"TOFU" herbicide screening report

preliminary results from K8 in 2022

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Introduction

IWG was planted in fall of 2021. In spring of 2022, PRE herbicides were applied and then IWG injury was scored ~10 days after application. In summer of 2022, POST herbicide treatments were applied and IWG injury was scored again ~10 days after application.

IWG injury was scored on a scale of 0-10, where 10 was severe damage. Scoring was done blind by Jesse in spring, and by Jesse Cole and Lara in summer.

The weed abundance was also visually scored. The site for this preliminary study was chosen because high weed pressure was expected, however there was very low weed pressure throughout the entire field during the study. The weed scores were meant to indicate relative differences in weeds among plots and if any sort of weed injury was visible. Due to the low weed pressure, the primary utility of the tofu data set is the IWG injury data.

Herbicides were applied at maximum rates and the summer applications were about 1-2 weeks later than ideal and IWG plants were already quite large and some seedheads were starting to emerge. The POST treatments were a worst case scenario and if no injury was observed in this study, it's very unlikely any injury will be observed.

Plot plan

		10'										
		70'									N	
	6'	101	102	103	104	105	106	107		W		E
PeWhe		acetochlor	acetochlor	acetochlor	acetochlor	acetochlor	acetochlor	acetochlor			S	
		weed-free control	weedy control	dicamba	bison	wolverine	facet L	axial XL				
		201	202	203	204	205	206	207				
		prowl	prowl	prowl	prowl	prowl	prowl	prowl				
		axial XL	weed-free control	wolverine	weedy control	facet L	bison	dicamba				
		301	302	303	304	305	306	307	30'			
		dual	dual	dual	dual	dual	dual	dual				
		wolverine	facet L	bison	weedy control	dicamba	weed-free control	axial XL				
		401	402	403	404	405	406	407				
		weedy control	weedy control	weedy control	weedy control	weedy control	weedy control	weedy control				
		dicamba	weedy control	bison	facet L	axial XL	weed-free control	wolverine				
		501	502	503	504	505	506	507				
		boundary	boundary	boundary	boundary	boundary	boundary	boundary				
		bison	axial XL	weedy control	dicamba	weed-free control	wolverine	facet L				
LegacyNet		PREs applied last week of April										
		POST applied first week of June										
		All applications at full labelled rates										
		weed-free treatments will be weeded by hand / hoe										
		visually score crop injury and weed injury and ground cover for wholeplot and subplot										
		possible: quantify dry biomass (crop and/or weed) % change from weedy+weed-free controls										
		possible: quantify yield change as % change from weedy+weed-free controls										
		possible: quantify % cover using canopeo										
		possible: fly drone over to detect changes in greenness + cool photo										
		only 1 rep, pilot study										

Datasets

```
## Rows: 35
## Columns: 7
## $ experimental_unit <dbl> 101, 102, 103, 104, 105, 106, 107, 201, 202, 203, 20~
## $ PRE               <chr> "acetochlor", "acetochlor", "acetochlor", "acetochlo~
## $ POST              <chr> "weed-free control", "weedy control", "dicamba", "bi~
## $ date              <dttm> 2022-05-19, 2022-05-19, 2022-05-19, 2022-05-19, 202~
## $ weed_vis_score    <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0~
## $ iwg_injury        <dbl> 4, 4, 4, 4, 4, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0~
## $ person            <chr> "jesse", "jesse", "jesse", "jesse", "jesse", "jesse"~
```

```
## Rows: 105
## Columns: 7
## $ experimental_unit <dbl> 101, 102, 103, 104, 105, 106, 107, 201, 202, 203, 20~
## $ PRE               <chr> "acetochlor", "acetochlor", "acetochlor", "acetochlo~
## $ POST              <chr> "weed-free control", "weedy control", "dicamba", "bi~
## $ date              <dttm> 2022-06-13, 2022-06-13, 2022-06-13, 2022-06-13, 202~
## $ weed_vis_score    <dbl> 2, 1, 3, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0~
## $ iwg_injury        <dbl> 0, 0, 0, 3, 2, 7, 1, 1, 0, 1, 0, 0, 5, 3, 3, 2, 3, 0~
## $ person            <chr> "jesse", "jesse", "jesse", "jesse", "jesse", "jesse"~
```

Spring data

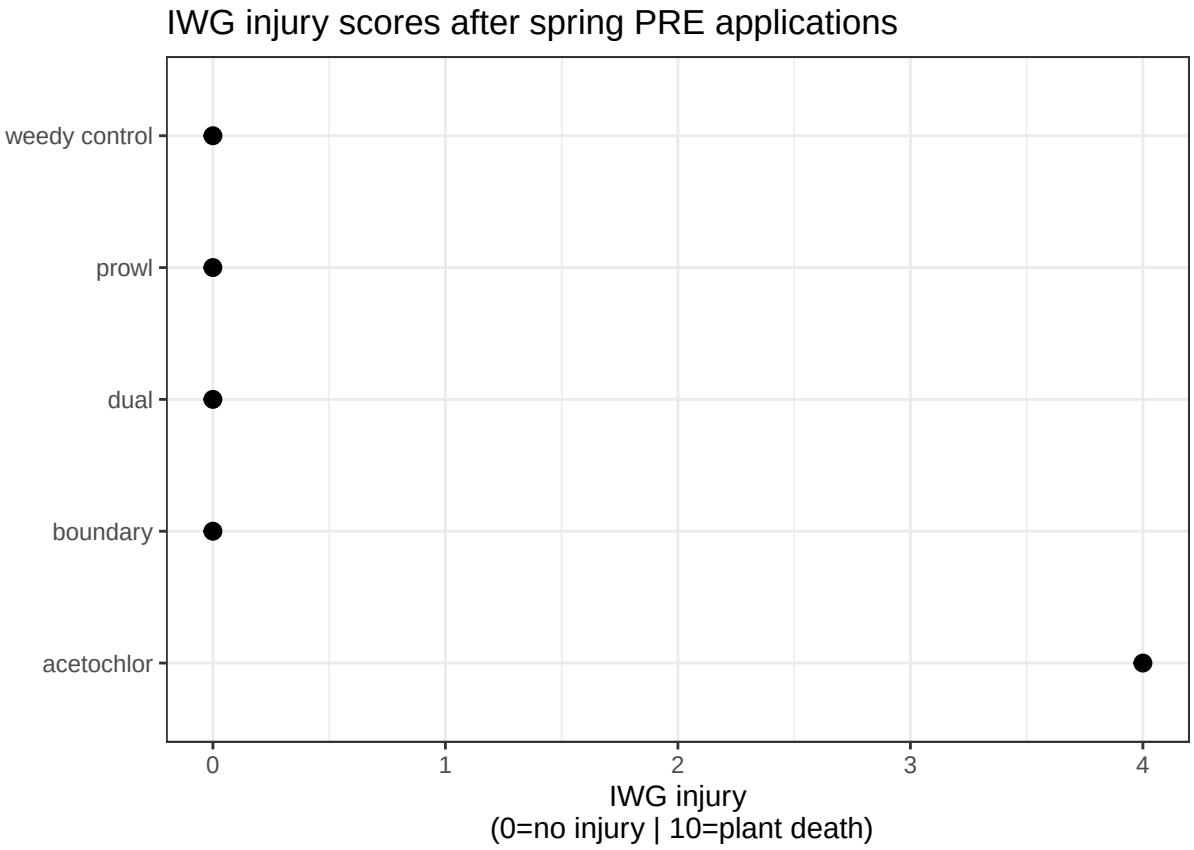

Table 1: IWG injury scores collected by Jesse on 19May2022

PRE	injury	weed	n
acetochlor	4	0	7
boundary	0	0	7
dual	0	0	7
prowl	0	0	7
weedy control	0	0	7

Summer data

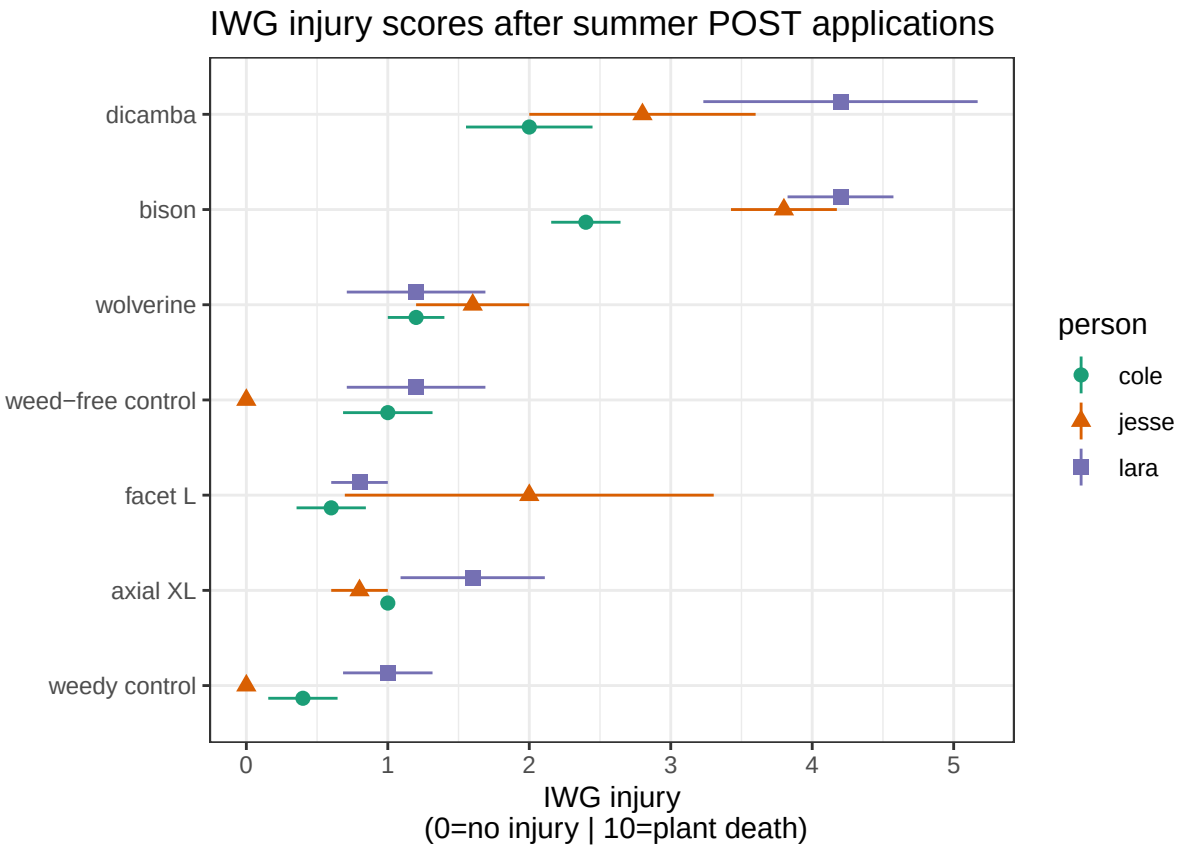

Table 2: IWG injury scores collected by Jesse on 13Jun2022

POST	injury	weed	n
axial XL	1.1	0.2	15
bison	3.5	0.6	15
dicamba	3.0	0.6	15
facet L	1.1	0.4	15
weed-free control	0.7	1.0	15
weedy control	0.5	0.6	15
wolverine	1.3	0.2	15

Findings

IWG was very resiliant to maximum rates of unlabelled herbicides applied at times when the risk of crop injury was high. All plants produced grain and there were no obvious differences in grain yield in the field, though samples have not yet been threshed.

With the exception of acetochlor, the PRE herbicides did not cause any observable damage to the IWG plant. Months after application, IWG plants that received an aceotochlor application were stunted.

ALL POST herbicides caused observable damage to the IWG plant. Of these herbicides, Axial XL caused the least damage. Axial XL (Pinoxaden) is a grass herbicide, which is exciting as we currently do not have any grass herbicides available.

Wolverine is an herbicide commonly used by the wheat breeding lab on wheatgrass. Here we observed crop injury though this may be due to the high rate and the late timing. The higher rates of injury observed in plots where dicamba and bison and facet were applied may be simply due to timing, as these growth regulators were applied to IWG after seedheads had begun to emerge.

The low injury observed in the PREs (prowl, dual and boundary) and the low injury in Axial XL even at a high rate and late timing is useful information if grass weeds pose a problem in future experiments. Pinoxaden controls foxtails and oat, but not brome.

Recommendations

Threshing samples and getting grain yields will help determine if IWG injury translated to differences in grain yield and will help determine the interaction between the PRE and POST applications to determine the worst performing programs.

Currently, the only option for the control of grass weeds is through PREs. Further trials looking at other grass herbicides and that look at different timings of the herbicides in this study would provide more information.

IWG is a very competitive plant that often doesn't warrant an herbicide application. The most injurious weeds to yield are likely winter annuals, which can be controlled with 2,4-D applied in the fall or early spring. Weed control, especially in patchy or underfertilized IWG stands can be helpful for ease of harvest, as large lambsquarter weeds can clog combine headers and add unwanted moisture to the grain tank. Again, 2,4-D is a good tool for the control of these summer annual escape weeds.

The primary reason to do further research into IWG tolerance to grass herbicides is for the scenario we observed in the NALI experiment where downy brome choked out the IWG and alfalfa. In this scenario, we did not know there was a history of Downy Brome at this site and our primary control method would have been a PRE we would've had to have applied after IWG emergence. If we had a POST grass herbicide for Downy Brome that was safe on IWG, it would've been able to save the study. Future research should look at other grass herbicides that could control downy brome and measure the effects of PRE and grass POST herbicides on *establishing* wheatgrass stands.