Cropping Systems to Control Tropical Soil-Borne Pests in Dryland-Grown Taro

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Fifty-five taro (Colocasia esculenta) cultivars were evaluated for resistance to the root-knot nematode Meloidogyne javanica. All cultivars were tested, although significant differences in the reproductive success of M. javanica were found within the taro germplasm.

Five field trials were conducted on four islands in Hawai'i to evaluate management practices for green manure crops. Overall, initial populations of root-knot nematodes were low and barely at the level of detection in several field trials, particularly on the islands of Moloka'i and Maui. No significant difference due to green manure treatments were found for subsequent taro yields in two field trials on Moloka'i and O'ahu.

On the island of Hawai'i, when root-knot nematodes were present in the soil at the start of the field trial, growth of green manures for 2.5 or 4 months had a beneficial effect on the individual fresh corm weight of the subsequent crop of taro. This beneficial effect could be due to: a) lower initial numbers of root-knot nematodes; b) lower numbers of reniform nematodes; and/or c) greater exchangeable potassium (K) in both soil and taro leaves, perhaps caused by slow release of nutrients during decomposition of green manure crops.

In contrast, on Maui, taro grown after nematode-susceptible buckwheat (Fagopyrum esculentum) inoculated with Meloidogyne javanica produced smaller corms in comparison with taro grown after nematode-non-host sunn hemp.

Based on analysis of the soil microbial community, the beneficial effects of green manures probably were not caused by changes in bacterial community diversity or population density. A five-minute video showing the highlights of growing green manure crops is available for viewing at the Sustainable Agriculture Research and Education (SARE) web site of the College of Tropical Agriculture and Human Resources, University of Hawai'i.

Figure 1. Corm and roots of taro cv. Kuye 373 affected severely by Meloidogyne javanica in in greenhouse evaluation conducted in the greenhouse.

Figure 2. Sorghum x sudangrass hybrid ‘Sordan 79’ (left) and sunn hemp (right) at 4 weeks after planting.

Figure 3. Nematode-susceptible buckwheat grown on Moloka'i to increase uniformity and nematode population (left) and plots on buckwheat rows caused by root-knot nematodes (right).

Figure 4. Conventional tillage of sorghum x sudangrass hybrid ‘Sordan 79’ on island of Hawai'i. Delayed tillage of ‘Sordan 79’ is shown in foreground.

Figure 5. Root-knot nematode (RKN) numbers at end of green manure decomposition period for sorghum x sudangrass ‘Sordan 79’ (SS) grown for 1, 2.5, and 4 months, sum hemp (SH) grown for 1, 2.5, and 4 months, weed mat (MAT), and weedy (WEED) control.

Figure 6. Root-knot nematode reproduction (initial population/final population) recorded under green manure crops grown for 1, 2.5, and 4 months in the Green Manure x Growing Duration experiment on island of Hawai'i.

Figure 7. Fresh weight of individual taro corms as affected by previous treatment of sorghum x sudangrass cv. ‘Sordan 79’ (SS) grown for 1, 2.5, and 4 months, sum hemp (SH) grown for 1, 2.5, and 4 months, weed mat (MAT), and weedy (WEED) control.

Figure 8. Fresh corm weight of taro ‘Maui lehua’ at 5 months after planting and numbers of reniform nematode on taro roots. Note the inverse relationship between corm fresh weight and numbers of reniform nematodes, suggesting that reniform nematodes adversely impacted taro yield.

In a preliminary field trial, sunn hemp (Crotalaria juncea) was found to be another promising green manure crop, because it fixes nitrogen, has a low-host status for reniform nematodes (Rotylenchulus reniformis), and produces good biomass accumulation.

Figure 9. Taro ‘Maui lehua’ grown for 3 months in the Green Manure x Growing Duration trial on island of Hawai'i. Taro grown in weed mat treatment (left) compared to those grown in plots that had 2.5-month-old ‘Sordan 79’ (right).

Figure 10. Demonstration of fall mowing (left) to cut down green manure crops on island of Moloka'i prior to plowing and tillage (right).