



Parasitic Nematodes in Corn

Summary

- Nematodes are small, thread-like organisms that feed on corn roots.
- Nematode feeding reduces plant vigor and creates openings for pathogens.
- The presence of nematodes can limit yield potential, but nematodes can remain undetected until a field is sampled as nematode symptoms can mimic others, such as drought and nutrient deficiency.
- Management of nematodes requires an integrated approach, and the correct identification of the species is critical.

Introduction

Nematodes are microscopic, thread-like organisms which can be found in virtually any field where corn is grown. While some species of nematodes can be beneficial, other nematodes parasitize plants and may reduce yield potential by limiting a plant's ability to take in water and nutrients.¹ Nematodes can also create openings for other pathogens to enter the plant and cause disease. The effects of nematodes in a corn field can vary from causing no obvious symptoms on corn plants to causing severe injury and tremendous yield loss.²

Mature females of some species—such as the root-knot nematode—can produce hundreds of eggs during a lifecycle, leading to rapid population growth.

Parasitic nematodes are classified by where they live while feeding on the plant, which is important information to have when sampling for nematodes. Endoparasitic nematodes live within the root structure of the plants they parasitize, while ectoparasitic nematodes live in the soil outside of the roots.

Life Cycle and Environment

Corn nematodes spend their entire life in the soil. Nematode populations in a field may vary based on soil type, environmental conditions, and whether growing plants are present or not. Corn nematodes may flare up in continuous corn cropping systems, but populations of some nematode species can still be maintained when a field is planted to a non-host crop such as soybean or alfalfa. Many nematode species thrive in sandy soils, though corn nematodes can be found almost anywhere, including heavier soils. Under favorable conditions, most parasitic nematodes of corn can complete their lifecycle (egg, four juvenile stages, egg-producing adult) in about one month, and a population may complete four or more lifecycles in one growing season.¹



Figure 1. Severe nematode injury in a corn field.
Photo credit: T. Jackson-Ziems,
University of Nebraska

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Symptoms

Symptoms of corn nematode feeding are typically found in irregular patches, not across a whole field (Figure 1). There are often no aboveground symptoms of nematode feeding unless population levels are extremely high, though symptoms may also intensify under stressful growing conditions. Belowground symptoms vary by nematode species (Table 1). For example, root-knot nematode infection typically causes galls (irregular swelling of the roots), while stubby-root nematodes cause stunted, blunt, and swollen roots. Foliar symptoms may be hard to identify, as they are not unique to nematode feeding and can be easily confused with nutrient deficiencies, herbicide damage, or insect damage.¹ The only way to accurately diagnose the presence of parasitic nematodes in corn is through soil and root sampling.

Table 1. Common symptoms of corn nematode injury.

Aboveground Symptoms	Belowground Symptoms
Thin stands	Swollen roots
Uneven plant height	Missing fine roots
Stunted plants	Root branching (bottle brushing)
Uneven development	Necrotic lesions on roots
Small ears and kernels	



Figure 2. Nematode injury to corn roots, note lack of fibrous root system. Image courtesy of J. Bond, Southern Illinois University.

Nematode Species

There are many different nematode species that interact with corn. They vary in size, feeding habit, damage potential, and preferred soil type (Table 2). Some nematodes can only be found in very sandy soils, while others can be found in a wide range of soil types. Listed below are nematodes that are economically important in corn production.

Lesion (*Pratylenchus* spp.)

Lesion nematodes are small, migratory endoparasites, and are probably the most important corn nematode in the Midwest. They can be found across a wide range of soil types. Damage from lesion nematodes can range from small water-soaked areas to severe necrosis of the roots.⁴ The damage threshold for lesion nematodes is 1,000 nematodes per gram of root, and populations can reach numbers of 10,000 to 84,000 nematodes. Threshold numbers may vary based on environmental conditions.⁵

Needle (*Longidorus* spp.)

Needle nematodes are among the most devastating type of nematodes in corn. They are ectoparasitic, and their presence is highly restricted to sandy soils. These nematodes damage corn roots by feeding on root tips, stunting the lateral roots, and essentially destroying the fibrous root system. Damage thresholds for needle nematodes are as low as one nematode per 100 cubic centimeters of soil; 25 nematodes per 100 cubic centimeters of soil can cause severe damage.⁴

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Lance (*Hoplolaimus* spp.)

Lance nematodes are endoparasites mostly found in sandy soils, but they can be found in many soil types. They are extremely common and have a wide range of hosts; therefore, crop rotation is ineffective in controlling lance nematodes.⁴

Dagger (*Xiphinema* spp.)

Dagger nematodes are ectoparasitic and can cause stunting and chlorosis of corn plants. They are found in sandy and silty loam soils and are known for their long lifecycle. They reproduce once per year and can live up to 5 years in favorable conditions. Tillage may be effective in controlling dagger nematodes.⁴

Stubby-root (*Paratrichodorus* sp.)

This ectoparasitic nematode is a serious pathogen in southern states and is found in sandy soils.⁵ Stubby-root nematodes can be very damaging. Symptoms include stunted, blunt, and swollen roots due to nematode feeding on the terminal ends of young roots.

Root-knot (*Meloidogyne* spp.)

Root-knot nematodes are endoparasitic, remain sedentary inside the root, and cause small galls on corn roots. Soybean plants are also a host of root-knot nematode, so rotation to soybean is not an effective control method.



Figure 3. Root-knot nematode injury to corn roots, note the injury to root tips.
Image courtesy of Clemson University.

Sampling for Nematodes

To confirm the presence of nematodes, soil and root samples must be collected and sent to a nematode testing laboratory for analysis. It is important to collect both soil and root samples to determine the presence of endoparasitic and ectoparasitic nematodes. Sampling should occur during the middle of the growing season, when nematode numbers are greatest and damage symptoms are apparent.^{1,2,3} Soil samples should be taken around the edge of symptomatic areas, at about 12 inches deep, within a few inches of the damaged plants (or intersecting the root zone). The soil should not be overly wet or dry when sampling, and at least 20 soil cores should be collected per sampling area (10 acres or less).³ Roots from two to three corn plants should also be collected. Root and soil samples should be refrigerated until the time of shipping.

A general field survey may also be conducted to determine the presence and potential risk of nematodes in a field. This is commonly done by taking soil samples post-harvest in fields where no damage symptoms have been observed. Additional information and instruction on nematode sampling can be found from your local Extension service or nematode testing laboratory.

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Management

Once corn nematodes are present in a field, management practices should be used to help minimize crop damage and keep population densities low. Because there are many nematode species, identification is essential for determining the appropriate control option. For certain nematode populations, the best management practice is crop rotation. Corn management practices that reduce crop stress may also help the crop overcome nematode attacks. Additionally, the following agronomic practices may help farmers manage potential nematode infestation:

- Fertilize – Plants suffering from nutrient deficiency are more susceptible to injury.
- Weed Control – Weeds are hosts for many nematodes; managing weeds can help keep nematode populations low.
- Crop Rotation – For certain nematode species, rotating to a non-host crop can keep population densities low.
- Chemical Control – Nematicides and seed treatments may be an effective control measure against corn nematodes.

Nematode management requires an integrated approach and is an ongoing process.

Sampling and identification of the nematodes present is crucial for creating an effective management strategy against corn nematodes.

Table 2. Common corn nematode characteristics and injury thresholds^{6,7}

Nematode Common Name	Feeding Habit	Primary Soil Type	Injury Potential	Injury Threshold (nematodes/100 cc soil)
dagger	ectoparasite	sandy soils	moderate	30 to 40
lance	endoparasite	roots in sandy soils	moderate	300 to 400 per gram of root
needle	ectoparasite	very sandy soils	high	1
ring	ectoparasite	soil	low	100
root-knot	endoparasite	roots and soil	low	100
root-lesion	ectoparasite	roots	moderate	1,000 per gram of root
spiral	ectoparasite	loamy soils	low	500 to 1000
sting	ectoparasite	very sandy soils	high	1
stubby-root	ectoparasite	sandy soils	moderate	40
stunt	ectoparasite	soil	low	100

Tylka, G. 2009. Common corn nematode characteristics. Iowa State University Extension and Outreach, ICM News.; Jagdale, G.B., Davis, R.F., Bertrand, P., et al. 2013. Guide for interpreting nematode assay results. University of Georgia Extension. Circular 834.

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Sources

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Performance may vary, from location to location and from year to year, as local growing, soil and environmental conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on their growing environment.

The recommendations in this material are based upon trial observations and feedback received from a limited number of growers and growing environments. These recommendations should be considered as one reference point and should not be substituted for the professional opinion of agronomists, entomologists or other relevant experts evaluating specific conditions.

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