

## Conducting Root Digs for Corn Rootworm

### Introduction

Root digs are an important part of managing corn rootworm (CRW) because they help to evaluate CRW pressure and with comparing the effectiveness of different control measures. Root digs should take place at the optimum time and the Iowa State University 0-3 node-injury scale (NIS) should be used to evaluate damage.

### Timing of Root Digging

Root damage from CRW is highest when the majority of larvae have completed the third larval stage, which is often around the tasseling stage of corn in July or August. The third larval stage can occur as early as June with above-average temperatures in spring and early summer. Ideally, there is a 2- to 3-week window when timing is optimal for digging roots. Digging roots too early before larvae have completed development can underestimate the amount of damage that can be present. Roots dug after most adults have emerged are often more difficult to wash and rate due to root regrowth.

### Considerations During Root Digging

- Five consecutive root balls should be dug in at least three random locations throughout the field. If evaluating the efficacy of different CRW treatments, dig several root balls per treatment.
- Digging roots from an area with no biotech trait to control CRW and/or no soil insecticide can help determine the overall CRW pressure.
- If the CRW larvae pressure is light in this 'untreated' area, it is likely that feeding differences will be minimal in treated areas of the field and further digging may not be warranted.
- Removing the upper portion of the plant about 1-2 feet above the root mass can help make handling (hauling out of the field, washing, etc.) much easier.

- Label the root masses with the treatment if applicable. Permanent marker on duct tape placed a few inches below where the stalk was cut works fairly well.
- Instead of digging the plants individually, it is often easier to dig in a large oval shape around five plants. Loosening the soil around the five-plant area can help keep the root masses intact and still allow separation of the plants.

### Washing

Washing roots immediately after digging may remove some of the smaller roots with the soil; therefore, roots should be soaked in a tub of water for 30 minutes or more to help loosen soil from the roots before washing. If CRW larvae or pupae are present in the root ball, they may float to the top of the water while soaking.

Roots should be washed carefully using a pressure washer or strong hose. To avoid unwanted injury, the pressure washer should be on low. After washing, the roots are ready to be rated.

### Root Rating

When rating roots, carefully pull the roots back at each node to allow for easier inspection of rootworm scarring and root pruning. The top three nodes should be evaluated, starting with the uppermost node which has all of the roots at least 1.5 inches into the soil. Brace roots should not be included in root damage assessments. To assign a damage rating, assess root pruning and scarring using the

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0-3 NIS rating scale from Iowa State University (Table 1 and Figure 1). If regrowth is extensive, consider removing it to more accurately assess damage to the original root system. Feeding scars appear as small, brown lesions.

If the feeding shown in Figure 1A was the extent of the damage on the root mass, it would receive an NIS rating of 0.05. Extensive feeding can result in larval tunneling, which is not shown in Figure 1.

Figure 1B shows a root tip that has been eaten by CRW. The root is longer than 1.5 inches so if that was the extent of the injury on the root mass, it would receive an NIS rating of 0.08. If this root had been pruned within 1.5 inches of the crown, it would receive an NIS rating of 0.1. Note the characteristic prolific regrowth of roots just above the injury in Figure 1B.

Figure 1C shows the 3 nodes that are used for evaluation. On the 1<sup>st</sup> node, approximately 50% of the roots were pruned to within 1.5 inches of the crown. On the 2<sup>nd</sup> node, 100% of the roots were pruned to within 1.5 inches of the crown. On the 3<sup>rd</sup> node, 75% of roots were pruned. The NIS root rating was 2.25.

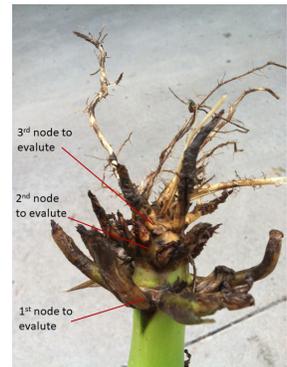
Figure 1D shows a closer view of heavy feeding from CRW. The appearance of this type of feeding is different from the visual effects of mechanical injury that might occur during the digging process.



**Figure 1A.** Extent of damage on root mass.



**Figure 1B.** Root tips had been eaten by CRW.



**Figure 1C.** Showed the 3 nodes that are used for evaluation of CRW damage.



**Figure 1D.** Heavy root feeding by CRW.

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## Root Ratings for Management Decisions

Generally, under good growing conditions, a NIS rating of 1.0 is when considerable economic loss is likely to occur. However, under adverse conditions, especially drought, a NIS rating of 0.25 can be enough to cause economic loss. It is important to consider the average NIS rating and consistency when evaluating options for managing CRW. Consistency of protection refers to the percentage of NIS ratings that are less than 0.25, the economic threshold under droughty conditions.

## References

Oleson, J.D., Park, Y.L., Nowatzki, T.M., and Tollefson, J.J. 2005. Node-injury scale to evaluate root injury by corn rootworms (Coleoptera: Chrysomelidae). *Journal of Economic Entomology*. 98(1):1-8.

## Legal Statements

ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. Performance may vary, from location to location and from year to year, as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on the grower's fields. ©2020 Bayer Group. All rights reserved. 5001\_S1

NIS Rating	Root Injury Description
0.00	No visible root injury
0.05	Root scarring
0.08	Severe root scarring or root tips pruned beyond 1.5 inches of crown
0.10	10% of a node pruned (often 1 root) within 1.5 inches of crown
0.25	25% of a node pruned within 1.5 inches of crown
0.75	75% of a node pruned within 1.5 inches of crown
1.0	A full node pruned within 1.5 inches of crown
1.5	One full node and 50% of another node pruned within 1.5 inches of crown
2.0	Two full nodes pruned within 1.5 inches of crown
3.0	Three full nodes pruned within 1.5 inches of crown (maximum value)