Season Long Fallow Weed Management Using

Weed Sensing Spray Technology and Glyphosate

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The objective of this study was to evaluate the economic savings associated with herbicide application using weed sensing spray technology compared to broadcast applications in fallow. Weed sensing spray systems operate by detection of differential reflection of chlorophyll facilitated by infrared radiation and is considered 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. Utilizing this technology in fallow can effectively reduce the cost associated with herbicide application compared to broadcast systems.

The study was established the Wilke Research and Extension Farm in Davenport, WA. Postemergence treatments were repeatedly applied to fallow ground at two different sites, one with high weed pressure, where an average of 917 mL was dispensed following the first weed sensing application (Site 1) and one with low weed pressure where an average of just 350 mL was dispensed following the first weed sensing application (Site 2), detailed in Table 1 and Table 2. The study was conducted in a randomized complete block design (RCBD) with 4 replications. Plots were 10' by 100'. Tank-mixed glyphosate (RT3), AMS and NIS were applied June 23rd by both weed sensing and broadcast sprayers at both sites. On July 27th applications were made weed sensing only at both sites. On August 17th applications were made broadcast and weed sensing at both sites.

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 and broadcast sprayers were pressurized by CO_2 and calibrated to deliver 29.4 or 10 gallon per acre, respectively. Note that the weed sensing applications occur at a higher carrier volume, influencing the amount of herbicide used by the weed sensing sprayer

Following each weed sensing application, milliliters dispensed was calculated to determine the actual product output of the weed sensing spray applications.

Results

At the high weed pressure site (Site 1), application 1 cost $4.61 A^{-1} for the broadcast and $8.81 A^{-1} for the weed sensing application. Application 2 did not receive a broadcast application because weed pressure did not require spraying. Application 2 weed sensing cost was $2.79 A^{-1}. Both broadcast and weed sensing applications were made for application 3 with a cost of $4.61 A^{-1} for the broadcast and $2.23 A^{-1} for the weed sensing (Table 3).

At the low weed pressure site (Site 2), application 1 cost $4.61 A^{-1} for the broadcast and $3.36 A^{-1} for the weed sensing application. Application 2 did not receive a broadcast application because weed pressure did not require spraying. Application 2 weed sensing cost was $4.35 A^{-1}. Both broadcast and weed sensing application were made for Application 3 with a cost of $4.61 A^{-1} for the broadcast and $4.44 A^{-1} for the weed sensing application (Table 3).

The cost for each application were summed to determine the total season long herbicide cost. The total cost for all broadcast applications was $9.22 A^{-1} and the total cost for all weed sensing applications at Site was $13.83 A^{-1} and $12.15 A^{-1} at site 2. Despite the spot spraying

action of the weed sensing sprayer, costs associated with herbicide application was still higher than when broadcast applied.

Significantly, substantially higher rates of herbicide was applied to each weed treated using the weed-sensing sprayer, and little herbicide was applied to bare ground. Although weed sensing applications are most effective at reducing costs when weed pressure is low, increasing the overall dose of herbicide to each weed treated is an additional benefit. Initial broadcast application followed by weed sensing applications mid-season would likely help to reduce herbicide costs when compared to reliance on weed sensing applications for the entire season, as would using similar rates of herbicide in the weed sensing sprayer. Carefully selecting the rate of herbicide and also scouting the area to be treated for percent cover of weeds would facilitate a balanced decision on herbicide rate, efficacy, and overall operational costs.

Table 1. *Weed sensing & broadcast application details for the high weed pressure site*

Study application	Application 1		Application 2		Application 3	
Date	June 23rd	June 23rd	July 27th	July 27th	August 17th	August 17th
Application method	Weed sensing	Broadcast	Weed sensing	Broadcast	Weed sensing	Broadcast
Weed size (in)	6 - 12	6 - 12	6 - 12	6 - 12	6 - 12	6 - 12
Air temperature (F)	72	72	76.7	76.7	84	84
Soil temperature (F)	70	70	72	72	76	76
Relative humidity (%)	50	50	30	30	30	30
Wind velocity (mph, direction)	5, S	5, S	6, NE	6, NE	6.4, S	6.4, S
Cloud cover	30%	30%	30%	30%	30%	30%

Table 2. *Weed sensing & broadcast application details for the low weed pressure site*

Study application	Application 1		Application 2		Application 3	
Date	June 23rd	June 23rd	July 27th	July 27th	August 17th	August 17th
Application method	Weed sensing	Broadcast	Weed sensing	Broadcast	Weed sensing	Broadcast
Weed size (in)	6 - 12	6 - 12	6 - 12	6 - 12	6 - 12	6 - 12
Air temperature (F)	72	72	76.7	76.7	84	84
Soil temperature (F)	70	70	72	72	76	76
Relative humidity (%)	50	50	30	30	30	30
Wind velocity (mph, direction)	5, S	5, S	6, NE	6, NE	6.4, S	6.4, S
Cloud cover	30%	30%	30%	30%	30%	30%

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

Site	Weed pressure	Application method	Application 1 June 23rd, 2020		Application 2 July 27th, 2020		Application 3 August 17th, 2020		Total
			Output	Cost	Output	Cost	Output	Cost	Cost
			GPA	*$ A^{-1}*	*GPA*	*$ A^{-1}*	*GPA*	*$ A^{-1}*	*$ A^{-1}*
1	High	Broadcast	15	4.61	0	0	15	4.61	9.22
1	High	Weed sensing	10.6	8.81	3.34	2.79	2.7	2.23	13.83
2	Low	Broadcast	15	4.61	0	0	15	4.61	9.22
2	Low	Weed sensing	4	3.36	5.21	4.35	5.3	4.44	12.15

Figure 1. Site 1 broadcast plot weed pressure 7 DAT (8/24/20)

Figure 2. Site 1 weed sensing plot weed pressure 7 DAT (8/24/20)

Figure 3. Site 2 broadcast plot weed pressure 7 DAT (8/24/20)

Figure 4. Site 2 weed sensing plot weed pressure 7 DAT 8/24/20)