RESEARCH NOTE/NOTA INVESTIGATIVA

VERMICOMPOSTING: A POTENTIAL MANAGEMENT APPROACH FOR THE RENIFORM NEMATODE, *ROTYLENCHULUS RENIFORMIS*

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ABSTRACT

Gabour, E. I., S. P. Marahatta, and J.-W. Lau. 2015. Vermicomposting: A potential management approach for the reniform nematode, *Rotylenchulus reniformis*. Nematropica 45:285-287.

Two laboratory experiments were conducted to determine the most effective method of using vermicompost for reniform nematode (*Rotylenchulus reniformis*) management in Hawaiian soils. The trials were conducted in January 2014 and June 2014 using 1-mon-old and 6-mon-old vermicompost. The vermicomposts were incorporated into reniform nematode-infested soil at 0%, 0.5%, 1.0%, and 2.0% (w/w) in 10-cm-d plastic pots. After 3 wk, nematodes were extracted using the Baermann funnel technique, and reniform nematodes were counted under an inverted microscope. Soil incorporation of 1-mon-old vermicompost at 1.0% resulted in the greatest reduction in reniform nematode numbers, but when the study was repeated with 6-mon-old vermicompost, a 1% vermicompost amendment did not decrease reniform nematode numbers. It appears that incorporation of 1-mon-old vermicompost at 1% to field soils will lower existing reniform nematode population density.

Key words: earthworm, microbial activity.

RESUMEN

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Se llevaron a cabo dos experimentos en laboratorio para determinar el método más efectivo de usar vermicompost para el manejo del nematodo reniforme (*Rotylenchulus reniformis*) en suelos hawaianos. Los ensayos se llevaron a cabo en enero 2014 y Junio 2014 usando vermicompost de uno y seis meses de edad. Los vermicomposts se incorporaron a suelos infestados por el nematodo reniforme en proporciones 0%, 0.5%, 1.0%, y 2.0% (peso/peso) en macetas de plástico de 10-cm-d. Después de 3 semanas, los nematodos se extrajeron usando la técnica del embudo de Baermann, y los nematodos reniformes se contaron en un microscopio invertido. La incorporación al suelo de vermicompost de un mes de edad al 1.0% dio lugar a la mayor reducción en el número de nematodos reniformes, pero cuando el estudio fue repetido con vermicompost de 6 meses de edad, el vermicompost al 1% no redujo el número de nematodos reniformes. Parece que la incorporación de vermicompost de un mes de edad al 1% al suelo reducirá las densidades de población del nematodo reniforme existentes.

Palabras clave: lombriz de tierra, actividad microbiana.

Vermicompost is a soil amendment and natural fertilizer derived from composting by earthworms and microorganisms. It is especially popular among organic farmers because vermicompost increases water-holding capacity in soil, adds necessary micronutrients, increases beneficial microbes in soil, and boosts crop resistance to pests (Sinha *et al*., 2011). Vermicompost can also suppress populations of plant-parasitic nematodes (D'Addabbo, 1995; Arancon *et al.*, 2002) and enhance plant growth (Edwards *et al*., 2007). Additionally, vermicompost is a biologically active material with 10 to 20 times greater microbial activity than soil alone (Edwards, 1995; Adhikary, 2012). This microbial activity could suppress the population density of plant-parasitic nematodes that may be present in infected soils.

The reniform nematode (*Rotylenchulus reniformis* Linford & Oliveria) is a plant-parasitic nematode that has been reported to be suppressed through organic soil amendment (D'Addabbo, 1995). In Hawaii, reniform nematodes are the most significant plant-parasitic nematode in pineapple (Rohrbach and Apt, 1986; Caswell and Apt, 1989; Wang *et al*., 2001) causing damage by feeding on lateral roots, reducing soil anchorage, and causing symptoms associated with an impaired root system. Arancon *et al.* (2003) found that addition of vermicompost at 5 tons/ha of field soil reduced the number of plant-parasitic nematodes in strawberry and grape crops. Amending reniform nematode-infested pineapple fields with vermicompost may reduce nematode densities, strengthening microorganism habitats for growing healthy pineapple plants while adding valuable micronutrients to field soil. The objective of this experiment was to determine the most effective use of vermicompost to amend soils to reduce reniform nematode populations in pineapple.

Two laboratory experiments (Trial I and Trial II) were conducted at Kaua`i Community College. In Trial I, soil was collected from a known infestation of plant-parasitic nematodes in a pineapple field at the University of Hawaii, College of Tropical Agriculture and Human Resources, Wailua Experiment Station in Kaua`i, HI. Soil samples were combined with locally prepared 1-mon-old vermicompost at 0%, 0.5%, 1.0%, and 2.0% (w/w), mixed thoroughly, then placed in plastic 400 cm³ pots. Water (20 ml) was added to each treatment, and all treatments were organized into a randomized complete block design. After 3 wk, nematodes were extracted using Baermann funnels for 7 d, and reniform nematodes were observed and tallied under an inverted microscope. In Trial II, the experiment was repeated with similar methodologies except that 6-mon-old vermicompost was applied. Data were subjected to one-way analysis of variance (ANOVA) using the general linear method (GLM) procedure in Statistical Analysis System (SAS Institute, Cary, NC). Nematode numbers were transformed {log (x+1)} prior to ANOVA to normalize data. Untransformed arithmetic means of data were separated by Waller-Duncan *K*-ratio (K = 100) *t*-test.

Soil amended with 1% one-month-old vermicompost reduced reniform nematode numbers ($P < 0.05$) (Fig. 1). Compared with a 0%

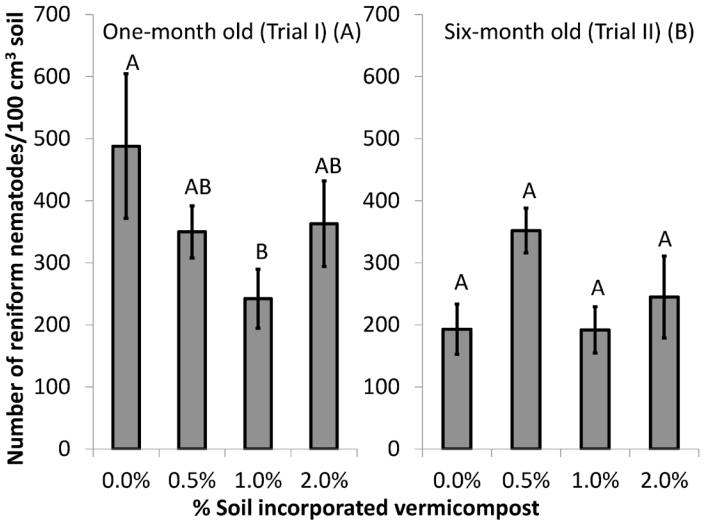

Fig. 1: The effects of 1-mon-old (A) and 6-mon-old (B) soil incorporated with vermicompost at 0%. 0.5%, 1.0%, and 2.0% (w/w) on reniform nematode at termination of the experiment. Means ± (SEM) were averaged with five replications. Means with same letter(s) do not differ according to Waller-Duncan K-Ratio (K = 100) *t*-test.

vermicompost application rate, lower population trends were seen for 0.5% and 2% although the differences in nematode numbers were not significant ($P > 0.05$). No differences were seen among application rates of vermicompost in the six-month-old compost. The nematode suppressive effect of 1% fresh vermicompost amendment (1-mon-old) is consistent with the findings of Arancon *et al*. (2002) and D'Addabbo (1995). It is possible that the 1% fresh vermicompost amendment enhanced soil microbial activities. As a consequence, the suppressive effect on reniform nematode may be a result of higher microbial activities as reported by Adhikary (2012) and Edwards (1995). Parthasarathi and Ranganathan (1999) affirmed that, as vermicast (a synonym of vermicompost) ages, a reduction in the moisture level leads to a decline in the microbial population and activity. Thus, the older vermicompost used in Trial II could have desiccated, diminishing microbial activities known to suppress reniform nematodes.

Based on these results, if Hawaiian pineapple farmers wish to use vermicompost as a soil amendment, incorporation of 1% fresh, 1-mon-old vermicompost may suppress the reniform nematode.

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LITERATURE CITED

Adhikary, S. 2012. Vermicompost, the story of organic gold: A review. Agricultural Sciences 3:905-917.

Arancon, N. Q., C. A. Edwards, and S. Lee. 2002. Management of plant parasitic nematode population by use of vermicompost. Proceedings of the Brighton Crop Conference. 18-21 November, Pests and Diseases, Vol. II. U. K.

Arancon, N. Q., P. Galvis, C. Edwards, and E. Yardim, 2003. The trophic diversity of nematode communities in soils. Pedobiologia 47:736-305.

Caswell, E. P., and W. J. Apt. 1989. Pineapple nematode research in Hawaii: Past, present, and future. Journal of Nematology 21:147-157.

D'Addabbo, T. D. 1995. The nematicidal effect of organic amendments: a review of the literature 1982-1994. Nematologia Mediterranea 23:299-305.

Edwards, C. A. 1995. Historical overview of vermicomposting. Biocycle 36:56-58.

Edwards, C. A., N. Q. Arancon, E. Emerson, and R. Pulliam. 2007. Suppressing plant-parasitic nematodes and arthropod pests with vermicompost teas. BioCycle 48:38-39.

Parthasarathi, K, and L. S. Ranganathan. 1999. Longevity of microbial and enzyme activity and their influence on NPK content in pressmud vermicasts. European Journal of Soil Biology 35:107-113.

Rohrbach, K., and W. J. Apt. 1986. Nematode and disease problems of pineapple. Plant Disease 70:81-87.

Sinha, R. K., G. Hahn, P. K. Singh, R. K. Suhane, and A. Anthonyreddy. 2011. Organic farming by vermiculture: Producing safe, nutritive and protective foods by earthworms. American Journal of Experimental Agriculture 1:363-399.

Wang, K.-H., B. S. Sipes, and D. P. Schmitt. 2001. Suppression of *Rotylenchulus reniformis* by *Crotalaria juncea*, *Brassica napus*, and *Tagetes erecta*. Nematropica 31:237-251.

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