# 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 soil borne 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 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 fungicides to provide effective control of *Rhizoctonia solani* using a resistant and susceptible sugarbeet variety.

## MATERIALS AND METHODS

A field trial was conducted at Hickson, ND in 2015. The site was inoculated on 23 April 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 37 lbs/A of inoculum. The inoculum was incorporated with a Konskilde field cultivator to about the two-inch depth before planting. The experimental design was a randomized complete block with four replicates. Field plots comprised of three 25-foot long rows spaced 22 inches apart. Plots were planted to stand on 27 April with seeds treated with Kabina 14g except the untreated checks. Counter 20G was applied at 9lb/A at planting to control insect pests. Weeds were controlled on 4 June and 24 June.

Treatments were applied either as in-furrow applications or as a POST application at different leaf stages. The in-furrow application was made 27 April (at planting) with a spray volume of 7.1 gal/A. The POST applications were made as follows: A-27 April; B-26 May; C-28 May; D-8 June; E-1 June; F-15 June; G-8 June; H-30 June; I-15 June; J-29 June; K-30 June; L-7 July. The POST applications were 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 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 middle two-rows of plots were harvested on 15 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

Dry conditions at planting resulted in slow and delayed emergence. There were no symptoms of Rhizoctonia seedling damping-off. Wilting, yellowing of leaves of older plants and plant death started in mid-June and continued throughout the season.

At harvest on 15 September, the stand count for the susceptible and the resistant varieties with no seed treatment (Kabina) had significantly lower stand when compared with the same variety treated with Kabina. Kabina seed treatments resulted in significantly higher plant stand on the resistant variety for all treatments compared to the non-treated resistant variety. None of the fungicide applications (at planting and post-planting) resulted in significantly higher tonnage or recoverable sucrose compared to the Kabina treated susceptible variety. The Kabina seed treatment of the resistant variety resulted in a trend for higher tonnage and recoverable sucrose (but not always statistically significant) compared to the non-treated resistant variety. The data suggest Kabina seed treatment generally provided some level of protection against the pathogen, but a highly resistant variety protected with Kabina is needed under the heavy disease conditions which prevailed. None of the in-furrow and /or post fungicide applications appeared to have significantly impacted tonnage or recoverable sucrose.

**References**


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Application Dates and timings for Table 1 on the following page:

A (IF) 27 April
B (A + 14 days) 26 May
C (60 – 65F Soil Temp) 28 May
D (C + 14 days) 8 June
E (4 Leaf) 1 June
F (E + 14 days) 15 June
G (6 Leaf) 8 June
H (G + 14 days) 30 June
I (8 Leaf) 15 June
J (I + 14 days) 29 June
K (10 Leaf) 30 June
L (K + 14 Days) 7 July

**Table 1. Effect of seed treatments and fungicides at controlling *R. solani* on sugarbeet at Hickson, ND in 2015**

| Cultivar and Treatment | Rate (unit) | Appl Code | Count (#/100') 15 Sept | Root Yield (t/A) | Sucrose Concentration (%) | SLM (%) | Recoverable (lb/t) | Sucrose (lb/A) |
|---|---|---|---|---|---|---|---|---|
| Susceptible Untreated* | | | 101 | 15.9 | 16.0 | 1.24 | 294.8 | 4,692 |
| Resistant Untreated* | | | 133 | 22.8 | 15.9 | 1.46 | 288.8 | 6,553 |
| Susceptible | | | 149 | 17.7 | 16.4 | 1.19 | 303.8 | 5,384 |
| Resistant | | | 192 | 28.9 | 15.4 | 1.40 | 280.6 | 8,132 |
| Susceptible/Quadris | 9.2 fl oz/a | A | 161 | 20.0 | 16.4 | 1.22 | 303.2 | 6,071 |
| Resistant/Quadris | 9.2 fl oz/a | A | 186 | 29.4 | 15.8 | 1.40 | 287.6 | 8,435 |
| Susceptible/Quadris<br>Susceptible/Quadris | 9.2 fl oz/a<br>9.2 fl oz/a | A<br>B | 153 | 17.7 | 16.1 | 1.24 | 297.3 | 5,240 |
| Resistant/Quadris<br>Resistant/Quadris | 9.2 fl oz/a<br>9.2 fl oz/a | A<br>B | 187 | 27.9 | 15.7 | 1.45 | 285.5 | 7,942 |
| Susceptible/Quadris | 9.2 fl oz/a | C | 124 | 16.6 | 16.2 | 1.24 | 298.3 | 4,944 |
| Resistant/Quadris | 9.2 fl oz/a | C | 176 | 25.4 | 16.5 | 1.43 | 301.5 | 7,648 |
| Susceptible/Quadris<br>Susceptible/Quadris | 9.2 fl oz/a<br>9.2 fl oz/a | C<br>D | 119 | 15.0 | 16.5 | 1.20 | 306.6 | 4,591 |
| Resistant/Quadris<br>Resistant/Quadris | 9.2 fl oz/a<br>9.2 fl oz/a | C<br>D | 163 | 25.5 | 16.1 | 1.46 | 293.0 | 7,467 |
| Susceptible/Quadris | 9.2 fl oz/a | E | 127 | 20.1 | 17.3 | 1.22 | 320.6 | 6,442 |
| Resistant/Quadris | 9.2 fl oz/a | E | 155 | 24.5 | 16.4 | 1.35 | 301.5 | 7,385 |
| Susceptible/Quadris<br>Susceptible/Quadris | 9.2 fl oz/a<br>9.2 fl oz/a | E<br>F | 143 | 19.7 | 16.6 | 1.21 | 307.4 | 6,066 |
| Resistant/Quadris<br>Resistant/Quadris | 9.2 fl oz/a<br>9.2 fl oz/a | E<br>F | 168 | 26.4 | 16.3 | 1.30 | 300.5 | 7,939 |
| Susceptible/Quadris | 9.2 fl oz/a | G | 129 | 16.1 | 16.1 | 1.26 | 297.3 | 4,760 |
| Resistant/Quadris | 9.2 fl oz/a | G | 156 | 26.0 | 16.1 | 1.43 | 293.4 | 7,643 |
| Susceptible/Quadris<br>Susceptible/Quadris | 9.2 fl oz/a<br>9.2 fl oz/a | G<br>H | 131 | 19.6 | 16.7 | 1.16 | 309.8 | 6,040 |
| Resistant/Quadris<br>Resistant/Quadris | 9.2 fl oz/a<br>9.2 fl oz/a | G<br>H | 168 | 26.0 | 16.8 | 1.22 | 311.1 | 8,114 |
| Susceptible/Quadris | 9.2 fl oz/a | I | 121 | 17.3 | 15.9 | 1.19 | 294.2 | 5,182 |
| Resistant/Quadris | 9.2 fl oz/a | I | 161 | 27.0 | 15.6 | 1.36 | 285.3 | 7,713 |
| Susceptible/Quadris<br>Susceptible/Quadris | 9.2 fl oz/a<br>9.2 fl oz/a | I<br>J | 128 | 17.6 | 17.3 | 1.16 | 321.9 | 5,660 |
| Resistant/Quadris<br>Resistant/Quadris | 9.2 fl oz/a<br>9.2 fl oz/a | I<br>J | 164 | 24.7 | 16.4 | 1.35 | 300.6 | 7,413 |
| Susceptible/Quadris | 9.2 fl oz/a | K | 116 | 16.2 | 17.6 | 1.16 | 327.9 | 5,279 |
| Resistant/Quadris | 9.2 fl oz/a | K | 149 | 24.3 | 16.0 | 1.31 | 292.9 | 7,097 |
| Susceptible/Quadris<br>Susceptible/Quadris | 9.2 fl oz/a<br>9.2 fl oz/a | K<br>L | 131 | 17.5 | 16.6 | 1.16 | 308.3 | 5,379 |
| Resistant/Quadris<br>Resistant/Quadris | 9.2 fl oz/a<br>9.2 fl oz/a | K<br>L | 166 | 25.6 | 16.2 | 1.28 | 297.4 | 7,585 |
| LSD (0.05) | | | 36.0 | 5.20 | 1.04 | 0.151 | 22.39 | 1,687.8 |

*Not treated with Kabina