Glufosinate and Tiafenacil Burndown Trial

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Objective. Assess the efficacy of various burndown herbicide programs based on glufosinate, including Lifeline and Rely 280, and tiafenacil.

Methods. This experiment was conducted at the UC Davis Plant Sciences Field Facility in Davis, CA. Fourteen herbicide treatments (see table 1 for treatment description) were laid out in small plot research study in a fallowed field, using 10'x30' plots in a randomized complete block design with four replicates. All herbicide treatments were applied on June 28, 2019 using a backpack sprayer pressurized with carbon dioxide and equipped with a four-nozzle (TeeJet AIXR11002) boom on 18" nozzle spacing. The sprayer was calibrated to 29 PSI in order to apply 30 GPA based on a 2 MPH application speed, and plots were treated down the center of each plot, along the longer axis. Plots were rated for visible weed control relative to nontreated plots and running checks in between plots. Weed species rated were prostrate pigweed (*Amaranthus blitoides*), common purslane (*Portulaca oleracea*), common lambsquarters (*Chenopodium album*), velvetleaf (*Abutilon theophrasti*), and horseweed (*Erigeron canadensis*), and ratings occurred 3, 7, 14, and 31 days after application. At the time of application, prostrate pigweed was up to 1' in diameter, common purslane was up to 1' in diameter, common lambsquarters was up to 1.5' tall, velvetleaf was up to 2' tall, and horseweed was up to 1' tall. Results were analyzed using analysis of variance in ARM 2019, with mean comparisons using protected least significant difference.

Results. Three days after application, no glufosinate-based treatment provided more than 51% average control for any weed species. For common lambsquarters, Lifeline + Motif provided reduced control compared to the equivalent rate of Rely 280 + Broadworks table (table 2). All tiafenacil-based treatments resulted in at least 68% control of all species and greater than 90% control of common purslane at this timing (table 3). Seven days after application, there were no statistical difference between glufosinate-based treatments, with the exception of Lifeline + Motif treatments providing somewhat reduced control of common lambsquarters (table 2). Tiafenacil-based treatments all provided good to excellent control of all rated weed species, though common purslane had begun regrowing begun by this date (figure 1).

Figure 1. Regrowth of common purslane treated with 25 g ai ha^{-1} tiafenacil, as observed on July 5, 2019, seven days after herbicide application.

Fourteen days after treatment, Lifeline GT treatments generally demonstrated improved control of prostrate pigweed (table 4), common purslane (table 3), and common lambsquarters (table 2) compared to other Lifeline-based treatments. The 99.2 fl oz ac^{-1} Lifeline GT treatment

provided reduced control of velvetleaf: at 68% compared to 94% average control from the higher rate of Lifeline GT and no less than 84% average control from any other glufosinate-based treatment (table 5). All glufosinate-based treatments resulted in between 71% and 88% control of horseweed (table 6). Tiafenacil with Roundup Powermax and tiafenacil with Rely 280 had lower prostrate pigweed control (table 4) but better common lambsquarters control (table 2) compared to other tiafenacil-based treatments. Tiafenacil alone at any rate resulted in fair control of common lambsquarters, between 48% and 56% (table 2). All tiafenacil treatments also resulted in fair to good control of horseweed, from 45% to 68%, with the exception of reduced control provided by the 75 g ai ha^{-1} tiafenacil treatment, which resulted in 36% control (table 6).

Thirty-one days after treatment, there were few differences between glufosinate-based treatments. Nearly all glufosinate-based treatments resulted in fair to good control of prostrate pigweed (table 4), common purslane (table 3), velvetleaf (table 5), and horseweed (table 6). However, Rely 280 resulted in 63% control and Rely 280 + Broadworks resulted in 79% average control of common lambsquarters, while Lifeline-based treatments resulted in at most 53% control of this species (table 2). Few differences existed between tiafenacil-based treatments, which generally resulted in good control of velvetleaf (table 5), fair control of prostrate pigweed (table 4) and common purslane (table 3), and poor to fair control of common lambsquarters (table 2) and horseweed (table 6).

Conclusions. Herbicide treatments based on both glufosinate and tiafenacil resulted in fast-acting burndown of relatively large weeds but also had limited efficacy by the end of the study due to regrowth. Control was highest at the 14 days after application rating for glufosinate-based treatments, while tiafenacil control peaked slightly earlier. The fast-appearing symptoms of tiafenacil gave way to regrowth, with only velvetleaf showing symptoms of good control by the end of the study. Glufosinate-based treatments also resulted in weed regrowth by the end of the study, and common lambsquarters, especially, was poorly controlled by the final rating at 31 days after treatment. The inclusion of systemic tank-mix herbicides did not consistently increase weed control, though Rely 280 + Broadworks did increase efficacy on common lambsquarters. It is important to note that this study was conducted on large weeds in mid-summer which would greatly impact the efficacy of most contact herbicides in this environment.

Table 1. Herbicides and herbicide rates used in this study

Trt No.	Herbicide Name	Rate	Adjuvant
1	Nontreated	N/A	N/A
2	Glufosinate (Lifeline)	56 fl oz a^{-1}	AMS 1% v v^{-1}
3	Glufosinate (Lifeline)	82 fl oz a^{-1}	AMS 1% v v^{-1}
4	Glufosinate + Glyphosate (Lifeline GT)	99.2 fl oz a^{-1}	AMS 1% v v^{-1}
5	Glufosinate + Glyphosate (Lifeline GT)	144 fl oz a^{-1}	AMS 1% v v^{-1}
6	Glufosinate (Lifeline)	56 fl oz a^{-1}	AMS 1% v v^{-1}
	Mesotrione (Motif)	3 fl oz a^{-1}	
7	Glufosinate (Lifeline)	56 fl oz a^{-1}	AMS 1% v v^{-1}
	Mesotrione (Motif)	6 fl oz a^{-1}	
8	Glufosinate (Rely 280)	56 fl oz a^{-1}	AMS 1% v v^{-1}
9	Glufosinate (Rely 280)	56 fl oz a^{-1}	AMS 1% v v^{-1}
	Mesotrione (Broadworks)	6 fl oz a^{-1}	
10	Tiafenacil	25 g ai ha^{-1}	AMS 1% v v^{-1}
			MSO 1% v v^{-1}
11	Tiafenacil	50 g ai ha^{-1}	AMS 1% v v^{-1}
			MSO 1% v v^{-1}
12	Tiafenacil	75 g ai ha^{-1}	AMS 1% v v^{-1}
			MSO 1% v v^{-1}
13	Tiafenacil	25 g ai ha^{-1}	AMS 1% v v^{-1}
	Glyphosate (Roundup Powermax)	870 g ai ha^{-1}	MSO 1% v v^{-1}
14	Tiafenacil	25 g ai ha^{-1}	AMS 1% v v^{-1}
	Glufosinate (Rely 280)	56 fl oz a^{-1}	MSO 1% v v^{-1}

Table 2. Control of common lambsquarters (*Chenopodium album*) 3, 7, 14, and 21 days after herbicide treatment (DAT) in this study. Treatment descriptions are in table 1. Means in the same column and with the same letter are not significantly different based on LSD (P>0.05).

	% visible control			
Trt No.	3 DAT	7 DAT	14 DAT	31 DAT
1	0.0 f	0.0 f	0.0 g	0.0 g
2	38.8 cde	47.5 de	32.5 ef	30.0 c-f
3	48.8 bcd	43.8 de	23.8 f	22.5 d-g
4	43.8 b-e	50.0 de	65.0 a-d	31.3 c-f
5	51.3 bc	58.8 bcd	81.3 a	52.5 bc
6	36.3 de	31.3 e	63.8 a-d	45.0 b-e
7	31.3 e	48.8 de	75.0 abc	46.3 bcd
8	45.0 bcd	57.5 cd	67.5 a-d	62.5 ab
9	55.0 b	75.0 abc	86.3 a	78.8 a
10	71.3 a	78.8 ab	47.5 def	17.5 fg
11	68.8 a	85.0 a	55.0 cde	13.8 fg
12	70.0 a	73.8 abc	56.3 b-e	21.3 efg
13	72.5 a	83.8 a	80.0 ab	37.5 c-f
14	72.5 a	82.5 a	78.8 abc	35.0 c-f

Table 3. Control of common purslane (*Portulaca oleracea*) 3, 7, 14, and 21 days after herbicide treatment (DAT) in this study. Treatment descriptions are in table 1. Means in the same column and with the same letter are not significantly different based on LSD (P>0.05).

	% visible control			
Trt No.	3 DAT	7 DAT	14 DAT	31 DAT
1	0.0 c	0.0 e	0.0 f	0.0 c
2	33.8 b	56.3 bc	65.0 cde	52.5 ab
3	30.0 b	47.5 bcd	61.3 de	46.3 b
4	32.5 b	52.5 bcd	77.5 a-d	72.5 a
5	33.8 b	45.0 cd	81.3 abc	55.0 ab
6	27.5 b	37.5 d	53.8 e	48.8 ab
7	33.8 b	45.0 cd	61.3 de	55.0 ab
8	37.5 b	62.5 b	73.8 a-d	61.3 ab
9	40.0 b	50.0 bcd	71.3 bcd	65.0 ab
10	91.3 a	95.5 a	82.5 ab	46.3 b
11	95.0 a	95.5 a	88.8 a	52.5 ab
12	95.0 a	95.0 a	81.3 abc	47.5 ab
13	93.8 a	95.5 a	75.0 a-d	62.5 ab
14	95.0 a	93.8 a	70.0 b-e	52.5 ab

Table 4. Control of prostrate pigweed (*Amaranthus blitoides*) 3, 7, 14, and 21 days after herbicide treatment (DAT) in this study. Treatment descriptions are in table 1. Means in the same column and with the same letter are not significantly different based on LSD (P>0.05).

	% visible control			
Trt No.	3 DAT	7 DAT	14 DAT	31 DAT
1	0.0 d	0.0 c	0.0 d	0.0 c
2	31.3 c	55.0 b	68.8 bc	60.0 ab
3	38.8 bc	51.3 b	61.3 c	50.0 ab
4	33.8 bc	53.8 b	80.0 ab	70.0 ab
5	33.8 bc	48.8 b	78.8 ab	60.0 ab
6	23.8 c	45.0 b	57.5 c	61.3 ab
7	37.5 bc	47.5 b	58.8 c	58.8 ab
8	35.0 bc	60.0 b	73.8 bc	65.0 ab
9	50.0 b	61.3 b	71.3 bc	73.8 a
10	80.0 a	85.0 a	82.5 ab	50.0 ab
11	93.8 a	93.8 a	92.5 a	45.0 b
12	90.0 a	93.0 a	82.5 ab	50.0 ab
13	95.0 a	96.0 a	73.8 bc	67.5 ab
14	92.5 a	95.5 a	73.8 bc	62.5 ab

Table 5. Control of velvetleaf (*Abutilon theophrasti*) 3, 7, 14, and 21 days after herbicide treatment (DAT) in this study. Treatment descriptions are in table 1. Means in the same column and with the same letter are not significantly different based on LSD (P>0.05).

	% visible control			
Trt No.	3 DAT	7 DAT	14 DAT	31 DAT
1	0.0 c	0.0 d	0.0 d	0.0 d
2	30.0 b	71.3 c	86.3 ab	80.0 ab
3	31.3 b	68.8 c	87.5 ab	70.0 bc
4	33.8 b	62.5 c	67.5 c	56.3 c
5	33.8 b	70.0 c	93.8 a	80.0 ab
6	38.8 b	71.3 c	85.0 ab	78.8 ab
7	45.0 b	72.5 c	83.8 ab	86.3 a
8	43.8 b	72.5 c	92.5 a	82.5 ab
9	48.8 b	76.3 bc	90.0 ab	82.5 ab
10	80.0 a	88.0 ab	81.3 b	83.8 ab
11	92.5 a	95.0 a	95.0 a	81.3 ab
12	93.8 a	91.3 a	91.3 ab	83.8 ab
13	91.3 a	95.0 a	95.0 a	85.0 ab
14	93.8 a	94.3 a	95.0 a	81.3 ab

Table 6. Control of horseweed (*Erigeron canadensis*) 3, 7, 14, and 21 days after herbicide treatment (DAT) in this study. Treatment descriptions are in table 1. Means in the same column and with the same letter are not significantly different based on LSD (P>0.05).

	% visible control			
Trt No.	3 DAT	7 DAT	14 DAT	31 DAT
1	0.0 c	0.0 e	0.0 d	0.0 f
2	27.5 b	66.3 bcd	71.3 a	43.8 b-e
3	27.5 b	63.8 bcd	80.0 a	60.0 abc
4	32.5 b	56.3 d	81.3 a	56.3 abc
5	36.3 b	65.0 bcd	82.5 a	71.3 a
6	37.5 b	60.0 cd	85.0 a	58.8 abc
7	35.0 b	62.5 cd	87.5 a	66.3 ab
8	37.5 b	63.8 bcd	82.5 a	47.5 a-d
9	43.8 b	67.5 bcd	85.0 a	63.8 ab
10	75.0 a	71.3 abc	46.3 bc	28.8 de
11	83.8 a	72.5 abc	67.5 ab	23.8 def
12	82.5 a	72.5 abc	36.3 c	20.0 ef
13	83.8 a	77.5 ab	45.0 bc	35.0 cde
14	82.5 a	85.0 a	62.5 ab	43.8 b-e