CUTT

Evaluation of Putting Green Nematode Populations

Program Spotlight

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This research project involved a survey of the distribution of nematode genera and population levels on the #2 putting green located at the Country Club of Ithaca. This green was selected because of its chronically reduced vigor and the previous diagnosis of nematode problems.

The most recent past survey of nematode occurrence was conducted in 1991 by Peter Mullin of the Department of Plant Pathology at Cornell University. Mullin examined 18 samples from various New York State golf courses and found numerous genera of plant parasitic nematodes.

Prior to that survey, a study was conducted in July-September 1976 on greens in southeastern New York (Murdoch et al. 1978). This study used a random sampling approach which unfortunately doesn't indicate the distribution patterns across a green. Due to the lack of information available on cool season phytonematodes, our survey has provided valuable information to turfgrass industry members and university researchers. Our survey focused on the distribution patterns and population levels across a putting green to learn how varied the population can be and in turn determine the accuracy of our current sampling procedures.

Procedures

The #2 putting green located at the Country Club of Ithaca was the site used to conduct the study. The putting green is approximately 15 x 22.5 m in size. 120 (1.5 x 1.5 m) blocks were established across the green. Within each 1.5 x 1.5 m sample block, 10 small cores (2.5 width x 15 cm deep) were collected in a systematic pattern to obtain at least 50 grams of soil per sample site. The 10 cores were mixed together, placed in a plastic bag, and labeled. Samples were transported to the diagnostic clinic and stored in a refrigerator until extractions, identification and nematode counts were made.

Samples were collected at three different sampling times. We predicted that soil temperatures may influence the population changes and that the optimum soil temperatures for the approximately 12 genera of plant parasitic nematodes that are found on cool season turfgrasses may vary depending on the genus of nematode. A record of soil temperatures and cultural practices conducted during the growing season were recorded but we encountered difficulty with our recording device and analysis of this information may take some time.

Nematode extractions were conducted using the sugar flotation extraction method. The sugar floatation method was chosen for the quick isolation of the nematodes. Fifty grams of soil were placed in a beaker with enough water to mix it thoroughly. The mixture was then poured through a 100- and a 400-mesh sieve to first collect any debris and then to catch the nematodes. The 400-mesh sieve was then rinsed into a vial that was centrifuged for approximately 5 minutes. The surfactant was decanted and a sugar solution added to the vial. The nematodes were located in the pellet formed by the centrifugation of the soil mixture. Therefore, the pellet was broken up by tapping the vial on a counter and placed back in the centrifuge for 45 seconds. The nematodes are not as dense as the sugar solution and are contained in it. The solution was poured off through a 400-mesh sieve. The sieve was rinsed to remove the sugar from the nematode environment and then rinsed into a vial for evaluation at a later time. All plant parasitic nematodes were identified to genus and population levels were recorded.

Data Collection

The collection of the soil samples was conducted on April 19, June 19, and September 10, 2000. Extractions of the nematodes were

conducted as quickly as possible after the collection dates. Six genera of plant parasitic nematodes were detected in these samples, *Hoplolaimus* sp., *Tylenchorhynchus* sp., *Meloidogyne* sp., *Criconemella* sp., *Pratylenchus* sp., and *Helicotylenchus* sp. Additionally, the free living nematodes were counted for informational purposes of later population comparisons.

The population numbers recorded were placed into color-coded maps for an easier visual assessment of the findings (see Figures 1-3). Three shades are used to represent low (1-49 nematodes/50 grams of soil for plant parasites and 1-249 nematodes/50 grams of soil for free living), moderate (50-99 nematodes/50 grams of soil and 250-499 nematodes/50 grams of soil for free living), and high (100+ nematodes/50 grams of soil and 500+ nematodes/50 grams of soil for free living) levels of infection. The determination of the levels used in our ranges was based on the first sampling. The ranges have no association with any population thresholds currently used in determining possible damage points.

Results

The overall population levels detected were lower than expected. The April collection date produced samples with relatively low population levels for all the plant parasitic and free-living nematodes observed. Low levels were expected at this time due to the cold temperature and continued dormancy of the turfgrass. The spring and summer were extremely wet which should have created ideal conditions for population expansion of the various nematodes.

In June we expected to see a significant rise in the nematode population numbers observed but that was not the case. Soil and air temperature was lower than normal for this time period and we suspect that may have been a factor. *Hoplolaimus* sp. increased slightly at the June collection then reduced slightly in September. Very few of these nematodes were detected to our surprise. This large nematode has been found in cool season turfgrasses and we expected higher numbers than we found. Of the 120 plots for each collection date we found only 96 total *Hoplolaimus* sp. in April, 126 in June, and 96 in September. The distribution pattern was quite interesting. Low levels of this nematode were detected at scattered sites across the green. An occurrence of this nematode was found at the top of the green with another occurrence found 10-15 feet away. This distribution pattern continued across the green and not only occurred in the April collection but continued through the June and September collections.

Tylenchorhynchus sp. appears to be the dominant plant parasitic nematode detected on this green. Although higher levels of one other genera of plant parasitic nematode, *Criconemella*, was found, the population threshold for damage caused by *Tylenchorhynchus* is lower and the nematodes are reported as being more damaging to the plant material. *Tylenchorhynchus* were detected at low levels throughout the green and the distribution of this nematode was very uniform across the green. The total populations were highest in the April collection. Population levels decreased in June with a moderate rebound in September.

Meloidogyne sp. were detected during the initial collection in April at numerous block locations within the green. Interestingly, none were detected in the June sampling. Then again in September the nematodes were found at a low level. This may be explained by the life cycle of this nematode. The J2s are the infectious, juvenile stage of the nematode. They are the life cycle stage we observed in the April sampling. This makes sense when we consider this early part of the growing season is most likely the time for infection by this nematode. By June the J2s had either died off or infected the plant tissue and were located within the root tissue not swimming around in the soil where we were collecting our nematodes for analysis. Therefore, none were found. By September these nematodes may have been reproducing again and a few juveniles were again present in the soil. Another interesting observation of this nematode was that they were found mainly in the lower section of the green. Whether this was due to the environmental conditions, soil temperatures, soil texture, water levels, etc., or to it being the location of the first inoculation of the green is unknown.

Criconemella sp. were detected at all collection dates. The total numbers began at 5,170 nematodes found in 120 samples on this green. The level decreased as seen in other genera during June and then returned to a higher level of 7,958 in September. The high numbers of this nematode would not be of concern to most nematologists. Previous studies have reported this nematode at very high levels without caus-

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Nematode Populations

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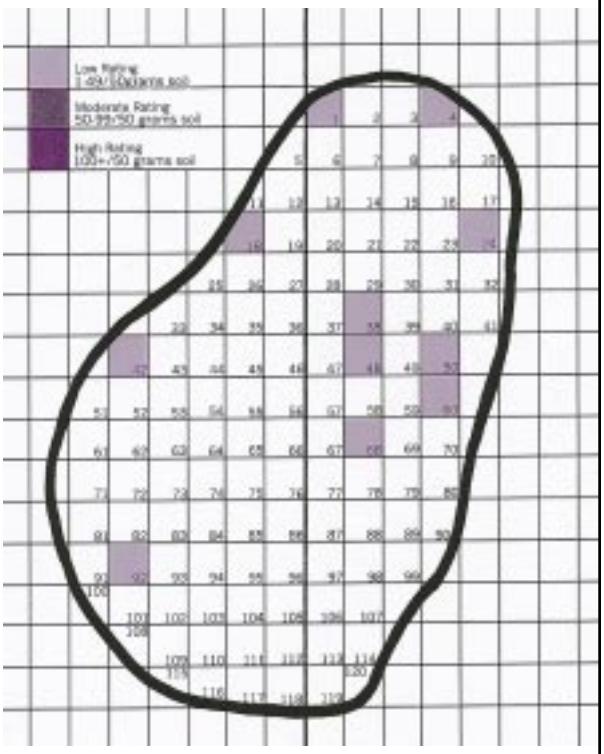
ing any symptoms of damage. This is the reason we believe the nematode to study in future analyses is *Tylenchorhynchus* sp. Like *Tylenchorhynchus* sp., the distribution pattern of *Criconemella* sp. was very uniform and spread across the green during all the sampling periods.

The levels and occurrence rate of *Pratylenchus* sp. and *Helicotylenchus* sp. were extremely low and are not considered an important factor in the nematode evaluation but the findings are included in this report.

The recording device used for the collected of the soil temperature and moisture levels was a WatchDog datalogger. The datalogger had the capability of recording the soil moisture at one site and the soil temperature at two different sites located approximately 25 feet apart on the green. The readings were collected and saved in a spreadsheet. We encountered difficulty during the summer months when we found the datalogger no longer operated correctly after just a few days of proper functioning. We needed to replace the batteries of the unit often and believe the problems arose due to very high humidity in the containers used to protect the unit from water and soil exposure.

Figure 1



Hoplolaimus *sp. incidence rates 4/19/00*

It was hopeful that a professional survey of the green could enlighten us on any possible association between topography and nematode population levels. Unfortunately, the green could not be surveyed at this time. The facility was hoping to have this done at their expense but could not fit it into their schedule this summer.

Discussion

This research project has provided us with some very valuable data to analyze. The different genera found help in determining the possible threats of damage and, when comparing this to other research projects, the distribution of these nematodes across our state and the country. The nematodes found are consistent with the nematodes present in past research projects.

Our collections did not produce high levels of nematode populations that would trigger a call for some type of management action being conducted on this green. The green has a number of factors that are contributing to the decline of the turf which is usually most apparent during the hot, dry summer months. The green is shaded during part of the day, which can reduced photosynthesis and allow pathogens to establish if drying time of the turf is prolonged. Additionally, the green was built in the 1950s and the subsoil is made up of a very tough clay composition. The presence of the plant parasitic nematodes is just another factor that contributes to the decline of the turf at this site.

This study has contributed to the assumption that *Tylenchorhynchus* sp. is the nematode of concern in the northeast on cool season turfgrasses. Other nematodes are present and at levels that may prove damaging but *Tylenchorhynchus* sp. are more abundant and the spatial distribution pattern on this green has shown that they are found uniformly. Therefore, we conclude that this nematode is the nematode of interest in our studies and further research should be conducted to learn about the conditions that promote infection and damage.

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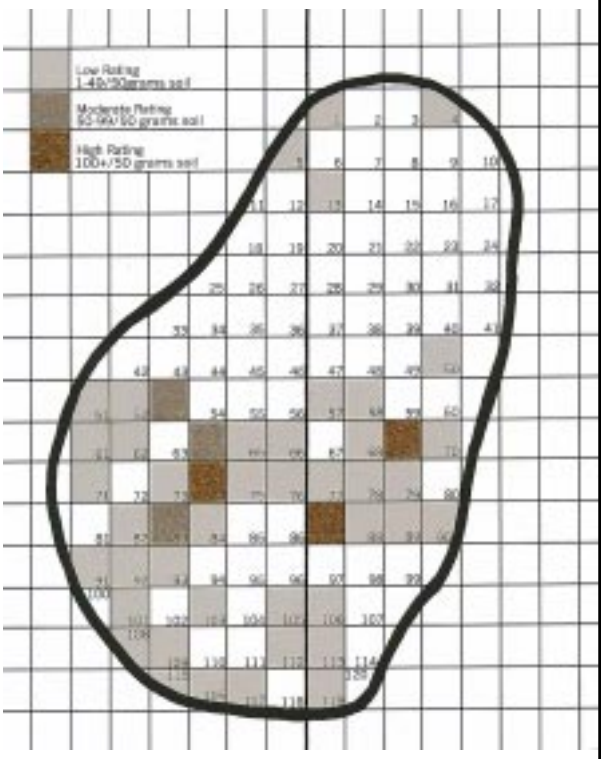
Therefore, we conclude that Tylenchorhyncus *sp. is the nematode of interest in our studies and further research should be conducted to learn about the conditions that promote infection and damage.*

The spatial distribution of the various genera of nematodes was very interesting. This information should be followed up with continued research of other sites to determine if the nematodes consistently tend to congregate in areas that they prefer on the green site. Our research showed that *Criconemella* sp. and *Tylenchorhynchus* sp. were all over the green while *Meloidogyne* sp. and *Hoplolaimus* sp. prefer lower and high locations respectively. Studying another green at a location fairly close to this green may provide us with answers to these questions.

The results of this research project show that the time of sampling and location of a single sample can heavily influence the outcome of a nematode analysis. Our data shows that an early April sample collection may be the most revealing when looking for diversity of the nematode genera and nematode population levels. Also, the location of the sample collection can be very important. If a sample was only taken from the upper center section of this green (around blocks 14-16), we may not have known of the presence of *Meloidogyne* sp. and *Hoplolaimus* sp. nematodes and depending of the sampling date, the presence of *Tylenchorhynchus* sp. and *Criconemella* sp. All the information collected during this project will prove quite valuable in determining better sampling procedures and will aid in the development of more research studies to help us understand these organism better than we do now.

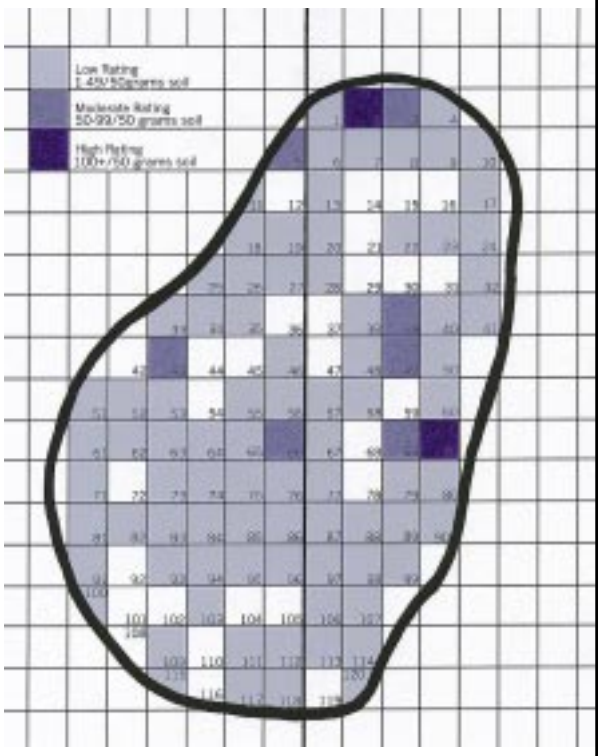
Karen Snover

Figure 2



Meloidogyne *sp. incidence rates 4/19/00*

Figure 3



Tylenchorhynchus *sp. incidence rates 4/19/00*

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