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G92-1108 Evaluating Corn Rootworm Soil Insecticide Performance

J. F. Witkowski

University of Nebraska-Lincoln, jwitkowski1@unl.edu

Lance J. Meinke

University of Nebraska - Lincoln, lmeinke1@unl.edu

Gary L. Hein

University of Nebraska - Lincoln, ghein1@unl.edu

Keith J. Jarvi

University of Nebraska - Lincoln, kjarvi1@unl.edu

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Evaluating Corn Rootworm Soil Insecticide Performance

This publication describes a technique used to evaluate the relative performance of insecticides in protecting corn roots from feeding damage by corn rootworm larvae.

*J. F. Witkowski, R. J. Wright, Extension Entomologists
L. J. Meinke, Associate Professor of Entomology
G. L. Hein, Extension Entomologist
K. J. Jarvi, Extension Assistant*

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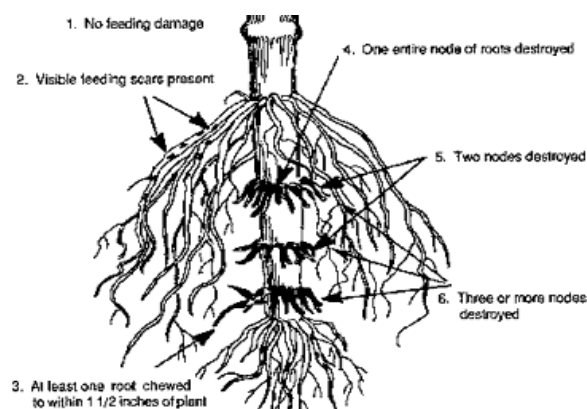
Insecticides applied at planting or cultivation time are commonly used in continuous corn to protect the roots from damage by western and northern corn rootworms.

Measuring the relative performance of these insecticides in protecting corn roots from rootworm larval damage is important. There are several ways to do this, including: 1) estimating the percent lodging of the plants beyond 30° from vertical; and 2) using one of several visual root damage rating scales.

The major disadvantages of the percent lodging technique are that significant lodging can occur in the absence of rootworm damage and, conversely, significant root damage can occur in the absence of lodging.

Visual root damage rating systems are commonly accepted by researchers in industry and at universities as the standard technique for measuring insecticide performance relative to other insecticides and to an untreated check. The rating system most commonly used for comparing insecticide performance is the "Iowa State University 1 to 6 Scale" (*Figure 1*). Another scale sometimes used in research is based on a 1-9 scale.

Figure 1. Description of the Iowa State University 1 to 6 root damage scale.



Rating	Description of root system
1	No noticeable feeding damage.
2	Feeding scars present but no root pruning.
3	At least one root pruned, but less than an entire node of roots pruned.
4	At least one full node of roots pruned but less than two full nodes.
5	At least two full nodes pruned, but less than three full nodes.
6	Three or more full nodes of roots pruned.

To qualify as a pruned root, the root must have been pruned to within 1 1/2" of the plant. It is not necessary for all of the pruned roots to originate from the same node to qualify as a root system with a full node pruned. It is only necessary that the number of roots pruned is equivalent to that in a full node.

Rootworm larvae have chewing-type mouthparts and tunnel into and remove plant tissue while feeding. Damage may appear as superficial feeding scars (discolored injury points) or as "root pruning," which results from larvae chewing through the entire diameter of the root and tunneling into the root. The root rating scale is based on both types of feeding.

The number of adult beetles emerging later in the season is not a good measure of soil insecticide performance, since these insecticides are applied in-furrow or in a narrow band, and only protect the central roots. Some larvae will be able to survive and produce adults by feeding on roots outside of the treated area even when highly effective materials are used.

Using the 1-6 Root Damage Rating System

Select several plants (5 to 10) from each of three to five different areas of the field, depending on its topography. Rootworm damage rarely occurs at random. Increasing the number of sample sites increases accuracy. Include at least one sample site from each field area, for example, low areas, side hills, etc. When using an untreated strip, paired sampling is appropriate; select similar sample sites in adjacent insecticide treated and untreated strips.

Select plants typical of the area with respect to size, spacing, and appearance. Do not pick only damaged plants. After a plant has been selected, remove it using a spade, sand shovel or other suitable tool. Be careful to extract the main part of the plant root system, typically leaving about a 9-inch cube of soil surrounding the root system. Thoroughly wash the root system to remove the soil from the roots, and rate it for root damage as soon as possible. To minimize evaluator bias, have one person rate all roots. If this is not feasible have one person rate all roots from one field or one replication of the trial.

A critical aspect of the rating system relates to the seasonal development of the corn plant and the seasonal incidence of the rootworm. The plant needs to be developed to the point where at least three root nodes are clearly visible. This usually occurs about late whorl or early tassel emergence. The degree of "root recovery" following larval damage varies according to the corn hybrid planted and environmental conditions. Consequently, a strong

rooted hybrid, under good growing conditions, may rapidly mask the severity of the rootworm damage. This "masking effect" is usually expressed by the development of a massive fibrous root system. Take root ratings as soon as possible after peak larval damage and when three root nodes are clearly visible. This is usually in early to mid-July in eastern Nebraska. When rating root systems that have developed dense fibrous regrowth, it may be necessary to split the root system in half by cutting down through the center of the stalk to observe the extent of damage close to the stalk.

Root damage ratings can be useful in measuring the relative performance of insecticides in protecting corn roots from feeding damage by corn rootworm larvae. However, **root damage ratings are not good predictors of yield.** Final yield is influenced by many factors in addition to rootworm damage, including soil moisture after rootworm feeding is completed, soil fertility and the ability of the hybrid to recover from root injury. Research has shown that a root damage rating of 3.0 or higher (1-6 scale) indicates a potential for grain yield loss, depending on crop growing conditions before and particularly after damage occurs. Under good growing conditions damage ratings above 3.0 may not result in economic loss, while under stressful growing conditions, economic loss may occur with root damage ratings below 3.0.

Evaluating Soil Insecticide Performance

Researchers at the University of Nebraska evaluate many registered soil insecticides used for rootworm control at planting or cultivation time at different locations. These studies provide accurate data on insecticide performance over a range of conditions and a number of years. The results of these tests are available from Extension specialists with the University of Nebraska Department of Entomology. Results from Nebraska and other states are published annually in *Insecticide and Acaricide Tests*, available from the Entomological Society of America, 9301 Annapolis Rd., Lanham MD 20706.

Because not all treated fields develop significant corn rootworm pressure, the effectiveness of an insecticide can only be determined when compared to an untreated check. Whenever possible, growers should leave several untreated strips as a means of evaluating the performance of insecticides under their application methods and growing conditions.

On-the-farm research using replicated strip trials is becoming more common. The most valuable information is obtained from studies where treatments are randomized and replicated (see EC 92-125, *On-farm Trials for Farmers Using the Randomized Complete Block Design*, for more information). Comparing two adjacent unreplicated treatments (for example, an insecticide treated strip vs. an adjacent untreated strip) or single strips of several insecticides compared with each other and a single, non-adjacent, untreated strip may not result in accurate comparisons.

To keep updated on new developments in rootworm soil insecticide research, see EC1563, *Corn Rootworm Management*, and the Department of Entomology's *Managing Corn Rootworm Adults*, *Nebraska Insecticide Recommendations*, *Managing Corn Rootworm Larvae* and *Nebraska Insecticide Recommendations*.

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