Wireworm Management for North Dakota Field Crops

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Phillip Glogoza, Extension Entomologist

Wireworms are among the most difficult insects to detect. Growers may not discover a wireworm problem until bare, patchy areas are observed in a field. Wireworms attack seeds or seedlings below ground. A crop may not come up well, or it may emerge and later become thin and patchy because of the wireworms' subterranean tunneling in the plant causing seedlings to wither and die. At least three species of wireworms in North Dakota are known to be injurious to crops.

Description

Wireworm larvae (Figure 1) are hard, smooth, slender, wire-like worms varying from 2 to 1 inches in length when mature. They are a yellowish-white to a coppery color with three pairs of small, thin legs behind the head. The last body segment is forked or notched.

Figure 1 

Adult wireworms (Figure 2) are bullet-shaped, hard-shelled beetles that are brown to black in color and about inch long. The common name "click beetle" is derived from the clicking sound that the insect makes when attempting to right itself after landing on its back.

Figure 2

Life History

Wireworms usually take three to four years to develop from the egg to an adult beetle. Most of this time is spent as a larva. Generations overlap, so larvae of all ages may be in the soil at the same time. Wireworm larvae and adults overwinter at least 9 to 24 inches deep in the soil. When soil temperatures reach 50 to 55 degrees Fahrenheit during the spring, larvae and adults move nearer the soil surface.

Adult females emerge from the soil, attract males to mate, then burrow back into the soil to lay eggs. Females can re-emerge and move to other sites where they burrow in and lay more eggs. This behavior results in spotty infestations throughout a field. Some wireworms prefer loose, light and well drained soils; others prefer low spots in fields where higher moisture and heavier clay soils are present.

Larvae move up and down in the soil profile in response to temperature and moisture. After soil temperatures warm to 50 F, larvae feed within 6 inches of the soil surface. When soil temperatures become too hot (>80 F) or dry, larvae will move deeper into the soil to seek more favorable conditions. Wireworms inflict most of their damage in the early spring when they are near the soil surface. During the summer months the larvae move deeper into the soil. Later as soils cool, larvae may resume feeding nearer the surface, but the amount of injury varies with the crop.

Wireworms pupate and the adult stage is spent within cells in the soil during the summer or fall of their final year. The adults remain in the soil until the following spring.

Damage

Wireworm infestations are more likely to develop where grasses, including grain crops, are growing. Crops susceptible to injury include small grains, corn, potatoes, sugar beets and vegetables. Legumes are less likely to be injured.

Wireworms damage crops by feeding on the germinating seed or the young seedling (Figure 3). Damaged plants soon wilt and die, resulting in thin stands. In a heavy infestation bare spots may appear in the field and reseeding is necessary.

Figure 3

Potato "seed pieces" are seldom damaged to a point where poor stands result. If soils are cool and sprouting is slowed, bacterial and fungal rot infections can occur and reduce stands. More important, the new tubers can be severely damaged. Wireworm-infested tubers have narrow tunnels, resulting in a lower market value and entry of disease organisms (Figure 4).

Figure 4

Sampling

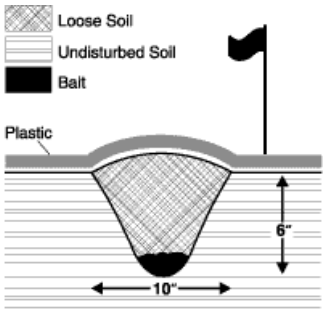
Decisions to use insecticides for wireworm management must be made prior to planting. No rescue treatments are available for controlling wireworms after planting.

There is no easy way to determine the severity of infestation without sampling the soil. Infestations vary from year to year. There may be considerable variation both within and between fields. Sometimes the past history of a field is a good indicator, especially if wireworms have been a problem in previous seasons. Also, crop rotations may impact population levels. A small grain: potato rotation is favorable for the increase of wireworm populations. Corn and sugar beets may contribute to increasing numbers of wireworms but are less favorable for wireworms than small grains.

Two sampling procedures are available. One procedure relies on the use of baits placed in the soil which attract the wireworms to the site. The other involves digging and sifting a soil sample for the presence of wireworms.

Baiting: In the fall, bury 1 to 2 cups of a 1:1 mixture of corn and wheat to a depth of 4 to 6 inches (Figure 5). Presoaking the whole grain bait one day prior to baiting increases the bait's attractiveness to wireworms by promoting seed germination and release of CO_2. Mound the soil over the top in a dome shape so rainwater runs off. Cover the mound with a piece of black plastic (3 square feet) to promote warming of the soil. Mark the site with a surveyor's flag. Soils must be moist and at least 45 F. There should be about one baiting site for each acre. Distribute traps randomly through the field. However, consider field history and other conditions that may influence the presence of wireworms, placing more traps in high risk locations. Dig up baits and surrounding soil after one to two weeks or leave until the spring. Count the number of wireworms per station and calculate an average per station.

Figure 5



Use Table 1 to interpret wireworm counts when making treatment decisions for potatoes. For other crops, if the average is greater than one wireworm per bait station, the risk of crop injury is high. In this case, a soil insecticide applied at planting to protect sugar beets and corn is recommended. Seed treatments alone may not be adequate to protect other crops. If the average is one or fewer wireworms per station, seed treatment of small grains, corn, and sunflower should be used. If no wireworms are found in the traps, risk of injury is low; however, wireworms may still be present but were not detected by the traps.

Table 1. How to Interpret Wireworm Counts from Bait Stations for Making Potato Treatment Decisions *

Average no. Wireworms per bait station	Risk of economic damage	IPM recommendation
0	Low (less than 1 chance in 10)	Control not needed or verify infestation level through soil sampling
up to 0.5	Moderate (1 chance in 3)	Sample soil and use decision card
up to 1.0	Less than 50:50	
up to 2.0	Probable (more than 50:50)	
up to 4.0	High (75 to 90% chance)	Apply insecticide at planting
more than 4.0	Extreme	Do not plant potatoes

** Source: Bechinski, et. al. 1994.*

In North Dakota, baiting should be done in the fall. If soil moisture and temperatures are adequate in the fall, wireworms

should be feeding in the top 6 inches of soil. They may be detected in the fall, or can be found in the spring, concentrated below the station. In the spring, wireworm activity may be delayed due to cold soils. Under these conditions, baiting and using a plastic cover may fail to stimulate enough wireworm activity to allow for a reliable estimate of the population.

Soil Sampling: Soil samples, ¼ square foot, are throughout the field. Each sample is taken to a depth of 12 inches. If conditions exist that favor wireworm populations, those areas of a field may be sampled more intensely. Equipment recommended for conducting sampling includes a 6½-inch diameter post hole digger (¼ square foot) or shovel (6 x 6 inches), and screen sieves (wooden frame with ½-inch hardware cloth stapled to the bottom and a second frame below it with a 8 to 16 mesh screen).

For potatoes, a decision card (Table 2) is used to record the number of wireworms found and help arrive at an accurate control decision. The advantage of this approach is that when wireworm populations are high, few samples are required to make an accurate decision. One decision card is used for every 30 to 40 acres.

For other crops, the following guidelines, based on a soil sample ¼ square foot in size and 12 inches deep, should be useful in determining wireworm management requirements:

- three to five wireworms in 50 samples, the field is safe for all crops, except potatoes;
- six to nine wireworms in 50 samples, the field is safe for small grains only, not including corn;
- 12 or more wireworms in 50 samples, damage is likely to occur to all crops. Such fields should be treated with an insecticide, seeded to legumes or summer-fallowed.

Table 2. Wireworm Decision Card for Making Potato Treatment Decisions*

Field/unit ID: _____ Date: _____			
No. Of Cores Examined	**DO NOT TREAT** if total is less than	**RUNNING TOTAL**: total number of wireworms	**TREAT:** if total exceeds
1	* *		1
2	* *		1
3	* *		1
4	* *		1
5	* *		1
6	* *		1
7	* *		1
8	* *		1
9	* *		1
10	* *		1
11	* *		1
12	* *		1
13	* *		1
14	* *		1
15	* *		1
16	* *		1
17	* *		1
18	* *		1
19	* *		2
20	* *		2
21	* *		2
22	* *		2
23	* *		2
24	* *		2
25	* *		2
26	* *		2
27	* *		2
28	* *		2
29	1		2
30	1		2
31	1		2

32	1		2
33	1		2
34	1		2
35	1		2
36	1		2
37	1		2
38	1		2
39	1		2
40	1		2
41	1		2
42	1		2
43	1		3
44	1		3
45	1		3
46	1		3
47	1		3
48	1		3
49	1		3
50	1		3

** = Designates that a decision is not possible
**Source: Bechinski, et. al. 1994.*

No Insecticide Needed

When the running total is less than the value in the column DO NOT TREAT, the wireworm infestation is probably below the threshold. You need 29 consecutive samples without wireworms before you safely can draw this conclusion.

Apply Insecticide

If the running total is greater than the value in the TREAT column, the wireworm infestation is probably greater than the economic threshold. Without insecticide, tuber damage will probably be greater than 3%.

Continue Sampling

When the running total is equal to or between the values in the two columns DO NOT TREAT and TREAT, a control decision can not be made. Continue to take samples until a decision is made or you have inspected 50 samples. After 50 samples, if the total is still between the two values, the wireworm infestation is too close to accurately classify the situation, and the field likely requires an insecticide application.

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