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Corn rootworm insecticide consistency

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Abstract
Labeled rates of corn rootworm insecticides have been tested in conventional-till (chisel plowed then field cultivated) fields over the past six years. For the past three years, these same insecticides have been examined in no-till fields. In all tests, insecticides went head-to-head in their ability to protect corn roots from corn rootworm larval injury. Roots from untreated check rows, in both tillages, averaged about 1.5 nodes (circles) of roots destroyed. Any tests that did not challenge an insecticide's performance (no obvious root pruning in the untreated rows) were not included in the analysis.

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 [1] **Lodged corn from rootworm larvae.**

What is insecticide consistency?

To evaluate insecticides, corn root systems are examined for feeding damage. To prevent potential yield-loss an insecticide should kill enough larvae so that **no more** than approximately one-third of a node of roots is eaten. If an insecticide did this every time, it would be 100 percent consistent. A six-year summary of insecticide consistency is presented in Table 1. There were no significant differences between any of the insecticides that provided >80 percent consistency, regardless of tillage. Yield-loss resulting from root feeding is highly correlated with plant stress (mainly caused by drought or lodging). In the absence of plant stress, root feeding alone (even heavy feeding) may not result in yield-loss. With adequate moisture, most root systems will compensate for lost roots with regrowth. However, coupling plant stress with root injury (>1/3 node) usually results in reduced yields.

Can tillage affect an insecticide's consistency?

In conventional-till fields, Aztec 2.1G, Counter 20CR, Force 3G, and Fortress 5G worked equally well when applied either T-band or in-furrow. However, in the no-till fields, Fortress 5G T-band was significantly less effective when compared with Fortress 5G in-furrow (50 percent versus 96 percent; Table 1).

Table 1. Summary of corn rootworm insecticide consistency data (1992-1997).

		Percentage consistency[a]		
Insecticide	**Placement**	**Combined tillages**	**Conv. till**	**No-till**
Counter 20CR	Furrow	95a[b]	92a	100a
Force 3G	T-band	95a	98a	85ab
Force 3G	Furrow	95a	94a	96ab
Counter 20CR	T-band	94a	95a	92ab
Aztec 2.1G	Furrow	93a	94a	92ab
Fortress 5G	Furrow	91a	89ab	96ab
Aztec 2.1G	T-band	91a	98a	73b
Lorsban 15G	T-band	90a	91a	88ab
Thimet 20G	T-band	75b	71c	85ab
Fortress 5G	T-band	69b	77bc	50c
Untreated Check	----	0c	0d	0d

[a]Consistency equals the percentage of times an insecticide treatment prevented potential yield-loss; data from 20 tests (65 conventional-till and 26 no-till replications) at various locations throughout Iowa. Untreated check root ratings were combined tillages 4.4, conventional-till 4.5, and no-till 4.4.

[b]Means within a column followed by the same letter are not significantly different (P £0.05, Ryan's Q test).

Corn rootworm insecticide performance has been satisfactory. Are there any data that relate various levels of rootworm injury to yield-loss?

The Iowa 1-6 root-rating scale is used to evaluate corn roots for rootworm injury:

0. no visible damage or only a few minor feeding scars;
1. some roots with feeding scars but none eaten off to within 1.5 inches of the plant;
2. several roots eaten off to within 1.5 inches of the plant but never the equivalent of an entire node of roots destroyed;
3. one node of roots destroyed or the equivalent;
4. two nodes of roots destroyed or the equivalent; and 6, three or more nodes of roots destroyed.

 [2] **Heavy feeding injury caused by rootworm larvae.**

Iowa State University data show there is very little yield advantage from using an insecticide when rootworm pressure is light (check root rating between 3 and 4). In 51 observations over 8 years where the check averaged 3.3, treating provided an **average** yield increase of 4.6 bu/acre. Over the same time period, in 64 observations with moderate to heavy corn rootworm pressure there was a 17 bu/acre yield advantage (Table 2). Also, the frequency of plant lodging can be related to the two corn rootworm pressure levels. Over 10 years where pressure was light, corn lodging occurred 7 percent of the time in the untreated check. In moderate to heavy pressure tests, lodging occurred 57 percent of the time.

 [3] **Corn rootworm larva.**

Table 2. Impact of two levels of corn rootworm larval injury on yield and lodging.

	Moderate to heavy pressure[a] (check >4)	Light pressure[b] (check 3-4)
Avg. check root rating	4.8	3.3
Avg. treatment root rating	2.8	2.4
Avg. treatment consistency (%)	61.0	86.0
Avg. yield increase (bu/acre)	17.0	4.6
Lodging in check (%)	57.0	7.0

[a]Check root ratings and yields based on 64 observations over 8 years; treatment data based on 384 observations (6 insecticides x 64 replications). Lodging based on 14 observations over 10 years.

[b]Check root ratings and yield based on 51 observations over 8 years; treatment data based on 306 observations (6 insecticides x 51 replications). Lodging based on 14 observations over 10 years.

How well has the new insecticide Regent worked?

Tests with granular and liquid formulations of Regent were started in 1991. Regent (fipronil), a product of Rhone-Poulenc, is in a new family of insecticides called phenylpyrazoles. Regent 80WG (wettable granule formulation) has just recently been labeled for control of corn rootworm. It is a restricted-use pesticide applied in-furrow at the rate of 2.6 ounces per gallon of water per acre. Microtubes attached to the planter's seed-drop tubes are used to place the insecticide in-furrow at the desired rate. In 1996 and 1997 Regent 80WG and other labeled insecticides were evaluated in six tests where corn rootworm feeding pressures ranged from moderately heavy (check = 4.5) to light (check = 3.5). An experiment at Ames that was planted very late in 1996 was not included in the summary because of minor rootworm infestations in three of the four replications. Head-to-head insecticide comparisons under these two pressure levels are presented in Table 3. (The moderately heavy pressure is

similar to test pressure in Table 1.). Regent 80WG provided consistent root protection under light pressure but not under moderately heavy pressure.

Table 3. Regent 80WG consistency (1996-1997).

		Moderately heavy pressure[a]		Light pressure[b]	
Insecticide	**Placement**	**Percentage consistency**	**Root rating**	**Percentage consistency**	**Root rating**
Force 3G	T-band	92a[c]	2.6a	100a	2.1a
Aztec 2.1G	T-band	83a	2.8a	100a	2.3ab
Lorsban	T-band	83a	2.9a	93ab	2.4abc
Counter 20CR	T-band	83a	2.6a	93ab	2.1a
Thimet 20G	T-band	75ab	2.9a	64b	3.0c
Aztec 2.1G	Furrow	75ab	2.8a	100a	2.3ab
Counter 20CR	Furrow	75ab	2.9a	93ab	2.1a
Force 3G	Furrow	75ab	2.8a	100a	2.4abc
Fortress 5G	Furrow	75ab	2.6a	86ab	2.5abc
Fortress 5G	T-band	67ab	2.7a	77ab	2.8bc
Regent 80WG	Furrow	25bc	3.6b	79ab	2.7abc
Untreated Check	----	0c	4.5c	0c	3.5d

[a] Data from 12 replications where check was >=4.

[b]Data from 14 replications were check was between 3 and 4.

[c]Means within a column followed by the same letter are not significantly different (P £ 0.05, Ryan's Q test).

How well has Furadan 4F performed?

Consistency data from 1993-1997 with Furadan 4F, Counter 20CR, and Force 3G are presented in Table 4. Postemergence applications of Furadan 4F gave 82 percent consistency, whereas the planting-time applications of Counter 20CR and Force 3G were significantly better (96 percent consistency). **Table 4. Furadan 4F consistency (1993-1997).[a]**

Insecticide	Placement[b]	Timing	Percentage consistency	Root rating
Counter 20CR	T-band or F	At-plant	96a[c]	2.2a
Force 3G	T-band or F	At-plant	96a	2.3a
Furadan 4F	Broadcast	Postemerge	82b	2.4a
Untreated Check	----	----	0c	4.4b

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