

Sustainable White Grub Management with *Steinernema scarabaei*: a New Highly White Grub-pathogenic and -specific Nematode

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Objectives:

1. To improve predictability of *S. scarabaei* applications by determining the effect of soil moisture and soil type on the nematode's infectivity and persistence.
2. To determine the control potential of *S. scarabaei* against white grubs, especially with respect to low application rates and long-term control.

Start Date: 2003

Project Duration: three years

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Presently available entomopathogenic nematode species provide only limited control of most of the important white grub species. Our overall objective is to develop the recently discovered nematode *Steinernema scarabaei* as a novel biocontrol agent for white grub management.

In laboratory and greenhouse experiments, *S. scarabaei* efficacy against grubs tended to be the highest in loamy sand, did not differ significantly among sandy loam, loam, silt loam, and clay loam, and tended to be the lowest in an acidic sand (pH 3.9) and a potting mix (69% OM). *S. scarabaei* was most infective at moderate soil moisture levels (-10 to -100 kPa), less in wet (-1 kPa), and moderately dry (-1,000 kPa) soil, and least infective in very dry soil (-3,000 kPa). Persistence of *S. scarabaei* was excellent in all the above substrate types, albeit somewhat reduced in clay loam, and was not significantly affected by soil moisture (-10 to -3,000 kPa).

Microplots (4 ft x 4 ft), enclosed by garden edging material, were seeded with oriental beetle, *Anomala orientalis*, late 2nd and early 3rd instars (10 per ft²) and treated with *S. scarabaei*. Grub and nematode populations were determined periodically by going through cup cutter cores and baiting soil samples with wax moth larvae, respectively. Three experiments are being conducted that were started in mid-September of 2002, 2003, and 2004, respectively.

Our field studies show that *S. scarabaei* reproduces very well in oriental beetle larvae and that the progeny emerging from the larvae infected by applied *S. scarabaei* provides additional control

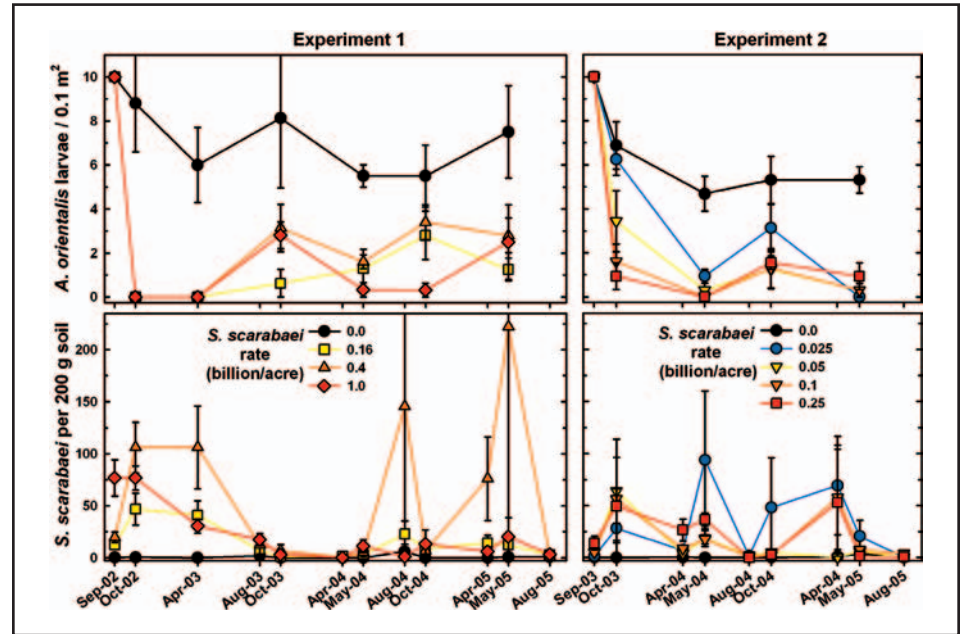


Figure 1. Population densities (\pm SE) of oriental beetle larvae (top graphs) and *S. scarabaei* (bottom graphs) in two experiments (left vs. right graph) after application of different *S. scarabaei* rates to 16 ft² microplots seeded with 160 3rd-instar oriental beetle.

(Figure 1). One month after application, 0.04 - 0.08 billion *S. scarabaei* per acre (b/a) (standard nematode rate is 1 to 2 b/a) provided 50 to 77% control, and 0.16 - 1.0 b/a provided 86 to 100% control. *S. scarabaei* number generally increased at one month after application showing good reproduction of the nematodes in their hosts. *S. scarabaei* also persisted well through winter and provided additional control in the following spring with 96 - 100% control at rates as low as 0.04 b/a.

During summer in the absence of hosts and with warm soil temperatures, *S. scarabaei* numbers dropped to low levels, but *S. scarabaei* persisted well enough to provide 62 - 91% control at rates of 0.05 - 1.0 b/a in the following grub generation. Despite the white grub suppression at one year after application, *S. scarabaei* numbers tended to stay at relatively low levels. However, in our first experiment started in 2002, *S. scarabaei* also persisted into the

third year after the application, but control more than two years after application was variable (31 - 94%).

We will continue sampling grub and nematode populations in these experiments for at least one more year.

Summary Points

- *S. scarabaei* is highly effective as a curative white grub control.
- Due to multiplication in infected grubs, even very low *S. scarabaei* rates can provide very high control rates within one month.
- The best long-term effect of *S. scarabaei* is expected with low rates that allow some grubs to survive until spring allowing *S. scarabaei* an additional reproduction cycle before summer.
- *S. scarabaei* is highly effective in a range of typical turf soil types, but is probably most effective in lighter soils.