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G84-702 Root and Soil Analyses for Nematodes in Corn

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This NebGuide describes how to interpret laboratory results of samples submitted for nematode analysis and discusses ten species that are potentially damaging to corn.

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Several kinds of plant parasitic nematodes (small, soil-inhabiting roundworms) are associated with root injury, poor plant color, stunted growth, and reduced grain yields in field corn. Symptoms caused by these pests are often confused with root rot diseases, nutritional deficiencies or climatic stresses. Special laboratory analyses are, therefore, necessary to determine if nematodes are the primary cause of reduced corn performance. Since corn growers may be unfamiliar with nematode diseases, the following discussion of laboratory reports may be helpful.

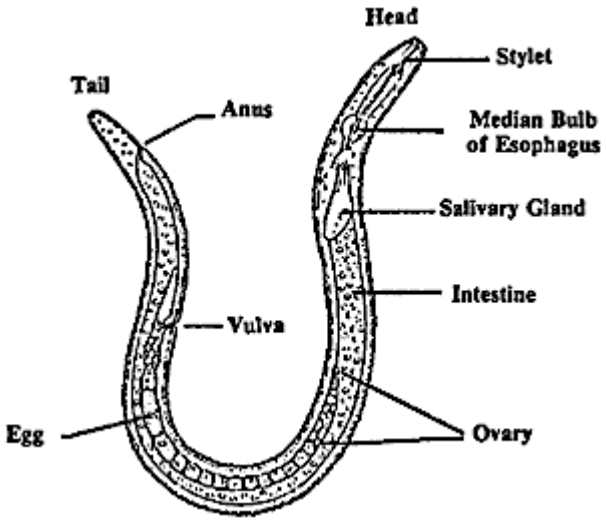
Nematodes that feed on the roots of corn plants are very small and cannot be seen without a microscope. Some nematode species live mostly in the soil and only partially penetrate the root. These are called *ectoparasites*. Others spend most of their lives totally within host tissue and are known as *endoparasites*. Both root and soil samples are needed for an accurate description of nematode disease potential in a corn field. Procedures for collecting samples are detailed in NebGuide *G80-492, How to Take a Soil Sample for Corn Nematode Assay*, which also lists several regional laboratories equipped to run nematode assays.

Most laboratories report nematode populations as 1) the number of nematodes of a specific type found per gram of air- or oven-dried root tissue, or as 2) the number found in 100 cubic centimeters (cc) of soil. Some labs, however, use a pint of soil instead of 100cc as their standard unit of measure for soil-dwelling nematodes. Since economic injury levels are reported as the number of nematodes per 100cc of soil, it is necessary to convert the number per pint to the number per 100cc in order to assess the results. Multiplying the number of nematodes per pint of soil by 0.21 converts it to the number per 100cc.

Example:

Nematode Type	Population Size	
	Per pint	Per 100cc
Dagger	139 (x 0.21) =	29
Sting	48 (x 0.21) =	10
Ring	482 (x 0.21) =	103

Interpreting of Nematode Analyses



Of the many different kinds of nematodes (*Figure 1*) that are associated with corn roots, only a few are parasitic. The amount of injury caused by a particular nematode at a given population will vary according to many interrelated factors. These include soil organic matter and texture, other forms of soil life, past and present crops, weed infestation, climatic factors (temperature and moisture), farming practices, use of pesticides, and/or the stage of crop development. Time of sampling is also an important variable since nematode populations decrease in winter months and increase during the growing season. Most samples are collected from stunted corn in mid to late season. Several kinds of parasitic nematodes are often present in the same field, and the total population may be significant.

Figure 1. General morphology of a female root lesion nematode.

The following is a guide to help interpret the results of samples submitted for nematode analysis. These are our best judgments based on existing knowledge.

Ectoparasites
(Nematodes per 100cc of soil)

Dagger nematode (*Xiphinema* spp.)

These nematodes are widespread and commonly found in most Nebraska corn fields. Population levels are usually higher in sandy soils than in finer textured soils. Numbers as high as 300 have been found, but are frequently less than 20. A level above 200 is almost certainly causing damage, but due to a lack of experimental proof, this is only an educated guess. Any number over 300 is probably significant.

Needle nematode (*Longidorus* spp.)

These are potentially devastating in localized areas of Iowa and Illinois, but are uncommon in Nebraska. When found, they are generally associated with very sandy soils. Levels above 40 to 50 are probably high enough to cause measurable yield loss.

Ring nematode (*Criconemoides* spp.)

These nematodes are common in sandy soils throughout Nebraska. They are moderately parasitic in greenhouse tests, but field testing has failed to demonstrate their potential for causing damage under natural conditions. The highest number found in Nebraska field tests was 540, but most counts are less than 20. Populations less than 100 are probably not important, but more research is needed.

Spiral nematode (*Helicotylenchus* spp.)

Spiral nematodes are found in both sandy and finer textured soils. Population levels are usually less than 25. Populations exceeding 1,000 have been reported in Iowa, but the highest count found in Nebraska field trials was 100. Numbers less than 100 are probably of minor importance.

Sting nematode (*Belonolaimus* spp.)

To date, these nematodes have only been found in localized fields in the northeast quarter and extreme western part of Nebraska. They have not been reported in Iowa or South Dakota. The highest number found in Nebraska was 310, but most samples showed less than 50 with the average about 27. The injury threshold level is estimated to be between 20 to 50, but more experimental data is needed.

Stubby Root nematode (*Paratrichodorus* spp.)

The incidence of these nematodes in Nebraska corn fields is very low and population levels rarely exceed 10 to 20. Neither Nebraska nor Iowa testing has found them to be important in reducing corn yields.

Stunt nematode (*Tylenchorhynchus* spp.)

Stunt nematodes were found in less than 10 percent of the corn fields in our Nebraska surveys and, when found, they were usually at low populations. They are generally considered to be mildly parasitic by most corn nematologists, but experimental data is lacking.

Endoparasites
(Nematodes per gram of dried roots)

Lance nematode (*Hoplolaimus* spp.)

These nematodes appear to be well adapted to our sandy soils and are occasionally seen in finer textured soils. They are known to be parasitic on corn in the field. Populations have been found exceeding 1,400, but most are in the 10 to 100 range. Populations above 300 to 400 have been associated with stunted corn in Iowa tests and should be considered economically threatening.

Lesion nematode (*Pratylenchus* spp.)

Lesion nematodes are common statewide. Probably the most important nematodes attacking corn, population levels sometimes reach 3,000 to 5,000 by mid to late summer. Our experimental data indicate that counts of 1,000 are sufficient to cause a measurable yield depression of about 4 bushels per acre. However, this threshold level may vary considerably with soil, climate, hybrid, cultural practices, and stage of growth. Mid to late season counts of between 1,000 and 3,000 may be threatening, and treatment the following spring should be considered.

Stem nematode (*Ditylenchus* spp.)

Many species of stem nematodes are found in soil throughout the United States, but they are not commonly associated with corn. Hence, they are largely ignored. A few species live inside plants such as rice, potatoes, alfalfa and onions and can cause serious losses to these crops. Sporadic occurrences of stem nematodes associated with corn have been reported in Iowa, but they are rarely found in Nebraska.

Other Stylet-Bearing Nematodes

There are numerous other kinds of stylet-bearing nematodes associated with corn roots or found in the roots' immediate soil environment. Some of these include the pin (*Paratylenchus* species), Dorylaims, various fungus feeders, a cystoid form, and several species belonging to the genus *Heterodera*. Note, however, that *Heterodera zeae* reported in Maryland in 1981 has not been identified in Nebraska.

Little or no research has been done on economic threshold levels for these nematodes. Hence, they are generally felt to be of little consequence by most corn nematologists.

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