Assessment of Nemacur-Alternatives For Controlling plant Parasitic Nematodes In Golf Greens, 2017

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Introduction

Nematodes cause significant damage to various golf courses throughout New England. We have lost Nemacur (fenamiphos) as a viable treatment for nematodes. There have been a number of alternative products that have emerged on the market for controlling nematodes; some are in the experimental stage and some are commercially-available. All claim to be effective; however, in almost all cases they have not performed as promised when applied at labeled rates to golf greens. It is important to test these materials in a systematic, statistically based manner to determine if they are effective for controlling nematodes.

This past season we tested Majestene (*Burkholderi*a spp. strain A396), Nimitz (fluensulfone), Montery Nematode Control (saponins of *Quillaja saponaria*) and ProNuCur HY (diatomaceous earth); all four products are registered as nematicides and make claims for efficacy. We also carried out an evaluation of *Pasteuria*-infected lance and stunt nematodes. In addition, we are studying a unique root-knot nematode from New Hampshire which may be undescribed.

Evaluation of Nimitz and Majestene, Franconia Golf Club, Springfield MA

Franconia Golf Course in Springfield, MA is more than 80 years old and consists of a mixture of *Poa* and bentgrass. Mechanical analysis of the soil has not yet been carried out. The baseline nematode assay was done on 25 April. Eighteen plots were divided between the Control, Majestene and Nimitz. Plots were arranged so that lance nematodes were fairly even over the six replications; this resulted in an uneven distribution of stunt nematodes, but we collected data on stunt regardless. Nimitz was applied to each plot of six plots by sprinkling with a shaker can at the rate of 60 lb/A for each of 4 applications at two-week intervals. Directly following application, 2.5 to 4-gal water/plot was applied by a watering can. Applications were made on: 24 May, 8 Jun, 22 Jun and 5 Jul.

Majestene was applied with the adjuvant Integrate. Majestene was applied at 8 qts/A and Integrate at 2 qts/A to six replicated plots; both materials were incorporated together in about 2 gal water in a watering can. An additional 2 gal of water was used to water the material into the root zone. Applications were made on the same day as Nimitz. Six control plots received no treatment. Four additional nematode assays were carried out at approximately 5-week intervals.

There was no phytotoxicity from the Nimitz or Majestene. The nematode population was higher for the Majestene treatment but not statistically higher. Lance and stunt nematodes were not statistically lowered by either treatment compared to the control (Figs. 1&2). Nimitz has been shown to control plant parasitic nematodes in trials other than mine. Majestene literature also claims reduction of root-knot nematodes in tomatoes. These products should be tested again before drawing any conclusions

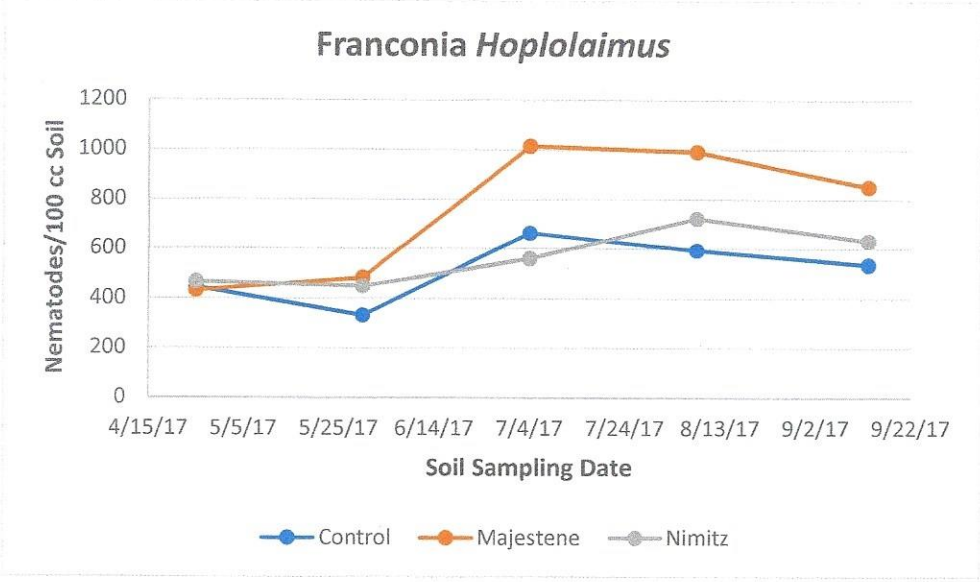

Fig. 1. Effect of Majestene and Nimitz on lance nematodes. There are no statistical differences. A season with a higher mid-season nematode population may have shown different results.

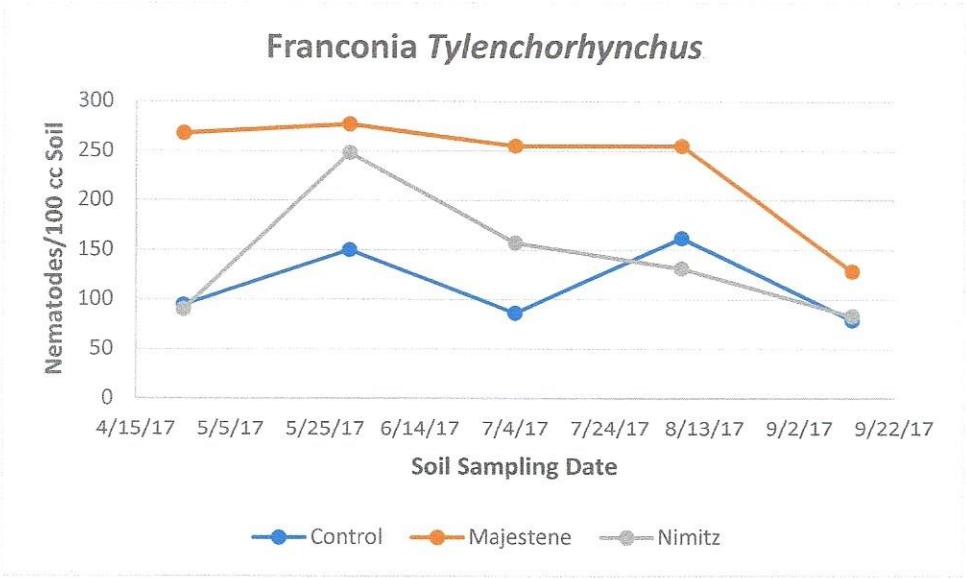

Fig. 2. Effect of Majestene and Nimitz on stunt nematodes. There are no statistical differences. A season with a higher mid-season nematode population may have shown different results.

Evaluation of Nimitz and Monterey Nematode Control (MNC), Northfield Country Club, Northfield, MA

Northfield golf club in Northfield, MA is more than 100 years old and consists of a mixture of annual bluegrass and creeping bentgrass. Sand top-dressing over the years resulted in approximately 4 in. of a loamy coarse sand (USDA criteria) perched on native soil. Mechanical analysis of the top 4 in. showed it to be 73.9% sand, 20.9% silt, and 5.3% clay. On 11 May, the

first nematode assay was carried out and eighteen plots were divided between the Control, Nimitz and MNC. Nimitz was applied to each plot of six replications by sprinkling with a shaker can at the rate of 60 lb/A for each of 2 applications at two-week intervals. Directly following application, 2.5 to 4-gal water/plot was applied by a watering can. Applications were made on: 24 May and 8 Jun. Monterey Nematode Control (saponins of *Quillaja saponaria*) was also applied to 6 separate plots on this green at the rate of 9 fl oz/1,000 sq ft. MNC was applied in a watering can and rinsed into the soil with 2.5 to 4-gal water/plot. Six control plots received no treatments. Due to severe phytotoxicity after two applications of Nimitz, the superintendent called off the research and follow up soil sampling was not carried out. Significant phytotoxicity occurred on both *Poa* and bentgrass.

Evaluation of Nimitz and Majestene, Northampton Country Club Leeds, MA

Northampton Country Club in Northampton, MA is more than 100 years old. The green consists of a mixture of annual bluegrass and creeping bentgrass. Sand top-dressing over the years resulted in approximately 4 in. of a loamy coarse sand (USDA criteria) perched on native soil. Mechanical analysis of the top 4 in. showed it to be 86.7% sand, 9.4% silt, and 3.9% clay. The baseline nematode assay was carried out on 29 Jun, which was probably too late in the season for a good trial, but this trial was set up to replace the trial in Northfield. Eighteen plots were divided between the Control, Majestene and Nimitz. Plots were arranged so that stunt nematodes were fairly even over the six replications; this resulted in an uneven distribution of lance nematodes, but we collected data on lance regardless. Nimitz was applied to each of six plots by sprinkling with a shaker can at the rate of 60 lb/A per application. Directly following application, 2.5 to 4-gal water/plot was applied by a watering can. Applications were made on: 6 Jul, 13 Jul. Phytotoxicity showed up after the second application so no more applications were carried out. We were able to finish taking samples through to the end of the season.

Nimitz proved to be phytotoxic but there was no visible damage from the Majestene applications. There were no statistical differences between the treatments; however, the trial was begun too late in the season to show differences. (Figs. 3&4)

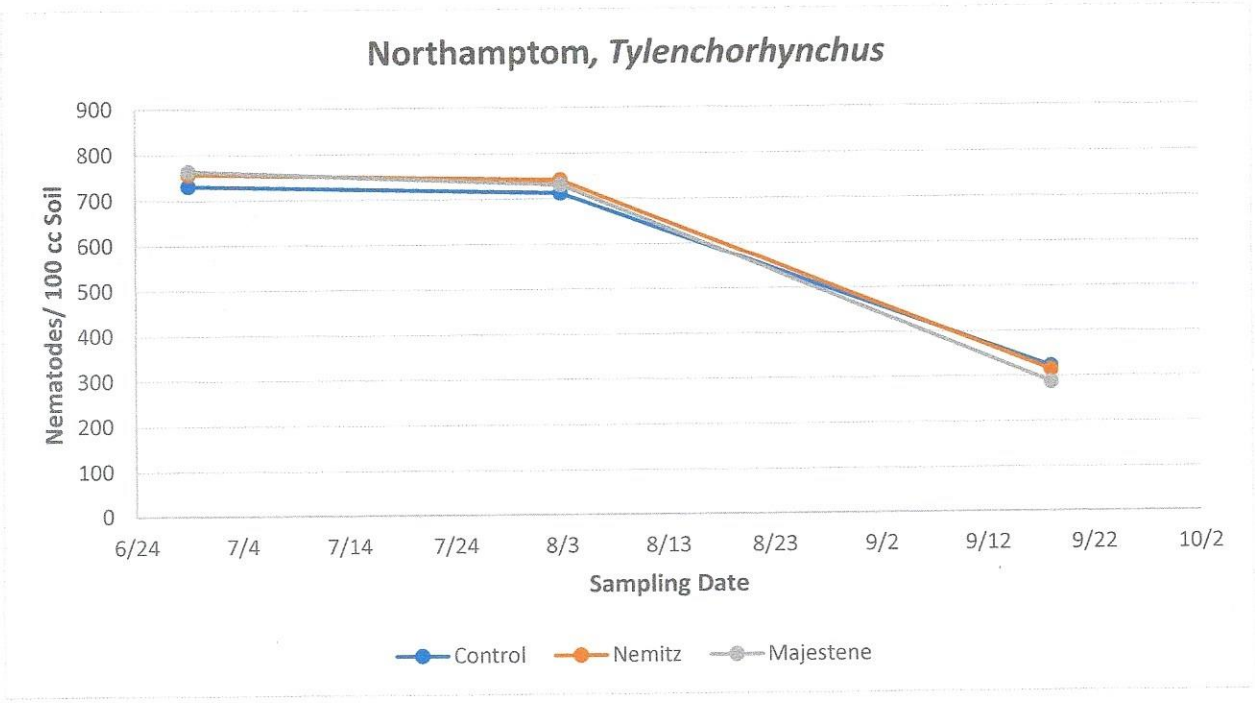

Fig. 3. Effect of Majestene and Nimitz on stunt nematodes. Two applications were made of each material but nematode populations began to fall early in the season thus no differences were seen in the treatments.

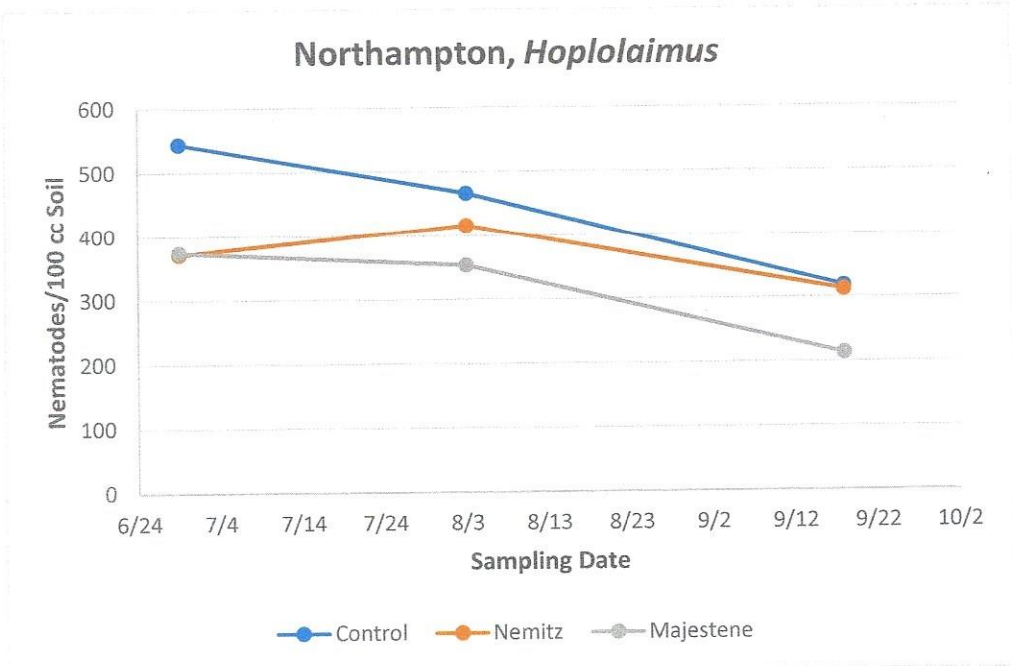

Fig. 4. Effect of Nimitz and Majestene on lance nematodes. Two applications were made of each material, but nematode populations began to fall early in the season thus no differences were seen in the treatments.

Effect of ProNuCur HY on nematodes at the Joseph Troll Turf Research Farm

ProNuCur (PNC) is diatomaceous earth, a product of living organisms called diatoms. It consists of 80 to 90% silica, 2 to 4% aluminum oxide and 0.5 to 2% iron oxide. Diatomaceous earth is sold as an insecticide where it has proven to be effective. It is registered for turfgrasses to control plant pathogenic nematodes.

"Fairway-height" turf at the Joseph Troll Turf Research Farm was selected for the trial. The product is too coarse for a golf green (Fig 5.) Twelve plots 2.5' x 4' feet were established, and nematodes were assayed. Few plant parasitic nematodes were found at this site but there were many free-living nematodes to serve as surrogates. Aerification was carried out before applying the PNC, and sand served as a top-dressing control. On 21 Jun we used the top-dressing rate of 9 cubic ft/1,000 sq ft which equaled 128 lb PNC/1,000 sq ft. The sand and PNC were brushed into the holes with a broom (Figs. 6,7&8). Subsequent nematode assays were taken on 16 Aug and 12 Oct. There was no difference between the PNC and the control but we did not expect anything in such a short time. We propose to reapply the material spring and fall following aerification and to
monitor the nematodes over the growing season.

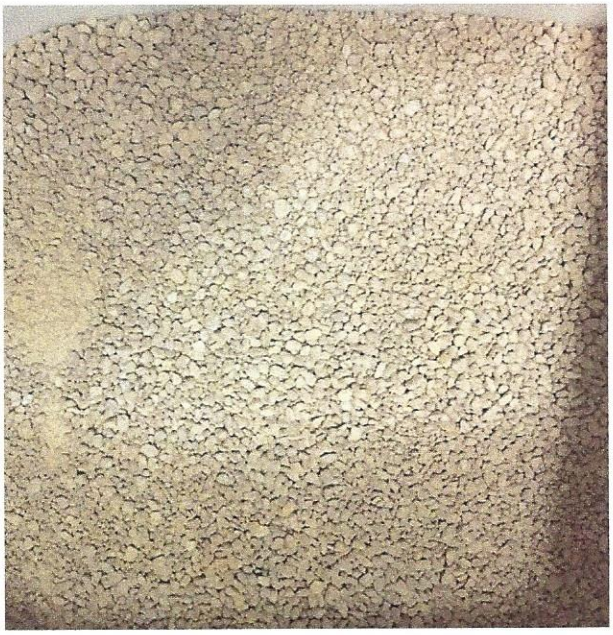

Fig. 5. ProNuCur HY in the container. A mixture of very fine and coarse material. The coarse material would not be appropriate for a golf green.

Fig. 6. ProNuCur and sand, after sprinkling on to aerified plots

Fig. 7. Brooming in the sand and ProNuCur.

Fig. 8. Sand and ProNuCur 1 week after application.

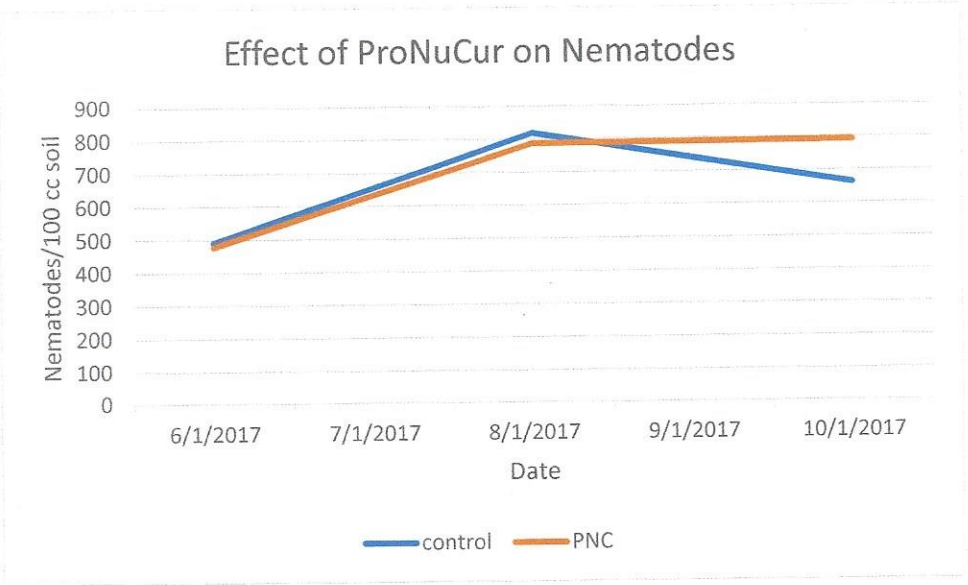

Fig. 9. Effect of ProNuCur compared to sand, on total nematodes in the soil. There is no statistical difference between the PNC and the control. Several years of application needs to be carried out.

Survey of the bacterial pathogen *Pasteuria* on stunt and lance nematodes

The bacterial pathogen *Pasteuria* is occasionally found in high numbers in populations of stunt and lance nematodes. Some data was collected about 12 years ago and these golf courses are being surveyed again to determine if the bacterial population has increased, or if the nematode populations have decreased. In 2016 and 2017, four greens at Twin Hills Golf Course, one green at the Orchards (three in 2017) have been assayed. In each case (for each green) 30 cores were taken and analyzed separately. For each core, the total number of nematodes and the number of infected nematodes were counted. Also, the number of external bacterial cells (which cause the infection) were estimated. From this data, the percentage of nematodes affected, and the average number of bacterial cells per nematode were calculated.

There was no statistical correlation between the number of infected nematodes and the total number of nematodes per core. Since 2004, green 3 at the Orchards went from 22% infected stunt nematodes to about 55% infection. Green 8 went from 28% infection to 50% infection. In both cases there was a considerable drop in nematodes, but you cannot make a fair comparison with a single assay. It would be more convincing to have done a season-long analysis of the nematode populations. In one green there was a drop in infection of lance nematodes from 38% in 2012 to 15% in 2017. There is a lot of data here and we are not done evaluating.

Lance nematode with the bacterium *Pasteuria* attached to the outside cuticle. From here, the bacterium enters the nematode with a penetration peg and then colonizes the interior of the nematode.

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