Spring Wheat Seed Treatment Demonstration – Taylor, ND 2004

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Summary

Seven registered and experimental seed treatments were evaluated in southwest North Dakota for the control of fungal root and crown diseases on hard red spring wheat (*Triticum aestivum* L. c.v. Parshall) by comparing disease, growth, and yield parameters of treated plots to an untreated check plot in southwest North Dakota. Dry soil conditions through out the summer and medium levels of soil-borne plant pathogens may have reduced the severity of the disease symptoms evaluated. No significant differences were detected in any of the parameters measured in this demonstration though the average yield for treated seed was nearly a bushel more per acre than the untreated seed.

Introduction

Seeds may be treated with fungicides for various reasons. These reasons include: 1) prevention of disease development because of seed-borne infection by pathogenic microorganisms; 2) protecting seeds and seedlings from invasion by soil-borne seedling invaders; and 3) protecting the plant from specific soil-borne pathogens that cause root and crown rots. A number of protectant or systemic seed treatments are registered for wheat seed treatment. Some are specific for certain seed or soil-borne fungi; others are wider spectrum. Often several products are used in combination or are formulated to provide control of a wider spectrum of diseases.

Soil-borne fungi and seed treatments are affected by individual or local soil environments so field demonstrations under local conditions are prudent. The purpose of this study was to demonstrate the ability of fungicide seed treatments to control root and crown pathogens in a continuous wheat rotation.

Methods

The demonstration was conducted on the Jay Elkin Farm near Taylor, ND, at a site that had been in continuous wheat for the previous five years. At the Elkin site, winter wheat was seeded in the fall of 2003 and eliminated from the plot area on 9 Apr 2004 with an application of Roundup Ultra Max at the rate of 20 fl oz/acre + 40 fl oz/acre Actamater (ammonium sulfate) spray adjuvant. The soil is a Morton silty clay loam. The soil was sampled on 2 Apr 2004 and analyzed at the NDSU Soil Testing Laboratory. The soil analysis indicated the soil contained 15 lbs/acre NO_3-N, 7 ppm P, 380 ppm K, 48 lbs/acre SO_4-S and 139 lbs/acre Cl. Organic mater content at the site was 3.9% and pH was 6.0. Urea at the rate of 220 pounds per acre was broadcast applied on 16 Apr 2004. Significant rainfall occurred the following day.

A randomized complete block design with four replications was used. Plots were 10 feet wide by 45 feet long with a four foot buffer of winter wheat seeded between each plot.

Parshall hard red spring wheat was treated with one of three experimental seed treatment fungicides prior to planting (Table 1) or one of four registered products at the labeled rate. Seed planted in the check (CHECK) plot was untreated. The field was not tilled prior to seeding. Seed was planted on 27 Apr 2004 with a Cross-slot no-till drill at the rate of 1.5 million seed per acre.

One post-emergent herbicide application was used to control weeds in the crop. This application was made on 8 Jun 2004 with a tank mix of 0.5 oz/acre of Harmony GT XP + 0.66 pt/acre of Puma. In addition to the herbicides 2 fl oz/acre of Tilt was applied at this time for foliar disease control.

Emergence evaluations were conducted when approximately 50% of the plants had emerged in the untreated plot on 19 May 2004 and the emergence completed count was made on 26 May 2004. Plant counts in three 4.9 m sections of row were collected and plants per square meter were calculated.

Root and crown samples from four plots per treatment were evaluated twice during the growing season. The first evaluation occurred between Zadoks 24 and 28 (tillering) and the second evaluation occurred at Zadoks 85 (soft dough). For the first evaluation, 15 plants were carefully dug from each plot and excess soil gently shaken from the roots. Samples were stored with the soil still on the roots in plastic bags and refrigerated until washed and analyzed. Plants selected for the first evaluation were evaluated for stage of development; length of the plant measured from the crown to the tip of the last fully extended leaf, extent of lesions on the subcrown internode, and counts of both seminal and crown roots. Twenty-five plants for the second evaluation were carefully dug and excess soil gently

shaken from the roots. The samples were stored with the soil still on the roots and refrigerated until the roots were washed and evaluated. For the second evaluation, subcrown internode, root color, and root mass were examined.

During Zadoks 85 (soft dough), soil from each of the untreated CHECK plots was sampled by discarding the first 5 cm of soil from the surface and retaining the next 5 cm of soil for the sample. These samples were then combined, mixed and a subsample placed in a plastic bag and submitted to Ribeiro Plant Lab, Inc., Bainbridge Island, WA for analysis of Pythium, Fusarium, and Rhizoctonia propagules. Pythium presence and levels were determined using a modification of the PARPH medium published by Jeffers and Martin (1986); Fusarium presence and levels were determined using Komada's medium (Komada, 1975); and Rhizoctonia presence and levels were determined using MKH at 1:1000 dilution (Sneth, 1991). Propagule counts for *Bipolaris sorokiniana*, the cause of common root rot, were not done.

Prior to harvest, mature plant height and head densities were determined. The plots were harvested on 24 Aug 2004 with a Massy Ferguson 8XP combine, which measured grain weight harvested, percent moisture of harvested grain, and grain test weight. Harvested area was measure and yields were calculated. Protein was determined at Southwest Grain Inc., Dickinson, ND. Grain yield, test weight, and protein were adjusted to 12% moisture basis (Hellevang, 1986).

All data were statistically analyzed using SAS Statistical software version 8.2.

Results and Discussion

Emergence

No significant differences were detected in the initial or at full emergence plant stands (Table 2) for any of the treatments, though Dividend RTA, Raxil MD, Raxil MD + Gaucho 480, and both treatments with L1217-A1 tended to have higher emergence levels than the CHECK. Raxil MD Extra and Raxil + L1028-A1 + Allegiance tended to reduce emergence compared to the CHECK treatment.

Grain Yield, Test Weight, and Protein

Grain yield (Table 3) was highest for Raxil MD + Gaucho 480 (40.1 bu/A) and Raxil MD Extra (40.0 bu/A) but not significantly higher than the CHECK treatment (38.4 bu/A). When all fungicide seed treatments were averaged in this trial, they yielded 0.9 bushels more per acre than the untreated CHECK treatment. Grain test weight averaged 56.5 pounds per bushel indicating stress had occurred during grainfill. Stress may have been a result of running out of water during August. Rainfall was 43% of normal for the entire growing season. June was the second driest ever recorded in the 108 year history of the Dickinson weather station with only 12% of normal or 0.46 inches of rainfall measured for that month. August precipitation was 36% of normal and was probably not sufficient to produce normal test weight grain.

Root Evaluations and Propagule Counts

No significant differences were detected in either the initial root and plant evaluation (Table 4) or the root and crown evaluation at the soft dough stage (Table 5). Propagule counts (Ribeiro 2004) were noted at medium levels for *Pythium* spp (250 ppg), *Fusarium* spp (520 ppg) and *Rhizoctonia* spp (20 ppg) at this site. The propagule levels detected at this site and dry conditions that existed during early season growth may have resulted in low infection rates and symptoms of soil-borne diseases and appeared to have minimal effect on the crop.

Implications of Demonstration

In this seed treatment demonstration, the applied fungicides did not have a significant effect on any of the parameters examined, although yield on the average was nearly a bushel more per acre for the fungicide treated seed compared to the untreated seed. Very dry conditions during germination and early growth through heading as well as medium levels of inoculum indicated by the propagule assay probably affected the results seen in this demonstration.

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Table 1. Active ingredients of seed treatments used on Parshall hard red spring wheat, Taylor, ND, 2004

Treatment	Status	Active ingredient and (percent concentration in product)	Product AI Rate	Active on disease[1]
Raxil MD	Registered	Tebuconazole (0.48) Metalaxyl (0.64)	5.0 fl oz/cwt	Seedling Blight, Pythium, Common Root Rot, Loose Smut
Raxil MD + Gaucho 480FS	Registered	Tebuconazole (0.48) Metalaxyl (0.64) Imidacloprid[2] (40.7)	5.0 fl oz/cwt + 0.16 fl oz/cwt	Seedling Blight, Pythium, Common Root Rot, Loose Smut
Raxil MD Extra	Registered	Tebuconazole (0.48) Metalaxyl (0.58) Imazalil 1.0)	5.0 fl oz/cwt	Loose smut, early season septoria complex, Pythium, Rhizoctonia, common root rot, Fusarium
Raxil + L1028-A1 (25 ppm) + Allegiance	Not Registered	Tebuconazole NA Metalaxyl (28.35)	10 ppm AE+ 25 ppm AE+ 0.1 fl oz/cwt	NA[3]
Rail + L1217-A1 (50 ppm) + Allegiance	Not Registered	Tabuconazole NA Metalaxyl (28.35)	10 ppm AE+ 50 ppm AE+ 0.1 fl oz/cwt	NA[3]
Rail + L1217-A1 (75 ppm) + Allegiance	Not Registered	Tabuconazole NA Metalaxyl (28.35)	10 ppm AE+ 75 ppm AE+ 0.1 fl oz/cwt	NA[3]
Dividend RTA	Registered	Difenoconazole (3.37) Mefenoxam (0.27)	5.0 fl oz/cwt	Pythium Damping-Off, Seedling Blight caused by soil-borne Fusarium Loose Smut

[1] Registered seed treatment for wheat has activity on seed-borne and/or soil-borne pathogen that causes these diseases.

[2] Gaucho 480 FS is an insecticide.

[3] NA = Information is not available.

Table 2. Stand counts for Parshall hard red spring wheat with various seed treatments, Taylor, ND, 2004.

Treatment	Initial count[1]	Full emergence[2]
	m^{-2}	m^{-2}
CHECK	94	255
Raxil MD	81	259
Raxil MD + Gaucho480[3]	92	288
Raxil MD Extra	89	248
Raxil2.6+L1028-A1 (25 ppm) +Allegiance	66	249
Raxil2.6+L1217-A1 (50ppm) +Allegiance	80	284
Raxil2.6+L1217-A1 (75ppm) +Allegiance	127	285
Dividend RTA	105	320
Mean	92	274
CV%	29.5	14.3
$LSD_{.05}$	NS	NS
Reps	4	4

[1] Initial count conducted on 17 May 2004.
[2] Full emergence count conducted on 26 May 2004.
[3] Gaucho 480 is an insecticide.

Table 3. Grian yield, test weight, protein, height, and head density at harvest of Parshall hard red spring wheat grown under various seed treatments, Taylor, ND, 2004.

			---------- Grain[1] ----------		
Treatment	Head density	Height	Yield	Test weight	Protein
	no m^{-2}	mm	bu/a	lb/bu	%
CHECK	295.3	792.9	38.4	56.8	16.1
Raxil MD	296.5	801.7	39.2	56.8	16.0
Raxil MD + Gaucho480[2]	261.3	804.6	40.1	57.3	16.0
Raxil MD Extra	284.6	800.8	40.0	56.8	15.8
Raxil2.6+L1028-A1 (25 ppm) +Allegiance	283.0	777.9	38.9	56.6	15.8
Raxil2.6+L1217-A1 (50ppm) +Allegiance	288.9	784.2	38.9	55.8	16.1
Raxil2.6+L1217-A1 (75ppm) +Allegiance	288.5	795.8	39.5	57.1	16.3
Dividend RTA	283.6	811.7	38.5	55.0	16.1
Mean	283.8	796.2	39.2	56.5	16.0
CV%	6.9	2.6	3.7	2.2	1.8
$LSD_{.05}$	NS	NS	NS	NS	NS
Reps	4	4	4	4	4

[1] Grain yield, test weight, and protein adjusted to 12% moisture basis
[2] Gaucho 480 is an insecticide.

Table 4. Initial root and plant evaluations of Parshall hard red spring wheat with various seed treatments, Taylor, ND, 2004.

					----- Roots -----	
Treatment	Plant length[1]	Growth stage	Tiller	Subcrown internode[2]	Seminal	Crown
	mm	Zadoks	plant^{-1}		plant^{-1}	plant^{-1}
CHECK	284	22.2	1.8	1.3	3.3	5.8
Raxil MD	297	23.3	1.6	1.1	3.1	5.2
Raxil MD + Gaucho480[3]	291	22.3	1.5	1.3	3.7	4.8
Raxil MD Extra	299	21.1	1.6	1.2	3.2	5.2
Raxil2.6+L1028-A1 (25 ppm) +Allegiance	275	21.8	1.9	1.1	3.1	5.7
Raxil2.6+L1217-A1 (50ppm) +Allegiance	286	21.6	1.7	1.4	3.7	5.5
Raxil2.6+L1217-A1 (75ppm) +Allegiance	305	21.3	1.8	1.1	3.1	6.0
Dividend RTA	297	21.1	1.6	1.5	3.5	5.2
Mean	291.6	21.8	1.7	1.2	3.3	5.4
CV%	10.1	6.2	26.3	19.6	14.6	14.4
LSD $_{.05}$	NS	NS	NS	NS	NS	NS
Reps	4	4	4	4	4	4

[1] Length measured from the crown to the tip of the last fully extended leaf of the plant.
[2] Subcrown internode rating 1-4. 1 = 0 to 25% internode covered with lesions; 2 = 25 to 50% covered with lesions; 3 = 50 to 75% covered with lesions; and 4= 75 to 100% covered with lesions.
[3] Gaucho 480 is an insecticide.

Table 5. Root and crown evaluation at the soft dough stage, Taylor, ND, 2004.

Treatment	Subcrown internode[1]	Root color[2]	Root mass[3]
CHECK	1.2	1.7	2.7
Raxil MD	1.1	1.5	2.8
Raxil MD + Gaucho480	1.0	1.5	3.0
Raxil MD Extra	1.0	1.4	2.8
Raxil2.6+L1028A1+Allegiance	1.0	1.6	2.9
Raxil2.6+L121750ppm+Allegiance	1.0	1.6	2.8
Raxil2.6+L121775ppm+Allegiance	1.0	1.6	2.8
Dividend RTA	1.0	1.3	3.2
Mean	1.0	1.5	2.9
CV%	8.8	14.4	8.8
$LSD_{.05}$	NS	NS	NS
Reps	4	4	4

[1]Subcrown internode rating, 1-4. 1 = less than 25% internode infected, 2 = 25-50% of internode infected, 3 = 50-75% of internode infected, mulitple lesions, and 4 = 75-100% of internode infected, lesions coalesced.
[2] Root color index 1 to 4. 1 = white, 4 = dark brown.
[3] Root mass index 1 to 4. 1 = few roots, 4 = substantial root system.