Renz Weed Science
COLLEGE OF AGRICULTURAL & LIFE SCIENCES
UNIVERSITY OF WISCONSIN-MADISON

Extension
UNIVERSITY OF WISCONSIN-MADISON

ID #19-14

UW – Madison Weed Science Renz Lab

Tolerance of Timothy to Bicyclopyrone

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Objective:

Determine whether bicyclopyrone applied both PRE and POST – emergence causes injury to new planting of Timothy (*Phleum pratense)* grown for seed.

Summary:

This trial was conducted at two locations, the Lancaster Agricultural Research Station (LARS) and the Arlington Agricultural Research Station (AARS). Data from each trial location is presented separately. Results found no differences in injury or growth reduction to Timothy from applications of bicyclopyrone applied alone or with other active ingredients PRE or POST. While weed control and resulting cover differed, results suggest bicyclopyrone is safe to be applied to timothy for weed control.

At 1.5 years after treatment at the AARS experiment, seedhead mass of established timothy was not reduced by treatments containing bicyclopyrone, suggesting that seed yield in the year after application was not negatively affected.

Index of Ratings and Results

Research Plot Information:

Plot Dimensions: 10 feet by 25 feet

Design: Randomized Complete Block, 4 blocks

Soil Type: AARS: 100% Plano silt loam 2 – 6 percent slopes – LARS: 100% Fayette silt loam 2 – 12 percent slopes

Notes:

AARS 1.5 YAT Seedhead Assessment:

- Harvest 20 ripened seedheads per plot on August 6th, 2020
- Air dried at 50°C for 1 week
- Seedheads pooled and weighed on a per plot basis

LARS:

- Poor spray coverage in plot 106 of treatment 3 at A-timing application due to low CO_2
- Poor spray coverage in plot 407 of treatment 8 at B-timing application due to low CO_2
- Treatment 11 at B-timing applied with 80% less ammonium sulfate than specified in protocol

Herbicide Treatments:

Trt. No.	Treatment (application timing)	Rate
1	Untreated Control (UTC)	-
2	bicyclopyrone (A)	3.4 fluid ounces per acre (fl oz/A)
3	bicyclopyrone (A)	6.8 fl oz/A
4	bicyclopyrone (A) N-Pak Ammonium Sulfate Liquid (N-Pak AMS) (B) Moxy 2 (B) Non-ionic Surfactant (NIS) (B)	3.4 fl oz/A 2.5% volume/volume (v/v) 16 fl oz/A 0.25% v/v
5	bicyclopyrone (A) N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	3.4 fl oz/A 2.5% v/v 4.8 fl oz/A 0.25% v/v
6	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 3.42 fl oz/A 0.25% v/v
7	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 6.8 fl oz/A 0.25% v/v
8	N-Pak AMS (B) Moxy 2 (B) NIS (B)	2.5% v/v 16 fl oz/A 0.25% v/v
9	N-Pak AMS (B) Moxy 2 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 16 fl oz/A 3.42 fl oz/A 0.25% v/v
10	N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	2.5% v/v 4.8 fl oz/A 0.25% v/v
11	N-Pak AMS (B) Starane Ultra 2.8 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 4.8 fl oz/A 3.42 fl oz/A 0.25% v/v
12	N-Pak AMS (B) Huskie 2.06 EC (B) NIS (B)	2.5% v/v 14.9 fl oz/A 0.25% v/v

Herbicide Applications:

Trial Location	Arlington		Lancaster	
Application Timing	**A-Timing**	**B-Timing**	**A-Timing**	**B-Timing**
Date	May 7th, 2019	June 13th, 2019	April 25th, 2019	June 6th, 2019
Time	5:00pm – 5:15pm	10:30am – 12:00pm	12:15pm – 12:45pm	2:10pm – 3:10pm

Equipment: Backpack sprayer (20 GPA) with 10-foot boom

Nozzles: Eight (8) Flat Tip XR TeeJet 11002 VS on 15-inch nozzle spacing

Regulator PSI: 38

Boom PSI: 26

Weather Data:

	Arlington		Lancaster	
Weather Station	**KWIARLIN2**		**KWILANCA5**	
Application Timing	**A-Timing**	**B-Timing**	**A-Timing**	**B-Timing**
Timothy Phenology at Application	Not emerged	4 – 5cm tall with 3 true leaves	Not emerged	3 – 4 cm tall with 2 true leaves
Temperature	76°F	59°F	70°F	82°F
Wind Speed and Direction	4mph N	12mph N	9.5mph NW	1mph S
Relative Humidity	76%	54%	72%	55%
Cloud Cover	40%	20%	90%	75%
Previous Rain Event Within 48 Hours	May 6th 2019, 0.15 inches	June 12th 2019, 1.11 inches	-	June 5th 2019, 0.44 inches
When ≥ 0.25 inches of precipitation occurred after treatment	May 8th 2019, 0.76 inches	June 16th 2019, 0.42 inches	April 27th 2019, 0.37 inches	June 12th 2019, 0.61 inches

Results: Lancaster Agricultural Research Station (LARS)

LARS: 25 days after first treatment, 17 days before second treatment. May 20th, 2019.

Trt. No.	Treatment	Rate	Timothy (% injury)	Timothy (% growth reduction)	Broadleaf Weeds (% control)
1	UTC	-	0.0 -	0.0 -	0.0 -
2	bicyclopyrone (A)	50g AI/Ha	0.0 -	0.0 -	86.3 -
3	bicyclopyrone (A)	100g AI/Ha	0.0 -	0.0 -	94.8 -
4	bicyclopyrone (A) N-Pak AMS (B) Moxy 2 (B) NIS (B)	50g AI/Ha 2.5% v/v 280 g AE/Ha 0.25% v/v	0.0 -	0.0 -	82.5 -
5	bicyclopyrone (A) N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	50g AI/Ha 2.5% v/v 118g AE/Ha 0.25% v/v	0.0 -	0.0 -	83.8 -
6	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 50g AI/Ha 0.25% v/v	-	-	-
7	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 100g AI/Ha 0.25% v/v	-	-	-
8	N-Pak AMS (B) Moxy 2 (B) NIS (B)	2.5% v/v 280g AE/Ha 0.25% v/v	-	-	-
9	N-Pak AMS (B) Moxy 2 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 280g AE/Ha 50g AI/Ha 0.25% v/v	-	-	-
10	N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	2.5% v/v 118g AE/Ha 0.25% v/v	-	-	-
11	N-Pak AMS (B) Starane Ultra 2.8 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 118g AE/Ha 50g AE/Ha 0.25% v/v	-	-	-
12	N-Pak AMS (B) Huskie 2.06 EC (B) NIS (B)	2.5% v/v 270g AI/Ha 0.25% v/v	-	-	-
Statistics[1]					
Least Significant Difference (LSD) P=.05			-	-	13.47
Standard Deviation			0.00	0.00	8.42
Coefficient of Variation (CV)			0.0	0.0	9.7
Treatment Prob(F)			1.000	1.000	0.2327

Note: Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).

[1] All statistical analyses were conducted in ARM software and assumptions of ANOVA were not evaluated.

LARS: 42 days after first treatment, 0 days after second treatment. June 6th, 2019.

Trt. No.	Treatment	Rate	Timothy (% injury)	Broadleaf Weeds (% injury)	Broadleaf Weeds (% control)
1	UTC	-	0.0 -	0.0 b	0.0 b
2	bicyclopyrone (A)	50g AI/Ha	1.3 -	32.5 a	63.8 a
3	bicyclopyrone (A)	100g AI/Ha	8.8 -	2.5 b	57.5 a
4	bicyclopyrone (A) N-Pak AMS (B) Moxy 2 (B) NIS (B)	50g AI/Ha 2.5% v/v 280 g AE/Ha 0.25% v/v	5.0 -	18.8 ab	36.3 a
5	bicyclopyrone (A) N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	50g AI/Ha 2.5% v/v 118g AE/Ha 0.25% v/v	0.0 -	13.8 ab	55.0 a
6	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 50g AI/Ha 0.25% v/v	-	-	-
7	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 100g AI/Ha 0.25% v/v	-	-	-
8	N-Pak AMS (B) Moxy 2 (B) NIS (B)	2.5% v/v 280g AE/Ha 0.25% v/v	-	-	-
9	N-Pak AMS (B) Moxy 2 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 280g AE/Ha 50g AI/Ha 0.25% v/v	-	-	-
10	N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	2.5% v/v 118g AE/Ha 0.25% v/v	-	-	-
11	N-Pak AMS (B) Starane Ultra 2.8 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 118g AE/Ha 50g AE/Ha 0.25% v/v	-	-	-
12	N-Pak AMS (B) Huskie 2.06 EC (B) NIS (B)	2.5% v/v 270g AI/Ha 0.25% v/v	-	-	-
Statistics					
LSD P=.05			11.49	19.80	31.82
Standard Deviation			7.46	12.85	20.65
CV			248.61	95.21	48.59
Treatment Prob(F)			0.4244	0.0238	0.0058

Note: Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).

LARS: 54 days after first treatment, 12 days after second treatment. June 18th, 2019.

Trt. No.	Treatment	Rate	Timothy (% injury)	Broadleaf Weeds (% injury)	Broadleaf Weeds (% control)	Broadleaf Weeds (% cover)
1	UTC	-	0.0 -	0.0 d	0.0 c	13.0 a
2	bicyclopyrone (A)	50g AI/Ha	0.8 -	23.8 cd	78.8 a	3.3 bc
3	bicyclopyrone (A)	100g AI/Ha	3.0 -	23.8 cd	76.3 a	3.5 bc
4	bicyclopyrone (A) N-Pak AMS (B) Moxy 2 (B) NIS (B)	50g AI/Ha 2.5% v/v 280 g AE/Ha 0.25% v/v	0.3 -	30.0 bcd	85.0 a	2.0 bc
5	bicyclopyrone (A) N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	50g AI/Ha 2.5% v/v 118g AE/Ha 0.25% v/v	0.5 -	7.5 d	95.0 a	0.8 c
6	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 50g AI/Ha 0.25% v/v	1.0 -	85.0 a	90.0 a	3.8 bc
7	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 100g AI/Ha 0.25% v/v	2.0 -	83.8 a	81.3 a	7.5 abc
8	N-Pak AMS (B) Moxy 2 (B) NIS (B)	2.5% v/v 280g AE/Ha 0.25% v/v	0.3 -	66.3 abc	66.3 a	10.3 ab
9	N-Pak AMS (B) Moxy 2 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 280g AE/Ha 50g AI/Ha 0.25% v/v	0.5 -	22.5 cd	96.3 a	1.3 c
10	N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	2.5% v/v 118g AE/Ha 0.25% v/v	0.8 -	37.5 bcd	71.3 a	4.5 bc
11	N-Pak AMS (B) Starane Ultra 2.8 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 118g AE/Ha 50g AE/Ha 0.25% v/v	0.8 -	58.8 abc	85.0 a	3.0 bc
12	N-Pak AMS (B) Huskie 2.06 EC (B) NIS (B)	2.5% v/v 270g AI/Ha 0.25% v/v	0.8 -	75.0 ab	88.8 a	2.3 bc
Statistics						
LSD P=.05			2.09	31.48	15.74	5.21
Standard Deviation			1.45	22.88	10.94	3.62
CV			162.02	51.11	14.37	79.06
Treatment Prob(F)			0.2888	0.0001	0.0001	0.0005

Note: Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).

LARS: 119 days after first treatment, 77 days after second treatment. August 22nd, 2019.

Trt. No.	Treatment	Rate	Timothy (% cover)	Broadleaf Weeds (% cover)	Broadleaf Weeds (% control)	Grass Weeds (% cover)	Grass Weeds (% control)	Bareground /Litter (% cover)	Timothy (% seedhead reduction)
1	UTC	-	50.0 -	35.0 a	0.0 d	13.5 -	0.0 -	1.5 -	33.8 -
2	bicyclopyrone (A)	50g AI/Ha	76.3 -	11.3 b	67.8 bc	11.8 -	34.3 -	0.8 -	3.8 -
3	bicyclopyrone (A)	100g AI/Ha	87.5 -	4.8 b	86.3 ab	7.8 -	42.8 -	0.0 -	0.0 -
4	bicyclopyrone (A) N-Pak AMS (B) Moxy 2 (B) NIS (B)	50g AI/Ha 2.5% v/v 280 g AE/Ha 0.25% v/v	72.3 -	4.5 b	87.0 ab	23.3 -	13.0 -	0.0 -	5.0 -
5	bicyclopyrone (A) N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	50g AI/Ha 2.5% v/v 118g AE/Ha 0.25% v/v	52.5 -	1.8 b	95.0 a	44.5 -	19.5 -	1.3 -	47.5 -
6	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 50g AI/Ha 0.25% v/v	72.5 -	0.0 b	100.0 a	26.3 -	6.5 -	1.3 -	12.5 -
7	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 100g AI/Ha 0.25% v/v	82.5 -	0.0 b	100.0 a	17.3 -	17.5 -	0.3 -	0.0 -
8	N-Pak AMS (B) Moxy 2 (B) NIS (B)	2.5% v/v 280g AE/Ha 0.25% v/v	61.3 -	17.5 b	53.3 c	21.0 -	17.5 -	0.3 -	22.5 -
9	N-Pak AMS (B) Moxy 2 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 280g AE/Ha 50g AI/Ha 0.25% v/v	77.5 -	0.0 b	100.0 a	22.3 -	13.0 -	0.3 -	7.5 -
10	N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	2.5% v/v 118g AE/Ha 0.25% v/v	61.3 -	15.0 b	57.0 c	23.5 -	24.0 -	0.3 -	27.5 -
11	N-Pak AMS (B) Starane Ultra 2.8 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 118g AE/Ha 50g AE/Ha 0.25% v/v	60.0 -	0.0 b	100.0 a	38.8 -	0.0 -	1.3 -	28.8 -
12	N-Pak AMS (B) Huskie 2.06 EC (B) NIS (B)	2.5% v/v 270g AI/Ha 0.25% v/v	76.3 -	0.0 b	100.0 a	23.0 -	10.3 -	0.8 -	7.5 -
Statistics									
LSD P=.05			32.03	16.00	17.81	27.01	37.76	2.01	41.08
Standard Deviation			22.27	11.12	12.38	18.77	26.25	1.40	28.56
CV			32.2	148.7	15.7	82.6	158.89	216.79	174.62
Treatment Prob(F)			0.3616	0.0017	0.0001	0.2978	0.5171	0.8039	0.3561

Note: Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).

Results: Arlington Agricultural Research Station (AARS)

AARS: 24 days after first treatment, 14 days before second treatment. May 31st, 2019.

Trt. No.	Treatment	Rate	Timothy (% growth reduction)	Corn (% cover)	Corn (% control)	Grass Weeds (% cover)	Grass Weeds (% control)	Broadleaf Weeds (% cover)	Broadleaf Weeds (% control)
1	UTC	-	0.0 -	1.0 -	0.0 -	0.5 -	0.0 -	0.8 -	0.0 -
2	bicyclopyrone (A)	50g AI/Ha	0.0 -	0.8 -	25.0 -	0.3 -	75.0 -	0.3 -	75.0 -
3	bicyclopyrone (A)	100g AI/Ha	0.0 -	0.3 -	75.0 -	0.3 -	75.0 -	0.3 -	75.0 -
4	bicyclopyrone (A) N-Pak AMS (B) Moxy 2 (B) NIS (B)	50g AI/Ha 2.5% v/v 280 g AE/Ha 0.25% v/v	0.0 -	0.3 -	75.0 -	0.5 -	50.0 -	0.3 -	75.0 -
5	bicyclopyrone (A) N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	50g AI/Ha 2.5% v/v 118g AE/Ha 0.25% v/v	0.0 -	0.5 -	50.0 -	0.0 -	100.0 -	0.3 -	50.0 -
6	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 50g AI/Ha 0.25% v/v	0.0 -	0.8 -	25.0 -	0.5 -	50.0 -	0.8 -	25.0 -
7	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 100g AI/Ha 0.25% v/v	0.0 -	0.5 -	50.0 -	0.5 -	50.0 -	0.8 -	25.0 -
8	N-Pak AMS (B) Moxy 2 (B) NIS (B)	2.5% v/v 280g AE/Ha 0.25% v/v	0.0 -	0.3 -	75.0 -	0.5 -	50.0 -	0.5 -	50.0 -
9	N-Pak AMS (B) Moxy 2 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 280g AE/Ha 50g AI/Ha 0.25% v/v	0.0 -	0.8 -	25.0 -	0.5 -	50.0 -	0.8 -	25.0 -
10	N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	2.5% v/v 118g AE/Ha 0.25% v/v	0.0 -	0.3 -	75.0 -	0.0 -	100.0 -	0.3 -	75.0 -
11	N-Pak AMS (B) Starane Ultra 2.8 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 118g AE/Ha 50g AE/Ha 0.25% v/v	0.0 -	0.5 -	50.0 -	0.0 -	100.0 -	0.3 -	50.0 -
12	N-Pak AMS (B) Huskie 2.06 EC (B) NIS (B)	2.5% v/v 270g AI/Ha 0.25% v/v	0.0 -	0.8 -	25.0 -	0.3 -	75.0 -	0.5 -	25.0 -
Statistics									
Least Significant Difference (LSD) P=.05		-	0.64	64.26	0.70	63.95	0.64	65.86	
Standard Deviation		0.00	0.45	44.66	0.49	44.45	0.45	45.78	
Coefficient of Variation (CV)		0.0	82.46	97.45	156.11	68.83	97.45	99.89	
Treatment Prob(F)		1.0000	0.2527	0.2527	0.6502	0.1132	0.3907	0.2867	

Note: Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).

AARS: 30 days after first treatment, 7 days before second treatment. June 6th, 2019.

Trt. No.	Treatment	Rate	Timothy (% growth reduction)	Broadleaf Weeds (% cover)	Broadleaf Weeds (% control)	Grass Weeds (% cover)	Grass Weeds (% control)
1	UTC	-	0.0 -	3.0 ab	0.0 -	0.8 -	0.0 c
2	bicyclopyrone (A)	50g AI/Ha	0.0 -	0.8 bc	75.0 -	0.3 -	75.0 ab
3	bicyclopyrone (A)	100g AI/Ha	0.0 -	0.5 c	50.0 -	1.0 -	83.5 a
4	bicyclopyrone (A) N-Pak AMS (B) Moxy 2 (B) NIS (B)	50g AI/Ha 2.5% v/v 280 g AE/Ha 0.25% v/v	0.0 -	1.5 abc	100.0 -	0.0 -	50.0 abc
5	bicyclopyrone (A) N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	50g AI/Ha 2.5% v/v 118g AE/Ha 0.25% v/v	0.0 -	1.8 abc	100.0 -	0.0 -	41.8 abc
6	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 50g AI/Ha 0.25% v/v	0.0 -	2.8 abc	100.0 -	0.0 -	33.5 bc
7	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 100g AI/Ha 0.25% v/v	0.0 -	2.8 abc	50.0 -	0.5 -	25.0 bc
8	N-Pak AMS (B) Moxy 2 (B) NIS (B)	2.5% v/v 280g AE/Ha 0.25% v/v	0.0 -	2.3 abc	50.0 -	1.0 -	33.5 bc
9	N-Pak AMS (B) Moxy 2 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 280g AE/Ha 50g AI/Ha 0.25% v/v	0.0 -	2.5 abc	75.0 -	0.3 -	25.0 bc
10	N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	2.5% v/v 118g AE/Ha 0.25% v/v	0.0 -	3.5 a	75.0 -	0.3 -	33.3 bc
11	N-Pak AMS (B) Starane Ultra 2.8 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 118g AE/Ha 50g AE/Ha 0.25% v/v	0.0 -	2.0 abc	25.0 -	1.3 -	33.3 bc
12	N-Pak AMS (B) Huskie 2.06 EC (B) NIS (B)	2.5% v/v 270g AI/Ha 0.25% v/v	0.0 -	2.8 abc	50.0 -	1.0 -	25.0 bc
Statistics							
LSD P=.05			-	1.39	59.17	1.16	31.55
Standard Deviation			0.00	0.97	41.13	0.81	21.93
CV			0.0	44.73	65.81	155.05	57.36
Treatment Prob(F)			1.0000	0.0026	0.0330	0.2749	0.0006

Note: Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).

AARS: 50 days after first treatment, 13 days after second treatment. June 26th, 2019.

Trt. No.	Treatment	Rate	Timothy (% injury)	Timothy (% cover)	Broadleaf Weeds (% cover)	Broadleaf Weeds (% control)	Grass Weeds (% cover)	Grass Weeds (% control)	Bareground /Litter (% cover)
1	UTC	-	0.0 -	55.0 abc	6.3 ab	0.0 c	5.0 -	0.0 -	33.8 -
2	bicyclopyrone (A)	50g AI/Ha	0.0 -	52.5 bc	6.5 ab	21.0 bc	6.0 -	5.0 -	35.0 -
3	bicyclopyrone (A)	100g AI/Ha	0.0 -	62.0 ab	1.5 b	76.0 ab	2.8 -	60.0 -	33.8 -
4	bicyclopyrone (A) N-Pak AMS (B) Moxy 2 (B) NIS (B)	50g AI/Ha 2.5% v/v 280 g AE/Ha 0.25% v/v	0.0 -	57.5 abc	1.8 b	72.0 a	5.8 -	20.0 -	35.0 -
5	bicyclopyrone (A) N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	50g AI/Ha 2.5% v/v 118g AE/Ha 0.25% v/v	0.0 -	58.5 abc	3.0 b	55.0 ab	4.8 -	35.0 -	33.8 -
6	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 50g AI/Ha 0.25% v/v	0.0 -	61.8 ab	0.5 b	92.0 a	6.5 -	0.0 -	31.3 -
7	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 100g AI/Ha 0.25% v/v	0.0 -	63.3 ab	0.5 b	92.0 a	2.5 -	50.0 -	33.8 -
8	N-Pak AMS (B) Moxy 2 (B) NIS (B)	2.5% v/v 280g AE/Ha 0.25% v/v	0.0 -	62.5 ab	2.3 b	64.0 ab	5.3 -	20.0 -	30.0 -
9	N-Pak AMS (B) Moxy 2 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 280g AE/Ha 50g AI/Ha 0.25% v/v	0.0 -	62.3 ab	0.5 b	92.0 a	3.5 -	40.0 -	33.8 -
10	N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	2.5% v/v 118g AE/Ha 0.25% v/v	0.0 -	49.3 c	12.0 a	18.0 bc	5.0 -	35.0 -	33.8 -
11	N-Pak AMS (B) Starane Ultra 2.8 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 118g AE/Ha 50g AE/Ha 0.25% v/v	0.0 -	65.0 a	1.0 b	84.0 a	1.5 -	70.0 -	32.5 -
12	N-Pak AMS (B) Huskie 2.06 EC (B) NIS (B)	2.5% v/v 270g AI/Ha 0.25% v/v	0.0-	57.8 abc	0.8 b	88.0 a	6.5 -	20.0 -	35.0 -
Statistics									
LSD P=.05			-	6.53	4.87	37.35	3.70	44.80	6.45
Standard Deviation			0.00	4.54	3.39	25.96	2.57	31.14	4.48
CV			0.0	7.70	111.36	41.32	56.06	105.28	13.41
Treatment Prob(F)			1.0000	0.0004	0.0005	0.0001	0.1307	0.0428	0.9148

Note: Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).

AARS: 63 days after first treatment, 26 days after second treatment. July 9th, 2019.

Trt. No.	Treatment	Rate	Timothy (% injury)	Broadleaf Weeds (% cover)	Broadleaf Weeds (% control)	Grass Weeds (% cover)	Grass Weeds (% control)	Bareground/ Litter (% cover)
1	UTC	-	0.5 -	11.3 b	0.0 d	2.0 -	12.5 -	2.5 -
2	bicyclopyrone (A)	50g AI/Ha	1.8 -	11.0 b	41.0 bc	2.0 -	12.5 -	2.5 -
3	bicyclopyrone (A)	100g AI/Ha	2.3 -	2.0 b	82.3 ab	2.8 -	12.5 -	2.8 -
4	bicyclopyrone (A) N-Pak AMS (B) Moxy 2 (B) NIS (B)	50g AI/Ha 2.5% v/v 280 g AE/Ha 0.25% v/v	1.8 -	3.3 b	71.0 abc	2.3 -	12.5 -	3.5 -
5	bicyclopyrone (A) N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	50g AI/Ha 2.5% v/v 118g AE/Ha 0.25% v/v	1.0 -	8.5 b	55.0 abc	2.5 -	25.0 -	3.0 -
6	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 50g AI/Ha 0.25% v/v	2.0 -	1.0 b	91.0 ab	1.8 -	25.0 -	3.0 -
7	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 100g AI/Ha 0.25% v/v	1.5 -	2.0 b	82.3 ab	2.0 -	12.5 -	3.3 -
8	N-Pak AMS (B) Moxy 2 (B) NIS (B)	2.5% v/v 280g AE/Ha 0.25% v/v	1.0 -	2.8 b	75.5 abc	2.3 -	12.5 -	2.3 -
9	N-Pak AMS (B) Moxy 2 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 280g AE/Ha 50g AI/Ha 0.25% v/v	1.3 -	0.5 b	95.5 a	1.3 -	37.5 -	3.5 -
10	N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	2.5% v/v 118g AE/Ha 0.25% v/v	0.8 -	42.3 a	30.0 cd	3.0 -	0.0 -	1.8 -
11	N-Pak AMS (B) Starane Ultra 2.8 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 118g AE/Ha 50g AE/Ha 0.25% v/v	1.3 -	1.8 b	84.3 ab	1.5 -	25.0 -	2.3 -
12	N-Pak AMS (B) Huskie 2.06 EC (B) NIS (B)	2.5% v/v 270g AI/Ha 0.25% v/v	1.3 -	1.3 b	88.8 a	2.3 -	25.0 -	3.3 -
Statistics								
LSD P=.05			1.02	19.74	32.49	1.75	35.46	1.88
Standard Deviation			0.71	13.72	22.59	1.22	24.65	1.30
CV			52.25	188.15	34.03	57.2	139.2	46.7
Treatment Prob(F)			0.0462	0.0089	0.0001	0.7631	0.7759	0.7135

Note: Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).

AARS: 459 days after first treatment, 422 days before after treatment. August 6th, 2020.

Trt. No.	Treatment	Rate	Timothy Seedhead Weight (g)
1	UTC	-	7.0 -
2	bicyclopyrone (A)	50g AI/Ha	6.5 -
3	bicyclopyrone (A)	100g AI/Ha	7.2 -
4	bicyclopyrone (A) N-Pak AMS (B) Moxy 2 (B) NIS (B)	50g AI/Ha 2.5% v/v 280 g AE/Ha 0.25% v/v	7.2 -
5	bicyclopyrone (A) N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	50g AI/Ha 2.5% v/v 118g AE/Ha 0.25% v/v	7.3 -
6	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 50g AI/Ha 0.25% v/v	7.2 -
7	N-Pak AMS (B) bicyclopyrone (B) NIS (B)	2.5% v/v 100g AI/Ha 0.25% v/v	6.6 -
8	N-Pak AMS (B) Moxy 2 (B) NIS (B)	2.5% v/v 280g AE/Ha 0.25% v/v	7.0 -
9	N-Pak AMS (B) Moxy 2 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 280g AE/Ha 50g AI/Ha 0.25% v/v	7.0 -
10	N-Pak AMS (B) Starane Ultra 2.8 (B) NIS (B)	2.5% v/v 118g AE/Ha 0.25% v/v	7.4 -
11	N-Pak AMS (B) Starane Ultra 2.8 (B) bicyclopyrone (B) NIS (B)	2.5% v/v 118g AE/Ha 50g AE/Ha 0.25% v/v	6.4 -
12	N-Pak AMS (B) Huskie 2.06 EC (B) NIS (B)	2.5% v/v 270g AI/Ha 0.25% v/v	7.1 -
Statistics			
LSD P=.05			1.148
Standard Deviation			0.798
CV			11.41
Treatment Prob(F)			0.8332

Note: Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).