

Redworms don't control, may spread avocado root rot

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TABLE 1. EFFECT OF REDWORMS ON HEIGHT INCREASE OF AVOCADO SEEDLINGS IN ROOT-ROT-INFESTED AND NONINFESTED SOIL

Treatment	Mean height increase (cm)*
Noninfested soil	75.1 a
Noninfested soil + manure	32.9 b
Noninfested soil + 5 oz worms + manure	21.8 b
Infested soil	4.0 c
Infested soil + 1 oz worms + manure	2.9 c
Infested soil, no worms + manure	1.9 c
Infested soil + 5 oz worms + manure	1.8 c
Infested soil + 5 oz dead worms + manure	0.0 c

* Numbers followed by different letters are significantly different at the 1% level by Duncan's multiple range test.

TABLE 2. EFFECT OF REDWORMS ON ROOT WEIGHTS OF AVOCADO SEEDLINGS IN ROOT-ROT-INFESTED AND NONINFESTED SOIL

Treatment	Mean root weight (gm)*
Noninfested soil	47.1 a
Noninfested soil + manure	19.5 b
Noninfested soil + 5 oz worms + manure	13.5 bc
Infested soil + 5 oz worms + manure	6.8 c
Infested soil	6.2 c
Infested soil + 1 oz worms + manure	5.4 c
Infested soil, no worms + manure	4.2 c
Infested soil + 5 oz dead worms + manure	2.0 c

* Numbers followed by different letters are significantly different at the 1% level by Duncan's multiple range test.

Six-month-old Topa-Topa avocado seedlings, which had been grown in root-rot-infested or noninfested soil: (A) infested soil only, (B) infested soil plus 1 ounce redworms (approximately 30 worms) plus manure, (C) infested soil, 5 ounces worms, and manure, (D) infested soil, 5 ounces dead worms, and manure, (E) infested soil with manure but no worms, (F) noninfested soil with manure, (G) noninfested soil, 5 ounces worms, and manure, (H) noninfested soil only.

The increased interest in redworms and their use as biological agents for several purposes has led to inquiries, by avocado growers and redworm industry representatives, about the worm's effectiveness in controlling avocado root rot caused by *Phytophthora cinnamomi*. At the request of the redworm industry, we initiated a greenhouse experiment to determine if the worms had any effectiveness in reducing root rot on avocados.

In November 1975, a two-month-old Topa-Topa avocado seedling was transplanted into each of 25 5-gallon containers containing soil infested with *P. cinnamomi* and into each of 15 containers of noninfested soil.

The plants were subjected to eight treatments with five replications per treatment as follows:

- A. Infested soil only
- B. Infested soil + 1 ounce worms

- C. Infested soil + 5 ounces worms + manure
- D. Infested soil + 5 ounces dead worms + manure
- E. Infested soil, no worms + manure
- F. Noninfested soil + manure
- G. Noninfested soil + 5 ounces worms + manure
- H. Noninfested soil only

One ounce of worms contains approximately 30 worms. Where manure was used, it was placed on top of the soil in a 1-inch layer before the seedling was planted.

Soil moisture in each treatment was monitored with tensiometers, and seedlings were watered as needed.

The experiment was terminated after four months. Plant heights were compared with heights taken at planting time, and root weights were recorded.

Visual observations and collected data demonstrate that redworms did not control avocado root rot in the greenhouse. Tables 1 and 2 show that adding manure to the pots significantly reduced the top and root growth of avocado seedlings in both infested and noninfested soils, and that adding worms to these soils further restricted growth instead of increasing growth, as would be expected if the worms were effective against root rot.

Cultures of *Phytophthora cinnamomi* were fed to redworms in the laboratory. Microscopic examination of

fecal material and dissections revealed that hyphae, chlamydospores, and oospores of *P. cinnamomi* can pass through worms without visible damage. Viable spores and hyphae were recovered from fecal material, and new *P. cinnamomi* colonies were established from these propagules.

Attempts to recover *P. cinnamomi* from worms removed from infested soil were hampered by the presence of many other soil fungi and bacteria. *Pythium* was recovered from worms that were removed from infested soil, washed in two changes of sterile water, then moved from plate to plate in the laboratory. *Pythium* was retained within the intestine up to 24 hours before release in fecal pellets.

Various fungi, including plant pathogens, have been isolated from the alimentary canal of the common earthworm. This worm has also been shown to increase the rate of spread of several soil fungi. It is not inconceivable, therefore, that the redworm is capable of spreading *Phytophthora cinnamomi* in avocado orchards.

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