EFFECT OF TIME OF FUNGICIDE APPLICATION ON DISEASE CONTROL AND QUALITY PARAMETERS USING A RHIZOCTONIA RESISTANT AND SUSCEPTIBLE SUGARBEET VARIETY

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Rhizoctonia root and crown rot, caused by *Rhizoctonia solani* Kühn, is currently the most devastating soilborne disease of sugarbeet (*Beta vulgaris* L.) in North Dakota and Minnesota. In the bi-state area, *R. solani* anastomosis group (AG) 1, AG-2-2, AG-4, and AG-5 cause damping off and AG-2-2 causes root and crown rot of sugarbeet (Windels and Nabben 1989). *R. solani* has a wide host range including broad leaf crops and weeds (Anderson 1982; Nelson et al. 1996). Severe disease occurs if sugarbeet follows beans or potato in a rotation (Baba and Abe 1966; Johnson et al. 2002). In fields with a history of high disease severity, growers may plant varieties that are more resistant but with significantly lower yield potential compared to more susceptible varieties (Panella and Ruppel 1996). All varieties, including Rhizoctonia resistant varieties, are susceptible to the pathogen in early growth stages.

The objective of this research was to determine the best times to apply fungicide to provide effective control of *Rhizoctonia solani* using a resistant and susceptible sugarbeet variety.

MATERIALS AND METHODS

Field trial was conducted in Hickson, ND in 2013. The site was inoculated on 28 May with *R. solani* AG 2-2 IIIB grown on barley. Inoculum was broadcast using a three-point mounted rotary/spinner type spreader calibrated to deliver 18 lbs/A of inoculum. The inoculum was incorporated with a Konskilde field cultivator to about the two-inch depth just before planting. The experimental design was a randomized complete block with four replicates. Field plots comprised of two 25-foot long rows spaced 22 inches apart. Plots were planted to stand on 29 May. Counter 20G was also applied at 9 lb/A at planting to control insect pests. Weeds were controlled with glyphosate on 25 June, 10 July, 19 July, 9 August and 22 August. Leaf spot was controlled with fungicide applications on 9 August and 22 August.

Treatments were applied either as in-furrow application; or as a POST application at different leaf stages. The in-furrow application was made on 28 May (at planting) with a spray volume of 9.5 gal/A. The POST applications were made as follows: A – 28 May; B – 28 May + 11 June; C – 11 June; D – 11 June + 28 June; E – 19 June; F – 19 June + 2 July; F – 19 June + 2 July; G – 2 July; H – 2 July + 15 July; I – 11 July; J – 11 July + 25 July; K - 15 July; L – 15 July + 29 July. The POST application was made using a bike sprayer with flat fan nozzles (4002E) spaced 22’’ apart, set 9.5 inches above the soil, and calibrated to deliver 17 gal solution/A at 40 p.s.i pressure to the middle four rows of plots in a 7” band centered over each row. The fungicide used was Quadris at 9.2 fl oz/A.

Stand counts were taken during the season and at harvest. The plots were harvested on 4 September and weights were recorded. Samples (12-15 roots) from each plot, not including roots on the ends of plots, were analyzed for quality at American Crystal Sugar Company tare laboratory at East Grand Forks, MN. The data analysis was performed with the ANOVA procedure of the Agriculture Research Manager, version 8 software package (Gylling Data Management Inc., Brookings, South Dakota, 2010). The least significant difference (LSD) test was used to compare treatments when the F-test for treatments was significant.

RESULTS AND DISCUSSIONS

At Hickson, planting was delayed by prolonged wet field conditions and was done when average daily soil temperature was 64 F. Rains immediately after planting delayed a band application designed to be applied at 65 F average soil temperature until 12 June, about one week after the soil temperature threshold of 65 F was reached. Emergence was good but crop growth was very slow because of late fertilization also delayed by wet conditions. Stand count was taken regularly during the season with the first on 19 June. Disease incidence was generally low throughout the growing season. No phytotoxicity was observed in any of the treatments, irrespective of whether Quadris was applied in-furrow or post application. The most effective treatments were those where Quadris was applied in-furrow resulting in significantly higher plant stand than the non-treated check. The post applications of Quadris starting at 11 June did not improve plant stand compared to when Quadris was used in-furrow. It is highly likely that none of the post applications of Quadris were effective because infection by *R. solani* had already occurred since conditions – average soil temperature of ≥65 F, adequate moisture and plants at a susceptible stage – were favorable. In the non-treated check, there were no differences in plant stand between the susceptible and resistant variety, probably because infection occurred just after planting before resistance could be expressed in the seedlings.

Tonnage and recoverable sucrose was relatively low because of late planting and poor growing conditions. Although Quadris in-furrow resulted in significantly higher populations, this did not result in significantly higher yields compared to other treatments since with lower populations.

These results indicate timing of Quadris is critical in controlling *R. solani* and must be applied before infection takes place. Both resistant and susceptible varieties were equally susceptible to the pathogen at the time of infection and Quadris applications after 65 F was attained were ineffective.

References

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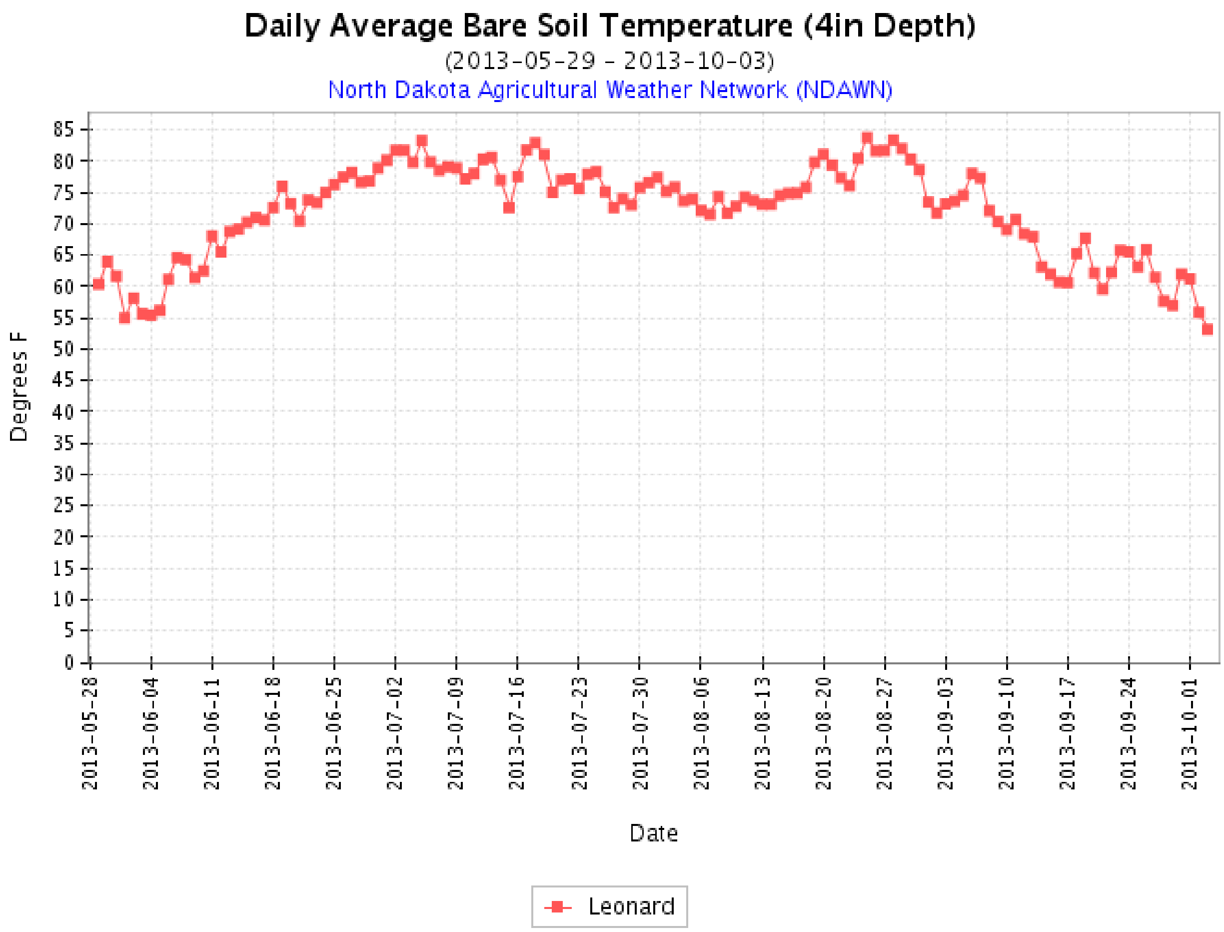
Daily Average Bare Soil Temperature (4in Depth)
(2013-05-29 - 2013-10-03)
North Dakota Agricultural Weather Network (NDAWN)
Degrees F
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
2013-05-28
2013-06-04
2013-06-11
2013-06-18
2013-06-25
2013-07-02
2013-07-09
2013-07-16
2013-07-23
2013-07-30
2013-08-06
2013-08-13
2013-08-20
2013-08-27
2013-09-03
2013-09-10
2013-09-17
2013-09-24
2013-10-01
Date
Leonard

Table 1. Effect of seed treatments, starter fertilizers, and fungicides at controlling *R. solani* on sugarbeet at Hickson, ND in 2013.

Cultivar and Treatment	Rate(Unit)	Appl Code	Count (#/100') Oct 3	Root Yield (t/A)	Sucrose Concentration(%)	SLM(%)	Recoverable Sucrose	
							(lb/t)	(lb/A)
Resistant Untreated Check			101	17.2	15.5	1.37	283	4900
Susceptible Untreated Check			105	16.0	15.6	1.13	289	4624
Resistant/Quadris	9.2 fl oz/a	A	138	17.7	15.3	1.25	282	5015
Susceptible/Quadris	9.2 fl oz/a	A	145	18.9	15.5	1.14	286	5431
Resistant/Quadris Resistant/Quadris	9.2 fl oz/a 9.2 fl oz/a	A B	148	18.4	15.6	1.29	286	5319
Susceptible/Quadris Susceptible/Quadris	9.2 fl oz/a 9.2 fl oz/a	A B	156	18.5	15.4	1.14	285	5286
Resistant/Quadris	9.2 fl oz/a	C	115	18.9	14.8	1.32	271	5120
Susceptible/Quadris	9.2 fl oz/a	C	105	16.8	15.6	1.14	290	4897
Resistant/Quadris Resistant/Quadris	9.2 fl oz/a 9.2 fl oz/a	C D	114	21.2	15.1	1.38	275	5819
Susceptible/Quadris Susceptible/Quadris	9.2 fl oz/a 9.2 fl oz/a	C D	108	19.8	15.5	1.17	286	5704
Resistant/Quadris	9.2 fl oz/a	E	124	20.7	15.2	1.35	278	5752
Susceptible/Quadris	9.2 fl oz/a	E	103	17.2	15.6	1.20	289	4974
Resistant/Quadris Resistant/Quadris	9.2 fl oz/a 9.2 fl oz/a	E F	114	19.2	15.4	1.29	283	5467
Susceptible/Quadris Susceptible/Quadris	9.2 fl oz/a 9.2 fl oz/a	E F	106	17.8	15.6	1.11	290	5189
Resistant/Quadris	9.2 fl oz/a	G	110	19.3	15.3	1.36	279	5393
Susceptible/Quadris	9.2 fl oz/a	G	109	18.2	15.7	1.13	292	5325
Resistant Quadris Quadris	9.2 fl oz/a 9.2 fl oz/a	G H	108	18.8	16.0	1.31	294	5570
Susceptible Quadris Quadris	9.2 fl oz/a 9.2 fl oz/a	G H	101	18.1	15.8	1.17	292	5304
Resistant/Quadris	9.2 fl oz/a	I	103	19.0	15.4	1.33	282	5374
Susceptible/Quadris	9.2 fl oz/a	I	108	18.5	15.9	1.15	296	5485
Resistant Quadris Quadris	9.2 fl oz/a 9.2 fl oz/a	I J	108	18.8	15.2	1.37	277	5215
Susceptible Quadris Quadris	9.2 fl oz/a 9.2 fl oz/a	I J	105	16.6	15.4	1.16	284	4770
Resistant Quadris	9.2 fl oz/a	K	104	17.9	15.1	1.13	275	4941
Susceptible Quadris	9.2 fl oz/a	K	105	18.7	15.4	1.10	285	5361
Resistant Quadris Quadris	9.2 fl oz/a 9.2 fl oz/a	K L	107	18.0	15.3	1.28	281	5083
Susceptible Quadris Quadris	9.2 fl oz/a 9.2 fl oz/a	K L	106	18.9	15.5	1.18	286	5409
LSD(0.05)			16	2.9	0.5	0.09	11	881