

Diagnostic and Control Methods of Plant Parasitic Nematodes of Potatoes **Ekaterini Riga, Nematologist, Washington State University, IAREC, Prosser, WA**

The effect of organic nematicides in combination with synthetic nematicides on survival of the root knot nematodes, *Meloidogyne chitwoodi*, and *M. hapla*, the stubby root nematode, *Paratrichodorus allius*, the lesion nematode *Pratylenchus penetrans*, and on the beneficial free-living nematodes was evaluated in both greenhouse and field studies. In addition, molecular diagnostic tests are developed to rapidly identify non-viruliferous and viruliferous *P. allius*.

Organic nematicides – active ingredients (Partial information is released by the manufacturers): **1) Dominator**, consists of 90% inert ingredients and 10% a biochemical compound; **2) Castor Oil Nematicide with Surfactants**, is Castor oil dispersed in microemulsion surfactants; **3) Liquid Compost Factor (LCF)** are heat pasteurized culture fluids of an edible mushroom grown on a slurry of food grade pineapple fruit juices/solids, molasses, papaya puree and water; **4) SLS/CA Enhanced Nematicide** consists of Sodium Lauryl Sulphate and Citric Acid and Molasses; **5) DiTera[®]** is a natural product from the hyphomycete fungus *Myrothecium* spp., is composed of proteins, sugars, and lipids; **6) Garlic Extract** is derived from garlic plants.

Greenhouse studies: Vydate (at half the recommended rate) in combination with the organic nematicides, DiTera, LCF, Dominator, SLS and Garlic Extract, significantly decreased the numbers of *M. chitwoodi* in comparison to the controls (Fig. 1). However, Vydate in combination with Neem Cake did not decrease the numbers of *M. chitwoodi*. Vydate (at half the recommended rate) in combination with Neem Cake, DiTera, Dominator and SLS, significantly decreased the numbers of *M. hapla* in comparison to the untreated controls (Fig. 2). The combination of Vydate with LCF, and Garlic Extract did not decrease the numbers of *M. hapla*. Fosthiazate in combination with organic nematicides significantly decreased the numbers of *M. hapla* in comparison to the untreated controls, except the combination with DiTera (Fig. 3). Fosthiazate used in combination treatments against *M. chitwoodi* caused 100% mortality (graph is not shown). Controls consisted of Vydate and Fosthiazate applied at full recommended rate.

Field study / Synthetic Nematicides and/or Organic Nematicides: Nematode data was collected before planting, pre-season (**PS**), middle of the season (**MS**) and after harvest (**H**). Telone (at half the recommended rate) in combination with DiTera increased the numbers of free-living nematodes in the soil. However, Telone (at full rate) on its own decreased the numbers of free-living nematodes in the soil (Fig. 4). Telone (at half the recommended rate) in combination with Dominator, and Castor Oil decreased the numbers of *M. chitwoodi* as effectively as Telone (at full rate). In addition, Dominator, castor Oil and DiTera on their own provided similar protection as Telone (at full rate) (Figure 5). Telone (at half the recommended rate) in combination with Dominator decreased the numbers of *M. hapla* as effectively as Telone (at full rate). Castor Oil provided similar protection as Telone (at full rate) (Fig. 6). Telone (at half the recommended rate) in combination with Dominator, Castor Oil and DiTera decreased the numbers of *P. allius* as effectively as Telone (at full rate). In addition, all of the organic nematicides on their own decreased the numbers of *P. allius* as effectively as Telone (at full rate) but only at harvest (Fig. 7).

Detection methods of stubby root nematode: DNA primers for non-viruliferous *P. allius* were developed. The primers were tested for species specificity against *P. terres*, a closely related species to *P. allius* found in the PNW. In addition, the *P. allius* primers were tested against plant parasitic nematode species found in WA potato fields. The *P. allius* primers were found to be robust and species specific for *P. allius* (Fig. 8).

RESULTS:

Figure 1. The effect of combining Vydate (at half the recommended rate) with organic nematicides on the survival of the root knot nematode, *Meloidogyne chitwoodi*

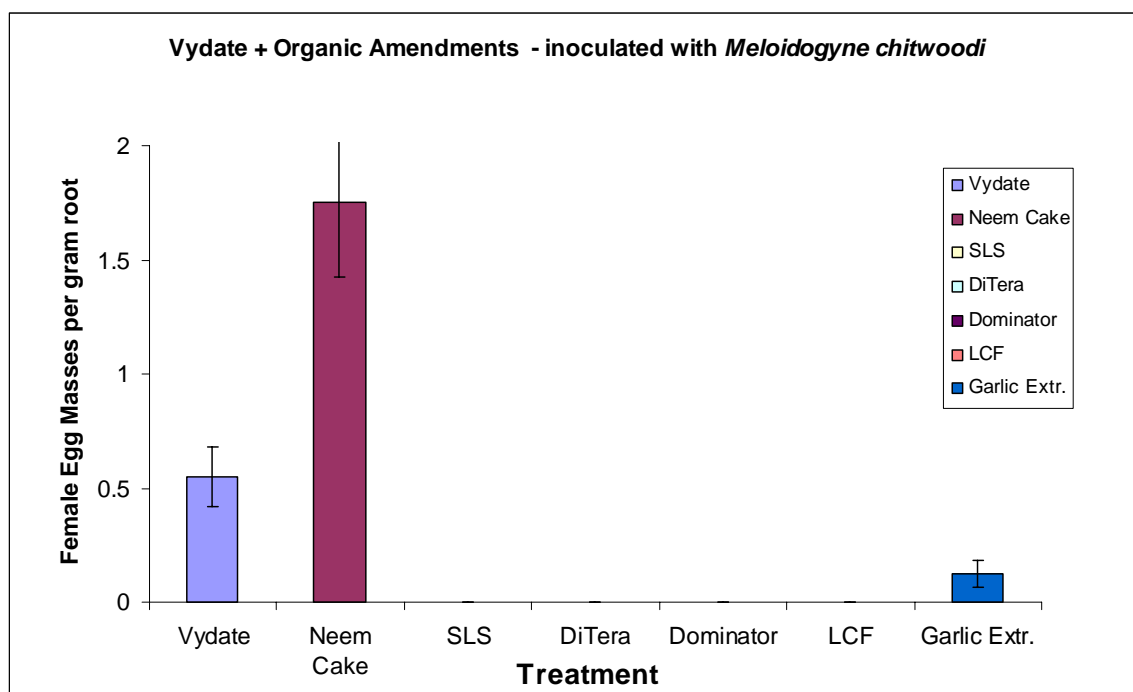


Figure 2. The effect of combining Vydate (at half the recommended rate) with organic nematicides on the survival of the root knot nematode, *Meloidogyne hapla*

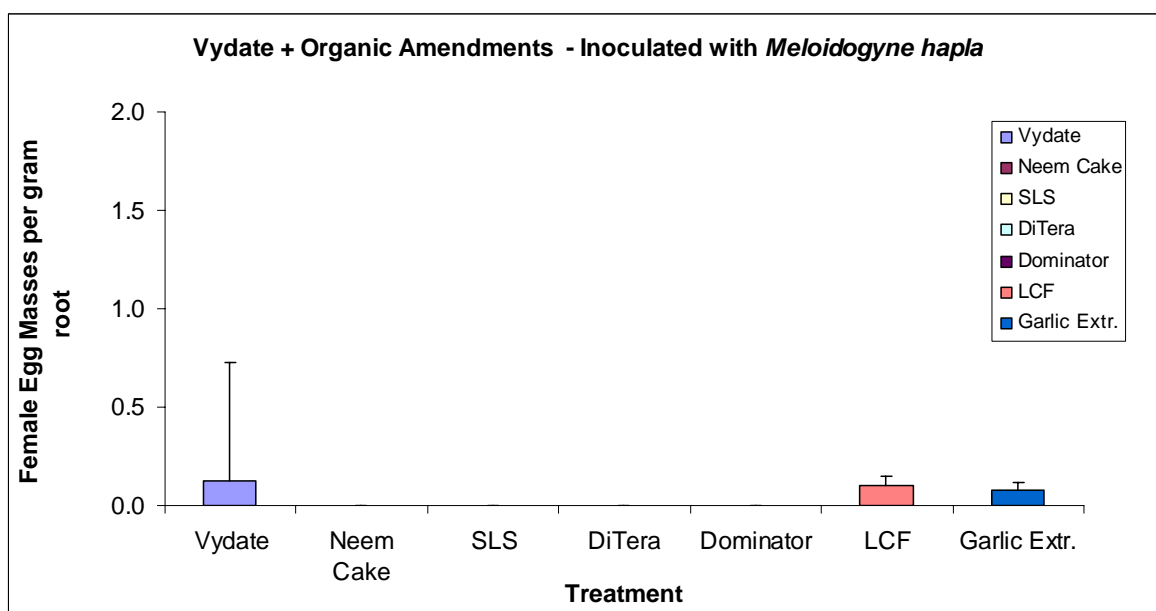


Figure 3. The effect of combining Fosthiazate (at half the recommended rate) with organic nematicides on the survival of the root knot nematode, *Meloidogyne hapla*

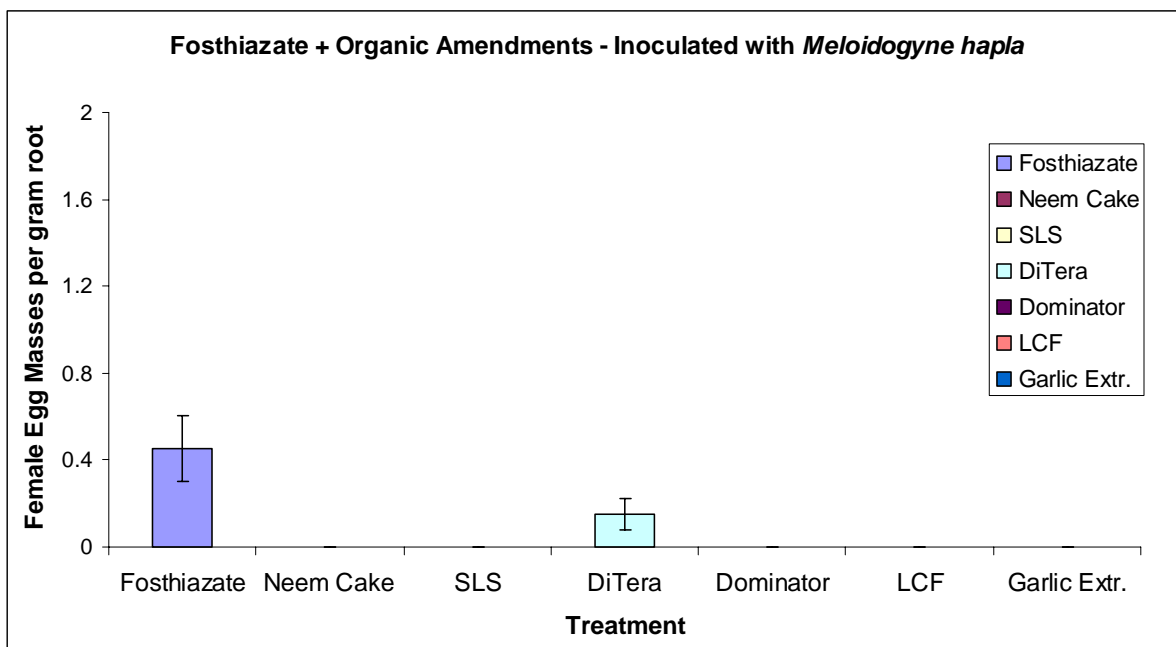


Figure 4. The effect of Organic and/ or synthetic nematicides on the survival of beneficial free-living nematodes - field study

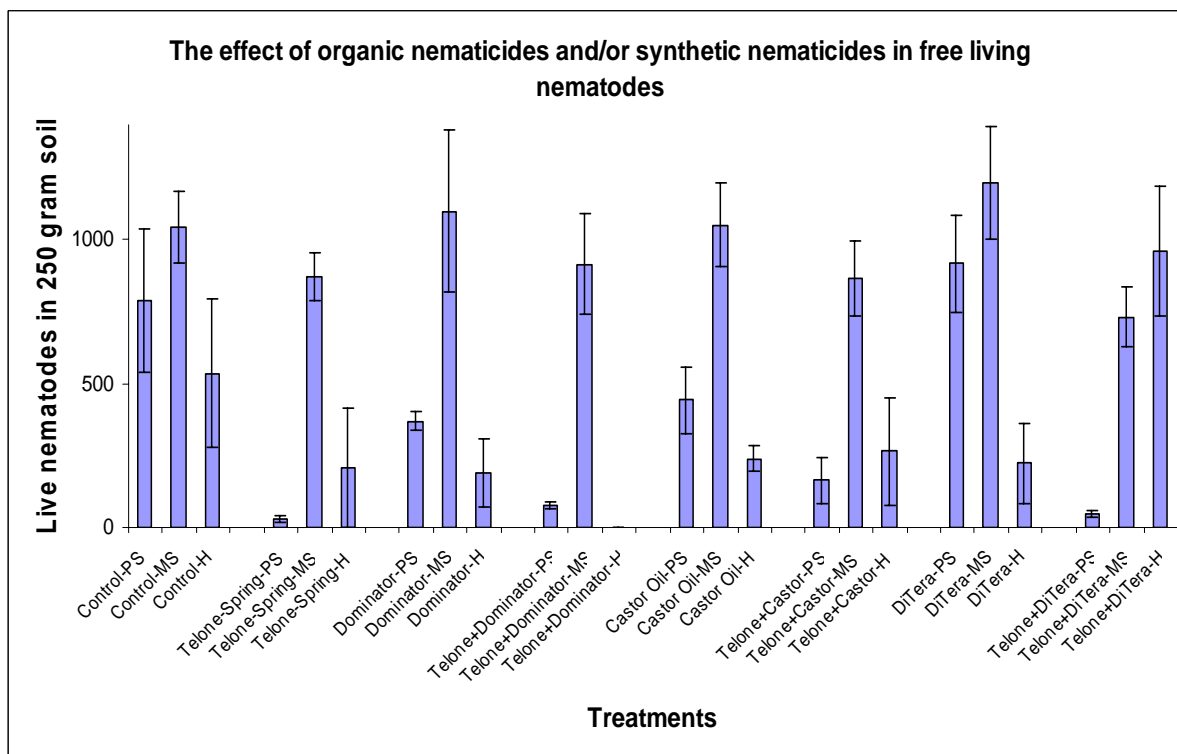


Figure 5. The effect of Organic and/ or synthetic nematicides on *Meloidogyne chitwoodi* - field study

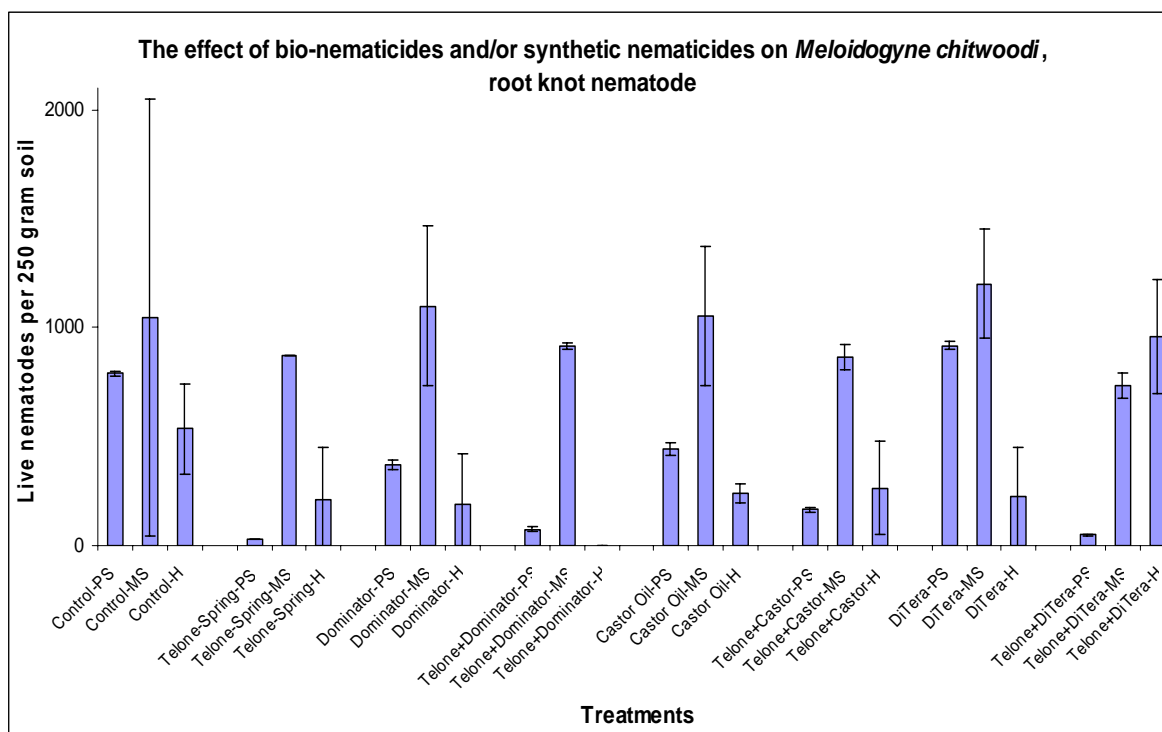


Figure 6. The effect of Organic and/or synthetic nematicides on *Pratylenchus penetrans* - field study

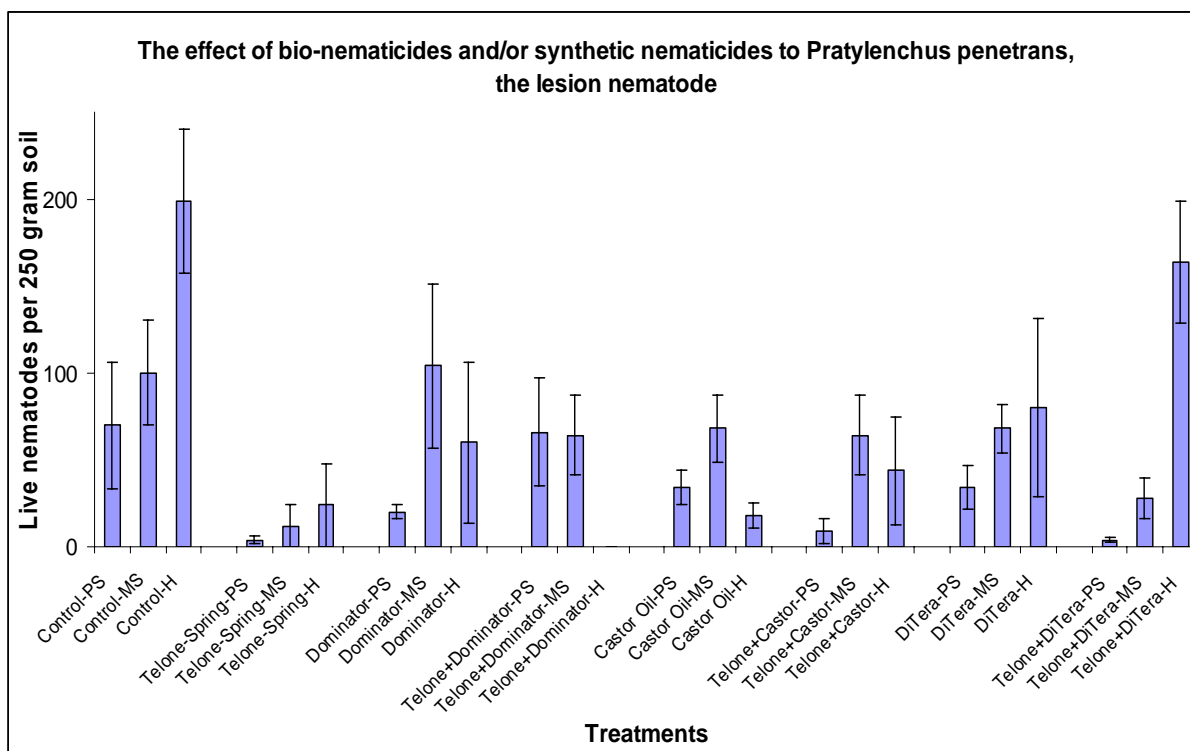


Figure 7. The effect of Organic and/ or synthetic nematicides on *Paratrichodorus allius* - field study

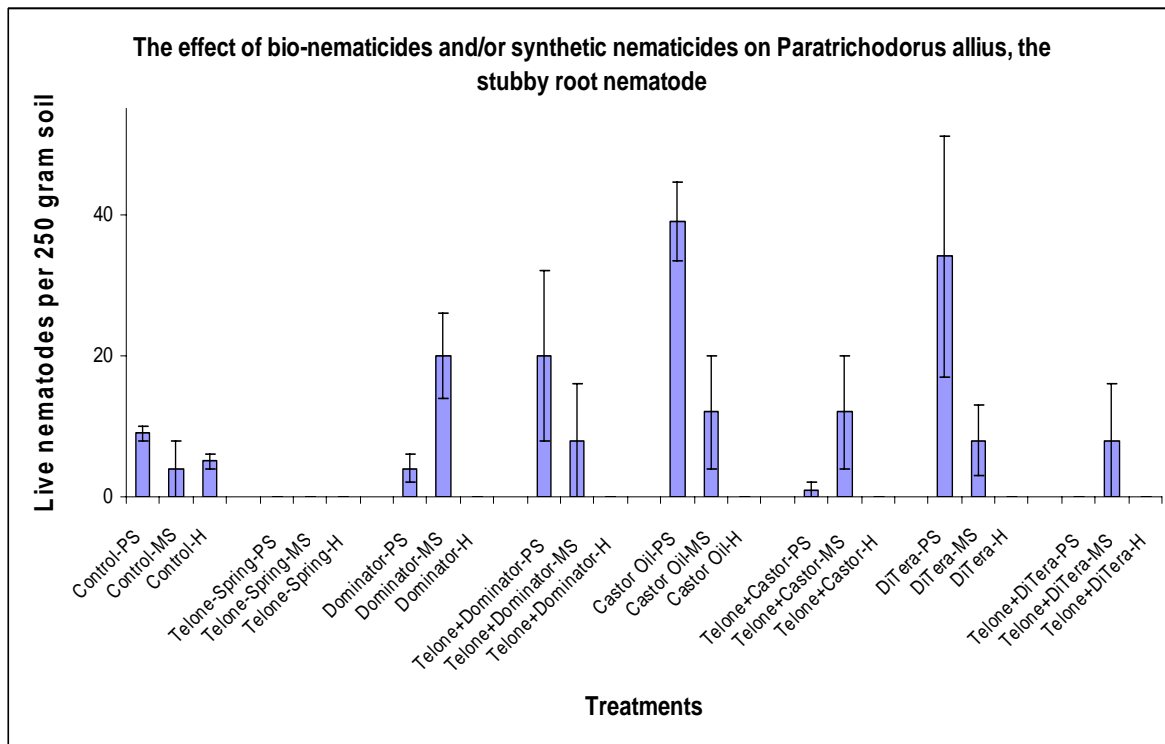
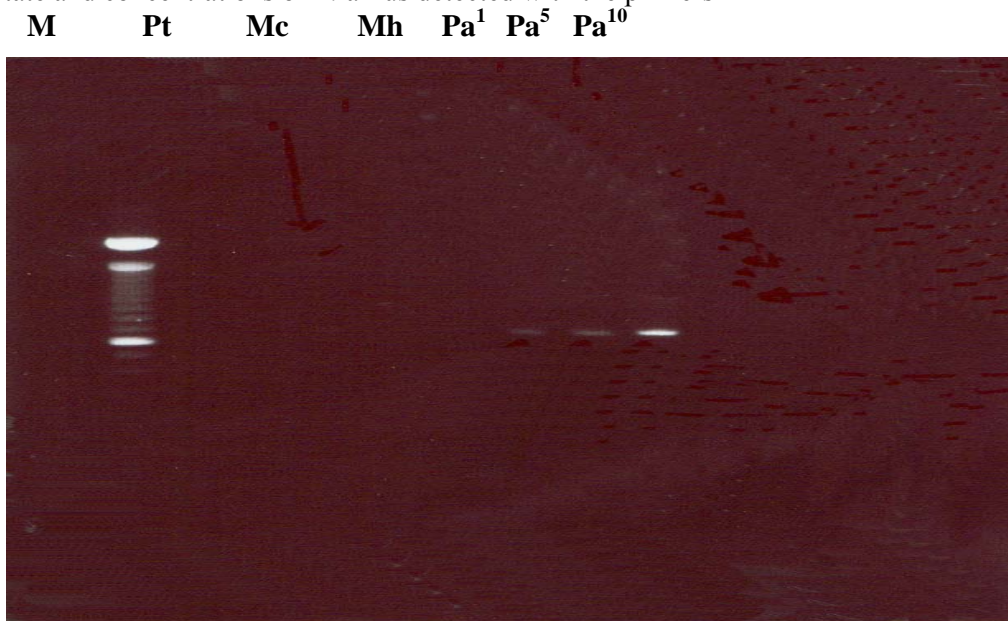


Figure 8. *Paratrichodorus allius* primers against a range of plant parasitic nematodes found in Washington State and concentrations of *P. allius* detected with the primers



M= marker, **Pt** = *Paratrichodorus terres*,

Mc= *Meloidogyne chitwoodi*, **Mh=** *Meloidogyne hapla*,

Pa¹ = one *P. allius*, **Pa⁵** = five *P. allius*, **Pa¹⁰** = ten *P. allius*

CONCLUSIONS: This first field trial has provided preliminary data that will lead to better understanding of application rates and timing of the bio-nematicides, on their own and in combination with synthetic nematicides. Bionematicides in conjunction with synthetic nematicides have the potential to keep the nematode populations low throughout the growing season. For the 2004 field season, all bio-nematicides, on their own and in combination with synthetic nematicides, will be applied every 15 days starting at 900 Degree Days and throughout the whole season, to provide better control against plant parasitic nematodes and to understand their role towards beneficial free-living nematodes.

In addition, primers for viruliferous stubby root nematodes are in the process of development.