

Weed Management in Fallow Using a Weed Sensing Sprayer

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The objective was to evaluate the economic efficiency of herbicide application using weed sensing sprayer technology compared to a broadcast application during fallow. Weed sensing sprayer systems use chlorophyll sensing technology to apply herbicide only when weeds are detected in a field and thus reduce the amount of herbicide used per application. Utilizing such 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 repeatedly applied to fallow ground at two different locations, one with low weed pressure and one with high weed pressure, detailed in Table 1 and Table 2. The study was conducted in a randomized complete block design (RCBD) with 4 replications. Plots were 10 ft by 100 ft for the low weed pressure study (site 1) and 10 ft by 80 ft long for the high weed pressure study (site 2). Site 1 (low weed pressure) had heavy straw residue and site 2 (high weed pressure) was bare ground. Tank-mixed Glyphosate (RT3), AMS and NIS were applied on June 12th by both weed sensing sprayers and broadcast sprayers. On June 25th and July 10th treatments were applied by the weed sensing sprayer only, and on July 25th by both weed sensing sprayers and broadcast sprayers. Glyphosate (RT3) was applied at a rate of 21.3 fl oz A⁻¹ along with NIS (0.25% v/v) and AMS (10 lb/100 gal) purchased at the following costs \$19.50 gal⁻¹ (RT3), \$0.27 lb⁻¹ (AMS), and \$33.78 gal⁻¹ (NIS) for all applications. Applications by both weed sensing spray systems and broadcast sprayers were pressurized by CO₂ and calibrated to deliver 29.4 and 10 gallons per acre, respectively. Following each weed sensing application, the milliliters dispensed was calculated to determine the actual product output of the weed sensing spray system. The weed sensing sprayer, a WEED-IT (www.weed-it.com), was purchased through the support of the Camp endowment.



Figure 1 (above). Weeds sprayed with weed sensing sprayer system. Blue dye was added to the application solution to check system efficacy.

Table 1. Weed sensing & broadcast application details for the heavy weed pressure study (site 2)

Study Application	Application 1		Application 2	Application 3	Application 4	
Date	June 12, 2019	June 12, 2019	June 25, 2019	July 10, 2019	July 25, 2019	July 25, 2019
Application Method	Weed Seeker	Broadcast	Week Seeker	Weed Seeker	Weed Seeker	Broadcast
Weed Size (in)	12	12	6	2-4	6	6
Air temperature (F)	83	83.4	66	72.1	70	74.4
Soil temperature (F)	18	20	19	16	12	16
Relative humidity (%)	26.3	26.3	32.4	27.5	33.2	33.2
Wind velocity (mph, direction)	4.9, NE	4.9, NE	3.5, NW	6.4, W	3.3, SW	7, SW
Cloud cover	30%	30%	83%	90%	30%	30%

Table 2. Weed sensing & broadcast application details for the low weed pressure study (site 1)

Study Application	Application 1		Application 2	Application 3	Application 4	
	June 12, 2019	June 12, 2019	June 25, 2019	July 10, 2019	July 25, 2019	July 25, 2019
Date	June 12, 2019	June 12, 2019	June 25, 2019	July 10, 2019	July 25, 2019	July 25, 2019
Application Method	Weed Seeker	Broadcast	Week Seeker	Weed Seeker	Weed Seeker	Broadcast
Weed Size (in)	12-24	12-24	6	6	6	6
Air temperature (F)	83	80.1	66	72.1	72	74.4
Soil temperature (F)	15	15	19	16	20	20
Relative humidity (%)	35.8	35.8	21.5	27.5	21.5	21.5
Wind velocity (mph, direction)	1.7, NE	4.7, NE	3.5, NW	2.2, SW	3.3, SW	7.4, SW
Cloud cover	30%	30%	83%	71%	83%	83%

Results

For the heavy weed pressure study (site 2), application 1 cost \$4.36 A⁻¹ for the broadcast and \$3.26 A⁻¹ for the weed sensing application. Application 2 and 3 did not include a broadcast application because weed pressure did not require spraying. Application 2 weed sensing cost \$0.20 A⁻¹ and application 3 cost \$1.26 A⁻¹. Both the broadcast and the weed sensing system were used again for application 4 with a cost of \$4.36 A⁻¹ for the broadcast and \$1.23 for the weed sensing system (Table 3).

For the low weed pressure study (site 1), application 1 cost \$4.36 A⁻¹ for the broadcast and \$0.57 A⁻¹ for the weed sensing application. Application 2 and 3 did not include a broadcast application because weed pressure did not require spraying. Application 2 weed sensing cost \$0.90 A⁻¹ and application 3 cost \$2.28 A⁻¹. Both the broadcast and the weed sensing system were used again for application 4 with a cost of \$4.36 A⁻¹ for the broadcast and \$1.84 for the weed sensing application (Table 3).

The costs for each application were added together to determine the total cost. The total cost for all broadcast applications equated to \$8.72 A⁻¹ and the total cost for all weed sensing applications equated to \$5.59 A⁻¹ for the low weed pressure study (site 1) and \$5.95 A⁻¹ for the high weed pressure study (site 2) (Table 3). The weed sensing system had lower costs per acre, based solely on chemicals and not on other input costs (fuel or equipment price), for the entire fallow season although it was used twice as often as a broadcast application.

Table 3. Weed sensing and broadcast application cost analysis per acre for each application

Site	Weed Pressure	Application Method	Application 1 June 12, 2019		Application 2 June 25, 2019		Application 3 July 10, 2019		Application 4 July 25, 2019		Total Cost
			Output	Cost	Output	Cost	Output	Cost	Output	Cost	
			GPA	\$ A ⁻¹	GPA	\$ A ⁻¹	GPA	\$ A ⁻¹	GPA	\$ A ⁻¹	
1	Low	Broadcast	10	\$4.36	0	\$0	0	\$0	10	\$4.36	\$8.72
1	Low	Weed Sensing	5	\$0.57	8	\$0.90	20	\$2.28	16	\$1.84	\$5.59
2	Heavy	Broadcast	10	\$4.36	0	\$0	0	\$0	10	\$4.36	\$8.72
2	Heavy	Weed Sensing	28	\$3.26	2	\$0.20	11	\$1.26	11	\$1.23	\$5.95

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.