Seed Treatment Trial Evaluating the Effectiveness of Different Active Ingredients Against Latent Root Rot and Crown Rots of Wheat

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Research Questions

• To determine the relative efficacy of different active ingredients for control of root rot diseases

• To develop best management practices for the use of seed treatments for spring wheat production in Minnesota

Results

In 2013 across all locations, no significant differences were detected in stand counts, plant heights, biomass or grain yield either between treatments or compared to the untreated control. In 2014, again no differences were detected for grain yield either between treatments or compared to the untreated control, except in the trials near Fergus Falls and Benson. In the Fergus Falls trial tebuconazole reduced grain yield compared to the untreated control (p=0.005). In the trial near Benson Raxil MD increased yield compared to the untreated control (P=0.015). This increase in grain yield was likely the result of a higher initial stand observed with Raxil MD when compared to the control (P= 0.014).

No late season symptoms were observed in plots at any of the sites in 2013 or 2014. Preliminary data from the fungal isolations made on mature crowns and roots suggests however that several fungal species, including Fusarium spp. can readily be found. Fungal isolations will continue through the winter months and this data will be analyzed to see if there are any differences in the fungal populations evident between treatments.

The preliminary results from this study suggest that seed treatments will not be needed indiscriminately for the protection of initial stand. The decision to use a seed treatment therefore will continue to be a function of the condition of the seed lot and whether loose smut or other seed born disease require control and/or the field history. In only 1 out of 8 environments across the past two years did one of the seed treatments result in a better initial stand compared to the untreated control. In addition, the preliminary data from the fungal isolations clearly show that, whilst we might be able to protect the germinating seed and therefore the initial stand establishment, mature plants are still susceptible to late-season infections. These data suggest that seed treatments are not efficacious throughout the whole growing season. Being able to control and/or reduce infections past the window of efficacy of the seed treatments is an important factor in years when plants are at risk of drought stress. These infected root systems are compromised and are less efficient at taking up water and nutrients. Therefore, rather than relying on seed treatments, genetic resistance to crown and root rot may provide better all-round disease control with less economic risk compared to a seed treatment.

Application/Use

Several fungal species are known to attack wheat seedlings which can result in seedling blights causing poor initial stand establishment. These include fungi such as *Pythium* spp., *Fusarium* spp., *Rhizoctonia*, and *Bipolaris sorokiniana*. In order to combat this, many crop protection companies have developed seed treatments which aim to combat these diseases and improve seedling vigor. This has led to their wide adoption in wheat growing regions around the world. However, there is little evidence in the scientific literature to demonstrate the efficacy of seed treatments against different fungi and the cost benefit of using these treatments to the grower each year.

Trying to understand which fungicide treatments give the best control of root diseases and the environmental factors which put stand establishment at the most risk, allow growers to only pay for seed treatments when they are likely to provide a benefit to the crop

Material and Methods

In 2013 and 2014 trials were located at four on-farm locations around the state of Minnesota. In 2013 sites were located at Strathcona, Crookston, Fergus Falls and Kimball. In 2014 The same locations were used except that the southern location was moved from Kimball to Benson. A randomized complete block design with 5 replicates was set up at each location. Plots were 5ft x 15 ft.

The seed treatments (listed in table 1 in the appendix) were applied to seed using a Hegi small-batch seed treater to coat seed. The rate of the product applied was selected according to labelling regulations. Treatments were selected on the basis of utilizing a range of different fungicides with different modes of action, and selecting both products which combine different fungicides as well as having individual active ingredients represented.

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Stand counts were made at the 2 leaf stage by counting the number of plants in a one foot section of row three times at randomly located sections of each plot to obtain an average. Plant heights were measured from the base of the plant to the top of the highest leaf at physiological maturity from 6 plants each plot representative of the average height in the plot. Biomass was measured by collecting and weighing the aerial parts of plants removed from three one foot sections in each plot after drying in a drying oven to remove moisture.

Economic Benefit to a Typical 500 Acre Wheat Enterprise

Indiscriminate use of seed treatments provides no economic benefit to a wheat enterprise whilst it increases the cost of production by $4.- to $12.- per acre. The decision to use a seed treatment therefore will continue to be a function of the condition of the seed lot and whether loose smut or other seed-born disease requires control and/or the field history. In only 1 out of 8 environments across the past two years did one of the seed treatments result in a better initial stand compared to the untreated control.

Related Research

The seed treatment trials conducted in Minnesota these past two years were also carried out by Pravin Gautam at North Dakota State University this past season as part of the Upper Great Plains Wheat pathology collaboration (UGPWPC).

Recommended Future Research

It is imperative that we set up a disease nursery with high inoculum pressure to continue testing the efficacy of seed treatment but also to allow us to assess the level of resistance to these pathogens in released varieties and breeding lines. Initial steps are already underway at the Northwest Research and Outreach to develop field inoculation methods for root rot diseases. The results in 2014 suggest that producing good disease pressure for crown rot is possible in a field situation and this work will continue in 2015. In these disease nurseries we will carefully monitor soil temperatures and other environmental conditions to allow correlation with disease development.

Appendix

Table 1. Fungicidal Seed Treatments Used in Trials

Treatment	a.i	conc.	amount	a.i	conc.	amount	a.i	conc.	amount
		(%)	(g a.i/lb)		(%)	(g a.i/lb)		(%)	(g a.i/lb)
Control									
Charter HL				triticonazole	50	0.023			
Stamina	pyrachlostrobin	18.4	0.022						
Stamina F3	pyrachlostrobin	1.59	0.022	triticonazole	1.59	0.022	metalaxyl	0.93	0.013
Dyna Shield							metalaxyl	28.35	0.063
Dyna Shield (reduced)							metalaxyl	28.35	0.010
Raxil MD				tebuconazole	0.48	0.007	metalaxyl	0.64	0.009
Raxil MD Extra	imazalil	1	0.015	tebuconazole	0.43	0.006	metalaxyl	0.58	0.009
Tebuconazole				tebuconazole	0.48	0.007			
Vibrance Extreme	sedaxane	1.22	0.010	difenoconazole	5.86	0.049	mefenoxam	1.46	0.012
Vibrance	sedaxane	45.45	0.011						
Systiva	fluxapyroxad	32	0.022						
Evergol Energy [1]	Prothioconazole	7.18	0.023	Penflufen	3.59	0.012	Metalaxyl	83.49	0.272
[1] Only used in the 2014 trials									