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Control of Rhizoctonia Crown and Root Rot with Fungicides, 2005.

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Introduction and summary

In Michigan, Rhizoctonia root and crown rot caused by *Rhizoctonia solani* Kuhn AG2-2 is the most common and serious soil-borne disease of sugar beet. *R. solani* survives as mycelium or sclerotia in the soil in organic debris and is thought to be most active at soil temperatures between 77 – 92^{o}F. Major issues have developed over the past few years with the introduction of effective fungicides for control of Rhizoctonia related to application timing of effective fungicides. In addition, some growers prefer to grow varieties which may be susceptible to Rhizoctonia and to manage the disease with fungicides as resistant varieties can have lower yield potential. In 2004, the Sugarbeet Industry funded research to determine the most effective timing of application of fungicides and effective dose rates necessary to control Rhizoctonia crown and root rot in sugar beet crops in Michigan using an empirical model based on the accumulation of soil disease severity values to effectively time fungicide applications. Results of trials in 2003 indicated that soil temperatures rarely reached 77^{o}F but significant development of crown and root rot still occurred. In 2004, applications were timed based on plant development only but in 2005, soil temperature and plant growth stages were compared as indicators for timing fungicide applications.

Sugar beet cv. E17 was PAT-treated and planted at the Michigan State University Bean and Beet Farm, Saginaw, MI 22 April (trial 1) and 2 May (trial 2). Seed was planted at 1" depth into four-row by 50-ft plots (ca. 4.375 in. between plants to give a target population of 275 plants/100ft. row) with 30" between rows replicated four times in a randomized complete block design. Fertilizer was drilled into plots immediately before planting, formulated according to results of soil tests (125 lb 46-0-0/A). No additional nitrogen was applied to the growing crop. In-furrow and pre-emergence fungicides were applied in the trials with a hand held R&D spray boom delivering 5 gal/A (50 p.s.i.) and using one XR8003 nozzle per row in a 6” band at planting. Fungicides were applied with a hand-held R&D spray boom delivering 25 gal/A (80 p.s.i.) and using three XR11003VS nozzles per row. Applications were made at planting; pre-emergence application two days after planting (DAP); 10 DAP equivalent to emergence; 20 DAP equivalent to leaf stage 2 – 4; 33 DAP equivalent to leaf stage 4 – 6; 45 DAP equivalent to leaf stage 6 – 8; and at disease severity value (DSV)-generated application timings (DSV 1, 2 and 3 are equivalent to reaching soil temperatures of 10, 15 and 20^{o}C, respectively). Cercospora leaf spot was controlled with a single application of, Eminent 125SL 0.813 pt on Jun 28. Weeds were controlled by cultivation and with a mixture of Pyramin DF at 5 lb/A plus Nortron at 4 pt/A applied at planting. Insects were controlled as necessary. Plant stand was rated 10, 20 and 30 (trial 1) DAP and up to 44 DAP (trial 2) and rate of emergence was calculated as the Relative Area under the Emergence Progress Curve [RAUEPC from 0 – 30 (trial 1) and 0 – 44 DAP (trial 2), maximum value = 100]. Plots were inoculated on Jun 12 (32 DAP) by spreading *R. solani* Anastemoses Group 2.2 infested millet grain across all plots. Plants with signs and symptoms of Rhizoctonia crown and root rot were counted 137 and 127 DAP (trials 1 and 2, respectively) on 26 Aug and expressed percentage dead-beets. Beet roots were machine-harvested on 16 Oct and individual treatments were weighed. Sucrose content has still to be determined. Meteorological data from MAWN station located on site.

Results

Average daily air temperature was variable during April and May due to regular precipitation (Figure 1). This resulted in slow soil temperature increase during the early part of the growing season up to 60 days after planting. At 4” soil depth the soil temperature never reached 70^{o}F (thought to be optimal for Rhizoctonia AG 2-2) but there was clear development of crown and root rot. In addition, the final plant stands were poor in 2005; on average only about 61.9%. The poor plant stands were due to continuous cool and wet weather during early May (Figure 1).

There were no significant differences among treatments in terms of plant stand from planting up to 30 days after planting (DAP). Final plant stands (30 DAP) were between 54.0 and 67.20%. There were no differences among treatments with respect plant stand measured as the relative area under the plant stand progression curve from planting to 30 DAP. There was 0 % damping-off caused by early season *R. solani* 44 DAP and no significant differences among treatments. The mean percentage of dead and dying sugarbeets 137

DAP (crown and root rot) in the non-treated plots was 12.3%. All treatments had a significantly lower percentage of plants with crown and root rot in comparison to the non-treated control. Treatments with symptoms of crown and root rot from 1.82 to 5.46, 2.54 to 6.64 and 12.3% (non-treated) were not significantly different.

There were no significant differences among treatments in terms of % sugar, clear juice purity or recoverable white sucrose per ton of sugarbeets, recoverable white sucrose per acre or yield (Table 2).

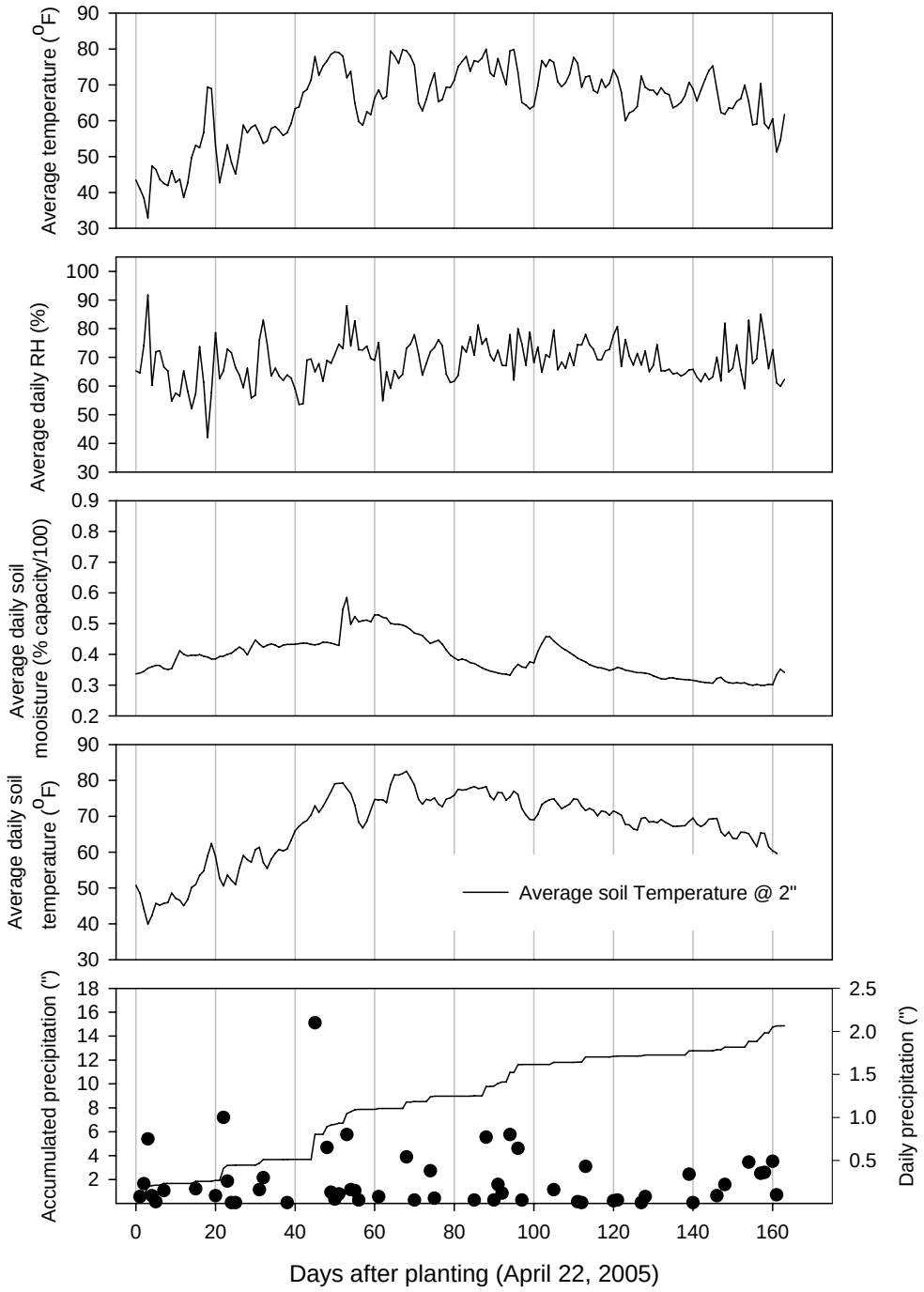

Figure 1. Average air temperature and average % Relative Humidity at 6 feet above the soil; average soil moisture at 2" depth (ratio of water holding capacity); average soil temperature at 2" depth and daily total precipitation and accumulated daily precipitation at the Bean and Beet farm Saginaw MI from Apr 22 to Oct 16, 2005.

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Table 1. Effect of fungicide application on plant stand and crown and root rot measured as dead-beets in sugarbeet exposed to *Rhizoctonia solani* AG2_2. Bean and Beet Farm, Saginaw, MI, 2005.

Chemical rate; application date; and DAP[a]					Plant stand (%) 10 DAP	Plant stand (%) 20 DAP	Plant stand (%) 30DAP	RAUEPC[b]	Dead-beets (%)[c]	
Amistar 80WDG	0.13	oz/1000 ft	Apr 22	0	2.1	51.9	54.0	11.7	4.1	b[d]
Amistar 80WDG	0.25	oz/1000 ft	Apr 24	2[e]	3.6	52.9	67.2	16.7	2.0	b
Amistar 80WDG	0.25	oz/1000 ft	May 2	10[f]	2.3	52.2	61.8	14.4	3.5	B
Amistar 80WDG	2.7	oz/A	May 12	20[g]	4.5	52.2	59.5	14.4	2.5	B
Amistar 80WDG	2.7	oz/A	May 25	33[h]	5.1	59.6	61.5	14.2	5.5	B
Amistar 80WDG	2.7	oz/A	Jun 1	45[i]	5.2	55.5	54.9	12.5	3.6	B
Amistar 80WDG	2.7	oz/A	May 10	DSV 1[j]	5.5	56.5	63.5	15.4	3.9	B
Amistar 80WDG	2.7	oz/A	May 25	DSV 2	3.9	54.5	62.3	14.8	4.8	B
Amistar 80WDG	2.7	oz/A	Jun 1	DSV 3	2.7	55.7	65.3	15.3	2.7	b
untreated				0	4.3	54.5	62.2	14.9	12.3	a
LSD P = 0.05					7.1	17.8	19.8	7.2		

[a] Application dates and days after planting.
[b] Relative area under the emergence progress curve from planting to 30 days after planting.
[c] Dead and dying sugarbeets (%) 137 DAP.
[d] Means followed by same letter are not significantly different at P = 0.05 (Tukey test).
[e] Pre-emergence application two days after planting.
[f] 10 DAP equivalent to emergence.
[g] 20 DAP equivalent to leaf stage 2 – 4.
[h] 33 DAP equivalent to leaf stage 4 – 6.
[i] 45 DAP equivalent to leaf stage 6 – 8.
[j] DSV-generated application timings (DSV 1, 2 and 3 are equivalent to reaching soil temperatures of 10, 15 and 20°C, respectively).

Table 2. Effect of fungicide application on sugar and yield in sugarbeet exposed to *Rhizoctonia solani* AG2_2. Bean and Beet Farm, Saginaw, MI, 2005.

Chemical rate; application date; and DAP[a]					% Sugar	Clear Juice Purity (%)	RWST[b] (lb)	RWSA[c] (lb)	Yield (t/A)
Amistar 80WDG	0.13	oz/1000 ft	Apr 22	0	16.8	94.1	242.4	4957	20.5
Amistar 80WDG	0.25	oz/1000 ft	Apr 24	2[e]	16.5	93.8	236.0	4824	20.5
Amistar 80WDG	0.25	oz/1000 ft	May 2	10[f]	16.5	94.1	238.3	4945	20.8
Amistar 80WDG	2.7	oz/A	May 12	20[g]	16.3	94.0	233.9	5101	21.8
Amistar 80WDG	2.7	oz/A	May 25	33[h]	16.3	94.4	235.5	4840	20.6
Amistar 80WDG	2.7	oz/A	Jun 1	45[i]	16.2	94.2	234.0	4239	18.1
Amistar 80WDG	2.7	oz/A	May 10	DSV 1[j]	16.6	95.4	245.4	4613	18.8
Amistar 80WDG	2.7	oz/A	May 25	DSV 2	16.2	94.2	233.7	4761	20.4
Amistar 80WDG	2.7	oz/A	Jun 1	DSV 3	16.6	94.3	240.1	4497	18.8
untreated				0	16.0	93.8	228.1	3872	17.0
LSD P = 0.05					1.29	2.25	26.90	1660.4	7.02

[a] Application dates and days after planting.
[b] RWST = Recoverable White Sucrose per Ton of Sugarbeets
[c] RWSA = Recoverable White Sucrose per Acre (Ton/A*RWST)
[d] Means followed by same letter are not significantly different at P = 0.05 (Tukey test).
[e] Pre-emergence application two days after planting.
[f] 10 DAP equivalent to emergence.
[g] 20 DAP equivalent to leaf stage 2 – 4.
[h] 33 DAP equivalent to leaf stage 4 – 6.
[i] 45 DAP equivalent to leaf stage 6 – 8.
[j] DSV-generated application timings (DSV 1, 2 and 3 are equivalent to reaching soil temperatures of 10, 15 and 20°C, respectively).