INTEGRATED MANAGEMENT STRATEGIES FOR RHIZOCTONIA CROWN AND ROOT ROT

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Introduction

Rhizoctonia crown and root rot caused by the fungus, *Rhizoctonia solani* AG 2-2 is one of the most damaging sugarbeet diseases worldwide. Losses are highest in warm, irrigated, production areas where sugarbeets are planted intensively. Once soil populations of this fungus are built up, rotation is of little value and growers are dependent on relatively ineffective cultural controls such as avoiding cultivating soil into the row, maintaining adequate, balanced fertility for good crop growth and maintaining adequate soil drainage. However, maintaining rotations with non-host crops such as corn or small grains and avoiding beans or alfalfa before beets will help keep soil populations of this strain of Rhizoctonia low. Where disease pressure is high, growers can plant specialty varieties with resistance. Available resistance is incomplete and these varieties typically have yield potentials 10-15% less than the best approved varieties, although some newer varieties such as Beta 4546 used in this research are 0-10% lower yielding than the best approved varieties. However, these varieties may not have other important disease resistant characteristics. Because predicting disease development and loss is difficult, growers have long wanted a control where yield potential is not compromised. Since 1995, we have explored the potential for chemical control by preventing crown infections of young plants. Our research and that of others clearly shows that most infections occur through the crown from sclerotia deposited there primarily during cultivation and that application of effective fungicides to the crown prior to cultivation will provide good control. Research from 1995-1998 served as the basis for a Section 18 label for Quadris. Data summarizing Quadris data from 1997-2000 are shown in Table 1. 1997 was a year of high disease severity while 2000 was of moderate disease severity and 1998 and 1999 were years of low disease severity based on the effects of inoculation. Our objective in 2000 trials was to evaluate proven fungicides and experimental fungicides on both a high yielding susceptible variety (Beta 8754) and a high yielding resistant variety(Beta 4546).

Materials and Methods

Research was done at the Eastern Agricultural Research Center at Sidney, MT on a Savage silty-clay loam soil in 1997-1999 and at the Southern Agricultural Research Center at Huntley, MT in 2000. The plot design was a split plot (varieties) randomized complete block with six replications. Plots were single rows 30 ft long and all plots except the uninoculated controls were inoculated with 14 grams / plot of ground barley infected with *R. solani* AG 2-2 at the 4 leaf stage. Fungicide applications were made just prior to application of inoculum at the 4 leaf stage or at the eight leaf or at row closure using a 6 inch band applied over the row with a single Spraying Systems 8002 VS nozzle @30psi= 18 gallons/acre. Following application plots at the 4 leaf stage plots were cultivated and irrigated. Plots were harvested in late September and rated for Rhizoctonia root rot on the 0-7 scale (Rupple et. al., 1979) and samples sent to Holly Sugar(1997-1999) or Western Sugar (2000) for determination of tare, % sugar and sugar loss to molasses.

Results

Results for Quadris(1997-2000) are presented are presented in Table 1. Overall the Quadris 0.075 oz.ai./1000 row ft. treatment applied at the 4 plus 8 leaf stage appears to be the best treatment although the 0.15 oz. ai./1000 row ft. rate applied at the 4 leaf stage treatment provided significant returns. Results of the 2000 study comparing resistant and susceptible varieties showed a clear advantage for planting the resistant Beta 4546 with this variety out yielding the susceptible variety by 1252 lbs. of sugar per acre(LSD @ 0.05=365 Lbs.). Loss in yield from inoculation was greater for the susceptible variety 1133 lbs. of sugar compared to 958 lbs. for the resistant variety. There was a significantly lower disease index for the resistant Beta 4546. When comparing timing on the susceptible variety it appears that application of Quadris @ 0.15 oz. ai./1000 row ft provides the best results at either the 4+8 leaf or at the 8 leaf stage with these treatments being equal to the 0.075 oz. rate of Quadris applied at the 4+8 leaf stage. Unlike work by Windels and Brantner (1999) our work showed little effect from row closure treatments. Flint @0.15 oz. applied at the 4 leaf stage provided control equal to Quadris at the same rate, but other Flint treatments did not increase yield. All treatments except BAS 500 provide significantly lower disease ratings than the inoculated check on Beta 8754. There were no significant effects on either yield or disease severity on the resistant Beta 4546.

Table 1. Effect of various rates and timing of Quadris on extractable sugar yield per acre in 1997, 1998, 1999 and 2000 through control of Rhizoctonia crown and root rot.

Treatment oz. ai. /1000row ft.-timing	Extractable Sucrose/Acre				
	1997	1998	1999	2000	Average 1998-2000
non inoculated check	7400*	6981	9725	9783	8830*
inoculated check	5380	6236	8843	8650	7910
Quadris 0.075-4 leaf	nd	7384	7896	nd	
Quadris 0.075-4+ 8 leaf	nd	7673	9396	10706*	9256*
Quadris 0.1-4 leaf	6920*	nd	nd	nd	
Quadris 0.15-4 leaf	nd	7176	9282	8893	8450*
Quadris 0.15-8 leaf	nd	nd	nd	10308*	
Quadris 0.15-4+8 leaf	nd	nd	nd	10168*	
Quadris 0.15-row closure	nd	nd	nd	9087	
Quadris 0.2-4 leaf	6120	nd	8935	nd	
FLSD P=0.1	945	1474	956	1376	523

*=significantly different from inoculated check

Table 2. Effect of crown applied fungicides on yield of susceptible (Beta 8754) and resistant (Beta 4546) sugarbeet inoculated with Rhizoctonia solani AG 2-2 at Huntley, MT in 2000.

	Yield Ton / Acre		Disease Index (0-100)		Extractable Sucrose/Acre	
Treatment oz. ai.1000 row ft	Beta 8754	Beta 4546	Beta 8754	Beta 4546	Beta 8754	Beta 4546
non inoculated	30.1*	33.4*	12.7*	9.4	9783*	11282
inoculated	25.9	30.4	28.1	10.9	8650	10324
Quadris 0.075 4+8 leaf	31.9*	30.6	9.1*	10.4	10705*	10289
Quadris 0.15- 4 leaf	27.9	35.2*	21.2*	10.5	8893	11671
Quadris 0.15-8 leaf	30.3*	31.6	14.8*	11.8	10308*	10423
Quadris 0.15-4+8 leaf	30.5*	32.7	11.7*	13.3	10168*	11272
Quadris 0.15-row close	27.8	32.4	18.9*	10.1	9087	10472
Moncut 0.367-4+8 leaf	27.0	32.0	17.4*	9.2	8575	10847
Flint 0.075-4 leaf	30.8*	31.5	23.0*	16.6	10217*	10416
Flint 0.075-4+8 leaf	29.3*	28.7	18.8*	15.9	9528	9910
Flint 0.075-8 leaf	24.8	31.5	21.2*	10.4	8328	10556
Flint 0.075-row close	27.5	33.8*	22.1*	13.6	8930	11085
Flint 0.15-4 leaf	28.1	29.3	16.8*	8.4	9039	9740
BAS 500 0.15-4 leaf	26.2	31.0	23.7	14.4	8488	9939
FLSD P=0.05	2. 96		5..5		967	

*=significantly different from inoculated check.

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