

Postemergence Weed Management in Fallow Using Weed Sensing Spray Technology

L.S. Fields, D. Appel, I.C. Burke

The objective of this study was to evaluate the effectiveness of herbicide application using weed sensing spray technology compared to broadcast application during the fallow season with multiple herbicides. The sprayer tested operates by detection of differential reflection of chlorophyll facilitated by infrared radiation and is considered a light-activated, sensor-controlled spray technology. By detecting chlorophyll in the field, weed sensing spray technologies [in this trial, a WEED-IT (www.weed-it.com)] spray only when weeds are present and thus reduce the amount of herbicide used per application or per area. Utilizing this technology 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 6 to 12 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



April 28th, 2020 by both the weed sensing sprayer and broadcast sprayer, both pressurized by CO₂ and calibrated to deliver 29.4 or 10 GPA, respectively. Following each weed sensing application, the milliliters dispensed was calculated and compared with the milliliters dispensed from the broadcast applications. Prickly lettuce (*Lactuca serriola*), common lambsquarters (*Chenopodium album*) and tumble mustard (*Sisymbrium altissimum*) were the three prominent weed species present in the plots at the time of application.

Weed control was quantified by visual assessment as percent control 9 days after treatment (DAT). Weed density was assessed 34 DAT along with biomass for dry weight measurements.

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

Study Application	<i>Weed-it</i>	<i>Broadcast</i>
Date	April 28, 2020	April 28, 2020
Application volume (GPA)	29.4	10
Crop stage	Fallow	Fallow
Air temperature (F)	60	60
Soil temperature (F)	50	50
Wind velocity, (mph, direction)	6, S	6, S
Cloud cover	20%	20%

Results

The trial was designed to assess the efficacy of the weed sensing sprayer compared to broadcast applications and focused on the typical weed species present in dryland wheat fallow production. Regardless of which sprayer was used, weed density, biomass harvested, and control 34 DAT were similar among treatments (Table 2, Table 3) for prickly lettuce, common lambsquarters, and tumble mustard. The weed sensor sprayer detected weeds present in the trial sufficiently to make it appear identical to a broadcast application. Weed sensing applications are as effective as broadcast applications at controlling prickly lettuce, common lambsquarters and tumble mustard.

The rate of herbicide is restricted to the per acre rate limitation on the herbicide label, and the rates used in our trial are an interpretation of the ‘spot treatment’ section of the respective labels. Of the products used, only RT3, Sharpen, and Gramoxone Inteon had ‘spot treatment’ sections, and we used the maximum spot treatment rate. Under certain conditions when weed densities are high, ‘spot treatment’ rates will result in a per acre rate greater than the labeled broadcast rate (and therefore mitigate any savings gained by using a weed sensing sprayer). It’s critical to scout before treatment and assess total per acre coverage of green plants per acre, and then determine a suitable rate based on cost savings goals and control outcomes. The threshold for weed sensing application effectiveness based on weed densities and herbicide applied is an important next step in our research to help farmers make more informed decisions about the rates of herbicides to use under specific conditions and also determine the calculated cost and return on investment.

The weed sensing sprayer was purchased through the support of the Camp Endowment and the Crop and Soil Science department.

Table 2. Prickly lettuce, common lambsquarters and tumble mustard biomass in response to herbicides applied broadcast or through a weed sensing sprayer in Davenport, WA 2020. Means followed by the same letter are not significantly different ($\alpha=0.05$).

Trt	Appl. Method	Rate*		Jun 1, 2020 34 DAT		
				Prickly lettuce	Common lambsquarters	Tumble mustard
				Biomass	Biomass	Biomass
		<i>lb ai A⁻¹</i>	<i>Field rate</i>	<i>g m²</i>	<i>g m²</i>	<i>g m²</i>
RT3 AMS	Broadcast	0.75	21.3 fl oz/A 8.5 lb/100 gal	0.00 b	0.05 a	0.14 b
RT3 AMS	Weed-It	5.30	4% v/v 8.5 lb/100 gal	0.04 b	0.40 a	0.07 b
Brox-M Agridex	Broadcast	1.00	2 pt/A 1% v/v	0.06 b	0.00 a	0.02 b
Brox-M Agridex	Weed-It	1.00	2 pt/A 1% v/v	0.22 b	0.07 a	0.00 b
Gramoxone Inteon Agridex	Broadcast	0.50	2 pt/A 1% v/v	0.17 b	0.13 a	0.34 b
Gramoxone Inteon Agridex	Weed-It	1.18	2% v/v 1% v/v	0.08 b	0.04 a	0.18 b
Sharpen RT3 MSO	Broadcast	0.03 0.75	1.5 fl oz/A 21.3 fl oz/A 1% v/v	0.00 b	0.00 a	0.00 b
Sharpen RT3 MSO	Weed-It	0.13 4.5	6 fl oz/A 21.3 fl oz/A 1% v/v	0.10 b	0.13 a	0.73 b
Liberty Agridex	Broadcast	0.53	29 fl oz/A 1% v/v	0.15 b	0.09 a	0.25 b
Liberty Agridex	Weed-It	0.53	29 fl oz/A 1% v/v	0.85 b	0.29 a	0.12 b
Nontreated				0.85 a	0.41 a	1.30 a

*For the broadcast treatments, the rate noted is the rate applied. For the 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

Table 3. Density of prickly lettuce, common lambsquarters and tumble mustard in response to herbicides applied broadcast or through a weed sensing sprayer in Davenport, WA 2020. Means followed by the same letter are not significantly different ($\alpha=0.05$).

Trt	Appl. Method	Rate*		Jun 1, 2020 34 DAT		
				Prickly lettuce	Common lambsquarters	Tumble mustard
				Density	Density	Density
		<i>lb ai A⁻¹</i>	<i>Field rate</i>	<i>plants/m²</i>	<i>plants/m²</i>	<i>plants/m²</i>
RT3 AMS	Broadcast	0.75	21.3 fl oz/A 8.5 lb/100 gal	0.00 b	0.11 a	0.05 b
RT3 AMS	Weed-It	5.30	4% v/v 8.5 lb/100 gal	0.05 b	0.61 a	0.04 b
Brox-M COC	Broadcast	1.00	2 pt/A 1% v/v	0.07 b	0.00 a	0.01 b
Brox-M COC	Weed-It	1.00	2 pt/A 1% v/v	0.20 ab	0.09 a	0.00 b
Gramoxone Inteon COC	Broadcast	.50	2 pt/A 1% v/v	0.14 b	0.30 a	0.14 ab
Gramoxone Inteon COC	Weed-It	1.18	2% v/v 1% v/v	0.09 b	0.13 a	0.09 b
Sharpen RT3 MSO	Broadcast	0.03 0.75	1.5 fl oz/A 21.3 fl oz/A 1% v/v	0.00 b	0.00 a	0.00 b
Sharpen RT3 MSO	Weed-It	0.13 4.5	6 fl oz/A 21.3 fl oz/A 1% v/v	0.09 b	0.16 a	0.15 ab
Liberty COC	Broadcast	.53	29 fl oz/A 1% v/v	0.11 b	0.25 a	0.18 ab
Liberty COC	Weed-It	.53	29 fl oz/A 1% v/v	0.06 b	0.35 a	0.06 b
Nontreated				0.34 a	0.27 a	0.32 a

*For the broadcast treatments, the rate noted is the rate applied. For the 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

Table 4. Prickly lettuce, common lambsquarters and tumble mustard percent control in response to herbicides applied broadcast or through a weed sensing sprayer in Davenport, WA 2020. Means followed by the same letter are not significantly different ($\alpha=0.05$).

Trt	Appl. Method	Rate*		May 7 th , 2020		
				9 DAT		
				Prickly lettuce	Common lambsquarters	Tumble mustard
		<i>lb ai A⁻¹</i>	<i>Field rate</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>
				%	%	%
RT3 AMS	Broadcast	0.75	21.3 fl oz/A 8.5 lb/100 gal	99 a	94 a	95 a
RT3 AMS	Weed-It	5.30	4% v/v 8.5 lb/100 gal	95 ab	84 a	86 a
Brox-M Agridex	Broadcast	1.00	2 pt/A 1% v/v	91 ab	98 a	93 a
Brox-M Agridex	Weed-It	1.00	2 pt/A 1% v/v	89 ab	88 a	90 a
Gramoxone Inteon Agridex	Broadcast	0.50	2 pt/A 1% v/v	88 ab	86 a	81 a
Gramoxone Inteon Agridex	Weed-It	1.18	2% v/v 1% v/v	88 ab	90 a	89 a
Sharpen RT3 MSO	Broadcast	0.03 0.75	1.5 fl oz/A 21.3 fl oz/A 1% v/v	98 a	100 a	100 a
Sharpen RT3 MSO	Weed-It	0.13 4.5	6 fl oz/A 21.3 fl oz/A 1% v/v	84 b	83 a	83 a
Liberty Agridex	Broadcast	0.53	29 fl oz/A 1% v/v	86 ab	85 a	84 a
Liberty Agridex	Weed-It	0.53	29 fl oz/A 1% v/v	86 ab	79 a	80 a
Nontreated				0	0	0

*For the broadcast treatments, the rate noted is the rate applied. For the 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.