Evaluating Fungicide Seed Treatment for Phytotoxicity to Hard Red Spring Wheat

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Summary

North Dakota producers of spring wheat (*Triticum aestivum* L.) commonly apply fungicide seed treatments in the field. Fungicide seed treatments must be applied to each seed uniformly at the recommended rate to provide early protection from seed- and soil-borne diseases. The objective of this demonstration was to show the reaction of seed treated with three different seed treatments (Raxil MD, Charter PB, and Vitavax 200 + FloPro IMZ) at three different rates (1X, 5X, and 10X). Emergence counts at approximately 50% emergence were significantly lower than the check plot when rates of all seed treatments were applied at the 5X and 10X. After emergence was complete, Vitavax 200 + FloPro IMZ at rates 5X and 10X produced stands with fewer plants than the check. Leaf development was slow when Raxil MD was applied at the 10X rate and when Vitavax 200 + FloPro IMZ was applied at the 5X and 10X rate.

Introduction

Seed applied fungicides in the northern Great Plains are commonly applied to seed as it is conveyed from the truck to the drill in the field. If equipment is not adjusted or calibrated properly, it is possible for some seed to have 25% of the labeled rate while other seed may have 400% of the labeled rate (Johnston and Grey, 2002) . Also if thorough mixing and coverage of the seed does not occur some seed will have too much fungicide while other seed will have none at all in the seed lot. Too little of a seed treatment product results in inadequate protection from disease; too much may put stress on emerging seedlings.

Materials and Methods

The demonstration was conducted in a field belonging to Ryan Kadrmas near Dickinson, ND. The previous crops in the field were sunflower in 2001, corn in 2000, and wheat in 1999. The soil was a Belfield-Savage silty clay loam (5-65-30% sand-silt-clay) with a pH of 7.1, organic mater content of 3.3%, nitrate nitrogen content of 46 pounds per acre to a depth of two feet, phosphorus content of 10 ppm, potassium content of 350 ppm, sulfate sulfur content of 41 pounds per acre to a depth of two feet and 21 pounds of Chloride per acre to a depth of two feet.

A randomized complete block design with six replications was used. Plots were 10 feet wide by 45 feet long with a four foot buffer of winter wheat seeded between each plot. A herbicide was applied on 4 May to control volunteer sunflower and emerging weeds and then 150 pounds per acre of 21-0-0-24 S, 55 pounds per acre of 11-55-0 and 50 pounds per acre of 0-0-60-60 Cl fertilizer was broadcast on 12 May.

Alsen hard red spring wheat seed was treated with one of three fungicide seed treatments at three different rates (Table 1). An untreated check was also included (Figure 1). The field was not tilled prior to seeding. Seed was planted at the rate of 1.5 million seed per acre on 22 May with a Hege plot drill with double disc openers.

Two post-emergent herbicide applications were used to control weeds. The first application was on 15 June with 0.4 oz per acre Harmony Extra + 0.4 pt per acre Puma. The second application occurred on 27 June with one pint per acre of Buctril.

Rainfall was recorded using a Rainwise self tipping bucket rain gauge and a Hobo event data logger which recorded precipitation in 1/100 inch increments. Temperature was tracked using a Hobo 8 temperature sensor/logger to record soil temperature two inches below the surface of the soil and air temperature.

Emergence and vigor evaluations were conducted when approximately 50% of the plants had emerged on 3 June and again at complete emergence on 17 June. Emergence counts (three counts per plot), vigor, and leaf stage were conducted on all six replications during the first evaluation and emergence counts (two counts per plot) and vigor were conducted on four replications during the second evaluation. Hail on 18 July completely destroyed the plot and surrounding fields (Figure 2) so evaluations at boot and harvest could not be completed .

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

Results and Discussion

Emergence and Vigor

Rainfall was 92% of normal for May but 132% of normal for both June and July. One precipitation event which occurred shortly after seeding but prior to emergence washed soil and crop residue off the plot area.

Emergence counts on 3 June were significantly lower than the check plot when rates of all seed treatments were applied at 5X and 10X (Table 2), but after emergence was completed only Vitavax 200 + FloPro IMZ at rates 5X and 10X (Table 2) (Figure 3, Figure 4, Figure 5) had lower emergence counts than the check plot. Vigor was low for Vitavax 200 + FloPro IMZ for rates 5X and on 3 June but only the 10X rates for Vitavax 200 + FloPro IMZ and Charter PB gave significantly lower vigor than the check on the 17 June evaluation. Leaf development was slow for Raxil MD applied at the 10X rate and for Vitavax 200 + FloPro IMZ applied at the 5X and 10X rate.

Grain Yield

Grain yield data was not collected from this plot since hail destroyed the plot prior to harvest. In a similar trial conducted in the intermountain west, no significant grain yield differences were detected (Johnston and Grey, 2002). That study found that plant stand was significantly affected for the Vitavax 200 + FloPro IMZ 10X treatment. Even when plant stands are adversely affected wheat has the ability to adjust to these reduced plant stands and yield well when conditions are favorable for extending plant development (Kumar et al., 1986; Sharratt et al., 1984; Aggarwal et al. 1986). Environment for wheat culture may not be as favorable in western North Dakota as it is in the intermountain west.

Implications of Demonstration

Application of seed treatments above labeled rates can injure germinating seed and plant stands, possibly reducing yields or producing yields no higher than those produced by untreated seed.

Cooperating Producer and Financial Support

The authors wish to thank Ryan Kadrmas for providing the use of his land to this demonstration. Also the authors wish to extend a thank you to Aventis for their financial support of this demonstration. This demonstration could not be carried through to maturity and harvest because a hail storm destroyed the plots. Further evaluations should be initiated to study the effects of uneven application of fungicide seed treatments.

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Table 1. Active ingredients of seed treatments used at Dickinson, ND, 2002.

Treatment	Status	Active ingredient and percent concentration in product	Product application rate	Active on disease[1]
Charter PB 1X	Not Registered in USA	Triticonazole (1.3) Thiram (13.0)	5.5 fl oz/cwt	NA[2]
Charter PB 5X	Not Registered in USA	Triticonazole (1.3) Thiram (13.0)	27.5 fl oz/cwt	NA[2]
Charter PB 10 X	Not Registered in USA	Triticonazole (1.3) Thiram (13.0)	55.0 fl oz/cwt	NA[2]
Raxil MD 1X	Registered	Tebuconazole (0.48) Metalaxyl (0.64)	5.0 fl oz/cwt	Seedling Blight, Pythium, Common Root Rot, Loose Smut
Raxil MD 5 X	Not Registered in USA	Tebuconazole (0.48) Metalaxyl (0.64)	25.0 fl oz/cwt	Seedling Blight, Pythium, Common Root Rot, Loose Smut
Raxil MD 10X	Not Registered in USA	Tebuconazole (0.48) Metalaxyl (0.64)	50.0 fl oz/cwt	Seedling Blight Pythium, Common Root Rot, Loose Smut
Vitavax 200 + FloPro IMZ 1X	Registered	Carboxin (17.0) Thiram (17.0) Imazalil (31.0)	3.5 fl oz/cwt + 0.25 fl oz/cwt	Common Root Rot Loose Smut Covered Smut Rhizoctonia, Pythium, Fusariuim
Vitavax 200 + FloPro IMZ 5X	Not Registered in USA	Carboxin (17.0) Thiram (17.0) Imazalil (31.0)	17.5 fl oz/cwt + 1.25 fl oz/cwt	Common Root Rot Loose Smut Covered Smut Rhizoctonia, Pythium, Fusariuim
Vitavax 200 + FloPro IMZ 10X	Not Registered in USA	Carboxin (17.0) Thiram (17.0) Imazalil (31.0)	35.0 fl oz/cwt + 2.5 fl oz/cwt	Common Root Rot Loose Smut Covered Smut Rhizoctonia, Pythium, Fusariuim

[1] Registered seed treatment for wheat has activity on seed-born and/or soil-borne pathogen that causes these diseases.
[2] NA = Not Available

Table 2. Emergence counts and vigor ratings for Alsen hard red spring wheat treated with selected seed treatment fungicides at various rates at Dickinson, ND, 2002

	------------ June 3 ------------			--- June 17 ---	
Treatment[a]	Plant density	Vigor[b]	Leaf stage[c]	Plant density	Vigor[b]
	no/ft2			no/ft2	
Check	20.0	6.8	1.63	30.8	7.3
Charter PB 1X	19.5	7.3	1.63	30.5	7.5
Charter PB 5X	18.0	6.7	1.58	30.8	6.8
Charter PB 10X	14.1	5.5	1.58	28.3	5.5
Raxil MD 1X	19.8	6.8	1.63	30.9	7.8
Raxil MD 5X	16.6	6.8	1.63	30.9	7.3
Raxil MD 10X	14.3	5.7	1.27	29.7	7.5
Vitavax 200 + FloPro IMZ 1X	19.5	6.0	1.67	30.0	7.3
Vitavax 200 + FloPro IMZ 5X	15.5	5.3	1.21	27.0	6.3
Vitavax 200 + FloPro IMZ 10X	3.6	1.7	0.38	10.5	4.0
Mean	16.1	5.9	1.42	27.9	6.7
CV%	11.3	20.7	12.7	7.3	13.6
LSD 0.05	1.4	1.4	0.21	3.0	1.3
LSD 0.01	1.9	1.9	0.28	4.0	1.8
Reps	6	6	6	4	4

[a] Treatment: Charter PB 1X = 5.5 fl oz/cwt; Raxil MD 1X = 5.0 fl oz/cwt; Vitavax 200 + FloPro IMZ 1X = 17.5 + 1.25 fl oz/cwt.

[b] Vigor score is a visual evaluation of the plant's color and size. On a scale of 1 – 10; 1 = low vigor, 10 = high vigor.

[c] Leaf stage is the average number of leaves per plant emerged.

Figure 1. The untreated Check Plot as it appeared on 3 June 2002 on the Ryan Kadrmas Farm, Dickinson, ND.

Figure 2. Two weeks after (1 Aug 2002) a hail storm destroyed the fungicide safety plots on the Ryan Kadrmas Farm on 18 July 2002. No yield data derived from these plots. The dark green winter wheat borders survived.

Figure 3. Plots as they appeared on 3 June 2002 treated with various rates of Charter PB on the Ryan Kadrmas Farm, Dickinson, ND.

Charter PB 1X

Charter PB 5X

Charter PB 10X

Figure 4. Plots as they appeared on 3 Jun 2002 treated with various rates of Raxil MD on the Ryan Kadrmas Farm, Dickinson, ND.

Raxil MD 5X

Raxil MD 10X

Figure 5. Plots as they looked on 3 Jun 2002 treated with various rates of Vitavax 200 + FloPro IMZ on the Ryan Kadrmas Farm, Dickinson, ND.


Vitavax 200 + FloPro IMZ 1X


Vitavax 200 + FloPro IMZ 5X


Vitavax 200 + FloPro IMZ 10X