

PROGRESS REPORT - CSANR Organic Cropping Research for the Northwest

TITLE: Post-Plant Management of Nematodes in Apple Orchards in WA

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KEYWORDS: plant parasitic nematodes, free-living beneficial nematodes, bionematicides

ABSTRACT: Washington State is the #1 producer of apples in the nation. Also, it produces two thirds of the US certified organic apples. However, the productivity of Apple Orchards can be improved if tools become available to the growers to manage diseases, especially those caused by plant parasitic nematodes. Plant parasitic nematodes can cause economically important losses to fruit trees and they are especially challenging to manage after apple tree post-plant. Our recent survey on apple orchards in Washington State contained high numbers of the lesion nematode, *Pratylenchus* spp. Numbers of the lesion nematode were above economic threshold and tree decline problems have been reported by the growers. Lesion nematodes penetrate into the roots and cause damage by feeding and migrating through the cortical tissue. The lesion nematode can be controlled with the use of synthetic nematicides, for example Nematicur. However, Nematicur will not be available to growers as of 2006 making nematode control difficult. Novel organic nematicides have the potential to decrease plant parasitic nematodes without affecting soil microorganisms including beneficial free-living nematodes. These bio-nematicides can be used by both conventional and organic apple growers at a comparable cost to synthetic nematicides but without the environmental implications and human exposure risks. In 2005, the following novel nematicides, (DiTera, NatureCur and SLS Enhanced Nematicide/Liquid Compost factor) were applied on organically and conventionally grown apple trees. The bio-nematicides are applied either through drip or micro-sprinkler irrigation. Although, perennial plants require several years to respond to bio-nematicidal treatments, the apple trees in our first season trial are responding to the bio-nematicidal treatments.

OBJECTIVES: The objective of this project is to study the effect of the following novel nematicides: **DiTera, SLS Enhanced Nematicide/Liquid Compost factor and NatureCur**, on plant parasitic nematodes, especially lesion nematodes under both conventional and organic apple orchards. DiTera is registered for Organic Apples, while the registration of the other bio-nematicides is pending. Presently, Organic Apple Growers do not have effective

bio-nematicides to control plant parasitic nematodes while Conventional Growers have limited choice of post-plant synthetic nematicides.

In addition, we will evaluate the potential of the above nematicides to enhancing beneficial free-living nematodes in the soil. Beneficial free-living nematodes contribute to soil health. This 3 year project will provide apple growers, both organic and conventional, with new tools to control plant parasitic nematodes. We have completed the 1st field season. However, two additional field seasons are required to obtain statistically meaningful data.

PROCEDURES: We have completed the 1st year of a 3 year field project on the efficacy of novel nematicides on an organic apple orchard (R. Fuller, Stormy Mountain Ranch, Chelan) and a conventional apple orchards (R. Garcia, Naches). Field trials are used to determine rates and efficacy of the above nematicides on the lesion nematode, and on the beneficial free-living. A randomized block design consisted of five trees per treatment and DiTera and SLS+LCF were replicated 3 times i.e. 30 trees per treatment and 15 trees per control. In addition, in Fuller's farm, three different rootstocks were used, so 135 trees were used in total. Apple trees in Fuller's farm were 1 year old, therefore, only trunk diameter and nematode data was collected. In Garcia's farm, NatureCur was applied using a randomized block design. The treatment was replicated 4 times i.e. 5 trees per treatment and 5 trees per control. The apple trees in Garcia's farm were 6 years old, so fruit yield, trunk diameter and nematode data was collected. Nematode data was collected in the spring prior to applications, mid-season and at harvest. Both plant parasitic and free-living nematodes were extracted from the soil using standard Nematology elutriator extraction techniques. In addition, where possible, feeder roots were collected and nematodes were extracted from the roots as the lesion nematode spends part of its life cycle inside the roots. Nematode were enumerated using a dissecting microscope and were expressed as # of nematodes per 250 cc soil and/or # of nematodes per gram root.

PROGRESS TOWARDS OBJECTIVES: Results from our study are according to the initial objectives proposed – please **see Appendix**. The only deviation from the initial proposal is that we used two farms as oppose to four as couple of the growers decided to pull out the apple trees and leave the land fallow for 1 year.

OUTPUTS: 1) Proceedings and poster presentation in 3rd National Organic Tree Fruit Research Symposium, June 6-8, 2005, Chelan, WA. RIGA, E. 2005. Title: "Bio-Nematicides for Management of Plant parasitic nematodes in organic apple orchards"

IMPACT: It is still a bit early to know how my work has influenced organic agricultural practices. However, consultants and extension agents are becoming more aware of the importance of plant parasitic nematodes to the tree fruit industry and of the new alternative bio-nematicides. In addition, several tree fruit growers have contacted me concerning plant parasitic nematodes in their fields. I have a 20% extension appointment and this is how I transfer new information to the industry.

In addition, I have initiated a new field trial using DiTera on two cherry orchards – a total of 6 acres in Wenatchee- against dagger nematodes.

INSTITUTION: WASHINGTON STATE UNIVERSITY

STATE: Washington State University

FUNDING AMOUNT(S): 12,500 (CSANR); \$15,000 match

Appendix / Results

Rene Garcia Farm – NatureCur Treatment:

NatureCur did not have any negative effect towards beneficial free-living nematodes (Fig.1). There is an increase of free-living nematodes 7 months post-application of NatureCur in comparison to the untreated controls but the increase is not significantly different.

There is a significant increase of the lesion nematode in the soil around the roots 7 months post-application of NatureCur in comparison to the controls (Fig. 2). **However, at the same time there is a significant decrease of the lesion nematode inside the roots of the treated apple trees in comparison to the controls (Fig. 3).**

There is no significant difference in the trunk diameter between the controls and the treated trees after 7 months post-application of NatureCur. Similarly there is no significant difference in the fruit weight the controls and the treated trees. **However, trees treated with NatureCur produced heavier apples with an average weight of 0.36 lbs per apple while the untreated trees produced apples with an average weight of 0.34 lbs per apple (data not shown).**

Ray Fuller Farm – DiTera and SLS+LCF Treatment:

There is a decrease in the lesion nematode - in the soil - in all DiTera treatments in all rootstocks, 17 months post-treatment (Fig, 4, 5, 6). However, the decrease is not significantly different in comparison to the untreated controls. No, lesion nematode root data has been collected as the seedlings are too young.

There is a decrease in the lesion nematode - in the soil - in SLS+LCF in M-26 rootstock, 17 months post-treatment but not in Bud-9 and G-16 rootstock (Fig, 4, 5, 6).

There is an increase of free-living nematodes 17 months post-application of DiTera and SLS+LCF on M-26 rootstock in comparison to the untreated controls. There is no reduction of free-living nematodes in Bud-9 and G-16 rootstocks (Fig. 7, 8, 9).

There is no significant difference in the trunk diameter of the treated trees in comparison to the controls (Fig 10). The trees are too young to produce fruit so no fruit data has been collected, yet.

Conclusions:

NatureCur significantly decreased lesion nematodes inside the roots of the treated apple trees in comparison to the controls – 7 months post-treatment.

DiTera also reduced lesion nematodes in the soil in comparison to the controls for all rootstocks – 17 months post-treatment. SLS+LCF reduced lesion nematodes only in M-26 rootstock.

NatureCur, DiTera and SLS+LCF did not have any negative effect towards beneficial free-living nematodes.

It will take at least 2 more years for the trees to respond to the treatments and to obtain lesion nematode control.

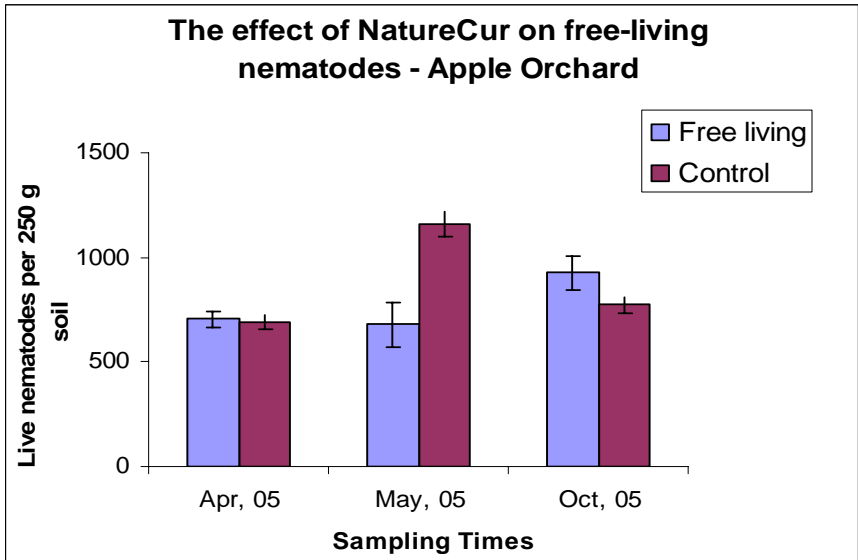


Figure 1.

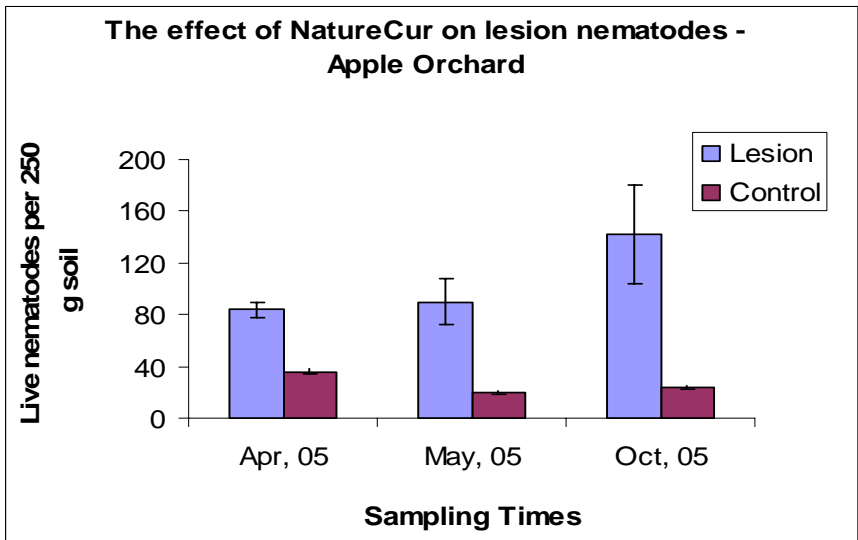


Figure 2.

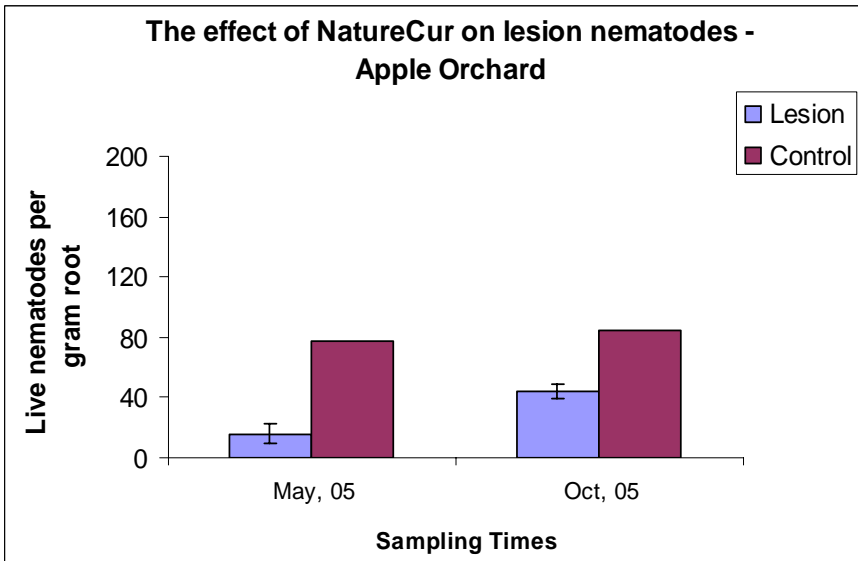


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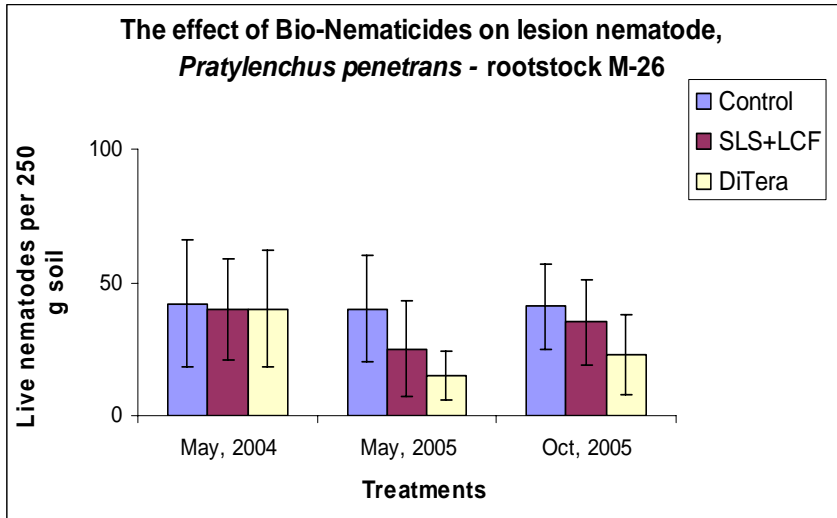


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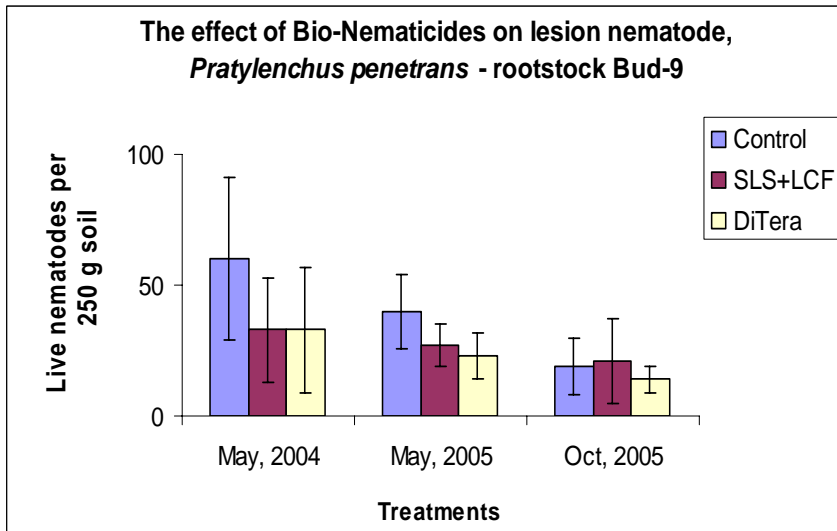


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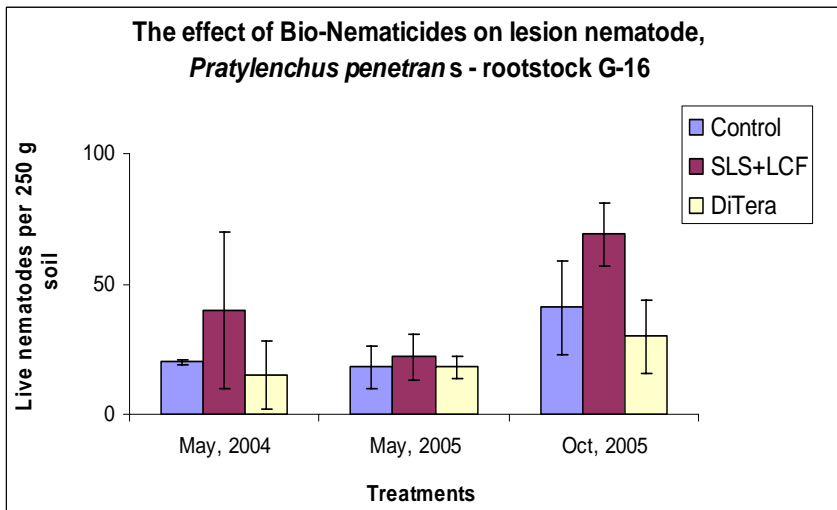


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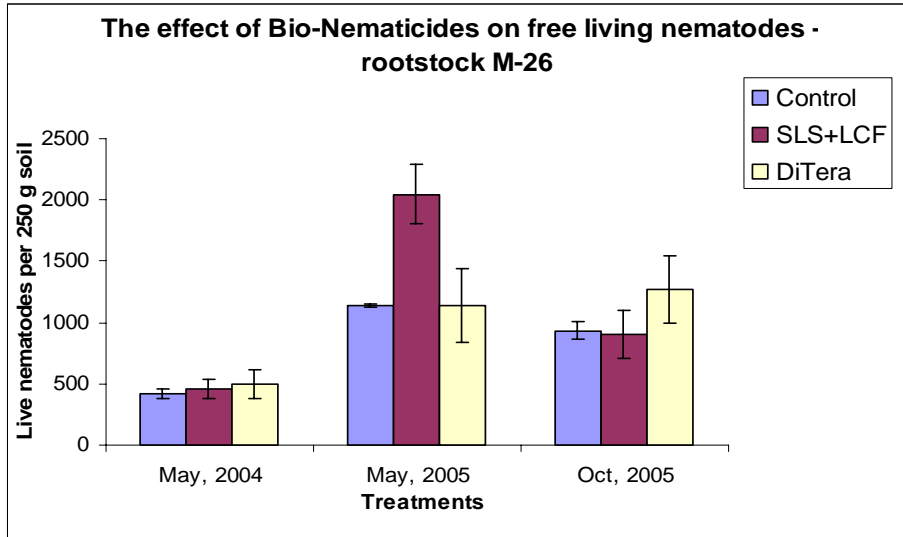


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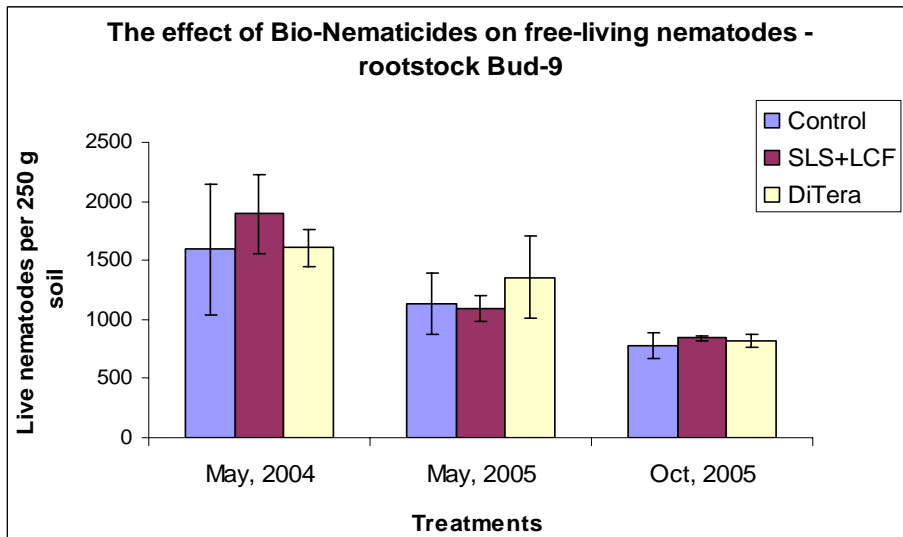


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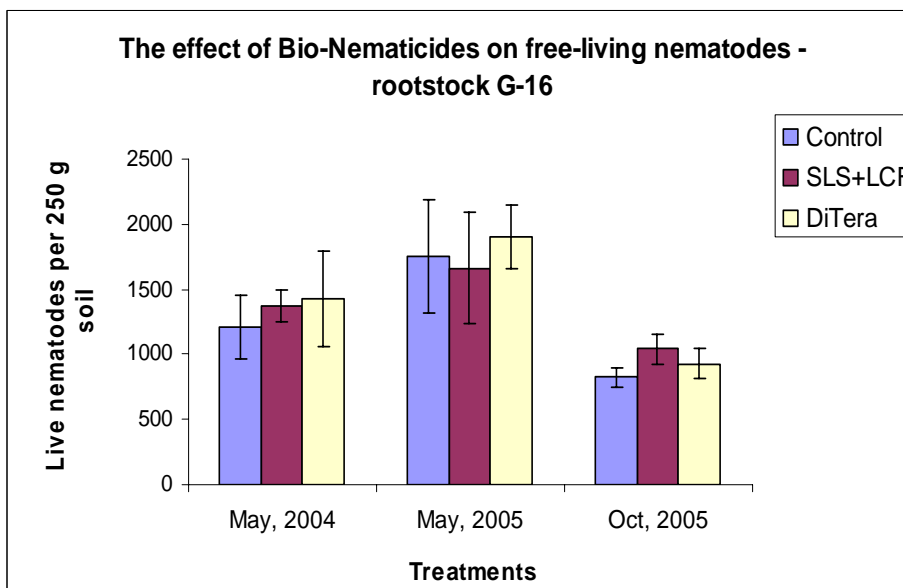


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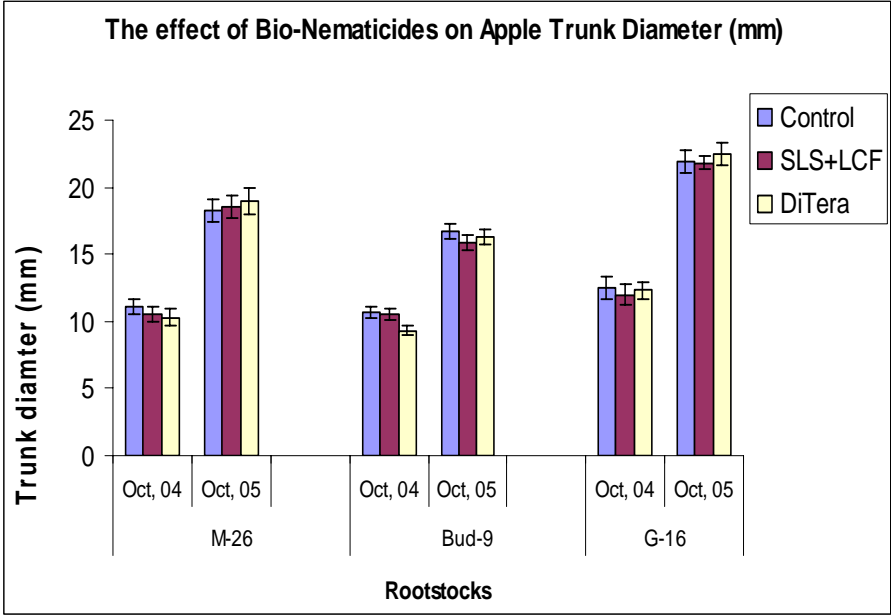


Figure 10