EFFECT OF FUNGICIDE SEED, IN-FURROW AND BAND TREATMENTS ON RHIZOCTONIA CROWN AND ROOT ROT IN MONTANA

Barry J. Jacobsen[1], Ken Kephart[2], Alice Pilergam[1], Sherry Turner[3] and Joyce Eckhoff[3]

1. Department of Plant Sciences and Plant Pathology, Montana State University, Bozeman, MT. 59717-3150, 2. Montana Agricultural Experiment Station, Southern Agricultural Research Center, Huntley, MT. and 3. Montana Agricultural Experiment Station, Eastern Agricultural Experiment Station, Sidney, MT

Introduction

Rhizoctonia crown and root rot occurs in every region that sugarbeets are grown. The disease is caused by a complex of Rhizoctonia solani 2-2 isg IV and isg III B, with the isg III B become more predominant in areas where corn is significant in rotations. Since the labeling of azoxystrobin (Quadris) in the mid 1990s growers have used banded and infurrow applications of this fungicide or products such as Headline, Gem or Proline. Efficacy of banded applications was greatly improved when researchers (Jacobsen, Khan) showed that applications must be made before soil temperatures at the 4 inch depth exceeded 70F and after soils at this depth were 60F, rather than a specific growth stage. However, timing for late planting or springs when soils warm up quickly was a problem or where growers often has a small window for optimal timing. In our 16 years of Rhizoctonia timing and application research in MT, the period for optimal timing ranged from 3-17 days depending on the spring. Growers with large acreages frequently could not get optimal timing on all their acres. While Rhizoctonia resistant varieties are available, they frequently have lower yield potential, do not have a full component of other disease resistances such as Rhizomania, Curly Top, Aphanomyces, Fusarium Yellows, and Cercospora and in our experience have also responded similarly to susceptible varieties to properly timed fungicide applications with both increased yields and reduced disease severity.

This research was initiated to determine if a combination of seed treatments or infurrow fungicide application could be combined with banded fungicide applications such that growers would have a larger window to apply banded fungicide applications and achieve a high level of control. Seed treatment fungicides will give some protection but alone do not provide satisfactory control. Infurrow fungicide applications have given inconsistent control with control being excellent in some years and poor in other years. In comparison, properly time band applications have always given the best control in our research and that of most others. Also based on our storage work and that of Campbell and Fugate with Rhizoctonia infected beets it has been that demonstrated that even a small percentage of infected beets will result in severe decay in the storage pile due to decay caused by Rhizoctonia, secondary bacteria and fungi. Beets in Rupple disease classes 4,5, or 6 are the highest risk with those in classes 0-3 having much lower storage risk. Thus improved control of Rhizoctonia crown and root rot is needed to reduce both field and storage losses.

The Rhizoctonia problem in MT appears to be increasing in severity. I believe the primary reason is that our most popular varieties are more susceptible than varieties of 5-10 years ago. Also dramatic increase of corn in the rotation is suspected to contribute to higher inoculum levels in fields.

Based on work by Windels and her group we chose to closely examine penthiopyrad seed treatments as part of the package. Infurrow work done by the Michigan group indicated that infurrow applications of Quadris could also be part of the package.

Methods and Materials

Research was done in 2014 at the Southern Agricultural Research Station at Huntley, MT and at the Eastern Agricultural Experiment Station at Sidney, MT . The soil type at Huntley was a Yellowstone silty clay loam and at Sidney a Savage silty clay loam. Both research fields were inoculated with 39 lb./A of Rhizoctonia infested barley. Inoculum was incorporated with a K tool. Inoculum was applied 7 days before planting at Huntley and 3 weeks before planting at Sidney. The delay at Sidney was due to wet conditions. The variety BTS 39RR8N was used in both plots and both plots used 24 inch row spacing. A base treatment of 60 gm/unit Poncho and 8 gm /unit Beta

+Thiram 42S @5.75 gm/unit, Apron XL @0.48 gm/unit and Tachigaren @20 gm/unit was applied to all seed. Kabina was applied at 10 and 14 gram/unit, Metlock-Rizolex was applied at 0.0155 fl oz + 0.031 fl oz/unit and Vibrance at 2.5 gram/unit. ASTEC of Sheridan, WY applied all seed treatments and made 4 M pellets. Infurrow applications of Quadris were done at 0.38 oz, Priaxor at 0.28 and Veritisan at 1.2 oz/ 1000 row ft. Infurrow applications were done with a CO_2 sprayer @25 PSI with a single 8002 nozzle in a 3 inch band applied just behind the furrow opener. Band applications were 0.38 oz Quadris or 0.28 oz Priaxor /1000 row ft applied with a CO_2 sprayer @30 PSI with a single 8002 nozzle in a 7 inch band. Band applications were made when soil temperatures reached 65F at the 4 inch level (4-6 leaf stage) or at the 10-12 leaf stage.

Plot design was a split plot with post-emergent band treatments as whole plots and pre-emergence treatments as split plots. Six replicates of 3 rows, 30 ft. long were used. Each harvested root was rated on the Rupple 0-7 scale and tare, sugar and SLM data were done by Western Sugar or Sidney Sugars. Rhizoctonia root ratings were normalized by conversion to a disease index to give values 0-100 with 0 equaling no disease and 100 completely rotted roots.

Results

Results are given in Table 1. Disease severity was lower at Sidney than at Huntley. Correlation of disease rating v yield was 0.94 for Hunley data and 0.19 for Sidney data. Seed treatments applied alone did not provide control. Control is measured as a combination of Disease Index, high percentage of roots in the Rupple 0-3 classes and yield of extractable sucrose At Sidney, only Quadris applied infurrow , at 65F, or Quadris 10-12 leaf + Quadris or Priaxor infurrow provided control whereas at Huntley, Quadris and Priaxor applied at the 10-12 leaf stage with or without Priaxor applied in-furrow at planting provided significant control. At Sidney the best control was achieved by combinations of Quadris applied infurrow followed by Priaxor or Quadris applied in 7" band at the 10-12 leaf stage. At Huntley Priaxor and Quadris applied at the 10-12 leaf stage provided optimal control when applied alone.. Combinations of Kabina (10g) and Vibrance seed treatments with Quadris at 10-12 leaf and Kabina 14 gm with Priaxor at 10-12 leaf also provided good control at Huntley. When considering only disease index, at Sidney all Quadris 65 F and Quadris infurrow followed by either Quadris or Priaxor at 10-12 leaf were superior treatments. At Huntley relative to disease% roots with Rupple ratings of 0-3 index Quadris or Priaxor infurrow, and all treatments with Quadris 65F, or Quadris or Priaxor 10-12 leaf provide improved control. At Sidney there was no improvement in % roots with Rupple ratings of 0-3 or in yield. Yield at Huntley compared to untreated was improved by either Quadris or Priaxor infurrow and all treatments with Quadris or Priaxor applied post emergence. At both locations improved disease control was strongly associated with increased sugar/ton.

Conclusions

Data in 2014 was somewhat different than in prior years in that combinations of Kabina seed treatments with post emergent band sprays were not equal to infurrow applications of Quadris or Priaxor. In 2011, 2012, and 2013 research the combination of penthiopyrad seed treatment at the 14 g/kg seed and Quadris band application at 4-12 leaf stages provided reduced disease severity, equal to a properly timed Quadris band treatment at 65F (4-6 leaf stage). In 2014 the Kabina 14 g treatment was not as good as the 10 gm treatment and misapplication is suspected since in other years there was no difference between Kabina applied at the 7, 14 or 28 g/unit levels. Vertisan applied infurrow was not as effective as either Quadris or Priaxors infurrow treatments. Priaxor has been tested infurrow in 2013 and 2014 with good results, The infurrow Quadris treatment plus band treatments at up to the 12 leaf stage provide good disease control. It should be pointed out that the 14g/kg Kabina seed treatment rate is ~ $1/200^{th}$ of the amount of fungicide as applied with the infurrow treatments. Based on 3 of 4 years of research growers should be excited about the prospects of a seed treatment or in 4 years infurrow treatments that will allow them to apply band treatments at any time from the 4 to the 12 leaf stages, allowing nearly 3 weeks to apply band treatments successfully. Thus the combination of penthiopyrad seed treatment or Quadris or Priaxor infurrow treatments and Quadris or Priaxor (2014 only) band treatment will allow a wider band treatment window than

temperature based spray scheduling. It should be pointed out that there is no label for use of Priaxor infurrow at this time.

Table1. Data from 2014 Integrated Sugarbeet Rhizoctonia Management Trials at Sidney and Hunley, MT

Pre -emergence treatment	Post emergence treatment	Sidney-EARC			Huntley-SARC		
		Disease index 0-100[1]	% roots in Rupple classes 0-3 rating[2]	Extractable Sucrose Lb/A	Disease index 0-100	% roots in Rupple classes 0-3 rating	Extractable Sucrose Lb/A
Un-inoculated	None	36.8 d[3]	95.8 ab	12213 a	28.0 a	73.2 a	9802 a
Inoculated	None	54.6 abc	74.1 de	11594 ab	83.7 d	17.0 d	2859 d
Kabina 10 gm	None				70.8 bcd	29.1 bcd	4529 cd
Kabina 14 gm	None	63.6 a	69.0 ef	9631 b	81.0 d	17.6 d	3246 d
Metlock-Rizolex	None				73.7 cd	26.2 cd	3813 cd
Vibrance	None	61.9 ab	65.7 f	11324 ab	80.6 d	21.2 d	3044 d
Quadris IF	None	44.0 cd	84.7 a-e	12772 a	55.1 bc	45.1bc	6491 bc
Priaxor IF	None	46.7 bcd	76.7 de	11948 ab	50.4 b	49.1 b	7468 ab
Vertisan IF	None	49.2 a-d	75.8 de	11548 ab	65.5 bcd	34.7 bcd	5039 bcd
Un-inoculated	Quadris @ 65 F	25.9 b	94.3 ab	12679 a	20.8 a	80.2 a	10757 a
Inoculated	Quadris @ 65 F	43.1 a	81.3 a-f	11805 ab	73.1 b	27.4 bc	4618 bc
Kabina 10 gm	Quadris @ 65 F				74.9 b	25.6 c	3987 c
Kabina 14 gm	Quadris @ 65 F	46.2 a	78.5 c-f	11418 ab	64.5 b	37.2 bc	6002 bc
Metlock-Rizolex	Quadris @ 65 F				63.4 b	35.0 bc	6121 bc
Vibrance	Quadris @ 65 F	50.5 a	78.3 c-f	10226 b	57.1 b	41.8 bc	6577 bc
Quadris IF	Quadris @ 65 F	37.0 ab	82.8 a-e	11958 ab	61.6 b	36.5 bc	7507 b
Priaxor IF	Quadris @ 65 F	42.3 a	86.0 a-d	11365 ab	53.4 b	49.0 b	7132 b
Vertisan IF	Quadris @ 65 F	42.1 a	86.0 a-d	12676 a	61.0 b	39.7 bc	6291 bc
Un-inoculated	Quadris 10-12 lf	37.9 c	97.7 a	12907 ab	10.2 a	91.5 a	11270 a
Inoculated	Quadris 10-12 lf	64.4 a	69.0 ef	10217 c	50.0 bc	53.1 bc	6690 c
Kabina 10 gm	Quadris 10-12 lf				47.4 bc	53.7 bc	7079 bc
Kabina 14 gm	Quadris 10-12 lf	50.8 abc	83.8 a-e	12158 abc	65.5 c	31.2 c	5722 c
Metlock-Rizolex	Quadris 10-12 lf				65.2 c	37.3 c	6369 c
Vibrance	Quadris 10-12 lf	57.4 ab	77.5 def	11069 bc	52.7 bc	51.6 bc	6996 bc
Quadris IF	Quadris 10-12 lf	38.6 c	87.8 a-d	13122 ab	59.7 c	38.8 c	6519 c
Priaxor IF	Quadris 10-12 lf	45.2 bc	81.0 b-f	12569 abc	35.7 b	66.4 b	9738 ab
Vertisan IF	Quadris 10-12 lf	49.0 abc	80.8 b-f	13534 a	48.6 bc	51.7 bc	7694 bc
Un-inoculated	Priaxor 10-12 lf	40.2 ab	97.0 ab	11291 ab	9.5 a	92.0 a	11364 a
Inoculated	Priaxor 10-12 lf	49.0 ab	77.5 def	10669 ab	41.9 b	61.4 b	8813 ab
Kabina 10 gm	Priaxor 10-12 lf				60.3 bcd	41.9 bc	5755 cde
Kabina 14 gm	Priaxor 10-12 lf	52.8 a	74.8 de	9800 b	51.8 bc	47.3 bc	7723 bcd
Metlock-Rizolex	Priaxor 10-12 lf				74.1 d	27.8 c	4561 e
Vibrance	Priaxor 10-12 lf	49.2 ab	74.5 de	11584 ab	73.1 cd	28.1 c	4970 de
Quadris IF	Priaxor 10-12 lf	35.0 b	90.7 a-d	12667 a	54.7 bcd	45.9 bc	7032 bcd
Priaxor IF	Priaxor 10-12 lf	39.5 ab	86.0 a-d	11573 ab	39.9 b	60.7 b	9606 ab
Vertisan IF	Priaxor 10-12 lf	41.9 ab	88.7 a-d	12827 a	45.4 b	57.0 b	8043 bc

1) Disease index calculated on Rupple scale of 0 (no disease)-7 (completely rotted roots) and the value 0 = no disease and 100 completely rotted roots
2) % storable is the % roots on the Rupple 0-3 ratings. Beets with 3 or less ratings will store well based on USDA/ARS Fargo research.
3) Numbers followed by different letters are significantly different at $P< 0.05$.