UNIVERSITY OF GUAM
LAND GRANT
agINNOVATION RESEARCH CENTER

RESEARCH SUMMARY

Enhancing Ecosystem Health:
Nematode Presence in UOG's Mango Orchards

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EXECUTIVE SUMMARY

A 2025 survey showed nematodes at the Ija Research & Education Center (IREC) under the University of Guam agInnovation Research Center were mainly plant-parasitic (~68%) and free-living (~32%). Soil analysis indicated low nitrogen and potassium levels, with a pH of ~6.0-6.5. The biological imbalance was linked to post-typhoon conditions, including moisture, compaction, organic matter loss, and reduced microbial activity.

What is a nematode?

Nematodes, or roundworms, are diverse worms categorized as free-living or plant-parasitic, based on their lifestyles and interactions with their environment.

Types of nematodes:

Plant-parasitic nematodes

Root-feeding nematodes identifiable by their stylet and stylet knob. One specific type known as root-knot nematodes (Figure 1) create root galls or "knots" while feeding on root cells. **Effects:** Feeding can lead to stunted growth and nutrient deficiencies, which can be harmful or fatal to plants.

Free-living nematodes

Non-parasitic groups (e.g., bacterivores/predators) are identified by their stoma and teeth morphology (Figure 2). Bacterivores feed on bacteria and decaying organic matter. Predatory nematodes consume other nematodes and small soil organisms, helping regulate soil food web populations. Fungivores feed on fungal hyphae, aiding in fungal population control in the soil. **Effects:** These groups support nutrient cycling and soil health by feeding on fungi, bacteria, and other nematodes, though some may also prey on beneficial nematodes.

Ecosystem implications

Nematode activity is a key indicator of ecosystem status. A parasitic-dominant nematode community indicates ecological stress and poses a threat to long-term mango growth by compromising root systems and nutrient uptake. In contrast, free-living nematodes, which are positive indicators of nutrient cycling and soil health, have a lower presence, consistent with observed nutrient depletion and reduced microbial activity. Nutrient depletion is linked to reduced fruit yield, with notably low potassium levels observed, which may adversely affect both fruit quality and overall yield.

Post-Mawar moisture shifts, compaction, and organic matter depletion were factors that likely shaped current nematode populations and reduced microbial activity.

Parasitic nematode infections have a cascading effect, weakening plant defense mechanisms, increasing susceptibility to other diseases (Figure 3), and reducing competitiveness against parasitic organisms.

Regular monitoring of nematode populations in agricultural systems, such as fruit orchards, is recommended to assess shifts in plant and soil health, as well as to diagnose treatment needs for deficiencies.

Management needs

Recommended soil enrichment strategies include applying potash and organic matter/compost, which can restore soil fertility, enhance microbial activity, and promote recovery and sustained productivity in the orchard. Additionally, soil enrichment creates a favorable environment for predatory nematodes, which can help control plant-parasitic nematodes and other organisms.

Conclusion

The findings from the 2025 survey reflect the sampled conditions but should not be interpreted as causal attributions. Nevertheless, nematodes serve as reliable indicators of soil biological status. Monitoring nematode community balance over time can help identify shifts in soil function and inform orchard management decisions.

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SURVEY FINDINGS

SOIL CHEMISTRY AND pH

N **Nitrogen**
Depleted in both zones

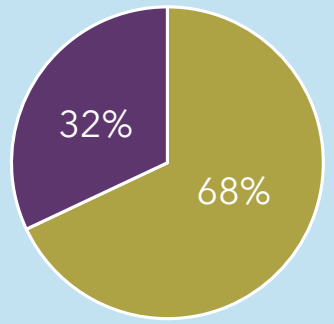
P **Phosphorous**
Sufficient in Zone 1
Depleted in parts of Zone 3

K **Potassium**
Depleted in both zones

pH **pH**
Approx. 6.0-6.5 across samples

NEMATODE TYPES FOUND

- **Plant-parasitic:** ~68% of observed nematodes
- **Free-living:** ~32% of observed nematodes



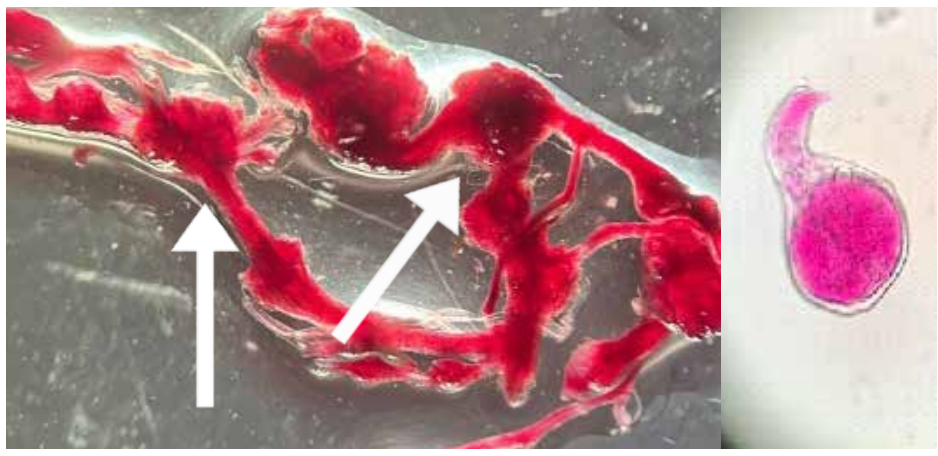


Figure 1. (Left) Root-knot nematode (RKN) infected roots (arrows pointing to root galls). (Right) A female RKN.

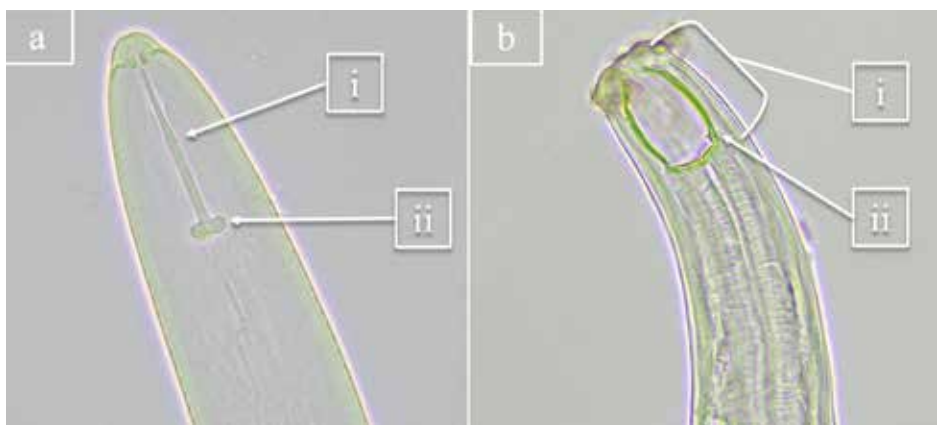


Figure 2: Images of nematodes: a) Plant-parasitic nematode, characterized by its stylet (i) and stylet knob (ii). (b) Predatory nematode, identified by its robust cuticularized stoma (i) and large tooth (ii). E.g *Mononchus* spp.

Figure 3. Overgrown vine on one of the two affected mango trees, species unknown and aphid infestation observed on mango leaves (left) and invasive vine (right).