Noncrop and Invasive Vegetation Management Weed Science

2018 Annual Research Report

UNIVERSITY
OF KENTUCKY

College of Agriculture
Department of Plant and Soil Sciences

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INFORMATION NOTE 2018 NCVM-1

Table of Contents

Forward

The information provided in this document represents a collaborative effort between the Roadside Environment Branch of the Kentucky Transportation Cabinet and the Department of Plant and Soil Sciences in the College of Agriculture at the University of Kentucky. The main priority of this project was to collect and disseminate information to the KTC REB to increase the efficiency of operations aimed at roadside environment management.

This report contains a summary of research conducted during the 2018 season. This document is primarily for the use of the Kentucky Transportation Cabinet. Other use is allowable if proper credit is given to the authors.

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Acknowledgements

The Kentucky Transportation Cabinet funded the majority of the research conducted during the 2018 season. A special recognition must go to P. David Cornett, Mike Smith, and others at the Central Office in Frankfort for supporting this research effort. Special acknowledgement must also go to the twelve district roadside environment managers and their crews for contribution of ideas and land to conduct part of this research.

Other personnel in the Weed Science and Turf Science groups who also aided in this project in terms of labor, equipment, and ideas include Charlie Slack, Sara Carter, Dr. J.D. Green, Ricky King, and Dr. Kenneth Cropper. Appreciation is also given to the farm crews at Spindletop Research Station for equipment and plot maintenance.

The research could not have been accomplished if not for the generous contributions of product. Contributors of product used include:

BASF Corporation
Bayer Crop Science
Dow AgroSciences
DuPont
Nufarm
PBI Gordon

External funding for research projects was received from Bayer Crop Science. The financial support of this organization is greatly appreciated.

We sincerely appreciate the effort and continued support of all our cooperators and look forward to future endeavors.

Species List

The following is a list of plant species discussed in the following document.

Scientific Name	Common Name
Apocynum cannabium	Hemp Dogbane
Chamaesyce maculate	Prostrate spurge
Cirsium arvense	Canada Thistle
Conium maculatum	Poison Hemlock
Cyndon dactylon (L.) Pers.	Bermuda Grass
Dipsacus fullonum	Common Teasel
Festuca arundinaceum (Schreb.) S.J. Darbyshire	Tall Fescue
Lactuca serriola	Prickly Lettuce
Medicago lupulina L.	Black Medic
Muhlenbergia schreberi J.F.Gmel.	Nimblewill
Plantago lanceolata L.	Buckhorn Plantain
Poa pratensis L.	Kentucky Bluegrass
Setaria faberi Herrm.	Giant Foxtail
Setaria pumila (Poir.) Roem. & Schult.	Yellow Foxtail
Sorghum halepense (L.) Pers.	Johnsongrass

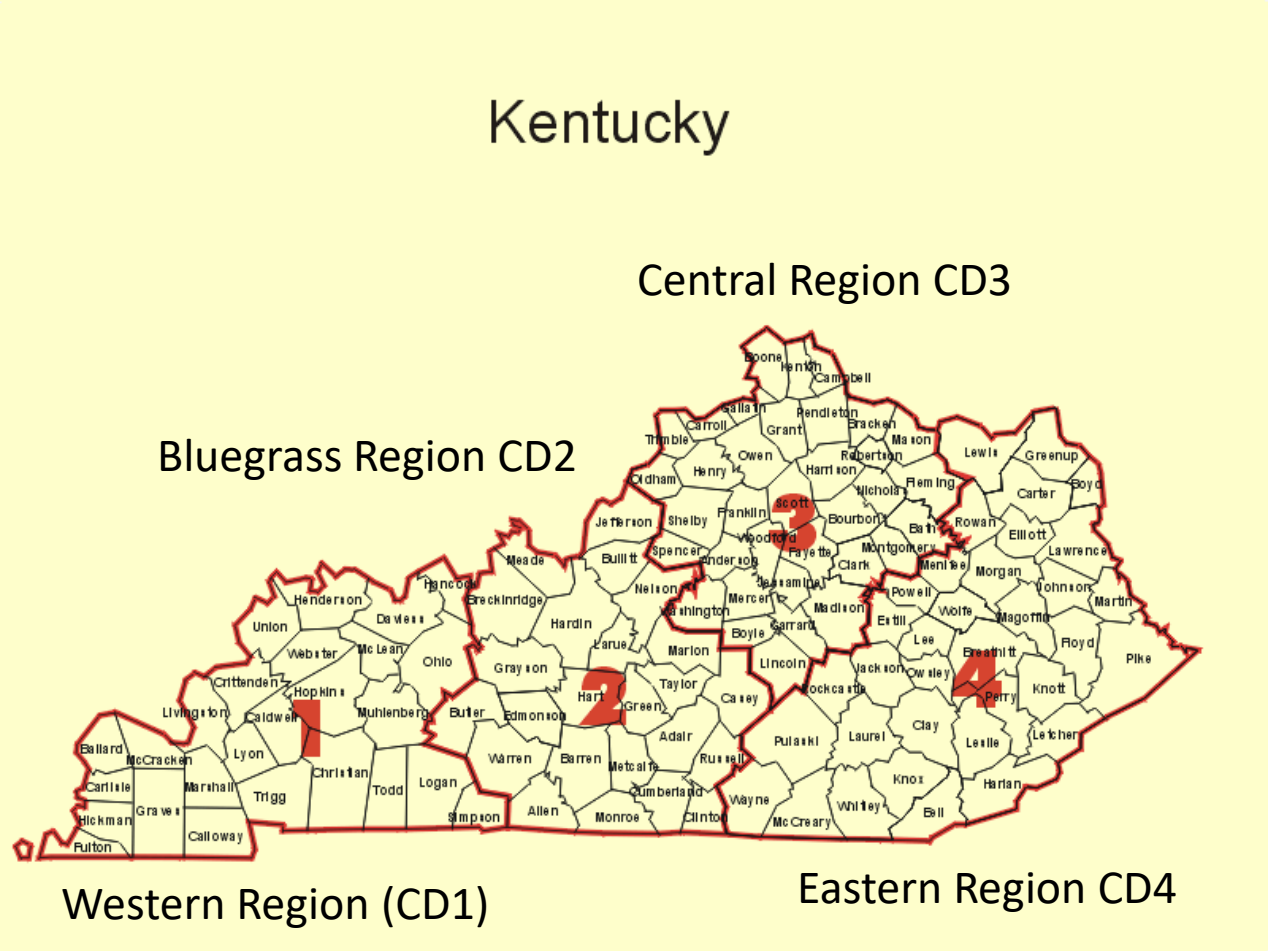
Herbicide List

The following is a list of herbicides discussed in the following document.

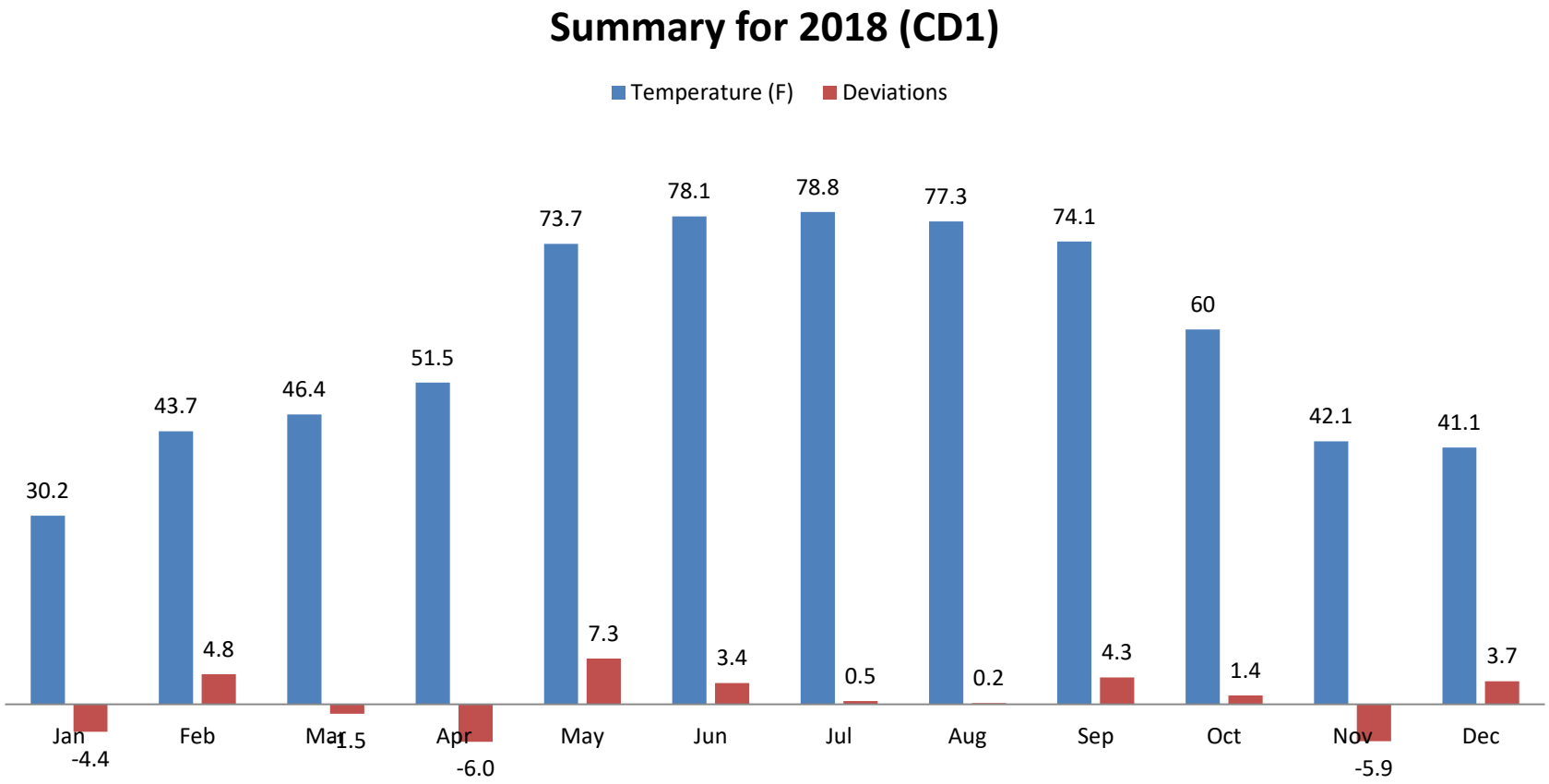
Product	Active Ingredient(s)	Concentration	Manufacturer
Acclaim Extra	fenoxaprop	0.57 lb per gallon	Bayer
Aneuw	prohexadione calcium	27.5% w/w	Nufarm
Cleantraxx	penoxsulam + oxyfluorfen	0.083 lb + 3.93 lb per gallon	Dow AgroSciences
Clearcast	imazamox	1 lb ae per gallon	BASF
Detail	saflufenacil	2.85 lb per gallon	BASF
Embark 2-S	mefluidide	2.0 lb ae per gallon	PBI Gordon
Envoy Plus	clethodim	0.97 lb per gallon	Valent
Esplanade	indaziflam	1.67 lb per gallon	Bayer
Fusilade II	fluazifop	2 lb per gallon	Syngenta
Fusion	fluazifop + fenoxaprop	2 lb + 0.56 lb per gallon	Syngenta
Hyvar X	bromacil	80% w/w	DuPont
Journey	imazapic + glyphosate	0.75 lb ae + 1.5 lb ae per gallon	BASF
Method	aminocyclopyrachlor	2 lb ae per gallon	Bayer
Milestone VM	aminopyralid	2 lb ae per gallon	Dow AgroSciences
MSMA	monosodium acid methanearsonate	6 lb per gallon	Drexel
Opensight	aminopyralid + metsulfuron	0.525 lb ae + 0.0945 lb ae per gallon	Dow AgroSciences
Oust XP	sulfometuron	75% w/w	DuPont
Oust Extra	sulfometuron + metsulfuron	56.25% + 15% w/w	DuPont
Outrider	sulfosulfuron	75% w/w	Monsanto
Overdrive	diflufenzopyr + dicamba	0.2 lb ae + 0.5 lb ae per gallon	BASF
Perspective	aminocyclopyrachlor + chlorsulfuron	39.5% + 15.8% w/w	DuPont
Polaris AC Complete	imazapyr	4 lb ae per gallon	Nufarm
Plateau	imazapic	2 lb ae per gallon	BASF
Poast Plus	sethoxydim	1 lb per gallon	BASF
Proclipse	prodiamine	65% w/w	Nufarm
Pyresta	2,4-D + pyraflufen-ethyl	3.5 lb ae + 0.0177 lb per gallon	Nichino America
Rodeo	glyphosate	4 lb ae per gallon	Dow AgroSciences
Roundup ProMax	glyphosate	4.5 lb ae per gallon	Monsanto
Sahara	diuron + imazapyr	62.22% + 7.78% w/w	BASF

Select Max	clethodim	0.97 lb per gallon	Valent
Solution Water Soluble	2,4-D	80.5% ae w/w	Nufarm
Streamline	aminocyclopyrachlor + metsulfuron methyl	39.5% + 12.6% w/w	DuPont
Vastlan	triclopyr	4 lb ae per gallon	Dow AgroSciences
Viewpoint	imazapyr + aminocyclopyrachlor + metsulfuron	31.6% + 22.8% + 7.3% w/w	DuPont

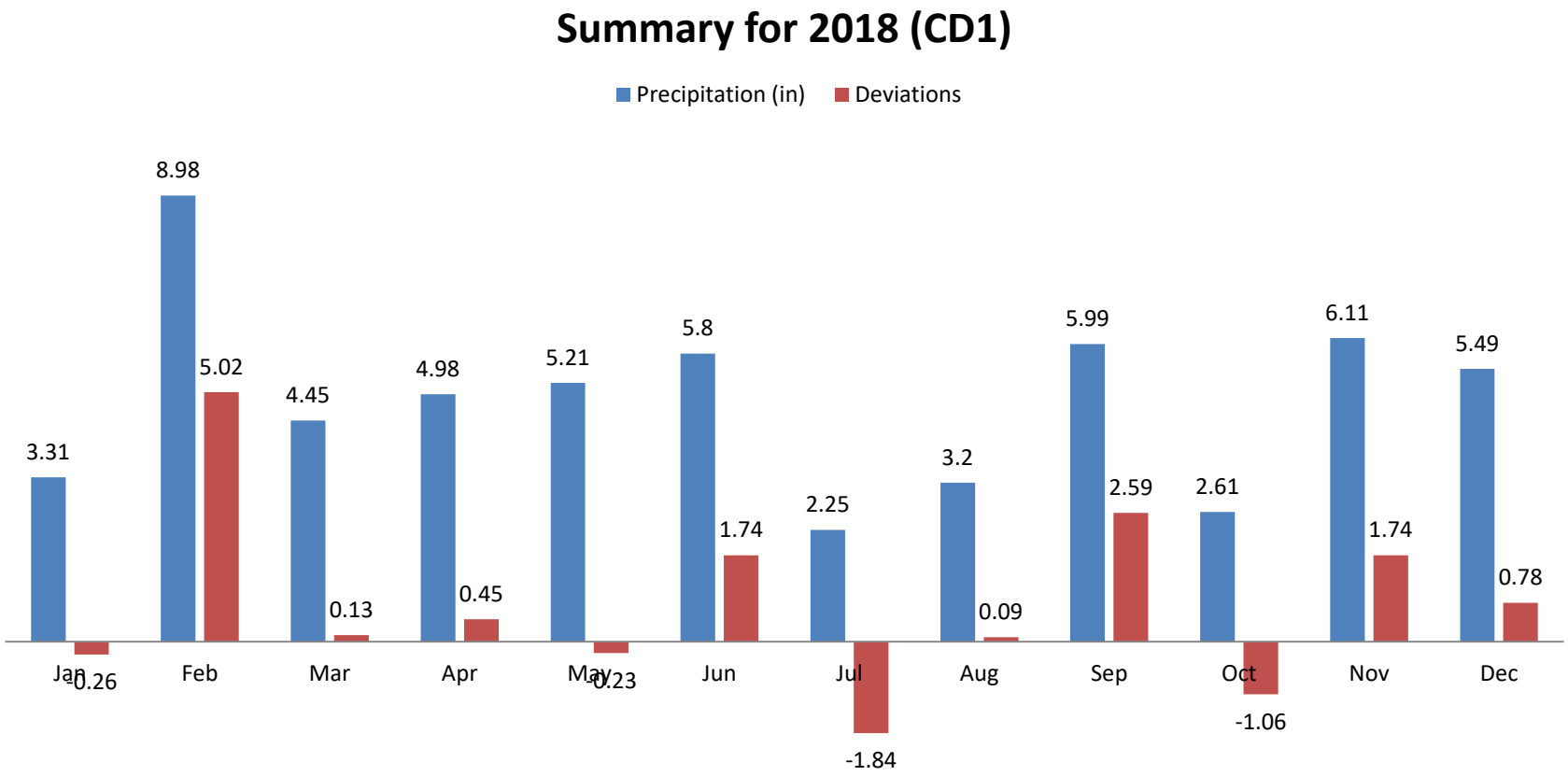
Map of Kentucky Climate Divisions



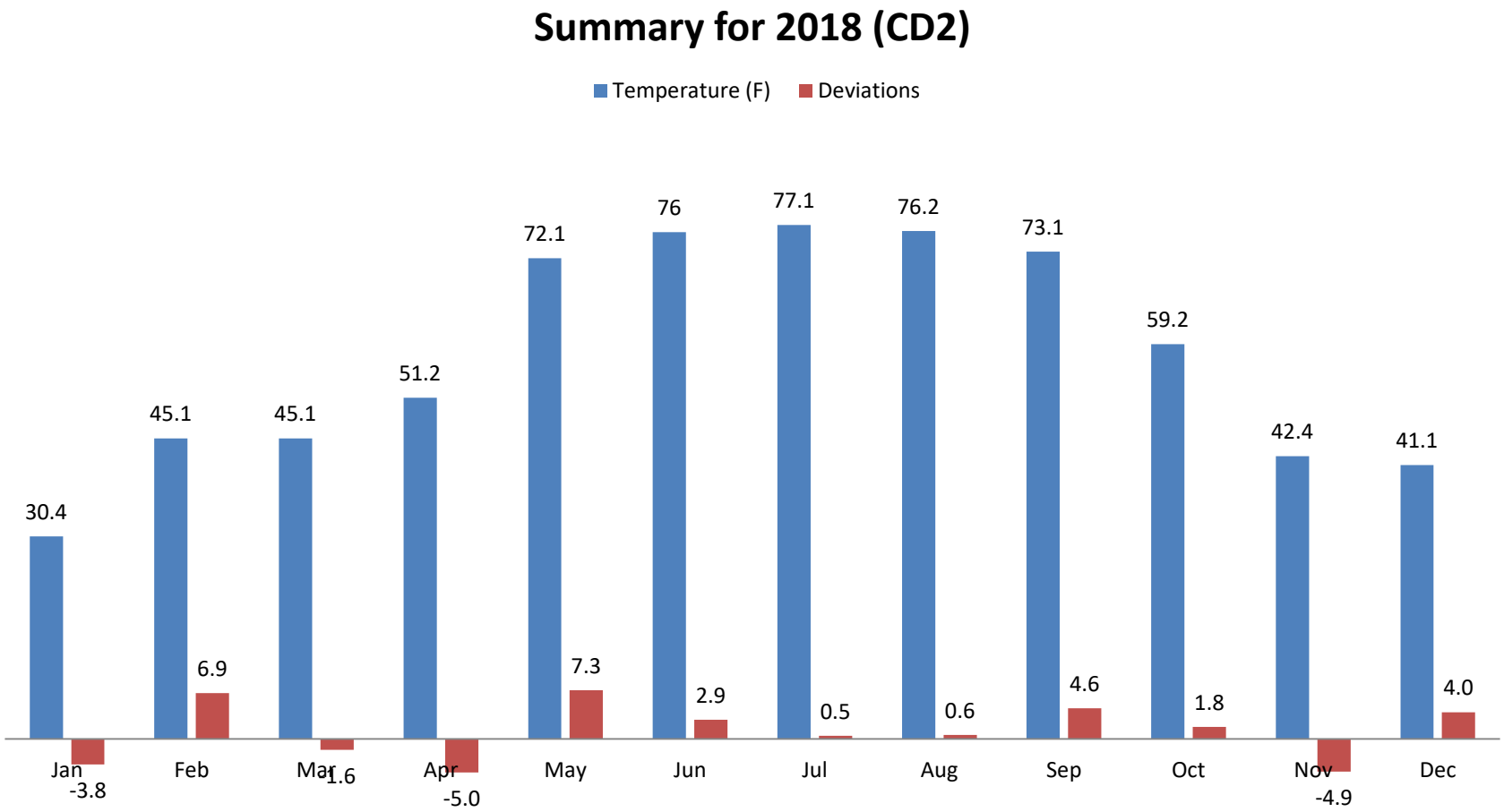
Western Region (CD1) Monthly Temperatures and Deviations from Normal (UKWAC)



Western Region (CD1) Monthly Precipitation and Deviations from Normal (UKWAC)



Central Region (CD2) Monthly Temperatures and Deviations from Normal (UKWAC)



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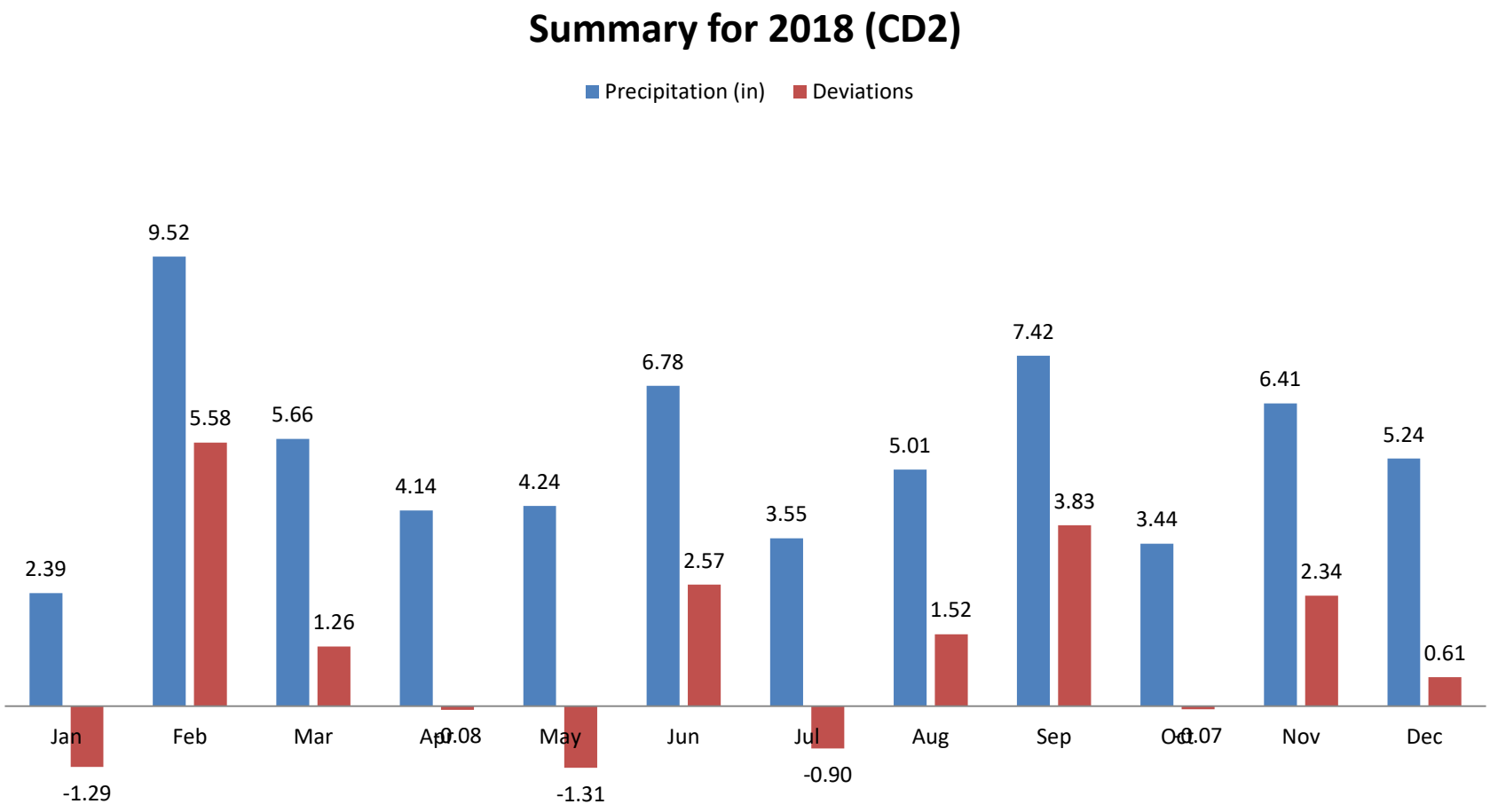

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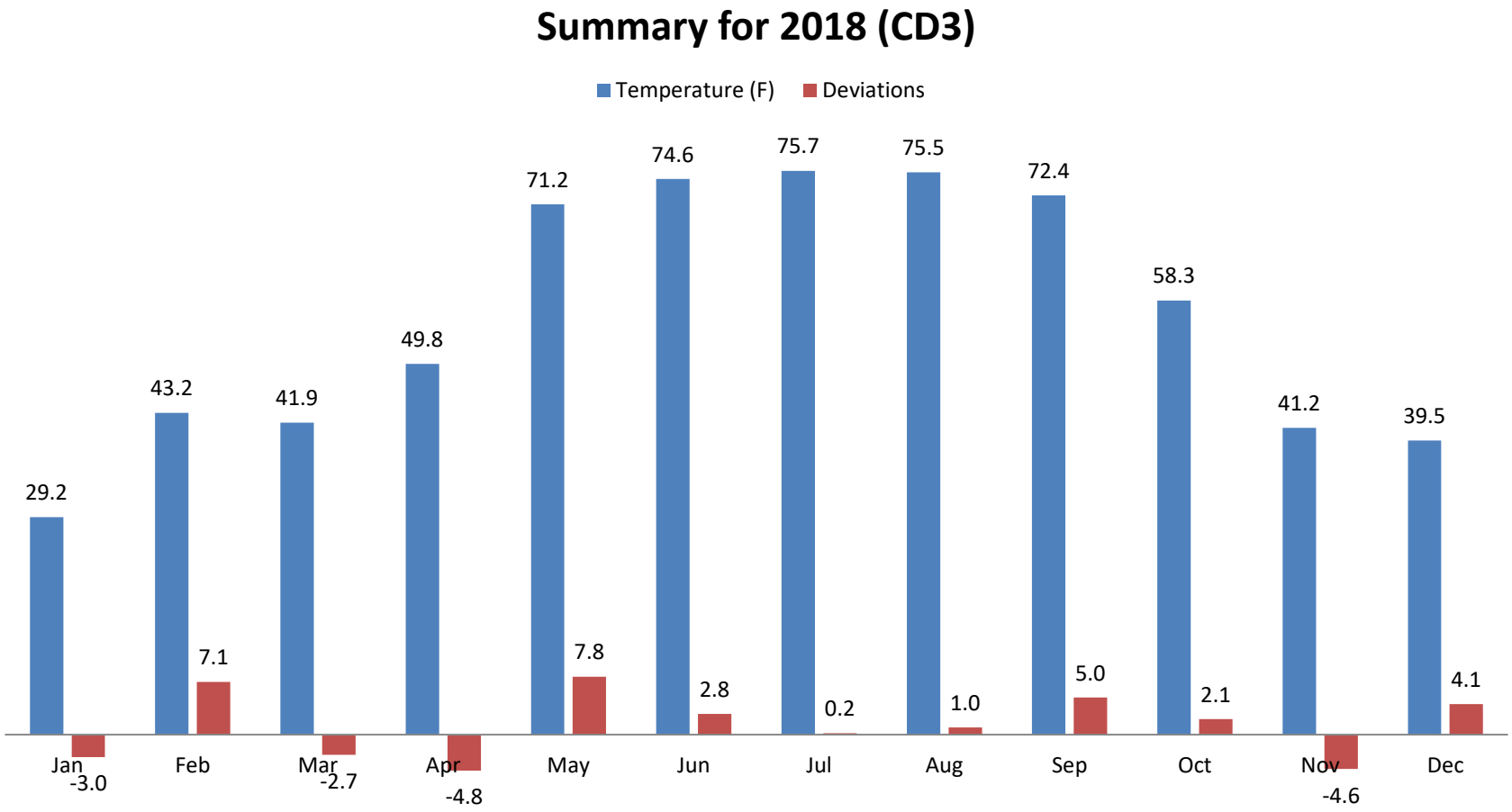
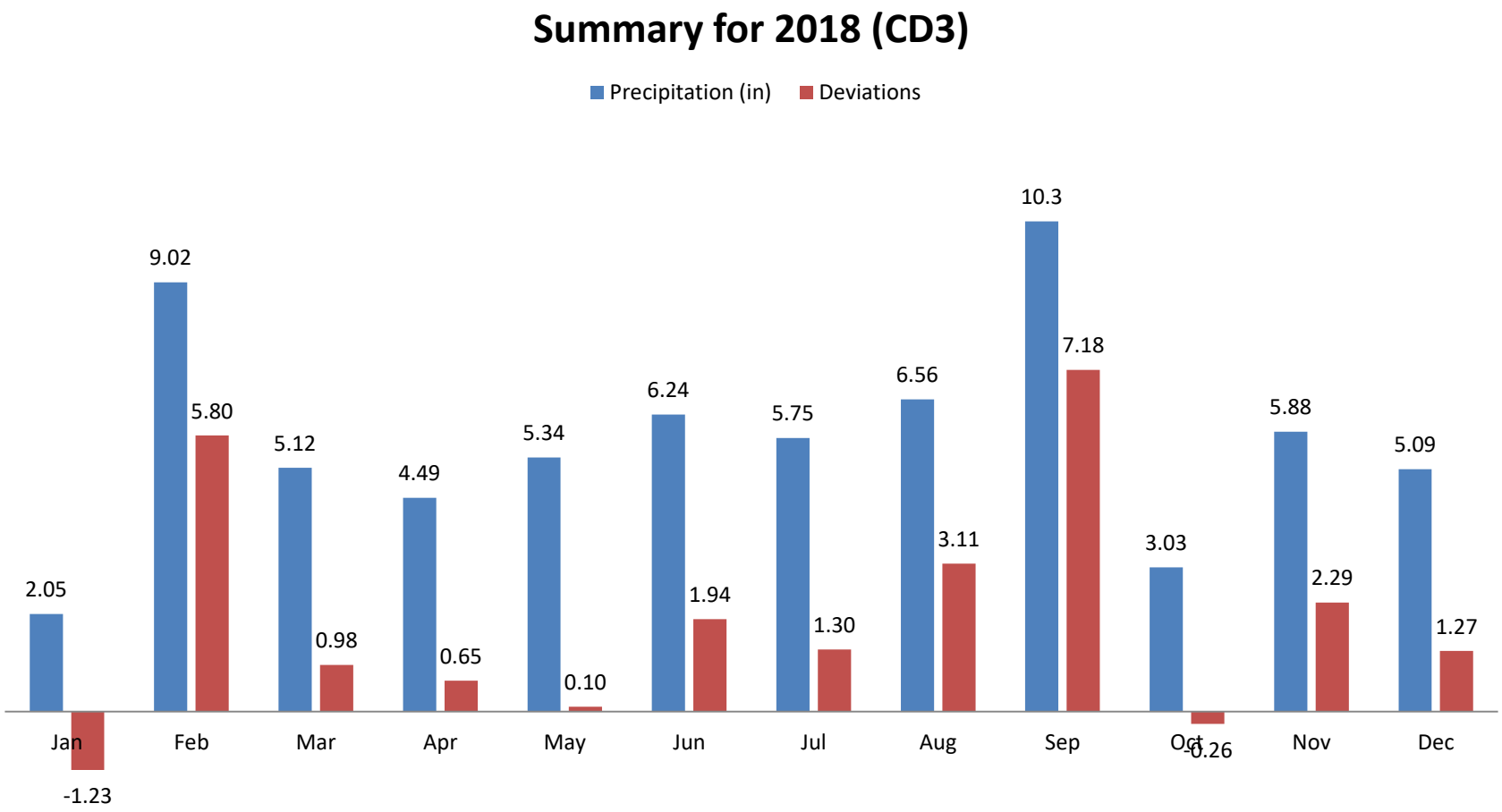
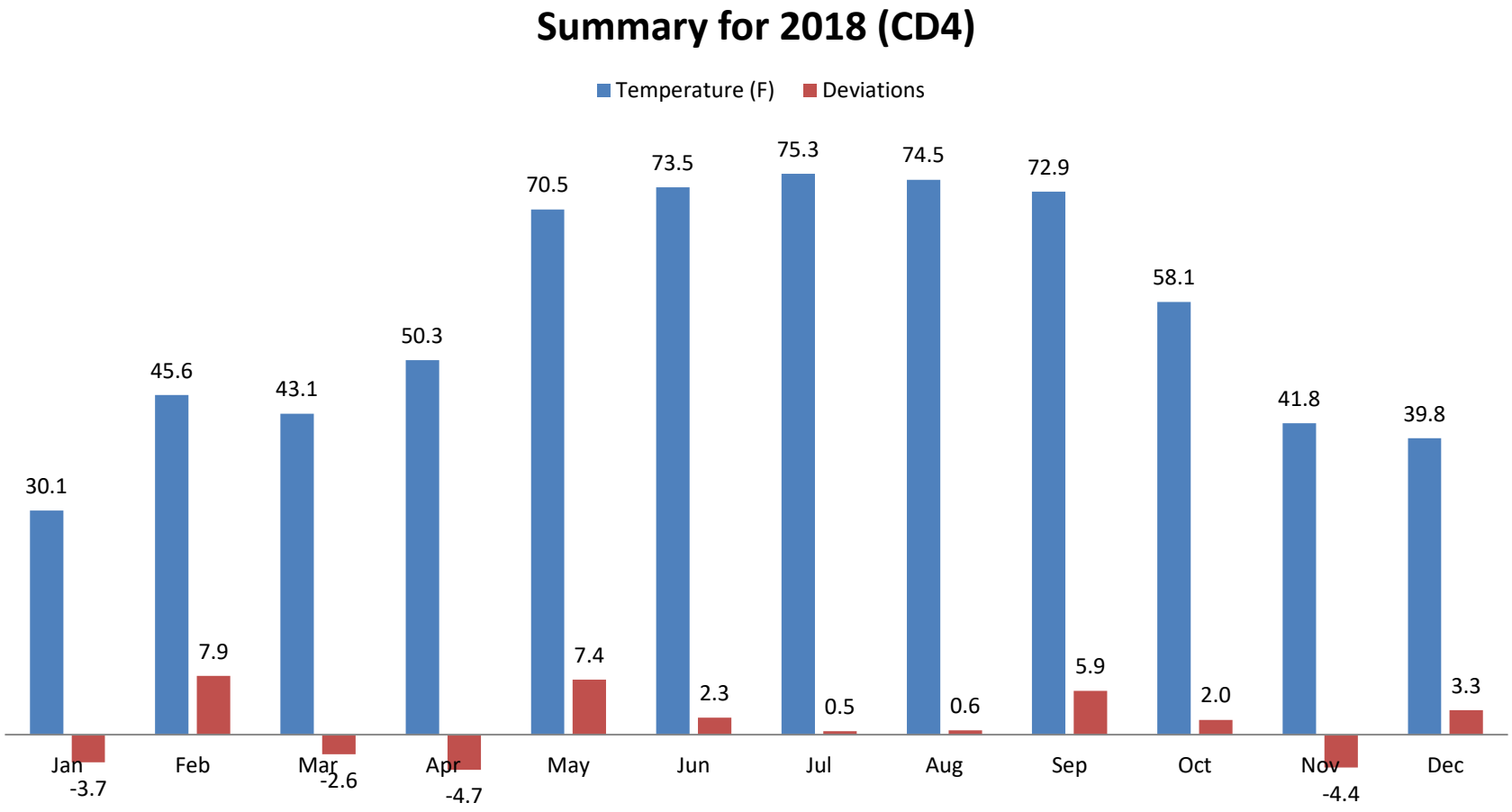
Bluegrass Region (CD3) Monthly Temperatures and Deviations from Normal (UKWAC)



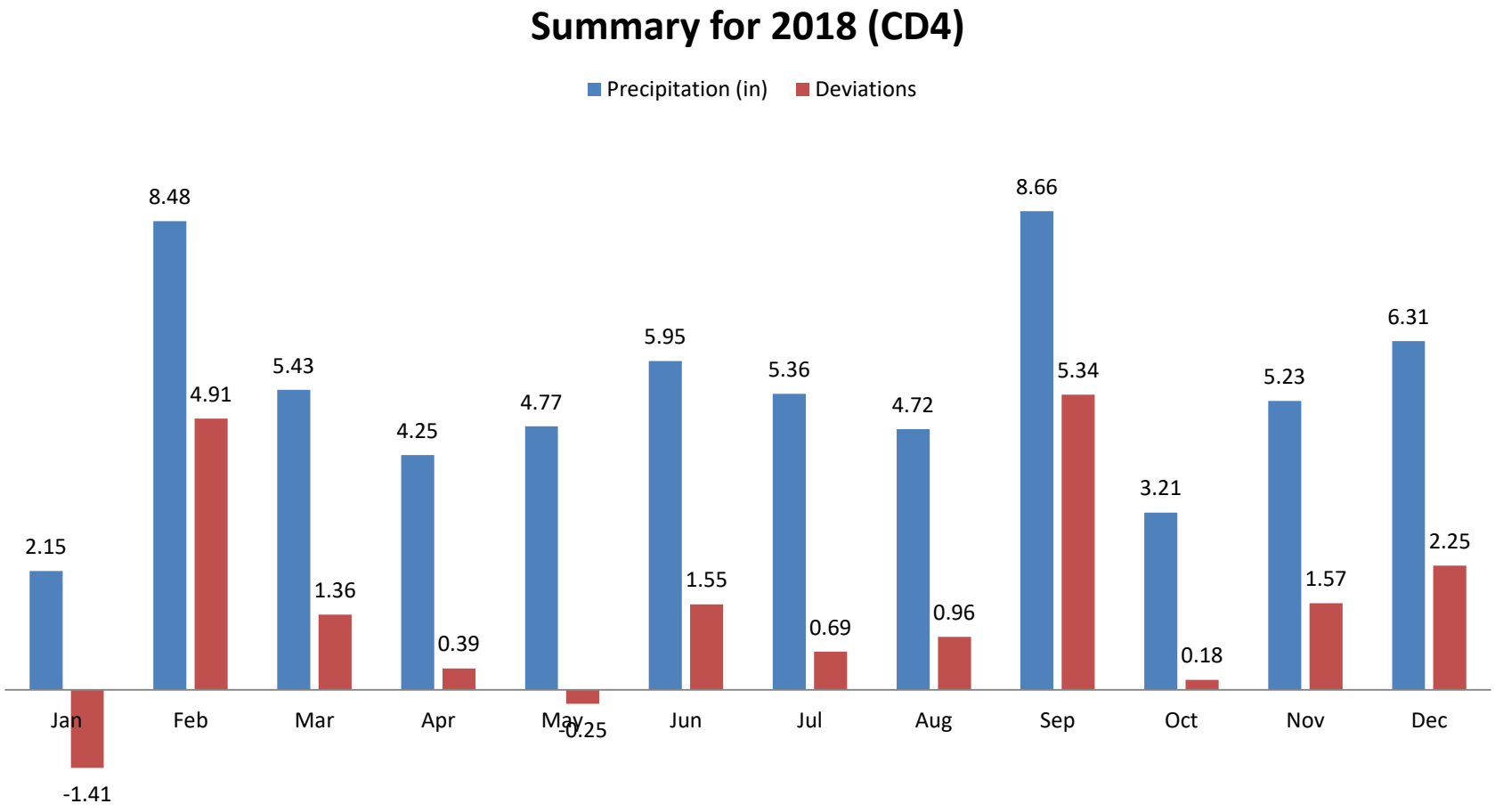
Bluegrass Region (CD3) Monthly Precipitation and Deviations from Normal (UKWAC)



Eastern Region (CD4) Monthly Temperatures and Deviations from Normal (UKWAC)



Eastern Region (CD4) Monthly Precipitation and Deviations from Normal (UKWAC)



2018 Cable Barrier Bareground Trial in Louisville

Introduction

Median cable barriers are designed to protect drivers from crossover accidents on interstates and highways. However, the vegetation under and adjacent to them must be managed for safety and aesthetics. Usually, this means using herbicides to maintain a vegetation free (bare ground) zone underneath the barriers. Broad-spectrum soil applied preemergence residual herbicides, in combination with a broad-spectrum post emergence herbicide like glyphosate, are the mainstay for maintaining these bare ground zones. However, there may be turf adjacent to the bare ground zone that should be maintained. Ideally, the residual herbicides will last all season long and not move off-site by leaching or erosion (movement of soil particles with adsorbed herbicide).

This trial was part of an ongoing effort to evaluate the vegetation control efficacy and desirable turf damage potential of a range of herbicide options when used for vegetation management under cable barriers.

Materials and Methods

The trial was established under and beside cable barrier with a mixed species turf underneath in the median of I-265 in Louisville, KY. The 18 treatments and 3 replications were arranged in a randomized complete block design. Treatments were applied at 25 gallons per acre onto 6.5 ft wide by 20 ft long plots on May 23, 2018. All herbicide treatments, except Roundup ProMax alone (Treatment 1) included Activator 90 at 0.25% v/v (Table 1a and 1b). Roundup ProMax (glyphosate) has no residual activity so other herbicides were included in the combinations with it to provide residual and pre-emergent control for the bare ground treatments. Different combinations also broadened the weed spectrum controlled and reduced the risk of developing problems with resistant weeds by using different Mechanisms of Action (MOA) groups (Table 1a and 1b). The trial included treatments which have been long term “standards” as well as newer products and combinations currently being used in KY. New treatments this year included one using Detail (saflufenacil) (Treatment 16) and one without glyphosate but controlling broadleaf weeds and suppressing grass growth behind guardrails (Treatment 17). Detail may be useful in areas with sensitive crops nearby as it is less persistent than other herbicides. It should be noted that the label calls for the use of MSO for accelerated burndown at 2 fl oz/ac in combination with glyphosate and Treatment 16 only used a NIS. The label also recommends the 6 fl oz/ac rate for residual control. This treatment combination will be included in next year’s trial.

The Louisville weather station reported 0.53 inches of rain over May 27 and 28 which would have activated the soil applied preemergence herbicide treatments. Additional rainfall was recorded from May 29 to June 1 (1.75 inches). These rainfall events may have contributed to the movement of some of the herbicides from where they were applied and damaged adjacent turf (Figures 1 to 5). Species present at application included flowering Buckhorn plantain (7 inch canopy), flowering tall fescue (24 inches to seedhead) plus Kentucky bluegrass which had mature seed heads (20 inches to seedhead).

Ratings of the proportion (%) of bare ground were taken 41 (7/3/2018) days after treatment (DAT) along with a rating of the extent of turf damage beyond the initial spray pattern, ranging from 0 (none) to 3 (severe). Visual assessments of the proportion (%) of bare ground, perennial grasses, annual grasses, and broadleaf weeds were taken 72 (8/3/2018), 119 (9/19/2018), and 153 (10/23/2017) DAT. The last rating was done after a hard freeze and many of the annual broadleaf plants, such as spurge, were killed. Data were analyzed using ARM software and treatment means were compared using Fisher's LSD at $p = 0.05$.

Results and Discussion

All the treatments with glyphosate (Treatments 1 to 16) had more bareground (35 to 100%) than those that did not (Treatments 15 and 16) (3 to 12%) 41 DAT (Tables 2a and 2b). Most of the treatments with soil active herbicides were in the top grouping (Treatments 2 to 14) (83 to 100%) except for Treatments 15 and 16 (35 to 75%). A number of treatments had turf damage consistent with movement of herbicides beyond the initial spray pattern (Tables 2a and 2b). Treatments with similar damage ratings included Sahara (Treatment 2), Hyvar (Treatment 3), Oust XP (Treatments 4 and 9), Perspective + Proclipse (Treatment 6), Streamline + Esplanade + Plateau (Treatment 10), and two treatments with imazapyr (Treatments 7and 8) (Tables 2a and 2b).

While most of the trial site had a mix of tall fescue and Kentucky bluegrass there were areas with fine fescues and bermudagrass. Their non-uniform distribution increased the plot by plot variability with some treatments. By 72 DAT some treatments had less bareground as perennial grasses recovered and annual grasses (mostly yellow foxtail) and broadleaves (mostly prostrate spurge) colonized the space (Tables 3a and 3b). Treatments in the top group for bareground (70 to 98%) included Sahara (Treatment 2), Hyvar (Treatment 3), Perspective + Proclipse (Treatment 6), Viewpoint + Esplanade (Treatment 7), AC Polaris Complete (Treatment 8), Esplanade + Oust (Treatment 9), Streamline + Esplanade + Plateau (Treatment 10), Method + Esplanade (Treatment 13) and Milestone + Esplanade (Treatment 14). Treatments with little or no soil residual herbicides were not different from control (2 to 13%) and included Roundup ProMax by itself (Treatment 1), Detail (Treatment 16), and Method + Plateau (Treatment 17). This last treatment did not have glyphosate applied and had the greatest perennial grass cover.

Later in the season more treatments have greater annual grass and broadleaf cover. 119 DAT treatments in the top group with high % bareground (58 to 85%) included Hyvar (Treatment 3), Viewpoint + Esplanade (Treatment 7), Oust + Esplanade (Treatment 9), Streamline + Esplanade + Plateau (Treatment 10), Method + Esplanade (Treatment 13), and Milestone + Esplanade (Treatment 14) (Tables 4a and 4b). Most the other treatments were not different from control (0 to 33%) except for Esplanade + Oust Extra (Treatment 15) (42%). Control plots were dominated by annual teff grass (90% cover). Detail (Treatment 16) had removed most of the perennial grass and had the most yellow foxtail cover (43%) in the trial. The Cleantraxx treatments (11 and 12) did not have as much foxtail but did have the most prostrate spurge cover (69 to 72%) in the trial.

The last assessment, 153 DAT, was done after a hard freeze and many of the annuals were killed. The treatments with the greatest amount of bareground (60 to 88%) were the same as at the

previous rating with the addition of the Cleantraxx treatments (11 and 12) after the death of much of the spurge cover (Tables 5a and 5b).

The vegetation under the cable barrier in this location gave a good test of how well some of these bare ground herbicides can perform over a season and into the next year. The plots will be assessed in spring 2019. These trials will continue to provide information for roadside managers.

Table 1a. Herbicide Treatments, Active Ingredients, Application Rates, and Mechanism of Action (MOA) Groups for Cable Barrier Bareground Trial. (Part 1 of 2)

Trt. No.	Product Name	Rate	Rate Unit	Active Ingredient(s)	ai Rate (per acre)	MOA Groups
1	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB AE	9
2	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB AE	9
	Sahara	10	LB/A	diuron + imazapyr	6.2 LB + 12.4 OZ	7 + 2
3	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB AE	9
	Hyvar	10	LB/A	bromacil	8 LB	5
4	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB AE	9
	Oust XP	3	OZ/A	sulfometuron	2.3 OZ	2
5	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB AE	9
	Perspective	9	OZ/A	aminocyclopyrachlor + chlorsulfuron	3.6 OZ + 1.4 OZ	4 + 2
	Esplanade	3.5	FL OZ/A	indaziflam	0.7 OZ	29
6	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB AE	9
	Perspective	9	OZ/A	aminocyclopyrachlor + chlorsulfuron	3.6 OZ + 1.4 OZ	4 + 2
	Proclipse	2.3	LB/A	prodiamine	1.5 LB	3
7	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB AE	9
	Viewpoint	18	OZ/A	aminocyclopyrachlor + imazapyr + metsulfuron	4.1 OZ + 5.7 OZ + 1.3 OZ	4 + 2 + 2
	Esplanade	3.5	FL OZ/A	indaziflam	0.7 OZ	29
8	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB AE	9
	Polaris AC Complete	2	PT/A	imazapyr	16 OZ AE	2
9	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB AE	9
	Esplanade	3.5	FL OZ/A	indaziflam	0.7 OZ	29
	Oust XP	3	OZ/A	sulfometuron	2.3 OZ	2
10	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB AE	9
	Streamline	8	OZ/A	aminocyclopyrachlor + metsulfuron	3.2 OZ + 1 OZ	4 + 2
	Esplanade	5	FL OZ/A	indaziflam	1 OZ	29
	Plateau	5	FL OZ/A	imazapic	1.3 OZ AE	2
11	Rodeo	1.5	QT/A	glyphosate	1.5 LB AE	9
	Cleantraxx	3	PT/A	penoxsulam + oxyfluorfen	0.5 OZ + 23.6 OZ	2 + 14
	Milestone VM	7	FL OZ/A	aminopyralid	1.8 OZ AE	4
12	Rodeo	1.5	QT/A	glyphosate	1.5 LB AE	9
	Cleantraxx	4.5	PT/A	penoxsulam + oxyfluorfen	0.7 OZ + 35.4 OZ	2 + 14

All herbicide treatments (except trt. #1) contained the adjuvant, Activator 90 at 0.25% v/v.

Table 1b. Herbicide Treatments, Active Ingredients, Application Rates, and Mechanism of Action (MOA) Groups for Cable Barrier Bareground Trial (Part 2 of 2)

Trt. No.	Product Name	Rate	Rate Unit	Active Ingredient(s)	ai Rate (per acre)	MOA Groups
13	Rodeo	1.5	QT/A	glyphosate	1.5 LB AE	9
	Method	12	FL OZ/A	aminocyclopyrachlor	3 OZ AE	4
	Esplanade	5	FL OZ/A	indaziflam	1 OZ	29
14	Rodeo	1.5	QT/A	glyphosate	1.5 LB AE	9
	Esplanade	6	FL OZ/A	indaziflam	1.3 OZ	29
	Milestone VM	7	FL OZ/A	aminopyralid	1.8 OZ AE	4
15	Rodeo	1.5	QT/A	glyphosate	1.5 LB AE	9
	Esplanade	3.5	FL OZ/A	indaziflam	0.7 OZ	29
	Oust Extra	1.5	OZ/A	sulfometuron + metsulfuron	0.8 OZ + 0.2 OZ	2 + 2
16	Rodeo	1.5	QT/A	glyphosate	1.5 LB AE	9
	Detail	2	FL OZ/A	saflufenacil	0.7 OZ	14
17	Method	12	FL OZ/A	aminocyclopyrachlor	3 OZ AE	4
	Plateau	3	FL OZ/A	imazapic	0.75 OZ AE	2
18	Nontreated Check					

All herbicide treatments (except trt. #1) contained the adjuvant, Activator 90 at 0.25% v/v.

Table 2a. Results for Cable Barrier Trial 41 DAT[1] (July 3, 2018) (Part 1 of 2)

				% Bareground	Turf Damage (0-3)[3]
Trt. No.	**Product Name**	**Rate**	**ate Unit**	**41 DAT**	
1	Roundup ProMax	1.3	QT/A	70 c[2]	0.0 c
2	Roundup ProMax Sahara	1.3 10	QT/A LB/A	100 a	1.3 ab
3	Roundup ProMax Hyvar	1.3 10	QT/A LB/A	100 a	1.3 ab
4	Roundup ProMax Oust XP	1.3 3	QT/A OZ/A	83 abc	1.0 abc
5	Roundup ProMax Perspective Esplanade	1.3 9 3.5	QT/A OZ/A FL OZ/A	79 abc	0.3 bc
6	Roundup ProMax Perspective Proclipse	1.3 9 2.3	QT/A OZ/A LB/A	94 ab	0.7 abc
7	Roundup ProMax Viewpoint Esplanade	1.3 18 3.5	QT/A OZ/A FL OZ/A	98 a	1.0 abc
8	Roundup ProMax Polaris AC Complete	1.3 2	QT/A PT/A	98 a	1.7 a
9	Roundup ProMax Esplanade Oust XP	1.3 3.5 3	QT/A FL OZ/A OZ/A	99 a	1.7 a
10	Roundup ProMax Streamline Esplanade Plateau	1.3 8 5 5	QT/A OZ/A FL OZ/A FL OZ/A	83 abc	0.7 abc
11	Rodeo Cleantraxx Milestone VM	1.5 3 7	QT/A PT/A FL OZ/A	97 a	0.0 c
12	Rodeo Cleantraxx	1.5 4.5	QT/A PT/A	98 a	0.0 c

All herbicide treatments (except trt. #1) contained the adjuvant, Activator 90 at 0.25% v/v.

[1] DAT = Days after treatment [2] Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.

[3] Turf damage ranged from 0 (none) to 3 (severe)

Table 2b. Results for Cable Barrier Trial 41 DAT[1] (July 3, 2018) (Part 2 of 2)

				% Bareground	Turf Damage (0-3)[3]
Trt. No.	**Product Name**	**Rate**	**Rate Unit**	**41 DAT**	
13	Rodeo	1.5	QT/A	91 ab[2]	0.3 bc
	Method	12	FL OZ/A		
	Esplanade	5	FL OZ/A		
14	Rodeo	1.5	QT/A	87 abc	0.0 c
	Esplanade	6	FL OZ/A		
	Milestone VM	7	FL OZ/A		
15	Rodeo	1.5	QT/A	75 bc	0.3 bc
	Esplanade	3.5	FL OZ/A		
	Oust Extra	1.5	OZ/A		
16	Rodeo	1.5	QT/A	35 d	0.0 c
	Detail	2	FL OZ/A		
17	Method	12	FL OZ/A	12 e	0.0 c
	Plateau	3	FL OZ/A		
18	Nontreated Check			3 e	0.0 c

All herbicide treatments (except trt. #1) contained the adjuvant, Activator 90 at 0.25% v/v.

[1] DAT = Days after treatment

[2] Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.

[3] Turf damage ranged from 0 (none) to 3 (severe)

Table 3a. Results for Cable Barrier Trial 72 DAT[1] (August 3, 2018) (Part 1 of 2)

				% Bareground	% Annual Grass	% Perennial Grass	% Broadleaves	% Spurge
Trt. No.	**Product Name**	**Rate**	**Rate Unit**	**72 DAT**				
1	Roundup ProMax	1.3	QT/A	12 ef[2]	22 c	0 d	65 a	63 a
2	Roundup ProMax Sahara	1.3 10	QT/A LB/A	97 a	1 d	0 d	2 fg	2 f
3	Roundup ProMax Hyvar	1.3 10	QT/A LB/A	98 a	0 d	0 d	1 g	1 f
4	Roundup ProMax Oust XP	1.3 3	QT/A OZ/A	53 bcd	6 d	35 bc	6 fg	5 f
5	Roundup ProMax Perspective Esplanade	1.3 9 3.5	QT/A OZ/A FL OZ/A	49 cd	5 d	45 ab	1 fg	1 f
6	Roundup ProMax Perspective Proclipse	1.3 9 2.3	QT/A OZ/A LB/A	75 abc	7 d	12 cd	6 fg	6 f
7	Roundup ProMax Viewpoint Esplanade	1.3 18 3.5	QT/A OZ/A FL OZ/A	96 a	2 d	0 d	2 fg	2 f
8	Roundup ProMax Polaris AC Complete	1.3 2	QT/A PT/A	70 abc	4 d	0 d	26 de	24 de
9	Roundup ProMax Esplanade Oust XP	1.3 3.5 3	QT/A FL OZ/A OZ/A	93 a	2 d	0 d	5 fg	1 f
10	Roundup ProMax Streamline Esplanade Plateau	1.3 8 5 5	QT/A OZ/A FL OZ/A FL OZ/A	70 abc	2 d	26 bcd	2 fg	2 f
11	Rodeo Cleantraxx Milestone VM	1.5 3 7	QT/A PT/A FL OZ/A	33 de	7 d	0 d	60 ab	60 ab
12	Rodeo Cleantraxx	1.5 4.5	QT/A PT/A	55 bcd	5 d	0 d	40 cd	38 cd

All herbicide treatments (except trt. #1) contained the adjuvant, Activator 90 at 0.25% v/v.

[1] DAT = Days after treatment

[2] Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.

Table 3b. Results for Cable Barrier Trial 72 DAT[1] (August 3, 2018) (Part 2 of 2)

				% Bareground	% Annual Grass	% Perennial Grass	% Broadleaves	% Spurge
Trt. No.	**Product Name**	**Rate**	**Rate Unit**	**72 DAT**				
13	Rodeo Method Esplanade	1.5 12 5	QT/A FL OZ/A FL OZ/A	83 ab[2]	3 d	11 cd	3 fg	3 f
14	Rodeo Esplanade Milestone VM	1.5 6 7	QT/A FL OZ/A FL OZ/A	72 abc	4 d	11 cd	12 efg	12 ef
15	Rodeo Esplanade Oust Extra	1.5 3.5 1.5	QT/A FL OZ/A OZ/A	53 bcd	2 d	35 bc	10 fg	5 f
16	Rodeo Detail	1.5 2	QT/A FL OZ/A	8 ef	37 b	8 cd	47 bc	47 bc
17	Method Plateau	12 3	FL OZ/A FL OZ/A	13 ef	7 d	71 a	9 fg	6 f
18	Nontreated Check			2 f	60 a	23 bcd	17 ef	10 ef

All herbicide treatments (except trt. #1) contained the adjuvant, Activator 90 at 0.25% v/v.

[1] *DAT = Days after treatment*

[2] *Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.*

Table 4a. Results for Cable Barrier Trial 119 DAT[1] (September 19, 2018) (Part 1 of 2)

				% Bareground	% Annual Grass	% Yellow Foxtail	% Perennial Grass	% Broadleaves	% Spurge
Trt. No.	**Product Name**	**Rate**	**Rate Unit**	**119 DAT**					
1	Roundup ProMax	1.3	QT/A	5 e[2]	35 c	25 b	0 d	60 ab	28 bcdef
2	Roundup ProMax Sahara	1.3 10	QT/A LB/A	33 bcde	12 def	8 cde	0 d	55 abc	33 bc
3	Roundup ProMax Hyvar	1.3 10	QT/A LB/A	60 abc	6 f	2 de	3 d	30 cde	29 bcde
4	Roundup ProMax Oust XP	1.3 3	QT/A OZ/A	22 de	28 cd	22 bc	37 abcd	13 def	9 cdefg
5	Roundup ProMax Perspective Esplanade	1.3 9 3.5	QT/A OZ/A FL OZ/A	30 cde	12 def	12 bcde	57 ab	2 f	1 g
6	Roundup ProMax Perspective Proclipse	1.3 9 2.3	QT/A OZ/A LB/A	30 cde	25 cde	17 bcde	23 bcd	22 def	22 bcdefg
7	Roundup ProMax Viewpoint Esplanade	1.3 18 3.5	QT/A OZ/A FL OZ/A	85 a	6 f	6 cde	2 d	7 def	7 cdefg
8	Roundup ProMax Polaris AC Complete	1.3 2	QT/A PT/A	20 de	20 cdef	13 bcde	0 d	60 ab	40 b
9	Roundup ProMax Esplanade Oust XP	1.3 3.5 3	QT/A FL OZ/A OZ/A	83 a	7 f	7 cde	0 d	9 def	1 g
10	Roundup ProMax Streamline Esplanade Plateau	1.3 8 5 5	QT/A OZ/A FL OZ/A FL OZ/A	58 abc	6 f	4 de	33 abcd	3 ef	3 efg
11	Rodeo Cleantraxx Milestone VM	1.5 3 7	QT/A PT/A FL OZ/A	9 de	12 def	10 bcde	0 d	78 a	72 a
12	Rodeo Cleantraxx	1.5 4.5	QT/A PT/A	18 de	10 ef	8 cde	0 d	72 a	69 a

All herbicide treatments (except trt. #1) contained the adjuvant, Activator 90 at 0.25% v/v.

[1] *DAT = Days after treatment*

[2] *Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.*

Table 4b. Results for Cable Barrier Trial 119 DAT[1] (September 19, 2018) (Part 2 of 2)

Trt. No.	Product Name	Rate	Rate Unit	% Bareground	% Annual Grass	% Yellow Foxtail	% Perennial Grass	% Broadleaves	% Spurge
				119 DAT					
13	Rodeo Method Esplanade	1.5 12 5	QT/A FL OZ/A FL OZ/A	82 a[2]	5 f	2 e	12 cd	2 f	1 g
14	Rodeo Esplanade Milestone VM	1.5 6 7	QT/A FL OZ/A FL OZ/A	67 ab	3 f	1 e	6 cd	24 def	24 bcdefg
15	Rodeo Esplanade Oust Extra	1.5 3.5 1.5	QT/A FL OZ/A OZ/A	42 bcd	6 f	6 cde	43 abc	11 def	2 fg
16	Rodeo Detail	1.5 2	QT/A FL OZ/A	5 e	53 b	43 a	8 cd	33 bcd	32 bcd
17	Method Plateau	12 3	FL OZ/A FL OZ/A	3 e	20 cdef	8 cde	70 a	7 def	6 defg
18	Nontreated Check			0 e	90 a	18 bcd	3 d	7 def	7 cdefg

All herbicide treatments (except trt. #1) contained the adjuvant, Activator 90 at 0.25% v/v.

[1] DAT = Days after treatment

[2] Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.

Table 5a. Results for Cable Barrier Trial 153 DAT[1] (October 23, 2018) (Part 1 of 2)

				% Bareground	% Annual Grass	% Perennial Grass	% Broadleaves
Trt. No.	**Product Name**	**Rate**	**Rate Unit**	**153 DAT**			
1	Roundup ProMax	1.3	QT/A	38 bcde[2]	50 b	0 d	12 cd
2	Roundup ProMax Sahara	1.3 10	QT/A LB/A	38 bcde	12 cd	0 d	50 ab
3	Roundup ProMax Hyvar	1.3 10	QT/A LB/A	63 ab	8 cd	7 d	22 bcd
4	Roundup ProMax Oust XP	1.3 3	QT/A OZ/A	18 def	8 cd	52 ab	22 bcd
5	Roundup ProMax Perspective Esplanade	1.3 9 3.5	QT/A OZ/A FL OZ/A	28 bcdef	7 cd	58 ab	3 d
6	Roundup ProMax Perspective Proclipse	1.3 9 2.3	QT/A OZ/A LB/A	35 bcdef	17 cd	28 bcd	20 cd
7	Roundup ProMax Viewpoint Esplanade	1.3 18 3.5	QT/A OZ/A FL OZ/A	83 a	8 cd	5 d	3 d
8	Roundup ProMax Polaris AC Complete	1.3 2	QT/A PT/A	22 cdef	24 c	0 d	54 a
9	Roundup ProMax Esplanade Oust XP	1.3 3.5 3	QT/A FL OZ/A OZ/A	83 a	7 cd	1 d	9 cd
10	Roundup ProMax Streamline Esplanade Plateau	1.3 8 5 5	QT/A OZ/A FL OZ/A FL OZ/A	58 abc	6 cd	33 bcd	2 d
11	Rodeo Cleantraxx Milestone VM	1.5 3 7	QT/A PT/A FL OZ/A	82 a	4 cd	2 d	12 cd
12	Rodeo Cleantraxx	1.5 4.5	QT/A PT/A	60 ab	3 d	1 d	37 abc

All herbicide treatments (except trt. #1) contained the adjuvant, Activator 90 at 0.25% v/v.

[1] DAT = Days after treatment

[2] Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.

Table 5b. Results for Cable Barrier Trial 153 DAT[1] (October 23, 2018) (Part 2 of 2)

				% Bareground	% Annual Grass	% Perennial Grass	% Broadleaves
Trt. No.	**Product Name**	**Rate**	**Rate Unit**	**153 DAT**			
13	Rodeo Method Esplanade	1.5 12 5	QT/A FL OZ/A FL OZ/A	85 a[2]	3 d	10 cd	2 d
14	Rodeo Esplanade Milestone VM	1.5 6 7	QT/A FL OZ/A FL OZ/A	85 a	5 cd	10 cd	0 d
15	Rodeo Esplanade Oust Extra	1.5 3.5 1.5	QT/A FL OZ/A OZ/A	40 bcd	3 d	51 abc	6 d
16	Rodeo Detail	1.5 2	QT/A FL OZ/A	15 def	52 b	22 bcd	12 cd
17	Method Plateau	12 3	FL OZ/A FL OZ/A	2 ef	13 cd	84 a	1 d
18	Nontreated Check			0 f	88 a	2 d	10 cd

All herbicide treatments (except trt. #1) contained the adjuvant, Activator 90 at 0.25% v/v.

[1] DAT = Days after treatment

[2] Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.

Figure 1: View of Plots in the Cable Barrier Trial on July 3, 2018 (41 Days After Treatment)
Note evidence of movement of some of the herbicides from where they were applied with damage to adjacent turf. The white line indicates the initial spray pattern. Treatment 1 (only Roundup ProMax) is the treatment at the bottom of the photo.

Figure 2: View of Treatment 1 plot in the Cable Barrier Trial on July 3, 2018 (41 Days After Treatment)
Only Roundup ProMax was sprayed for this treatment and one can see the extent of the spray pattern.

Figure 3: View of Treatment 2 and 1 plots the Cable Barrier Trial on July 3, 2018 (41 Days After Treatment)
Treatment 2 (Roundup ProMax + Sahara) was sprayed on the plot in the foreground. Note the turf damage beyond the initial spray pattern as seen on the plot closer to the truck which only had Roundup ProMax applied.

Figure 4: View of Treatment 3, 2, and 1 Plots in the Cable Barrier Trial on July 3, 2018 (41 Days After Treatment)

Treatment 3 (Roundup ProMax + Hyvar) was sprayed on the plot in the foreground. The extent of the damage appears to be greater than the Treatment 2 plot. Note the turf damage beyond the initial spray pattern as seen on the plot closest to the truck, which only had Roundup ProMax applied.

Figure 5: View of Treatment 4, 3, 2, and 1 Plots in the Cable Barrier Trial on July 3, 2018 (41 Days After Treatment)

Treatment 4 (Roundup ProMax + Oust) was sprayed on the plot in the foreground. Note the turf damage beyond the initial spray pattern as seen on the plot closest to the truck, which only had Roundup ProMax applied.

2017 PGR Options for Tall Fescue Management (2018 Assessments)

Tall fescue is a widely adapted species and is a common roadside and other unimproved turf cool-season grass. Frequent mowing is the most common management regime for departments of transportation. Plant Growth Regulators (PGRs) are potential tools to reduce turf growth and aid in keeping our roadways safe for travelers. PGRs are currently classified into six categories, Classes A – F, based on their mechanism of action. This trial includes examples of Class A, C, and D PGRs and was established to evaluate some PGR options for roadside management. Class A are late GA synthesis blockers, Class C are mitotic/cell division inhibitors, and Class D are herbicidal. Seedhead suppression is an effective means to reduce mowing for the first cycle. PGRs for this are normally applied in the early spring. This trial was established to evaluate some PGR options for roadside management. Fall application of PGRs may also have a benefit with seedhead suppression the following spring.

Materials and Methods

A trial was established in 2017 at Spindletop Research Farm in Lexington KY arranged as a complete block design with 21 PGR treatments and three replications. Plots were 7 ft by 20 ft with running unsprayed checks (3 ft wide) between each of the plots. The treatments were five PGRs applied before the first mowing and one to two weeks after each of the three mowings plus control. Products tested were Embark 2S (mefluidide) [Class C], Plateau (imazapic) [Class D], Opensight (aminopyralid + metsulfuron methyl) [Class D], Anuew (prohexadione calcium) [Class A], and Perspective (aminocyclopyrachlor + clorsulfuron) [Class D] (Table 1). All applications were at 25 gallons per acre and included a non-ionic surfactant at 0.25% v/v. Application dates were 4/26/2017, 6/1/2017, 8/8/2017, and 10/6/2017. Mowing dates were 5/22/2017, 7/26/2017, and 9/26/2017.

Plots from the fourth application date were assessed for seedhead density, seedhead height, and foliage canopy height in 2018; 220 (5/14/2018), 235 (5/29/2018), and 255 (6/18/2018) days after that application (DAT4). Data were analyzed using ARM software and treatment means were compared using Fisher's LSD at $p = 0.05$.

Results and Discussion

The spring after fall applications of these PGRs most treatments had reductions in seedhead heights but only Embark, Plateau, and Perspective had lower seedhead densities than control at the first assessment date (5/14/2018) 220 DAT4 (Table 2). At the next two assessments (235 and 255 DAT4) the Embark (Class C) and Plateau (Class D) treatments had the lowest heading density (13 to 21%) while the other Class D treatments (Opensight and Perspective) had less seedhead suppression (63 to 87% seedhead density). Anuew (Class A) had no effect on heading at these assessments.

The Embark and Plateau treatments may have reduced tall fescue heading enough to delay the first mowing but other grass species on the roadside may not have been affected equally by the PGR treatments. In a previous trial by our group (Omielan and Witt, 2012) fall application of a higher rate of Plateau (4 fl oz/ac) + 2,4-D as a safener had similar reductions in tall fescue

seedheads. The most consistent seedhead suppression was with spring application but fall applications may have the "benefit" of seedhead suppression perhaps as a result of fall herbicide applications to control biennial weeds at the fall rosette stage. With Class D PGRs they may be applied primarily for growth regulation or primarily for weed control, depending on the desired management outcome(s).

Literature Cited:

Omielan, J and Witt, W. 2011/2012 Fall Spring Tall Fescue Seedhead Suppression Trial (IVM 2012 Annual Research Report)

Table 1. Herbicide Treatments, Active Ingredients and Application Rates.

Product (s)	Rate (per Acre)	Active Ingredient(s)	ai Rate (per Acre)
Embark 2S	24 fl oz	mefluidide	6 oz ae
Plateau	2 fl oz	imazapic	0.5 oz ae
Opensight	2.5 oz	aminopyralid + metsulfuron methyl	1.3 oz ae + 0.24 oz
Anuew	1 lb	prohexadione calcium	4.4 oz
Perspective	4.75 oz	aminocyclopyrachlor + chlorsulfuron	1.9 oz + 0.75 oz
Unsprayed Control			

All herbicide treatments contained the adjuvant, Activator 90 at 0.25% v/v.

Table 2. Herbicide Treatments, Heading Density, Seedhead Height, and Canopy Height after Fourth PGR Application the Following Spring

Product (s)	Rate (per Acre)	Timing	May 14, 2018		May 29, 2018		June 18, 2018		
			Heading	Ht (in)	Heading	Ht (in)	Heading	Ht (in)	Canopy (in)
			(220 DAT4[1])		(235 DAT4)		(255 DAT4)		
Embark 2S	24 fl oz	after third mowing	23 c[2]	23 b	21 d	41	15 c	41 b	13 ab
Plateau	2 fl oz	after third mowing	10 d	21 b	20 d	41	13 c	41 b	13 ab
Opensight	2.5 oz	after third mowing	80 ab	26 ab	87 b	42	70 b	41 b	14 a
Anuew	1 lb	after third mowing	85 ab	23 b	100 a	42	100 a	41 b	13 ab
Perspective	4.75 oz	after third mowing	75 b	23 b	63 c	41	72 b	41 b	12 b
Unsprayed Control			90 a	29 a	100 a	41	100 a	44 a	14 a

[1] DAT4 = Days after treatment after third mowing

[2] Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.

2018 PGR Options for Tall Fescue Management

Tall fescue is a widely adapted species and is a common roadside and other unimproved turf cool-season grass. Frequent mowing is the most common management regime for departments of transportation. Plant Growth Regulators (PGRs) are potential tools to reduce turf growth and aid in keeping our roadways safe for travelers. PGRs are currently classified into six categories, Classes A – F, based on their mechanism of action. This trial includes examples of Class A, C, and D PGRs and was established to evaluate some PGR options for roadside management. Class A are late GA synthesis blockers, Class C are mitotic/cell division inhibitors, and Class D are herbicidal. Seedhead suppression is an effective means to reduce mowing for the first cycle. PGRs for this are normally applied in the early spring. This trial was established to evaluate some PGR options for roadside management.

Materials and Methods

A trial was established in 2018 at Spindletop Research Farm in Lexington KY arranged as a complete block design with 21 PGR treatments and three replications. Plots were 7 ft by 20 ft with running unsprayed checks (3 ft wide) between each of the plots. The treatments were five PGRs applied before the first mowing and one to two weeks after each of the three mowings plus control. Products tested were Embark 2S (mefluidide) [Class C]), Plateau (imazapic) [Class D], Opensight (aminopyralid + metsulfuron methyl) [Class D], Anuew (prohexadione calcium) [Class A], and Perspective (aminocyclopyrachlor + clorsulfuron) [Class D] (Table 1). All applications were at 25 gallons per acre and included a non-ionic surfactant at 0.25% v/v. . Application dates were 4/29/2018, 6/14/2018, 8/24/2018, and 10/19/2018 for the 2018 trial. Mowing dates were 5/29/2018, 8/10/2018, and 10/11/2018.

Tall fescue color was assessed every two weeks by comparison to the running check strips. The color rating ranges from 0 (dead) to 9 (full green). The color of the check strips was set at 8. Heading (%) was assessed before the first mowing. Canopy heights were measured every two weeks as well. Data were analyzed using ARM software and treatment means were compared using Fisher's LSD at $p = 0.05$.

Results and Discussion

After the first PGR application all treatments had fescue shorter than control 15 days after treatment (DAT1) and lower heading density (Table 2). At this assessment only Anuew was no less green than control. By 30 DAT1 all treatments were still shorter than control and while all the treatments had lower heading (%) (1-57%) (Figure 1), Plateau had almost no seedheads (Table 2). There would likely not have been any more seedheads emerging based on previous trials (Omielan and Witt, 2012) and the Plateau treatment would have saved at least one mowing. Anuew was the only treatment with the same green color as control. After mowing, all the treatments except Plateau had the same green color at 46 DAT1. Plateau was more green than control. Figure 2 summarizes what happened, as regards green color, to these treated plots over the course of the season. There were no effects on color beyond 46 DAT1. Figure 3 summarizes the effects on turf height over the course of the season. There were no consistent treatment effects beyond 30 DAT1.

After the first mowing and the second application all the PGR treatments had less green color 16 DAT2 as well as shorter turf with the Class D PGR treatments (Plateau, Opensight, and Perspective) (Table 3). The Embark, Plateau, and Perspective treatments had less green color 31 DAT2 but color had recovered in all treatments in subsequent evaluations. All treatments had shorter turf 31 DAT2 while only Plateau, Anuew, and Perspective were shorter 49 DAT2. By the time of the second mowing 57 DAT2 there were no differences in height. Figure 4 summarizes the effects on color with these plots and the effects did not extend beyond 31 DAT2. Figure 5 summarizes the treatment effects on fescue height. Most treatments, except for Embark, reduced turf height beyond the second mowing (Table 4 and Figure 5). Plateau only had shorter turf until 86 DAT2 while Opensight, Anuew, and Perspective had consistently shorter turf until 99 DAT2.

After the second mowing and the third PGR application, all the treatments except Anuew had lower green color 15 DAT3 and all treatments except Embark had lower fescue height (Table 4). Anuew did not have lower green color ratings while the other treatments did 28 DAT3. All the treatments had shorter turf at this assessment. Color recovered with Plateau and Anuew but was still less green for the other treatments 44 DAT3. Turf height was shorter for all the treatments except for Plateau and Opensight at that assessment date. After mowing there were no further treatment effects on color or height (Table 4) (Figures 6 and 7).

After the third mowing and the fourth PGR application, the Plateau, Opensight, and Persepctive treatments had less green color at 11 and 30 DAT4 (Table 5) (Figure 8). Plateau and Perspective consistently reduced turf height at both assessments while Anuew did at 11 DAT4 and Opensight did 30 DAT4 (Figure 9).

The effects of the PGR treatments in most cases did not extend beyond the next mowing this year. All the PGR treatments reduced seedhead density and height after the first application timing with the greatest reduction with Plateau. In general, many of the treatments reduced grass height along with turf color but color recovered. Anuew had less effect on color than the other treatments at most of the ratings.

The differences in rainfall between 2017 (see 2017 Research Report) and 2018 should help put the results and responses in perspective. Lexington had a record amount of precipitation in the 2018 calendar year. Other areas of the state had near “normal” rainfall. In 2017 total precipitation was 10% above “normal” (30 year average) for the whole year but 6.4 inches or 23% above normal for the growing season (April to October). In 2018 total precipitation was 62% above normal for the whole year and 15.9 inches or 58% above normal for the growing season. We need to take this into consideration when using this information in making management decisions.

We also had an earlier killing freeze than in 2017. Plots that were treated late in the season (October 19) will be evaluated in 2019 for spring seedhead suppression.

Literature Cited:

Omielan, J and Witt, W. 2011/2012 Fall Spring Tall Fescue Seedhead Suppression Trial (IVM 2012 Annual Research Report)

Table 1. Herbicide Treatments, Active Ingredients and Application Rates.

Product (s)	Rate (per Acre)	Active Ingredient(s)	ai Rate (per Acre)
Embark 2S	24 fl oz	mefluidide	6 oz ae
Plateau	2 fl oz	imazapic	0.5 oz ae
Opensight	2.5 oz	aminopyralid + metsulfuron methyl	1.3 oz ae + 0.24 oz
Anuew	1 lb	prohexadione calcium	4.4 oz
Perspective	4.75 oz	aminocyclopyrachlor + chlorsulfuron	1.9 oz + 0.75 oz
Unsprayed Control			

All herbicide treatments contained the adjuvant, Activator 90 at 0.25% v/v.

Table 2. Herbicide Treatments, Turf Color, Fescue Heights and % Heading after First PGR Application

Product (s)	Rate (per Acre)	Timing	May 14, 2018			May 29, 2018			June 14, 2018	
			Color (0-9)	Ht (in)	Heading (%)	Color (0-9)	Ht (in)	Heading (%)	Color (0-9)	Ht (in)
			15 DAT1[1]			30 DAT1			46 DAT1	
Embark 2S	24 fl oz	before first mowing	6.5 bc[2]	14 b	8 bc	6.8 b	17 c	28 c	8.0 b	12
		after first mowing								
		after second mowing								
		after third mowing								
Plateau	2 fl oz	before first mowing	5.5 cd	11 b	2 c	5.7 c	11 d	0.3 d	8.1 a	12
		after first mowing								
		after second mowing								
		after third mowing								
Opensight	2.5 oz	before first mowing	4.0 e	10 b	2 c	6.7 b	14 cd	25 cd	8.0 b	12
		after first mowing								
		after second mowing								
		after third mowing								
Anuew	1 lb	before first mowing	7.2 ab	14 b	17 b	8.0 a	35 b	57 b	8.0 b	13
		after first mowing								
		after second mowing								
		after third mowing								
Perspective	4.75 oz	before first mowing	5.2 d	10 b	0 c	6.0 c	17 b	13 cd	8.0 b	12
		after first mowing								
		after second mowing								
		after third mowing								
Unsprayed Control			8.0 a	26 a	77 a	8.0 a	44 a	100 a	8.0 b	12

[1] DAT1 = Days after treatment before first mowing

[2] Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.

Table 3. Herbicide Treatments, Turf Color, and Fescue Heights after Second PGR Application

Product (s)	Rate (per Acre)	Timing	June 30, 2018		July 15, 2018		Aug 2, 2018		Aug 10, 2018		Aug 24, 2018	
			Color (0-9)	Ht (in)	Color (0-9)	Ht (in)	Color (0-9)	Ht (in)	Color (0-9)	Ht (in)	Color (0-9)	Ht (in)
			62 DAT1[1] (16 DAT2[2])		77 DAT1 (31 DAT2)		95 DAT1 (49 DAT2)		103 DAT1 (57 DAT2)		117 DAT1 (71 DAT2)	
Embark 2S	24 fl oz	before first mowing	8.1 a[3]	15 ab	8.0 a	15 ab	8.0	17 a	8.0	18	8.0	14 abc
		after first mowing	6.8 b	14 ab	6.2 c	12 def	8.0	16 ab	8.0	19	8.0	15 ab
		after second mowing										
		after third mowing										
Plateau	2 fl oz	before first mowing	8.3 a	14 abc	8.0 a	15 ab	8.0	16 ab	8.0	20	8.0	14 abc
		after first mowing	5.5 cd	12 c	7.0 b	12 efg	8.0	14 b	8.0	19	8.0	14 bc
		after second mowing										
		after third mowing										
Opensight	2.5 oz	before first mowing	8.1 a	13 bc	8.0 a	13 cde	8.0	15 ab	8.0	16	8.0	14 abc
		after first mowing	6.2 bc	12 c	7.3 ab	13 def	8.0	15 ab	8.0	17	8.0	14 bc
		after second mowing										
		after third mowing										
Anuew	1 lb	before first mowing	8.1 a	15 a	8.0 a	15 a	8.0	16 ab	8.0	18	8.0	15 abc
		after first mowing	6.8 b	13 bc	7.7 ab	11 fg	8.0	14 b	8.0	16	8.0	13 c
		after second mowing										
		after third mowing										
Perspective	4.75 oz	before first mowing	8.0 a	14 abc	8.0 a	14 bcd	8.0	16 ab	8.0	18	8.0	14 bc
		after first mowing	5.2 d	12 c	7.2 b	11 g	8.0	14 b	8.0	17	8.0	14 bc
		after second mowing										
		after third mowing										
Unsprayed Control			8.0 a	14 ab	8.0 a	15 abc	8.0	17 a	8.0	19	8.0	16 a

[1] DAT1 = Days after treatment before first mowing

[2] DAT2 = Days after treatment after first mowing

[3] Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.

Table 4. Herbicide Treatments, Turf Color, and Fescue Heights after Third PGR Application

Product (s)	Rate (per Acre)	Timing	Sept 8, 2018		Sept 21, 2018		Oct 7, 2018	
			Color (0-9)	Ht (in)	Color (0-9)	Ht (in)	Color (0-9)	Ht (in)
			132 DAT1[1] (86 DAT2[2]) (15 DAT3[3])		145 DAT1 (99 DAT2) (28 DAT3)		161 DAT1 (115 DAT2) (44 DAT3)	
Embark 2S	24 fl oz	before first mowing	8.0 a[4]	19 ab	8.3 a	21 a	8.0 a	27 a
		after first mowing	8.0 a	19 abc	8.0 a	21 a	8.0 a	26 a
		after second mowing	7.2 b	18 abcd	5.8 b	15 bcd	7.3 bc	19 d
		after third mowing						
Plateau	2 fl oz	before first mowing	8.0 a	19 abc	8.0 a	20 a	8.0 a	25 ab
		after first mowing	8.0 a	18 abcd	8.0 a	17 ab	8.0 a	23 abcd
		after second mowing	6.3 c	17 bcd	6.0 b	15 cd	7.7 ab	21 bcd
		after third mowing						
Opensight	2.5 oz	before first mowing	8.0 a	16 cd	8.0 a	18 abc	7.5 bc	23 abcd
		after first mowing	8.0 a	17 bcd	8.0 a	19 ab	8.0 a	23 abcd
		after second mowing	6.7 bc	16 d	6.3 b	16 bcd	7.6 b	22 bcd
		after third mowing						
Anuew	1 lb	before first mowing	8.0 a	18 abcd	8.0 a	18 abc	8.0 a	23 abcd
		after first mowing	8.0 a	17 bcd	8.0 a	18 abc	8.0 a	24 abc
		after second mowing	7.8 a	15 d	6.7 a	14 d	8.0 a	19 d
		after third mowing						
Perspective	4.75 oz	before first mowing	8.0 a	18 abcd	8.0 a	18 abc	8.0 a	23 abcd
		after first mowing	8.0 a	17 ncd	8.0 a	18 abc	8.0 a	22 abcd
		after second mowing	6.3 c	15 d	6.3 b	16 bcd	7.2 c	20 cd
		after third mowing						
Unsprayed Control			8.0 a	20 a	8.0 a	20 a	8.0 a	25 ab

[1] DAT1 = Days after treatment before first mowing *[2] DAT2 = Days after treatment after first mowing*

[3] DAT3 = Days after treatment after second mowing

[4] Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.

Table 5. Herbicide Treatments, Turf Color, and Fescue Heights after Fourth PGR Application

Product (s)	Rate (per Acre)	Timing	Oct 30		Nov 18	
			Color (0-9)	Ht (in)	Color (0-9)	Ht (in)
			184 DAT1[1] (138 DAT2[2]) (67 DAT3[3]) (11 DAT4[4])		203 DAT1 (157 DAT2) (86 DAT3) (30 DAT4)	
Embark 2S	24 fl oz	before first mowing	8.0 a[5]	12 ab	8.0 a	14 a
		after first mowing	8.0 a	13 a	8.0 a	13 ab
		after second mowing	8.0 a	11 abcde	8.0 a	12 cdef
		after third mowing	8.0 a	11 abcde	7.8 a	13 ab
Plateau	2 fl oz	before first mowing	8.0 a	11 abcde	8.0 a	14 a
		after first mowing	8.0 a	11 bcde	8.0 a	12 abcd
		after second mowing	8.1 a	11 cde	8.1 a	13 abc
		after third mowing	7.3 b	10 de	6.7 b	11 ef
Opensight	2.5 oz	before first mowing	7.8 a	10 e	7.9 a	13 abc
		after first mowing	8.0 a	10 de	8.0 a	12 abcd
		after second mowing	8.2 a	11 bcde	8.1 a	12 bcde
		after third mowing	7.0 b	12 abcd	6.5 b	11 def
Anuew	1 lb	before first mowing	8.0 a	11 bcde	8.0 a	13 abc
		after first mowing	8.0 a	11 abcde	8.0 a	12 abcd
		after second mowing	8.1 a	11 cde	8.1 a	12 cdef
		after third mowing	7.8 a	10 de	7.9 a	12 cdef
Perspective	4.75 oz	before first mowing	8.0 a	11 abcde	8.0 a	13 abc
		after first mowing	8.0 a	11 cde	8.0 a	13 abc
		after second mowing	8.1 a	11 cde	8.0 a	12 bcde
		after third mowing	7.2 b	10 de	6.7 b	10 f
Unsprayed Control			8.0 a	12 abc	8.0 a	13 abc

[1] DAT1 = Days after treatment before first mowing *[2] DAT2 = Days after treatment after first mowing*

[3] DAT3 = Days after treatment after second mowing *[4] DAT4 = Days after treatment after third mowing*

[5] Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.

Figure 1. Example of plot with reduced tall fescue color, height, and seedhead density 30 days after the April 29 application. This happens to be an Embark 2S plot.

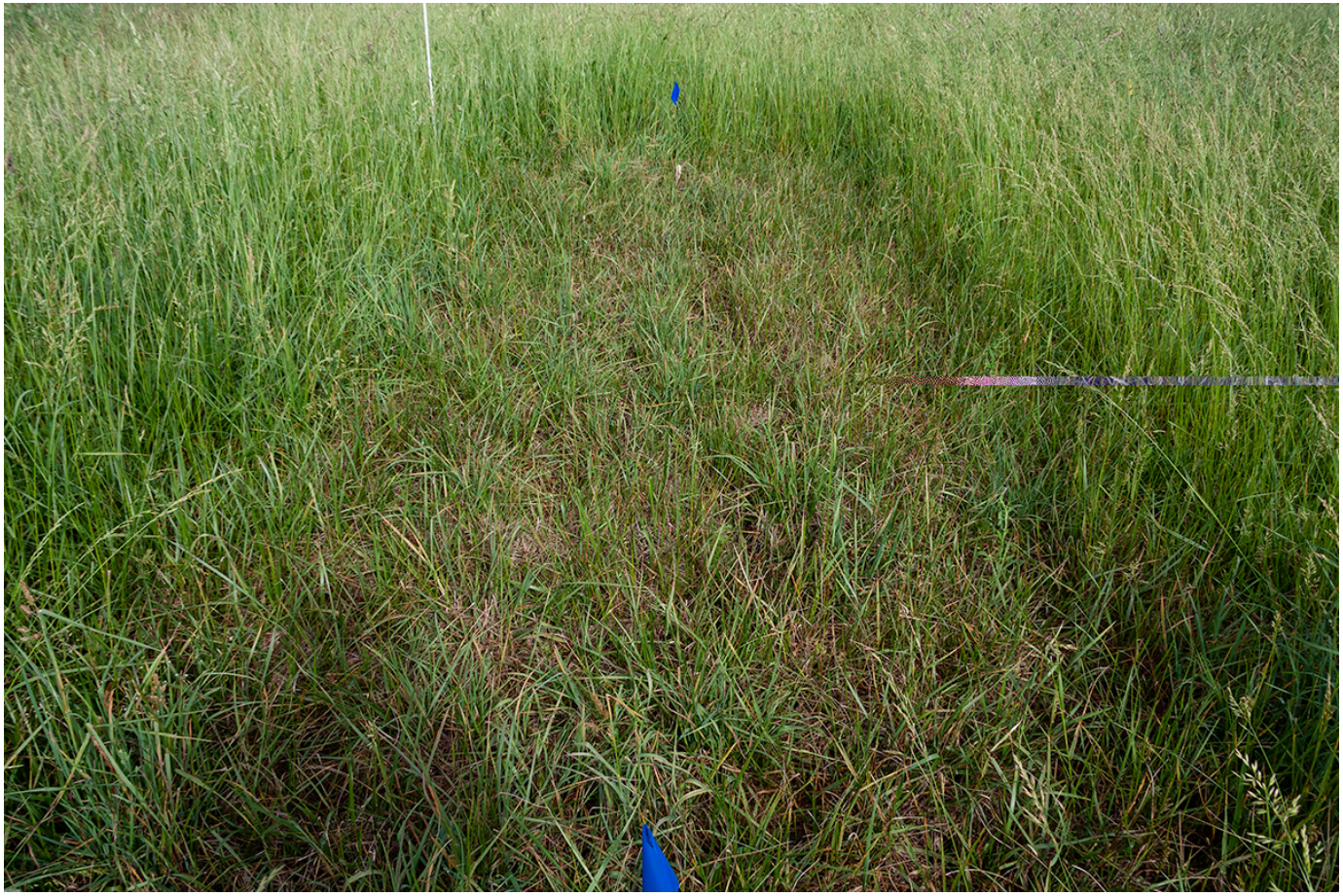
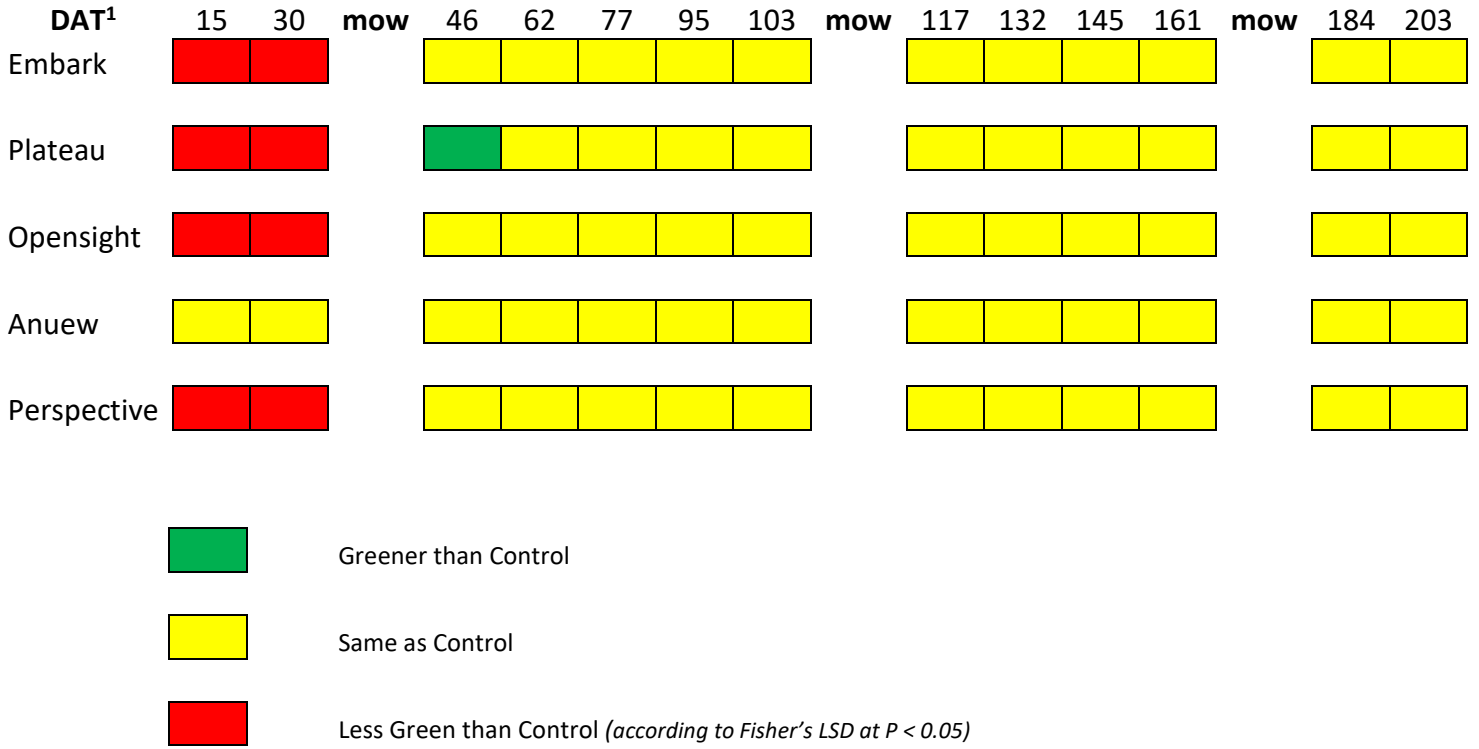
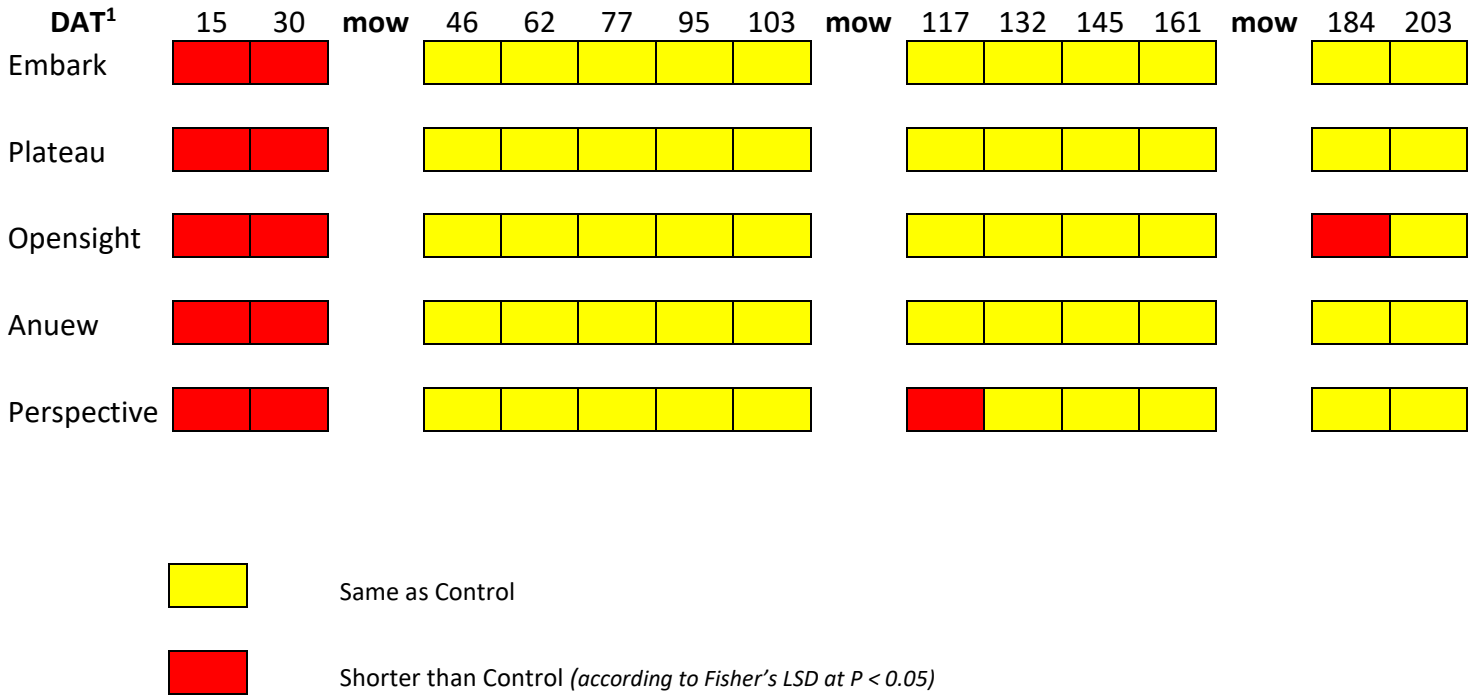


Figure 2. Summary of Turf Color with PGR Application before First Mowing



[1] *DAT = Days after treatment*

Figure 3. Summary of Fescue Height with PGR Application before First Mowing

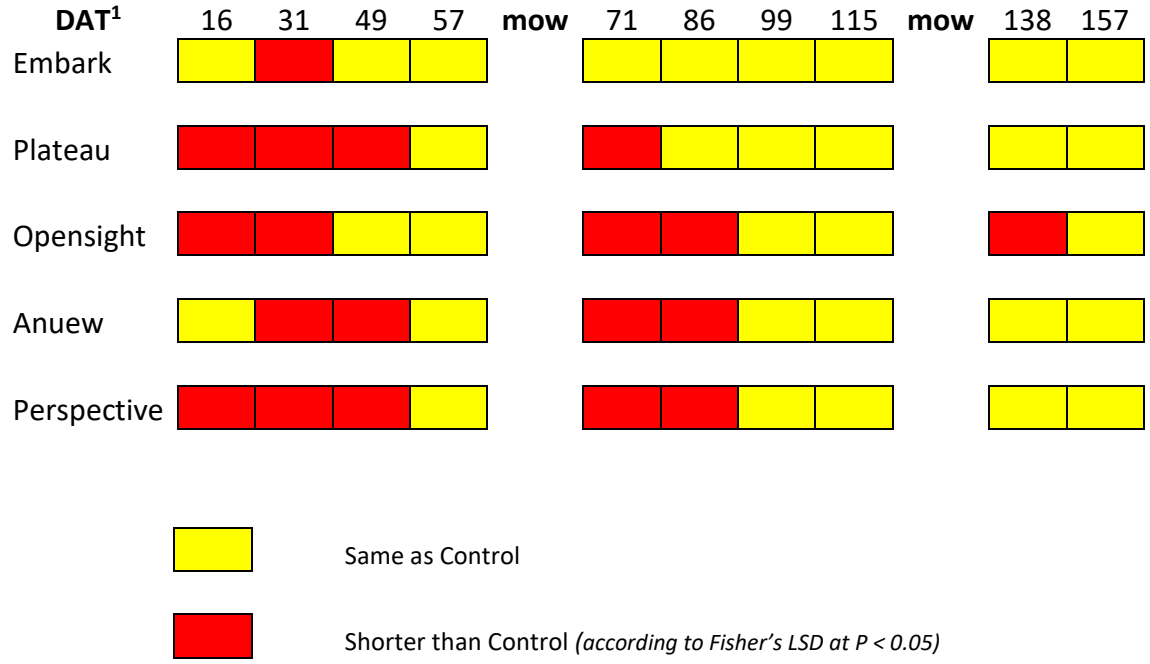


[1] *DAT = Days after treatment*

Figure 4. Summary of Turf Color with PGR Application after First Mowing

[1] *DAT = Days after treatment*

Figure 5. Summary of Fescue Height with PGR Application after First Mowing

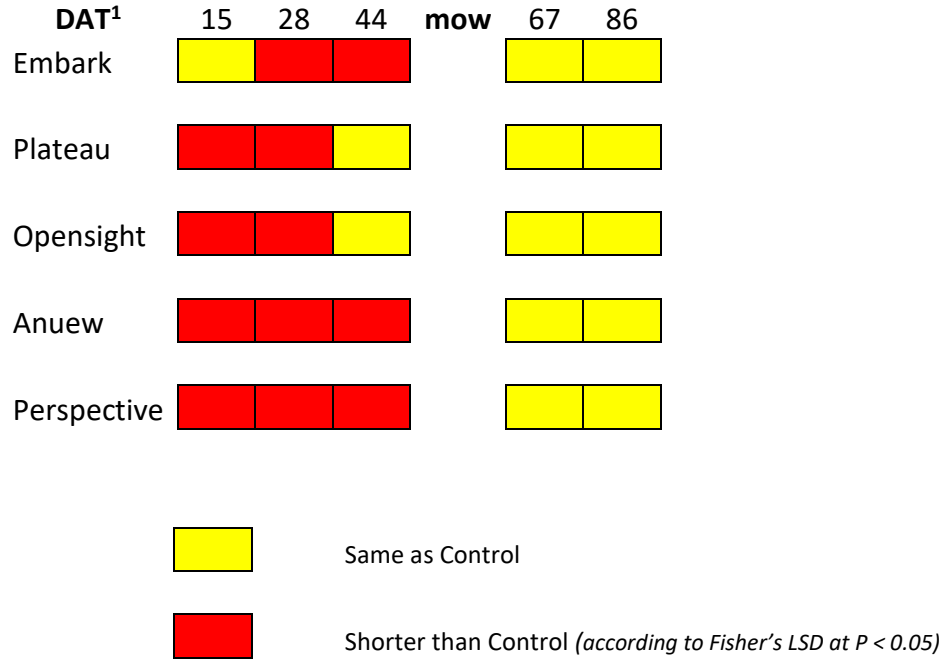


[1] *DAT = Days after treatment*

Figure 6. Summary of Turf Color with PGR Application after Second Mowing

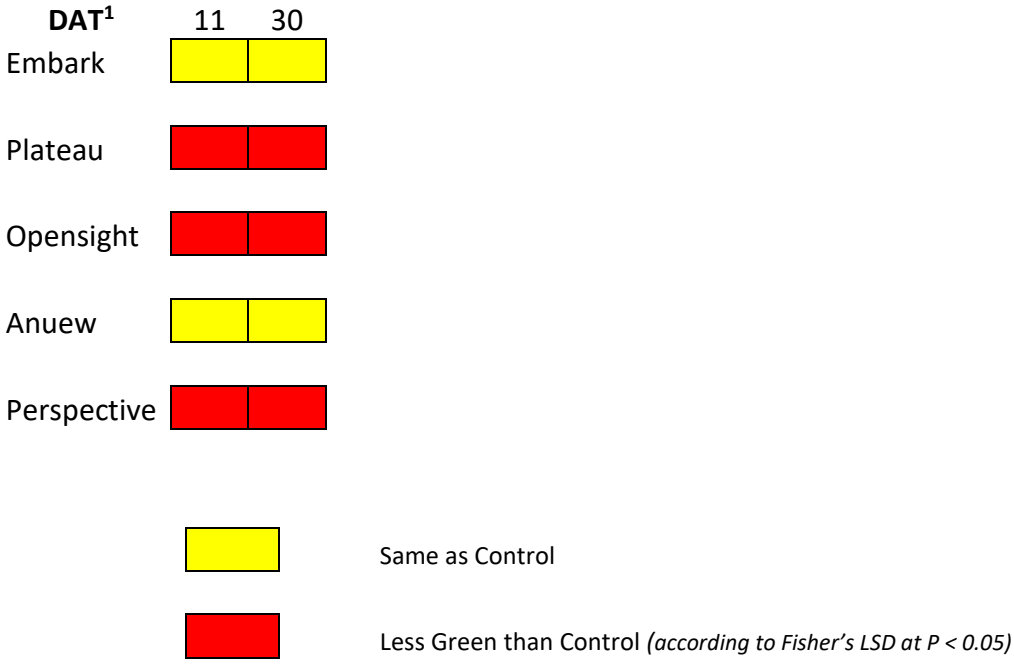
[1] *DAT = Days after treatment*

Figure 7. Summary of Fescue Height with PGR Application after Second Mowing



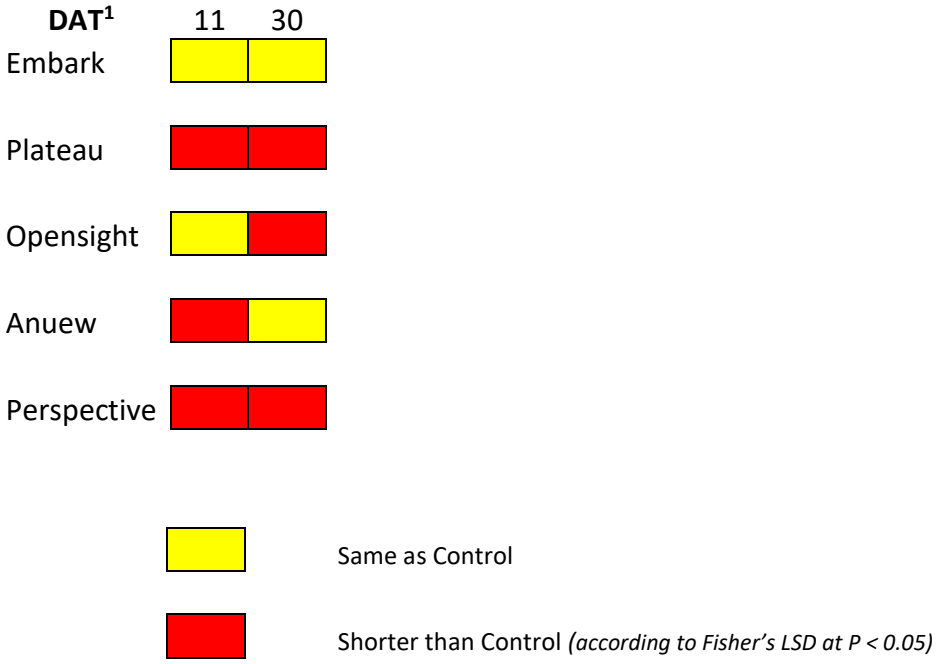
[1] *DAT = Days after treatment*

Figure 8. Summary of Turf Color with PGR Application after Third Mowing



[1] *DAT = Days after treatment*

Figure 9. Summary of Fescue Height with PGR Application after Third Mowing



[1] *DAT = Days after treatment*

2017 Johnsongrass Control Trial in Rowan County (including 2018 Assessment)

Introduction

Johnsongrass (Sorghum halepense) is a perennial warm-season grass, listed as a noxious weed in Kentucky, that is a common problem on right-of-ways. There are a number of herbicides labeled and available to control johnsongrass on right-of-ways. However, some of these are nonselective or are selective for johnsongrass but can still damage desirable cool-season turf, such as tall fescue. One of the safer johnsongrass control herbicides to use on tall fescue is Fusion but a label change in 2012 made it unavailable for use on right-of-way sites. This trial is a continuation of the evaluation of a range of johnsongrass control/suppression options.

Materials and Methods

The site was mowed July 25, 2017 and the late season regrowth was treated August 30, 2017 along an entrance ramp near I64 in Rowan County KY. The trial had 20 treatments with 3 replications arranged in a randomized complete block design with 7 ft by 20 ft plots. Application was at 30 gallons /acre. The johnsongrass was 36 to 58 inches tall with an overall average canopy height of 48 inches and about 5% of plants had emerged seedheads. Johnsongrass control was assessed 23 (9/22/2017), 53 (10/22/2017), and 302 (6/28/2018) days after treatment (DAT). Data were analyzed using ARM software and treatment means were compared using Fisher's LSD at $p = 0.05$.

Table 1 lists the treatments, active ingredients and application rates. The 2011 Fusion label rates for selective control of johnsongrass were 7 to 9 oz/A (Treatments 1 and 2). The rates on the label for Envoy are 16 and 32 fl oz/A (Treatments 3 and 4). Previous trials had used 13, 15, and 17 fl oz/A to find the best selective rate with less fescue damage. The labeled Fusilade II rates are 16 to 24 oz/A (Treatments 5 and 6). The Acclaim Extra label lists 20 oz/A per acre to control seedling johnsongrass 12 – 24 inches tall (Treatment 7); 39 oz/A to control rhizome johnsongrass 24 to 60 inches tall (Trt. 8); and a combination of Acclaim Extra plus Fusilade (0.5 plus 3.5 oz/A), for improved turfgrass tolerance and to control rhizome johnsongrass 10 to 25 inches tall (Treatment 9). The Outrider label rates for selective johnsongrass control in tall fescue turf are 0.75 to 1 oz/A (Treatments 10 and 11). Treatment 12 is MSMA applied alone and Treatment 13 is MSMA applied in combination with Outrider at 0.75 oz/A. Clearcast (Treatment 14) has an aquatic label and may be used close to waterways. The high rate of Plateau used in Treatment 15 will severely damage tall fescue. Poast Plus is a herbicide option we have not tested recently and has control of rhizome johnsongrass up to 25 inches tall on the label for this region of the U.S. (Treatments 16 and 17). Roundup (Treatment 18) and Journey (Treatment 19) are non-selective.

Results and Discussion

The regrowth of the johnsongrass at this site was vigorous and the plants were quite large at time of application. All the treatments controlled johnsongrass to some extent 23 and 53 days after

treatment (DAT) (Table 2). The most effective treatments had 68 to 78% control 23 DAT. They were both rates of Envoy (Treatments 3 and 4), both rates of Fusilade II (Treatments 5 and 6), both rates of Acclaim Extra (Treatments 7 and 8), the combination of Acclaim + Fusilade (Treatment 9), both rates of Poast (Treatments 16 and 17), and Roundup ProMax (Treatment 18).

At 53 DAT the top group of treatments had 83 to 93% control with many of the same treatments as at 23 DAT. At the second rating they were the high rate of Fusion (Treatment 2), both rates of Envoy (Treatments 3 and 4), both rates of Fusilade II (Treatments 5 and 6), the high rate of Acclaim Extra (Treatment 8), the combination of Acclaim + Fusilade (Treatment 9), Roundup ProMax (Treatment 18), and Journey (Treatment 19).

Next spring at 302 DAT the top group of treatments had 69 to 93% control and many of these were not in the top in the 2017 ratings. At this spring rating they were both rates of Envoy (Treatments 3 and 4), the high rate of Fusilade II (Treatment 6), both rates of Outrider (Treatments 10 and 11), both MSMA by itself and in combination with Outrider (Treatments 12 and 13), Clearcast (Treatment 14), Plateau (Treatment 15), Roundup ProMax (Treatment 18), and Journey (Treatment 19).

The treatments showing aboveground control more quickly may not necessarily be the ones with the best long term control. Outrider performed well in our trials but is slower to show foliar control.

Table 1. Herbicide Treatments, Active Ingredients and Application Rates.

Trt. No.	Product Name	Rate	Rate Unit	Active Ingredient(s)	ai Rate (per acre)
1	Fusion Activator 90	7 0.25	FL OZ/A % V/V	fluazifop + fenoxaprop	1.75 oz + 0.49 oz
2	Fusion Activator 90	9 0.25	FL OZ/A % V/V	fluazifop + fenoxaprop	2.25 oz + 0.63 oz
3	Envoy COC	16 1	FL OZ/A % V/V	clethodim	1.9 oz
4	Envoy COC	32 1	FL OZ/A % V/V	clethodim	3.9 oz
5	Fusilade II Activator 90	16 0.25	FL OZ/A % V/V	fluazifop	4 oz
6	Fusilade II Activator 90	24 0.25	FL OZ/A % V/V	fluazifop	6 oz
7	Acclaim Extra Activator 90	20 0.25	FL OZ/A % V/V	fenoxaprop	1.4 oz
8	Acclaim Extra Activator 90	39 0.25	FL OZ/A % V/V	fenoxaprop	2.78 oz
9	Acclaim Extra Fusilade II COC	7 14 1	FL OZ/A FL OZ/A % V/V	fenoxaprop fluazifop	0.5 oz 3.5 oz
10	Outrider Activator 90	0.75 0.25	OZ/A % V/V	sulfosulfuron	0.563 oz
11	Outrider Activator 90	1 0.25	OZ/A % V/V	sulfosulfuron	0.75 oz
12	MSMA	32	FL OZ/A	monosodium acid methanearsonate	24 oz
13	Outrider MSMA	0.75 32	OZ/A FL OZ/A	sulfosulfuron monosodium acid methanearsonate	0.563 oz 24 oz
14	Clearcast MSO	32 1	FL OZ/A % V/V	imazamox	4 oz ae
15	Plateau MSO	8 1	FL OZ/A % V/V	imazapic	2 oz ae
16	Poast Plus MSO	2.25 1	PT/A % V/V	sethoxydim	4.5 oz
17	Poast Plus MSO	3.75 1	PT/A % V/V	sethoxydim	7.5 oz
18	Roundup ProMax	22	FL OZ/A	glyphosate	12.4 oz ae
19	Journey MSO	21.3 1	FL OZ/A % V/V	imazapic + glyphosate	2 oz ae + 4 oz ae
20	Nontreated Check				

Table 2. Herbicide Treatments and % Control 23, 53, and 302 Days After Treatment (DAT)

Trt. No.	Product Name	Rate	Rate Unit	23 DAT	53 DAT	302 DAT
1	Fusion Activator 90	7 0.25	FL OZ/A % V/V	40 efg[1]	75 cde	55 cde
2	Fusion Activator 90	9 0.25	FL OZ/A % V/V	60 bcde	88 ab	60 bcde
3	Envoy COC	16 1	FL OZ/A % V/V	70 abcd	87 abc	77 abc
4	Envoy COC	32 1	FL OZ/A % V/V	77 ab	88 ab	83 ab
5	Fusilade II Activator 90	16 0.25	FL OZ/A % V/V	72 abc	87 abc	60 bcde
6	Fusilade II Activator 90	24 0.25	FL OZ/A % V/V	75 ab	88 ab	69 abcde
7	Acclaim Extra Activator 90	20 0.25	FL OZ/A % V/V	85 a	73 de	47 ef
8	Acclaim Extra Activator 90	39 0.25	FL OZ/A % V/V	68 abcd	85 abcd	52 de
9	Acclaim Extra Fusilade II COC	7 14 1	FL OZ/A FL OZ/A % V/V	78 ab	93 a	45 ef
10	Outrider Activator 90	0.75 0.25	OZ/A % V/V	23 gh	72 e	78 abc
11	Outrider Activator 90	1 0.25	OZ/A % V/V	32 fg	78 bcde	80 ab
12	MSMA	32	FL OZ/A	43 efg	77 bcde	83 ab
13	Outrider MSMA	0.75 32	OZ/A FL OZ/A	50 cdef	80 bcde	87 a
14	Clearcast MSO	32 1	FL OZ/A % V/V	27 fg	72 e	75 abcd
15	Plateau MSO	8 1	FL OZ/A % V/V	33 fg	80 bcde	91 a
16	Poast Plus MSO	2.25 1	PT/A % V/V	72 abc	52 f	23 fg
17	Poast Plus MSO	3.75 1	PT/A % V/V	75 ab	75 cde	27 f
18	Roundup ProMax	22	FL OZ/A	75 ab	87 abc	92 a
19	Journey MSO	21.3 1	FL OZ/A % V/V	47 defg	83 abcde	93 a
20	Nontreated Check			0 h	0 g	0 g

[1] Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.

2018 Johnsongrass Control Trial in Bowling Green

Introduction

Johnsongrass (Sorghum halepense) is a perennial warm-season grass, listed as a noxious weed in Kentucky, that is a common problem on right-of-ways. There are a number of herbicides labeled and available to control johnsongrass on right-of-ways. However, some of these are nonselective or are selective for johnsongrass but can still damage desirable cool-season turf, such as tall fescue. One of the safer johnsongrass control herbicides to use on tall fescue is Fusion but a label change in 2012 made it unavailable for use on right-of-way sites. This trial is a continuation of the evaluation of a range of johnsongrass control/suppression options.

Materials and Methods

The plan was to establish trials early and later in the season at the site in Bowling Green, KY at the Natcher Parkway and Hwy 68 (Russellville Rd.) interchange. However, there was only enough area with a good stand of johnsongrass for one application timing. The area was mowed May 24, 2018 and the regrowth was treated June 8, 2018. The trial had 18 treatments with 3 replications arranged in a randomized complete block design with 7 ft by 20 ft plots. Application was at 30 gallons /acre. The johnsongrass canopy was 32 inches tall with flowering plants (5% flowering) 43 inches tall. Johnsongrass control was assessed 25 (7/3/2018), 66 (8/13/2018), 103 (9/19/2018), and 130 (10/16/2018) days after treatment (DAT). Data were analyzed using ARM software and treatment means were compared using Fisher's LSD at p = 0.05.

Table 1 lists the treatments, active ingredients and application rates. The 2011 Fusion label rates for selective control of johnsongrass were 7 to 9 oz/A (Treatments 1 and 2). The labeled Fusilade II rates are 16 to 24 oz/A (Treatments 3 and 4). The Acclaim Extra label lists 20 oz/A per acre to control seedling johnsongrass 12 – 24 inches tall (Treatment 5); 39 oz/A to control rhizome johnsongrass 24 to 60 inches tall (Trt. 6); and a combination of Acclaim Extra plus Fusilade (0.5 plus 3.5 oz/A), for improved turfgrass tolerance and to control rhizome johnsongrass 10 to 25 inches tall (Treatment 7). The Outrider label rates for selective johnsongrass control in tall fescue turf are 0.75 to 1 oz/A (Treatments 8 and 9). Treatment 10 is MSMA applied alone and Treatment 11 is MSMA applied in combination with Outrider at 0.75 oz/A. Clearcast (Treatment 12) has an aquatic label and may be used close to waterways. The high rate of Plateau used in Treatment 13 will severely damage tall fescue. Detail + Plateau was suggested as a combination (Treatment 14) with enhanced control of johnsongrass. The combination of Method + Detail + Plateau (Treatment 15) was one suggested to suppress johnsongrass growth, in areas such as behind guardrails. Roundup ProMax (Treatment 16) and Journey (Treatment 17) are non-selective.

Results and Discussion

By the time of the first rating 25 DAT some of the dead foliage had been dry for a while and there was already considerable regrowth on some of the plots (Table 2). If earlier ratings had been taken the % control for the MSMA plots would have been higher than 12% as the foliar damage is evident relatively quickly before the regrowth starts. The most effective group of treatments had 68 to 90% control. They included the high rate of Fusion (Treatment 2), both Fusilade rates (Treatments 3 and 4), the Acclaim + Fusilade combination (Treatment 7), both rates of Outrider (Treatments 8 and 9), Clearcast (Treatment 12), both Plateau treatments (numbers 13 and 14), Roundup (Treatment 16) and Journey (Treatment 17).

Control was 78% with Roundup ProMax (Treatment 16) 25 DAT while it was 0% at subsequent assessments (Table 2). The regrowth was thicker and taller than the untreated control. There may not have been much glyphosate translocated to rhizome buds and dormant buds started growing after the existing culms were killed (McWhorter, 1972).

At 68 DAT the top group of treatments had 68 to 88% control and included the high rates of Fusion (Treatment 2) and Fusilade (Treatment 4), the Acclaim + Fusilade combination (Treatment 7), both rates of Outrider (Treatments 8 and 9), both Plateau treatments (numbers 13 and 14), and Journey (Treatment 17).

By 103 DAT some treatments had more regrowth and lower control ratings while some were slower acting and had higher % control (Table 2). The top group of treatments had 50 to 82% control and were the same as at 68 DAT but added the low rate of Fusion (Treatment 1), both rates of Acclaim (Treatments 5 and 6), and the Outrider + MSMA combination (Treatment 11).

The last rating of the season 130 DAT had 45 to 83% control for the top group of treatments which were the same as at 103 DAT except that the low rate of Acclaim (Treatment 5) was not high enough to be included.

The Method + Detail + Plateau combination (Treatment 15) did not have high control ratings but did reduce the growth of johnsongrass and might have utility in controlling growth in areas such as behind guardrails early in the season. The treatments showing aboveground control more quickly may not necessarily be the ones with the best long term control. Ratings will be taken in spring 2019.

Literature Cited:

McWhorter, C.G. 1972. Factors affecting johnsongrass rhizome production and germination. Weed Sci. 20: 41-45.

Table 1. Herbicide Treatments, Active Ingredients and Application Rates.

Trt. No.	Product Name	Rate	Rate Unit	Active Ingredient(s)	ai Rate (per acre)
1	Fusion	7	FL OZ/A	fluazifop + fenoxaprop	1.75 oz + 0.49 oz
	Activator 90	0.25	% V/V		
2	Fusion	9	FL OZ/A	fluazifop + fenoxaprop	2.25 oz + 0.63 oz
	Activator 90	0.25	% V/V		
3	Fusilade II	16	FL OZ/A	fluazifop	4 oz
	Activator 90	0.25	% V/V		
4	Fusilade II	24	FL OZ/A	fluazifop	6 oz
	Activator 90	0.25	% V/V		
5	Acclaim Extra	20	FL OZ/A	fenoxaprop	1.4 oz
	Activator 90	0.25	% V/V		
6	Acclaim Extra	39	FL OZ/A	fenoxaprop	2.78 oz
	Activator 90	0.25	% V/V		
7	Acclaim Extra	7	FL OZ/A	fenoxaprop	0.5 oz
	Fusilade II	14	FL OZ/A	fluazifop	3.5 oz
	COC	1	% V/V		
8	Outrider	0.75	OZ/A	sulfosulfuron	0.563 oz
	Activator 90	0.25	% V/V		
9	Outrider	1	OZ/A	sulfosulfuron	0.75 oz
	Activator 90	0.25	% V/V		
10	MSMA	32	FL OZ/A	monosodium acid methanearsonate	24 oz
11	Outrider	0.75	OZ/A	sulfosulfuron	0.563 oz
	MSMA	32	FL OZ/A	monosodium acid methanearsonate	24 oz
12	Clearcast	32	FL OZ/A	imazamox	4 oz ae
	MSO	1	% V/V		
13	Plateau	8	FL OZ/A	imazapic	2 oz ae
	MSO	1	% V/V		
14	Detail	1	FL OZ/A	saflufenacil	0.36 oz
	Plateau	8	FL OZ/A	imazapic	2 oz ae
	MSO	1	% V/V		
15	Method	6	FL OZ/A	aminocyclopyrachlor	1.5 oz ae
	Detail	1	FL OZ/A	saflufenacil	0.36 oz
	Plateau	3	FL OZ/A	imazapic	0.75 oz ae
	MSO	1	% V/V		
16	Roundup ProMax	22	FL OZ/A	glyphosate	12.4 oz ae
17	Journey	21.3	FL OZ/A	imazapic + glyphosate	2 oz ae + 4 oz ae
	MSO	1	% V/V		
18	Nontreated Check				

Table 2. Herbicide Treatments and % Control 25, 66, 103, and 130 Days After Treatment (DAT)

Trt. No.	Product Name	Rate	Rate Unit	25 DAT	66 DAT	103 DAT	130 DAT
1	Fusion Activator 90	7 0.25	FL OZ/A % V/V	37 efg[1]	50 bcde	72 a	62 abc
2	Fusion Activator 90	9 0.25	FL OZ/A % V/V	72 abc	72 abcd	77 a	70 ab
3	Fusilade II Activator 90	16 0.25	FL OZ/A % V/V	68 abcd	27 ef	32 bcd	47 abcd
4	Fusilade II Activator 90	24 0.25	FL OZ/A % V/V	87 a	73 abcd	78 a	80 ab
5	Acclaim Extra Activator 90	20 0.25	FL OZ/A % V/V	47 cdef	45 cde	52 abc	42 bcd
6	Acclaim Extra Activator 90	39 0.25	FL OZ/A % V/V	58 bcde	50 bcde	78 a	65 ab
7	Acclaim Extra Fusilade II COC	7 14 1	FL OZ/A FL OZ/A % V/V	83 ab	68 abcd	82 a	82 ab
8	Outrider Activator 90	0.75 0.25	OZ/A % V/V	87 a	72 abcd	80 a	75 ab
9	Outrider Activator 90	1 0.25	OZ/A % V/V	85 ab	83 ab	82 a	83 a
10	MSMA	32	FL OZ/A	12 gh	18 ef	22 cd	42 bcd
11	Outrider MSMA	0.75 32	OZ/A FL OZ/A	30 fg	50 bcde	50 abc	45 abcd
12	Clearcast MSO	32 1	FL OZ/A % V/V	88 a	38 de	18 cd	17 de
13	Plateau MSO	8 1	FL OZ/A % V/V	85 ab	72 abcd	53 abc	60 abc
14	Detail Plateau MSO	1 8 1	FL OZ/A FL OZ/A % V/V	90 a	78 abc	63 ab	55 abcd
15	Method Detail Plateau MSO	6 1 3 1	FL OZ/A FL OZ/A FL OZ/A % V/V	40 def	20 ef	30 bcd	22 cde
16	Roundup ProMax	22	FL OZ/A	78 ab	0 f	0 d	0 e
17	Journey MSO	21.3 1	FL OZ/A % V/V	86 a	88 a	73 a	63 ab
18	Nontreated Check			0 h	0 f	0 d	0 e

[1] Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.

2017 Fescue Damage by Johnsongrass Control Options (including 2018 Assessments)

Introduction

Johnsongrass (Sorghum halepense) is a perennial warm-season grass, listed as a noxious weed in Kentucky, that is a common problem on right-of-ways. There are a number of herbicides labeled and available to control johnsongrass on right-of-ways. However, some of these are nonselective or are selective for johnsongrass but can still damage desirable cool-season turf, such as tall fescue. One of the safer johnsongrass control herbicides to use on tall fescue is Fusion but a label change in 2012 made it unavailable for use on right-of-way sites. This trial evaluates the damage and recovery of tall fescue after application of some of these herbicide control options.

Materials and Methods

The trial was established August 26, 2017 at Spindletop Research Farm on a tall fescue field when the plants were 10 inches high. The trial had 20 treatments with 3 replications arranged in a randomized complete block design with 3.5 ft by 10 ft plots and 1.5 ft wide unsprayed buffers between each of the plots. Application was at 30 gallons per acre. Tall fescue color was assessed every two weeks by comparison to the running check strips. The color rating ranges from 0 (dead) to 9 (full green). The color of the check strips was set at 8. Plots were assessed 14 (9/9/2017), 29 (9/24/2017), 45 (10/10/2017), 57 (10/22/2017), and 75 (11/9/2017) days after treatment (DAT). In the spring tall fescue stand density was assessed visually from 0 (none) to 10 (full stand) 262 (5/15/2018) and 276 (5/29/2018) DAT. Data were analyzed using ARM software and treatment means were compared using Fisher's LSD at $p = 0.05$.

Table 1 lists the treatments, active ingredients and application rates. The 2011 Fusion label rates for selective control of johnsongrass were 7 to 9 oz/A (Treatments 1 and 2). The rates on the label for Envoy are 16 and 32 fl oz/A (Treatments 3 and 4). Previous trials had used 13, 15, and 17 fl oz/A to find the best selective rate with less fescue damage. The labeled Fusilade II rates are 16 to 24 oz/A (Treatments 5 and 6). The Acclaim Extra label lists 20 oz/A per acre to control seedling johnsongrass 12 – 24 inches tall (Treatment 7); 39 oz/A to control rhizome johnsongrass 24 to 60 inches tall (Trt. 8); and a combination of Acclaim Extra plus Fusilade (0.5 plus 3.5 oz/A), for improved turfgrass tolerance and to control rhizome johnsongrass 10 to 25 inches tall (Treatment 9). The Outrider label rates for selective johnsongrass control in tall fescue turf are 0.75 to 1 oz/A (Treatments 10 and 11). Treatment 12 is MSMA applied alone and Treatment 13 is MSMA applied in combination with Outrider at 0.75 oz/A. Clearcast (Treatment 14) has an aquatic label and may be used close to waterways. The high rate of Plateau used in Treatment 15 will severely damage tall fescue. Poast Plus is a herbicide option we have not tested recently and has control of rhizome johnsongrass up to 25 inches tall on the label for this region of the U.S. (Treatments 16 and 17). Roundup (Treatment 18) and Journey (Treatment 19) are non-selective.

Results and Discussion

Some treatments showed good safety on tall fescue with color ratings that were consistently not different from the nontreated check over all the ratings while others showed recovery by the end of the season (Table 2). Treatments with color ratings consistently not different from control included both rates of Fusion (Treatments 1 and 2), both rates of Acclaim Extra (Treatments 7 and 8), MSMA by itself (Treatment 12) and in combination with Outrider (Treatment 13). Treatments that recovered by 75 DAT included the low rate of Envoy (Treatment 3), both rates of Fusilade (Treatments 5 and 6), the combination of Acclaim + Fusilade (Treatment 9), both rates of Outrider (Treatments 10 and 11), both rates of Poast (Treatments 16 and 17), and Roundup (Treatment 18). The high rate of Envoy (Treatment 4), Clearcast (Treatment 14), Plateau (Treatment 15), and Journey (Treatment 19) did not recover before the end of the season.

In the spring the tall fescue stand density improved for many treatments between the two rating dates in 2018 (Table 3). By late May (276 DAT) the top group of treatments had density ratings from 6.8 to 9.0 while the sparsest treatments ranged from 1.2 to 5. The latter group included the high rate of Envoy (Treatment 4), Clearcast (Treatment 14), Plateau (Treatment 15), both rates of Poast (Treatments 16 and 17), Roundup (Treatment 18), and Journey (Treatment 19). These would not be recommended if one wants to preserve existing fescue in the application area

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Table 1. Herbicide Treatments, Active Ingredients and Application Rates.

Trt. No.	Product Name	Rate	Rate Unit	Active Ingredient(s)	ai Rate (per acre)
1	Fusion Activator 90	7 0.25	FL OZ/A % V/V	fluazifop + fenoxaprop	1.75 oz + 0.49 oz
2	Fusion Activator 90	9 0.25	FL OZ/A % V/V	fluazifop + fenoxaprop	2.25 oz + 0.63 oz
3	Envoy COC	16 1	FL OZ/A % V/V	clethodim	1.9 oz
4	Envoy COC	32 1	FL OZ/A % V/V	clethodim	3.9 oz
5	Fusilade II Activator 90	16 0.25	FL OZ/A % V/V	fluazifop	4 oz
6	Fusilade II Activator 90	24 0.25	FL OZ/A % V/V	fluazifop	6 oz
7	Acclaim Extra Activator 90	20 0.25	FL OZ/A % V/V	fenoxaprop	1.4 oz
8	Acclaim Extra Activator 90	39 0.25	FL OZ/A % V/V	fenoxaprop	2.78 oz
9	Acclaim Extra Fusilade II COC	7 14 1	FL OZ/A FL OZ/A % V/V	fenoxaprop fluazifop	0.5 oz 3.5 oz
10	Outrider Activator 90	0.75 0.25	OZ/A % V/V	sulfosulfuron	0.563 oz
11	Outrider Activator 90	1 0.25	OZ/A % V/V	sulfosulfuron	0.75 oz
12	MSMA	32	FL OZ/A	monosodium acid methanearsonate	24 oz
13	Outrider MSMA	0.75 32	OZ/A FL OZ/A	sulfosulfuron monosodium acid methanearsonate	0.563 oz 24 oz
14	Clearcast MSO	32 1	FL OZ/A % V/V	imazamox	4 oz ae
15	Plateau MSO	8 1	FL OZ/A % V/V	imazapic	2 oz ae
16	Poast Plus MSO	2.25 1	PT/A % V/V	sethoxydim	4.5 oz
17	Poast Plus MSO	3.75 1	PT/A % V/V	sethoxydim	7.5 oz
18	Roundup ProMax	22	FL OZ/A	glyphosate	12.4 oz ae
19	Journey MSO	21.3 1	FL OZ/A % V/V	imazapic + glyphosate	2 oz ae + 4 oz ae
20	Nontreated Check				

Table 2. Herbicide Treatments and Fescue Color (0-9) 14, 29, 45, 57, and 75 Days After Treatment (DAT)

Trt. No.	Product Name	Rate	Rate Unit	14 DAT	29 DAT	45 DAT	57 DAT	75 DAT
1	Fusion Activator 90	7 0.25	FL OZ/A % V/V	7.8 ab[1]	7.9 a	7.7 ab	8.0 a	7.9 a
2	Fusion Activator 90	9 0.25	FL OZ/A % V/V	7.6 abc	7.5 ab	7.2 ab	7.5 abc	8.0 a
3	Envoy COC	16 1	FL OZ/A % V/V	6.2 e	2.7 fg	3.3 fg	5.2 e	7.0 ab
4	Envoy COC	32 1	FL OZ/A % V/V	6.3 e	1.3 h	0.8 i	3.2 f	3.8 d
5	Fusilade II Activator 90	16 0.25	FL OZ/A % V/V	7.5 abcd	6.3 bcd	6.5 bc	7.2 abc	7.9 a
6	Fusilade II Activator 90	24 0.25	FL OZ/A % V/V	7.0 d	4.7 e	3.8 ef	5.7 de	7.3 a
7	Acclaim Extra Activator 90	20 0.25	FL OZ/A % V/V	8.0 a	8.0 a	8.0 a	8.0 a	8.0 a
8	Acclaim Extra Activator 90	39 0.25	FL OZ/A % V/V	7.9 a	8.0 a	8.0 a	8.0 a	8.0 a
9	Acclaim Extra Fusilade II COC	7 14 1	FL OZ/A FL OZ/A % V/V	7.6 abc	6.2 cd	6.7 bc	7.3 abc	8.0 a
10	Outrider Activator 90	0.75 0.25	OZ/A % V/V	7.0 d	5.7 de	5.5 cd	6.7 bcd	7.8 a
11	Outrider Activator 90	1 0.25	OZ/A % V/V	7.2 cd	6.2 cd	4.7 de	6.3 cde	7.9 a
12	MSMA	32	FL OZ/A	8.0 a	8.0 a	8.0 a	8.0 a	8.0 a
13	Outrider MSMA	0.75 32	OZ/A FL OZ/A	7.8 a	7.3 abc	7.2 ab	7.7 ab	8.0 a
14	Clearcast MSO	32 1	FL OZ/A % V/V	7.0 d	3.3 f	0.5 i	1.5 g	2.8 d
15	Plateau MSO	8 1	FL OZ/A % V/V	7.2 bcd	5.5 de	1.0 i	2.7 fg	5.7 bc
16	Poast Plus MSO	2.25 1	PT/A % V/V	7.2 cd	3.2 f	4.5 def	5.3 e	6.7 ab
17	Poast Plus MSO	3.75 1	PT/A % V/V	6.3 e	2.5 fgh	1.5 hi	3.7 f	6.8 ab
18	Roundup ProMax	22	FL OZ/A	5.3 f	3.0 f	2.5 gh	5.7 de	7.2 ab
19	Journey MSO	21.3 1	FL OZ/A % V/V	6.2 e	1.7 gh	1.2 i	2.5 fg	4.2 cd
20	Nontreated Check			8.0 a	8.0 a	8.0 a	8.0 a	8.0 a

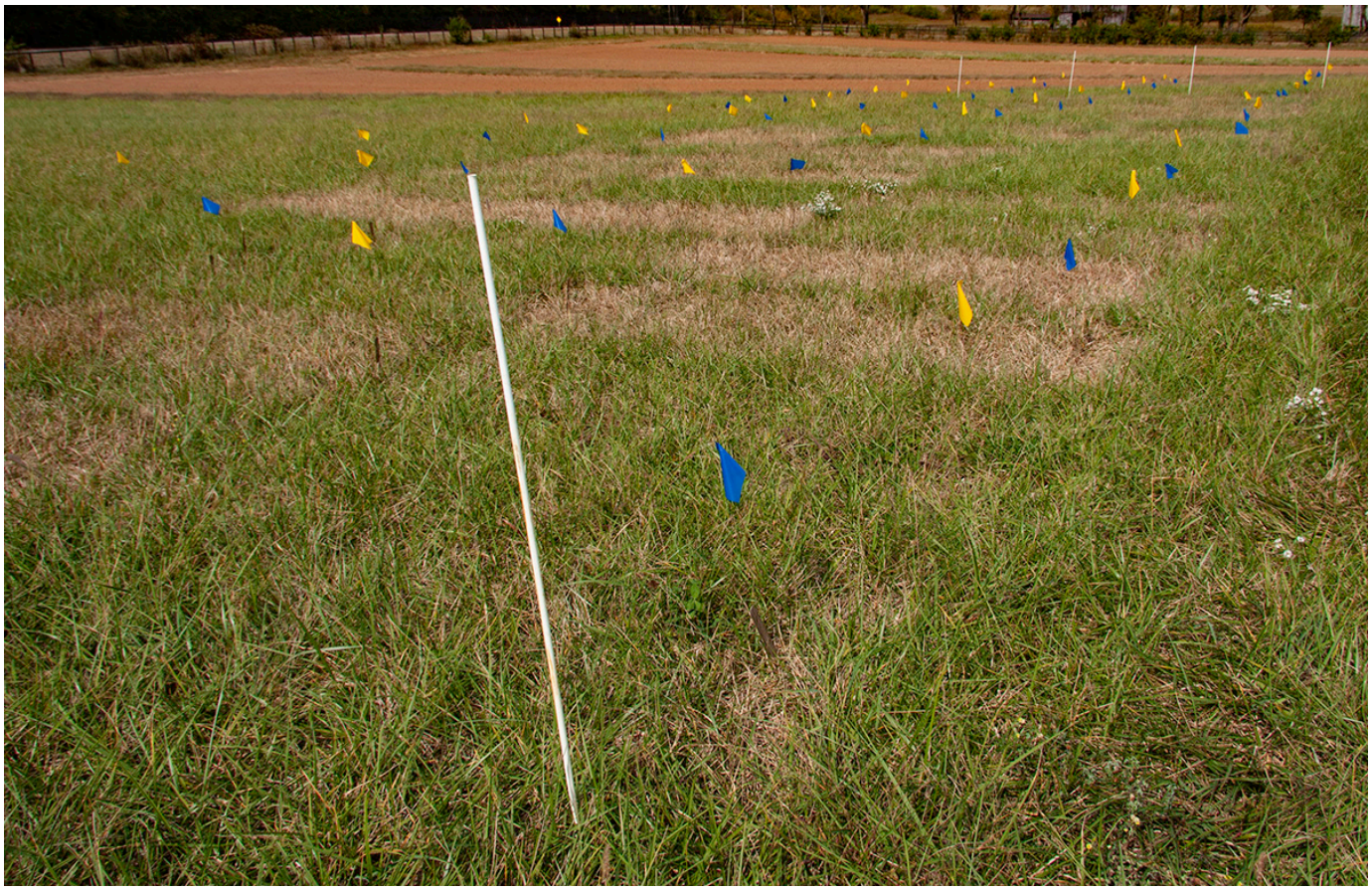
[1] Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.

Table 3. Herbicide Treatments and Stand Density (0-10) 262 and 276 Days After Treatment (DAT)

Trt. No.	Product Name	Rate	Rate Unit	262 DAT	276 DAT
1	Fusion Activator 90	7 0.25	FL OZ/A % V/V	8.0 a[1]	8.3 a
2	Fusion Activator 90	9 0.25	FL OZ/A % V/V	6.0 ab	9.0 a
3	Envoy COC	16 1	FL OZ/A % V/V	6.3 ab	6.8 ab
4	Envoy COC	32 1	FL OZ/A % V/V	3.2 cd	5.0 bc
5	Fusilade II Activator 90	16 0.25	FL OZ/A % V/V	4.8 bc	7.0 ab
6	Fusilade II Activator 90	24 0.25	FL OZ/A % V/V	6.3 ab	8.0 a
7	Acclaim Extra Activator 90	20 0.25	FL OZ/A % V/V	7.0 ab	9.0 a
8	Acclaim Extra Activator 90	39 0.25	FL OZ/A % V/V	7.0 ab	8.3 a
9	Acclaim Extra Fusilade II COC	7 14 1	FL OZ/A FL OZ/A % V/V	6.0 ab	9.0 a
10	Outrider Activator 90	0.75 0.25	OZ/A % V/V	6.0 ab	8.7 a
11	Outrider Activator 90	1 0.25	OZ/A % V/V	5.3 abc	7.3 ab
12	MSMA	32	FL OZ/A	7.0 ab	7.7 a
13	Outrider MSMA	0.75 32	OZ/A FL OZ/A	6.7 ab	8.7 a
14	Clearcast MSO	32 1	FL OZ/A % V/V	1.5 d	1.2 e
15	Plateau MSO	8 1	FL OZ/A % V/V	2.7 cd	4.0 cd
16	Poast Plus MSO	2.25 1	PT/A % V/V	3.0 cd	3.0 cde
17	Poast Plus MSO	3.75 1	PT/A % V/V	1.8 d	2.3 de
18	Roundup ProMax	22	FL OZ/A	1.7 d	2.7 cde
19	Journey MSO	21.3 1	FL OZ/A % V/V	3.0 cd	2.7 cde
20	Nontreated Check			6.8 ab	9.0 a

[1] Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.

Figure 1: Overall View of the Plots 45 DAT (Oct. 6, 2017)
The plots in the foreground were treated with Fusion (Treatments 1 and 2) and one can see the damaged fescue from other treatments as well as the unsprayed borders between plots.



2018 Poison Hemlock Control Trial near Richmond

Introduction

Poison hemlock (*Conium maculatum*) is a highly toxic biennial, listed as a noxious weed in Kentucky, that is a common problem on right-of-ways. Infestations occur along roadsides, field margins, ditches, marshes, meadows, and low-lying areas, but this plant prefers shaded areas with moist soil. It can grow up to ten feet tall. The stems are ribbed and hollow with purplish streaks or splotches, which are characteristic for identification. Poison hemlock reproduces by seeds that fall near the plant and disperse via fur, birds, water, and, to a limited extent, wind. Most seeds fall from September through December, but they can fall as late as the end of February. The seeds germinate in the fall, but the plant usually does not bolt and produce flowers until the second spring, which is when they are most noticeable. This trial evaluates a number of herbicide control options including new formulations of 2,4-D with lower volatility (DMA4 vs Freelexx) plus the new formulation of triclopyr (Garlon 3A vs Vastlan).

Materials and Methods

The trial was established May 7, 2018 on an area mowed once a year along I75 near Richmond, KY with a thick stand of poison hemlock. The trial had 9 treatments with 3 replications arranged in a randomized complete block design with 7 ft by 25 ft plots. Application was at 20 gallons per acre. The poison hemlock plants had bolted (32 to 48 inches tall) but not yet flowered. There were also Canada thistle plants (average of 24 inches tall) and common teasel plants (average of 12 inches tall) in most of the plots at application. Plots were assessed 9 (5/16/2018) and 52 (6/28/2018) days after treatment (DAT). It was not possible to assess the plots later in the season as giant foxtail was covering the treated plot area. Vetch was covering the control plot area. Data were analyzed using ARM software and treatment means were compared using Fisher's LSD at $p = 0.05$.

Results and Discussion

All the herbicide treatments (Table 1) had dramatic effects on the tall poison hemlock plants (Figure 1) 9 DAT. There were no differences in control between the DMA 4 and Freelexx formulations 9 or 52 DAT (Table 2). However, the older Garlon 3A was slower (33% control) than Vastlan (50% control) 9 DAT but had the same % control at 52 DAT (97 to 98% control). Most of the hemlock plants were brown and dry 52 DAT but there was still some green tissue and % control was lower for the Milestone and Opensight than the other treatments. Method had the best early control (55%) on common teasel but it was not possible to get teasel rating on the second date. The best early control ratings on Canada thistle (50 to 63% control) were for DMA 4, Milestone, Solution Water Soluble, and Opensight 9 DAT.

An early spring assessment will be done in 2019 to evaluate if there is extended control with soil residual herbicides, like Milestone, Method, and Opensight.

Table 1. Herbicide Treatments, Active Ingredients and Application Rates.

Trt. No.	Product Name	Rate	Rate Unit	Active Ingredient(s)	ai Rate (per acre)
1	DMA 4	4	PT/A	2,4-D	1.9 lb ae
2	Freelexx	4	PT/A	2,4-D	1.9 lb ae
3	Milestone	5	FL OZ/A	aminopyralid	1.25 oz ae
4	Method	15	FL OZ/A	aminocyclopyrachlor	3.75 oz ae
5	Solution Water Soluble	2.28	LB/A	2,4-D	1.84 lb ae
6	Garlon 3A	1.5	QT/A	triclopyr	18 oz ae
7	Vastlan	1.1	QT/A	triclopyr	18 oz ae
8	Opensight	2.5	OZ/A	aminopyralid + metsulfuron	1.31 oz ae + 0.24 oz
9	Nontreated Check				

All herbicide treatments contained the adjuvant, Activator 90 at 0.25% v/v.

Table 2. Herbicide Treatments, Application Rates, and Data.

				Hemlock Control (%)	Teasel Control (%)	Canada Thistle Control (%)	Hemlock Control (%)
Trt. No.	**Product Name**	**Rate**	**Rate Unit**	**9 DAT**			**52 DAT**
1	DMA 4	4	PT/A	52 ab[1]	10 cde	55 ab	98 a
2	Freelexx	4	PT/A	35 ab	10 cde	13 d	90 abc
3	Milestone	5	FL OZ/A	40 ab	30 b	50 abc	82 c
4	Method	15	FL OZ/A	68 a	55 a	25 bcd	98 a
5	Solution Water Soluble	2.28	LB/A	45 ab	20 bcd	63 a	91 abc
6	Garlon 3A	1.5	QT/A	33 bc	5 de	5 d	97 ab
7	Vastlan	1.1	QT/A	50 ab	13 cde	18 cd	98 ab
8	Opensight	2.5	OZ/A	40 ab	25 bc	58 ab	87 bc
9	Nontreated Check			0 c	0 e	0 d	0 d

All herbicide treatments contained the adjuvant, Activator 90 at 0.25% v/v.

[1] Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.

Figure 1: View of the Opensight and Control Plots 9 DAT (May 16, 2018)
The effects of the herbicide treatment are quite dramatic on the poison hemlock!

2018 Selective Broadleaf Control Trials near Richmond

Introduction

One of the objectives of roadside vegetation management is the selective control of broadleaf weeds, without damaging desirable grasses, such as tall fescue. Other objectives include brush control and grass growth regulation. There are a number of herbicides and combinations of products available for roadside managers. This trial evaluated the efficacy some of these.

Materials and Methods

The trial was established June 29, 2018 on an area mowed periodically, after the first mowing of the season, along I75 near Richmond, KY. The trial had 14 treatments with 3 replications arranged in a randomized complete block design with 7 ft by 20 ft plots. Application was at 25 gallons per acre. The area had a mix of broadleaf weeds and still had some desirable grasses. Most plots had Canada thistle (9 inches tall) as well as johnsongrass (20 inch canopy). Some of the plots had flowering buckhorn plantain (6 inch canopy and 15 inch seedheads) as well as prickly lettuce (15 inches tall). There was also a patch of hemp dogbane (15 inches tall).

The treatments and active ingredients are listed in Table 1. Many were applied at the maximum annual rate which included Milestone (Treatment 1) and Opensight (Treatment 2). Perspective (Treatment 3) and Streamline (Treatment 4) were both applied at the maximum selective rate and both can be applied at higher rates for bareground. However, even the selective rate can result in turf yellowing and reduced growth. The reduced growth may even be desirable. Method (Treatments 6 to 8) is a new product with only the aminocyclopyrachlor component of Perspective and Streamline. Method at 7.2 fl oz per acre has the same amount of this a.i. as 4.5 oz per acre of Perspective and Streamline. Method by itself lists good plantain and brush control from 10 to 18 fl oz per acre. Combinations of Milestone or Method + Plateau (Treatments 11 and 12) had been suggested for grass growth reduction as well as weed control. A higher rate of Method + Plateau (Treatment 13) was suggested for grass growth regulation plus brush control behind guardrails.

Plots were assessed 31 (7/30/2018) and 68 (9/5/2018) days after treatment (DAT). Data were analyzed using ARM software and treatment means were compared using Fisher's LSD at $p = 0.05$.

Results and Discussion

Good initial control of a range of broadleaf weeds was observed (68 to 92%) 31 DAT (Table 2) for most of the treatments. The least control (63 to 65%) was with the two lowest rates of Method (Treatments 6 and 7). The greatest degree of grass damage (43 to 57%) was with the combinations including Plateau (Treatments 11 to 13) and Streamline (Treatment 4). There were also treatments that had little to no grass damage and these included Milestone (Treatment 1), Opensight (Treatment 2), Pyresta + ProClipse (Treatment 5), low rate of Method (Treatment 6),

Overdrive + Vastlan (Treatment 9), and Freelexx + Vastlan (Treatment 10). The greatest control of Canada thistle 31 DAT was with the high rate of Method (Treatment 8) and the combinations with Plateau (Treatments 11 to 13). The greatest initial control of johnsongrass was with the high rate of Method (Treatment 8) and the combinations with Plateau (Treatments 11 to 13).

By the second rating 68 DAT the site was overtaken by giant foxtail. There was also johnsongrass in most of the plots (Table 2). The plots with the least foxtail cover were the mid-rate of Method (Treatment 7) and the combinations with Plateau (Treatments 11 to 13). In future trials we may need to temporarily remove the plot flags and mow the plots on the same schedule to evaluate the broadleaf control under the standard mowing regime of three times per year. These plots will be evaluated in spring 2019 for Canada thistle control.

Table 1. Herbicide Treatments, Active Ingredients and Application Rates.

Trt. No.	Product Name	Rate	Rate Unit	Active Ingredient(s)	ai Rate (per acre)
1	Milestone VM	7	FL OZ/A	aminopyralid	1.8 OZ AE/A
2	Opensight	3.3	OZ/A	aminopyralid + metsulfuron	1.7 OZ AE + 0.3 OZ/A
3	Perspective	4.5	OZ/A	aminocyclopyrachlor + chlorsulfuron	1.8 OZ + 0.7 OZ/A
4	Streamline	4.5	OZ/A	aminocyclopyrachlor + metsulfuron	1.8 OZ + 0.6 OZ/A
5	Pyresta	24	FL OZ/A	2,4-D + pyraflufen-ethyl	0.66 LB AE + 0.05 OZ/A
	Proclipse	2	LB/A	prodiamine	1.3 LB/A
6	Method	4	FL OZ/A	aminocyclopyrachlor	1 OZ AE/A
7	Method	6	FL OZ/A	aminocyclopyrachlor	1.5 OZ AE/A
8	Method	12	FL OZ/A	aminocyclopyrachlor	3 OZ AE/A
9	Overdrive	5	OZ/A	diflufenzopyr + dicamba	1 OZ AE + 2.5 OZ AE/A
	Vastlan	16	FL OZ/A	triclopyr	8 OZ AE/A
10	Freelexx	48	FL OZ/A	2,4-D	22.8 OZ AE/A
	Vastlan	32	FL OZ/A	triclopyr	16 OZ AE/A
11	Milestone VM	6	FL OZ/A	aminopyralid	3 OZ AE/A
	Plateau	3	FL OZ/A	imazapic	0.75 OZ AE/A
12	Method	6	FL OZ/A	aminocyclopyrachlor	1.5 OZ AE/A
	Plateau	3	FL OZ/A	imazapic	0.75 OZ AE/A
13	Method	12	FL OZ/A	aminocyclopyrachlor	3 OZ AE/A
	Plateau	3	FL OZ/A	imazapic	0.75 OZ AE/A
14	Nontreated Check				

All herbicide treatments contained the adjuvant, Activator 90 at 0.25% v/v.

Table 2. Herbicide Treatments, Application Rates, and Data.

				Broadleaf Control (%)	Grass Damage (%)	Johnsongrass Control (%)	Canada Thistle Control (%)	Giant Foxtail Cover (%)	Johnsongrass Cover (%)
Trt. No.	**Product Name**	**Rate**	**Rate Unit**	**31 DAT**				**68 DAT**	
1	Milestone VM	7	FL OZ/A	72 abc[1]	13 cde	25 defg	88 ab	85 a	9
2	Opensight	3.3	OZ/A	70 abc	3 de	35 def	92 a	75 ab	18
3	Perspective	4.5	OZ/A	92 a	37 b	35 def	90 a	52 abc	13
4	Streamline	4.5	OZ/A	92 a	43 ab	40 cde	92 a	67 abc	17
5	Pyresta Proclipse	24 2	FL OZ/A LB/A	68 abc	3 de	10 fg	65 b	50 abc	22
6	Method	4	FL OZ/A	63 c	15 cde	30 def	72 ab	88 a	10
7	Method	6	FL OZ/A	65 bc	18 cd	47 bcd	65 b	35 bc	33
8	Method	12	FL OZ/A	90 a	28 bc	68 ab	93 a	47 abc	27
9	Overdrive Vastlan	5 16	OZ/A FL OZ/A	73 abc	15 cde	20 efg	77 ab	72 ab	20
10	Freelexx Vastlan	48 32	FL OZ/A FL OZ/A	83 abc	0 e	15 efg	80 ab	63 abc	30
11	Milestone VM Plateau	6 3	FL OZ/A FL OZ/A	72 abc	45 ab	65 abc	70 ab	27 c	37
12	Method Plateau	6 3	FL OZ/A FL OZ/A	73 abc	43 ab	80 a	73 ab	40 bc	17
13	Method Plateau	12 3	FL OZ/A FL OZ/A	88 ab	57 a	80 a	91 a	40 bc	12
14	Nontreated Check			0 d	0 e	0 g	0 c	48 abc	35

All herbicide treatments contained the adjuvant, Activator 90 at 0.25% v/v.

[1] *Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.*

Evaluation of Lespedeza Control Options on a Reclaimed Mine Site

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University of Kentucky[1] and Dow AgroSciences[2]

INTRODUCTION

Sericea lespedeza (*Lespedeza cuneata*) has been used in mine reclamation for many years in the past. It is no longer recommended as it can be aggressive in growth and dominate an area interfering with establishment of other species and regeneration of trees and shrubs.

OBJECTIVE

Evaluate the use and timing of some herbicides to control lespedeza to facilitate establishment of native grasses and forbs.

MATERIALS & METHODS

The trial was established at the Wendell H. Ford Regional Training Center, Greenville Kentucky on an area with a mix of lespedeza and Indian grass with a 6 x 2 factorial set of treatments and 4 replications arranged in a randomized complete block design. The six herbicide treatments also had either dormant seeding done or not. There were two timings for each of the three herbicides. All the herbicides included primarily foliar active products as well as aminopyralid as a foliar and soil residual product. The **herbicides** were as follows:

Opensight @ 3.3 oz/a (aminopyralid @ 121 g ae/ha + metsulfuron @ 22 g/ha)

PastureGard HL @ 12 fl oz/a (triclopyr @ 315 g ae/ha + fluroxypyr @ 105 g ae/ha) **+ Milestone VM @ 3 fl oz/a** (aminopyralid @ 53 g ae/ha)

Garlon 4 Ultra @ 1 pt/a (triclopyr @ 560 g ae) **+ Milestone VM @ 3 fl oz/a** (aminopyralid @ 53 g ae/ha)

Plots were 3 m by 9 m with running unsprayed checks (3 m) between each of the plots. All applications were at 187 L/ha and included a non-ionic surfactant (Activator 90) at 0.25% v/v.

The **first applications** were on **Sept. 26, 2013** for **Trt. 1-6**, with the lespedeza at 90 cm height, marestail at 125 cm, common ragweed at 115 cm, annual marsh elder at 105 cm and Indian grass at 175 cm. The **second application** was on **Oct. 21, 2013** for **Trt. 7-8.** Dormant seeded plots were **sown March 18, 2014** by mixing the seed mix with vermiculite to increase the volume and then broadcasting over the plot areas. The **last herbicide application** was on **June 8, 2014** for **Trt. 9-12** with the lespedeza at 60 to 90 cm height and the common ragweed at 30 cm.

Lespedeza control (%) was assessed at the time of the last application on June 6, 2014 for Trt. 1-6 (253 Days after Treatment) (DAT) and 228 DAT for Trt. 7-8. Lespedeza control (%) was assessed on Oct. 23, 2014 as well as % cover of lespedeza, grasses, other broadleaves, and bareground. This was 392, 367, and 139 DAT after the first, second, and third application dates, respectively. Percent cover of lespedeza, grasses, other broadleaves, and bareground were assessed on Oct. 7, 2015. This was 741, 716, and 488 DAT after the first, second, and third application dates, respectively. Data were analyzed using ARM software and treatment means were compared using Fisher's LSD at p = 0.05.

Figure 1: View of the plots at the beginning of the trial.

RESULTS & DISCUSSION

Table 1. Treatments and Results

		Rated June 6, 2014		Rated Oct. 23, 2014						Rated Oct. 7, 2015				
Trt. No.	Product	DAT[1]	Lespedeza Control (%)	DAT	Lespedeza Control (%)	Lespedeza (% cover)	Grasses (% cover)	Other Broadleaf (% cover)	Bareground (%)	DAT	Lespedeza (% cover)	Grasses (% cover)	Other Broadleaf (% cover)	Bareground (%)
1	Opensight	253	94 a[2]	392	73 b	27 d	62 ab	12 abc	0 b	741	55 c	43 b	3 ab	0 b
2	Opensight	253	94 a	392	81 b	19 de	51 bc	20 ab	10 ab	741	65 bc	31 bc	4 ab	0 b
3	PastureGard HL Milestone VM	253	54 d	392	38 c	60 bc	11 e	21 a	9 ab	741	96 a	3 d	1 ab	0 b
4	PastureGard HL Milestone VM	253	58 d	392	40 c	49 c	20 de	19 ab	14 ab	741	84 ab	15 cd	1 ab	0 b
5	Garlon 4 Ultra Milestone VM	253	38 f	392	19 e	81 a	10 e	9 bc	1 b	741	99 a	1 d	0 b	0 b
6	Garlon 4 Ultra Milestone VM	253	43 e	392	25 de	75 ab	8 e	11 abc	4 b	741	96 a	2 d	1 ab	1 a
7	Opensight	228	83 c	367	32 cd	66 abc	26 de	3 c	5 b	716	94 a	6 d	1 ab	0 b
8	Opensight	228	89 b	367	43 c	58 bc	39 cd	4 c	0 b	716	97 a	2 d	1 ab	0 b
9	PastureGard HL Milestone VM	0	0 g	139	94 a	6 e	58 abc	19 ab	15 ab	488	31 d	65 a	4 ab	0 b
10	PastureGard HL Milestone VM	0	0 g	139	96 a	5 e	52 bc	16 ab	25 a	488	25 d	70 a	5 a	0 b
11	Garlon 4 Ultra Milestone VM	0	0 g	139	98 a	3 e	77 a	14 abc	6 b	488	17 d	81 a	3 ab	0 b
12	Garlon 4 Ultra Milestone VM	0	0 g	139	97 a	3 e	78 a	9 bc	11 ab	488	14 d	84 a	3 ab	0 b

All treatments included Activator 90 @ 0.25%
Dormant seeded plots (Trt. 2, 4, 6, 8, 10, 12) were sown March 18, 2014. However no plants from this were observed at any of the assessments.

[1]Days after treatment
[2]Means followed by the same letter are not different according to Fisher's Protected LSD at P < 0.05.

The spring after fall applications of Opensight (Trt. 1-2) had good control (94%) of lespedeza with less control when applied later in the season (Trt. 7-8)(83 to 89%). The fall applications of PastureGard + Milestone and Garlon + Milestone were less effective. Application in late summer on smaller plants may have been more effective.

A year after our fall application (392 DAT) the first Opensight treatment still had good control (73 to 81%) while the late fall application (367 DAT) was less (32 to 43%). The spring applications of PastureGard + Milestone and Garlon + Milestone had good control of lespedeza (94 to 98%) 139 DAT. These treatments along with the early Opensight treatment had 3 to 27% lespedeza cover and 78 to 52% grasses as vegetative cover. The grasses were predominantly previously established Indian grass. There was a mix of other broadleaf species but most of the cover was from common ragweed. No plants from the dormant seeding were observed at any of the assessments. Perhaps we would have had better results if had sown the seed mix on the snow so it had good moisture availability early in the season.

By fall in 2015 (741 DAT) lespedeza was dominant in many plots. We still had good control with the early Opensight (55 to 65% cover) and spring applications (14 to 31% cover). These treatments had 31 to 84% grasses as cover. There were not many other broadleaf species at this end of season rating. We had a wet July with 4.6 inches more precipitation than the long term average which may have resulted in good growth of the lespedeza and Indian grass plants.

SUMMARY

An early fall application of Opensight was effective for lespedeza control while a very late application was not. Fall applications of PastureGard + Milestone and Garlon + Milestone were not very effective but spring applications were, when the plants were smaller and actively growing. Controlling lespedeza resulted in more growth of already established grasses like Indian grass. Herbicides can be effective management tools in promoting desirable prairie species.

PastureGard HL and Opensight can both provide excellent control of lespedeza when timed correctly. The land manager has to be aware of this as well as the residual activity of the product applied. Given the lack of soil residual activity from PastureGard HL, a quicker plantback time can be achieved but it's more likely other broadleafs can reinvade. Opensight on the other hand provides excellent residual control of other broadleafs but requires a delay in overseeding. It's recommended that PastureGard be used June through early September and Opensight be used in September and early October.

Brooke, J.M., and Harper, C.A. 2016. Herbicides are Effective for Reducing Dense Native Warm-season Grass and Controlling a Common Invasive Species, Sericea Lespedeza. Journal of the Southeastern Association of Fish and Wildlife Agencies 3:178–184

Dow Agrosciences, 2012. Invasive Plant Management with Milestone® and Other Herbicides: A Practical And Technical Guide For Natural Area Managers

PGR Options for Roadside Tall Fescue Management (2017 – 2018)

Joe Omielan and Michael Barrett
University of Kentucky

INTRODUCTION

Tall fescue is a widely adapted species and is commonly used on roadsides in the transition zone. Multiple mowings are the most common tall fescue management regime for transportation departments. Plant Growth Regulators (PGRs) could potentially reduce mowing while maintaining safe highway conditions. PGRs are currently classified into six categories, Classes A – F, based on their mechanism of action. This trial includes examples of Class A, C, and D PGRs and was established to evaluate some PGR options for roadside management. Class A are late GA synthesis blockers, Class C are mitotic/cell division inhibitors, and Class D are herbicidal.

OBJECTIVE

Evaluate the effect of effect of selected PGRs on tall fescue color, seedhead production, and growth.

MATERIALS & METHODS

The trial was established in 2017 and 2018 at the Spindletop Research Farm in Lexington KY. It was arranged as a complete block design with 21 PGR treatments and three replications. Plots were 2 m by 6 m with running unsprayed checks between each of the plots. PGRs were applied before the first mowing and one to two weeks after each of the three mowings. The control had no PGR applied. Mowing was done May 22, July 26, and September 26 in 2017 and May 29, August 10, and October 11 in 2018.

Products tested were Embark 2S (mefluidide [Class C]) at 24 fl oz/A, Plateau (imazapic)(Class D) at 2 fl oz/A, Opensight (aminopyralid + metsulfuron methyl [Class D]) at 2.5 fl oz/A, Anuew (prohexadione calcium [Class A]) at 1 lb/A, and Perspective (aminocyclopyrachlor + clorsulfuron [Class D]) at 4.75 oz/A. All applications were at 234 L/ha and included a non-ionic surfactant at 0.25% v/v. Application dates were April 26, June 1, August 8, and October 6 in 2017 and April 29, June 11, August 24, and October 19 in 2018.

Tall fescue color was assessed by comparison to the running check strips. The color rating ranges from 0 (dead) to 9 (full green). The color of the check strips was set at 8. Seedhead density was assessed before the first mowing. Canopy heights were measured every two weeks through the growing season. Data were analyzed using ARM software and treatment means were compared using Fisher's LSD at p = 0.05.

Figure 1. Example of plot with reduced tall fescue color, height, and seedhead density 26 days after the April 26 application in 2017.

RESULTS & DISCUSSION

Table 1. Tall fescue color, canopy height, and seedhead density 30 days after the April 29 application.

Product(s)	Color (0-9)	Canopy Ht (in)	Seedhead Density (%)
Embark 2S	6.8 *b*	17 *c*	28 *c*
Plateau	5.7 *c*	11 *d*	0.3 *d*
Opensight	6.7 *b*	14 *cd*	25 *cd*
Anuew	8.0 *a*	35 *b*	57 *b*
Perspective	6.0 *c*	17 *b*	13 *cd*
Control	8.0 *a*	44 *a*	100 *a*

Means followed by the same letter are not different according to Fisher's Protected LSD at P < 0.05.

Table 2. Tall fescue color and canopy height 31 days after the June 14 application.

Product(s)	Color (0-9)	Canopy Ht (in)
Embark 2S	6.2 *c*	12 *def*
Plateau	7.0 *b*	12 *efg*
Opensight	7.3 *ab*	13 *def*
Anuew	7.7 *ab*	11 *fg*
Perspective	7.2 *b*	11 *g*
Control	8.0 *a*	15 *abc*

Means followed by the same letter are not different according to Fisher's Protected LSD at P < 0.05.

Table 3. Tall fescue color and canopy height 28 days after the August 24 application.

Product(s)	Color (0-9)	Canopy Ht (in)
Embark 2S	5.8 *b*	15 *bcd*
Plateau	6.0 *b*	15 *cd*
Opensight	6.3 *b*	16 *bcd*
Anuew	7.7 *a*	14 *d*
Perspective	6.3 *b*	16 *bcd*
Control	8.0 *a*	20 *a*

Means followed by the same letter are not different according to Fisher's Protected LSD at P < 0.05.

Table 4. Tall fescue color and canopy height 30 days after the October 19 application.

Product(s)	Color (0-9)	Canopy Ht (in)
Embark 2S	7.8 *a*	13 *ab*
Plateau	6.7 *b*	11 *ef*
Opensight	6.5 *b*	11 *def*
Anuew	7.9 *a*	12 *cdef*
Perspective	6.7 *b*	10 *f*
Control	8.0 *a*	13 *abc*

Means followed by the same letter are not different according to Fisher's Protected LSD at P < 0.05.

Figure 2. Tall fescue color in plots treated with PGRs on April 29 through the season. Red cells indicate the tall fescue was less green than the control and yellow cells indicate color equal to the control (P < 0.05).

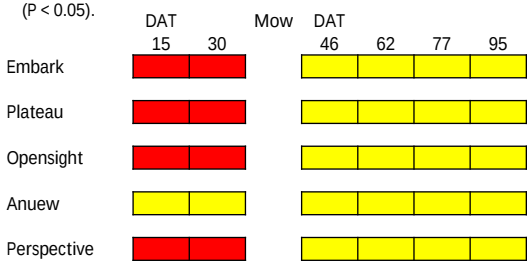
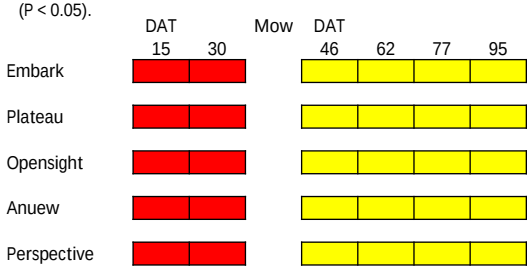


Figure 3. Tall fescue canopy height in plots treated with PGRs on April 29 through the season. Red cells indicate the tall fescue height was less than the control and yellow cells indicate height equal to the control (P < 0.05).



SUMMARY

The effects of the PGR treatments were variable in the two years. Plateau, Opensight and Perspective reduced seedhead density and height after the first application timing in 2017 (data not shown) while all treatments did so in 2018 (Table 1 and Figure 1). Tables 1-4 show data for the plots at a similar time after all four application timings in 2018.

In general, many of the treatments reduced grass height along with turf color but color recovered (Figures 2 and 3). Anuew had less effect on color than the other treatments at most of the ratings.

Growth reduction was observed to extend beyond mowing cycles in 2017 (data not shown) but in 2018 with above average moisture this was not the case.

Plots that were treated late in the season in 2017 had some seedhead suppression next spring. Plots treated late in the 2018 season (October 19) will be evaluated in 2019 for spring seedhead suppression.

2018 Roadside Environment Update

Thursday March 29, 2018 at KYTC District 7 Office

763 New Circle Road, NW Lexington, KY

Agenda

8:30 – 9:00 a.m. Coffee, Orange Juice & Donuts

9:00 – 9:10 a.m. Opening Remarks (David Cornett)

9:10 – 10:00 a.m. Summary and discussion of Research Trials (part 1) (information on dormant stem, guardrail (bareground chemistries), and wildflower trials plus summary of water quality testing) (Cat. 3, 6, 10) (Dr. Joe Omielan)

10:00 – 10:30 a.m. New herbicide products and mixes (Greg Ressler, Red River Specialities)

10:30 – 11:30 a.m. Summary and discussion of Research Trials (part 2) (information on PGR and johnsongrass trials plus knapweed biocontrol update) (Cat. 3, 6, 10) (Dr. Joe Omielan)

11:30 – 12:00 p.m. Pollinator Conservation Agreement with US Fish and Wildlife Service (General) (Dave Harmon and Ellen Mullins, KYTC)

12:00 – 12:40 p.m. Lunch (Box Lunches)

12:40 – 1:00 p.m. "Secrets" to success with flower plots (General) (Paul Hayse, KYTC District 4)

1:00 – 2:00 p.m. Contract Administration (Jodyi Hall, KYTC Purchasing)

2:00 – 3:00 p.m. KYTC Master Agreement Contract Update / Proposed Changes Discussion (Darrell Burks, KYTC)

Pesticide CEUs approved: General (*1 CEU*)
Cat. 3, 6, 10 *(2 CEU*)

Attendance: 34 KYTC, 2 UK, 1 Industry

Breakdown of KYTC attendance: Central Office (4), Dept. Environ. Analysis (2), DHE Office (1) D1 (4), D2 (1), D3 (1), D4 (3), D5 (2), D6 (5), D7 (3), D8 (2), D9 (1), D10 (2), D11 (2)

Vegetation Management for Highway Rights of Way Workshop
Thursday August 16, 2018 at Morgan County Extension Office,
1002 Prestonsburg Street, West Liberty KY 41472

Agenda

8:30 – 9:00 a.m. Registration (coffee and donuts)

9:00 – 10:00 a.m. Weed ID (Dr. JD Green) (Group A) & Herbicide Injury Demo (Dr. Joe Omielan) (Group B)

10:00 – 11:00 a.m. Weed ID (Dr. JD Green) (Group B) & Herbicide Injury Demo (Dr. Joe Omielan) (Group A)

11:00 – 12:00 p.m. Turf and Landscape Management (Dr. Gregg Munshaw) (fertility on mowed turf, mowing heights, turf/landscape weeds, managing pollinator plots/waystations)

12:00 – 1:00 p.m. Lunch

1:00 – 2:00 p.m. Pesticide Spill Response (Dr. Ed McCracken) with the assistance of the D10 Crew and their spray truck.

2:00 – 3:00 p.m. Tour of Morgan County Demonstration Farm (Sarah Fannin and Tom Steele, Morgan County Extension) (warm season grasses, potential new crops (i.e., hemp, tea), harvesting and redirecting water from roofs, maintaining good drainage, keeping cattle watered and happy, fencing and pasture management)

CEU's in this workshop: 3 General and 2 Specific (Categories 3, 5, 6, 10, 12) (approved)

Dr. JD Green will provide information and practice in identifying crops and weeds. (Cat. 3, 5, 6, 10, 12)

Dr. Joe Omielan will lead the group in an exercise examining herbicide injury symptoms on different crop species (Cat. 3, 5, 6, 10, 12)

Dr. Gregg Munshaw will provide information on fertility management such as slow release N fertilizers, benefits of higher mowing heights, managing turf / landscape weeds and managing pollinator plots/waystations (General)

Dr. Ed McCracken will provide information on how to respond to and clean up pesticide spills. The D10 Crew and their spray truck will demonstrate how to respond to a spill. (General)

Sarah Fannin and Tom Steele will lead us on a tour of the Morgan County Demonstration Farm and some of the projects they are working on. They will include warm season grasses, potential new crops (i.e., hemp, tea), water management, harvesting and redirecting water from roofs, maintaining good drainage, keeping cattle watered and happy, fencing and pasture management. (General)

For more information contact Joe Omielan at 859-967-6205, e-mail joe.omielan@uky.edu

Attendance: 36 KYTC, 4 UK

Breakdown of KYTC attendance: Central Office (2), Dept. Environ. Analysis (1)
D5 (4), D6 (6), D9 (8), D10 (9), D11 (5), D12 (1)