



Crop Science Report

RESEARCH/EXTENSION

CEREAL CYST NEMATODE (*Heterodera avenae* Woll.)

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The cereal cyst nematode (CCN) is a destructive pest of oats, wheat, barley, rye and other grasses including fescues, ryegrass, bromes and bluegrass. Known also as the oat cyst nematode or cereal eelworm, this pest is found in many parts of the world, including Australia, South Africa, Japan, Israel, India, Europe, and Canada. It was first discovered in the United States in 1974 in Washington County, Oregon. It is now known to be present in Union County, Oregon; Whitman County, Washington; Idaho, California and Michigan.

Damage

The cereal cyst nematode attacks the roots of host plants, interfering with the uptake of nutrients and water from the soil. Because the nematodes do not cause direct damage to the above ground parts of plants, they often go undetected. Poor growth in one or more spots in a field is usually the first sign of an infestation. Plant symptoms generally include stunting, yellowing, poor tillering, poor stress tolerance, roots which are becoming thickened and branched, and premature death. These symptoms often resemble and are confused with nutrient deficiencies, aluminum toxicity, or infestation by diseases such as take-all or barley yellow dwarf virus.

Damage due to this organism is most severe on spring grains as seed germination and root development coincide with the time of year when CCN larva

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are emerging from cysts in the soil. In Southern Australia, damage to spring cereals is estimated to exceed \$70 million per year.

The effect on winter cereals is unclear. Work in Washington County, Oregon, suggests that winter cereals are damaged little by CCN provided other management practices and environmental conditions are not substandard. At the time of spring "hatch", winter cereals have dense root systems and are extremely vigorous in Western Oregon. This vigor may lessen or mask the damaging effects of the nematode. Effects of the CCN on winter cereals in eastern Oregon, where the period of active growth is more closely associated with the period of CCN egg hatch, remains unknown.

Description

The CCN adult female is a lemon-shaped cyst, less than 1/25 inch (1 millimeter) in length. The male is worm-like and about twice the length of the female. Females are white initially, but gradually change to a dark brown color as the cyst hardens. The cyst is barely visible to the unaided eye - almost the color and size of finely ground coffee. Eggs and larva are microscopic and white.

The nematode can be identified through field observations. Look for areas of a field showing stunted growth or other symptoms of poor performance. Dig up the roots, wash them off and examine them carefully. When plants are three to six weeks old, roots will have regions which are thickened and branched. Cysts will not be evident until the cereal is near flowering. If infestation is suspected, plant and/or soil samples can be sent to a nematode analysis laboratory for verification.

Life Cycle

The cereal cyst nematode develops in three stages - egg, larva, and adult. The entire life cycle takes only nine to fourteen weeks, but climatic conditions generally restrict the pest to one generation each year under North American conditions.

During development, the female nematodes undergo a series of biological changes. Once they enter the plant roots and begin feeding, they become stationary, swell, and break through the roots, but remain attached by a thin neck. After fertilization, several hundred eggs develop within the female. She dies, and her hard brown body becomes a cyst filled with eggs. The cyst drops off the roots and remains in the soil over winter.

The following spring, from February to April, larva may hatch from up to 75% of the the eggs, escape from the cyst, and attach to plant roots. Thus, spring planted crops are more severely damaged than winter-planted crops.

The cyst walls are highly resistant to decay and protect the unhatched eggs. Eggs in the cyst can remain viable in the soil for several years.

Control

It should be pointed out once again, that the effect of CCN on winter cereals is unknown. In other areas of the world where CCN is a major pest, spring cereals are dominant. Observations in mild winter areas at this time would indicate that winter cereals, if properly managed, are not severely affected by cereal cyst nematode. If severe infestations are present and damage to winter cereals is suspected, the following control procedures can be considered:

1. Fallow

A long fallow period (2 or more years) can reduce the level of cereal cyst nematode, provided the fallow is clean - that is, grass hosts for CCN such as wild oats, ryegrass and bromes, are contained. Fallow can be a viable option given current farm programs.

2. Rotations

It has been demonstrated that rotations including non-host plants such as peas, clovers, alfalfa, potatoes, etc. which are free of grassy weeds can reduce cereal cyst nematode populations; however, one year without cereal hosts only reduces the level of cereal cyst nematode. If the CCN level was high initially, a single year break crop is not likely to reduce the population to a satisfactory level. Long term rotations i.e. three to four years out of grasses, will be necessary in order to achieve effective control.

3. Resistant Varieties

Resistant crop varieties, when available, provide the most effective, economic control for CCN. Resistant or tolerant spring wheat varieties are currently grown in parts of Australia; however, there is no reason to believe that these varieties will be successful in other areas. There are more than ten races of this pest, each race inflicting different levels of damage on different species and/or varieties of cereal grains. The race of nematode found in Washington County, Oregon, is most severe on oats and causes little damage to winter wheat. The host range of the nematode population in Union County is unknown.

4. Chemical Control

In Australia, nematicides have been shown to be effective in the control of CCN. Temik, Vydate, Counter and Furadan have Australian registration. At present, there is no research evidence to suggest that chemicals can effectively or economically be used to control CCN in Oregon.

5. Reduced Cultivation

Research in Australia and other countries has shown that grains sown using no-till equipment suffer less damage from CCN than those which are sown following conventional tillage. The benefit of reduced tillage is believed to be due to less mixing of cysts or larva through the soil and the trapping of nematodes by roots of volunteer grain and grassy weeds which are generally killed with herbicides during the no-till seeding operation. When the host dies, the infesting, immature larva also dies. No research on the effect of reduced tillage on cereal cyst nematode populations in Oregon has been conducted.

6. Seeding Rate Effects

Cereal cyst nematodes develop mainly on the seminal root system of cereals. Research in Australia shows that the number of CCN females per root system is essentially the same, regardless of seeding rate. Therefore, when higher seeding rates are used, a greater number of root systems are infected, more cysts are produced, and the rate of nematode build-up in a soil is increased. This research would suggest using a slightly lower seeding rate should help to reduce CCN populations.

Equipment Cleaning

As the cereal cyst nematode is a soil borne pest, soil should not be moved from infested to non-infested fields. All tillage and harvest equipment which may carry soil should be thoroughly cleaned before being moved to other sites. Steam cleaning is the most effective procedure though high pressure water systems can be used. In addition to cleaning equipment, care should be taken not to transfer soil from infested fields on plant roots (nursery stock), plant parts (potato tubers, mint stolons, bulbs, etc.) or mud-caked livestock. Caution is also suggested when moving hay or straw which carried infested soil or dust. Attempts should be made to use soil conservation practices in order to prevent nematode movement through wind-blown or water carried soil particles.

How You Can Help

You can help to control and prevent the spread of cereal cyst nematode by reporting possible new infestations. Contact your County Agent if you see symptoms of infestation - yellow, stunted plants, reduced yields or other unexplained crop damage. If you suspect an infestation, soil should be sampled and submitted to the Nematology Lab at Oregon State University for testing. Your county agent can assist in this process.

References

Material in this handout was excerpted from the following publications:

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