

Research Progress Report

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

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DATE (period which report covers): April 2004 to December 2004

KEYWORDS: plant parasitic nematodes, bionematicides

ABSTRACT: Washington State is the #1 producer of apples in the nation. In addition, it produces two thirds of the US certified organic apples. However, the productivity of apple orchards can be improved if new tools become available to the growers to manage diseases. Plant parasitic nematodes can cause diseases that result in economically important losses to fruit trees and they are challenging to manage after apple orchards have been established. Through a recent soil survey of apple orchards in Washington State, we found that many samples contained high numbers of the lesion nematode, *Pratylenchus* spp. Numbers of the lesion nematode were above the economic threshold in many samples, and apple decline problems have been reported by several growers. Lesion nematodes penetrate into tree roots and cause damage by feeding and migrating through the cortical tissue. The lesion nematode can be controlled with the use of synthetic nematicides. However, several nematicides will no be available to growers, making nematode control more difficult. Newly developed 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. During the first field season, the following novel nematicides, (DiTera, NatureCur and SLS Enhanced Nematicide/Liquid Compost factor) were applied on apple trees. Perennial crops respond slowly to bio-treatments, and we anticipate it will require at least three years for plants to respond to the bio-nematicidal treatments in this study. Therefore, the first season results do not show any significant control of plant parasitic nematodes.

OBJECTIVES: The objective of this project is to study the effect of the novel nematicides, DiTera, and SLS Enhanced Nematicide/Liquid Compost factor, on plant parasitic nematodes, especially on lesion nematodes, in both conventional and organic apple orchards. Through field trials, we will determine the rates and efficacy of these nematicides on the lesion nematode, on any other plant parasitic nematodes found in the orchard, and on beneficial free-living nematodes. DiTera is registered for certified 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 choices of synthetic nematicides. In addition, we will evaluate the potential of the above nematicides to enhance beneficial free-living nematodes in the soil. This will be a 3 year project and will provide organic and conventional apple growers with new tools to control plant parasitic nematodes.

PROCEDURES: This is a 3 year field project to test the efficacy of novel nematicides on both an organic apple orchard (R. Fuller, Stormy Mountain Ranch, Chelan) in a study that we established in

2004 and on three conventional apple orchards (D. Anyan, G. S. Long Co., INC, Yakima) on which we started preliminary studies. The study design on Fuller’s farm is based on a randomized block design with five trees per treatment and 3 replications. Treatments in 2004 included DiTera, SLS Enhanced Nematicide/Liquid Compost factor, and an untreated control (no nematicide applied). NatureCur was applied on trees on conventional farms – the same statistical design as above. Nematicides were applied on the soil surface using a back pack sprayer and then watered in via micro-sprinklers followed by irrigation applied via micro-sprinklers. Treatments were applied monthly starting in May till October. Bio-nematicides will be applied every year at the same rate and timing unless the data indicates differently. Nematode data was collected in the spring prior to nematicide 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, 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 species and numbers were identified and counted using a dissecting microscope. Three years of field data is required to evaluate the effect of the nematicides on plant parasitic and free-living nematodes. In addition, fruit yield data and trunk diameter measurements will be collected. The following table shows application rates, time of application and information on the bio-nematicides.

Table 1. Application rates of nematicides

Treatment	Rates
LCF + SLS/CA ¹	2 quart/ acre at 1:400 dilution (LCF) and 1 quart / acre at 1% solution (SLS)
DiTera® ²	15 pounds / acre
NatureCur ³	5000 ppm

¹ SLS/CA Enhanced Nematicide / LCF applied early spring (when soil temperature at 45⁰ - 50⁰F) and then monthly till October – watered in via micro-sprinklers.

² DiTera® ES applied early Spring (when soil temperature at 45⁰ - 50⁰F) and then monthly till October - watered in via micro-sprinklers.

³ NatureCur applied early Spring (when soil temperature at 45⁰ - 50⁰F) and then monthly till October - watered in via micro-sprinklers.

Table 2. Bio-nematicide information

1) Liquid Compost Factor (LCF) : is a heat pasteurized culture fluids of an edible mushroom grown on slurry of food grade pineapple fruit juices/solids, molasses, papaya puree and water. This formulation is undergoing EPA registration and it acts as a plant growth enhancer – thus it will be combined with SLS. **SLS/CA Enhanced Nematicide**: consists of Sodium Lauryl Sulphate and Citric Acid (both 25B Minimal Risk Pesticide), and Molasses. This formulation is undergoing IR4 registration and is effective against a wide range of plant parasitic nematode species. These products are produced by ABR LLC.

2) DiTera® is a natural product from the hyphomycete fungus *Myrothecium* spp. DiTera® is certified for organic apple orchards (OMRI status A; (<http://www.omri.org/>)). In addition, it been approved by EPA and has been tested against the following plant parasitic nematodes: *Meloidogyne hapla* (Northern Root-knot nematode), *Xiphinema* spp. (Dagger) and *Pratylenchus penetrans* (Lesion). This product is produced by Valent BioSciences.

3) NatureCur is a natural product derived from Black Walnut. It is categorized as a biological pesticide and it is except from tolerance based upon FIFRA 25 (b). It has been tested against the following plant parasitic nematodes and a wide range of crops: *Meloidogyne hapla* (Northern Root-knot nematode), *Xiphinema* spp. (Dagger) and *Pratylenchus penetrans* (Lesion). This product is being manufactured by G.S. Long Co.

PROGRESS TOWARDS OBJECTIVES: Year 2004-2005: A field trial was initiated at Mr. Fuller's farm using 4 different Gala rootstocks. Soil samples will be processed by the end of December. Additional trials were initiated with Mr. Doug Anyan, G.S. Long (Appendix 1 – included part of the field data – the rest of the samples will be processed by the end of December). Two treatments were used: DiTera and SLS/LCF and controls in Fuller's farm and NaturCur was applied only in G.S. Long fields.

OUTPUTS: We just completed collecting data from the first field season. Several of the samples will be processed by the end of December. In addition, perennial crops respond slowly to bio-treatments. Therefore, results from this work have not been presented or published yet. However, based on preliminary data collected so far, a grant proposal has been submitted to the Tree Fruit Commission for additional funding.

IMPACT: It is too early to know this. However, consultants and extension agents are becoming more aware of the importance of plant parasitic nematodes to the apples industry and the new alternative bio-nematicides.

INSTITUTION: Washington State University

STATE: WA

FUNDING SOURCE(S): Tree Fruit commission grant submission - pending

FUNDING AMOUNT(S): approx 15,000 - PENDING

ORGANIC RESEARCH LAND (indicate number of acres on all that apply) - for 2004

Station	_____non-organic	_____transitional	_____certified
On-farm	_____non-organic	_____transitional	<u>0.25 acres</u> certified

FARMER COOPERATOR(S): Number: **1 for 2004**
Name: R. Fuller, Apple Grower, Stormy Mt., Chelan, WA
For 2005 Doug Anyan, G.S. Long, will provide us with 3 additional Apple Grower Collaborators - conventional

Preliminary data on the effect of NatureCur on lesion nematodes – 2004 field data.

