

# Wireworm Management

## for North Dakota Field Crops

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 1½ 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.

Adult wireworms (Figure 2) are bullet-shaped, hard-shelled beetles that are brown to black in color and about ½ 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.

### 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



Figure 1

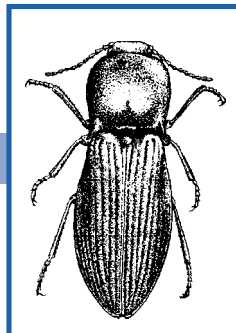


Figure 2



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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.

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).

## 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<sub>2</sub>. 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

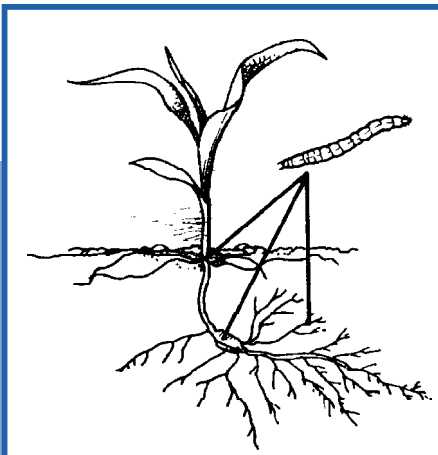


Figure 3

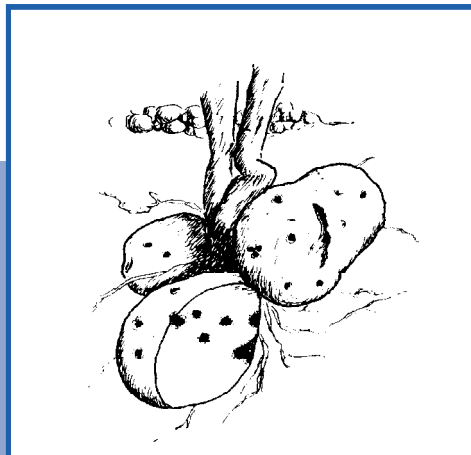


Figure 4

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.

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.

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

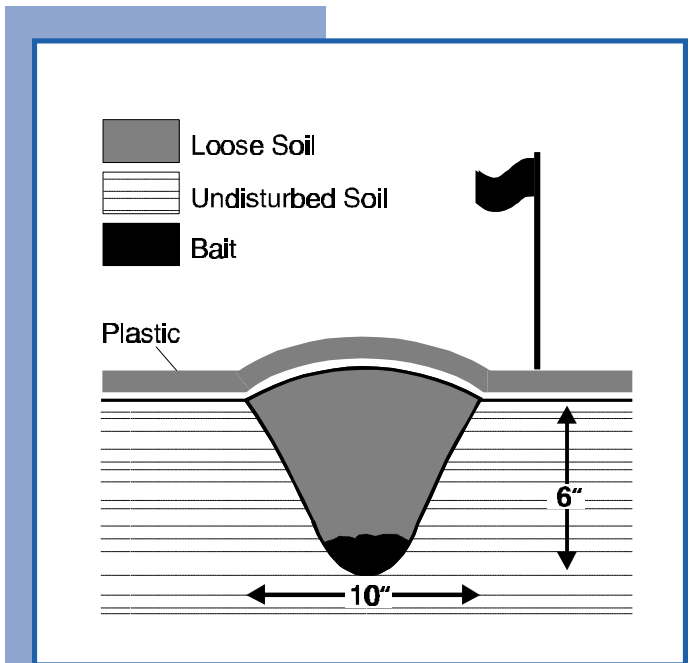


Figure 5

sampling includes a 6¾-inch diameter post hole digger (¼ square foot) or shovel (6 x 6 inches), and screen sieves (wooden frame with ¼-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

## 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)	
up to 1.0	Less than 50:50	Sample soil and use decision card
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.

## 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	No. Of Cores Examined	DO NOT TREAT if total is less than	RUNNING TOTAL: total number of wireworms	TREAT if total exceeds
1	_____	_____	1	26	_____	_____	2
2	_____	_____	1	27	_____	_____	2
3	_____	_____	1	28	_____	_____	2
4	_____	_____	1	29		_____	2
5	_____	_____	1	30		_____	2
6	_____	_____	1	31		_____	2
7	_____	_____	1	32		_____	2
8	_____	_____	1	33		_____	2
9	_____	_____	1	34		_____	2
10	_____	_____	1	35		_____	2
11	_____	_____	1	36		_____	2
12	_____	_____	1	37		_____	2
13	_____	_____	1	38		_____	2
14	_____	_____	1	39		_____	2
15	_____	_____	1	40		_____	2
16	_____	_____	1	41		_____	2
17	_____	_____	1	42		_____	2
18	_____	_____	1	43		_____	3
19	_____	_____	2	44		_____	3
20	_____	_____	2	45		_____	3
21	_____	_____	2	46		_____	3
22	_____	_____	2	47		_____	3
23	_____	_____	2	48		_____	3
24	_____	_____	2	49		_____	3
25	_____	_____	2	50		_____	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.

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.

## Suggested Management Methods

### Cultural Control:

This includes any cultivation or seeding practice which will discourage wireworm feeding in the field. Such practices as shallow tillage, shallow seeding, seeding with press drill, and clean summer fallow are all helpful in reducing future wireworm damage.

### Chemical Control:

#### *Seed Treatments*

Several insecticides are approved for use as seed treatments to protect seeds from wireworms and the seedcorn maggot. Insecticides applied to the seed just before planting time is an inexpensive means of reducing wireworm damage to growing crops. For maximum benefits, treat shortly before seeding; prolonged storage after treatment may reduce germination.

If on-farm treaters are used, be sure they are properly calibrated to apply the recommended dosages.

Seed treatment is primarily a protective measure and does not necessarily result in eliminating the wireworm menace from a field. Also, seed treatment will not prevent wireworms from chewing on below-ground portions of seedlings.

#### *Methods of Seed Treatment*

**Dry Drill Box Treaters:** Insecticides may be applied to the seed in any type of dry treater that will give uniform coverage. However, it is extremely important to avoid over treating or overdosing. Also, be sure that there is no streaking or incomplete coverage of kernels.

**Liquid Seed Treaters:** These treaters are designed to treat seed with insecticide, fungicide or both. An advantage of the liquid treaters over dry drill box treaters is that this type of treater eliminates the possibility of self contamination often associated with dust treaters.

Do not store treated grain in bins intended for storing grain going to commercial food or feed channels. Seed treated with an insecticide or fungicide must not be sold on the market, except as seed, nor should it be fed to livestock.

#### *Soil Applied Insecticide Treatments*

Soil insecticides are used to prevent damage to plants from soil insect pests. They are applied as a preventive measure since rescue treatments are generally ineffective. Use of these products should be based on some knowledge of the pest being present which is determined by field scouting. Using soil insecticides strictly as insurance against injury is discouraged.

### Other Resources:

**Bechinski, E. J., L. E. Sandoval, G. P. Carpenter, & H. W. Homan. 1994.** Integrated Pest Management Guide to Wireworms in Potatoes. University of Idaho Extension Circular.

**Table 3.**  
**Seed Treatments approved by Crop**

Seed Treatment	Corn	Wheat	Barley	Soybean	Sunflower	Dry Bean	Peas	Sugarbeet	Canola
Agrox Premiere	✓								
Assault 25	✓			✓					
Barracuda *	✓			✓					
DB Green	✓	✓	✓						
Diazinon 50W	✓						✓		
Enhance Plus		✓	✓						
Gaucho 75ST*, 480*, 600*	✓	✓	✓					✓	✓
Gaucho XT *		✓	✓						
Germate Plus	✓					✓			
Helix *									✓
Helix XTra*									✓
Isotox F	✓	✓			✓	✓			
Kernel Guard	✓					✓	✓		
Kernel Guard Supreme	✓			✓					
Lorsban 50SL*	✓					✓	✓		
Grain Guard Plus	✓	✓	✓	✓					
Raze	✓								
Sorghum Guard	✓	✓	✓	✓	✓		✓		

**Table 4.**  
**Insecticide/Fungicide Composition of Seed Treatments**

	% fungicide								% insecticide						
	Maneb	Carboxin	Captan	Metalaxyl	Tebuconazol	Difenoconazole	Mefanoxam	Fludioxnil	Lindane	Diazinon	Chlorpyrifos	Permethrin	Tefluthrin	Imidacloprid	Thiamethoxam
Agrox Premiere	-	-	14.7	1	-	-	-	-	25	15.5	-	-	-	-	-
Assault 25	-	-	-	-	-	-	-	-	-	-	-	25	-	-	-
Barracuda *	-	-	-	-	-	-	-	-	-	-	-	25	-	-	-
DB Green	50	-	-	-	-	-	-	-	18.8	-	-	-	-	-	-
Diazinon 50W	-	-	-	-	-	-	-	-	-	50	-	-	-	-	-
Enhance Plus	35	20	-	-	-	-	-	-	18.8	-	-	-	-	-	-
Gaucho XT *	-	-	-	0.82	0.62	-	-	-	-	-	-	-	-	75	-
Gaucho 480 *	-	-	-	-	-	-	-	-	-	-	-	-	-	40.7	-
Gaucho 600 *	-	-	-	-	-	-	-	-	-	-	-	-	-	48.7	-
Gaucho 75ST *	-	-	-	-	-	-	-	-	-	-	-	-	-	75	-
Germate Plus	-	14	-	-	-	-	-	-	25	15	-	-	-	-	-
Helix *	-	-	-	-	-	1.3	0.4	0.13	-	-	-	-	-	-	10.3
Helix Xtra *	-	-	-	-	-	1.3	0.4	0.13	-	-	-	-	-	-	20.7
Isotox F	-	-	12.2	-	-	-	-	-	25	-	-	-	-	-	-
Kernel Guard	-	-	15	-	-	-	-	-	25	15	-	-	-	-	-
Kernel Guard Supreme	-	14.4	-	-	-	-	-	-	-	-	-	10.4	-	-	-
Lorsban 50SL*	-	-	-	-	-	-	-	-	-	-	50	-	-	-	-
Grain Guard Plus	50	-	-	-	-	-	-	-	18.8	-	-	-	-	-	-
Raze	-	-	-	-	-	-	-	-	-	-	-	-	27	-	-
Sorghum Guard	-	-	32.8	-	-	-	-	-	16.6	-	-	-	-	-	-

\*Available only through commercial seed treatment.

**Table 5.**  
**Corn Soil Insecticides Labeled for Use Against Wireworm**

Insecticide	Dosage in Lb AI/Acre	Product Per Acre	Restrictions on Use
Aztec 2.1 G <b>RUP</b>	0.12 - 0.15 lb/acre	6.7 oz/1,000 ft of row - any row spacing	May be applied at planting as band, T-band, or in-furrow treatment. Cover or incorporate spills (including end row spillage). Do not use on other crops grown for food or forage.
Counter 15 G <b>RUP</b>	1 lb/acre	8 oz/1,000 ft or row - any row spacing	Apply in a 7-inch band or in-furrow at planting. Do not apply Accent or Beacon herbicide to corn treated with Counter 15 G.
Capture 2EC <b>RUP</b>	0.0046 lb/1,000 ft of row	0.3 fl oz/1,000 ft of row	Apply as a 5 to 7 inch T-band over an open seed furrow. Position spray nozzle behind the planter shoe, in front of press wheel. Apply in a min. of 3 gals. finished spray per acre.
Force 1.5 G and 3 G <b>RUP</b>	0.1 - 0.125 lb/acre	1.5 G: 8-10 oz /1,000 ft of row 3 G: 4 - 5 oz/1,000 ft of row - any row spacing	Apply in a 7-inch band or in-furrow behind the planter shoe in front of the press wheel. Do not rotate to another crop within 30 days after application.
Fortress 2.5 G and 5 G <b>RUP</b>		2.5 G: 6 oz/1,000 ft of row - any row spacing 5 G: 3 oz/1,000 ft of row - any row spacing	Apply as a T-band or in-furrow at planting. Do not apply as a surface band behind the press wheel. Granules exposed on the soil surface must be incorporated. Crop rotational intervals: corn - anytime; other crops - 30 days.
Lorsban 15 G <b>RUP</b>	1.2 - 2.4 lb/acre	8 - 16 oz/1,000 ft of row	T-Band or in-furrow at planting. If high wireworm numbers are anticipated, add insecticide seed treatment to planter box to augment control
Lorsban 4E <b>RUP</b>	2 lb/acre	4 pts	Broadcast ppi in sufficient water to the soil surface and incorporate into the soil.
Mocap 10 G <b>RUP</b>	1 lb/acre	12 oz/1,000 ft or row - any row spacing	Apply in a 7-inch band at planting. Do not apply in contact with seed!
Thimet 20 G <b>RUP</b>	1 lb/acre	6 oz/1,000 ft of row - any row spacing	Place granules in a 7-inch band over the row directly behind the planter shoe in front of the press wheel. Do not place Thimet in direct contact with seed!
Warrior <b>RUP</b>	0.015 lb/acre	1.92 fl oz	Apply at planting time as an in-furrow treatment for the control of wireworms. Apply into the seed furrow. May be applied in either water or liquid starter fertilizer.

**RUP** — Restricted use pesticide

**Table 6.**  
**Sugarbeet Soil Insecticides Labeled for Use Against Wireworm**

Insecticide	Dosage in Lb AI/Acre	Product Per Acre	Restrictions on Use
Counter 15G <b>RUP</b>	1 - 1.8 lb/acre	5.9 - 11.9 lbs or 4 - 5 oz/1,000 ft of row	Apply as a 5-inch band treatment at planting time. <b>Do not place in direct contact with seed.</b> Fields must be posted.
Lorsban 15G <b>RUP</b>	1.5 - 2 lb/acre	10 - 13.4 lbs or 6.5 - 9 oz/1,000 ft of row	Lorsban 15G can provide suppression of low to moderate infestations at these rates.

**RUP** — Restricted use pesticide

Do not use lindane or any other chlorinated hydrocarbon insecticide on sugarbeet seed. Check with your company field representatives before treating beet seed with an insecticide.

**Table 7.****Potato Soil Insecticides Labeled for Use Against Wireworm**

Insecticide	Dosage in Lb AI/Acre	Product Per Acre	Restrictions on Use
Disulfoton 15 G (Di-Syston) <b>RUP</b>		15 - 23 oz/1,000 ft of row	Band application at planting. Do not apply Di-Syston within 75 days of harvest. Do not plant food or feed crop in rotation after a field treatment with Di-Syston unless it is a registered use for Di-Syston.
Imidacloprid (Genesis)		8 - 16 fl oz (0.4 - 0.8 fl oz per 100 lbs of seed-pieces)	This is a seed-piece application ONLY. Treatments provide protection only to the seed piece, not to daughter tubers. Plant seed-pieces as soon as possible after cutting and treating. Do not apply any subsequent application of imidacloprid (Gaucho, Admire in furrow, or Provado) following Genesis seed-piece treatment.
Phorate 20 G (Thimet) <b>RUP</b>		11.3 - 17 oz/1,000 ft of row	Band application at planting. Do not apply Thimet within 90 days of harvest.

**RUP** — Restricted use pesticide

**NOTE:** The lower rate of application is suggested in light or sandy soils and the higher rate is suggested in heavy or clay soils.

**For more information on this and other topics, see: [www.ag.ndsu.nodak.edu](http://www.ag.ndsu.nodak.edu)**



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