STRATEGIES FOR CONTROL OF RHIZOCTONIA CROWN AND ROOT ROT IN SUGARBEET IN MONTANA IN 2015

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Introduction

Rhizoctonia crown and root rot (RCRR) has become the disease of greatest concern in sugarbeet in the last few years in Montana and elsewhere. This may be because we are raising more susceptible varieties or that other disease problems have been minimized by resistant varieties and other controls. It can be found in all areas where sugarbeet is grown. The disease is caused by a fungal complex of *Rhizoctonia solani* isolates, including the AG 2-2 isg IV and isg III B. In Montana, isg III B is now the most predominant strain, a shift from the predominance of the isg IV in the past two decades. The isg III B is typically more predominant in areas in rotation with corn. Sugarbeet varieties with resistance to RCRR are available to producers, however, they often have lower yield potential or do not have other important disease resistance. The primary means of control of RCRR are dependent on fungicide seed, in-furrow and band treatments. In the mid-1990's, the labeling of azoxystrobin (Quadris) allowed growers to use in-furrow and banded applications to control the disease. Much work has been done to determine optimal timing using temperature windows for application (Jacobsen, Khan), however, 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 level of control, but can have widely varied levels of efficacy. To date, banded applications have provided the best level of control of *Rhizoctonia solani*. This research was designed to determine if a combination of seed treatment fungicides could be successfully used in combination with banded fungicide applications to increase the window of application available to producers, thereby providing more efficient means of control.

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 ~7 days prior to planting. Experimental fields were furrow irrigated. The sugar beet hybrid BTS 39RR8N was planted on April 24th using 24 inch row spacing. All seed treatment applications made in 2015 received a base treatment consisting of Allegiance FL (0.16 g metalaxyl/unit), Tachigaren 70WP (14 g hymexazol/unit), and Cruiser 5FS (68 g thiamethoxam/unit). Additional seed treatments applied including Kabina 40S (at both the 10 and 14 g penthiopyrad/unit), Vibrance (2.5 g sedaxane/unit), and Stamina (15 g pyraclostrobin/unit) combined with Systiva XS (at both the 2.5 and 5 g fluxapyroxad/unit). All seed treatments were applied and made into 4M pellets by ASTEC Inc., Sheridan, WY. Banded applications were made using the 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 were applied when sugar beet plants had reached the 4-8 leaf or the 10-12 leaf stage of growth. Priaxor was applied only at the 10-12 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 six times. Mature sugar beet roots were harvested on September 14, 2015 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 rotten roots. Total weight of each harvested row was recorded. A subsample of roots was obtained from each harvested row to determine purity, sucrose content, and sugar-loss-to-molasses, performed by the Western Sugar Cooperative Tare Lab in Billings, MT.

Results
Results are presented in Table 1. Correlation of disease rating vs. yield was 0.72, lower than in years past, but still highly correlated. The Kabina, Vibrance, and Stamina+Systiva 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 in these disease classes are considered to be safe for storage (Campbell), and as the recoverable sugar yield per acre. Quadris applied at the 4-8 leaf stage and the 10-12 leaf stage, and Priaxor applied at 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 2015 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). In 2015, no statistical differences were found between seed treatments. This may be due to weather conditions being hotter and drier on average. Data from 2011, 2012, and 2013 have indicated that a combination of Kabina (14g/unit) and a Quadris band application between the 4-12 leaf stage were equal to a properly timed Quadris band treatment applied at 65°F. 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.

Table 1. Data from 2015 Rhizoctonia Management Trials at Huntley, MT

Post-emergence treatment	Pre-emergence treatment	Huntley-SARC				
		Disease Index (0-100)	% roots in Ruppel classes 0-3 rating	Net Root Yield (tons/acre)	Recoverable Sugar per acre (lb/a)	Recoverable Sugar per Ton (lb/ton)
None	Uninoculated	17.0 c	87.9 a	32.7 a	9,910 a	304.7 a
	Inoculated	52.8 ab	52.5 b	21.4 b	5,791 b	266.1 b
	Kabina 10 g	71.4 a	27.2 c	21.0 b	5,790 b	273.4 b
	Kabina 14 g	61.0 ab	41.8 bc	19.4 b	5,458 b	267.9 b
	Vibrance 2.5 g	52.6 b	50.9 b	24.3 ab	6,530 b	269.1 b
	Stamina 15 g + Systiva 2.5 g	62.2 ab	40.0 bc	19.2 b	5,005 b	254.0 b
	Stamina 15 g + Systiva 5 g	58.7 ab	44.6 bc	22.3 b	5,782 b	255.3 b
Quadris at 4-8 leaf	Uninoculated	17.3 b	83.0 a	31.4 a	9,359 a	296.7 a
	Inoculated	35.0 ab	66.8 ab	30.3 a	9,250 a	304.0 a
	Kabina 10 g	46.9 a	55.5 b	28.5 a	8,112 a	282.9 a
	Kabina 14 g	40.7 a	61.9 b	31.2 a	9,314 a	300.4 a
	Vibrance 2.5 g	47.3 a	51.6 b	25.9 a	7,467 a	283.0 a
	Stamina 15 g + Systiva 2.5 g	39.5 a	62.2 b	28.4 a	8.406 a	293.7 a
	Stamina 15 g + Systiva 5 g	39.1 a	62.7 b	29.7 a	8,593 a	291.6 a
Quadris at 10-12 leaf	Uninoculated	10.0 c	91.5 a	38.5 a	11,668 a	303.2 a
	Inoculated	24.8 bc	76.6 ab	32.9 ab	9,869 ab	301.0 a
	Kabina 10 g	46.1 a	57.5 bc	29.6 b	8,451 b	285.7 a
	Kabina 14 g	45.3 a	56.6 c	28.6 b	8,183 b	287.2 a
	Vibrance 2.5 g	28.5 abc	73.9 abc	31.1 ab	8,994 ab	285.3 a
	Stamina 15 g + Systiva 2.5 g	35.7 ab	64.7 bc	29.9 b	8,767 b	292.6 a
	Stamina 15 g + Systiva 5 g	33.8 ab	67.9 bc	33.8 ab	10,014 ab	298.1 a
Priaxor at 10-12 leaf	Uninoculated	16.9 b	85.0 a	37.0 a	11,276 a	304.5 a
	Inoculated	40.3 a	62.7 b	26.0 b	7,360 b	278.1 b
	Kabina 10 g	41.5 a	60.2 b	27.0 b	8,056 b	295.6 ab
	Kabina 14 g	42.2 a	59.7 b	30.4 ab	9,185 ab	301.1 ab
	Vibrance 2.5 g	46.1 a	55.4 b	28.7 ab	8,554 b	298.5 ab
	Stamina 15 g + Systiva 2.5 g	46.3 a	54.9 b	28.8 ab	8,571 b	285.8 ab
	Stamina 15 g + Systiva 5 g	44.2 a	58.6 b	29.9 ab	8,903 ab	299.0 ab

1) Disease index calculated on Ruppel Scale (0-7) where 0% represents no disease and 100% represents completely rotten roots
2) % roots in Ruppel class (0-3) represent the percentage of roots believed to store well based on USDA-ARS Fargo research.
3) Means within a treatment grouping and column followed by a different letter are considered different at $p<0.05$.