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Corn rootworm insecticides evaluated

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Abstract
Two integrated pest management strategies are used widely to protect corn roots from corn rootworm injury: crop rotation and insecticides. If corn is not rotated, or if extended diapause has been documented to occur in a particular field, then a soil insecticide might be necessary to protect the roots in 2000. The reason we say it *might* be necessary is because many fields do not have a rootworm population of a sufficient size to cause economic damage. Believe it or not, there are thousands of continuous cornfields across the state in which a rootworm insecticide is not necessary.

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Two integrated pest management strategies are used widely to protect corn roots from corn rootworm injury: crop rotation and insecticides. If corn is not rotated, or if extended diapause has been documented to occur in a particular field, then a soil insecticide might be necessary to protect the roots in 2000. The reason we say it *might* be necessary is because many fields do not have a rootworm population of a sufficient size to cause economic damage. Believe it or not, there are thousands of continuous cornfields across the state in which a rootworm insecticide is not necessary. Without field scouting information from last August, it is difficult to know if you will need a soil insecticide in 2001. If an insecticide is used next year, protection of corn roots should be one of the major considerations when selecting a product.

Corn rootworm insecticides were evaluated in side-by-side trials at several locations across the state. These field trials measure insecticide performance in protecting corn roots under a wide range of environmental conditions. Performance is measured two ways: root ratings and percentage consistency.

This year we are making a major change in the way the root injury information is presented.

We have abandoned the traditional Iowa 1-6 scale and in its place implemented the Iowa State node-injury scale. The Iowa State node-injury scale was developed by one of us (J.O.) because it more accurately reflects the relationship of injury from the low end to the high end of the scale (Table 1). For example, with the Iowa 1-6 scale a rating of 3 did not necessarily rate twice as much injury as a rating of 1.5. But with the Iowa State node-injury scale, there is a straight linear relationship and a rating of 3 does indicate twice as much injury as a rating of 1.5. We encourage you to view the interactive root rating page [1]. This interactive site will allow you to compare the Iowa 1-6 scale to the Iowa State node-injury scale, plus follow the progression of injury by rootworm larvae on a computerized root.

Injury by corn rootworm larvae can result in a significant amount of the roots being injured or removed from the plant. A low Iowa State node-injury root rating (0.25) is highly desirable (this is essentially the same amount of injury as 2.5 on the Iowa 1-6 scale). This low root rating indicates that the insecticide adequately protected the roots from economic injury. Each insecticide was measured under moderate-to-heavy feeding pressure. Roots in the 2000 experiments from the untreated plots averaged 1.68, which indicates that 1 2/3 root nodes have been eaten away.

Looking at root ratings and how they translate into the performance of an insecticide can be difficult to understand. Another measurement of root protection we use is called consistency. Consistency is measured by the percentage of times in which the insecticide-treated roots averaged a rating of 0.25 or less on the Iowa State node-injury scale when moderate or large

populations of corn rootworm larvae attacked the roots. An easy way to understand percentage consistency is to think of it as being similar to a baseball batting average; the higher the number, the better the performance.

No insecticide was 100 percent consistent in providing adequate protection (a rating of 0.25 or less) during 2000. Even the best products sometimes failed, but this was rare. Most products gave very good root protection most of the time based on the percentage consistency. From a statistical standpoint, everything in Table 2 from Force 3G down to Capture 2EC provided similar levels of consistency. However, a number of products did not perform well and these can be found near the bottom of the table. It is important to point out that the two seed treatments, ProShield and Prescribe, are very poor at protecting roots from corn rootworm injury. One year's data strongly indicates that the seed treatments simply do not provide an acceptable level of root protection against moderate-to-large populations of corn rootworm larvae. There are other insecticides that give consistently better root protection. Table 3 provides a 3-year overview of soil insecticide performance in head-to-head comparisons.

Consistent performance is one factor to consider when using a corn rootworm insecticide. Other factors worthy of consideration might be cost, pounds of active ingredient being applied per acre, ease of handling, application equipment needed, other pests controlled, restricted-use labeling, and potential hazards to surface water.

Table 1. Iowa State node-injury scale.

Root Rating	Description
0.00	No feeding damage (lowest rating that can be given)
1.00	One node (circle of roots), or the equivalent of an entire node, eaten back to within approximately 2 inches of the stalk (soil line on the 7th node)
2.00	Two nodes eaten
3.00	Three or more nodes eaten (highest rating that can be given)

Damage in between complete nodes eaten is noted as the percentage of the node missing, i.e.,1.50 = 1 1/2 nodes eaten; 0.25 = 1/4 of one node eaten, etc.

Table 2. Summary of root injury ratings and percentage of consistency for planting-time and postemergence insecticide treatments, 2000. Iowa State University corn rootworm efficacy tests (six locations).

		Iowa State Node-Injury[b,c,d]				
Insecticide	**Placement[a]**	**Full**	**Partial (%)**		**% Consistency[b,c,e]**	
Force 3G	T-band	0	9	a	96	a

Aztec 2.1G	T-band	0	9	a	96	a
Fortress 5G	T-band (SB)	0	9	a	95	a
Force 3G	Furrow	0	13	a	94	a
Aztec 2.1G	Furrow	0	14	a	91	a
Counter 20CR	T-band	0	15	a	89	ab
Fortress 5G	Furrow (SB)	0	18	a	86	abc
Lorsban 15G	T-band	0	21	a	83	abc
Counter 20CR	Furrow	0	25	a	76	abc
Capture 2EC	T-band	0	29	a	75	abc
Furadan 4F	B'cast-nc	0	39	a	67	bcd
Lorsban 15G	Furrow	0	44	ab	65	cd
Thimet 20G	T-band	0	47	ab	66	bcd
Regent 4SC	Furrow-M	0	76	b	51	d
ProShield	Seed Treatment	1	30	c	22	e
Prescribe	Seed Treatment	1	46	cd	9	e
CHECK	--	1	68	d	13	e

[a]T-band and furrow, granular insecticide applied at planting time; B'cast-nc, liquid insecticide broadcasted (June 2-12), no cultivation; SB, SmartBox application (all others are Noble application); Furrow-M, microtube application, in-furrow (water carrier rate of 4 gallons/acre).

[b]Head-to-head comparisons; chemical means based on 96 observations; multiple check means based on 204 observations; 27 of 36 replications analyzed; replications that did not have sufficient larval feeding to challenge a product's performance (UTC rep mean <0.75 of a node injured) were deleted from these analyses.

[c]Means sharing a common letter do not differ significantly according to Ryan's Q Test (P < 0.05).

[d]Full, number of nodes completely eaten; partial, percentage of a node (or an additional node) eaten.

[e]% consistency = percentage of times node-injury rating was 0.25 (1/4 node eaten) or less.

Table 3. Three-year (1998-2000) summary of root injury ratings and percentage consistency for planting-time and postemergence insecticide treatments. Iowa State University corn rootworm efficacy tests (15 locations).

		Iowa State Node-Injury[b,c,d]				
Insecticide	**Placement[a]**	**Full**	**Partial (%)**		**% Consistency[b,c,e]**	
Force 3G	Furrow	0	13	a	91	a
Aztec 2.1G	Furrow	0	15	ab	88	a
Aztec 2.1G	T-band	0	16	ab	87	ab
Force 3G	T-band	0	17	abc	84	abc
Counter 20CR	T-band	0	26	abc	79	abc
Counter 20CR	Furrow	0	29	abcd	76	abc
Fortress 5G	Furrow (SB)	0	34	abcd	73	bc
Furadan 4F	B'cast-nc	0	39	bcde	70	cd
Lorsban 15G	T-band	0	39	bcde	70	cd
Fortress 5G	T-band (SB)	0	40	cde	69	cd
Lorsban 15G	Furrow	0	53	def	57	d
Regent 4SC	Furrow-M	0	60	ef	56	d
Thimet 20G	T-band	0	65	f	57	d
CHECK	--	1	72	g	10	e

[a]T-band and Furrow, granular insecticide applied at planting time; B'cast-nc, liquid insecticide broadcasted during the first 2 weeks of June, no cultivation; SB, SmartBox application (all others are Noble application); Furrow-M, microtube application, in-furrow (water carrier rate of 1 gallon/acre in 1998 and 1999; 4 gallons/acre in 2000).

[b]Head-to-head comparisons in 69 replications (chemical means based on 252 observations; multiple check means based on 594 observations; replications that did not have sufficient larval feeding to challenge a product's performance (UTC rep mean <0.75 of a node injured) were deleted from these analyses.

[c]Means sharing a common letter do not differ significantly according to Ryan's Q Test ($P < 0.05$).

[d]Full, number of nodes completely eaten; partial, percentage of a node (or an additional node) eaten.

[e]% consistency = percentage of times node-injury rating was 0.25 (1/4 node eaten) or less.