South Farm	4.9	6.0	2.2	60	2450	307	411	2	66	32	Silty Clay Loam

Daily Rainfall and Temperature Data for
Kansas City, Missouri, 1994[1].

	April			May		
Date	Temp Max	(°F) Min	Rainfall (inches)	Temp Max	(°F) Min	Rainfall (inches)
1	71	41		51	38	0.05
2	70	42	0.03	52	41	0.01
3	53	29	0.96	63	44	0.10
4	69	38		71	46	
5	67	29		78	50	
6	46	26	0.32	76	59	0.92
7	58	31		56	47	0.80
8	67	44		64	41	
9	66	49		74	51	
10	52	45	1.23	77	51	
11	52	46	1.27	81	54	
12	48	40	0.57	81	60	
13	70	38	0.03	76	60	
14	81	52		77	60	
15	81	46	0.12	77	56	0.48
16	77	42	0.05	80	59	
17	86	46		80	57	
18	81	61		78	53	
19	80	59		76	53	
20	76	52		78	51	
21	74	47	0.11	80	56	
22	66	45	0.75	82	57	
23	75	47		83	59	
24	82	57		85	64	
25	80	64		84	60	
26	78	63		81	54	0.05
27	77	37		81	47	
28	63	41	3.10	78	58	
29	55	34	0.25	77	62	
30	48	37	1.38	85	56	
31				90	64	

[1] Weather data were recorded at Lee's Summit, approximately 10 miles south of field plots.

Daily Rainfall and Temperature Data for
Maitland, Missouri, 1994[1]

	May			June			July		
Date	Temp Max	(°F) Min	Rainfall (inches)	Temp Max	(°F) Min	Rainfall (inches)	Temp Max	(°F) Min	Rainfall (inches)
1	52	37		76	57	0.26	89	65	0.72
2	54	42	0.01	63	54	0.59	82	66	0.24
3	62	43		72	54		79	64	0.01
4	69	40	0.04	79	62		91	71	0.13
5	78	43	0.04	81	62	1.04	90	70	
6	56	48	0.14	89	65		89	70	
7	58	40	0.07	83	63		86	69	0.05
8	63	35		69	61	0.09	75	57	0.18
9	74	45		70	50		80	54	
10	79	41		81	59	0.26	84	61	0.61
11	85	53		81	56	0.36	88	68	
12	78	46		84	62	0.48	90	65	
13	77	52		90	72		86	62	
14	71	58	0.35	90	78		81	62	
15	77	51		88	72		81	58	
16	80	50		87	70	0.03	84	65	0.22
17	79	57		90	73		86	64	
18	78	46		93	71		86	61	
19	78	48		91	69		94	70	
20	79	58		94	70		81	64	0.87
21	81	58		90	68		82	61	0.01
22	84	54		87	70		82	60	
23	87	59	0.19	77	62	0.30	87	57	
24	89	62		83	59		81	64	
25	85	56	0.05	91	60	0.44	85	58	0.19
26	69	47		79	62		76	57	
27	75	42		83	58		77	53	
28	80	49		84	59		79	50	
29	75	63	0.46	84	59		82	48	
30	86	59		87	59		84	53	
31	79	62	0.12				88	61	

[1] Weather data were recorded at Albany, Missouri, approximately 36 miles east of field plots.

Daily Rainfall and Temperature Data for
New Florence, Missouri, 1994[1]

	April			May		
Date	Temp (°F) Max	Min	Rainfall (inches)	Temp (°F) Max	Min	Rainfall (inches)
1	55	42		52	34	Trace
2	67	54		54	36	
3	62	50	0.13	55	38	
4	58	45		64	44	
5	67	49		69	48	
6	41	35	0.07	74	52	Trace
7	43	36	0.46	64	50	0.71
8	57	43		56	46	Trace
9	59	49		68	48	
10	62	52	0.85	72	48	
11	61	53	1.98	74	48	
12	64	54	3.05	78	52	0.47
13	68	59		78	51	
14	74	63		79	51	
15	90	70		78	48	1.85
16	60	56		79	49	
17	78	66		72	49	
18	78	65		78	48	
19	81	69		80	43	
20	82	70		82	45	
21	81	69		83	49	
22	65	55		84	52	
23	65	56		89	62	
24	81	71		85	62	
25	81	73		84	60	0.09
26	85	77	0.96	81	55	Trace
27	85	66	1.57	69	43	
28	61	54	1.22	74	50	
29	78	58	0.36	76	54	
30	48	41	1.75	78	59	0.11
31				78	60	Trace

[1] Weather data were recorded at KWRE ratio station in Warrenton, Missouri approximately 15 miles of field plots.

Daily Rainfall and Temperature Data for University of Missouri
South Farms, Columbia, Missouri, 1994.

	June			July			October		
Date	Temp Max	(°F) Min	Rainfall (inches)	Temp Max	(°F) Min	Rainfall (inches)	Temp Max	(°F) Min	Rainfall (inches)
1	80	64		86	66		88	64	
2	82	58	0.28	90	65		86	58	
3	72	54	0.44	86	66		82	60	
4	72	53	0.02	90	64		76	55	
5	79	61		94	75		73	46	
6	82	64	0.18	93	73		71	54	
7	86	63		92	67	0.11	84	63	
8	89	61	0.15	88	65	0.46	78	50	1.59
9	69	57	0.11	76	57	Trace	57	37	0.05
10	69	59		81	59		65	37	
11	81	59		84	64	0.07	63	37	
12	85	67		88	61		65	43	
13	88	69		87	67		70	52	0.15
14	90	74		88	68	Trace	67	42	
15	91	73		89	65		64	49	0.01
16	90	71		86	65		66	58	
17	90	68		82	63	0.63	70	58	0.33
18	91	68		79	63	0.03	72	61	
19	91	72		91	71		67	58	0.12
20	94	71		95	72		73	45	
21	94	69		88	68	Trace	75	50	
22	94	71		88	62	0.11	72	54	0.11
23	91	71	0.27	84	63		73	40	
24	88	63	0.29	88	64		66	44	0.23
25	82	62		84	64		61	28	
26	90	64	0.92	88	65	0.02	52	26	
27	83	61		73	54	0.24	55	31	
28	84	66		82	55		63	39	
29	89	63		81	55		64	45	
30	86	61		85	59		63	48	
31				87	62		68	44	0.70

COOPERATING COMPANIES

American Cyanamid Company

DowElanco

Du Pont Agricultural Products

FMC Corporation

Micro Flo Company

Miles Inc.

Rhône-Poulenc Ag Company

Zeneca