Linuron (Linex) for Broadleaf Weed Control in Alfalfa

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Methods

The study was established at the Washington State University Research Farm near Othello, WA. Treatments were applied at three separate timings; pre-bud formation (application A), 5" tall crop stand before 1st cutting (application B), and split applications of Linex at 5" tall crop stand before 1st cutting and 6" tall crop stand after first cutting (application A & B), detailed in Table 1 and Table 2. The study was conducted in a randomized complete block with 4 replications. Plots were 10' by 30' long.

Crop injury and crop stunting were visually rated for application A 33, 45, and 53 days after treatment (DAT). Crop injury was visually rated for application B 10 and 18 DAT. Plots were harvested using a sickle-bar mower on May 3, 2016, June 28, 2016, and August 9, 2016. Plant heights from two plants in each plot were recorded prior to harvest. Swaths of 2.5' by 30' were cut up the center of the plot, collected into totes and weighed in the field. Grab samples fresh weights were collected from each plot before being dried in an oven set at 60˚C to determine percent moisture at harvest and hay dry matter yields were calculated.

Percent data were arcsine square-root transformed. All data were subjected to an analysis of variance using the statistical package built into the Agricultural Research Manager software system (ARM 8.5.0, Gylling Data Management).

Results

No significant crop injury was observed 33 and 45 days after application code A (linuron applied pre-emergence). Significant crop injury was observed 10 days after application for all treatments applied at timing B, with the greatest percent injury of 60% for the highest rate of Linex (2.0 lb ai A^{-1}) + NIS (0.25 % v/v) (Table 2). Crop injury from the application B timing worsened 18 DAT (Table 2). Linex at 0.5, 1.0, and 2.0 lb ai A^{-1} with NIS (0.25 % v/v) caused 25, 43 and 73% injury, respectively (18 DAT). Injury was also observed when linuron was applied after the first cutting, but only for the highest rate of linuron (2.0 lb ai A^{-1}). Significant crop stunting of 18% occurred 10 DAT for Linex at 2.0 lb ai A^{-1} with NIS (0.25% v/v), while no other treatments had visual crop stunting. Eighteen days after application B, there was significant crop stunting for all applications made to 5" alfalfa prior to the first cutting (Table 1). Alfalfa in all treatments had recovered by the second cutting.

The effects of application B were also observed at the 1st cutting. The average plant heights and yields were significantly lower than that of applications A (Table 2). At 2nd cutting, minor difference in plant height were observed however no significant difference in yield were determined for any of treatment. By the 3rd cutting, crop previously injured by applications had grown out and there was no significant difference between plant heights or yield for any of the treatments.

Table 1. *Treatment application details*

Study Application	**A**	**B**	**C**
Date	February 26, 2016	April 1, 2016	May 27, 2016
Application volume (GPA)	15	15	15
Crop Stage	1” alfalfa	5” alfalfa	3-6” alfalfa after first cutting
Air temperature (˚F)	44	60	56
Soil temperature (˚F)	41	54	65
Wind velocity (mph, direction)	6, W	4, E	10, W

Table 2. *Percent injury and crop stunting of alfalfa following applications of Linex at different rates with and without the addition of a surfactant, Induce (NIS). Othello, WA, 2015 -2016. Means followed by the same letter are not statistically different (α=0.05).*

Treatment	**Application Code**	**Rate**		*March 30, 2016*	*April 11, 2016*		*April 19, 2016*		*June 6, 2016*	*July 14, 2016*
				Crop Injury	**Crop Injury**	**Crop Stunting**	**Crop Injury**	**Crop Stunting**	**Crop Injury**	**Crop Injury**
			lb ai/A	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Nontreated				0	0 a	0 a	0 a	0 a	0	0
Linex	A	1 pt/A	0.50	0	0 a	0 a	0 a	0 a	0	0
Linex	A	2 pt/A	1.00	0	0 a	0 a	0 a	0 a	0	0
Linex	A	4 pt/A	2.00	0	0 a	0 a	0 a	0 a	0	0
Linex Induce (NIS)	B B	1 pt/A 0.25 % v/v	0.50	0	23 b	0 a	25 b	9 ab	0	0
Linex Induce (NIS)	B B	2 pt/A 0.25 % v/v	1.00	0	41 c	0 a	43 c	13 b	0	0
Linex Induce (NIS)	B B	4 pt/A 0.25 % v/v	2.00	2	60 d	18 b	73 d	40 c	0	0
Linex Linex Induce (NIS)	A C C	1 pt/A 1 pt/A 0.25 % v/v	0.50 0.50	0	0 a	0 a	0 a	0 a	5	0
Linex Linex Induce (NIS)	A C C	2 pt/A 2 pt/A 0.25 % v/v	1.00 1.00	0	0 a	0 a	0 a	0 a	11	0
Linex Linex Induce (NIS)	A C C	4 pt/A 4 pt/A 0.25 % v/v	2.00 2.00	0	0 a	0 a	0 a	0 a	25	0

Table 3. *Alfalfa plant heights and yield for the 1st, 2nd, and 3rd cuttings applications of Linex at different rates with and without the addition of a surfactant, Induce (NIS). Othello, WA, 2015 - 2016. Means followed by the same letter are not statistically different (α=0.05).*

Treatment	Application Code	Rate		June 7, 2016 1st Cutting		June 28, 2016 2nd Cutting		August 19, 2016 3rd Cutting	
				Plant Ht	Yield	Plant Ht	Yield	Plant Ht	Yield
			lb ai/A	cm	lb DM/A	cm	lb DM/A	cm	lb DM/A
Nontreated				68 ab	6090 a	74 a	5880	67	4230
Linex	A	1 pt/A	0.50	62 b	5900 a	75 a	4780	57	4410
Linex	A	2 pt/A	1.00	65 ab	6150 a	72 ab	5820	57	3810
Linex	A	4 pt/A	2.00	63 ab	5930 a	75 a	5160	62	4140
Linex Induce (NIS)	B B	1 pt/A 0.25 % v/v	0.50	53 c	3330 b	71 ab	5260	67	4920
Linex Induce (NIS)	B B	2 pt/A 0.25 % v/v	1.00	48 c	2710 bc	73 ab	6870	68	4500
Linex Induce (NIS)	B B	4 pt/A 0.25 % v/v	2.00	41 d	1700 c	70 ab	4970	78	4330
Linex Linex Induce (NIS)	A C C	1 pt/A 1 pt/A 0.25 % v/v	0.50 0.50	71 a	6150 a	68 ab	5410	77	4320
Linex Linex Induce (NIS)	A C C	2 pt/A 2 pt/A 0.25 % v/v	1.00 1.00	66 ab	6060 a	68 ab	5390	69	4500
Linex Linex Induce (NIS)	A C C	4 pt/A 4 pt/A 0.25 % v/v	2.00 2.00	67 ab	5530 a	61 b	5530	71	4410

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