

## Interpretation: Deciding on the need for management?

The observed root-galling severity scale has been closely correlated with soil nematode counts made by direct extraction and identification of nematodes from the soil. This has made it possible to establish threshold severity ratings that can be used as benchmarks to decide on the need to treat. If planting onions, an average root-galling severity rating of 3 or higher indicates that the area sampled will need to be treated either with a chemical nematicide or to be rotated to a non-host crop such as oats, corn, wheat, rye, etc. However for a more sensitive crop like carrot, fields or sections of a field with an average RGS rating of 2 or higher should be treated before being planted to carrots. For potato and bean crops which are more tolerant to NRKN infection, use a RGS threshold of 4.



## Example Field

Prior to planting carrots in 2003, two large fields were extensively sampled (one composite soil sample/ acre each consisting of 10 sub-samples) and NRKN infestation levels were assessed using this lettuce bioassay. Of the 23 acres sampled in one field (Figure 1), only 4 acres at the average NRKN damage threshold carrots (RGS  $\geq 2$ ).

The collaborating grower decided not to treat this field and treated only the heavily infested sections of the second field with oxamyl at a 2 gal/acre rate at planting. All the carrots in both fields were considered marketable at the end of the season.

## Summary

Bioassaying your soil with lettuce to detect root-knot nematode infestation levels is only as accurate as the thoroughness of the sampling procedure and the number of composite soil samples collected. Therefore, the more soil samples collected per field the greater understanding of the NRKN distribution

1.0	1.0	1.5	1.0	2.0
	1.0	1.0	1.5	2.0
1.0	1.0	1.0	1.5	1.0
	1.5	1.0	2.0	1.0

**Figure 1.** One of the two sampled fields. Shaded areas indicate acre blocks that were at the NRKN management threshold level for carrots. This data illustrates the variability of root-knot nematode distribution that is often observed within a field which is more pronounced in heavily infested fields.

within the field and the accuracy of the infestation level. This bioassay is an excellent tool for managing the northern root-knot nematode on an as needed basis and it will contribute to reducing nematode damage and increasing profitability.



## For additional information contact:

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**PLEASE NOTE that this research is ongoing and that this protocol is continually being improved to increase its user friendliness.**

## Visual Assessment of Root-Knot Nematode Soil Infestation Levels using a Lettuce Bioassay



## Introduction

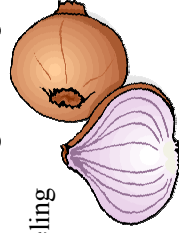
The northern root-knot nematode (NRKN) is a major pathogen of vegetables grown in New York. Crop growth in heavily infested fields is often patchy and uneven. Carrots become forked, stubby, hairy, and develop galls on the fine roots and on the carrots themselves. Infected onions exhibit stunting, delayed maturity, larger necks and smaller bulbs. Onion roots show small galls or root-thickening and extensive branching. Lettuce plants become stunted and produce small, loose and often unmarketable heads. Distinct and large galls are formed on infected lettuce roots.

Crop rotation with a non-host crop such as corn, wheat, sudangrass or oats and/or the use of cover crops although effective at managing NRKN by reducing infestation levels, is generally not cost-effective especially on high value organic soils. Chemical nematicides are also effective but are costly and often applied unnecessarily. This soil bioassay with lettuce was developed to enable the visual assessment of NRKN infestation levels along with the use of crop specific economic thresholds to determine if NRKN management either biologically or chemically based is needed.

## Materials

The following materials will be needed to conduct the bioassay:

- Pails and plastic bags for collecting soil samples
- Permanent marker for labeling
- Trowel/shovel
- Pots/containers
- 1 to 3 week old lettuce seedlings (any cultivar)
- Greenhouse bench/table space with light
- Watering can/bottle



## Protocol

**Soil sampling.** A minimum of four composite soil samples should be collected per field (a sample/ 2-3 acres is preferred). The more composite samples collected per field the more accurate the assessment of the nematode population and distribution within the field. Each composite sample should be approx. 1-2 liters in volume and consist of 15 to 20 sub-samples collected following an X or V pattern across the sampling area.

**Sample storage.** Maintain samples in cool location out of direct sunlight. Ideally, samples are bioassayed soon after being collected but samples can be placed in cold storage at about 40F for several months, if needed. Thus, it is possible to sample in the fall and conduct the bioassays in early spring.

**Lettuce.** Germinate and grow lettuce seedlings for either 1 week on a moist paper towel in a covered container under a source of light or grow for 2 to 3 weeks in a  $\leq 200$  count plug tray or purchase lettuce seedlings from a greenhouse. Soil-less media should be shaken off roots prior to using in the bioassay.

**Bioassay set-up.** Thoroughly mix each soil sample and place in 2 or 4 pots/containers with drainage holes and plant with 2 lettuce seedlings. Maintain in a greenhouse or on a workbench under lights, watering daily or as needed for 4 to 6 weeks. Fertilize once a week with a solution of complete fertilizer, if needed.

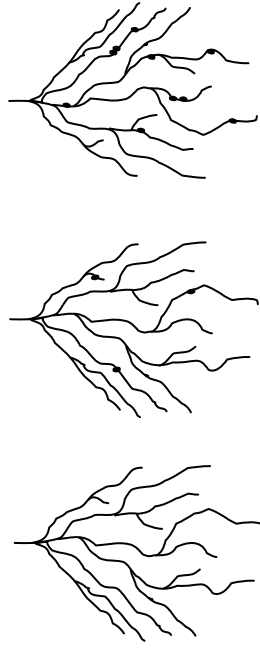
**Bioassay take-down.** After 4 to 6 weeks, remove plants from the pots/containers and wash roots free of soil, then examine and rate for root-galling severity.



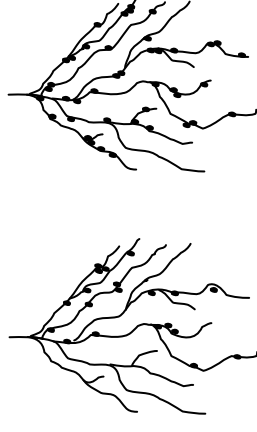
## Root-galling severity scale

The severity of the root-galling on the lettuce is a reflection of the NRKN infestation level in the soil. It can be scored by counting the total number of galls observed per root system and using a 1 to 5 galling severity scale (see diagram below).

Rate each lettuce plant separately using the 1 to 5 scale then average the ratings for each sample. This represents the average root-galling severity rating that can be used to determine whether or not that section of field needs to be treated or rotated out prior to planting the next crop.



**RGS 1 = no galls**    **RGS 2 = 1-4 galls**    **RGS 3 = 5-12 galls**



**RGS 4 = 13-40 galls**    **RGS 5 = >40 galls**



**Severely galled lettuce roots with a RGS = 5.**