

# Cultural and Chemical Controls of *Rhizoctonia solani* in Michigan Potato Fields



## Introduction and Objectives:

*Rhizoctonia solani* causes a number of disease symptoms on potato plants throughout the growing season. In spring, mycelia develops from sclerotia on the seed piece or from the soil, grows and infects developing stems, roots and stolons (Fig. 1). In severe cases, *R. solani* delays emergence and prunes off daughter tubers and stems, which can lead to a reduction in overall plant health, yield quantity and quality. As daughter tubers mature, *Rhizoctonia* can form sclerotia (black scurf) on the skin of the tubers (Fig. 2). Although substantial studies of the impact of fungicides on control of *R. solani* have been conducted, there is little information on the impact a) environmental factors such as soil temperature that impact disease severity across a range of potato varieties or b) the timing of the fungicide applications in conjunction with seed treatments on *Rhizoctonia* diseases of potatoes.

The objectives of this study were to evaluate the effect of

1. Soil temperature at the time of planting across a range of potato varieties and
2. Timing of application of fungicides  $\pm$  seed treatment on the development of *R. solani*.

## Materials and Methods:

### Planting based upon soil temperature experiment

- Tubers were planted when the average soil temperature over a five day period reached 8, 14, and 20 C for control of *Rhizoctonia* diseases.
- Nine commonly grown potato varieties were tested at each temperature (Atlantic, FL 1833, FL 1867, FL 1879, Jacqueline Lee, Michigan Purple, Pike, Russet Norkotah, and Snowden)

### Fungicide application timing experiment

- Experiment located at two different sites
- Three varieties were tested (FL 1879, Russet Norkotah, and Superior)
- See Table 4 for experiment treatment matrix

## Results:

### Planting based upon soil temperature experiment

Table 1. Effect of planting time on incidence and severity of sclerotia on potato tubers of different varieties caused by *Rhizoctonia solani*.

Timing	Incidence of black scurf on tubers (%)	Severity of black scurf on tubers (%)
8	85.6 a	43.6 a
14	25.4 b	14.3 b
20	14.4 b	10.0 b

Table 2. Effect of soil temperature at planting time on incidence and severity of black scurf on tubers of different varieties of potato.

Variety	8 C		20 C	
	Incidence	Severity	Incidence	Severity
Atlantic	89.44 a	47 abc	29 ab	19.3 ab
FL 1833	100 a	67.3 a	9.97 bc	3.33 b
FL 1867	91.24 a	42.7 abc	7.58 bc	4 ab
FL 1879	69.76 a	29 c	2.38 c	1 b
Jac Lee	95.83 a	65.3 ab	28.4 ab	27.3 a
MI Purple	93.94 a	38.3 abc	0 c	0 b
Pike	82.78 a	31 bc	8.98 bc	3 b
Russet	90.77 a	30.7 bc	5.68 bc	1 b
Snowden	80.3 a	46 abc	37 a	27.3 a

Figure 1. Potato plants showing necrotic cankers (arrows) on the white underground stems.



Table 4. The effect of the timing of application of different fungicides on non-treated and Maxim-treated seed on percentage of stems and stolons with canker on the potato varieties FL 1879 and Russet Norkotah.

Seed treatment	In-furrow	Emergence	14 day post-emergence	Control of stem canker		Control of stolon canker	
				FL 1879	Russet Norkotah	FL 1879	Russet Norkotah
No	Amistar	Amistar	-	-	-	-	
			-	-	-	-	
	Moncut	Moncut	-	-	-	-	
			-	-	-	-	
	Headline	Headline	+	+	++	-	
			-	-	-	-	
Yes	Amistar	Amistar	+	+	++	-	
			-	-	-	-	
	Moncut	Moncut	-	-	-	-	
			-	-	-	-	
	Headline	Headline	-	+	-	+	
			-	-	-	-	
-	+	-	-	-			

- + Significantly less stem or stolon canker, when compared to the untreated control (no seed treatment, no secondary fungicide)
- ++ Significantly less stem or stolon canker, when compared to either the untreated control (no seed treatment, no secondary fungicide) or the seed treatment only
- No significant difference from the untreated control

### Fungicide application timing experiment

Table 3. Effect of seed treatment (fludioxonil, Maxim 4 SF) on tuber and stem numbers, and disease symptoms for three potato varieties.

Variety	Seed Treatment	Tuber number	Stem number	Percent stems with >5% girdling	Percent stolons with >5% girdling	Incidence of black scurf on tubers (%)
Superior	No	16 b	3.1 b	24.3 a <sup>v</sup>	10.7 a	13.5 a
	Yes	22 a	4.1 a	10.7 b	3.6 b	3.1 b
FL 1879	No	35 a	4.6 b	44.8 a	33.4 a	62.4 a
	Yes	40 a	5.9 a	31.4 b	26.2 a	59.1 a
Russet	No	29 a	4.2 b	69.1 a	37.8 a	51.1 a
Norkotah	Yes	31 a	4.9 a	60.9 a	28.6 b	46.8 a

Figure 2. Black scurf on mature tubers (var. Jacqueline Lee)



## Conclusions:

Symptoms of disease caused by *Rhizoctonia solani* were evident in both experiments.

- The later plantings, based upon soil temperature (14 and 20 C), had significantly less incidence and severity of black scurf on the progeny tubers compared to the early planting (8 C). However, the later planted treatments (14 and 20 C) were not significantly different in terms of incidence or severity of black scurf. Clearly, cold temperature enhances the development of *Rhizoctonia* disease symptoms and perhaps retards plant development and growth.
- The application of a seed treatment with a secondary fungicide generally had less early stem and stolon canker, tuber black scurf and better plant health. Depending upon the variety, the choice of the second fungicide applied was found to be important, as was the timing of the application, for disease control. However, the most important control measure was the application of the seed treatment itself.
- These two experiments indicated that planting when soil temperature reached about 14 C and using an effective seed treatment should provide adequate control for *Rhizoctonia solani* disease symptoms. These results indicated that the use of a seed treatment in conjunction with a secondary application of fungicide for control of *R. solani* may not be necessary except perhaps in situations where seed tubers are severely affected by black scurf. Planting black scurf-free seed and planting into soils at about 14 C may help reduce the reliance on the application of a secondary fungicide application directed at reduction of *Rhizoctonia* diseases of potatoes.
- The experiments are in the process of being repeated in the 2005 growing season.