Weed management and nematode communities in organic coffee farms of Puerto Rico

Nydia L. Mejías, Marisol Dávila, Yaniria Sánchez and Mariangie Ramos

Department of Agricultural Technology, University of Puerto Rico at Utuado

Introduction

Organic coffee production is a promising sustainable agricultural enterprise for the Central Region of Puerto Rico. Our current SSARE R&E is examining the effectiveness of different organic weed management practices at both suppressing weeds and conserving the natural resources of organic coffee agroforestry systems (CAFS). Weeds compete with coffee plants, causing significant yield reductions[1]. Also, weed management practices are relevant to the ecosystem service of nematode diversity conservation.

Nematodes are wormlike animals that play a significant role in the decomposition of soil organic matter, mineralization of plant nutrients, and nutrient cycling, serving as indicators of the ecological condition of soils[3]. Weed management practices could affect nematode communities of CAFS by suppressing or enhancing parasitic or free-living nematodes[2].

Objectives

The SSARE YSEG Scholar collaborated in the following Project Objectives:

- Evaluate the effectiveness of different organic weed management practices in established organic CAFS and coffee farms transitioning to organic CAFS.
- Determine the effect of different organic weed management practices on the ecosystem service of soil nematode diversity conservation.

Methods

1. **Study sites**: The UPRU site is site is a coffee plantation transitioning to organic agroforestry management and the Orocovis site is an established organic coffee agroforestry system.

2. **Experimental Design**: The experiment followed a completely randomized design with four repetitions. Five organic weed management treatments were examined (Figure 1).

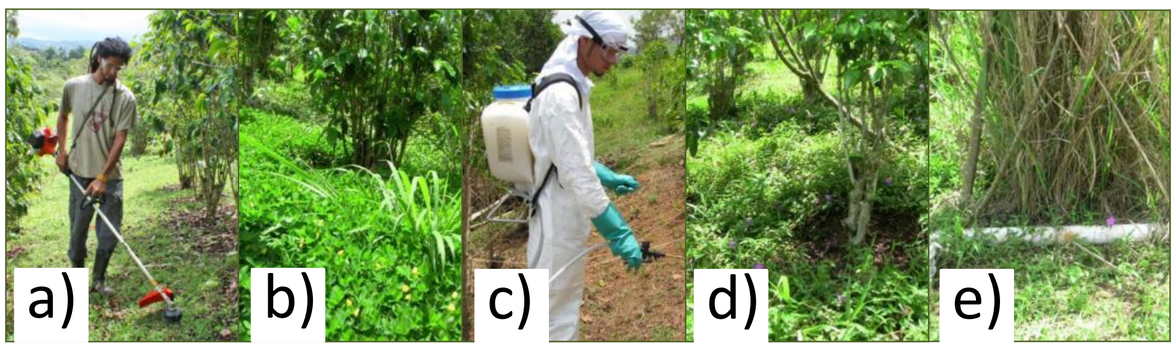

Figure 1. Weed management treatments evaluated: a) trimmer; b) cover crop *Arachis pintoi* ; c) OMRI-listed herbicide; d) cover crop *Heterotis rotundifolia*; and e) no management (control).

3) **Weed biomass sampling**: Above ground dry weed biomass was recorded for each plot monthly after treatment application, using a 0.25 m2 quadrat.

4) **Nematode sampling, processing and identification** (Figure 2)

Figure 2. YSEG Scholar conducting the nematode sampling and processing: a) collecting soil samples at UPRU site; b) grinding soil samples; and extraction of nematodes using c) sieves and d) centrifuge.

5) **Statistical Analyses**: Weed biomass, nematode abundance and species richness were compared among weed management treatments with ANOVA statistical analysis. Fisher's LSD test was used to determine significant differences between means.

Results

1) **Weed biomass:** Weed management treatments had significant effect on weed biomass at the UPRU site (Figure 3), but not at the Orocovis site (data not shown).

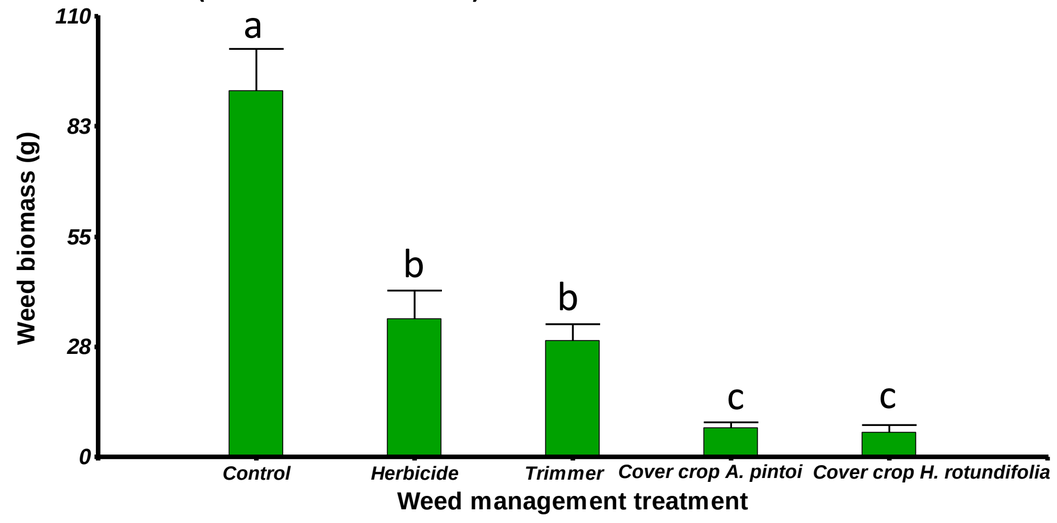

Figure 3. Bar graph showing the mean dry weed biomass collected in each weed management tratment at UPRU site. Different letters indicate significant differences at $P = 0.05$. Error bars are shown.

2) **Nematode communities:** Weed management treatments did not have a significant effect on nematode total abundance or species richness at either site. UPRU communities were dominated by plant feeder *Helicotylenchus spp.* and bacterial feeder *Cephalobus spp.* , except *A. pintoi* treatment which was dominated by plant feeder *Rotylenchlus* spp. Orocovis communities were dominated by plant-feeder *Criconemella spp* (Figure 4).

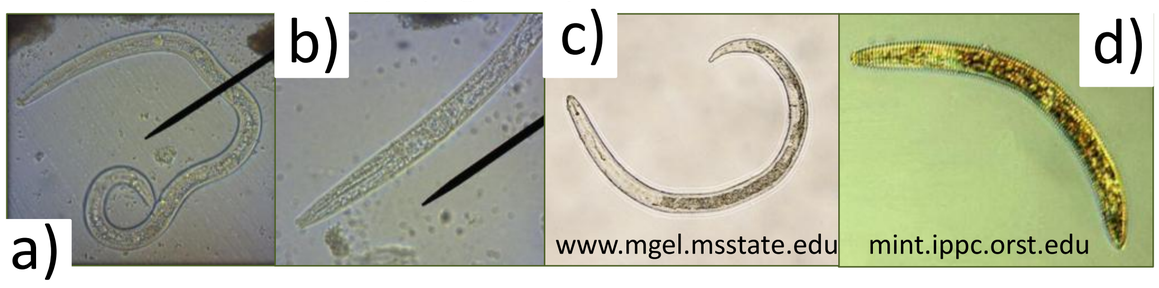

Figure 4. Most abundant nematode species: a) *Helicotylenchus spp.;* b) *Cephalobus spp.;* c) *Rotylenchlus spp.;* and d) *Criconemella spp.*

Conclusions

1) Cover crop treatments suppress weeds more effectively than trimmer or organic herbicide treatments.
2) Weed managements tested do not appear to affect nematode abundance, but further community composition analyses should be performed.

Acknowledgements

This project was supported through SSARE Young Scholar Enhancement Grant and SSARE R&E Project # LS10-231. Additional logistical aid was provided by UPR-Utuado Café CORMO Project.

References

1) Aguilar V, Staver C and Milberg P (2003) Weed vegetation response to chemical and manual selective ground cover management in a shaded coffee plantation. Weed Research 43: 68-75.
2) Herrera IC and Marban-Mendoza N (1999) Effects of leguminous cover crops on plant parasitic nematodes associated with coffee in Nicaragua. Nematropica 29: 223-232.
3) Neher DA (2001) Role of Nematodes in Soil Health and Their Use as Indicators. Journal of Nematology 33(4): 161–168. .

Contact information

YSEG Scholar
Nydia L. Mejías
nydia.mejias@upr.edu
Phone: 787-235-7884

Project Director
Mariangie Ramos, Ph.D.
mariangie.ramos@upr.edu
Phone: 787-675-1520