



RUTGERS

New Jersey Agricultural
Experiment Station

2021

Turfgrass Proceedings

The New Jersey Turfgrass Association

In Cooperation with
Rutgers Center for Turfgrass Science
Rutgers Cooperative Extension

2021 RUTGERS TURFGRASS PROCEEDINGS

of the

GREEN EXPO Turf and Landscape Conference

December 7-9, 2021

Borgata Hotel

Atlantic City, New Jersey

The Rutgers Turfgrass Proceedings is published yearly by the Rutgers Center for Turfgrass Science, Rutgers Cooperative Extension, and the New Jersey Agricultural Experiment Station, School of Environmental and Biological Sciences, Rutgers, The State University of New Jersey in cooperation with the New Jersey Turfgrass Association. The purpose of this document is to provide a forum for the dissemination of information and the exchange of ideas and knowledge. The proceedings provide turfgrass managers, research scientists, extension specialists, and industry personnel with opportunities to communicate with co-workers. Through this forum, these professionals also reach a more general audience, which includes the public.

This publication includes lecture notes of papers presented at the 2021 GREEN EXPO Turf and Landscape Conference. Publication of these lectures provides a readily available source of information

covering a wide range of topics and includes technical and popular presentations of importance to the turfgrass industry.

This proceedings also includes research papers that contain original research findings and reviews of selected subjects in turfgrass science. These papers are presented primarily to facilitate the timely dissemination of original turfgrass research for use by the turfgrass industry.

Special thanks are given to those who have submitted papers for this proceedings, to the New Jersey Turfgrass Association for financial assistance, and to Anne Diglio and Barbara Fitzgerald for administrative support.

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NON-SELECTIVE HERBICIDES TO ESTABLISH AND MAINTAIN BARE GROUND

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INTRODUCTION

The objective of this experiment was to evaluate two different glufosinate products (Cheetah Pro and Finale) alone and in combination with various pre-emergence herbicides for bare ground weed control in turfgrass.

MATERIALS AND METHODS

This experiment was conducted at the Rutgers Adelphia Research and Extension Farm in Adelphia, NJ on a stand of perennial ryegrass, Kentucky bluegrass, white clover (*Trifolium repens*), and dandelion (*Taraxacum officinale*). The site also had a history of the winter annual weed hairy bittercress (*Cardamine hirsute*). The site was mowed weekly at 2.5" with a rotary mower and irrigated by rainfall only. No fertilizers or plant protectants were applied during the experiment.

Treatments (Table 1) were arranged in a randomized block design and replicated four times. Plots measured 4' by 7' and included a 12" wide non-treated buffer strip between each plot providing a 3' by 7' treated area. Treatments were applied using a CO₂-powered sprayer calibrated to apply 44 GPA through a single 9504EVS nozzle at 44 PSI. A single application of each herbicide treatment was made on August 20, 2020.

Control of all species was evaluated on a 0 (no injury or weed green cover reduction) to 100 (complete death or weed green cover reduction) percent scale relative to the non-treated control. All data were subjected to ANOVA in ARM (v9) and Fisher's Protected LSD (P=0.05) was used to separate means.

RESULTS

White Clover Control

Glufosinate-containing treatments (Finale and Cheetah Pro) generally provided similar white clover control on all rating dates (Table 2). These treatments provided more control than RoundUp PowerMax until 3 WAT where all treatments provided >95% control. All treatments provided 100% clover control at the conclusion of the experiment.

Dandelion Control

Glufosinate-containing treatments generally provided similar dandelion control and more control than RoundUp PowerMax from 2 days after treatment (DAT) until 3 weeks after treatment (WAT; Table 3). At 10 WAT in October, RoundUp PowerMax alone and glufosinate-containing treatments in combination with SureGuard, Gallery, and Dimension provided more dandelion control than other treatments. At the conclusion of the experiment in May, Cheetah Pro + SureGuard provided 86% control compared to ≤45% for Cheetah Pro alone.

Perennial Ryegrass and Kentucky Bluegrass Control

Glufosinate-containing treatments provided more perennial ryegrass and Kentucky bluegrass control than RoundUp PowerMax at 2 and 4 DAT (Tables 4 and 5). All treatments provided ≥96% perennial ryegrass and Kentucky bluegrass control from 2 WAT until 10 WAT in October. At the conclusion of the experiment in May, Finale + AMS provided more perennial ryegrass control than Finale + Dimension and Gallery.

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Hairy Bittercress Control

On 13 May 2021, glufosinate alone provided no bittercress control while glufosinate tank-mixed with Dimension, Gallery, or SureGuard provided similar (>75%) control (data not presented). Glufosinate + flumioxazin provided 100% bittercress control which was statistically similar to the 75% control provided by glufosinate + Gallery.

CONCLUSIONS

Tank-mixing glufosinate with residual herbicides such as flumioxazin, dithiopyr, and isoxaben provided more dandelion and hairy bittercress control than glufosinate alone, which is attributed to control of dandelion emergence from seed after treatment and control of hairy bittercress emergence from seed in the fall. Glufosinate and glyphosate provided similar control of white clover and Kentucky bluegrass, but this contrasts with previous research where glyphosate was more effective for Kentucky bluegrass control (McCullough et al. 2006). Glyphosate tended to provide more perennial ryegrass control than glufosinate which is more representative of previous research where glyphosate provides better control of perennial species.

REFERENCES

McCullough PE, Hart SE, Askew S, Dernoeden PH, Reicher Z, Weisenberger D (2006) Kentucky bluegrass control with postemergence herbicides. *HortScience* 41:255-258.

Table 1. Herbicide treatments applied in 2020 at the Rutgers Adelphia Plant Science Research and Extension Farm in Freehold, NJ for control of white clover (*Trifolium repens*), dandelion (*Taraxacum officinale*), perennial ryegrass (*Lolium perenne*) and Kentucky bluegrass (*Poa pratensis*) species to maintain bare ground.

Treatment	Trade name	Active ingredient	Product rate (per acre)
1	Non-treated	–	–
2	Cheetah Pro + AMS ¹	glufosinate	82 fl oz + 2 lbs
3	Cheetah Pro + AMS	glufosinate	56 fl oz + 2 lbs
4	Cheetah Pro + SureGuard SC + AMS	glufosinate + flumioxazin	56 + 12 fl oz + 2 lbs
5	RoundUp PowerMax	glyphosate	32 fl oz
6	Finale	glufosinate	128 fl oz
7	Finale + AMS	glufosinate	128 fl oz + 2 lbs
8	Finale + Gallery SC	glufosinate + isoxaben	128 + 31 fl oz
9	Finale + Dimension 2EW	glufosinate + dithiopyr	128 + 32 fl oz

¹Ammonium sulfate 21-0-0

Table 2. White clover (*Trifolium repens*) control following herbicide applications in 2020. Control was evaluated on a 0 (no necrosis or green cover reduction) to 100 (complete death or green cover reduction) percent scale relative to the non-treated control.

		White clover control						
Herbicide		22 Aug 2 DAT ¹	24-Aug 4 DAT	28-Aug 1 WAT	1-Sep 2 WAT	11-Sep 3 WAT	30-Sep 6 WAT	27-Oct 10 WAT
1	Non-treated	0 c ²	0	0 c	0 c	0 d	0 b	0 b
2	Cheetah Pro + AMS ¹	75 a	97 a	100 a	100 a	100 a	100 a	100 a
3	Cheetah Pro + AMS	75 a	95 ab	100 a	100 a	100 a	100 a	100 a
4	Cheetah Pro + SureGuard + AMS	75 a	98 a	100 a	100 a	100 a	100 a	100 a
5	RoundUp PowerMax	33 b	60 d	78 b	90 b	98 b	100 a	100 a
6	Finale	70 a	90 c	100 a	100 a	100 a	100 a	100 a
7	Finale + AMS	73 a	93 b	100 a	100 a	100 a	100 a	100 a
8	Finale + Gallery	73 a	95 ab	100 a	100 a	96 c	100 a	100 a
9	Finale + Dimension 2EW	73 a	95 ab	100 a	100 a	99 ab	100 a	100 a

¹Abbreviations: DAT, days after treatment; WAT, weeks after treatments

²Means followed by the same letter are not significantly different according to Fisher's Protected LSD test; P=0.05

Table 3. Dandelion (*Taraxacum officinale*) control following herbicide applications in 2020. Control was evaluated on a 0 (no necrosis or green cover reduction) to 100 (complete death or green cover reduction) percent scale relative to the non-treated control.

		Dandelion control							
Herbicide		22 Aug	24-Aug	28-Aug	1-Sep	11-Sep	30-Sep	27-Oct	13-May
		2 DAT ¹	4 DAT	1 WAT	2 WAT	3 WAT	6 WAT	10 WAT	38 WAT
1	Non-treated	0 c ²	0	0 c	0 c	0 c	0 b	0 b	0 d
2	Cheetah Pro + AMS ¹	46 a	90 b	100 a	100 a	100 a	95 abc	30 cd	42 bc
3	Cheetah Pro + AMS	43 a	85 c	100 a	100 a	100 a	92 abc	47 bc	45 bc
4	Cheetah Pro + SureGuard + AMS	40 a	95 a	100 a	100 a	100 a	83 c	88 a	86 a
5	RoundUp PowerMax	15 b	40 e	77 b	90 b	95 b	100 a	89 a	55 abc
6	Finale	43 a	80 d	100 a	100 a	100 a	96 ab	13 cd	28 bcd
7	Finale + AMS	43 a	80 d	100 a	100 a	100 a	95 abc	38 cd	40 bc
8	Finale + Gallery	47 a	80 d	100 a	100 a	100 a	93 abc	80 ab	23 cd
9	Finale + Dimension 2EW	43 a	80 d	100 a	100 a	100 a	85 bc	85 ab	62 ab

¹Abbreviations: DAT, days after treatment; WAT, weeks after treatments

²Means followed by the same letter are not significantly different according to Fisher's Protected LSD test; P=0.05

Table 4. Perennial ryegrass (*Lolium perenne*) control following herbicide applications in 2020. Control was evaluated on a 0 (no necrosis or green cover reduction) to 100 (complete death or green cover reduction) percent scale relative to the non-treated control.

		Perennial ryegrass control							
Herbicide		22 Aug 2 DAT ¹	24-Aug 4 DAT	28-Aug 1 WAT	1-Sep 2 WAT	11-Sep 3 WAT	30-Sep 6 WAT	27-Oct 10 WAT	13-May 38 WAT
1	Non-treated	0 c ²	0	0 c	0 c	0 c	0 b	0 b	0 c
2	Cheetah Pro + AMS ¹	70 a	95 a	97 ab	100 a	100 a	100 a	100 a	93 ab
3	Cheetah Pro + AMS	60 c	90 b	97 ab	100 a	100 a	100 a	100 a	90 ab
4	Cheetah Pro + SureGuard + AMS	63 b	90 b	97 ab	100 a	100 a	100 a	100 a	87 ab
5	RoundUp PowerMax	20 d	45 d	98 a	100 a	100 a	100 a	100 a	98 a
6	Finale	60 c	88 b	97 ab	100 a	100 a	100 a	100 a	83 ab
7	Finale + AMS	60 c	85 c	97 ab	100 a	100 a	100 a	100 a	95 ab
8	Finale + Gallery	60 c	85 c	97 ab	100 a	100 a	100 a	100 a	82 b
9	Finale + Dimension 2EW	60 c	85 c	95 b	100 a	110 a	100 a	110 a	80 b

¹Abbreviations: DAT, days after treatment; WAT, weeks after treatments

²Means followed by the same letter are not significantly different according to Fisher's Protected LSD test; P=0.05

Table 5. Kentucky bluegrass (*Poa pratensis*) control following herbicide applications in 2020. Control was evaluated on a 0 (no necrosis or green cover reduction) to 100 (complete death or green cover reduction) percent scale relative to the non-treated control.

		Kentucky bluegrass control						
Herbicide		22 Aug 2 DAT ¹	24-Aug 4 DAT	28-Aug 1 WAT	1-Sep 2 WAT	11-Sep 3 WAT	30-Sep 6 WAT	27-Oct 10 WAT
1	Non-treated	0 c ²	0	0 c	0 c	0 c	0 b	0 b
2	Cheetah Pro + AMS ¹	60 a	85 a	97 b	98 a	100 a	100 a	100 a
3	Cheetah Pro + AMS	57 ab	80 b	97 b	98 a	100 a	100 a	100 a
4	Cheetah Pro + SureGuard + AMS	57 ab	85 a	97 b	98 a	100 a	100 a	100 a
5	RoundUp PowerMax	20 d	50 c	98 ab	98 a	98 b	100 a	100 a
6	Finale	50 c	80 b	100 a	98 a	100 a	100 a	100 a
7	Finale + AMS	57 ab	80 b	96 b	98 a	100 a	100 a	100 a
8	Finale + Gallery	57 ab	80 b	96 b	97 ab	100 a	100 a	100 a
9	Finale + Dimension 2EW	53 bc	80 b	93 c	96 b	100 a	100 a	100 a

¹Abbreviations: DAT, days after treatment; WAT, weeks after treatments

²Means followed by the same letter are not significantly different according to Fisher's Protected LSD test; P=0.05