

# Wireworms: A Pest of Monumental Proportions

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Wireworms are the larval or immature stage of click beetles (Coleoptera: Elateridae). They are soil-dwelling insect pests that affect a wide variety of field crops in North America and around the globe. Click beetles (Figure 1) are tan or brown-to-black in color, narrow, and around ½ to ¾ inch (1.25 to 1.9 cm) long. When placed on their backs, they can “spring” into the air, causing a distinct clicking sound as they turn right-side up.

Adult beetles do little damage when feeding on flowers and pollen. However, wireworms can cause severe damage, especially when feeding on seeds, roots, crowns, and seedlings (Figure 2; and Figure 3, page 2). Wireworms are pests of over 40 crops in the Pacific Northwest (PNW), including pastures, potatoes, onions, carrots, corn, wheat, sugar beets, beans, and barley. The wireworms’ biological fitness can be attributed to this wide range of hosts and the lack of effective broad-spectrum pesticides and non-chemical options to control them.

## Root of the problem

In the past, conventional broad-spectrum insecticides, such as organophosphates, have been used to control wireworms. However, due to the removal of some key insecticides from the market, wireworms are reemerging as a problem in the western regions of the United States. Current chemical formulations have not been consistently effective in controlling this pest and some have a potentially negative impact on



Figure 1. Click beetles



Figure 2. Wireworm

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beneficial insects, topics that are part of several ongoing studies. Some of the relatively recent chemical formulations (i.e., neonicotinoids) do not cause considerable wireworm mortality but instead act more as repellents. Following exposure to neonicotinoids, wireworms may stop feeding for a few weeks but then recover.

Depending on the species, wireworms can live 2 to 10 years in the soil and move vertically through the soil profile, allowing them to escape certain insecticide treatments. Since many older, broad-spectrum insecticides are no longer available and a resurgence of wireworm damage is occurring, it is necessary to reevaluate the status of this pest and establish better and more integrated management practices. Producers and scientists recognize the increasing threat wireworms pose to sustainable agriculture. The presence of multiple species, each with a different ecology and distribution, makes it difficult to establish a single, widely used Integrated Pest Management (IPM) program.

### Monitoring wireworms

Due to wireworms' patchy distribution in fields, consistent scouting before planting is the best method for assessing the potential risk of wireworm infestations. In the Pacific Northwest, the best time to set traps is mid-March through May. During the winter months, wireworms are not considered a problem since they dig deep into the soil profile. When wireworms move toward the soil surface in the spring to feed, they are attracted to carbon dioxide (CO<sub>2</sub>) released from sprouting seeds and/or to increased moisture and mild temperatures. If the soil is dry, wireworms will move deeper into the soil to reach the moisture line.

Random soil sampling (by digging and screening soil) is one way to estimate wireworm presence; however, many samples are required. Another inexpensive and effective method is the "pantyhose trap," a type of baited trap that can accompany soil sampling.

To assemble the trap (Figure 4, page 3), fill a clear pantyhose with ½ cup of oats (or spring wheat, corn, or barley), then soak for 24 hours. Bury the traps 6 to 8 inches (15 to 20 cm) deep. Distribute the traps randomly throughout a field. For effective sampling, it is best to place 25 traps for every 30 acres (12 hectares). Leave the baited traps in the field for 7 to 10 days to give wireworms enough time to find them. Cover the

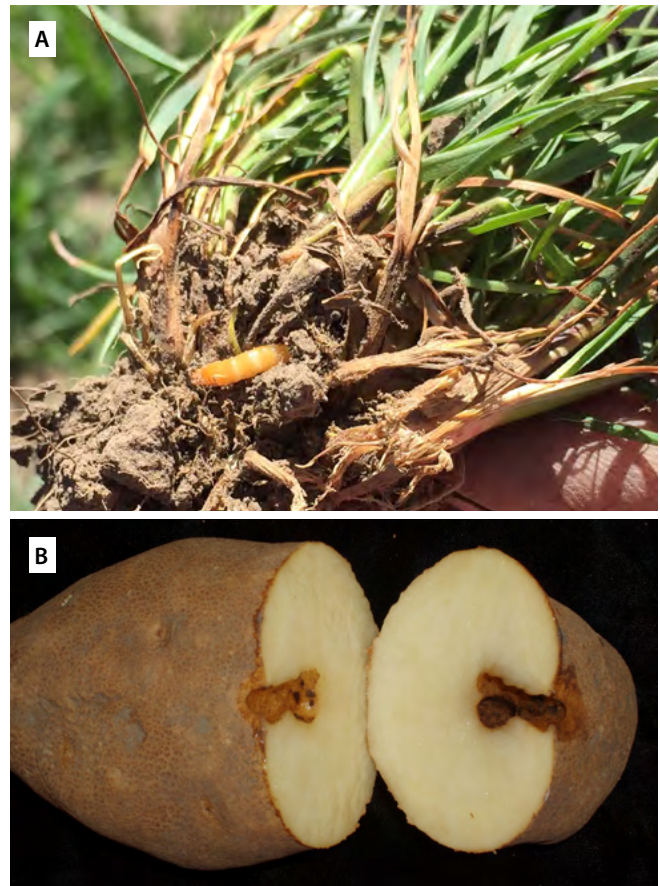


Figure 3. Feeding damage caused by wireworms in wheat (A) and potato (B)

ground above each trap with a piece of dark plastic. The dark plastic will absorb heat from the sun and keep the ground temperature high and promote CO<sub>2</sub> release.

When collecting the traps, also collect the surrounding soil. The trap locations should be changed when resetting the traps in the field. Once you recover the traps and place new ones, sort the traps and surrounding soil for the presence of wireworms. Monitor traps at least 3 weeks before planting.

### Wireworm identification

Wireworm identification is difficult. It is much easier to identify the adult click beetles, but the species of adults you see in the field do not necessarily represent the species of wireworms present in the soil. Because wireworms live 2 to 10 years in the soil, some species may emerge as adults in a particular year, while others remain in the soil.

Some wireworm species appear similar, even identical, to the naked eye. The most damaging genera of wireworm in the PNW can usually be distinguished

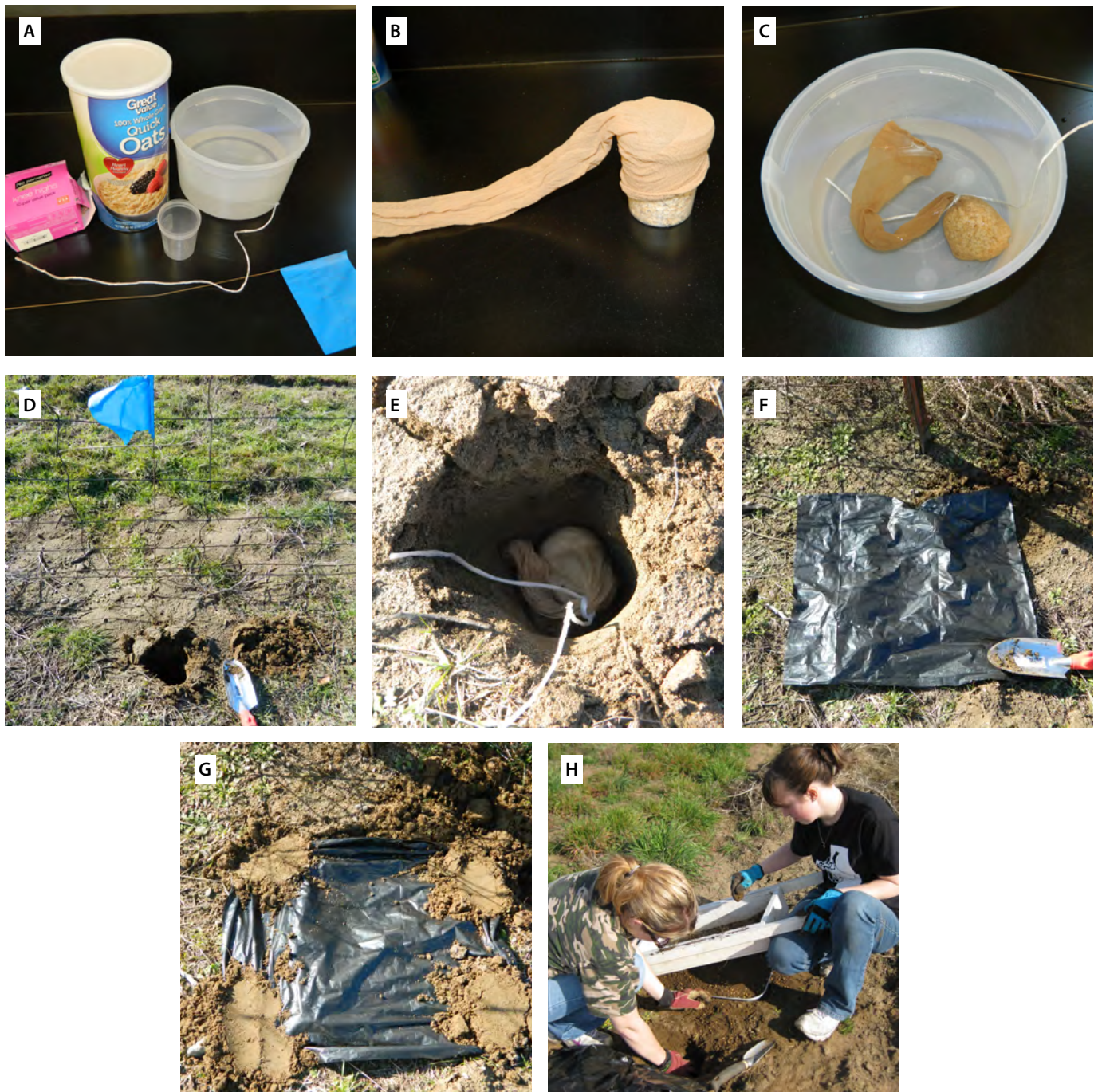


Figure 4. Trapping wireworms. Materials needed: Pantyhose, oats, medium and small containers, and string (A). Add dry oats to the small container; pass the container through the pantyhose and empty the oats at the bottom (B). Tie the pantyhose off with string and soak it over night (C). Select a site to bury the trap and set a flag to mark the location (D). Put the trap in the ground (E) and then cover the site with a black plastic bag (F). Cover the sides of the plastic bag with dirt so the plastic does not fly away (G). After 7 to 10 days, remove the trap and sieve the soil to recover your samples (H).

by the shape of the “tail end.” For example, *Limonius* spp. have a “keyhole” shape on their last abdominal segment (Figure 5, page 4). However, the “keyhole” shape varies among *Limonius* species, making it difficult to identify a wireworm’s species. Other genera of wireworm have no distinguishing “tail end” characteristic; the last segment comes to a rounded point.

Other characteristics to look for are sutures along the dorsal (top) side of the specimen on abdominal segments 4, 5, and 6, but these can be difficult to differentiate. There are slight differences in the mouthparts. However, the mouthparts are not the most reliable diagnostic characteristic due to general wear and tear, and whether the specimen is in its first



Figure 5. “Tail end” of a wireworm

year living in the soil or its last. In older wireworms, the mouthparts may be very worn down and challenging to use as an identifying characteristic.

Despite these obstacles in identification, researchers are working on developing diagnostic keys. Research is also being done at the molecular level to identify species that are physically similar and cannot be distinguished from one another visually under a microscope.

### Farming practices and wireworm incidence

Farming practices can have an effect on wireworm population. A preliminary survey was conducted in clover plots in eastern Oregon from June 2014 to March 2015. Three cropping systems were studied:

1. Semi-organic in transition to organic with only OMRI-certified sprays
2. Semi-conventional field with 50% of treatments received by conventional fields
3. Conventional field with a standard broad-spectrum control

Two baited traps were randomly distributed in each of the treatment plots. Traps were collected every 7 to 10 days along with surrounding soil, and new traps were buried in a different location within each plot. The traps and soil were sorted back in the laboratory, and all wireworms were counted, collected, and identified. Preliminary results revealed significantly more wireworms in the semi-conventional plots than the semi-organic and conventional plots (Figure 6). The only species found was *Limoniuss* genus, mostly *L. californicus*, the Pacific Coast wireworm.

### Managing wireworms

Wireworms require a long-term management plan and integrated strategies along with new insecticides for effective control. Most of the available chemical options are listed in the Pacific Northwest Insect Management Handbook (<https://pnwhandbooks.org/insect>). However, it is important to understand that wireworm mortality may no longer be accomplished using organophosphates; a combination of IPM strategies needs to be closely studied.

Nonchemical management methods may be adapted, depending on the wireworm species present and the crop planted. Examples include rotating crops, soil drying (for wireworms that prefer irrigated land), soil flooding (for dryland wireworms), mechanical damage by cultivating land, planting resistant crop varieties, using trap crops, and harvesting early (where possible).

The history of wireworm damage in a field can be of great importance when making decisions about which crop to grow. For example, if a field has a history of grass or seed production, it can also be an indicator that wireworm damage may be worse in that particular field.

### Looking to the future

Future wireworm research should involve evaluating the role of the landscape in wireworm distribution between and within fields. In addition, research should include monitoring insect movement out of the crop into non-cultivated and natural habitats after harvest. The management history of fields is

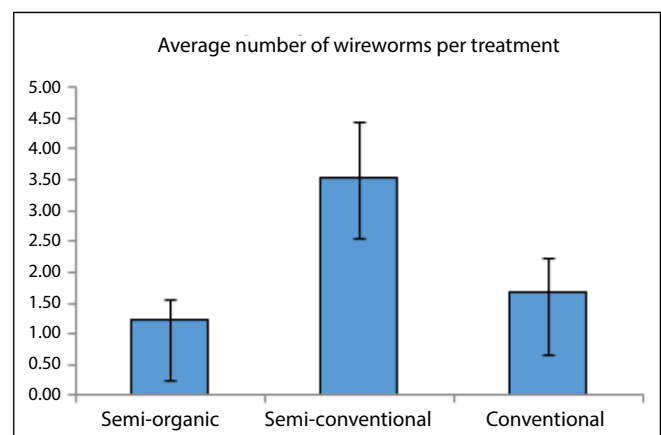


Figure 6. Mean number of *Limoniuss* spp. found per each trap location over the 2014–2015 season, June through March ( $F=3.61$ ,  $df=2$ ,  $p<0.0311$ ).

important in assessing the factors that contribute to wireworm success, reduction, and movement in an agricultural landscape.

## For more information

### OSU Extension and PNW Cooperative publications

*Wireworm: Biology and Nonchemical Management in Potatoes in the Pacific Northwest* (PNW 607)  
<https://catalog.extension.oregonstate.edu/pnw607>

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