CONTROL OF RHIZOCTONIA CROWN AND ROOT ROT WITH SEED TREATMENTS AND POST APPLIED FUNGICIDES IN COMMERCIAL GROWER FIELDS

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Rhizoctonia Crown and Root Rot (RCRR) have dramatically increased in the last decade in the Red River Valley to the point where it is now the most severe root disease impacting yield and quality. Yield losses when environmental conditions favor the disease can exceed 30%. Occasionally disease severity in a field is so great that the field will not be accepted for long term storage and has to be abandoned. University research using fungicides shows that they are a viable option for disease management but they are tested under controlled, usually inoculated conditions which leaves growers asking if the individual fungicide or combination of fungicides perform similar within their variable field environment. Options including newly labeled seed treatments, at plant fungicide applications and post emergence applied fungicides have growers wondering if they need to be looking at season long approaches to combatting this disease or if they can get by with one timely application and achieve maximum returns.

OBJECTIVE

To determine a fungicide management strategy for highest economic returns to MN and ND Red River Valley sugarbeet growers, using currently labeled fungicides for Rhizoctonia crown and root rot, in a commercial sugarbeet field setting.

MATERIAL AND METHODS

In 2011 and 2012 strips using SES Vanderhave commercial varieties with and without seed treated fungicides were planted into Glyndon association soil on Peter and Roberta Carson's farm near St. Thomas ND. The strips were planted at 4.5" seed spacing using the growers 12 row Monosem planter and each plot individually harvested with an Amity 6 row commercial harvester. In both years the band applied fungicides, at the 4-6 leaf stage, were in a 7" band and at 5 gallons/acre. The broadcast application was at full rows closed and 15 gallons/acre. Treatments in both years were randomized and replicated 4 times. Post emergence applications were based on sugarbeet leaf stage and not 4" soil temperatures. Fertility, weeds and insects were controlled based on best management practices for the grower's farm. Cercospora was controlled based on date of initial spots and weather.

In 2011 SES Vanderhave 36813 with and without Dynasty fungicide seed treatment was planted on May 18. Each treatment plot was 11 ft wide (6-22" rows) by 2375' long. Average daily soil temperatures at 4" below soil surface were recorded from a nearby North Dakota Agricultural Weather Network (NDAWN) weather station. Products used, use rates and timings included: Dynasty (Azoxystrobin) as a fungicide seed treatment on the seed coat at planting. Quadris (Azoxystrobin) was used at 9.5 fl oz/acre and band applied at the 4-6 leaf stage. Proline (Prothioconazole) was broadcast applied at 5.7 fl oz/acre on full rows closed sugarbeets. The treatments included: 1) Check – Non Dynasty (ND) treated seed alone, 2) ND followed by (*fb)* Quadris, 3) ND *fb* Proline, 4) ND *fb* Quadris *fb* Proline, 5) Dynasty treated (DT) seed alone, 6) DT *fb* Quadris, 7) DT *fb* Proline, 8) DT *fb* Quadris *fb* Proline. Banded application of Quadris

was on June 16 and Proline broadcast applied on Aug 1. On Aug 26 all plots received a 9.0 oz/acre Headline application for Cercospora. Two reps of the test were harvested on Oct 17 and 2 reps harvested on Oct 18. Three subsamples from each load were taken and sent to the American Crystal Sugar Company lab in East Grand Forks MN to determine quality

In 2012 SES Vanderhave 36812 with and without Metlock fungicide seed treatment was planted on Apr 26. Each treatment plot was 11 ft wide (6-22" rows) by 2250' long. Average daily soil temperatures at 4" below soil surface were recorded from portable weather recording equipment located within the field boundaries. Stand counts were made on May 10, 21 and Jun 1. Stand counts consisted of 4-25' lengths of row per plot. Products used, use rates and timings included Metlock (Metconazole) as a fungicide seed treatment applied to the seed coat at planting. Quadris (Azoxystrobin) was used at 10.0 fl oz/acre and band applied at the 4-6 leaf stage. Proline (Prothioconazole) had two application timings one band applied at the 4-6 leaf stage and one broadcast applied on full rows closed sugarbeets. The use rate of Proline was 5.7 fl oz/acre for both application timings. Proline treatments with (L) following indicate the later rows closed application time. Headline EC (Pyraclastrobin) was used at 9 fl oz/acre at planting. The Headline was applied as a 4" T-band at 4 gallons/acre (GPA). Vertisan (Penthiopyrad) was applied as a T-band at plant and as a post emergence treatment at the 4-6 lf stage. Vertisan rates used in T-band were either 19.0 fl oz/acre at 4 GPA or 28.5 fl oz/acre at 6 GPA. The post emergence applied Vertisan was band applied at 19.0 fl oz/acre. The treatments included 1) Check – Non Metlock (NM) treated seed alone, 2) NM *fb* Quadris, 3) NM *fb* Proline, 4) NM *fb* Proline (L) 5) NM *fb* Quadris *fb* Proline (L), 6) Metlock treated (MT) seed alone, 7) MT *fb* Quadis, 8) MT *fb* Proline, 9) MT *fb* Vertisan, 10) MT *fb* Proline (L), 11) MT *fb* Quadris *fb* Proline, 12) Headline T-banded at plant with NM (HTBNM) seed alone, 13) HTBNM *fb* Quadris, 14) HTBNM *fb* Proline, 15) HTBNM *fb* Proline (L), 16) HTBNM *fb* Quadris *fb* Proline (L), 17) Headline T-banded at plant with MT (HTBMT) seed alone, 18) HTBMT *fb* Quadris , 19) HTBMT *fb* Proline, 20) HTBMT *fb* Proline (L), 21) HTBMT *fb* Quadris *fb* Proline (L), 22) Vertisan T-banded at plant (VTB) @ 19.0 fl oz/acre alone, 23) VTB @ 28.5 fl oz/acre alone, 24) Vertisan @ 19.0 fl oz/acre (4-6 leaf stage), 25) VTB @ 19.0 fl oz/acre *fb* Vertisan @ 19.0 fl oz/acre (4-6 leaf stage), 26) Vertisan (VTB) @ 19.0 fl oz/acre *fb* Quadris. All Vertisan treatments were applied to non Metlock seed. Banded application of Quadris, Proline and Vertisan was made on May 26 and Proline broadcast applied on July 20. Broadcast applications for Cercospora included Inspire 7 fl oz/acre on July 20, Agri Tin 8 fl oz/acre on Aug 13 and Headline 9.0 fl oz/acre on Aug 27. Two reps of the test were harvested on Sept 24, one rep on Sept 25 and the last rep harvested on Sept 26. Three subsamples from each load were taken and sent to the American Crystal Sugar Company lab in East Grand Forks MN to determine quality.

RESULTS

2011 Results

Figure 1. Recorded average daily temperatures at 4" soil depth of St. Thomas fungicide test.

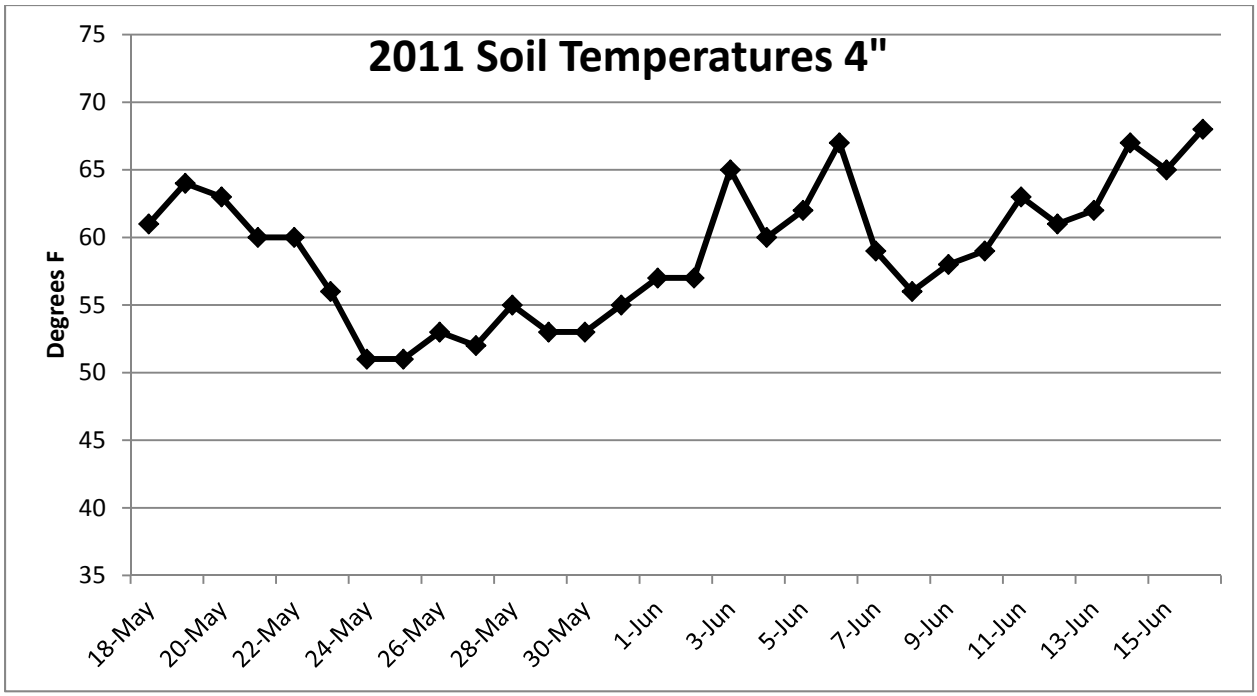

Table 1. Revenue, yield and quality results from 2011 fungicide strip trial near St. Thomas ND.

Treatment	Revenue/acre (Dollars)	RSA (Lb/acre)	Tpa (Tons)	RST (Lb/ton)	Sugar (%)	Slm (%)	Tare (%)
Quadris	1265	8739	25.6	343	18.3	1.15	1.92
Quadris *fb* Proline (L)	1259	8722	25.6	341	18.2	1.13	1.28
Dynasty *fb* Quadris	1237	8655	25.7	337	18.0	1.17	1.93
Dynasty *fb* Quadris *fb* Proline (L)	1216	8510	25.3	337	18.0	1.19	1.84
Proline (L)	1072	7523	22.4	335	17.9	1.16	1.90
Check	1036	7314	22.0	332	17.9	1.23	2.08
Dynasty *fb* Proline	1036	7378	22.5	329	17.6	1.20	1.79
Dynasty	1004	7145	21.8	329	17.7	1.21	1.80
LSD (*P=0.05*)	63	357	1.0	8	0.4	0.07	0.75
CV	3.8	3.0	2.8	1.7	1.5	4.07	27.9

Discussions centering on soil temperatures versus beet size have been and continue as a source of confusion among growers and consultants. Figure 1 showed we were near the 65^{o}F threshold about the time we were planting then cooled down for the next couple weeks and finally exceeded 65^{o}F about 2 weeks after planting but about 2 weeks before application. The data indicates that a Quadris application at the 4-6 leaf stage was the most beneficial. The late Proline application alone was numerically better than the check. In both years of this test the late Proline application was looked at as a possible rescue treatment in the event an application at the 4-6 leaf stage wasn't available or if there may be some additional benefit in a season long approach. The late Proline application is not being looked at as a possible optimal timing. In

this test Dynasty treated seed seemed to have a negative impact when compared to the check or treatments using non Dynasty treated seed. Since there were no stand counts taken it is hard to determine if there was seed phytotoxicity or something else contributing to the lower yields and RSA when Dynasty treated seed was used.

2012 Results

Figure 2. Recorded average daily temperatures at 4" soil depth at St. Thomas fungicide test.

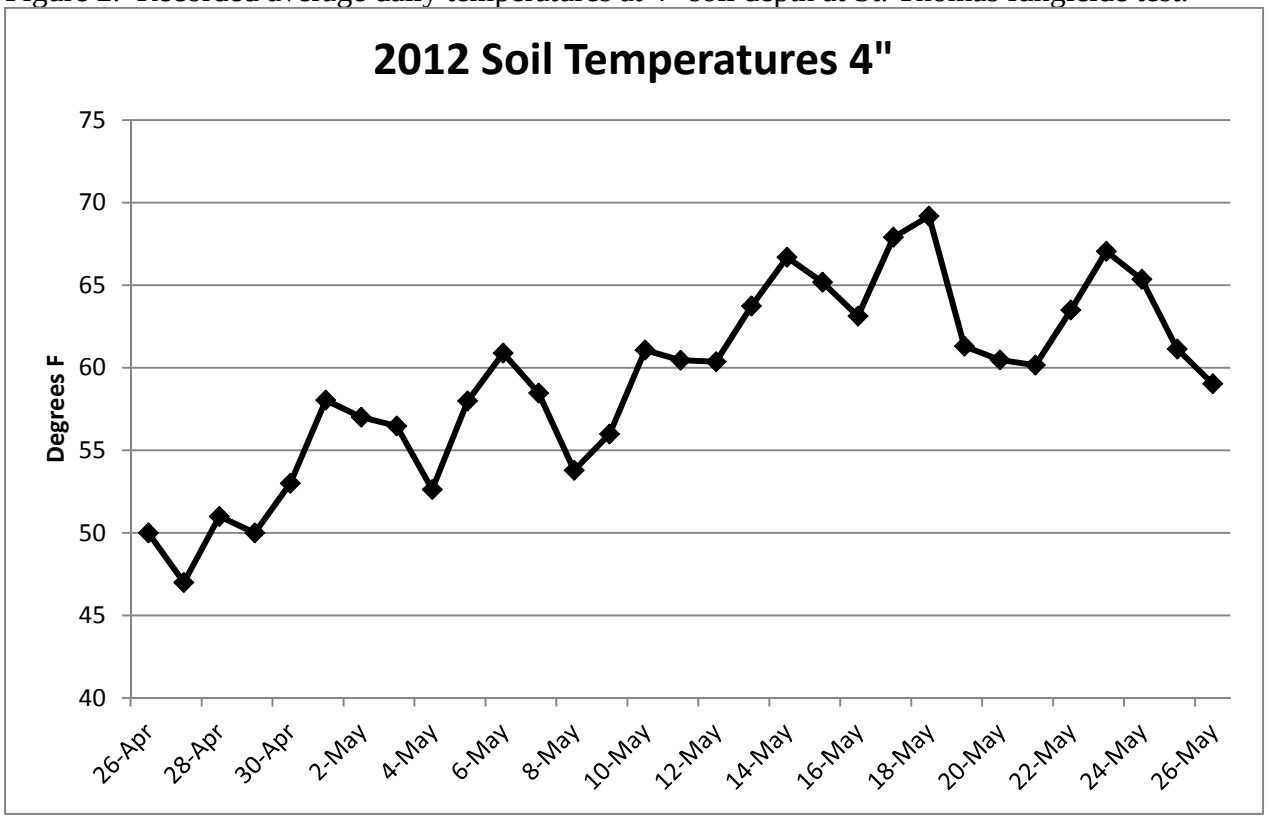

Table 2. 2012 Stand emergence counts from fungicide strip trial near St. Thomas ND.

Treatments	Count 1 May 10	Count 2 May 21	Count 3 Jun 1
Check – Non Metlock seed	151	198	200
Metlock seed treatment alone	156	209	210
Quadris	149	197	196
Proline	145	189	194
Proline (L)	135	192	199
Metlock *fb* Quadris	155	208	213
Metlock *fb* Proline	153	208	210
Metlock *fb* Proline (L)	151	198	200
Quadris *fb* Proline (L)	143	199	207
Metlock *fb* Quadris *fb* Proline (L)	152	203	199

Headline in-furrow alone	116	173	179
Headline *fb* Quadris	109	178	182
Headline *fb* Proline	120	183	185
Headline *fb* Proline (L)	101	156	172
Headline *fb* Quadris *fb* Proline (L)	114	172	177
Headline w/ Metlock seed alone	147	198	206
Headline w/ Metlock *fb* Quadris	142	186	193
Headline w/ Metlock *fb* Proline	154	198	209
Headline w/ Metlock *fb* Proline (L)	127	188	190
Headline w/ Metlock *fb* Quadris *fb* Proline (L)	135	197	204
Vertisan (IF) @ 19.0 oz/acre	137	192	201
Vertisan (IF) @ 28.5 oz/acre	139	195	202
Vertisan @ 19.0 oz/acre (4-6 lf)	128	189	195
Vertisan (IF) @ 19.0 oz *fb* Vertisan @ 19.0 oz (4-6 lf)	144	191	196
Vertisan (IF) @ 19.0 oz/acre *fb* Quadris	139	199	202
LSD (P=0.05)	20	28	16
CV	10	11	6

Table 3. Revenue, yield and quality results from 2012 fungicide strip trial near St. Thomas ND.

Treatments	Revenue (($)	RSA (lbs)	Yield (tons)	Sugar (%)	RST (lbs)	LTM (%)	Tare (%)
Check – Non Metlock seed	1565	8895	24.2	19.5	368	1.16	1.73
Metlock seed treatment alone	1627	9205	25.1	19.4	368	1.05	1.35
Quadris	1641	9240	24.9	19.6	372	1.03	1.83
Proline	1626	9173	24.9	19.5	370	1.02	1.53
Proline (L)	1538	8694	23.6	19.5	369	1.05	1.48
Metlock *fb* Quadris	1627	9202	24.9	19.5	370	1.03	1.80
Metlock *fb* Proline	1701	9611	26.0	19.6	370	1.05	1.53
Metlock *fb* Proline (L)	1628	9214	25.0	19.5	369	1.03	0.95
Quadris *fb* Proline (L)	1618	9133	24.7	19.5	370	1.03	1.10
Metlock *fb* Quadris *fb* Proline (L)	1684	9601	26.5	19.3	364	1.08	1.00
Headline in-furrow alone	1578	8939	24.3	19.5	368	1.11	1.25
Headline *fb* Quadris	1544	8740	23.7	19.6	369	1.10	1.59
Headline *fb* Proline	1583	8917	24.0	19.6	372	1.04	1.35
Headline *fb* Proline (L)	1550	8756	23.6	19.6	371	1.10	1.23
Headline *fb* Quadris *fb* Proline (L)	1547	8789	24.0	19.4	366	1.08	1.81
Headline w/ Metlock seed alone	1697	9648	26.4	19.4	366	1.08	1.24
Headline w/ Metlock *fb* Quadris	1659	9330	25.2	19.6	371	1.03	1.44
Headline w/ Metlock *fb* Proline	1679	9394	25.0	19.8	376	1.03	1.15
Headline w/ Metlock *fb* Proline (L)	1619	9157	24.9	19.5	369	1.05	0.85
Headline w/ Metlock *fb* Quadris *fb* Proline (L)	1652	9353	25.3	19.6	370	1.08	1.33
Vertisan (IF) @ 19.0 oz/acre	1636	9305	25.4	19.4	366	1.08	1.70
Vertisan (IF) @ 28.5 oz/acre	1658	9393	25.6	19.4	367	1.03	1.18
Vertisan @ 19.0 oz/acre (4-6 lf)	1583	8967	24.3	19.5	369	1.08	1.68

Vertisan (IF) @ 19.0 oz *fb* Vertisan @ 19.0 oz (4-6 lf)	1653	9327	25.3	19.6	370	1.05	1.58
Vertisan (IF) @ 19.0 oz/acre *fb* Quadris	1622	9090	24.3	19.7	375	0.99	1.73
Metlock *fb* Vertisan @ 19.0 oz/acre (4-6 lf)	1627	9215	25.0	19.5	369	1.03	1.61
LSD (P=0.05)	89	451	1.2	0.4	10	0.10	0.72
CV	3.9	3.5	3.6	1.6	1.9	6.5	35.3

Soil temperatures at planting were cooler in 2012 than 2011. This may most likely be due to the earlier planting date however the 65^{o}F threshold was reached about 2.5 weeks after planting but still about 2 weeks before the application. Stand count data in this test indicates that Metlock seed treatment appeared to not have any phytotoxic issues from the first count to the 3rd count. Headline used at plant on non Metlock seed consistently showed a reduction in stand and at the final count the stand was reduced about 10% when compared to the check without Headline. Headline used at plant on Metlock treated seed seemed to react differently. Although there seemed to be a drag on initial stand counts, by the final count stands were similar to the check. Although not significant initially the Vertisan at plant treatments showed a possible delay in stand emergence by the 2nd count the stands were nearly the same as the check and by the 3rd count there were not any noticeable differences in stand counts.

In this test the high rate of Vertisan at plant and the Headline with Metlock seed at plant treatments did significantly increase revenue, RSA, and yield compared to the check. The Metlock seed treatment alone did not significantly increase revenue, RSA or yield but when used in combination with a post emergence product at the 4-6 leaf stage several of the combinations significantly increased returns compared to the individual products. In this test when we saw the stand loss from Headline at plant the additional post treatments did not significantly increase yields or quality above the check treatment. The late Proline treatment alone in this test also did not increase yield or quality suggesting that the treatment may be too late to provide any help against RCRR. The season long multiple treatment approach where that late treatment was present, and we significantly increased yield or quality was most likely influenced from the at plant and 4-6 leaf post application.

DISCUSSION

Data from 2011 indicated that an application of Quadris at the 4-6 leaf stage maximized returns while 2012 data indicated that most returns were maximized with an at plant fungicide treatment then following with a 4-6 leaf treatment. In looking at this limited 2 year data it appears that one application of fungicide may not maximize returns every year and there is really no way to know which fungicide or combination a grower could have gotten by with until after the fact. Based on this data a grower utilizing at plant fungicide(s) with a follow up treatment at the 4-6 leaf stage is hedging their bet at maximizing economic returns over time. We plan to continue this project using labeled products to collect more years of data which will be required to determine trends and if the trends offset and justify the additional fungicide costs.

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