ASSESSMENT OF NEMACUR-ALTERNATIVES FOR CONTROLLING PLANT PARASITIC NEMATODES IN GOLF GREENS, 2016

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Introduction

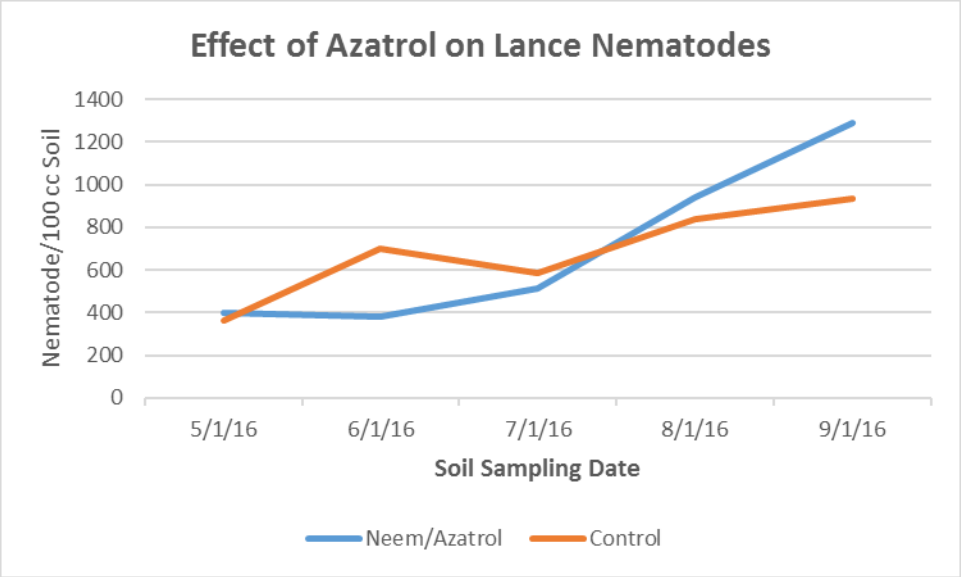
Nematodes cause significant damage to various golf courses throughout New England. We have lost Nemacur (fenamiphos) as a viable treatment for nematodes. There have been a number of alternative products that have emerged on the market for controlling nematodes; some are in the experimental stage and 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. It is important to test these materials in a systematic, statistically based manner to determine if they are effective for controlling nematodes.

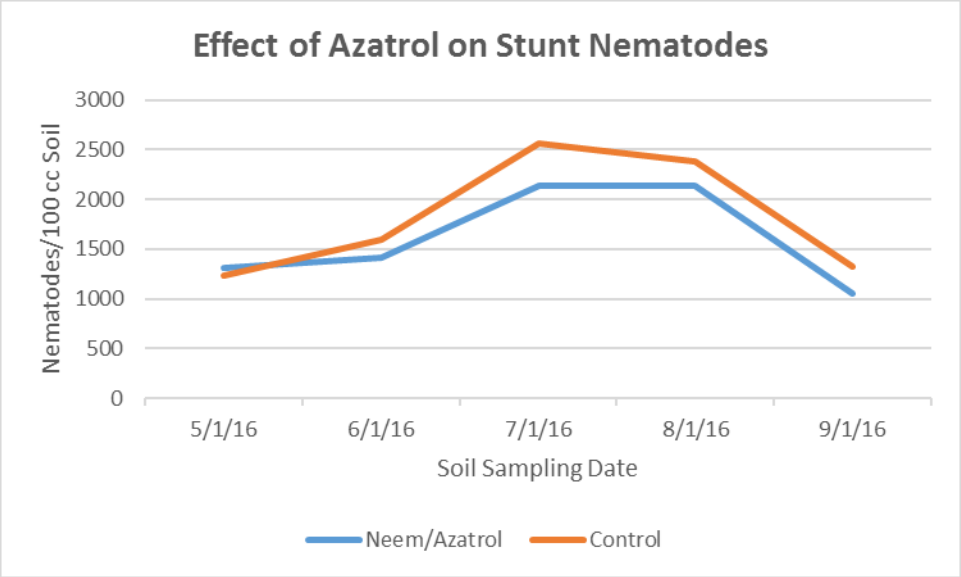
This past year I proposed to study MeloCon and Majestene, along with a field study on the bacterial parasite *Pasteuria* however, I could not find a company rep that would come through with the MeloCon or Majestene. So my report will be on Azatrol done at 5X labeled, several proprietary materials and the bacterial parasite *Pasteuria*.

Evaluation of Azatrol® for controlling plant parasitic nematodes in golf greens

A golf green in Northampton, Massachusetts was treated to evaluate Azatrol (azadirachtin). The green was approximately 35 years old and consisted 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. Azatrol was applied to each plot in a 2.0 gal watering can at the rate of 78.8 fl oz/1,000 sq ft which is approximately 5 times the labeled rate for turf insects. Application was followed by 3 gal of clear water per plot; a total of 0.224 in. of water. Applications were made on: 27 May and 23 Jun. The treatments and control were replicated six times (plots were 6 ft x 6 ft) and completely randomized. Soil was sampled on 5 May, 8 Jun, 18 Jul, 19 Aug and 23 Sep by removing 10, 1 x 4 in. soil cores per plot and bulking together. Nematodes were recovered by wet sieving/sugar flotation and identified to genus. *Tylenchorhynchus* (stunt) and *Hoplolaimus* (lance) nematodes were assessed. The data were subjected to analysis of variance.

No phytotoxicity was observed at this high rate of Azatrol but it was rinsed into the soil with clear water. Stunt and lance nematode populations were not affected by the treatment, and no differences in turf quality were noted between the treated and untreated plots.

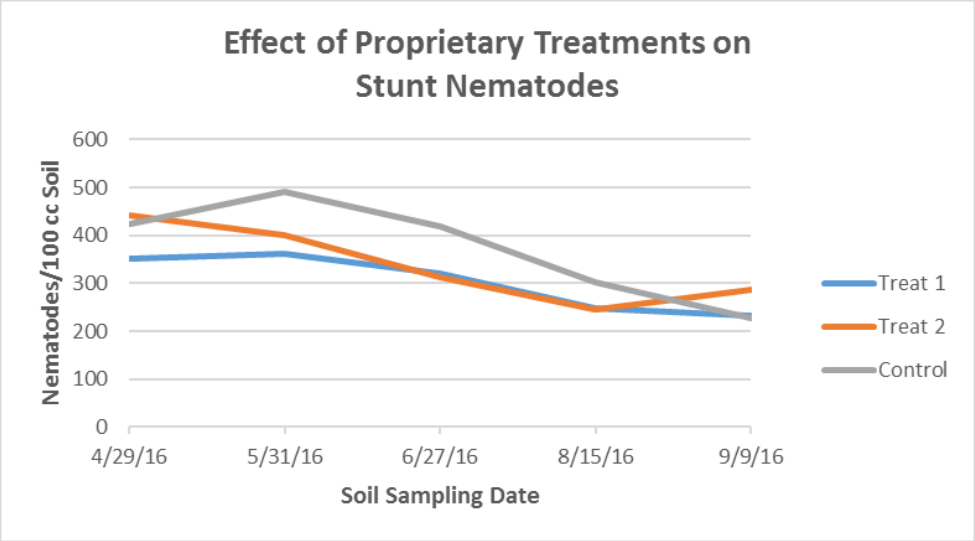

Effect of Azatrol on Lance Nematodes
Nematode/100 cc Soil
1400
1200
1000
800
600
400
200
0
5/1/16
6/1/16
7/1/16
8/1/16
9/1/16
Soil Sampling Date
Neem/Azatrol
Control

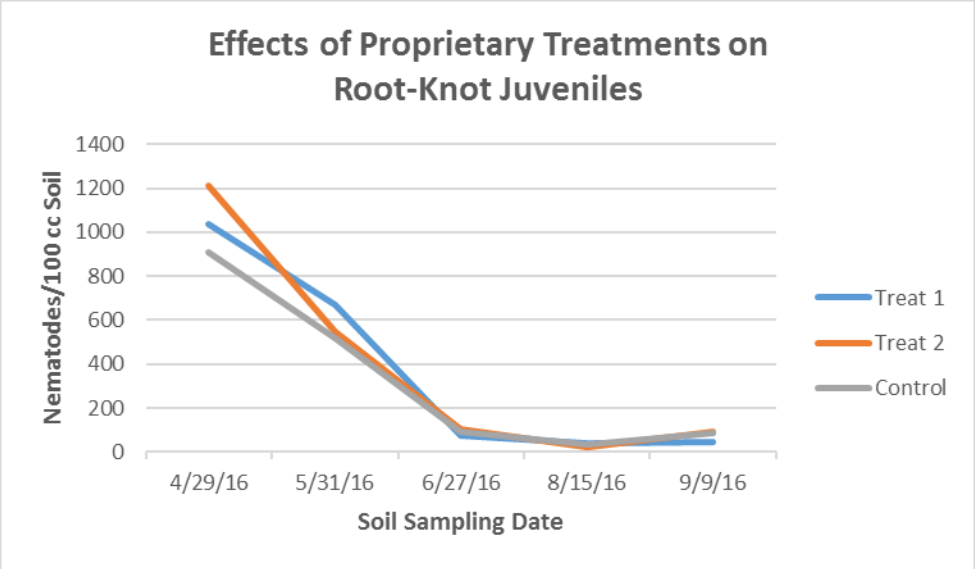

Effect of Azatrol on Stunt Nematodes
Nematodes/100 cc Soil
3000
2500
2000
1500
1000
500
0
5/1/16
6/1/16
7/1/16
8/1/16
9/1/16
Soil Sampling Date
Neem/Azatrol
Control

Evaluation of Proprietary-1 for Controlling Plant Parasitic Nematodes in Golf Greens

A golf course in Wilbraham, 89 years old, was chosen to evaluate two proprietary treatments against stunt (*Tylenchorhynchus*) and root-knot (*Meloidogyne nassi*) nematodes. Lance (*Hoplolaimus*) ring (*Criconemella*) and spiral (*Helicotylenchus*) nematodes were also present, and counted, but not well represented across all plots so statistical analysis was not relevant. The golf greens are considered "push-up greens" but top dressing over approximately 40 years has resulted in about 4 inches of a loamy course sand (USDA textural class). This soil contained 77.8 % sand, 15.3% silt and 7% clay. Soil pH was 5.3 and organic matter content was 5.4%. Treatments were applied to each 36 sq ft by shaking 22.5 g from a sprinkler, equivalent to 60 lb/A. This was followed by approximately 5 gal water applied with a watering can, approximately 0.22 inches. Each treatment was replicated 6 times. Nematode assays were carried out 5 times, once before the first application and repeated approximately every 5 weeks. Nematodes were extracted by wet-sieving and sugar flotation, and counted by genus. To evaluate the root-knot nematode population, a 6th assay will be taken mid-April of 2017. Root-knot juveniles of this species have only one life cycle per year, move into the roots in early summer and the next generation occurs in early spring.

Results This was a hot, dry summer, in fact the hottest and driest ever recorded in Massachusetts. The nematode population was uncharacteristically flat, or trended down from the spring (See graph of *Tylenchorhynchus*). Typically, we have a significant rise in nematodes toward the middle of the summer and then the population often gradually comes down. The lack of population increase made it impossible to see differences in the treatments. Note that the *Meloidogyne* (root-knot) population fall is typical of this species as the juveniles move into the roots and cannot be detected by soil extraction. A final nematode assay will be carried out in mid-April to assess effects on the root-knot populations and all other nematodes will be counted at this time. For the data presented here, there were no significant differences in treatments in either the *Tylenchorhynchus,* or *Meloidogyne* populations. The other nematodes were not distributed well enough throughout the plots to evaluate the treatments but the data is presented.



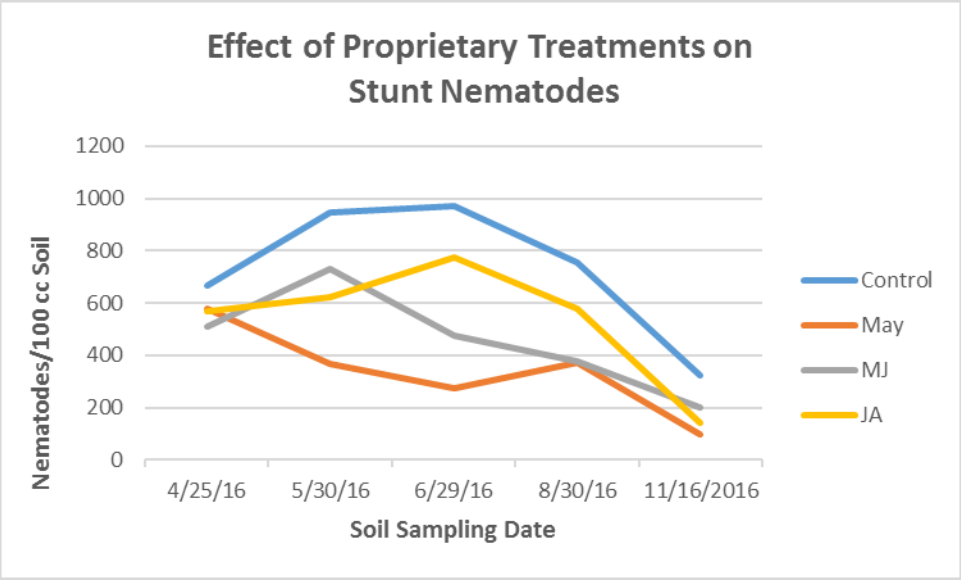


Evaluation of Proprietary-2 for Controlling Plant Parasitic Nematodes in Golf Greens

A golf course located in Westfield Massachusetts, approximately 55 years old, was chosen to study the efficacy of a proprietary treatment at three different timings. The golf green is a "push-up" type green and top-dressing over the years has resulted in approximately 4 in. of a loamy sand. Mechanical analysis of the top 4 in. showed it to be 79.6% sand, 16.5% silt, and 4.0% clay. USDA criteria classify this soil as a loamy sand. This golf green has had a history of high population of lance nematodes and a moderate population of stunt nematodes. After the first base-line nematode assay in April, plots were arranged to best fit the *Tylenchorhynchus* population; however, this skewed the *Hoplolaimus* population to the extent that comparisons of this nematode were not possible. There were three treatments and an untreated control.

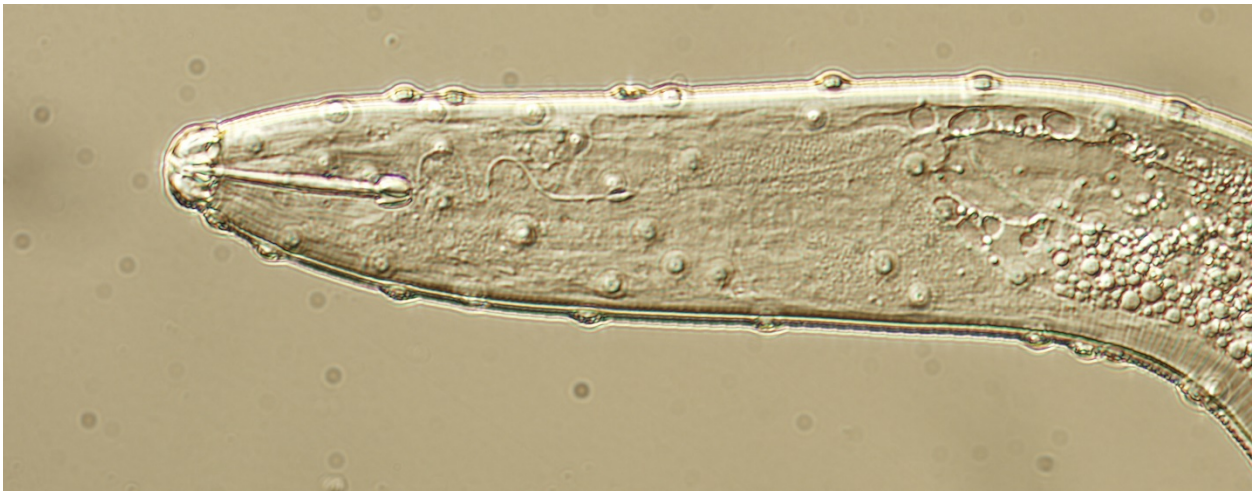
Each treatment was replicated 5 times and each replicated plot was 6 X 6 feet Treatments consisted of: 1) Application in May. 2) Application in May (the second application to the May plots) and June, and 3) Application in June (the second application to the June plots) and August. Applications were made 24 May, 21 Jun, 11Aug. Applications were made in the morning before the greens were mowed. The application rate of was 0.3927 fl oz/1,000 sq ft (0.417 ml/plot) Soil samples for nematode evaluations were taken on 25 April, 1 Jun, 29 Jun, 30 Aug and 16 Nov. For nematode evaluations, 10 cores were taken from each plot and bulked as one sample per plot. Nematodes were recovered by wet sieving/sugar flotation and identified to genus. Only *Tylenchorhynchus* (stunt nematode) was assessed as other nematodes were not distributed in all the plots. The data were subjected to analysis of variance.

Results Nematodes: Though the untreated control appears to be significantly higher through much of the summer, plot to plot variation kept the probability above the cutoff of p=0.05. On 29 Jun, the stunt nematode population was significantly less than the control at p=0.075. On 30 Aug, the stunt nematode population in the May/June and May treatments were statistically lower (p=0.05) than the control. On 16 Nov, the *Tylenchorhynchus* population in the in the May and June/August treatments was statistically lower than the controls (p=0.05). *Hoplolaimus* was not distributed evenly enough to make a meaningful evaluation. There were no differences in turf quality from an aesthetic standpoint but the population of stunt nematodes was below damaging levels. The baseline data for root length showed that the May/June treatment was significantly longer than the control roots.



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. Currently I am still trying to work out methodology to determine how to evaluate the effect of *Pasteuria* on nematode populations. In 2016, four greens at Twin Hills Golf Course, two greens at Northfield Golf Course and one green at the Orchards 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 are calculated. So far, 210 cores have been examined. This data is still being evaluated.



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.