

Effects of organic mulch on indigenous entomopathogenic nematodes and entomopathogenic fungi in a no-till cropping system

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Fig 1. Effects of Conventional tillage and No-till

Introduction

Rising **restrictions on synthetic pesticide** use has prompted farmers to look for alternative pest management strategies. Entomopathogenic nematodes (EPN) and insect entomopathogenic fungi (EPF) show promising results as insect biological control agents, but are often challenged by failure to persist in the field when introduced using augmentative biocontrol approaches. This study focus on an alternative approach known as conservation biological control, in which indigenous biological control agents are enhanced by providing a favorable environment. It is hypothesized that cultural practices like cover cropping followed by no-till practice would provide organic matter, reduce soil disturbance, and maintain higher soil moisture thus increasing population densities and effectiveness of soil-borne entomopathogenic fungi and nematodes.

Research questions: Does organic mulch from cover crop and reduced soil disturbance from no-till 1) maintain higher soil moisture, 2) increase soil entomopathogenic fungi and **nematodes** and 3) increase corn yields.

Materials and Methods

Field Experiment:

A field trial was conducted at the University of Hawaii Poamoho Experiment Station. Three pre-plant soil treatments shown in Fig. 2 were installed in 2.4 x 11 m² plots for 3 months. 'Hawaii Supersweet #10' corn (Zea mays) was then planted. All plots were irrigated and fertilized with 16-16-16 equally following commercial practice. Parameters monitored periodically throughout the experiment include:

1.Soil water properties (gravimetric soil moisture, water potential, and water infiltration)

2.Relative abundance of entomopathogenic nematodes and fungi (using White trap larva baiting method)

3.Corn growth (Corn height, chlorophyll content, and yields)

Fig 3. Larva bait assay



Larvae baits 10 larvae were placed in soil samples for 3 days at 21°C at 60% moisture in petri dishes

White Traps Dead larvae were transferred to filter paper moistened with a moat of water, incubated for 2 weeks



Organic mulch from crop residue

> Higher soil water retention

Higher soil microbial activity from reduced soil disturbance







Laboratory Larvae bait assay: Entomopathogenic agents (EPN and EPF) were baited using mealworm larvae (*Tenebrio* molitar) and placed on White Traps to identify the causal agent(s) of larva mortality. EPFs isolates were identified to species level using PCR primers for ITS regions 4 and 5. Soil was monitored 1, 2, and 3 months after corn planting.

Current results suggested that no-till practice could enhance EPFs but not EPNs. Future research is in place to explore potential tri-trophic interactions between target arthropod pests, EPN, EPF and nematode-trapping fungi in the soil.







Fig 4. Soil moisture and water infiltration rate affected by bare ground (BG), cover crop with no-till (NT) and soil solarization (Sol) treatments over a 2-month period after corn planting. Columns followed by same letter are not different based on Waller-Duncan k-ratio (k=100) t-test.



Natural Enemies in Soil

Fig 5. Mortality of meal worm larvae incubated in soil from bare ground (BG), cover crop with no-till (NT) and soil solarization (Sol) infected by entomopathogenic nematodes (EPN) or entomopathogenic fungi (EPF) at 2 months after corn planting. Columns followed by same letter are not different based on Waller-Duncan k-ratio (k=100) t-test.

- Gravimetric soil moisture content measurements indicated that **NT had higher** soil moisture content (P < 0.05) than BG and Sol (Fig. 4) which might have provided a conducive environment for EPN and EPF.
- Although relative abundance of EPN and EPF were not different among treatments 1 month after corn planting, higher relative abundance of EPF was detected in NT than BG and Sol (P < 0.05) 2 months after corn planting (Fig. 5). This suggested that conservation tillage was more favorable for EPF than EPN.
- Preliminary assay indicated that Metarhizum anisopliae and Fusarium solani and oxysporum were most commonly found EPFs at this field site.
- Corn was also greener, taller and producing higher yield in NT than BG and Sol (P <</p> 0.05, data not shown) supporting the hypothesis that no-till cover cropping/mulching can be a viable option for farmers.

Conclusion



