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Wireworm Management in Cotton

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Wireworms are soil-dwelling larvae of certain groups of beetles that feed on germinating seeds, roots, and lower stems of field crops, including grains and cotton. There are two types of wireworms: true wireworms and false wireworms. True wireworms are larvae of click beetles (Family: Elateridae), while false wireworms are larvae of varying darkling beetle species (Family: Tenebrionidae) (Table 1).

Table 1. Commonly found wireworms and false wireworms in the Texas High Plains.

True wireworms (Click beetles)	False wireworms (Darkling beetles)
Family: Elateridae	Family: Tenebrionidae
Genera: *Aeolus, Conoderus, Agriotes, Melanotus*	Genera: *Eleodes, Blapstinus, Eusattus*

Description

Click beetle adults vary in size but are usually about half of an inch long (Fig. 1). They are hard-bodied and elongated beetles, and are somewhat rounded toward the head with a tapered abdomen. Most click beetles, when placed on their backs, will right themselves by performing a rapid-flexing motion that propels it vertically, while making a clicking sound. Adults are usually brown to grayish-black depending on species.

Figure 1. A click beetle (*Conoderus* sp.).
(Photo courtesy of Suhas Vyavhare)

Darkling beetles also vary in size and shape and are hard-bodied. The beetles in the genus *Eleodes* (Fig. 2) are about 1 inch long and black with grooves along their elytra (hardened forewings). When disturbed, they raise their abdomens and appear to stand on their heads. Because they can squirt a foul-smelling substance to deter predators, they are also referred to as stink beetles. The *Blapstinus* species (Fig. 3) are one of the most common false wireworm pests that are found in crop fields in the Texas High Plains region. *Blapstinus* beetles are about one-quarter of an inch long and about half as wide, and dull black to reddish-brown.

Figure 2. A darkling beetle (*Eleodes* sp.).
(Photo courtesy of Suhas Vyavhare)

Figure 3. A darkling beetle (*Blapstinus* sp.).
(Photo courtesy of Suhas Vyavhare)

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The larvae of true and false wireworms look alike and are difficult to distinguish. They can vary in size depending on developmental stage and species. Late-stage larvae are about 1 inch long. They are hard-bodied, segmented, and yellow to dark brown in color, with darker heads and three pairs of true legs clustered on the thorax just behind the head (Fig. 4).

Figure 4. Wireworm larvae. *(Photo courtesy of Patrick Porter)*

Biology

In early spring, the adults become active and lay eggs in the soil in clusters. Egg-laying continues throughout the summer and into the fall. The adults, as well as larvae produced from the late summer and fall egg-lays, overwinter in the soil. In general, click beetles prefer to lay their eggs in moist soil, while darkling beetles favor drier soil. Neonates (newly hatched larvae) are more susceptible to starvation, cannibalism, and harsh conditions, compared to later stages of larval development. The larvae are strictly soil-dwellers and rarely seen unless removed from the soil. They move slowly, pulling themselves with their legs, dragging themselves through the soil while feeding on seeds, roots, and other subsurface plant parts. After surviving the first winter, wireworms become established within the local population and can remain active for several years, depending on the species and environmental factors.

Damage

It is the larval stages that damage crops. The adult click beetles and darkling beetles cause no damage, except for members of the genus *Blapstinus* in which adult beetles sometimes girdle or clip cotton seedlings off at the soil level much like cutworms (Fig. 5). True and false wireworm larvae damage cotton by feeding on the root, hypocotyl (stem of the germinating seedling), and cotyledon (seed leaves) of plants as they emerge from the soil (Fig. 6). Root-feeding can kill plants but usually results in stunting. Feeding injury can also make seedlings more prone to disease infection. The most severe damage occurs when the hypocotyl is severed, killing the plant, which results in a reduced plant stand.

Figure 5. Stem girdling and chewing injury by *Blapstinus* beetles. *(Photo courtesy of Suhas Vyavhare)*

Figure 6. Wireworm injury. *(Photo courtesy of Patrick Porter)*

Larvae also feed on the growing point of the plant, slowing the growth of the main stem. These plants often take on a "Christmas tree" appearance after they emerge (Fig. 7). In small grains, wireworm damage appears as hollowed-out seeds, and tunneled or shredded stems. Injured seedlings will often turn yellow and show wilting symptoms.

Figure 7. Christmas-tree-like growth from subsurface wireworm feeding on the plant terminal. *(Photo courtesy of Suhas Vyavhare)*

Monitoring

Scouting. In the spring, keep an eye out for *Blapstinus* beetles. They are very common in dry regions such as the South Plains and Rolling Plains. The beetles can be found around the plant bases, under rocks, and in plant debris. Scouting for wireworm larvae is more challenging due to their subterranean lifestyle and patchy distribution. Bait traps with grain can help detect wireworm presence, but can have difficulty determining overall population size or infestation level. These traps are based on the behavioral trait that wireworms sense and move toward carbon-dioxide-producing sources in the soil (e.g., germinating seeds and respiring plant roots). Wireworm sampling using grain baits involves placing whole wheat seed (or a 1:1 mixture of whole wheat and corn) in a sock, soaking it in water for 24 hours, and then burying it in the ground about 6 inches deep. The traps are retrieved after 10 to 14 days to count the number of wireworms present on and around them (Fig. 8). Bait trapping needs to be done a few weeks before planting when soil temperatures reach a minimum of 50 degrees Fahrenheit.

When inspecting bait traps, one can encounter other organisms that are sometimes confused with wireworms. The wireworm body is divided into three parts: the head, thorax, and abdomen. They **always have three pairs of thoracic legs**. Stiletto fly larvae (Family: Therevidae) are often confused with wireworms. These are white with darker head capsules, are longer and thinner than wireworms, and lack legs (Fig. 9). Ground beetle larvae (Family: Carabidae), which are beneficial predators, also have three pairs of legs, but are distinguished by their prominent mandibles and two long, forked projections on the abdominal tip.

Figure 8. A wireworm on a bait trap.
(Photo courtesy of Suhas Vyavhare)

Figure 9. A stiletto fly larva.
(Photo courtesy of Suhas Vyavhare)

Field scouting planted cotton fields prior to emergence is difficult and can be time-consuming. However, wireworm damage severity and the likelihood of field-by-field crop establishment for known problem areas can be assessed by scouting. When sampling seedlings, the plants must be excavated and evaluated for wireworm damage presence and severity. When using this scouting method, the actual larva is a rare find, but plant damage and crop establishment rates can be assessed well-ahead of waiting for larger plants to express symptoms. If replanting is necessary, it is best to know as soon as possible.

Management

Fallowing/starvation: Summer fallow and maintaining weed-free fields help reduce egg-laying by adults and starves young larvae of food. For established populations, summer fallowing may not suffice because older larvae can go without food for several months and resume feeding when the crop is planted.

Tillage: Wireworm populations tend to be higher in minimum-till or no-till systems. Tillage can help reduce wireworm numbers by disturbing the soil, and exposing larvae and pupae to predators, desiccation, or mechanical injury. It also disrupts their habitat, and can reduce the survival of eggs and young larvae. However, tillage alone is usually not sufficient for long-term control and is most effective when integrated with other management strategies such as insecticide seed treatments.

Cover crop management: In fields with a known history of wireworm infestations, insecticide seed treatments on cover crops (e.g., broflanilide in wheat) may help reduce wireworm load and may benefit subsequent crop establishment.

Planting timing and condition: Planting cotton in good soil conditions will facilitate quicker seedling establishment and reduce exposure time to wireworms when cotton is small and most vulnerable. Plant shallow and when soil temperatures are optimum to allow rapid germination and seedling development. It is also important to use high-quality seeds with good vigor to establish a proper stand.

Chemical control: Spraying for click beetles and/or darkling beetles or their larvae is not a viable wireworm management strategy. Foliar insecticide applications may be used for *Blapstinus* beetles when they are present in large numbers and damaging the stand with their chewing injuries.

Preventive measures are the only options for wireworm control. However, the lack of effective wireworm products labeled for use in cotton remains an issue. Neonicotinoid seed treatments such as imidacloprid and thiamethoxam can provide early-season protection by temporarily intoxicating wireworms. However, their efficacy is often variable and inconsistent. In fields with a known history of wireworms, use additional in-furrow treatments (e.g., aldicarb, imidacloprid, phorate, and pyrethroids).

Frequently Asked Questions About Wireworms

1. Does crop rotation help control wireworms?

Wireworms are resilient insects that feed on a variety of host plants and decaying organic matter, and they can survive long periods without feeding. While newly hatched larvae require suitable food sources during their first year of development, established or resident wireworm populations can persist across many different crops. Due to their long life cycle and broad host range, crop rotation has not proven to be a consistently effective management strategy.

2. Do cover crops contribute to wireworm buildup?

Wireworm populations tend to increase when food sources are available year-round. Cover crops provide a continuous food source, and if the selected cover crop is a favorable host, wireworm populations can build up more rapidly. Small grains such as wheat can extend the feeding season, enhancing survival of young larvae. Crop residue also provides shelter for adult beetles during egg-laying.

Although cover crop residue may harbor wireworms, it also provides important agronomic benefits, including improved soil health, weed suppression, and protection of young seedlings from wind and sand injury. These benefits are particularly valuable in

Table 2. Examples of commercial seed treatment packages in cotton.

Company	Cotton Seed Brand	Seed Treatment Package Offered	Insecticide Active Ingredient at Standard Rate
Bayer Crop Science	Deltapine	Acceleron Basic	None
		Acceleron Standard	Imidacloprid
		Acceleron Elite	Imidacloprid
BASF	FiberMax, Stoneville	Core Seed Treatment Package	None
		Prime Seed Treatment Package	Imidacloprid
Corteva Agriscience	PhytoGen	PhytoGen TRiO	Imidacloprid
Americot	NexGen	CottolyST Base	None
		CottolyST Base Plus	None
		CottolyST Enhanced	Imidacloprid
		CottolyST Premier	Imidacloprid
Syngenta		Avicta Elite Cotton Plus with Vibrance	Imidacloprid + thiamethoxam

regions such as the South Plains where frequent, high winds threaten early-season stand establishment.

Therefore, when selecting cover crops, it is important to balance these agronomic benefits against the potential risk of wireworm population increases.

3. Are there wireworm-resistant crop cultivars?

There are currently no known field crop cultivars with resistance to wireworms. While some genetic differences may exist among varieties, there is little to no documented information on resistance traits that provide reliable protection against wireworm damage.

4. Is biological control using artificial releases of beneficial nematodes effective?

Entomopathogenic nematodes, such as *Heterorhabditis bacteriophora* and *Steinernema carpocapsae*, have been evaluated for wireworm management. The persistent strains of these nematodes can live in the soil for several years, and are capable of infecting and killing wireworms. However, research with commercially available nematode products has produced inconsistent results so far, and their effectiveness under field conditions remains variable.

5. What is the economic threshold for wireworms?

There are no established economic thresholds or effective rescue treatments for wireworms. Their subterranean behavior and long life cycle make it difficult to develop reliable action thresholds. As a result, management typically relies on preventive practices such as seed treatments and knowledge of field history.

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