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Field Crops Research

Testing for Fungicide Drift in Cereal Rye Trials

Staff Contact:
Liz Kolbe – (515) 232-5661
liz@practicalfarmers.org

Cooperator:
- **Tim Sieren - Keota**
- **Dick Sloan - Rowley**

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http://bit.ly/pfi_fieldcrops

In a Nutshell

- Two farmers tested Spray strips and No-Spray control strips of cereal rye for fungicide residue.
- This project was a secondary project within "Fungicide and Plant Growth Regulator Effect on Cereal Rye Production" (Gailans et al., 2016).

Key Findings

- At Sieren's farm, no propiconazole residue was found above the detectable limit of 0.05 ppm in No-Spray control strips.
- At Sloan's farm, metconazole residues of 0.02 ppm were found in both control strip samples, compared to the 1.30 ppm baseline residue level in the sprayed sample.

Project Timeline
2016

Background

Farmers that apply their own pesticides can prevent pesticide drift by using the correct nozzles and settings, and waiting for good spraying conditions. Still, some farmers were curious if their chemical applications were, indeed, as accurate as they thought. To test this, two farmers doing fungicide trials in small grains took plant samples in "spray" strips and "no-spray" control strips to be analyzed for fungicide residue.

Methods

Trials were conducted by Tim Sieren near Keota in Washington County in SE Iowa and Dick Sloan near Rowley in Buchanan County in NE Iowa. Both farmers were growing cereal rye seed crops and applying fungicides. Sampling for fungicide drift occurred in each no-spray control strip; a single sprayed strip at each farm was sampled to provide the baseline value (100% contamination) for comparison. Foliage samples for fungicide residue analysis were taken by combining 9 sampling grabs along transects in the strips, as shown in **Figure 1** and **Figure 2**. Strips ran the length of the field at each location. Trial design details and results for the yield study, "Fungicide and Plant Growth Regulator Effect on Cereal Rye Production," are available on the PFI website (Gailans et al., 2016).

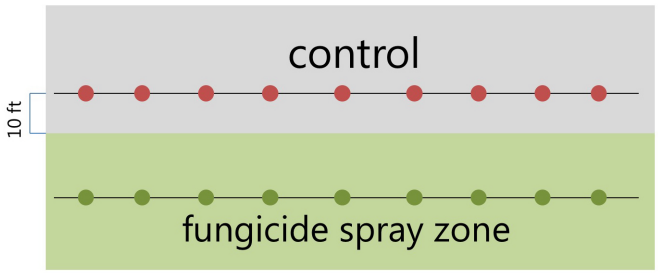
Cereal rye growing at Dick Sloan's farm in April 2016.

On May 18, Sieren sprayed test strips with SharShield PPZ (generic for Tilt), which is 41.8% propiconazole, at a rate of 2.6 oz/ac. The cereal rye was at 75% heading. After the no-entry period stated on the label had expired, Sieren took cereal rye foliage samples from the four no-spray strips in the paired strip trial, 10 ft from the sprayed edge (**Figure 1**). During fungicide application there was a slight breeze from the southeast, moving diagonally across the north-south running strips.

Sloan sprayed Caramba (8.6% metconazole) on May 23 at 9:00 a.m. at a rate of 15.3 oz/ac. The Independence airport weather at the time was clear sky, south winds at 17 mph, 73˚F, 44% relative humidity. The control strip was to the north of the sprayed plot. Sloan left a single check strip that did not receive a fungicide in a field of cereal rye, and took samples 10 ft and 30 ft into the check strip (**Figure 2**), waiting to sample until the no-entry period had expired.

Refrigerated samples were shipped Next Day to Environmental Micro Analysis (EMA) in Woodland, CA for analysis. The lab used standard gas chromatography to detect propiconazole to a reporting limit of 0.05 ppm. For the metconazole, EMA used liquid chromatography triple quadrupole mass spectrometry (LC/MS/MS), a more sensitive tool. Samples were tested only for fungicides sprayed by the farmer.

Figure 1

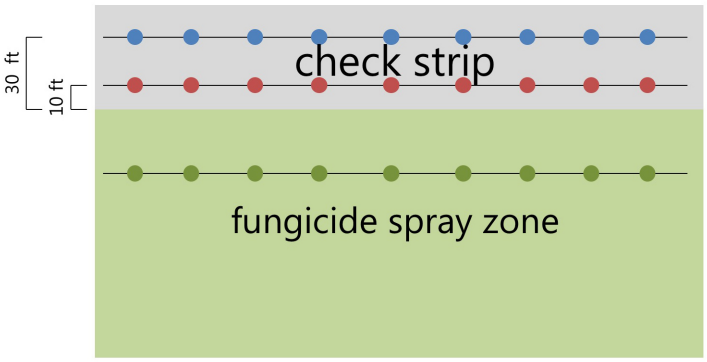


● = sample point (1 of 9) at 10 ft from edge of spray zone. Combine all reds for 1 bagged sample, labeled with the plot #. Repeat for each control plot.

● = sample point (1 of 9) within fungicide spray zone. Combine all greens for 1 bagged sample, labeled "spray zone." One spray zone sample is sufficient to provide a baseline concentration.

Figure 1. Sampling protocol at the Sieren farm near Keota. Sieren collected cereal rye foliage samples along a single transect from each of the four no-spray (control) strips and one of the four spray strips.

Figure 2



● = Sample point (1 of 9) at 30 ft from edge. Combine all blues for 1 bagged sample, labeled "30 ft."

● = sample point (1 of 9) at 10 ft from edge. Combine all reds for 1 bagged sample, labeled "10 ft."

● = sample point (1 of 9) within fungicide spray zone. Combine all greens for 1 bagged sample, labeled "spray zone."

Figure 2: Sampling protocol at the Sloan farm near Rowley. Sloan collected cereal rye foliage samples along two transects in the no-spray check strip and along one transect in the sprayed portion of the field.

Results and Discussion

Results from the chemical analysis of Spray (baseline) samples and No-Spray control samples are summarized in **Table 1**.

Sieren Farm

No propiconizole residue was found in Sieren's No-Spray strips at the reporting limit of 0.05 ppm. The results fit Sieren's expectations for drift (none detected), based on the weather conditions at the time of application. However, compared with the baseline value – 0.43 ppm in the Spray strip – a detection of 0.05 ppm would be 12% of the full spray concentration; a high limit for those concerned with drift, when the allowable limit on a particular crop may be 0.00 ppm. In instances where lower tolerance limits are needed, more sensitive analysis is possible through LC/MS/MS (used to analyze metconazole samples), at a higher cost (Environmental Micro Analysis, 2016). Case files from the Pesticide Bureau at the Iowa Department of Agriculture and Land Stewardship have reported residues of propiconozole as low as 0.22 ppb (0.0022 ppm), using liquid chromatography triple quadrupole mass spectrometry (LC/MS/MS), which they use for all fungicide sample analysis (Iowa Laboratory Facility, 2016).

Sloan Farm

For Sloan, there was a bit of residue in both the 10-ft and 30-ft control strip samples; 0.02 ppm, or 1.5% of baseline level found in the spray strip (0.43 ppm). Though 0.02 ppm is under the Maximum Residue Level for all crops listed on the Caramba (metconazole) label, for crops not on the label (most fruit and vegetable crops) any level of residue above 0.00 ppm would render the crop unsalable.

Said Sloan, "I thought the 10-ft sample might be higher than the 30-ft, but I would say the results are encouraging that drift is under control in that situation. We did have a south wind and the boom was not far above the tall rye, so the foliage caught the spray."

Table 1

Fungicide Residue Analysis Results

Farm	Sieren					Sloan		
Chemical	SharShield PPZ (propiconizole)					Caramba (metconazole)		
Plot	Spray	No-Spray 1	No-Spray 2	No-Spray 3	No-Spray 4	Spray	10-ft No-Spray	30-ft No-Spray
Residue detected (ppm)	0.43	Mis-sampled	ND[a]	ND	ND	1.30	0.02	0.02

[a] ND: None detected

Reporting limits (RL): propiconizole 0.05 ppm; metconazole 0.01 ppm

The RL is the lowest concentration at which an analyte can be detected in a sample and its concentration can be reported with a reasonable degree of accuracy and precision. The RL is typically about three to five times higher than the method detection limit (MDL), and can vary by lab and over time (California Department of Public Health, 2005).

Conclusions and Next Steps

In this demonstration project, two farmers checked the precision of their fungicide application to cereal rye by sending foliage samples for chemical analysis. Samples were taken from no-spray control strips of an on-going fungicide trial in cereal rye, and compared to the baseline sample from the sprayed strips at each farm. No residue was found in Sieren's control strips, though an analysis with higher sensitivity could have been used. Sloan's control strips showed residue of 0.02 ppm metconazole in both control strips.

Farmers are cautious with chemicals for their personal safety and cost effectiveness, but are mindful of the harm pesticide drift can have on neighboring specialty crops, too. Says Sloan, "It's a serious issue, especially with the high value crops and the multiple years of investment it takes to meet standards for food." When pesticide drift to sensitive crops occurs, the crop affected is unsalable, and the plant back period pushes losses further. For example, no leafy vegetables or brassicas can be planted within 30 days of Caramba application; unlisted crops (most other fruits and vegetables) have a 120-day plant back time (BASF Corporation, 2013). No succeeding crops intended for food, feed, or grazing not listed on the SharShield PPZ label can be planted within 105 days of SharShield PPZ application (Sharda USA LLC, 2010).

As farmers work together toward responsible pesticide use, we hope more farmers will test their own application precision and that of their contracted insecticide and fungicide applicators.

References

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PFI Cooperators' Program

PFI's Cooperators' Program gives farmers practical answers to questions they have about on-farm challenges through research, record-keeping, and demonstration projects. The Cooperators' Program began in 1987 with farmers looking to save money through more judicious use of inputs. If you are interested in conducting an on-farm trial contact Stefan Gailans @ 515-232-5661 or stefan@practicalfarmers.org.