

METRIBUZIN SAFETY IN WHEAT DEPENDS ON VARIETY PLANTED AND APPLICATION RATE

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INTRODUCTION

Metribuzin is a photosystem-II inhibiting herbicide that has a wide applicability on a number of weed species. Metribuzin is especially useful for managing Italian ryegrass and will also help manage broad leaf weeds that are resistant to synthetic auxin herbicides, such as dicamba or 2,4-D. However, safety of metribuzin used postemergence on wheat varies with variety. Occasionally, weather conditions such as cold temperatures or clouds have led to widespread damage on winter wheat where metribuzin was applied.

OBJECTIVE

To mitigate crop damage from metribuzin in winter wheat systems, a greenhouse study was conducted to determine the metribuzin tolerance of 75 wheat varieties commonly grown in Kentucky.

MATERIALS AND METHODS

To remove the impact of weather conditions on the damage done to wheat, metribuzin was applied to the 75 cultivars in controlled greenhouse conditions using a spray chamber to apply accurate doses uniformly. All 75 wheat varieties from the 2024 University of Kentucky variety testing program were sprayed with metribuzin at the 3-leaf stage with 100g ha^{-1} , 400g ha^{-1} , 1600 ha^{-1} , and 6400g ha^{-1} of metribuzin, in addition to an untreated control. 21 days after the metribuzin was applied to the wheat, visual injury ratings were recorded where “1” was no discoloration or damage, “2” was mild discoloration on the leaves, “3” was severe discoloration on the leaves, “4” was that the growing point was wilted but there was still some green in the leaves, “5” was that the plant was completely dead. Once visual rating was completed, each plant (including controls) was cut down to the growing point so that regrowth could be measured. 14 days after each plant was cut down the growing point, the regrowth was cut and weighed (fresh). Three replications of each genotype at each dose were recorded. Additionally, a field trial was performed spraying the plants at the tillering stage with 1471g ha^{-1} to determine if the greenhouse study was correlated with response under field growing conditions.

RESULTS AND DISCUSSION

Using the raw data from injury ratings and biomass of the regrowth, reliability (H^2), treatment/genotype mean estimates (BLUEs) and other statistics were calculated (Table 1). Clearly, the best dose to differentiate the tolerance of varieties to metribuzin was 400g ha^{-1} in this trial. The reliability of varieties for injury rating and regrowth in % of the untreated control (PCRG) was the highest at 400g ha^{-1} with estimates of 0.821 for the injury rating and 0.782 for PCRG. As expected, the average injury ratings increased and PCRG decreased as the dose was increased. However, at the 400g ha^{-1} , there was different responses among varieties (Table 2).

At 400g ha^{-1} there was a high correlation between injury ratings and PCRG ($s=0.72$, Figure 1) indicating that visual ratings which are much easier to measure could be used to predict how well wheat varieties

will recover (regrow) after metribuzin applications. Between the two methods of assessment many of the top/worst tolerating lines were identical. Producers interested in applying metribuzin to their wheat would be better off selecting Dyna-Gro 9172, USG 3352, or USG 3463 as the variety in their fields, as these varieties were identified as the most tolerant varieties by both measures (Table 2). Conversely, producers applying metribuzin would likely have issues with crop damage if they chose to grow GROWMARK FS 606, AgriMAXX EXP 2314, AgriMAXX 545, Dyna-Gro 9231, USG 3884, X14-1049-27-10-1 or X14-1049-27-10-1, as these varieties were identified as the least tolerant using both measures.

CONCLUSION

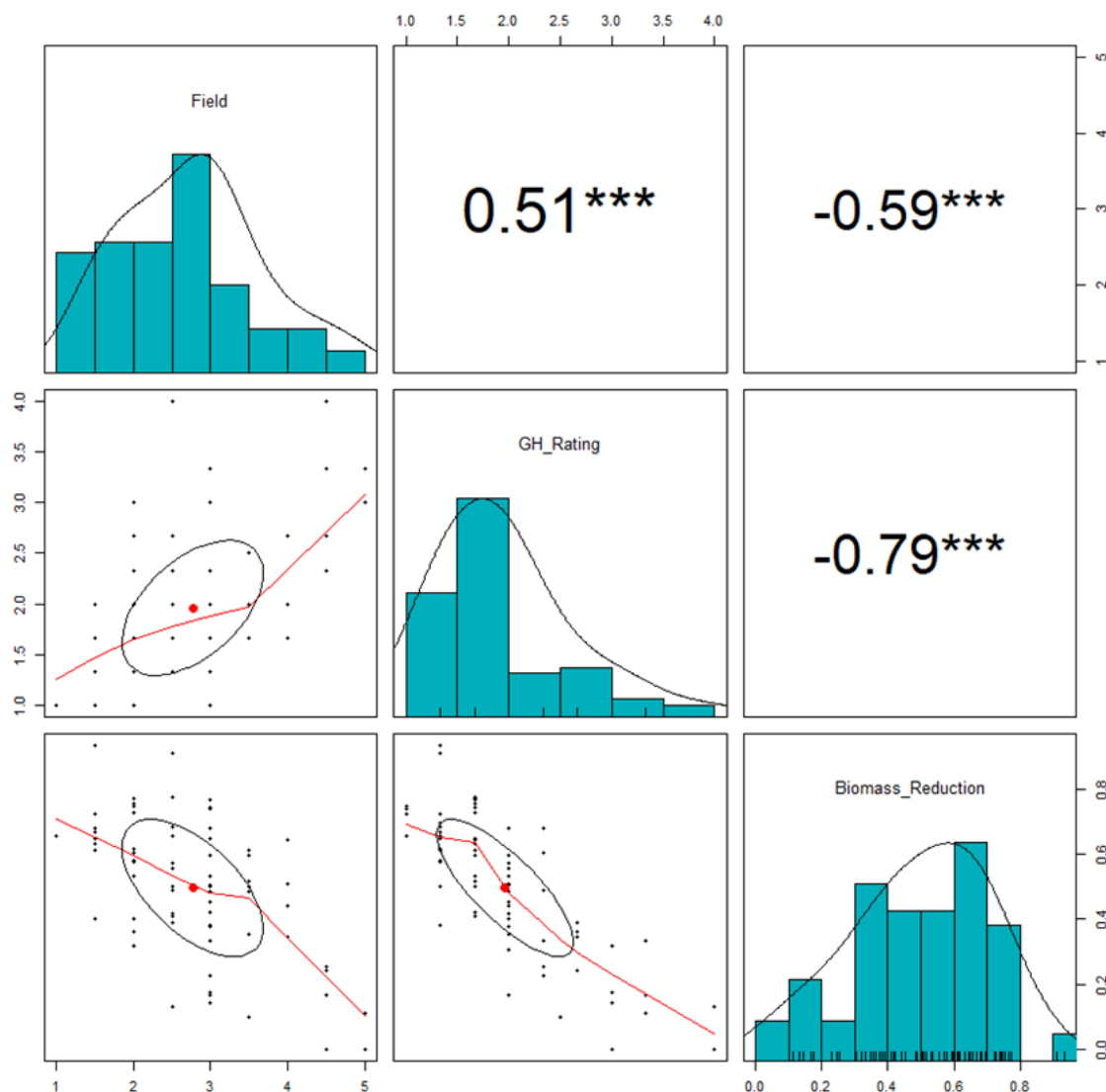


Figure 1. Distributions and correlations of the BLUEs for trial 1 of wheat varieties response to metribuzin. Spearman correlation is on the upper diagonal. Scatter plots with a line corresponding to a smoothing spline are below the diagonal. Rating is the injury rating from 1 to 5 where 5 is the most severe damage. PCRg is the percent of the control for regrowth. For Ratings and PCRg the “g” is grams per hectare applied.

Clearly, the choice of variety and dose impact the ability of wheat to tolerate a metribuzin treatment. At 400g ha⁻¹ some varieties of wheat are nearly undamaged while other varieties are completely dead. With a high reliability associated with variety at 400g ha⁻¹ it is apparent that metribuzin tolerance in wheat is genetically controlled and that selection for more metribuzin tolerant wheat varieties is possible. However, the environment also impacts the ability of wheat plants to tolerate metribuzin which was not possible to test in this experiment. In the future, we will work to develop markers for metribuzin tolerance to assist local wheat breeders in the development of metribuzin tolerant lines.

ACKNOWLEDGEMENTS

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TABLES

Dose per hectare	<u>Injury Rating (1-5)</u>				<u>Regrowth in % of Untreated Control</u>			
	H ² (Cullis)	Mean	BLUE Min	BLUE Max	H ² (Cullis)	Mean	BLUE Min	BLUE Max
GH 100g	0.624	1.31	1	2.33	0	95	64	180
GH 400g	0.821	1.96	1	4	0.782	50	0	93
GH 1600g	0.739	4.39	3	5	0	1	0	33
Field 1471g	0.916	2.8	1	5				

Table 1. Descriptive metrics from Metribuzin trial on wheat in the greenhouse during March 2024. N = 75, BLUE is the best linear unbiased estimates and H² (Cullis) is the broad sense heritability estimated using the Cullis et al. 2006 method. BLUEs are basically the treatment mean for each genotype at each dose. BLUEs are very similar to the mean response of a wheat variety.

<u>Injury Ratings</u>		<u>PCRG</u>	
Most Tolerant	Least Tolerant	Most Tolerant	Least Tolerant
CROPLAN CP8045	AgriMAXX 545	AgriMAXX 516	AgriMAXX 545
Dyna-Gro 9151	AgriMAXX EXP 2314	AgriMAXX EXP 2312	AgriMAXX EXP 2314
Dyna-Gro 9172	Dyna-Gro 9231	Dyna-Gro 9172	AgriMAXX EXP 2405
Go Wheat 4059S	Dyna-Gro 9542	Dyna-Gro 9422	CROPLAN CP8224
Go Wheat 6056	GROWMARK FS 597	KWS529	<u>Dyna-Gro 9231</u>
GROWMARK FS 745	GROWMARK FS 606	PEMBROKE 2021	GROWMARK FS 606
GROWMARK FS WX24A	USG 3574	USG 3329	USG 3884
KWS525	USG 3884	USG 3352	<u>X14-1049-27-10-1</u>
<u>USG 3352</u>	X14-1049-27-10-1	USG 3463	X14-1107-95-18-5
<u>USG 3463</u>	X14-1107-95-18-5	X14-1009-84-4-3	X14-1128-23-12-5

Table 2. Ten most and least tolerant varieties to 400g ha⁻¹ metribuzin assessed with both injury ratings and percent of control for the regrowth (PCRG).