INTEGRATED MANAGEMENT STRATEGIES FOR RHIZOCTONIA CROWN AND ROOT ROT

Barry Jacobsen[1], Nina Zidack[1], Ken Kephart[2], and John Ansley[1]
1. Department of Plant Sciences and Plant Pathology, Montana State Univerity, Bozeman, MT. 2. Montana Agricultural Experiment Station -Southern Agricultural Research Center, Huntley, MT.

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 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 1995-2000 served as the basis for a full EPA label for Quadris in 2000. Data summarizing Quadris data from 1998-2002 are shown in Table 1. 2002 and 2001 were years 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. Disease severity in 2002 was the highest seen in our research on this topic. Two factors favored disease development, severe curly top virus infection and very warm conditions following inoculation.

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, 2001 and 2002. The plot design was a 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 8, 10, 12-14 leaf stage 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, 2001,2002) for determination of tare, % sugar and sugar loss to molasses.

Results: Results for Quadris(1998-2002) 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. In 2000 and 2001, the 0.15 oz ai./1000 row ft applied at the 8 leaf stage provided statistically equal yields to applied at the 4 leaf stage.

Table 1. Effect of various rates and timing of Quadris on extractable sugar yield per acre in 1998, 1999, 2000 and 2001through control of Rhizoctonia crown and root rot.

Treatment oz. ai. /1000row ft.-timing	Extractable Sucrose/Acre					
	1998	1999	2000	2001	2002	Average 1998-2002
non inoculated check	6981	9725	9783	9758 *	4375 *	8119*
inoculated check	6236	8843	8650	7313	65	6221
Quadris 0.075-4+ 8 leaf	7673	9396	10706*	10048*	3347 *	8234*
Quadris 0.15-4 leaf	7176	9282	8893	9254	3315* (0.4 oz)	8651*
Quadris 0.15-8 leaf	Nd	nd	10308*	9809*	0	
Quadris 0.15-4+8 leaf	Nd	nd	10168*	nd	3394 *	
FLSD P=0.1	1474	956	1376	2140	834	503

*=significantly different from inoculated check

Data for the effect of Quadris, Gem, Headline, Topsin M, Blocker and MSU 127 on control of Rhizoctonia crown and root rot on the variety Beta 8754 in 2002 at Huntley are given in Table 2.

Table 2. Results of 2002 Rhizoctonia Crown and Root Rot Control Trials-Huntley, MT

Treatment	Timing	Sucrose/A	Disease Index 0-100
Uninoculated		4375 a	32.2 g
Inoculated	4 leaf	65 f	87.0 a
Blocker 4 F 10 pt/A	4 leaf	87 f	86.7 a
Topsin M 0.335 oz./1000 row ft.	4 leaf	343 def	84.1 abc
Topsin M 0.67 oz./1000 row ft.	4 leaf	171 ef	84.8 abc
Topsin M 0.67 oz./1000 row ft.	8 leaf	124 f	86.4 ab
Topsin M 0.335 oz./1000 row ft.	4 + 8 leaf	65 f	86.1 ab
Topsin M 0.67 oz./1000 row ft	4 + 8 leaf	593 def	81.1 abc
Quadris 0.4 oz. ai. 1000 row ft.	4 leaf	3315 ab	47.0 f
Quadris 0.2 oz. ai. 1000 row ft.	4 +8 leaf	3757 a	46.9 f
Quadris 0.15 oz. ai. 1000 row ft. + MSU 127	4 + 8 leaf	3394 ab	46.5 f
Quadris 0.15 oz. ai. 1000 row ft. + MSU 127	8 leaf	0 f	87.5 a
Quadris 0.075 oz. ai. 1000 row ft. + MSU 127	4 +8 leaf	3347 ab	48.9 f
Gem 0.075 oz. ai. 1000 row ft.	4 +8 leaf	2232 bc	61.9 e
Gem 0.15 oz. ai. 1000 row ft.	4 leaf	1634 cd	66.6 de
Headline 0.15 oz. ai. 1000 row ft.	4 +8 leaf	1458 cde	73.5 cde
Headline 0.075 oz. ai. 1000 row ft. +MSU 127	4 +8 leaf	802 def	79.5 abc
Headline 0.15 oz. ai. 1000 row ft	6-8 leaf	22 f	87.4 a
Headline 0.15 oz. ai. 1000 row ft +MSU 127	4 + 8 leaf	2205 bc	65.2 de
Headline 0.15 oz. ai. 1000 row ft +MSU 127	10 leaf	129 f	85.3 abc
Headline 0.15 oz. ai. 1000 row ft +MSU 127	4 leaf	1170 cdef	74.3 bcd

Variety: Beta 8754 **Planted:** 4/26/02**, Harvested** 10/14/02

Ground barley inoculum applied @ 4 leaf stage, 6/17/02, at approximately 15 grams/30 row ft. 8 leaf spays applied 6/26/02 and 10 leaf spray applied 7/3/02.

Disease Index: ratings done at harvest using Rupple 0 (no disease)**-**7 root (completely rotted), the # of roots in each class are multiplied by the class number and the sum of all class products divided by the number of classes X the total # of roots and this quotient X 100. Thus an index of 0= no disease and 100 = 100% of roots completely rotted.

Note: Yield were reduced by an epidemic of beet curley top virus. Disease incidence appeared uniform across the plots

Only Quadris, Gem and Headline at the 4 or 4 + 8 leaf stage treatments increased yield and only the Quadris treatments reduced disease severity. Quadrsi provided the best performance followed by Gem 4 + 8 leaf and 4 leaf stage. Headline was less effective. The biological MSU 127 increased yield where Headline was applied at 0.15 oz. ai./1000 row ft at the 4 + 8 leaf stage. Applications at the 8 leaf stage were ineffective under these severe conditions. Blocker (PCNB) and Topsin M were not effective.

This research was supported by the Western Sugar Joint Grower Research Board, The Montana Agricultural Experiment StationBeta Seeds, Bayer, BASF, Pennwalt and Syngenta companies.