Postemergence Weed Management in Fallow Using Weed Sensing Spray Systems

L.S. Fields, D. Appel, Zuger R.J & I.C. Burke

The objective of this study was to evaluate the effectiveness of herbicide application using weed sensing spray technology compared to a broadcast application during fallow season with multiple herbicides. Weed sensing sprayer systems use chlorophyll sensing technology to target spray only when weeds are present in a field and thus reduce the amount of herbicide used per application. Utilizing these technologies in fallow rotations can effectively reduce the cost associated with herbicide application and improve application accuracy when compared to broadcast systems.

The study was established at the Wilke Research and Extension Farm in Davenport, WA. Postemergence treatments were applied to fallow ground with weed pressure where most weeds ranged from roughly 2 to 6 inches, detailed in Table 1 and Table 2. The study was conducted in a split-plot design with 4 replications. Plots were 10' by 30' long. Herbicides were applied on May 28th, 2019 by both a weed sensing spray system and a broadcast sprayer both pressurized by CO2 and calibrated to deliver 29.4 and 10 GPA, respectively. Following each weed sensing application, the milliliters dispensed was calculated and compared with the milliliters dispensed from broadcast application(s). The weed sensing sprayer, a WEED-IT (www.weed-it.com), was purchased through the support of the Camp endowment. Tumble mustard (*Sisymbrium altissimum*), prickly lettuce (*Lactuca serriola*), and downy brome (*Bromus tectorum*) were the three predominant weed species present in the plots at the time of application.

Weed control was visually assessed as percent control 28 days after treatment (DAT). Weed counts were taken 35 DAT along with biomass for dry weight measurements. All data was subjected to a two-way analysis of variance using the University Edition Statistical Analysis Software (SAS University), where treatment and application method were fixed effects and block was considered random. LSD results are presented in Table 2, below, the letters associated with each value indicate significant differences between application methods, where values with the same letter are not significantly different.

Table 1. *Weed sensing spray system and broadcast treatment application details*

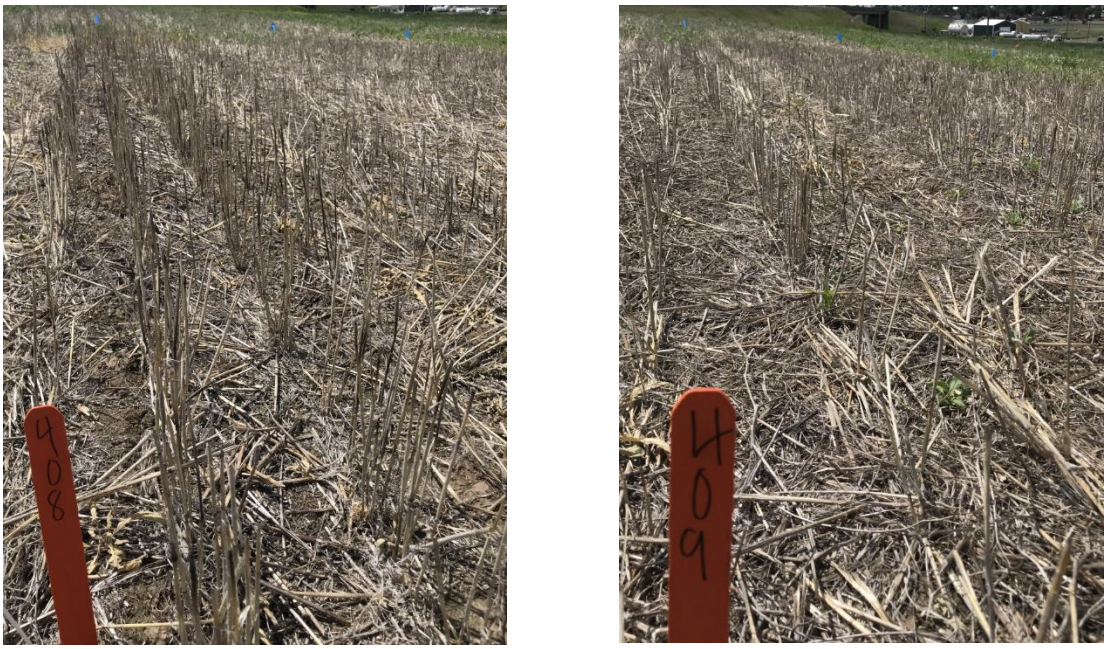
Study Application	*Weed-it*	*Broadcast*
Date	May 28, 2019	May 28, 2019
Application volume (GPA)	29.4	10
Crops Stage	Fallow	Fallow
Air temperature (F)	85	85
Soil temperature (F)	15	15
Wind velocity (mph, direction)	4.5, SW	4.5, SW
Cloud cover	15%	15%

Results

Effect of broadcast vs. weed sensing application was assessed with a focus on the prevalent weeds present in the study area; tumble mustard, prickly lettuce, and downy brome. All three species were controlled by RT3 (glyphosate) treatments with no application method effect (Table 2.).

When RT3 was applied with Sharpen (saflufenacil), tumble mustard control was greatest when applied broadcast compared to weed sensing technology with 0 g m^{-2} biomass (0 plants) for broadcast and 8 g m^{-2} biomass (10 plants) for the weed sensing application method. Prickly lettuce and downy brome control with Sharpen/RT3 had no differences between application method, however the broadcast method was more effective, likely due to lack of detection by the weed sensing sprayer (Table 2). The sprayer, depending on settings, can fail to detect small weeds.

Figure 1. *RT3 + Sharpen treatment 28 DAT through broadcast (left) and weed sensing (right)*



Brox-M was the next most effective treatment. Both broadcast and weed-sensing application methods were effective at controlling tumble mustard and prickly lettuce.

Liberty application by both application methods was effective at controlling prickly lettuce with 0 g m^{-2} biomass (0 plants). Downy brome control by Liberty was greatest when applied with weed sensing technology compared to broadcast with 0.3 g m^{-2} biomass (1 plants) for weed sensing technology and 2 g m^{-2} biomass (1 plants) for broadcast. Tumble mustard control by Liberty was also greatest when applied

with weed sensing technology compared to broadcast with 12 g m^{-2} biomass (10 plants) for weed sensing technology and 26 g m^{-2} biomass (18 plants) (Table 2.).

Gramoxone controlled prickly lettuce by broadcast application with 0 g m^{-2} biomass (0 plants). Broadcast application with Gramoxone was less effective at controlling prickly lettuce with 1 g m^{-2} biomass (3 plants). Downy brome control with Gramoxone was greatest when applied broadcast compared to weed sensing technology with 1 g m^{-2} biomass (2 plants) for broadcast and 13 g m^{-2} biomass (3 plants) for weed sensing. Gramoxone did not control tumble mustard. Tumble mustard biomass when Gramoxone was applied broadcast was 61 g m^{-2} (42 plants) and when applied with weed sensing technology was 69 g m^{-2} (24 plants) (Table 2).

Table 2. *Weed sensing vs broadcast effect on tumble mustard, prickly lettuce, and downy brome biomass and counts. Davenport, WA 2019. Means followed by the same letter are not significantly different (α=0.05).*

Trt	Appl. Method	Rate*		*July 2, 2019 35 DAT*					
				Tumble Mustard		**Prickly Lettuce**		**Downy Brome**	
				Biomass	***Counts***	***Biomass***	***Counts***	***Biomass***	***Counts***
		lb ai A^{-1}	*Field rate*	*g m^{-2}*	*# m^{-2}*	*g m^{-2}*	*# m^{-2}*	*g m^{-2}*	*# m^{-2}*
RT3 AMS	Broadcast	0.75	21.3 fl oz/A 8.5 lb/100 gal	0 e	0 e	0 b	0 b	0 c	0 b
RT3 AMS	Weed-It	5.30	4% v/v 8.5lb/100 gal	0 e	0 e	0 b	0 b	0 c	0 b
Brox-M Agridex	Broadcast	1.00	2 pt/A 1% v/v	2 de	3 e	0 b	0 b	8 ab	2 ab
Brox-M Agridex	Weed-It	1.00	2 pt/A 1% v/v	1 e	1 e	0.1 b	2 ab	0 c	0 b
Gramoxone Intoen Agridex	Broadcast	0.50	2 pt/A 1% v/v	61 a	42 a	0 b	0 b	1 bc	2 ab
Gramoxone Intoen Agridex	Weed-It	1.18	2% v/v 1% v/v	69 a	24 a	1 a	3 a	13 a	3 a
Sharpen RT3 MSO	Broadcast	0.03 0.75	1.5 fl oz/A 21.3 fl oz/A 1% v/v	0 e	0 e	0 b	0 b	0 c	0 b
Sharpen RT3 MSO	Weed-It	0.13 4.5	6 fl oz/A 21.3 fl oz/A 1% v/v	8 cd	10 cd	0.8 ab	1 ab	2 bc	1 ab
Liberty Agridex	Broadcast	0.53	29 fl oz/A 1% v/v	26 b	18 ab	0 b	0 b	2	1 ab
Liberty Agridex	Weed-It	0.53	29 fl oz/A 1% v/v	12 c	10 bc	0 b	0 b	0.3	1 ab

* For broadcast treatments, the rate noted is the rate applied. For treatments applied through the weed sensing sprayer, the rate listed is the equivalent broadcast rate. The actual rate applied is dependent on weed density and is much lower.

Disclaimer

Some of the pesticides discussed in this presentation were tested under an experimental use permit granted by WSDA. Application of a pesticide to a crop or site that is not on the label is a violation of pesticide law and may subject the applicator to civil penalties up to $7,500. In addition, such an application may also result in illegal residues that could subject the crop to seizure or embargo action by WSDA and/or the U.S. Food and Drug Administration. It is your responsibility to check the label before using the product to ensure lawful use and obtain all necessary permits in advance.