STRATEGIES FOR CONTROL OF RHIZOCTONIA CROWN AND ROOT ROT IN SUGARBEET IN MONTANA IN 2016

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Introduction

In the last several years, Rhizoctonia crown and root rot (RCRR) has emerged as the disease of greatest concern to sugarbeet production in Montana and elsewhere. This could be due to the fact that producers are planting more susceptible varieties with higher yield and sugar content. Another possibility is that other disease problems have been minimized by resistant varieties and other controls. It is found in nearly all sugarbeet production areas. The disease is caused by a fungal complex of *Rhizoctonia solani* isolates, including the anastomosis group (AG) 2-2 intraspecific group (isg) IV and isg III B. In Montana, isg III B is now the predominant strain, a shift from the isg IV in the past two decades. Isg III B is typically more predominant in areas including corn in rotation. Sugarbeet varieties with resistance to RCRR are available to producers; however, they often have lower yield potential or lack other important disease resistance traits. The primary means of control of RCRR are fungicidal seed treatments, in-furrow and band fungicide treatments. In the mid-1990's, the labeling of azoxystrobin (Quadris) allowed growers to use in-furrow and banded applications to control the disease. Previous work to determine optimal timing using temperature windows (soil temp ~65°F) for application (Jacobsen, Khan) achieves excellent control, however, because the window is narrow (3-4 days), growers are often unable to meet these windows for their entire crop acreage.

Therefore, there is great interest to increase the timing window of fungicide applications available to producers in order to achieve high levels of control in the field. Seed treatment fungicides provide some protection, but do not provide season-long control when applied alone. In-furrow applications also provide some control, but have widely varied levels of efficacy. To date, banded applications have provided the best control of RCRR. Previous research was successfully demonstrated that a combination of seed treatment fungicides could be used with banded fungicide applications to increase the window of application available to producers for optimal, efficient control. This study expanded and replicated seed treatments used for control, as well as examination of both and early (4-8 leaf stage) and a late (10-12 leaf stage) application of foliar fungicides.

Methods and Materials

Field studies were conducted at the Southern Agricultural Research Center located near Huntley, MT. Soils are a Fort Collins clay loam. The research site was inoculated with 39 lb/acre of *Rhizoctonia solani* (AG 2-2 isg III B) infested barley. Inoculum was incorporated with a field cultivator ~5 days prior to planting. Experimental fields were furrow irrigated. The sugar beet hybrid BTS 39RR8N was planted on May 5th using 24 inch row spacing. All seed treatment applications received a base treatment of Apron XL (0.07 g mefanoxam/unit), Tachigaren 70WP (14 g hymexazol/unit), Maxim 4FS (0.02 g/unit) and Cruiser 5FS (68 g thiamethoxam/unit). Additional seed treatments applied included Kabina 40S (14 g penthiopyrad/unit), Vibrance (2.5 g sedaxane/unit), Stamina (15 g pyraclostrobin/unit) combined with Systiva XS (at 2.5 and 5 g fluxapyroxad/unit) and Metlock (0.02 g metconazole/unit) combined with Rizolex (0.5 g tolclofos-methyl/unit). All seed treatments were applied and made into 4M pellets by ASTEC Inc., Sheridan, WY. Banded applications were made using a single 8002 nozzle at 30 PSI adjusted for a seven-inch band. Quadris was applied at 8.3 fl oz of product/acre (0.38 fl oz /1,000 ft row) or Priaxor at 8.0 fl oz of product/acre (0.37 fl oz/1,000 ft row). Band applications of Quadris and Priaxor were applied when sugar beet plants had reached the 4-8 (early)or 10-12 (late) leaf stage of growth.

All treatments were arranged in a split-plot design. The banded applications plus an untreated check treatment served as whole plot treatments. The seed treatment fungicides, including both un-inoculated and inoculated rows of the base treatment seed served as split-plot treatments. Individual plots consisted of

three, 30 foot rows planted on 24 inch centers. All whole plot/split plot combinations were replicated four times. Mature sugar beet roots were harvested on September 19-21, 2016 from the center row of each plot with each root individually rated using the Ruppel scale (0-7) with 0 being no disease symptoms, and 7 being completely rotted roots. Total weight of each harvested row was recorded. A subsample of roots was taken from each harvested row to determine purity, sucrose content, and sugar-loss-to-molasses, as performed by the Western Sugar Cooperative Tare Lab in Billings, MT.

Results

Results are presented in Table 1. Disease rating vs yield was highly correlated (-0.83). The Kabina, Vibrance, Stamina+Systiva, and the Metlock+Rizolex seed treatments applied alone failed to control the disease, measured as a combination of disease index, percentage roots classified in the 0-3 Ruppel classes (roots are considered to be safe for storage (Campbell)), and recoverable sugar yield per acre. Quadris and Priaxor applied at the 4-8 leaf stage and the 10-12 leaf stage provided significant control. While all post-emergent band applications reduced disease index and increased the percentage of roots rated 0-3, and recoverable sugar (lbs/a), they were found not to be statistically different from each other. All seed treatments performed statistically the same in the 2016 season.

Conclusions

This work demonstrates that the use of seed treatments at planting extends the window of foliar fungicide band application from the 4-6 to the 10-12 leaf stages, supporting findings from previous years (Jacobsen). A caveat exists in that due to the late infection periods observed in the last two years, expected benefits directly due to the seed treatments were not achieved. In 2016, no statistical differences were found between seed treatments. This is in agreement with data obtained in 2015. Data from the last two years indicated that a combination of seed treatments and a properly timed foliar fungicide applications were equal to a 65°F applications. This is considered highly desirable to extend the window of application resulting in disease reduction and to shift away from a temperature based application paradigm, allowing growers more time to apply fungicides to their acreage. This study shows that excellent control for RCRR can be achieved in a longer window. Previous studies showed that fungicide application was most efficacious within a 3-4 day window. This work expands that window beyond 65°F without compromising RCRR control. An increase in high performing seed treatments available to producers that function equally to Kabina is also desirable.

Table 1. Data from the 2016 Rhizoctonia trials

		Disease Index		Net Root Yield (tons/acre)		Recoverable Sugar (%)		Recoverable Sugar per ton (lb/ton)	
None	Uninoculated	15.9	c	36.0	a	13.9	a	278.7	a
	Inoculated	76.4	a	17.0	c	11.7	bc	234.2	bc
	Kabina 14g	68.8	ab	21.8	bc	11.5	bc	230.9	bc
	Vibrance 2.5g	68.9	ab	21.3	bc	11.5	bc	229.2	bc
	Stamina 15g + Systiva 2.5g	50.6	b	28.8	ab	12.7	ab	253.5	ab
	Stamina 15g + Systiva 5g	73.7	a	21.2	bc	11.3	c	225.9	c
	Metlock 0.2g + Rizolex 0.5g	69.2	ab	22.7	bc	11.4	bc	227.9	bc
Priaxor at 4-8 leaf stage	Uninoculated	16.2	c	35.2	a	14.3	a	285.7	a
	Inoculated	40.8	ab	30.7	ab	12.9	b	257.0	b
	Kabina 14g	37.7	b	31.2	ab	12.9	b	258.4	b
	Vibrance 2.5g	41.3	ab	30.1	ab	13.2	ab	264.4	ab
	Stamina 15g + Systiva 2.5g	54.9	ab	26.8	ab	12.8	b	256.6	b
	Stamina 15g + Systiva 5g	59.8	a	24.9	b	12.7	b	253.4	b
	Metlock 0.2g + Rizolex 0.5g	52.6	ab	27.0	ab	12.5	b	249.4	b
Priaxor at 10-12 leaf stage	Uninoculated	13.7	c	36.0	a	13.8	a	276.8	a
	Inoculated	46.0	ab	30.5	ab	12.8	ab	255.6	ab
	Kabina 14g	52.3	ab	26.2	b	13.1	ab	262.2	ab
	Vibrance 2.5g	56.7	a	27.6	b	13.3	ab	266.6	ab
	Stamina 15g + Systiva 2.5g	34.9	b	32.3	ab	12.9	ab	257.8	ab
	Stamina 15g + Systiva 5g	53.8	ab	28.6	ab	12.6	b	251.0	b
	Metlock 0.2g + Rizolex 0.5g	52.1	ab	26.8	b	12.7	ab	253.1	ab
Quadris at 4-8 leaf stage	Uninoculated	12.9	c	38.7	a	13.6	a	271.1	a
	Inoculated	37.7	b	35.6	ab	13.1	ab	262.3	ab
	Kabina 14g	54.9	ab	27.3	bc	12.9	ab	257.2	ab
	Vibrance 2.5g	56.4	ab	25.5	c	12.9	ab	257.4	ab
	Stamina 15g + Systiva 2.5g	53.9	ab	26.0	c	12.3	b	245.1	b
	Stamina 15g + Systiva 5g	53.6	ab	25.0	c	12.6	ab	251.7	ab
	Metlock 0.2g + Rizolex 0.5g	59.1	a	24.7	c	13.2	ab	264.8	ab
Quardris at 10-12 leaf stage	Uninoculated	19.8	c	35.0	a	14.0	a	279.2	a
	Inoculated	39.3	abc	26.8	ab	13.4	a	267.4	a
	Kabina 14g	39.2	abc	28.8	ab	13.1	a	263.0	a
	Vibrance 2.5g	47.8	ab	29.2	a	10.7	b	214.0	b
	Stamina 15g + Systiva 2.5g	32.8	bc	32.9	a	13.2	a	264.2	a
	Stamina 15g + Systiva 5g	38.9	abc	28.1	ab	13.2	a	263.7	a
	Metlock 0.2g + Rizolex 0.5g	56.4	a	20.6	b	11.7	b	234.1	b

1) Disease index calculated on Ruppel Scale (0-7) where 0% represents no disease and 100% represents completely rotten roots
2) Means within a treatment grouping and column followed by a different letter are considered different at $p<0.05$.