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 hosts, although significant differences in the reproductive success of *M. javanica* were found within the taro germplasm.

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

Twenty-two green manure species were evaluated in the greenhouse for biomass growth and resistance to *M. javanica* and taro pathogen *Pythium aphanidermatum*. Sorghum x sudangrass hybrids (*Sorghum* × *drummondii* 'Sordan 79' or 'Graze-all MST') appeared to be among the best green manure species, because they were very poor hosts to *M. javanica*, produced copious amounts of biomass, and grew well when inoculated with *M. javanica* and *P. aphanidermatum*.

Table 1. Mean fresh weights (g) and reproductive factors (Rf) of sorghum x sudangrass hybrids infected with treatments of *Meloidogyne javanica* (+N), *Pythium aphanidermatum* (+P), both pathogens (+N+P), or neither (-N-P).

Plant	Treatments				Rf
	+N [1]	+P [2]	+N+P [3]	-N-P [4]	
Piper	23.77	34.79	35.37	21.51 b[a]	0.41
Sordan 79	41.60	44.60	40.71	30.94 a	0.47
Tastemaker	55.03	55.58	44.12	29.42 a	2.01
Bale All III (MST)	21.41	40.00	21.00	26.00 a	1.74
Graze-all (MST)	51.48	50.46	38.02	36.48 a	0.19
Bale All BMR (MST)	52.28	56.27	35.92	39.16 a	2.79
Baler	55.69	59.32	46.66	34.62 a	1.20

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

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 differences due to green manure treatments were found for subsequent taro yields in two field trials on Moloka'i and O'ahu.

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

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

Table 2. Plant part dry weights of taro 'Bun long' at 3 months after planting. Treatment means in a column not followed by the same letter are significantly different ($p < 0.05$).

Treatment	Main Leaf Blade Dry Wt., kg/ha		Main Petiole Dry Wt., kg/ha		Corm Wt., kg/ha		Sucker Petiole Dry Wt., kg/ha	
Graze-all	714	ab	1085	ab	1120	ab	400	ab
Scarletade	422	b	597	bc	742	bc	226	abc
Orangeade	498	b	702	bc	734	bc	132	bc
Sunn Hemp	987	a	1577	a	1249	a	552	a
Buckwheat	261	b	365	c	470	c	37	c
Weeds	560	ab	794	bc	866	abc	296	abc

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.

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) to greater exchangeable potassium (K) in both soil and taro leaves, perhaps caused by slow release of nutrients during decomposition of green manure crops.

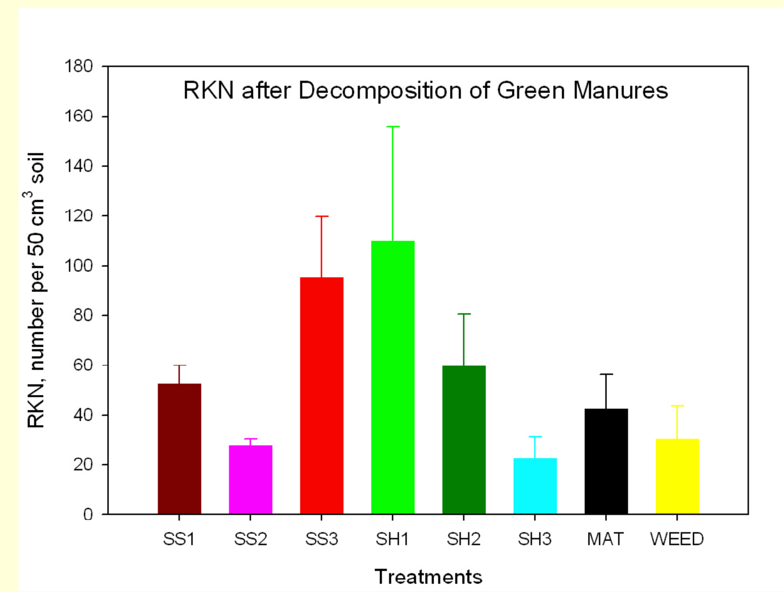

Figure 5. Root knot nematode (RKN) numbers at end of green manure decomposition period for sorghum x sudangrass 'Sordan 79' (SS) grown for 1, 2.5, and 4 months, sunn hemp (SH) grown for 1, 2.5, and 4 months, weed mat (MAT), and weedy (WEED) control.

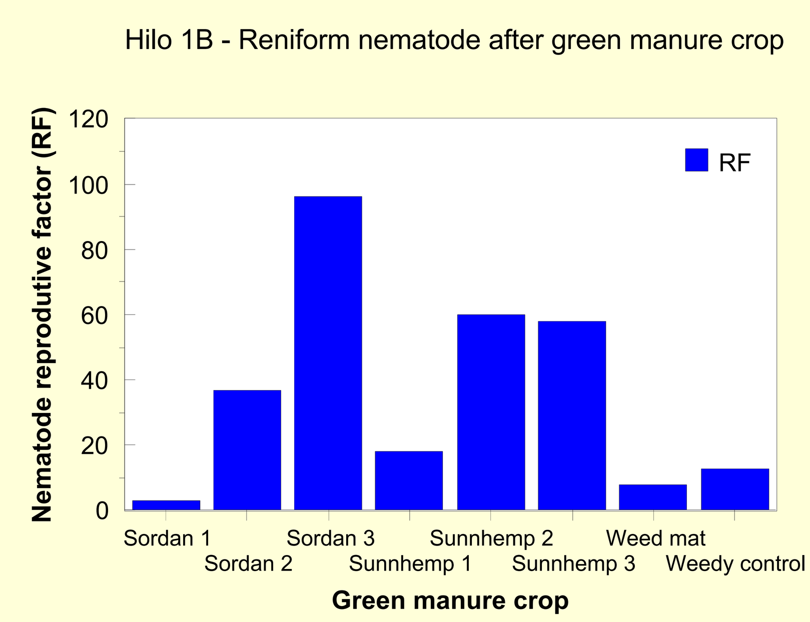

Figure 6. Reniform nematode reproduction (initial population/final population) recorded under green manure crops grown for 1, 2.5, or 4 months in the Green Manure x Growing Duration experiment on island of Hawai'i.

Figure 7. 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).

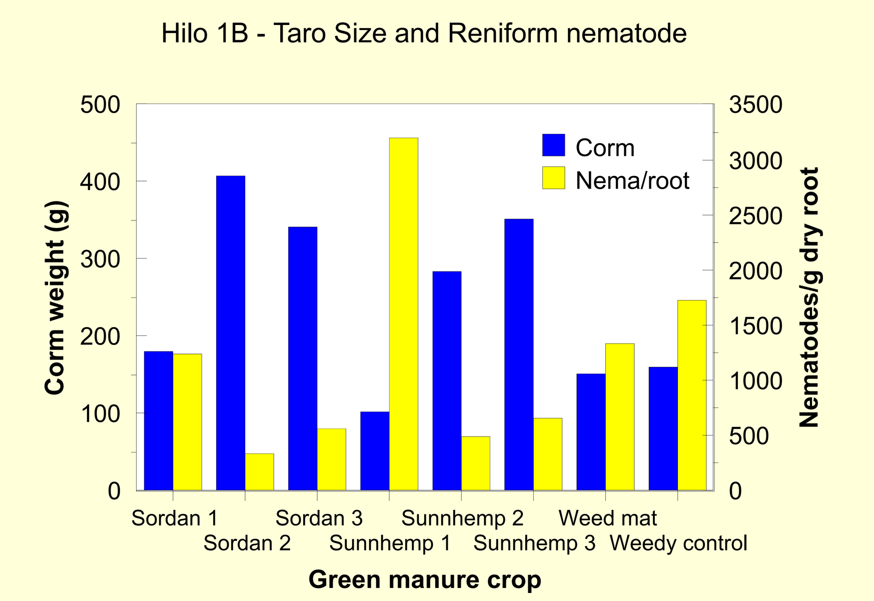

Figure 8. Fresh corm weight of taro 'Maui lehua' at 5 months after planting and numbers of reniform nematode on taro roots. Note the inverse relationship between corm fresh weight and numbers of reniform nematodes, suggesting that reniform nematodes adversely impacted taro yield.

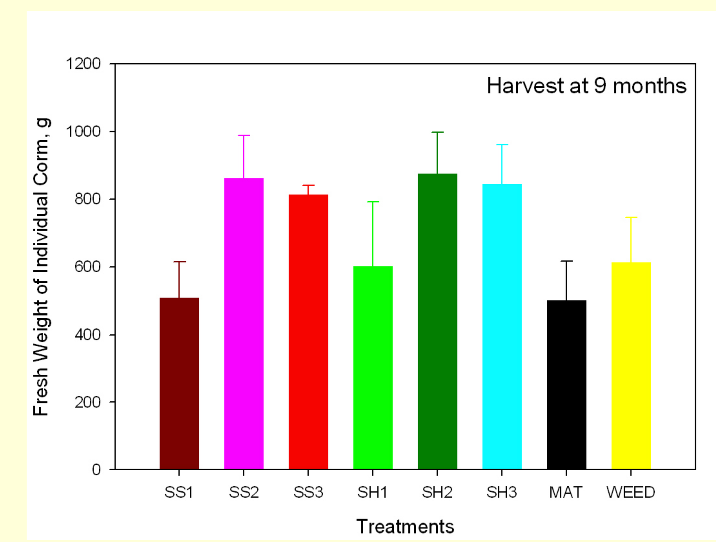

Figure 9. Fresh weight of individual taro corms as affected by previous treatments of sorghum x sudangrass cv. Sordan 79 (SS) grown for 1, 2.5, and 4 months, sunn hemp (SH) grown for 1, 2.5, and 4 months, weed mat (MAT), and weedy (WEED) control.

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 Field Day was held on Moloka'i to demonstrate the growth of various green manure crops and management techniques such as flail mowing of green manures and treatment of vegetative propagating materials of taro to minimize spread of nematodes. A five-minute video showing the highlights of growing green manure crops was produced and 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 10. Demonstration of flail mower (left) to cut down green manure crops on island of Moloka'i prior to plowing and tilling (right).