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UW – Madison Weed Science Renz Lab

Forb tolerance to ProClova Herbicide (GF-3731)

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Objective:

Determine if differences in forb tolerance exist with applications of florpyrauxifen (SiteVue) when mixed with 2,4-D (ProClova), aminopyralid (DuraCor) or triclopyr.

Summary:

Eight native forb species were present in high enough densities to evaluate impacts from herbicide treatments in the year of application. Some level of injury was observed on all forbs the year of treatment, with <50% of foliage injured within the first month with most species/treatments. Fleabane was sensitive to all treatments with high mortality by summer. Canada goldenrod was sensitive to mixtures of florpyrauxifen mixed with triclopyr with over 60% injury through August. In contrast florpyrauxifen mixed with 2,4-D (ProClova) and aminopyralid (DuraCor) injured bergamot more than other treatments. Other species evaluated showed high (<16%) to moderate (16-50%) tolerance, but results are highly variable.

One year after treatments (13 MAT) only one species (Canada goldenrod) had higher cover compared to the nontreated control (P<0.05). Wild bergamot, aster spp., yarrow, and stiff goldenrod appeared relatively tolerant to all treatments one YAT. Black eyed susans were susceptible to aminopyralid containing products and compass plant to florpyrauxifen. While Canada goldenrod cover was reduced with some treatments it was still abundant in all plots.

Large reductions in all forbs was observed in 2023. This likely was due to the drought experienced in 2023. No differences in forb cover were observed in this year. Despite the lack of differences, it appears that several forbs maintain cover at similar levels as the non-treated controls (see graphs below for detailed information). These results suggest that other factors may be a bigger influence in forb cover than one herbicide application two years prior.

Notes

Cover data wasn't taken for plots 204, 205, and 206 in summer 2022 due to being inadvertently mowed by the land owner (Dane County Parks). Thus the following treatments only had two replications to create averages: ProClova 24 fl oz/A, ProClova 32 fl oz/A and XDE-848 BE 0.21 fl oz/A + Remedy Ultra 16 fl oz/A.

Abnormally dry conditions were experienced during the 2023 growing season which may be affecting data collected during that time.

Herbicide Treatments

Treatment Number	Treatment	Rate
1	ProClova MSO	24 fluid ounces per acre (fl oz/A) 1% volume/volume (%v/v)
2	ProClova MSO	32 fl oz/A 1% v/v
3	DuraCor MSO	12 fl oz/A 1% v/v
4	XDE-848 BE (Florpyrauxifen) Remedy Ultra MSO	0.21 fl oz/A 16 fl oz/A 1% v/v
5	Milestone Activator 90	5 fl oz/A 0.25% v/v
6	Nontreated Control (NTC)	-

Herbicide Application

Date	June 22nd, 2021, 11:10am – 12:10pm
Equipment	CO_2 pressurized 10-foot boom sprayer (20 GPA)
Nozzles & spacing	Eight Teejet 11002 VS nozzles with 15-inch spacing
Regulator PSI	42

Weather Data	
Weather Station	KWIVERON36
Temperature	65.6°F – 67.7°F
Wind Speed and Direction	3.9 mph NW – 3.5 mph NNW
Relative Humidity	48% - 49%
Cloud Cover	33%
Previous Rain Event Within 48 Hours	June 20th, 2021 – 0.29 inches
When ≥ 0.25 inches of precipitation occurred after treatment	June 29th, 2021, 12:04pm – 1.89 inches

Research Plot Information	
Plot Dimensions	20’ by 20’
Design	Randomized Complete Block, 3 blocks
Soil Type	Batavia & Basco silt loam
Soil Characteristics	27% clay, 0.7% organic matter, 6.2 pH, 4% slope

Plants Present at Application – Developmental Stage		
Species	**Average Height (cm)**	**Phenological Stage**
Canada thistle (*Cirsium Arvense*)	42	30% flowering, 70% vegetative
Canada goldenrod (*Solidago canadensis*)	98	100%vegetative
Aster sp. (*Symphyotrichum sp.*)	81	100% vegetative
Blue vervain (*Verbena hastata*)	57	100% vegetative
Tall cinquefoil (*Potentilla arguta*)	38	100% vegetative
Stiff goldenrod (*Solidago rigida*)	71	100% vegetative
Prairie sunflower (*Helianthus pauciflorus*)	53	100% vegetative
Grass-leaved goldenrod (*Euthamia graminifolia*)	60	100% vegetative
Fleabane sp. (*Erigeron sp.*)	94	100% flowering
Common evening primrose (*Oenothera biennis*)	54	100% vegetative
Compassplant (*Silphium laciniatum*)	78	100% vegetative
Wild bergamot (*Monarda fistulosa*)	86	100% vegetative
Common yarrow (*Achillea millefolium*)	82	100% flowering
Black-eyed Susan (*Rudbeckia hirta*)	70	50% vegetative, 50% flowering

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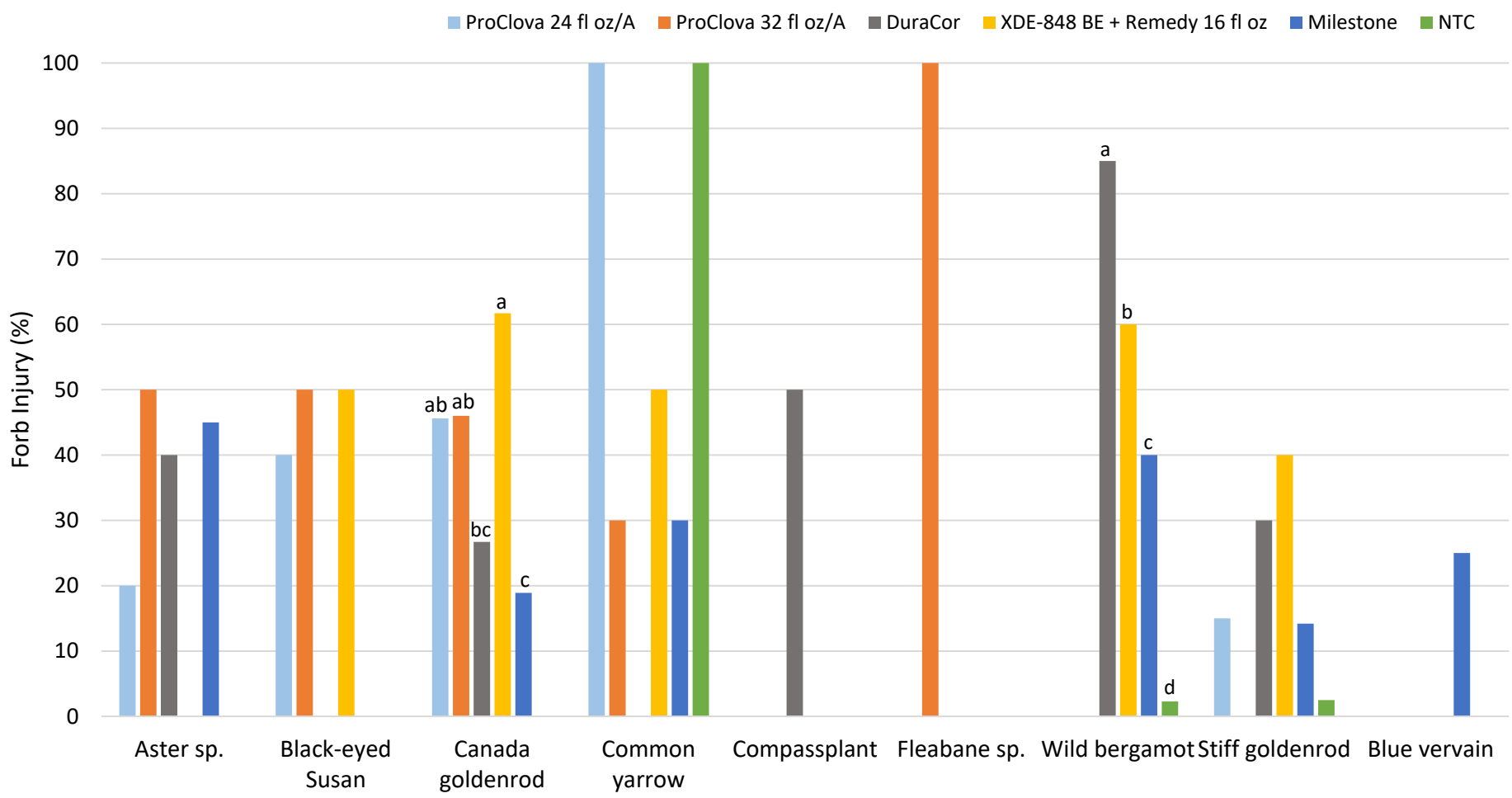
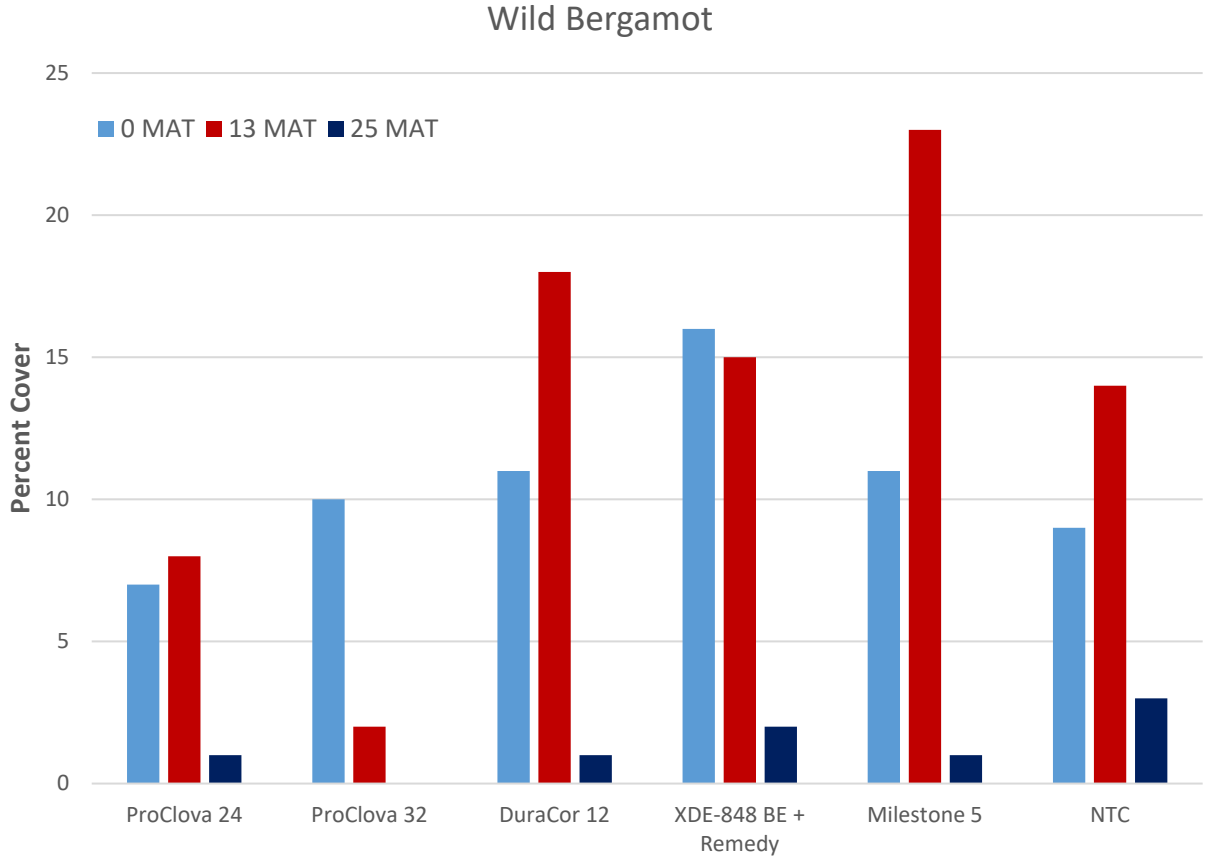
Native Forb Injury 52 DAT - August 13th, 2021



Bars labeled with the same letter are not significantly different (P=0.05, LSD).

Results:

Change in cover of wild bergamot 2 years following treatments



No differences in cover among treatments (P>0.05)

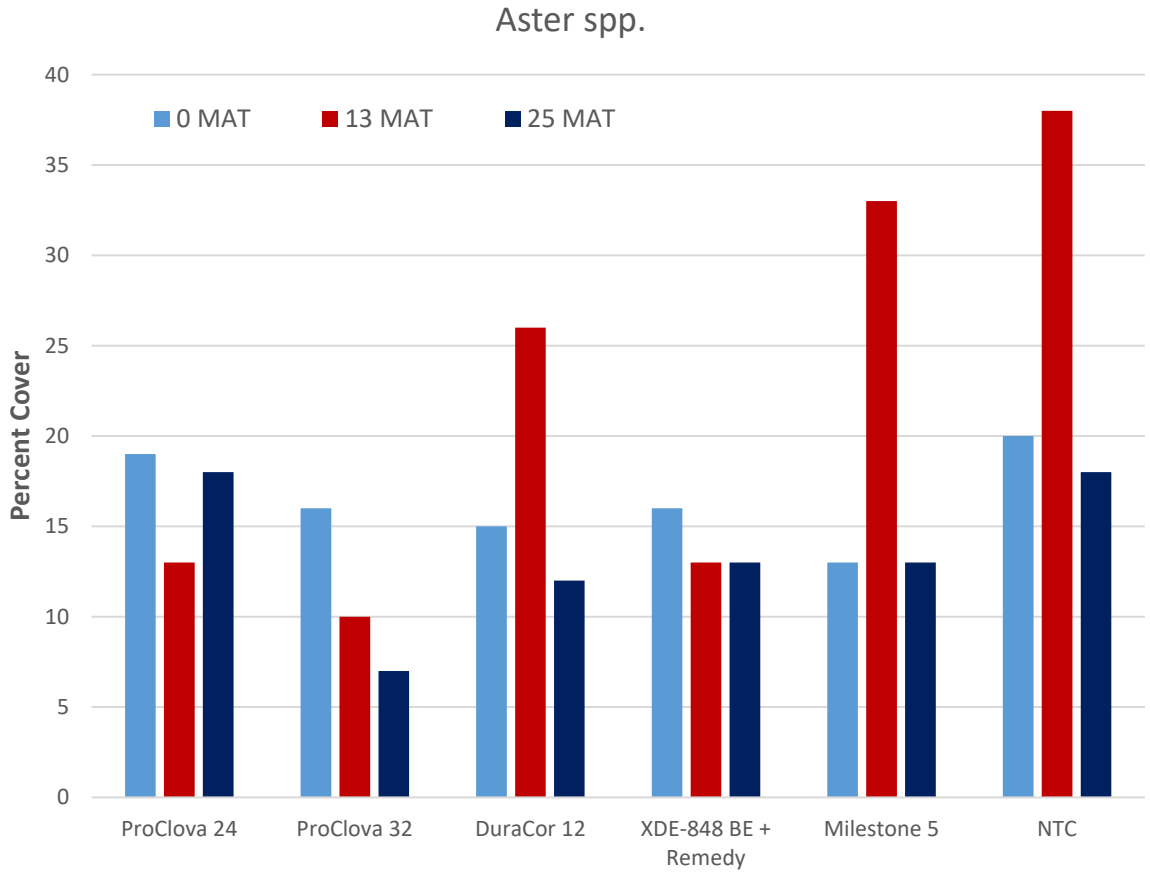
No significant differences were seen in cover 13 or 25 MAT in all treatments.

Higher rates of ProClova may cause additional injury.

Cover reduced 3-5x across entire site from 13 to 25 MAT.

Reduction in cover make it difficult to assess long-term effects from herbicide treatment.

Change in cover of Aster spp. 2 years following treatments



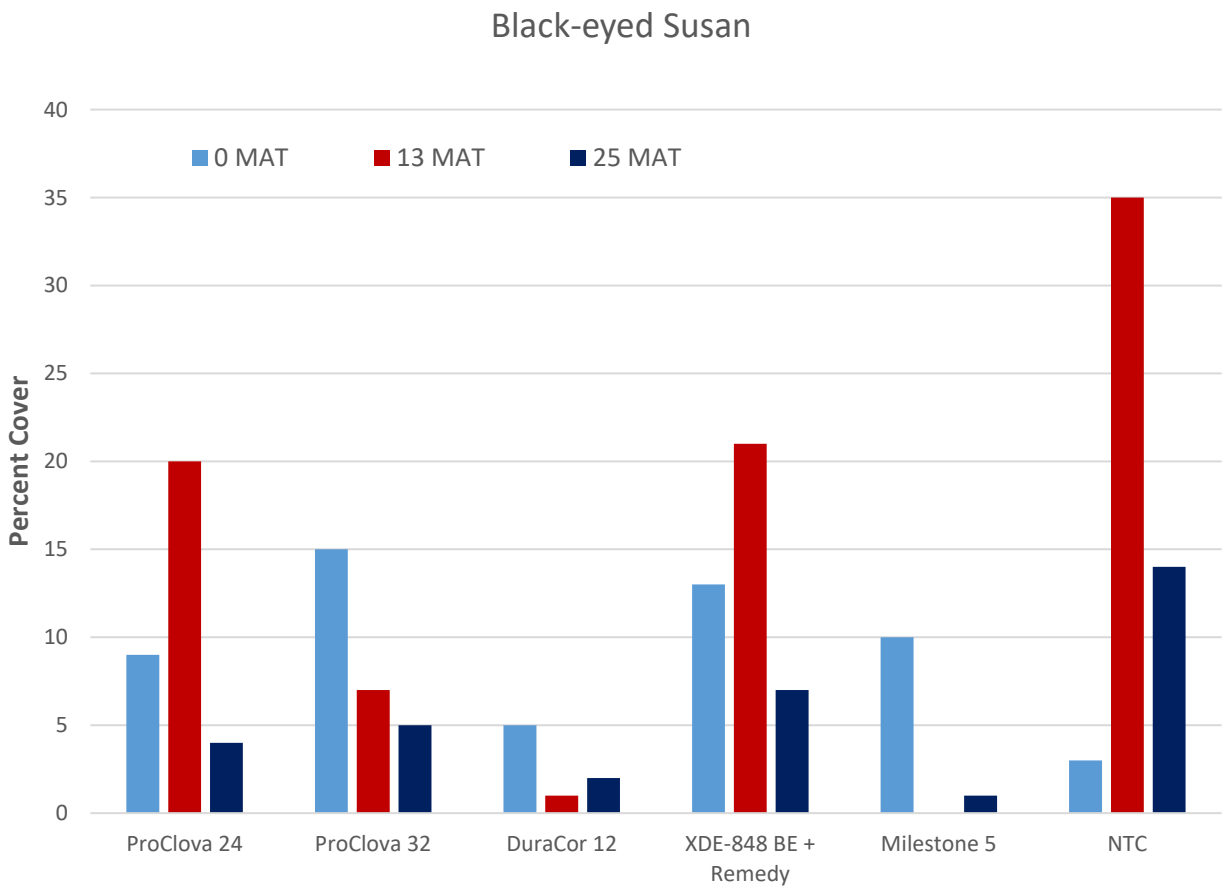
No differences in cover among treatments (P>0.05)

Aster cover 25 MAT was between 7-18%.

There were no significant differences seen in cover for any treatments 13 and 25 MAT when compared to the NTC.

The low rate of ProClova (24 fl oz/a) appears safer to asters vs the high rate (32 fl oz/a).

Change in cover of black eyed Susan 2 years following treatments

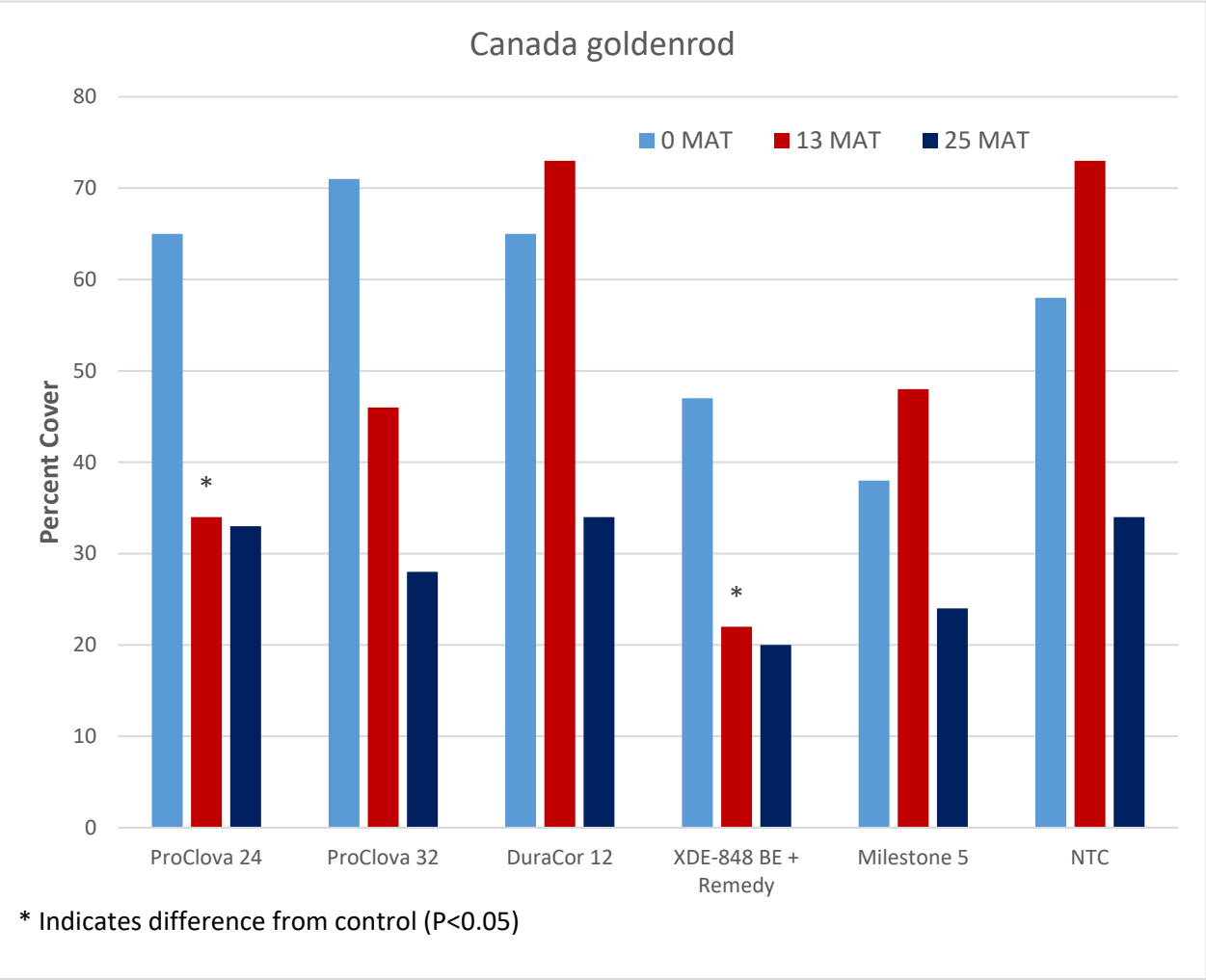


No differences in cover among treatments (P>0.05)

No significant differences were seen in cover for all treatments 13 and 25 MAT when compared to NTC.

Aminopyralid containing treatments reduced black-eyed susan cover, but other treatments did not impact populations dramatically over the course of the experiment.

Change in cover of Canada goldenrod 2 years following treatments

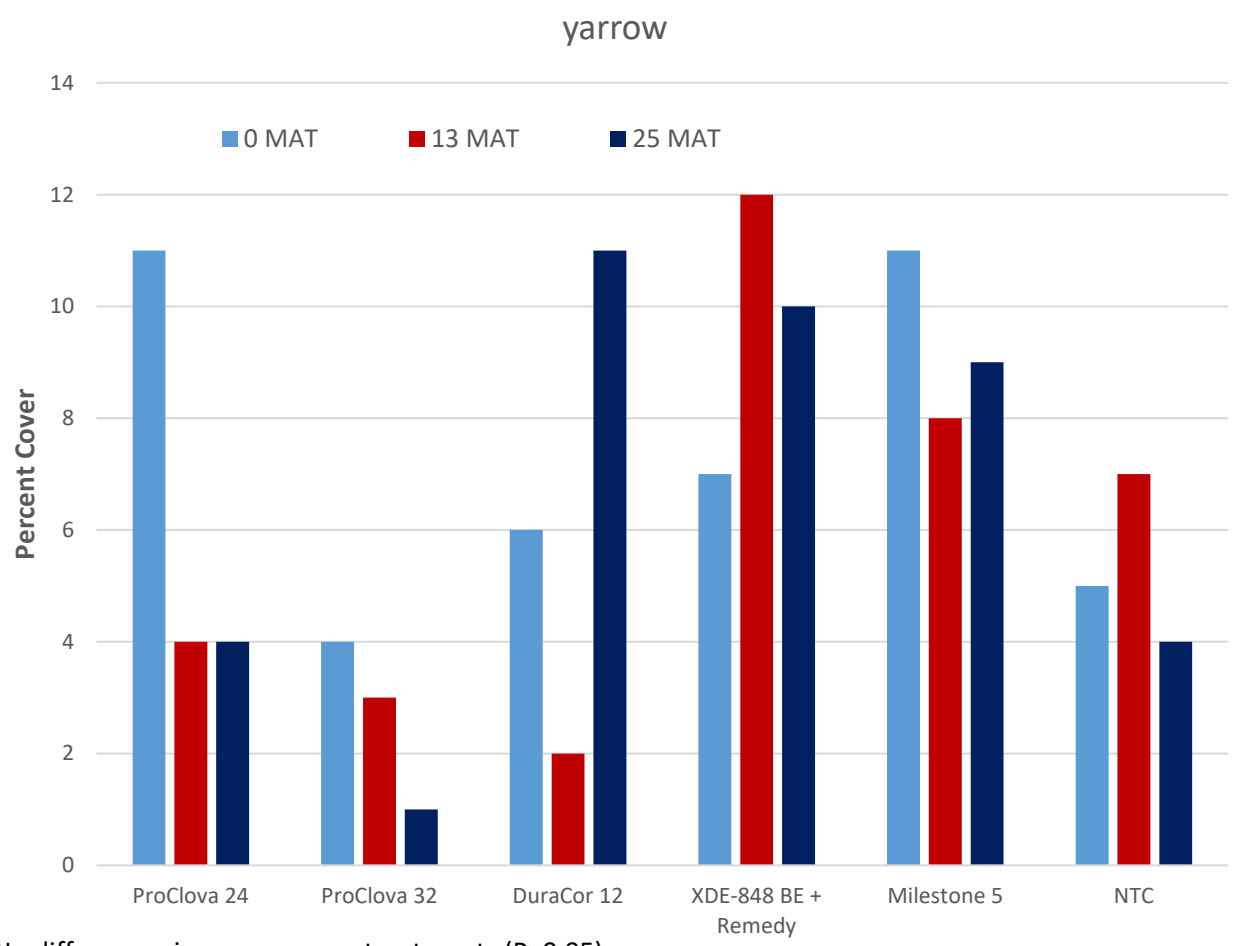


* Indicates difference from control (P<0.05)

While cover was reduced by several treatments 13 MAT, these differences did not persist 25 MAT when compared to the NTC.

None of these treatments were effective in long-term suppression of this species.

Change in cover of yarrow 2 years following treatments



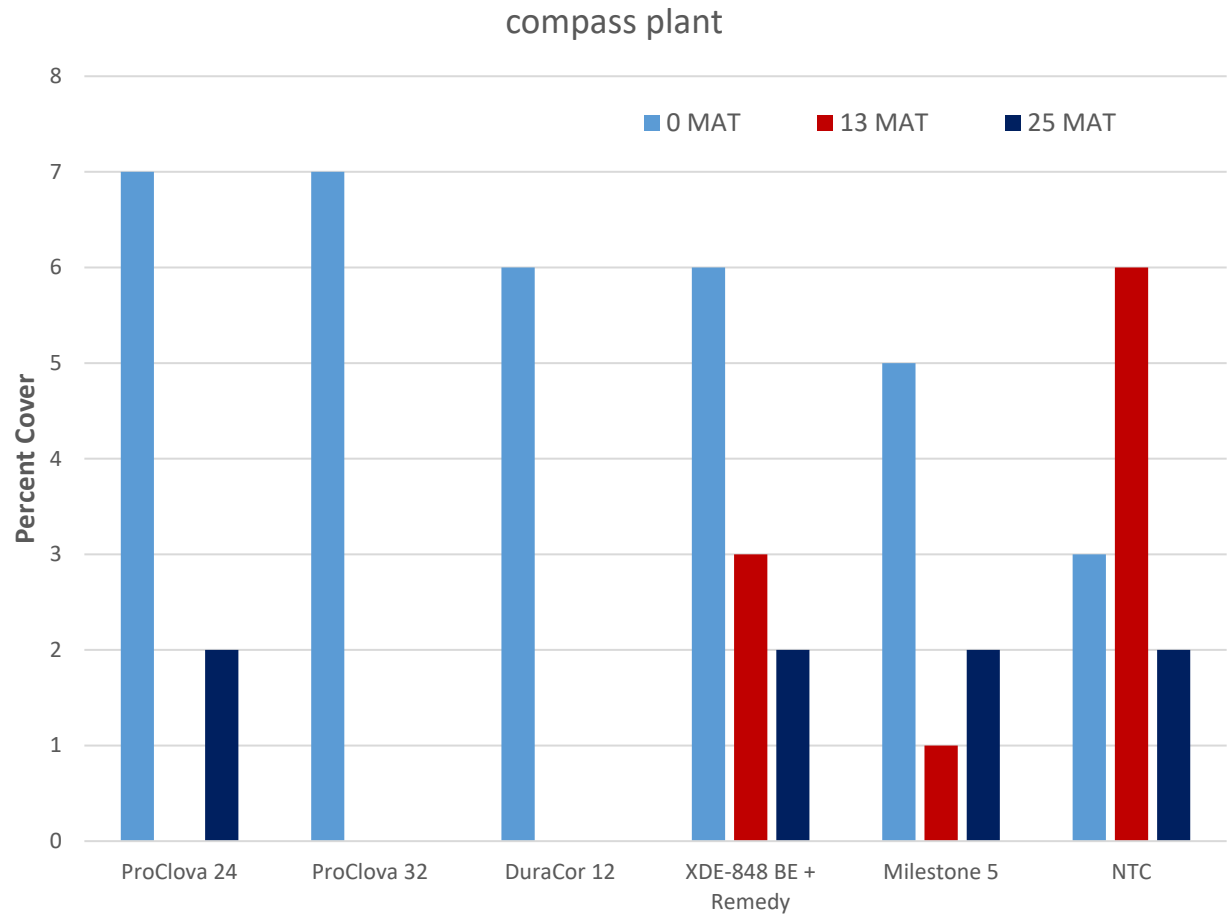
No differences in cover among treatments (P>0.05)

No significant differences were seen in all treatments 13 and 25 MAT when compared to the NTC.

Milestone and Xde-848+Remedy appeared to be the safest products.

Caution should be used interpreting the data due to the low and variable cover.

Change in cover of compass plant 2 years following treatments



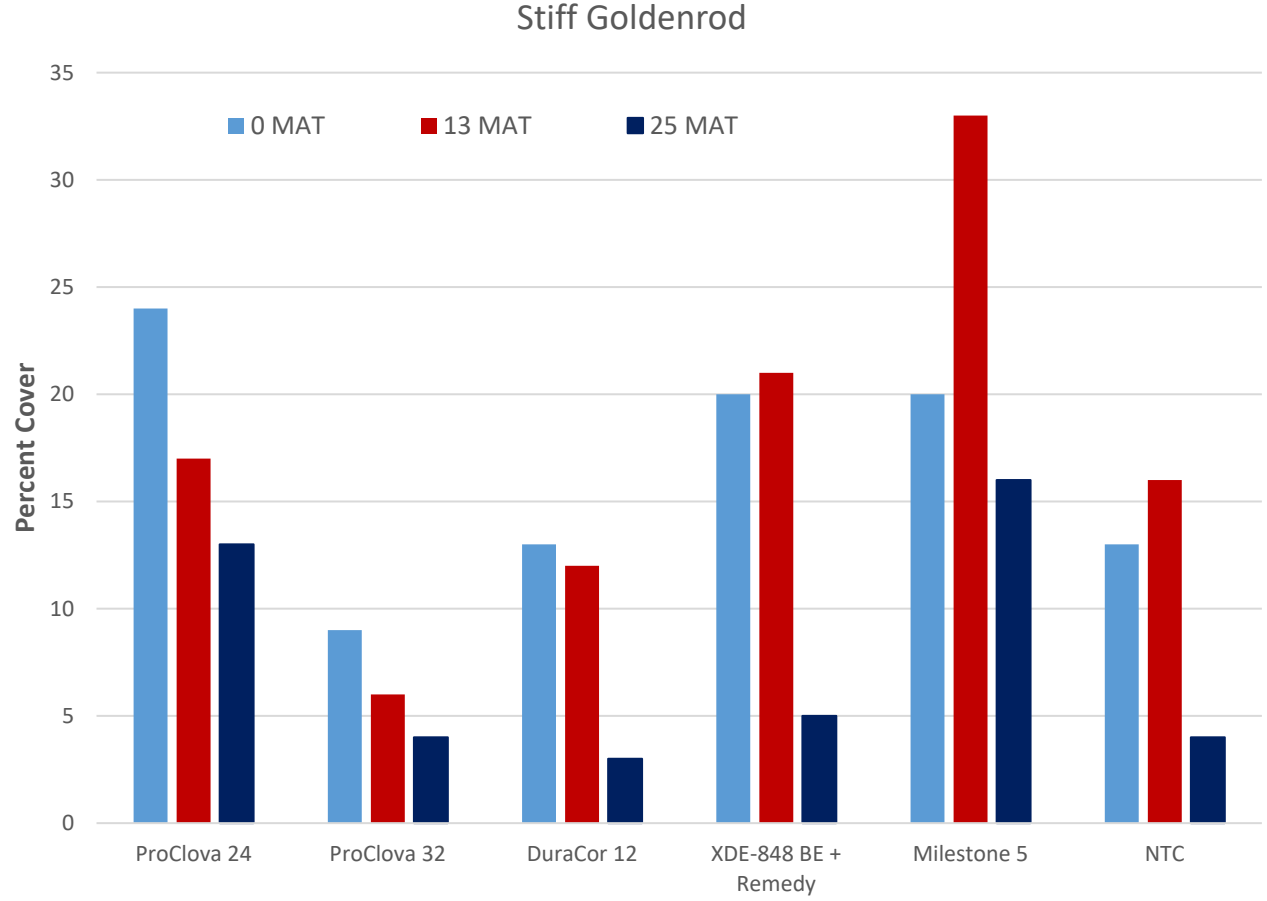
No differences in cover among treatments (P>0.05)

No significant differences were seen in cover for all treatments 25 MAT when compared to the NTC.

Xde-848+Remedy and Milestone both showed promise with limited injury observed. ProClova @ 24 fl oz/a, while was not observed 13 MAT, displayed similar cover as the NTC 25 MAT.

Caution should be used interpreting the data due to the low and variable cover.

Change in cover of stiff goldenrod 2 years following treatments



No differences in cover among treatments (P>0.05)

No significant differences in cover were seen at 13 and 25 MAT in all treatments when compared to the NTC.

All treatments, and the NTC, saw decreases in cover 25 MAT when compared to 13 MAT.

All treatments appear to have no long-term effects on stiff goldenrod with Milestone and ProClova at 24 fl oz/A showing the highest cover.

Key to Injury Ratings:				
Tolerant (0-15% injury/mortality)	Moderately Tolerant (16-50% injury/mortality)	Moderately Susceptible (51-75% injury/mortality)	Susceptible (76-100% injury/mortality)	No Data

15 DAT – July 7th, 2021 (1/2)							
Trt. No.	Treatment	Rate	Black-eyed Susan Injury (%)	Canada Goldenrod Injury (%)	Common Yarrow Injury (%)	Compass plant Injury (%)	Fleabane sp. Injury (%)
1	ProClova	24 fl oz/A	20	35 a	10	30	20
2	ProClova	32 fl oz/A	.	36 a	20	40	45
3	DuraCor	12 fl oz/A	.	18 b	.	20	40
4	XDE-848 BE Remedy Ultra	0.21 fl oz/A 16 fl oz/A	25	38 a	10	25	.
5	Milestone	5 fl oz/A	.	19 b	10	20	50
6	NTC	-	.	3 c	5	0	5
Statistics[1]							
LSD P=.05			.	13.22	.	.	.
Standard Deviation			.	7.02	.	.	.
CV			.	27.51	.	.	.
Treatment Prob(F)				0.0035			

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

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

15 DAT – July 7th, 2021 (2/2)						
Trt. No.	Treatment	Rate	Grass-leaved Goldenrod Injury (%)	Stiff Goldenrod Injury (%)	Wild Bergamot Injury (%)	Aster Sp. Injury (%)
1	ProClova	24 fl oz/A	20	18 -	90 -	55 -
2	ProClova	32 fl oz/A	.	.	.	25 -
3	DuraCor	12 fl oz/A	20	20 -	65 -	.
4	XDE-848 BE Remedy Ultra	0.21 fl oz/A 16 fl oz/A	.	10 -	25 -	20 -
5	Milestone	5 fl oz/A	.	9 -	25 -	20 -
6	NTC	-	.	5 -	0 -	3 -
Statistics[2]						
LSD P=.05			.	43.62	127.06	47.32
Standard Deviation			.	12.42	10	20.87
CV			.	103.95	23.73	91.84
Treatment Prob(F)				0.84	0.1911	0.2803

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

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

29 DAT – July 21st, 2021 (1/2)							
Trt. No.	Treatme nt	Rate	Black-eyed Susan Injury (%)	Canada Goldenrod Injury (%)	Common Yarrow Injury (%)	Compass plant Injury (%)	Fleabane Sp. Injury (%)
1	ProClova	24 fl oz/A	40	48 bc	55	30	.
2	ProClova	32 fl oz/A	.	50 b	33	.	93
3	DuraCor	12 fl oz/A	.	36 bc	.	40	.
4	XDE-848 BE Remedy Ultra	0.21 fl oz/A 16 fl oz/A	15	72 a	10	35	.
5	Milestone	5 fl oz/A	.	28 c	10	.	.
6	NTC	-	.	2 d	5	.	90
Statistics[3]							
LSD P=.05			.	20.17	.	.	.
Standard Deviation			.	10.72	.	.	.
CV			.	29.39	.	.	.
Treatment Prob(F)				0.0013			

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

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

29 DAT – July 21st, 2021 (2/2)							
Trt. No.	Treatment	Rate	Wild Bergamot Injury (%)	Aster Sp. Injury (%)	Stiff Goldenrod Injury (%)	Grass-leaved Goldenrod Injury (%)	Blue Vervain Injury (%)
1	ProClova	24 fl oz/A	93	40 -	21 -	.	.
2	ProClova	32 fl oz/A	.	.	.	.	.
3	DuraCor	12 fl oz/A	100	55 -	35 -	35	.
4	XDE-848 BE Remedy Ultra	0.21 fl oz/A 16 fl oz/A	55	.	40 -	.	.
5	Milestone	5 fl oz/A	45	38 -	15 -	.	20
6	NTC	-	0	1 -	0 -	.	.
Statistics[4]							
LSD P=.05			.	25.94	22.01	.	.
Standard Deviation			.	2.5	6.27	.	.
CV			.	10.19	27.96	.	.
Treatment Prob(F)				0.0559	0.1001		

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

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

52 DAT – August 13th, 2021 (1/2)							
Trt. No.	**Treatment**	**Rate**	**Aster Sp. Injury (%)**	**Black-eyed Susan Injury (%)**	**Canada Goldenrod Injury (%)**	**Common Yarrow Injury (%)**	**Compassplant Injury (%)**
1	ProClova	24 fl oz/A	20	40	46 ab	100	.
2	ProClova	32 fl oz/A	50	50	46 ab	30	.
3	DuraCor	12 fl oz/A	40	.	27 bc	.	50
4	XDE-848 BE Remedy Ultra	0.21 fl oz/A 16 fl oz/A	.	50	62 a	50	.
5	Milestone	5 fl oz/A	45	.	19 bc	30	.
6	NTC	-	0	.	0 c	100	.
Statistics[5]							
LSD P=.05			.	.	27.31	.	.
Standard Deviation			.	.	14.79	.	.
CV			.	.	42.16	.	.
Treatment Prob(F)					0.0119		

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

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

52 DAT – August 13th, 2021 (2/2)						
Trt. No.	Treatment	Rate	Fleabane Sp. Injury (%)	Wild Bergamot Injury (%)	Stiff Goldenrod Injury (%)	Blue Vervain Injury (%)
1	ProClova	24 fl oz/A	.	.	15 -	.
2	ProClova	32 fl oz/A	100	.	.	.
3	DuraCor	12 fl oz/A	.	85 a	30 -	.
4	XDE-848 BE Remedy Ultra	0.21 fl oz/A 16 fl oz/A	.	60 b	40 -	.
5	Milestone	5 fl oz/A	.	40 c	14 -	25
6	NTC	-	.	2 d	3 -	.
Statistics[6]						
LSD P=.05			.	2.59	21.81	.
Standard Deviation			.	0.25	6.21	.
CV			.	0.56	31.93	.
Treatment Prob(F)				0.0038	0.1315	

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

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