

# **SAMPLING FOR NEMATODES IN SOIL**

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Plant-parasitic nematodes live primarily in the soil and are generally too small to be seen with the naked eye. They usually occur in greatest numbers in the top 12 inches of soil, although this varies with species. Horizontal distribution of nematodes is irregular in cultivated soil, but is most numerous in roots or in soil around the roots of host plants. Soil texture also influences the occurrence of nematodes in a field. For instance, root-knot nematodes are usually more prevalent in a sandy soil than in a clay soil.

Most plant-parasitic nematodes attack plant roots, but there are some species that parasitize above-ground plant parts. Symptoms on roots include knots or galls, lesions, excessive root branching, injured root tips (which may have a stubby appearance), diminished root system, and root rots. Above-ground plant symptoms that occur from infected roots are not always distinct, but may appear as suppressed growth, chlorotic foliage, and excessive wilting during hot or dry weather. Certain nematodes, such as the alfalfa stem nematode, infect the buds and stems of plants which results in swollen buds, shortened internodes, and stunted and distorted plants. Some nematodes infect leaves, flowers, and seeds. Symptoms are often difficult to diagnose, and plants must be examined carefully to determine the cause of the problem.

Symptoms on plants growing in a field may indicate whether or not control measures are needed before a susceptible crop is planted. Many weeds are excellent hosts of nematodes and sometimes show symptoms to indicate that a field is infested. For example, dandelion and Canada thistle, when infected with the Northern and Columbia root-knot nematodes, respectively, form distinct galls. Lesions occur on roots infected with the root-lesion nematode, but this symptom can be difficult to diagnose from other root pathogens.

Soil sampling to determine if nematodes are present and to estimate populations is essential in deciding if control measures are needed. A soil analysis from a qualified laboratory may save the cost of nematode treatment.

## Soil Sampling Procedure

### Sampling Tools

Samples can be taken with a soil sampling tube (a 1-inch diameter soil probe is most commonly used), trowel, or shovel.

### When and Where to Sample

Soil samples are best taken whenever soils are not excessively wet, dry, or frozen. To detect root-knot nematode populations in potato fields, soil samples are best taken during September or October because populations are usually higher during this time. During December to February, nematode populations are usually lower and may be barely detectable in March or April. Research has shown this is especially true for the Columbia root-knot nematode *Meloidogyne chitwoodi*, and may also be true for the Northern root-knot nematode, *M. hapla*.

Samples should be taken in the row to include soil from the root zone by first discarding the top 2 inches of soil and then sampling to a depth of 12 inches. Include feeder roots in samples whenever possible.

### Sample Size

Each sample should consist of approximately a pint to a quart of soil obtained from a composite sample consisting of 10 or more subsamples (soil probes or cores). The number of subsamples will depend on the size of the area in question: (1) if less than 1 acre, at least 10 subsamples should be taken; (2) 1 to 5 acres, take a *minimum* of 20 subsamples; (3) 6 to 10 acres, from 50 to 100 subsamples. It is best that a sample not represent more than 5 acres. The subsamples should be thoroughly mixed in a clean container, and a pint to a quart of this soil put into a plastic bag and sealed. The bag should be labeled and submitted for nematode analysis.

Nematodes are not uniformly distributed, but are rather spotty in the field. Therefore, the more samples taken from a given area the better the chances for nematode detection. If cost is a limiting factor in the number of samples submitted for nematode analysis, the field should be divided into larger sections (10, 15, 20, etc., acres) and as many subsamples taken as possible from each section (100 or more samples).

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### Pattern to Use in Taking Subsamples

The sampling pattern will depend on the crop and field configuration. Samples need to represent the area in question. For example, the recommended pattern for sampling a 3-acre (30 cores) field is illustrated in Fig. 1-A, while a recommended pattern for a single plant or tree is shown in Fig. 1-B. Samples for perennial crops should be taken in the feeder-root zone (dripline) of living plants (Fig. 1-C), because nematode populations usually decrease in soil around dying or dead plants.

### When Samples Should be Separated

In each field, subsamples should be taken from the area with a *common crop history* which will be planted to a single crop. For example, if a field is to be planted to potatoes the next year, and if half of the field was in corn and the other in alfalfa, each area should be sampled separately with care taken not to mix the samples. This is important because the Columbia root-knot nematode will readily infect and reproduce on corn, but only slightly or not at all on alfalfa. The Northern root-knot nematode, however, will readily infect and reproduce on alfalfa, but not on corn. If the *soil type* varies in the field, take one sample from each. This is especially necessary if root-knot nematodes are suspected as they are most abundant in coarser textured soils. Care should be taken to clean

the sample tool often and between each sample area.

### Sample Identification

Sample location, field number, cropping history, and other identifying notations should be made to relocate sampled area easily. Indicate if plant-parasite nematodes have been previously identified in sampled areas. Do not forget to include your name, address, and telephone number.

### Handling and Storage of Samples

Nematodes die rapidly at temperatures above 100°F/38°C or if allowed to dry. Samples should be put in plastic or plastic-lined soil sample bags to prevent drying and then stored at relatively cool temperatures, but not freezing. While in the field, keep samples out of direct sunlight to avoid overheating. Samples also may be damaged by heat if they remain in a closed car or trunk for only a short time, unless stored in some type of cooling container such as a styrofoam chest. To prevent loss of sample, secure bag tightly and place in corrugated boxes before mailing.

### Where to Send Samples for Analysis

Send samples to a reputable laboratory for nematode analysis. A list of laboratories can be obtained from most county Extension offices.

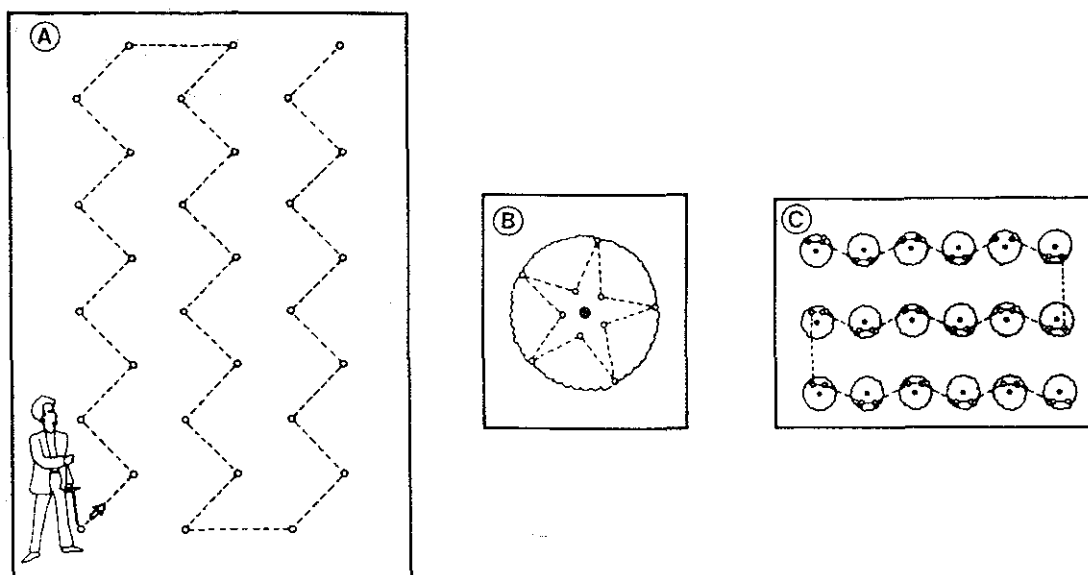


Figure 1. Diagrams for collecting soil samples. (A) Recommended pattern to collect subsamples in a 1-5 acre area. (B) Pattern to collect subsamples of a single plant or tree. (C) Pattern to collect subsamples of a perennial crop. (From Barker, K.R. and C.J. Nusbaum, 1971, by permission. Diagnostic and advisory programs, pp 281-301. *In Plant Parasitic Nematodes*, Vol. 1, Morphology, Anatomy, Taxonomy, and Ecology, B.M. Zuckerman, W.F. Mai, and R.A. Rohde, Eds., xiv + 345 pp. Academic Press, New York.)