RADISH (*Raphanus sativus* 'Cabernet')
Rhizoctonia root and hypocotyl rot; *Rhizoctonia solani*
Clubroot; *Plasmodiophora brassicae*

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Evaluation of biopesticides and fungicides to control Rhizoctonia root and hypocotyl rot and clubroot of radish, 2006.

The experiment was conducted at the Ohio Agricultural Research and Development Center Muck Crops Agricultural Research Station, Celeryville, OH on Linwood muck soil, pH 5.4. Fertilizer (N-P-K-S 18-0-17-17, 500 lb/A) was broadcast and incorporated into the test field on 1 May. The field was disked, leveled, and raised beds were prepared on 7 Jun. Radish cv. Cabernet was direct seeded, and the herbicide Dual II Magnum was applied at 1.5 pt/A on 12 Jun. Treatments were arranged in a randomized complete block design with four replications. Each plot consisted of three, 20 ft rows seeded at a rate of 10 seeds/ft. The field was overhead irrigated with 0.7 in. water on 13 Jun. Muscodor was applied at the rate of 1.9 and 3.5 oz/ft^3 soil at 7 and 5 days before planting by using a broadcast spreader and a Land Pride RTA 2064 rototiller to incorporate the product to a 4 in. depth. The insecticide Sevin XLR Plus was applied on 28 Jun at the rate of 1 qt/A. Treatments applied as in-furrow and foliar sprays were applied in 24.75 gal water/A at 15 psi by using a Stan-Hay vacuum seeder/sprayer containing three TeeJet 8002VS nozzles spaced 18 in. apart with a spray band of 7 in. on 12 and 20 Jun, respectively. Radishes were harvested from a 10 ft section of the center row for each treatment on 10 Jul and number of marketable radishes, radishes with Rhizoctonia root rot symptoms, radishes with clubroot, healthy culls and damaged culls were recorded. Average maximum temperatures for 12-30 Jun and 1-10 Jul were 80.1 and 80.2°F; average minimum temperatures were 56.1 and 57.6°F and rainfall amounts were 3.70 and 0.80 in., respectively. Data were analyzed by ANOVA using SAS statistical software. Means were separated using Fisher's protected least significant difference test.

Rhizoctonia disease pressure was high in this trial, reaching an average incidence of 53.3% in the untreated control. All of the Muscodor biofumigation treatments significantly reduced Rhizoctonia root and hypocotyl rot compared to both the untreated (raw seed) control and the standard Thiram seed treatment. Treatments with Moncut, Ranman or Serenade did not reduce Rhizoctonia disease incidence compared to the untreated control or the thiram standard. Clubroot pressure was high in this trial, and no treatment reduced clubroot disease incidence compared to the untreated control or the standard. Marketable yield was low in all plots due to high disease pressure, and none of the treatments resulted in higher marketable yield than the untreated control. However, three of the Muscodor treatments significantly increased marketable yield compared to the thiram standard treatment. The Apron XL seed treatment alone and combined with Maxim seed treatment and an in-furrow application of Quadris, as well as all of the Muscodor treatments, the low rate of Serenade, and Moncut significantly increased total yield compared to the untreated control and the thiram seed treatment standard.

Treatment and rate /A	% Rhizoctonia	% Clubroot	Marketable yield (no./plot)	Total yield (no./plot)
Muscodor 3.5 oz/ft^3 soil 7 days before planting	6.9 c[*]	72.8 a	14.5 a[**]	80.0 ab
Muscodor 1.9 oz/ft^3 soil 7 days before planting	11.7 c	72.1 a	11.0 ab	75.5 a-d
Muscodor 3.5 oz/ft^3 soil 5 days before planting	9.0 c	79.4 a	10.5 ab	80.3 ab
Muscodor 1.9 oz/ft^3 soil 5 days before planting	8.1 c	86.2 a	3.8 a-d	82.8 a
Serenade ASO 0.5% (in-furrow)	42.8 ab	79.4 a	0.5 d	77.8 ab
Serenade ASO 1.0 % (in-furrow)	51.6 ab	81.3 a	1.0 cd	67.8 b-e
Serenade ASO 2.0 % (in-furrow)	42.3 ab	71.5 a	2.8 bcd	66.8 b-e
Moncut 70-DF 1.1 lb (in-furrow)	47.6 ab	72.6 a	5.0 a-d	75.0 a-d
Ranman 400SC 6 fl oz (in-furrow)	45.1 ab	67.5 a	3.0 bcd	58.5 e
Apron XL 0.32 fl oz/100 lb seed + Maxim 4FS 0.16 fl oz/100 lb seed	46.4 ab	42.2 a	8.8 abc	63.8 cde
Apron XL 0.32 fl oz/100 lb seed + Maxim 4FS 0.16 fl oz/100 lb seed + Quadris 2.08SC 0.6 fl oz/1000 ft row (in-furrow)	37.2 ab	79.2 a	2.0 bcd	74.0 a-d
Apron XL 0.32 fl oz/100 lb seed + Maxim 4FS 0.16 fl oz/100 lb seed + Quadris 2.08SC 0.6 fl oz/1000 ft row (foliar)	51.3 ab	57.5 a	2.5 bcd	65.5 de
Apron XL 0.32 fl oz/100 lb seed + Maxim 4FS 0.16 fl oz/100 lb seed + Quadris 2.08SC 0.4 fl oz/1000 ft row (in-furrow) followed by Quadris 0.4 fl oz/1000 ft row (foliar)	51.2 ab	50.0 a	6.8 a-d	63.0 de
Apron XL 0.32 fl oz/100 lb seed	40.0 ab	76.2 a	3.8 bcd	75.0 a-d
Untreated Control (raw seed)	53.3 a	60.2 a	4.3 a-d	55.8 e
Standard (Thiram 50WP 8 fl oz/100 lb seed)	33.6 b	77.7 a	1.0 cd	56.0 e
P value	0.0001	0.6354	0.068	0.0021

[*]Values are the means of four replicate plots; means followed by the same letter within a column are not significantly different at $P \leq 0.07$ Means were separated using Fisher's protected least significant difference test.

[**]Marketable yield data were square root transformed prior to analysis; non-transformed means are reported.