PAIRING GENETICS AND FUNGICIDES IN WHEAT PRODUCTION

Paul Esker and Shawn P. Conley[1]

With the wheat commodity prices staying high, the interest in wheat in the state remains very strong. Over the past few years, we have discussed many issues associated with managing wheat in Wisconsin (Esker et al. 2008), in particular knowledge of the following factors for use of foliar fungicides as part of an IPM program: (i) active scouting of fields, (ii) knowledge of growth stage, (iii) knowledge of disease risk, (iv) knowledge of the variety planted, (v) estimating stand quality post-dormancy, (vi) overall crop development in the spring, (vii) weather, (viii) understanding the different fungicides and targeted diseases, and (ix) commodity prices. However, linking both genetics and fungicides is not a trivial set of research questions. For example, in 2009 and 2010, the winter wheat variety trial at Janesville was duplicated in size thus enabling the application of a fungicide at flag leaf emergence (fungicide: Quilt). However, results from that trial indicated that there was no evidence of an effect of foliar fungicide nor an interaction of variety and fungicide (Lackermann, 2010). One explanation was that the disease intensity at Janesville was relatively low in both years but this also highlights that the appropriate use of a foliar fungicide should be for disease control.

To improve our knowledge of how wheat varieties in the state react to different diseases, we are exploring the use of non-parametric methods to rank wheat varieties in terms of both yield and disease. Based on preliminary analyses with data collected from the Winter Wheat Performance Test locations (http://coolbean.info) in 2009 and 2010, the primary disease of interest was powdery mildew (*Blumeria graminis*, Fig. 1).

The goal with using a rank-based approach to pair disease and yield is to provide a stable method for annual and across-year comparisons since that may then link with other management tactics like the use of foliar fungicides. The general ranking methodology was to rank wheat varieties within each location-year by yield, where a 1 indicated the highest yield, and by disease, where a 1 indicated the least disease. Based on further statistical analyses, results indicated that there were three varieties that had both lower yield and a worse disease reaction (Table 1), while there were 12 varieties that had high yield and a good disease reaction.

[1] Assistant Professor and Field Crops Extension Plant Pathologist and Associate Professor and State Soybean and Small Grains Specialist, Dept. Plant Pathology and Agronomy, Univ. of Wisconsin-Madison.
Portions of this material was based upon work supported by the U.S. Department of Agriculture, under Agreement #59-0206-9-088; this was a cooperative project with the U.S. Wheat & Barley Scab Initiative.

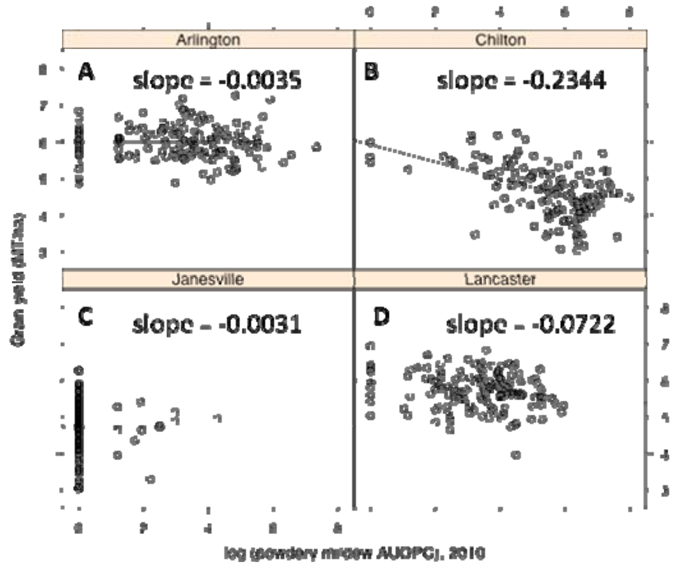

Figure 1. Grain yield as a function of powdery mildew (log-transformed area under disease progress curve). Slope values indicated that there was an effect of powdery mildew at Chilton, while other locations had a much smaller effect.

Table 1. Lowest and highest ranked varieties when examining both yield and disease reaction (powdery mildew) using a non-parametric statistical approach. Varieties within each category were not statistically different from one another (P < 0.05).

Lowest ranked varieties	Highest ranked varieties
P02333A1-23-9	Hopewell
Pro Seed Genetics Pro220	PIP720
Kaskaskia	P25R47
	Sunburst
	PIP760
	LW1050
	IL01-11934
	Branson
	Jung 5988
	LW960
	Jung 5830
	PIP 729

The ability to provide improved management information by pairing genetics and fungicides, we can design controlled trials that target specific diseases and answer fungicide questions. In 2010, we had a trial at the Lancaster ARS targeting Fusarium head blight (FHB; *Fusarium graminearum*) that examined both foliar fungicide and wheat variety (cultivar). The foliar fungicides examined were: (i) untreated check (UTC), (ii) Proline (6.5 fl oz/A) @ Feekes 10.5.1, and (iii) Proline (3.0 fl oz/A) + Folicur (3.0 fl oz/A) @ Feekes @ 10.5.1). Wheat varieties were (with relative FHB resistance, where MR = moderately resistant, MS = moderately susceptible, and S = susceptible): Kaskaskia and Truman (MR) , IL01-11934 and PIP720 (MS), and LW860 and LW863 (S). Results indicated that there were differences in the log-FHB incidence by wheat variety (P = 0.0109, Fig. 2A) and an effect of fungicide on Fusarium damaged kernels (P = 0.0109, Fig. 2B). While there was an interaction of wheat variety and fungicide (P = 0.0446), grain yield differed among public versus private varieties and the greatest response to a foliar fungicide application was for public varieties.

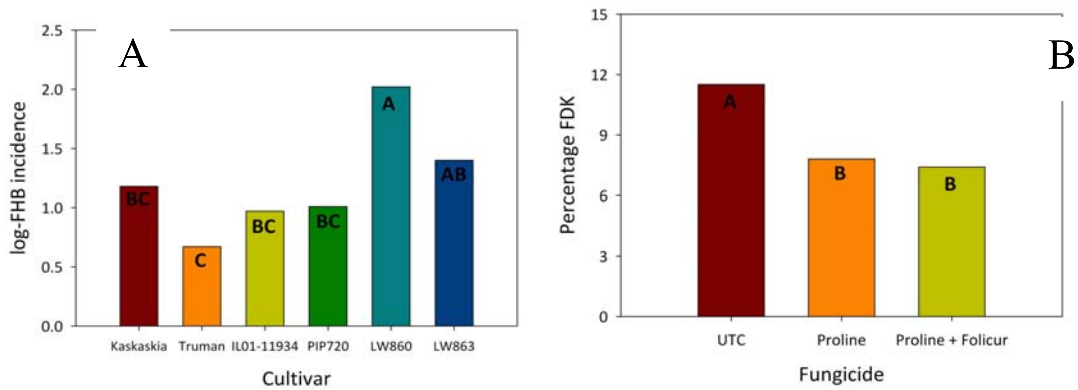

Figure 2. Effect of wheat variety (cultivar) (A) on the log-Fusarium head blight incidence and fungicide (B) on the percentage of Fusarium damaged kernels (FDK). Means with the same letters are not statistically different based on Fisher's protected LSD (alpha = 0.05).

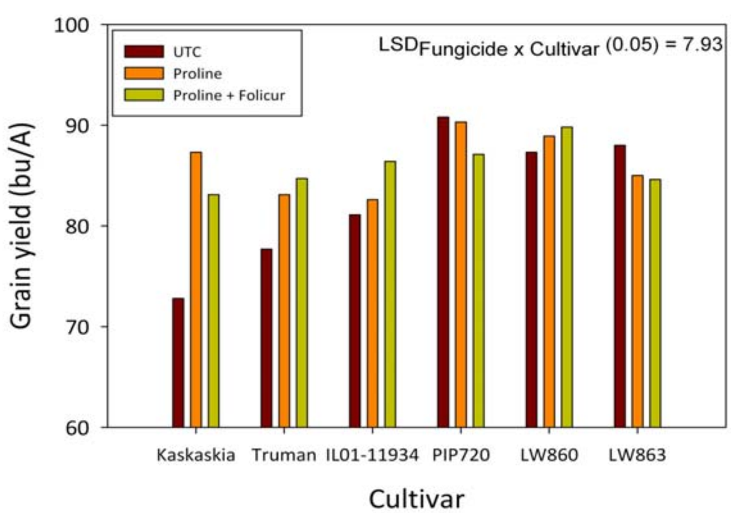

Figure 3. Interaction of wheat variety (cultivar) and foliar fungicide on grain yield at Lancaster in 2010. The P-value was 0.0446 and the Fisher's protected LSD (5% level) was 7.93.

Overall, our current research in Wisconsin has shown that improved management decisions can be made by examining both grain yield and disease reaction. Grain yield is still the key primary component but integrated disease related information can greatly influence if a foliar fungicide will be warranted.

References

Esker, P., C. Grau, S. Conley, and J. Gaska. 2008. Foliar fungicides for winter wheat in 2008. Wis. Crop Manager 15(5):24-25.

Lackermann, K.V. 2010. M.S Thesis, Dept. of Plant Pathology, Univ. of Wisconsin-Madison.