Noncrop and Invasive Vegetation Management Weed Science

2016 Annual Research Report

UNIVERSITY
OF KENTUCKY

College of Agriculture
Department of Plant and Soil Sciences

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INFORMATION NOTE 2016 NCVM-1

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Forward

The information provided in this document represents a collaborative effort between the Roadside Environment Branch (REB) of the Kentucky Transportation Cabinet (KTC) 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 2016 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.

Direct any questions, concerns, complaints, or praise regarding this publication to:

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

BASF Corporation
Bayer Crop Science
Dow AgroSciences
DuPont
Nufarm
PBI Gordon

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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
Ambrosia trifida L.	Giant Ragweed
Andropogon virginicus L.	Broomsedge
Apocynum cannabinum L.	Hemp Dogbane
Aralia spinosa L.	Devil's Walking Stick
Arundo donax L.	Giant Reed
Bromus secalinus L.	Cheat
Conium maculatum L.	Poison Hemlock
Digitaria sanguinalis (L.) Scop.	Large Crabgrass
Erigeron canadensis (L.) Cronquist	Marestail
Erigeron philadelphicus L.	Philadelphia Fleabane
Euphorbia maculata L.	Spotted Spurge
Festuca arundinaceum (Schreb.) S.J. Darbyshire	Tall Fescue
Liquidambar styraciflua L.	Sweetgum
Liriodendron tulipifera L.	Tulip Poplar
Lonicera japonica Thunb.	Japanese Honeysuckle
Lonicera maackii (Rupr.) Herder	Amur Honeysuckle
Medicago lupulina L.	Black Medic
Panicum dichotomiflorum Michx.	Fall Panicum
Plantago lanceolata L.	Buckhorn Plantain
Poa pratensis L.	Kentucky Bluegrass
Polygonum cuspidatum Siebold & Zucc.	Japanese Knotweed

Pueraria montana (Lour.) Merr.	Kudzu
Rubus allegheniensis	Blackberry
Rhus glabra L.	Smooth Sumac
Setaria faberi Herrm.	Giant Foxtail
Setaria pumila (Poir.) Roem. & Schult.	Yellow Foxtail
Sorghum halepense (L.) Pers.	Johnsongrass
Ulmus alata Michx.	Winged Elm

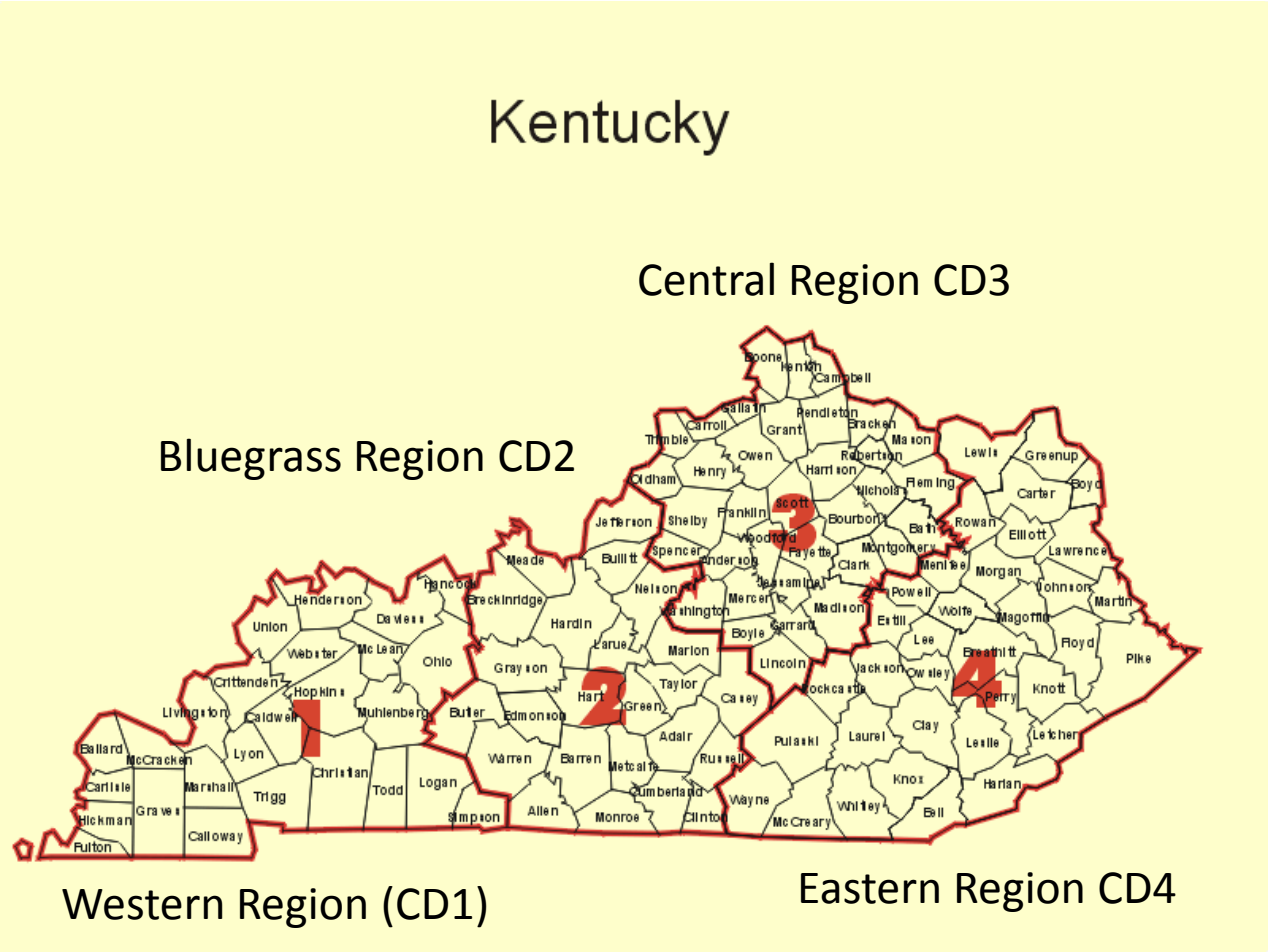
Herbicide List

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

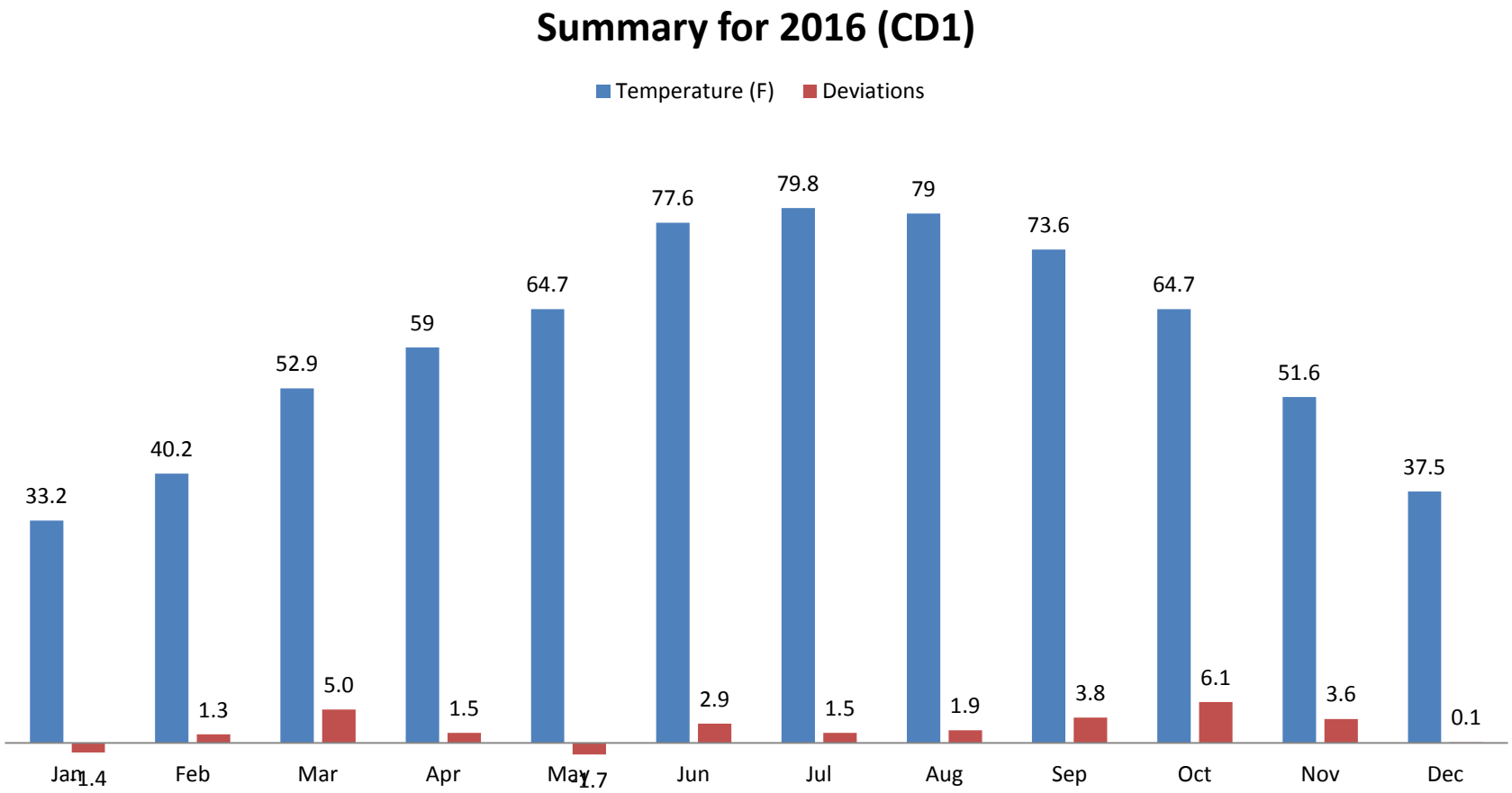
Product	Active Ingredient(s)	Concentration	Manufacturer
Acclaim Extra	fenoxaprop	0.57 lb per gallon	Bayer
Aneuw	prohexadione calcium	27.5% w/w	Nufarm
BK 800	2,4-D + 2,4-DP + dicamba	1.89 lb ae + 0.94 lb ae + 0.47 lb ae per gallon	PBI Gordon
Cleantraxx	penoxsulam + oxyfluorfen	0.083 lb + 3.93 lb per gallon	Dow AgroSciences
Embark 2-S	mefluidide	2.0 lb ae per gallon	PBI Gordon
Endurance	prodiamine	65% w/w	Syngenta
Esplanade	indaziflam	1.67 lb per gallon	Bayer
Formula 40	2,4-D	3.67 lb ae per gallon	Nufarm
Fusilade II	fluazifop	2 lb per gallon	Syngenta
Garlon 3A	triclopyr amine	3 lb ae per gallon	Dow AgroSciences
Garlon 4 Ultra	triclopyr ester	4 lb ae per gallon	Dow AgroSciences
Hyvar X	bromacil	80% w/w	DuPont
Journey	imazapic + glyphosate	0.75 lb ae + 1.5 lb ae per gallon	BASF
Milestone VM	aminopyralid	2 lb ae per gallon	Dow AgroSciences
Milestone VM Plus	aminopyralid + triclopyr	0.1 lb ae + 1.0 lb ae per gallon	Dow AgroSciences
Opensight	aminopyralid + metsulfuron	0.525 lb ae + 0.0945 lb ae per gallon	Dow AgroSciences
Oust XP	sulfometuron	75% w/w	DuPont
Outrider	sulfosulfuron	75% w/w	Monsanto
Patriot	metsulfuron	60% w/w	Nufarm
Patron 170	2.4-D + 2,4-DP	1.71 lb ae + 0.87 lb ae per gallon	Nufarm
Payload	flumioxazin	51% w/w	Valent
Pendulum AquaCap	pendimethalin	3.8 lb 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
Proclipse	prodiamine	65% w/w	Nufarm
Pyresta	2,4-D + pyraflufen-ethyl	3.5 lb ae + 0.0177 lb per gallon	Nichino America
Razor Pro	glyphosate	3 lb ae per gallon	Nufarm

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
Streamline	aminocyclopyrachlor + metsulfuron methyl	39.5% + 12.6% w/w	DuPont
Transline	clopyralid	3 lb ae per gallon	Dow AgroSciences
Viewpoint	imazapyr + aminocyclopyrachlor + metsulfuron	31.6% + 22.8% + 7.3% w/w	DuPont

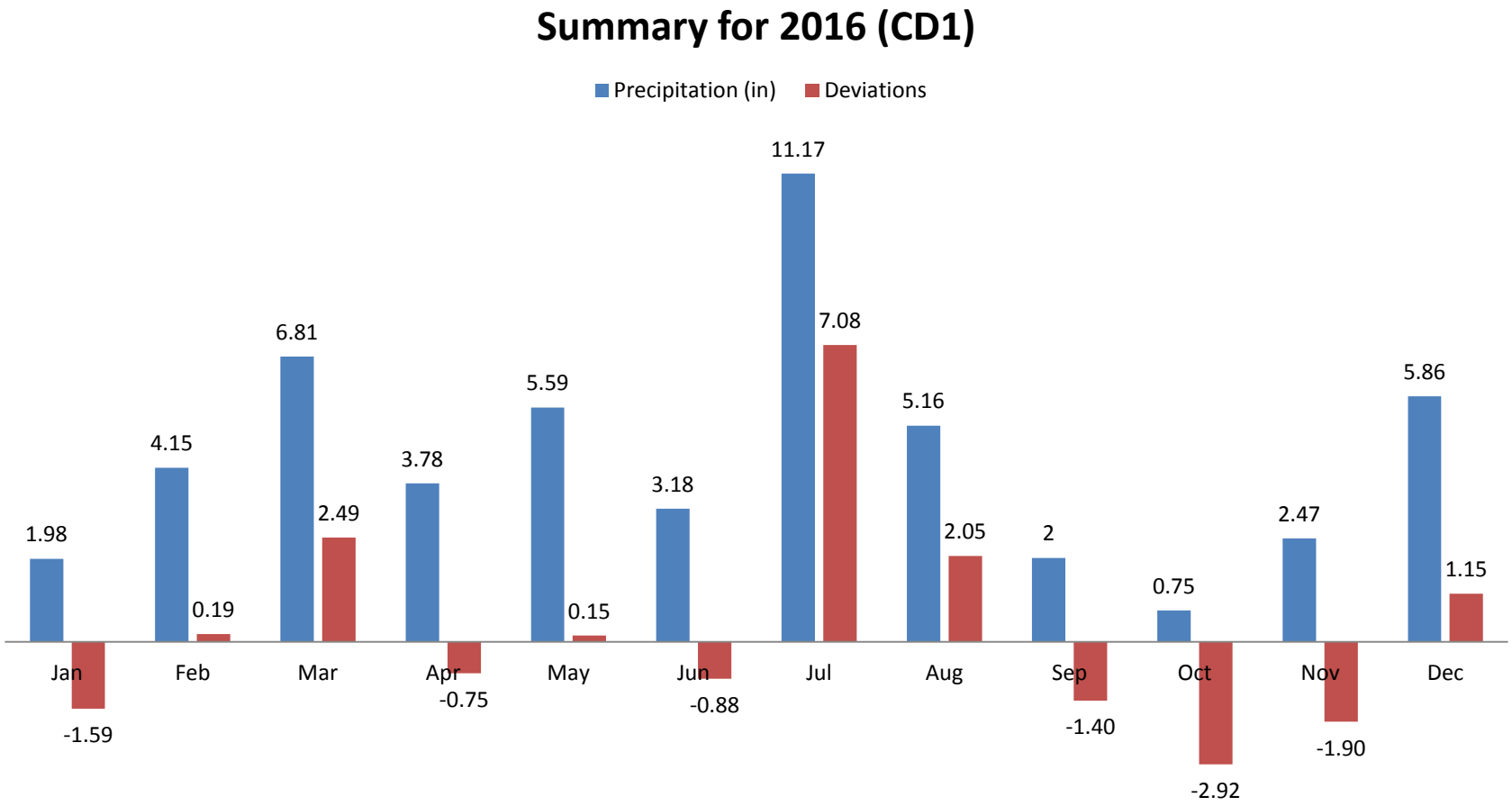
Map of Kentucky Climate Divisions



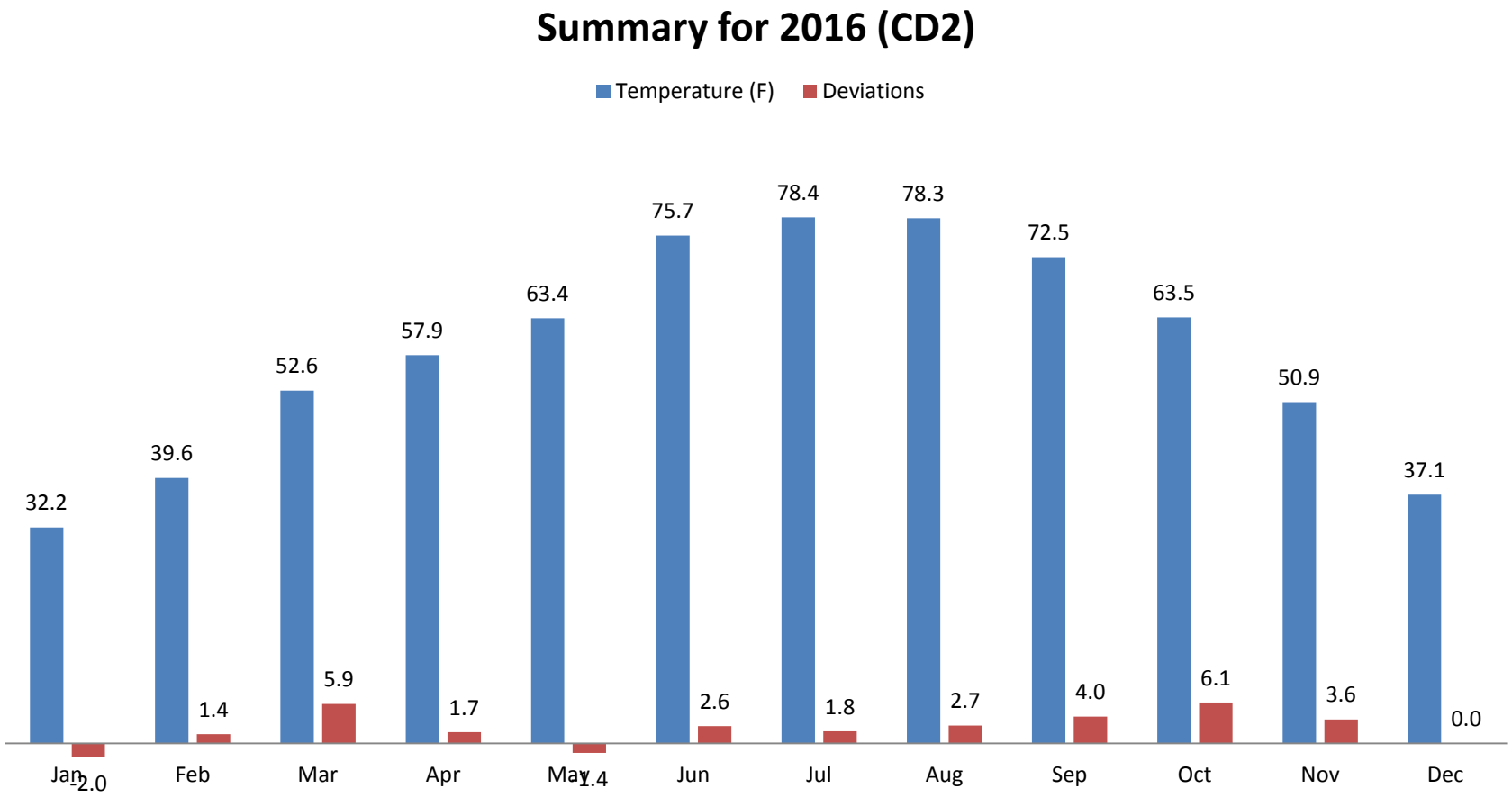
Western Region (CD1) Monthly Temperatures and Deviations from Normal (UKWAC)



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



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



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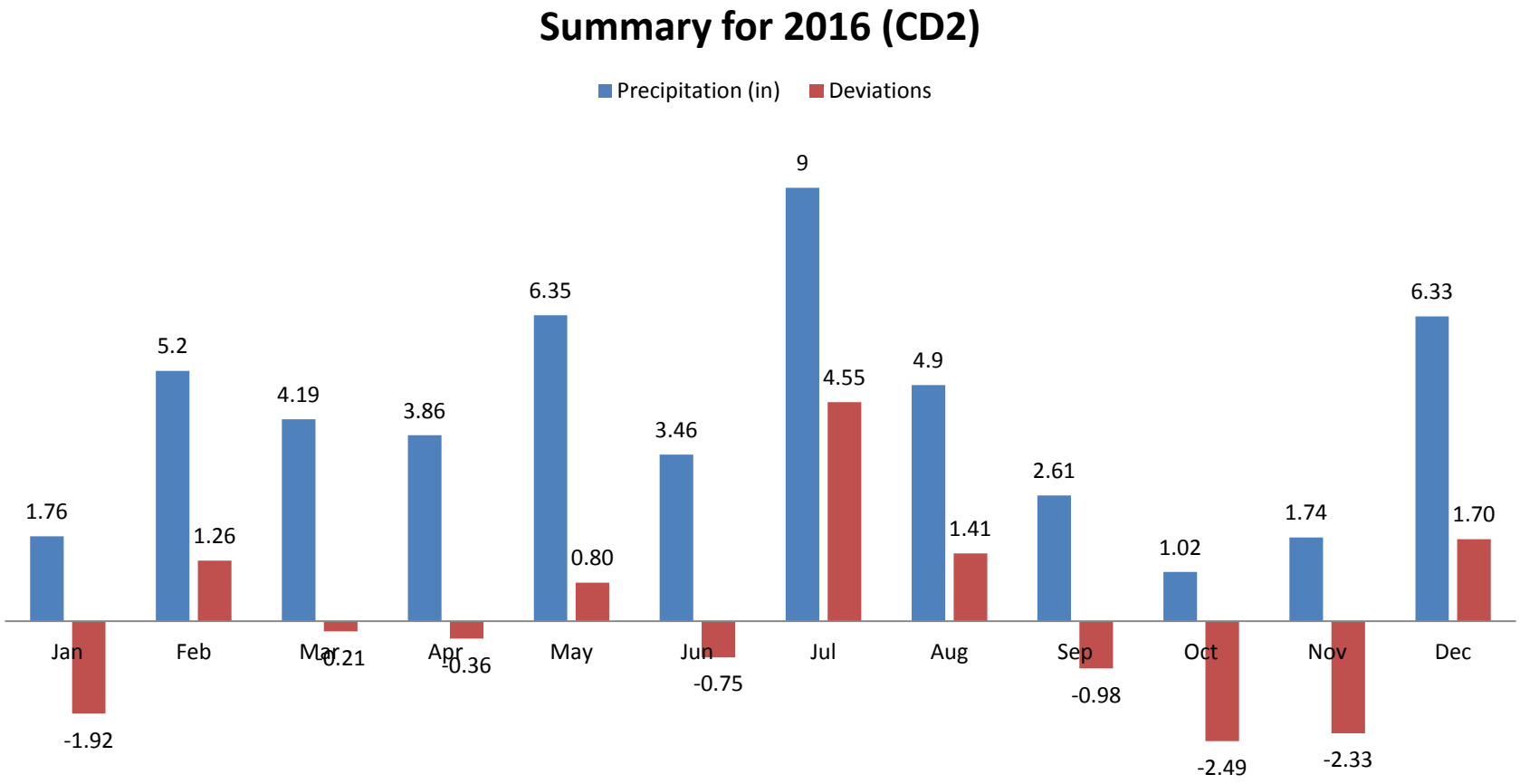
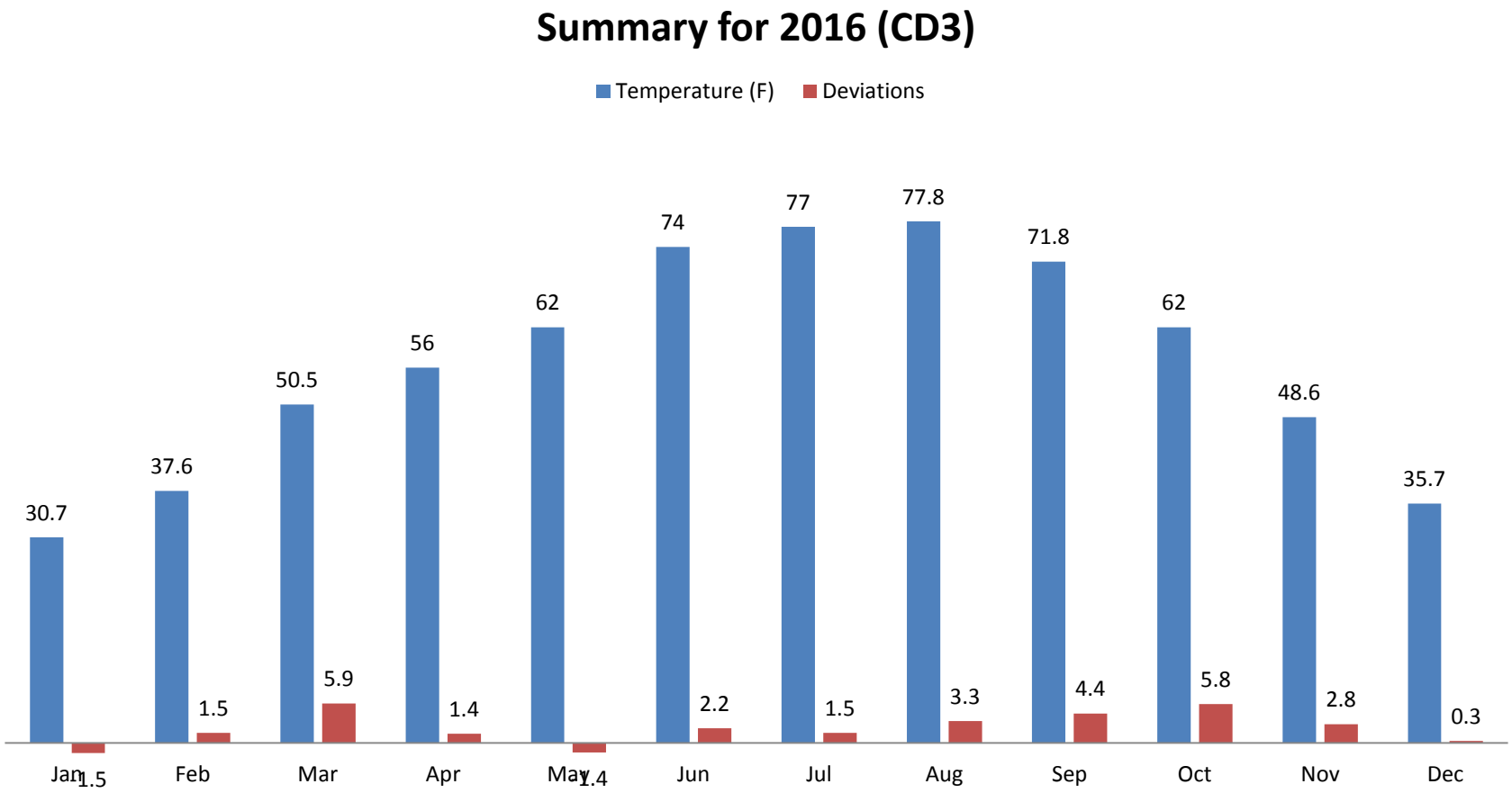
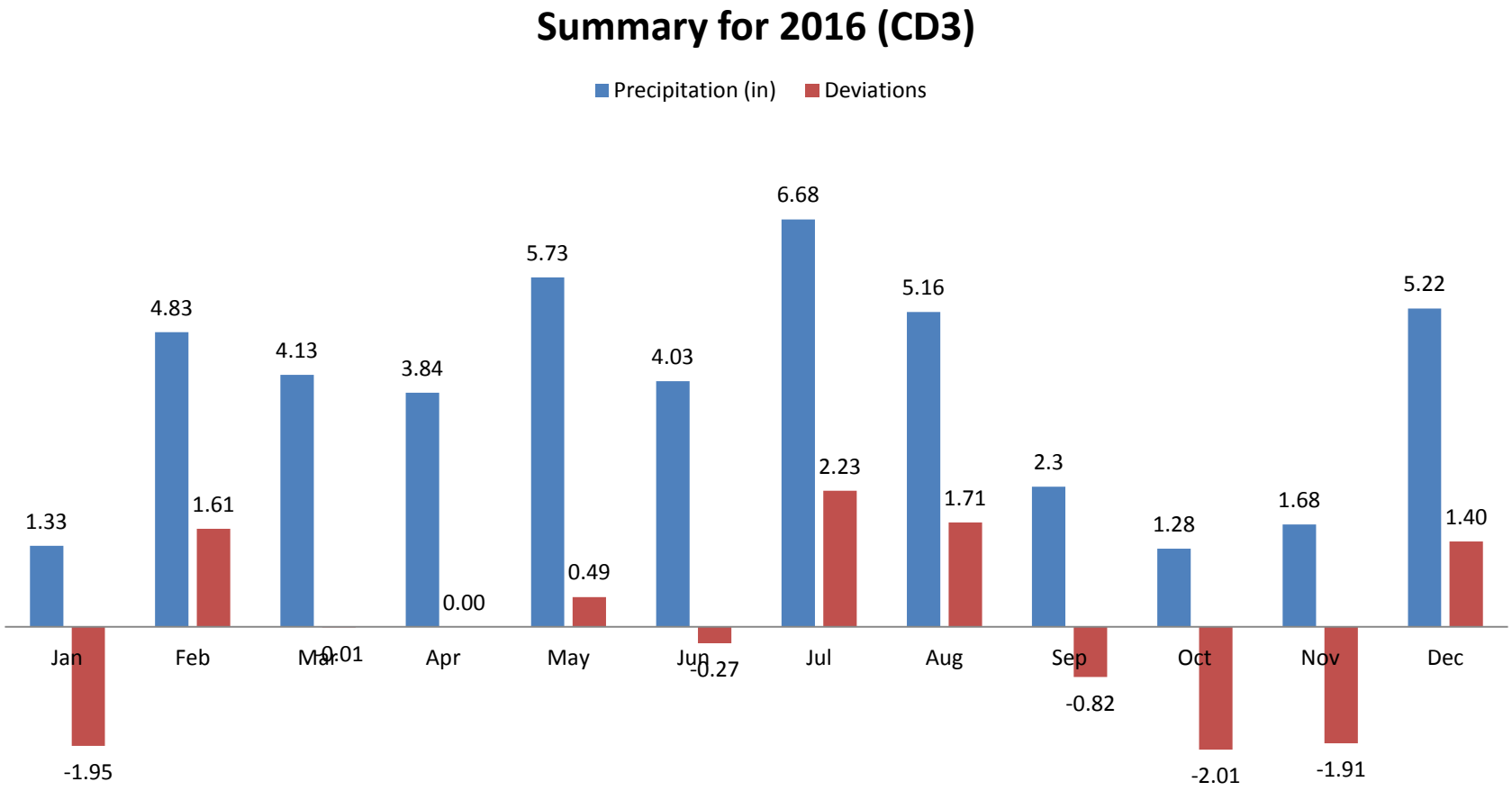
Central Region (CD2) Monthly Precipitation and Deviations from Normal (UKWAC)



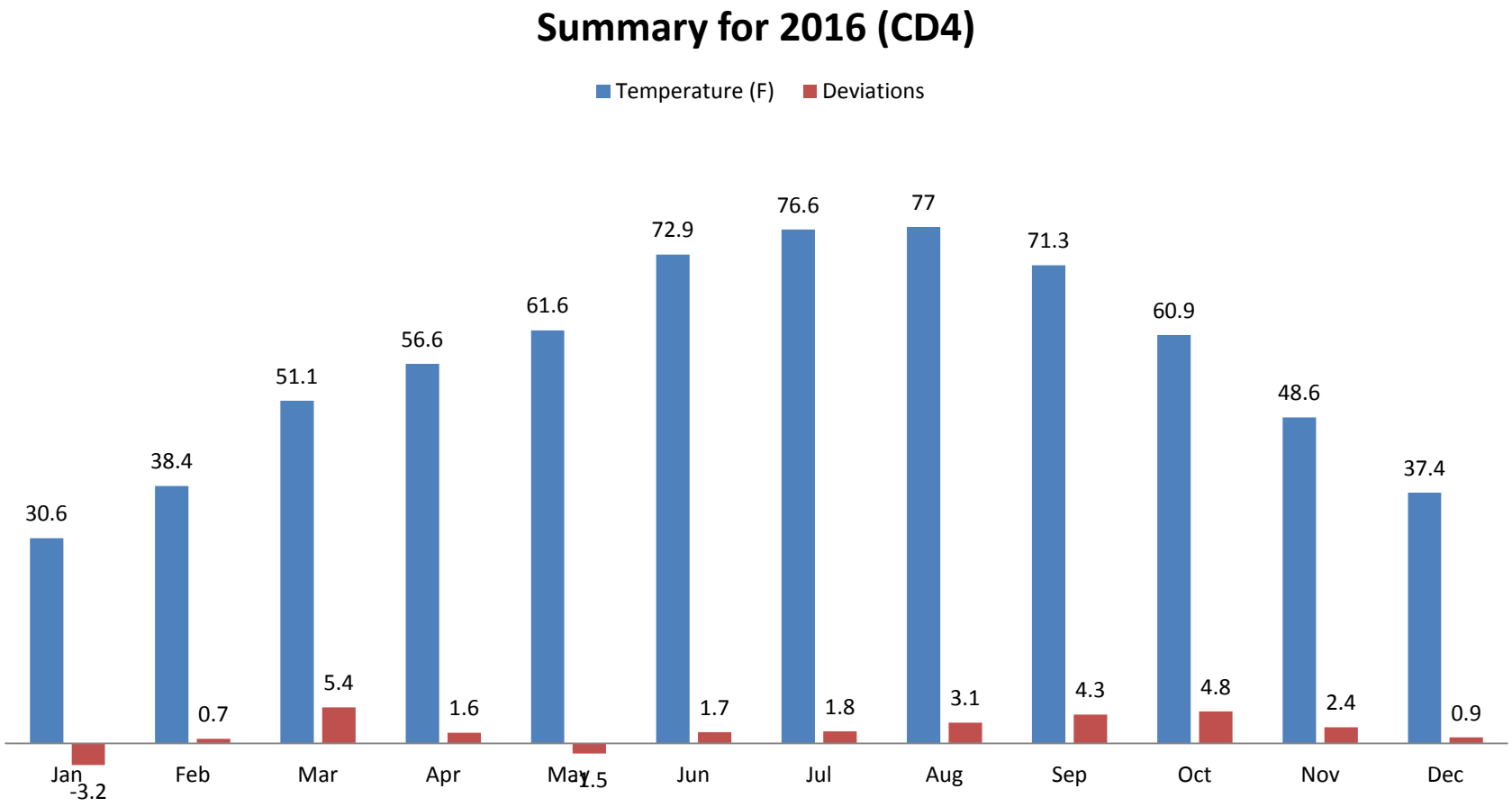
Bluegrass Region (CD3) Monthly Temperatures and Deviations from Normal (UKWAC)



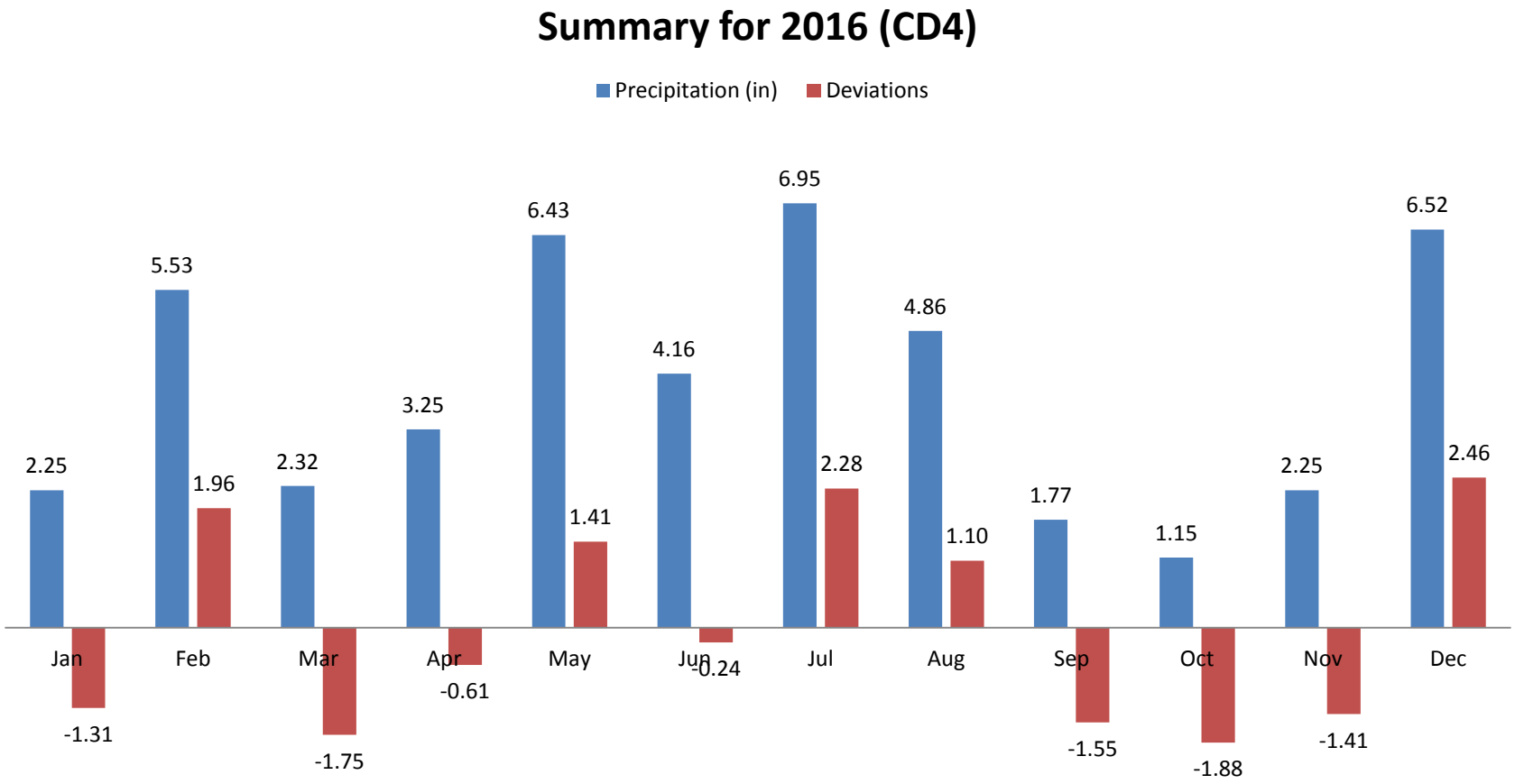
Bluegrass Region (CD3) Monthly Precipitation and Deviations from Normal (UKWAC)



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



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



2015 Johnsongrass Control x Mowing Timing Trial

Introduction

Johnsongrass (*Sorghum halepense*) is a perennial warm season grass, listed as a noxious weed in Kentucky (Kentucky Revised Statutes http://www.lrc.state.ky.us/KRS/176-00/051.PDF), and is a common problem on right-of-ways. There are a number of herbicides labeled and available to control johnsongrass on right-of-ways. A key to achieving high levels of johnsongrass control is translocation of the herbicide from the leaves to the rhizomes. However, routine mowing, as part of roadside management, could reduce johnsongrass control by removing leaf material along with the herbicide applied to it before translocation occurs. A practical question from managers is: "How long after a herbicide application do we need to wait before mowing without reducing herbicide efficacy on johnsongrass?" We repeated a study originally conducted in 2014 in 2015 to answer this question. Here we report the results collected in 2015 plus final control ratings taken in 2016.

Materials and Methods

The study was established August 24, 2015 at an interchange near Bardstown KY. Four herbicide treatments (Outrider [sulfosulfuron] 0.25 oz/A, Fusilade II [fluazifop] 6 oz/A, Acclaim Extra [fenoxaprop] 2.8 oz/A, and Acclaim Extra plus Fusilade II [0.5 and 3.5 oz/A] were applied to 10 ft x 60 ft strips. Applications were made at 30 gallons per acre carrier volume and included either a surfactant or a crop oil concentrate (Table 1). The herbicide treatments were applied when johnsongrass plants were, on average, 36 inches tall with a range from 30 to 48 inches. Six mowing treatments, the same day as herbicide treatment, one day after herbicide treatment (AHT), 2 days AHT, one week AHT, two weeks AHT, or no mowing (Table 2) were performed four times as 10 ft x 40 ft strips across the herbicide treatments in a split block design. Mowing height was 4 inches. Visual assessments of percent johnsongrass control were done 32 (9/25/2015), 45 (10/8/2015), 53 (10/16/2015), and 298 (6/17/2016) 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

In this (2015) trial, regrowth of johnsongrass after mowing was slower than in 2014. One reason may be the timing of rainfall. There was 6.3 inches of rain in August 2014 but only 2.8 inches in August 2015 (long term rainfall average for August, for this region, is 3.5 inches). Environmental variability between years is one reason experiments should be conducted in more than one year. The data from the 2014 trial suggested that a 1 or 2 day mowing delay after Fusilade II and Fusilade II plus Acclaim Extra application or a 1 to 2 week mowing delay after Acclaim Extra treatment were necessary for best johnsongrass control (see 2015 report).

In this trial, 32 DAT all the unmowed plots had less control (76-80%) than the best control in the mowed plots (98-89%) (Table 3). Acclaim Extra mowed the same day as the application had less control than the other herbicide treatments that were mowed the same day as they were

applied. At 45 DAT, there were more symptoms on and control of the unmowed plots but not much new growth on the mowed plots (Table 4). The Acclaim Extra and the Acclaim + Fusilade plots mowed the same day had the lowest control ratings 53 DAT (Table 5).

Control of perennial weeds like johnsongrass requires a sustained effort and assessing herbicide efficacy requires assessments into the next growing season. Did the treatments suppress growth or did they control the plants? The next year (2016), 298 DAT, the growth between replications for individual treatments was very variable making it difficult to statistically separate treatment effects (Table 6). However, the Acclaim Extra treatment mowed the same day as application still had the lowest numerical control rating.

The results suggest there is no reason to change the recommendations based on the results of the trial started in 2014. These trials suggest that managers have more flexibility in timing with some products. However, you still want to wait a week or two after spraying Acclaim Extra before mowing.

Table 1. Herbicide Treatments and Active Ingredients for Mowing x Johnsongrass Control Trial

Treatment	Product Name	Rate	Rate Unit	Active Ingredient(s)	ai Rate (per acre)
1	Outrider Activator 90	1 0.25	OZ/A % V/V	sulfosulfuron	0.25 oz
2	Fusilade II Activator 90	24 0.25	FL OZ/A % V/V	fluazifop	6 oz
3	Acclaim Extra Activator 90	39 0.25	FL OZ/A % V/V	fexoxaprop	2.8 oz
4	Acclaim Extra Fusilade II COC	7 14 1	FL OZ/A FL OZ/A % V/V	fexoxaprop fluazifop	0.5 oz 3.5 oz

Table 2. Timing of Mowing Treatments

Treatment	Timing of Mowing Treatment
1	Same day as herbicide application
2	1 Day after herbicide application
3	2 Days after herbicide application
4	1 Week after herbicide application
5	2 Weeks after herbicide application
6	No Mowing

Table 3: Johnsongrass Control (%) 32 Days after Treatment in 2015

Mowing Time after Application	Outrider	Fusilade II	Acclaim Extra	Acclaim + Fusilade
Same day	89 *abcde*	89 *abcd*	84 *cdef*	86 *bcdef*
1 Day	94 *ab*	92 *abc*	97 *a*	95 *ab*
2 Days	95 *ab*	94 *abc*	97 *a*	95 *ab*
1 Week	95 *ab*	94 *abc*	95 *ab*	97 *a*
2 Weeks	97 *a*	95 *ab*	97 *a*	98 *a*
No Mowing	80 *def*	76 *f*	80 *def*	78 *ef*

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

Table 4: Johnsongrass Control (%) 45 Days after Treatment in 2015

Mowing Time after Application	Outrider	Fusilade II	Acclaim Extra	Acclaim + Fusilade
Same day	90 *ab*[1]	90 *ab*	84 *b*	84 *b*
1 Day	90 *ab*	91 *ab*	92 *ab*	95 *a*
2 Days	92 ab	93 *ab*	94 *ab*	93 *ab*
1 Week	*96 a*	93 *ab*	93 *ab*	92 *ab*
2 Weeks	93 *ab*	93 *ab*	92 *ab*	87 *ab*
No Mowing	89 *ab*	89 *ab*	92 *ab*	84 *b*

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

Table 5: Johnsongrass Control (%) 53 Days after Treatment in 2015

Mowing Time after Application	Outrider	Fusilade II	Acclaim Extra	Acclaim + Fusilade
Same day	81 *abc*[1]	85 *abc*	72 *c*	75 *bc*
1 Day	83 *abc*	91 *a*	91 *a*	90 *ab*
2 Days	93 *a*	89 *ab*	90 *ab*	87 *ab*
1 Week	90 *ab*	86 *abc*	88 *ab*	93 *ab*
2 Weeks	87 *ab*	88 *ab*	89 *ab*	91 *a*
No Mowing	89 *ab*	87 *ab*	95 *a*	96 *a*

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

Table 6: Johnsongrass Control (%) 298 Days after Treatment in 2015

Mowing Time after Application	Outrider	Fusilade II	Acclaim Extra	Acclaim + Fusilade
Same day	48 *a*[1]	36 *ab*	13 *b*	21 *ab*
1 Day	38 *ab*	41 *ab*	21 *ab*	24 *ab*
2 Days	55 *a*	54 *a*	36 *ab*	48 *a*
1 Week	55 *a*	51 *a*	29 *ab*	29 *ab*
2 Weeks	51 *a*	50 *a*	36 *ab*	23 *ab*
No Mowing	50 *a*	38 *ab*	23 *ab*	23 *ab*

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

2014 / 2016 Kudzu Control Trial

Introduction

Kudzu (*Pueraria montana*) is an invasive deciduous twining, trailing, mat-forming, woody leguminous vine that forms dense infestations along forest edges, rights-of-way, old homesteads, and stream banks. It colonizes by vines rooting at nodes and spreads by seed dispersal. The plants have extensive root systems with large tuberous roots that can be 3 to 10 feet deep. Kudzu can dominate a site to the exclusion of other vegetation. Repeated herbicide applications, along with other management measures, are required to reduce the kudzu infestations. Vegetation managers in many states use picloram for kudzu control but it has not been used extensively in KY in recent years (W. Witt, personal communication). This trial evaluated the efficacy of some potential alternate herbicide options to picloram for kudzu control.

Materials and Methods

This study was initiated on June 24, 2014 by mowing a kudzu-infested abandoned tobacco field near Beattyville KY. The field had been burned in March, 2014 and the dominant vegetation was a mix of kudzu and giant ragweed at the time of mowing. Plots were 30 feet by 30 feet with 10 foot alleys separating them and were arranged in a 10 treatment randomized complete block design with three replications. On July 25, 2014, after kudzu regrowth, 9 herbicide treatments were applied in 30 gallons per acre carrier. The average kudzu canopy height was 14 inches with a range of 9 to 18 inches. Two of the treatments (Garlon 1.5 gal/A and Rodeo 4 qt/A) were reapplied on September 25, 2014. These same treatments were reapplied on July 23 and September 24 in 2015. Alleyways were mowed and Milestone was applied to minimize encroachment of kudzu from outside the trial area and from outside the plots in 2014 and 2015 but not in 2016, as described by Minogue et al (2011). Encroachment seemed to be "under control" early in 2016 but we were only able to complete the mid season assessment as kudzu had encroached on the trial area and no end of season assessment was done.

Table 1 lists the treatments, active ingredients and application rates. All the treatments were applied at the maximum annual amount specified on the herbicide product label. Garlon 3A and Rodeo can be applied more than once per year so one treatment of each (Treatments 4 and 6) received half the maximum rate in July and again in September. Most treatments included a non-ionic surfactant (Activator 90) at 0.5% v/v except for the Streamline treatment that included methylated seed oil (MSO) at 1% v/v. Visual assessments of percent kudzu control and green vegetative cover (0-100%) were done 32 (8/26/2014) and 62 (9/25/2014) days after initial treatment (DAIT) in 2014. Visual assessments of percent green vegetative cover by kudzu, grasses, and other broadleaves, as well as percent bare ground, were done 363 (7/23/2015) and 426 (9/24/2015) DAIT in 2015. Visual assessments of percent green vegetative cover by kudzu, grasses, giant ragweed, and broadleaves other than kudzu were done 689 (6/13/2016) and 760 (8/23/2016) DAIT in 2016. Data were analyzed using ARM software and treatment means were compared using Fisher's LSD at $p = 0.05$.

Results and Discussion

In 2014, all the treatments, with the exceptions of Transline and Patron 170, controlled kudzu 98% or better 32 DAIT (Table 2). Control with Transline and Patron 170 was still good 32 DAIT, but only 92%. However, by 62 DAIT, control with Patron 170 declined to 72% while control with Transline was 96% (Table 2). Streamline, Garlon 3A (either as a single or split application), and Opensight all resulted in better control (99-100%) than Transline or Patron 170 62 DAIT. Control with Rodeo (either as a single or split application, 99 and 98%, respectively) and BK 800 (98%) 62 DAIT was higher than Patron 170 but not significantly different than the other treatments.

Transline and Patron 170 allowed for more regrowth of vegetation than the other treatments, 83 and 70% green vegetation cover, respectively, 32 DAIT (Table 2). However, by 62 DAIT, these treatments, as well as the split Garlon treatment, both Rodeo treatments, and BK 800, had green vegetation cover equal to that of the untreated plots (Table 2). Streamline was the most injurious to other vegetation (13% green cover) followed by Opensight (63% green cover) and the single application (1.5 gal/A) of Garlon (80% green cover).

At the time of the first assessment and reapplication of the treatments in 2015 (363 DAIT), Patron 170 had 83% kudzu cover (Table 3) while the other treatments ranged from 28 to 4% cover. Annual grasses and other broadleaf species covered the areas not dominated by kudzu. Streamline had the most bare ground (21%).

Sixty-three days after the 2015 applications and 426 days after the initial treatments in 2014, the kudzu cover was 67% in plots treated with Patron 170, 8% with Transline and 0-3% for the other herbicide treatments (Table 4). There was 77-93% annual grass cover in the Garlon 3A, Opensight, and BK 800 treatments. Broadleaf cover was highest (73-77%) in plots with either of the two Rodeo treatments. Streamline resulted in higher bare ground than with Transline, Garlon 3A, Opensight, BK800, the split Rodeo treatment or Patron 170 but not the Rodeo at 8 qt/A.

At the first assessment in 2016 (689 DAIT and 200 days after 2015 applications), the kudzu cover was 47% in plots treated with Patron 170 and 0-5% for the other herbicide treatments (Table 5). This same group of herbicide treatments had 57-83% grass cover, which was predominantly cheatgrass and large foxtail. Most of the plots included giant ragweed and a mix of other broadleaf species, such as large poison hemlock plants, except for the control, which only had kudzu (37%) and giant ragweed (63%) visible.

The site looked quite different at the last rating on August 25, 2016 (760 DAIT and 271 days after 2015 applications) with tall giant ragweed plants and encroaching kudzu plants as the dominant vegetation. We rated the plots from the back of the truck to view them. We had not seen this amount of growth in 2015. Looking at the monthly precipitation for the region (Climate Division 4), the long term average for May is 5 inches. In 2014, we had 3.4 inches, in 2015 1.8 inches, and in 2016 6.4 inches (Figure 1). Perhaps these differences in rainfall distribution played a role in the extent of kudzu and giant ragweed growth.

The kudzu cover was 70% for the Patron 170 plots and 0-10% for the other herbicide treatments 271 days after 2015 applications 760 DAIT (Table 6). The amount of grass cover decreased from the previous assessment (10-65%) for these herbicide treatments with no grass visible in the Patron 170 and control plots. The amount of giant ragweed cover increased from the previous assessment and it was the predominant vegetation in many of the treatments.

In summary, Transline, Streamline, Garlon 3A, Rodeo, Opensight, and BK 800 provided excellent kudzu control after two applications spaced one year apart. Patron 170 would not be a recommended treatment for kudzu control. However, a sustained effort is required to keep the kudzu from encroaching on the cleared areas again.

Minogue, P.J., S.F. Enloe, A. Osiecka, and D.K. Lauer. 2011 Comparison of aminocyclopyrachlor to common herbicides for kudzu (Pueraria montana) management. Invasive Plant Sci. Management. 4: 419-426.

Table 1. Treatments and Active Ingredients for Kudzu Control Trial

Treatment	Product Names	Rate	Rate Unit	2014/15 Application Dates	Active Ingredient(s)	ai Rate (per acre)
1	Transline	21	FL OZ/A	7/25/2014	clopyralid	7.9 oz ae
	Activator 90	0.5	% V/V	7/23/2015		
2	Streamline	11.5	OZ/A	7/25/2014	aminocylcopyrachlor + metsulfuron	4.5 oz + 1.4 oz
	COC	1	% V/V	7/23/2015		
3	Garlon 3A	3	GAL/A	7/25/2014	triclopyr	9 lb ae
	Activator 90	0.5	% V/V	7/23/2015		
4	Garlon 3A	1.5	GAL/A	7/25/2014	triclopyr	4.5 lb ae
	Activator 90	0.5	% V/V	7/23/2015		
	Garlon 3A	1.5	GAL/A	9/25/2014	triclopyr	4.5 lb ae
	Activator 90	0.5	% V/V	9/24/2015		
5	Rodeo	8	QT/A	7/25/2014	glyphosate	8 lb ae
	Activator 90	0.5	% V/V	7/23/2015		
6	Rodeo	4	QT/A	7/25/2014	glyphosate	4 lb ae
	Activator 90	0.5	% V/V	7/23/2015		
	Rodeo	4	QT/A	9/25/2014	glyphosate	4 lb ae
	Activator 90	0.5	% V/V	9/24/2015		
7	Opensight	3.3	OZ/A	7/25/2014	aminopyralid + metsulfuron	1.7 oz ae + 0.3 oz
	Activator 90	0.5	% V/V	7/23/2015		
8	BK 800	2	GAL/A	7/25/2014	2,4-D + 2,4-DP + dicamba	3.78 lb ae + 1.88 lb ae + 0.94 lb ae
	Activator 90	0.5	% V/V	7/23/2015		
9	Patron 170	6.9	PT/A	7/25/2014	2,4-D + 2,4-DP	1.47 lb ae + 0.75 lb ae
	Activator 90	0.5	% V/V	7/23/2015		
10	Untreated Check					

Table 2: Results for Kudzu Control Trial (2014)

Treatment	Product Names	Rate	Rate Unit	2014 Application Date	% Kudzu Control		% Green Vegetation Cover	
					32 DAT[1]	62 DAT	32 DAT	62 DAT
1	Transline	21	FL OZ/A	7/25	92 *b*[2]	96 *b*	83 *ab*	100 *a*
	Activator 90	0.5	% V/V					
2	Streamline	11.5	OZ/A	7/25	100 *a*	100 *a*	2 *e*	13 *d*
	COC	1	% V/V					
3	Garlon 3A	3	GAL/A	7/25	100 *a*	100 *a*	10 *de*	80 *b*
	Activator 90	0.5	% V/V					
4	Garlon 3A	1.5	GAL/A	7/25	98 *a*	100 *a*	38 *c*	97 *a*
	Activator 90	0.5	% V/V					
	Garlon 3A	1.5	GAL/A	9/25				
	Activator 90	0.5	% V/V					
5	Rodeo	8	QT/A	7/25	100 *a*	99 *ab*	25 *cde*	97 *a*
	Activator 90	0.5	% V/V					
6	Rodeo	4	QT/A	7/25	98 *a*	98 *ab*	30 *cd*	96 *a*
	Activator 90	0.5	% V/V					
	Rodeo	4	QT/A	9/25				
	Activator 90	0.5	% V/V					
7	Opensight	3.3	OZ/A	7/25	98 *a*	99 *a*	18 *cde*	63 *c*
	Activator 90	0.5	% V/V					
8	BK 800	2	GAL/A	7/25	99 *a*	98 *ab*	28 *cd*	98 *a*
	Activator 90	0.5	% V/V					
9	Patron 170	6.9	PT/A	7/25	92 *b*	72 *c*	70 *b*	100 *a*
	Activator 90	0.5	% V/V					
10	Untreated Check				0 *c*	0 *d*	100 *a*	100 *a*

[1] *DAT = Days after treatment*

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

Table 3: Results for Kudzu Control Trial (2015) (before 2015 applications 363 DAIT[1])

Treatment	Product Names	Rate	Rate Unit	% Vegetation Cover			
				% Kudzu	% Grass	% Other Broadleaves	% Bare Ground
1	Transline Activator 90	21 0.5	FL OZ/A % V/V	28 *b*[2]	38 *abc*	33 *abcd*	0 *b*
2	Streamline COC	11.5 1	OZ/A % V/V	4 *c*	36 *abc*	40 *abc*	21 *a*
3	Garlon 3A Activator 90	3 0.5	GAL/A % V/V	5 *c*	52 *ab*	30 *bcd*	13 *ab*
4	Garlon 3A Activator 90 Garlon 3A Activator 90	1.5 0.5 1.5 0.5	GAL/A % V/V GAL/A % V/V	17 *bc*	65 *a*	15 *cd*	3 *ab*
5	Rodeo Activator 90	8 0.5	QT/A % V/V	17 *bc*	15 *bc*	65 *a*	3 *ab*
6	Rodeo Activator 90 Rodeo Activator 90	4 0.5 4 0.5	QT/A % V/V QT/A % V/V	8 *bc*	30 *abc*	62 *ab*	0 *b*
7	Opensight Activator 90	3.3 0.5	OZ/A % V/V	20 *bc*	53 *ab*	17 *cd*	10 *ab*
8	BK 800 Activator 90	2 0.5	GAL/A % V/V	20 *bc*	68 *a*	10 *cd*	2 *ab*
9	Patron 170 Activator 90	6.9 0.5	PT/A % V/V	83 *a*	3 *c*	13 *cd*	0 *b*
10	Untreated Check			98 *a*	0 *c*	2 *d*	0 *b*

[1] *DAIT = Days after initial treatment*

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

Table 4: Results for Kudzu Control Trial (2015) (63 days after 2015 applications 426 DAIT[1])

Treatment	Product Names	Rate	Rate Unit	2015 Application Date	% Vegetation Cover			
					% Kudzu	% Grass	% Other Broadleaves	% Bare Ground
1	Transline Activator 90	21 0.5	FL OZ/A % V/V	7/23	8 *c*[2]	65 *b*	23 *b*	3 *b*
2	Streamline COC	11.5 1	OZ/A % V/V	7/23	0 *d*	35 *c*	3 *c*	44 *a*
3	Garlon 3A Activator 90	3 0.5	GAL/A % V/V	7/23	0 *d*	77*ab*	10 *bc*	13 *b*
4	Garlon 3A Activator 90 Garlon 3A Activator 90	1.5 0.5 1.5 0.5	GAL/A % V/V GAL/A % V/V	7/23 9/24 	0 *d*	88 *ab*	7 *bc*	3 *b*
5	Rodeo Activator 90	8 0.5	QT/A % V/V	7/23	3 *cd*	2 *d*	73 *a*	22 *ab*
6	Rodeo Activator 90 Rodeo Activator 90	4 0.5 4 0.5	QT/A % V/V QT/A % V/V	7/23 9/24 	2 *cd*	7 *d*	77 *a*	13 *b*
7	Opensight Activator 90	3.3 0.5	OZ/A % V/V	7/23	0 *d*	93 *a*	2 *c*	5 *b*
8	BK 800 Activator 90	2 0.5	GAL/A % V/V	7/23	2 *cd*	80 *ab*	9 *bc*	8 *b*
9	Patron 170 Activator 90	6.9 0.5	PT/A % V/V	7/23	67 *b*	20 *cd*	13 *bc*	0 *b*
10	Untreated Check				95 *a*	0 *d*	5 *bc*	0 *b*

[1] *DAIT = Days after initial treatment*

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

Table 5: Results for Kudzu Control Trial (2016) (200 days after 2015 applications 689 DAIT[1])

Treatment	Product Names	Rate	Rate Unit	2015 Application Date	% Vegetation Cover			
					% Kudzu	% Grass	% Giant Ragweed	% Broadleaves other than Kudzu
1	Transline Activator 90	21 0.5	FL OZ/A % V/V	7/23	5 *b*[2]	58 *a*	5 *bc*	50 *ab*
2	Streamline COC	11.5 1	OZ/A % V/V	7/23	0.3 *b*	82 *a*	16 *b*	18 *c*
3	Garlon 3A Activator 90	3 0.5	GAL/A % V/V	7/23	0 *b*	70 *a*	2 *bc*	30 *bc*
4	Garlon 3A Activator 90 Garlon 3A Activator 90	1.5 0.5 1.5 0.5	GAL/A % V/V GAL/A % V/V	7/23 9/24	0 *b*	83 *a*	7 *bc*	17 *c*
5	Rodeo Activator 90	8 0.5	QT/A % V/V	7/23	0.3 *b*	58 *a*	13 *bc*	41 *abc*
6	Rodeo Activator 90 Rodeo Activator 90	4 0.5 4 0.5	QT/A % V/V QT/A % V/V	7/23 9/24	0 *b*	80 *a*	9 *bc*	20 *c*
7	Opensight Activator 90	3.3 0.5	OZ/A % V/V	7/23	0 *b*	73 *a*	12 *bc*	27 *bc*
8	BK 800 Activator 90	2 0.5	GAL/A % V/V	7/23	2 *b*	57 *a*	0 *c*	42 *abc*
9	Patron 170 Activator 90	6.9 0.5	PT/A % V/V	7/23	47 *a*	13 *b*	0 *c*	40 *abc*
10	Untreated Check				37 *a*	0 *b*	63 *a*	63 *a*

[1] *DAIT = Days after initial treatment*

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

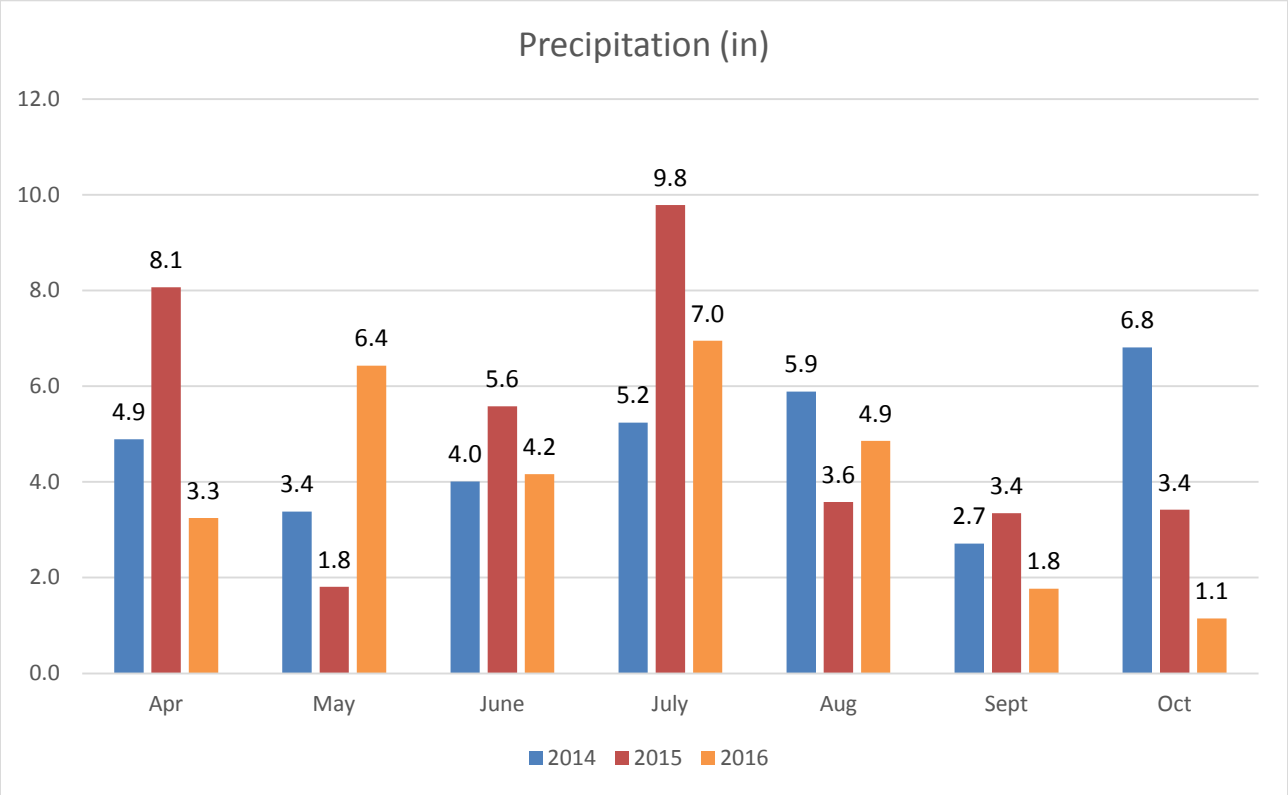
Table 6: Results for Kudzu Control Trial (2016) (271 days after 2015 applications 760 DAIT[1])

Treatment	Product Names	Rate	Rate Unit	2015 Application Date	% Vegetation Cover			
					% Kudzu	% Grass	% Giant Ragweed	% Broadleaves other than Kudzu
1	Transline Activator 90	21 0.5	FL OZ/A % V/V	7/23	8 *b*[2]	10 *bc*	37 *ab*	82 *a*
2	Streamline COC	11.5 1	OZ/A % V/V	7/23	0 *b*	62 *a*	38 *ab*	38 *abc*
3	Garlon 3A Activator 90	3 0.5	GAL/A % V/V	7/23	1 *b*	65 *a*	33 *ab*	34 *abc*
4	Garlon 3A Activator 90 Garlon 3A Activator 90	1.5 0.5 1.5 0.5	GAL/A % V/V GAL/A % V/V	7/23 9/24 	0 *b*	47 *abc*	53 *ab*	53 *abc*
5	Rodeo Activator 90	8 0.5	QT/A % V/V	7/23	0 *b*	30 *abc*	68 *a*	70 *ab*
6	Rodeo Activator 90 Rodeo Activator 90	4 0.5 4 0.5	QT/A % V/V QT/A % V/V	7/23 9/24 	0 *b*	52 *ab*	45 *ab*	48 *abc*
7	Opensight Activator 90	3.3 0.5	OZ/A % V/V	7/23	0 *b*	33 *abc*	67 *a*	67 *ab*
8	BK 800 Activator 90	2 0.5	GAL/A % V/V	7/23	10 *b*	43 *abc*	25 *ab*	45 *abc*
9	Patron 170 Activator 90	6.9 0.5	PT/A % V/V	7/23	70 *a*	0 *c*	3 *b*	30 *bc*
10	Untreated Check				92 *a*	0 *c*	8 *b*	8 *c*

[1] *DAIT = Days after initial 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: Monthly Precipitation (inches) for 2014 – 2016 for Climate Division 4



2016 Dormant Stem Brush Control Trial

Introduction

One of the challenges of vegetation management on right-of-ways is the rapid growth of woody plants. While mechanical (mowing) and chemical options are available during the growing season to manage woody vegetation, dormant-stem applications are an option outside the growing season that can extend the spray (management) season. Herbicides are applied to brush vegetation while there are no leaves on the deciduous plants. The herbicide is applied to the branches and trunks and the herbicide moves into the plant by penetrating the thin bark layer. The most effective timing is generally about six weeks prior to bud break up to the beginning of bud break (Dow AgroSciences, 2014). However, applications must be made when the bark, stems, and branches are dry. This trial was established to compare the efficacy of some product combinations for controlling brush species.

Materials and Methods

A trial was established in an area of mixed brush regrowth near Nortonville in western Kentucky along the Western KY Parkway. Four treatments plus a control, listed in Table 1, were applied on March 8, 2016 before bud break at 50 GPA using a TeeJet® Boomless tip mounted on the rear of an ATV. Plots were 40 ft long X 12 ft wide and were arranged as a RCBD with 4 replications. The woody vegetation was 5-6 ft in height at application. The species in the plots included tulip poplar, sweet gum, winged elm, smooth sumac, devil's walking stick, and blackberry. There was also Japanese honeysuckle, giant reed, and other herbaceous plants in the plots.

The same four herbicide treatments were applied along the Parkway in four large demonstration plots near the State Police station and salt dome on February 26, 2016. The shoulders of the east and westbound lanes from mile markers 38.7 to 42.1 were used. A roadside sprayer with an articulated boom was used to apply the products to the brush. However, we were unable to collect rating data on these as the Parkway was undergoing pavement grinding and resurfacing during the season and it was not safe to work in this area.

All the herbicide mixes included basal oil to help get the herbicide through the bark and surfactant to emulsify the oil with the water carrier. All the mixes also included different rates of Garlon 4 Ultra (triclopyr) which does not have residual soil activity. The components with some soil activity are dicamba in BK800, aminopyralid in Milestone, aminocyclopyrachlor + imazapyr + metsulfuron in Viewpoint, and metsulfuron in Patriot (Table 1).

The small plots were rated visually 57 (5/3/2016), 72 (5/18/2016), 114 (6/29/2016), and 205 (9/28/2016) days after treatment (DAT). Data collected were % woody stem leaf out and % herbaceous cover 57 DAT and % leaf out and % green cover from woody vegetation which was split into lower and upper canopy cover 72 DAT. For the 114 and 205 DAT ratings, %

bareground, % herbaceous cover, and % woody lower and upper canopy cover (overlapping canopy at this point) data were collected. Data were analyzed using ARM software and treatment means were compared using Fisher's LSD at p = 0.05.

Results and Discussion

The spray coverage, or rather the lack of coverage, was evident in the large and small plots after leaf out. This illustrates the importance of good coverage for the most efficacious control results.

At the first rating, 57 DAT, all the herbicide treatments had less % leaf out (2-7%) on the woody stems than the control plots (Table 2). In many of the plots, small grass and broadleaf herbaceous seedlings were evident. A couple weeks later, 72 DAT, all the herbicide treatments still had less leaf cover from the woody vegetation than control (Table 2).

Later in the season (114 DAT), the Garlon + Milestone and Patron + Garlon + Patriot treatments (Treatments 2 and 4) had more bare ground than control (Table 3). At this time, the lower woody canopy cover was the same as control for the BK800 + Garlon and Garlon + Viewpoint treatments (Treatments 1 and 3) while the upper canopy cover was the same as control for the Parton + Garlon + Patriot treatment (Treatment 4). By the time of the last assessment (205 DAT), the herbaceous cover, which was predominantly grasses, was greater than the control in the Garlon + Milestone and Garlon + Viewpoint treatments (Treatments 2 and 3) (Table 3). The Garlon + Milestone and Patron + Garlon + Patriot treatments (Treatments 2 and 4) still had more bareground than control and these treatment plus the Garlon + Viewpoint treatment (Treatment 3) still had less lower canopy cover than control.

All the treatments had good initial results in brush suppression but many of the plants still leafed out from buds outside the spray pattern and continued to grow. Assessments next season should provide information on how many of these plants actually died and how efficacious the herbicide mixes were.

Dow Agrosciences, 2014. Dormant-stem Herbicide Treatments for Rights-of-Way Brush Control

Table 1. Herbicide treatments, active ingredients and application rates for Dormant Stem Brush Control Trial.

Trt. No.	Product(s)	Rate per acre	Active Ingredient(s)	ai Application Rate (per acre)
1	BK800 Garlon 4 Ultra Basal Oil Surfactant	1.5 gal 0.5 gal 2 gal 1 gal	2,4-D + 2,4-DP + dicamba triclopyr	2.84 lb ae + 1.41 lb ae + 0.71 lb ae 2 lb ae
2	Garlon 4 Ultra Milestone Basal Oil Surfactant	2 gal 7 fl oz 2 gal 1 gal	triclopyr aminopyralid	8 lb ae 1.8 oz ae
3	Garlon 4 Ultra Viewpoint Basal Oil Surfactant	1 gal 12 oz 2 gal 1 gal	triclopyr aminocyclopyrachlor + imazapyr + metsulfuron	4 lb ae 2.7 oz + 3.8 oz + 0.9 oz
4	Patron 170 Garlon 4 Ultra Patriot Basal Oil Surfactant	6.9 pt 1 gal 3 oz 2 gal 1 gal	2,4-D + 2,4-DP triclopyr metsulfuron	1.47 lb ae + 0.75 lb ae 4 lb ae 1.8 oz
5	Untreated Control			

Table 2: Brush Control Trial Results in 2016 (part 1)

						Woody Vegetation Cover		
			% Leaf Out	% Herbaceous Cover	% Leaf Out	% Green Cover	% Lower Canopy	% Upper Canopy
Trt. No.	**Product(s)**	**Rate per acre**	**57 DAT[1]**		**72 DAT**			
1	BK800 Garlon 4 Ultra Basal Oil Surfactant	1.5 gal 0.5 gal 2 gal 1 gal	7 b[2]	3	9 b	20 b	11 b	9 b
2	Garlon 4 Ultra Milestone Basal Oil Surfactant	2 gal 7 fl oz 2 gal 1 gal	2 c	9	3 b	11 b	8 b	3 b
3	Garlon 4 Ultra Viewpoint Basal Oil Surfactant	1 gal 12 oz 2 gal 1 gal	5 bc	1	9 b	16 b	5 b	11 b
4	Patron 170 Garlon 4 Ultra Patriot Basal Oil Surfactant	6.9 pt 1 gal 3 oz 2 gal 1 gal	3 bc	2	8 b	14 b	6 b	8 b
5	Untreated Control		100 a	2	100 a	100 a	53 a	48 a

[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 3: Brush Control Trial Results in 2016 (part 2)

					Woody Vegetation Cover				Woody Vegetation Cover	
			% Herb[1] Cover	% Bare	% Lower Canopy	% Upper Canopy	% Herb Cover	% Bare	% Lower Canopy	% Upper Canopy
Trt. No.	**Product(s)**	**Rate per acre**	**114 DAT[2]**				**205 DAT**			
1	BK800 Garlon 4 Ultra Basal Oil Surfactant	1.5 gal 0.5 gal 2 gal 1 gal	39	4 b[3]	53 a	20 b	23 bc	4 b	53 ab	21
2	Garlon 4 Ultra Milestone Basal Oil Surfactant	2 gal 7 fl oz 2 gal 1 gal	35	15 a	23 b	26 b	36 ab	18 a	34 b	13
3	Garlon 4 Ultra Viewpoint Basal Oil Surfactant	1 gal 12 oz 2 gal 1 gal	29	3 b	38 ab	25 b	48 a	5 b	35 b	13
4	Patron 170 Garlon 4 Ultra Patriot Basal Oil Surfactant	6.9 pt 1 gal 3 oz 2 gal 1 gal	29	6 ab	29 b	34 ab	25 bc	8 ab	36 b	31
5	Untreated Control		11	0 b	54 a	58 a	13 c	4 b	56 a	28

[1] Herbaceous Cover

[2] *DAT = Days after treatment*

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

2016 Guardrail Trial near Louisa

Introduction

For highway safety, guardrails need to be kept clear of visual obstructions. Usually that means maintaining a vegetation free zone underneath them. Applications of broad-spectrum pre-emergent residual herbicides, in combination with a broad spectrum post-emergent herbicide like glyphosate, are the mainstay for bare ground maintenance operations. Ideally, the pre-emergent herbicides will last all season long and not move off-site by leaching or erosion (movement of soil particles with adsorbed herbicide). Evaluating the efficacy of these products and product combinations in comparison with older products is an ongoing effort.

Materials and Methods

The trial was established under and beside guardrail along KY 32 near Louisa, KY with 13 treatments and 3 replications arranged in a randomized complete block design. On June 1, 2016, treatments were applied at 25 gallons/acre with a spray swath on either side of the guardrail for a plot width of 6.5 ft and length of 12 ft (two areas between guardrail posts per plot). All herbicide treatments, except Roundup ProMax alone (Treatment 1), included Activator 90 at 0.25% v/v (Table 1).

Roundup ProMax (glyphosate) has no residual activity so other herbicides were included in combinations with it to provide residual and pre-emergent control. The Jackson weather station reported 0.19 and 1.22 inches of rain on June 3 and 5, respectively, which would have activated the pre-emerge herbicide treatments. A new product to the IVM market, Cleantraxx from Dow AgroSciences, was included in this year's trials. Cleantraxx is a product with two herbicide mechanisms of action (Groups 2 and 14) which will help with resistance management, as it is the only Group 14 (PPO inhibitor) product in the trial.

The weeds present at application included perennial grasses (flowering tall fescue), flowering fleabane, flowering buckhorn plantain, hemp dogbane and bush honeysuckle. This section of guardrail had not been sprayed for several seasons. Visual % bare ground and percent cover of perennial grasses, annual grasses, and broadleaf species were assessed 65 (8/5/2016), 107 (9/16/2016), and 148 (10/27/2016) days after treatment (DAT). Weeds present in many of the plots 148 DAT included tall fescue, broomsedge, large crabgrass, foxtails, fall panicum, buckhorn plantain, black medic, and spurge. Data were analyzed using ARM software and treatment means were compared using Fisher's Protected LSD at $p = 0.05$.

Results and Discussion

All herbicide treatments had more bareground (97-99%) than the control (12%) 65 DAT with the Roundup ProMax alone (Treatment 1) having less than the other herbicide treatments (Table 2). The Roundup ProMax alone treatment had broadleaf % cover similar to the control (32-42%).

Herbicide treatments with soil residual activity (Treatments 2-12) had more bare ground than the control or Roundup ProMax alone 107 DAT (Table 3). Some older products had less bareground than the best performers. These included Sahara (Teatment. 2), Oust (Treatment 4), and Polaris

(Treatment 8). The Roundup ProMax alone (Treatment 1) had the most annual grass cover (23%) while the Oust XP treatment (Treatment 4) had the second most (16%). Once again, the Roundup ProMax alone treatment had broadleaf % cover similar to the control (30-45%).

At the end of the season, 148 DAT, herbicide treatments with soil residual activity (Treatments 2-12) had more bare ground than the control or Roundup ProMax alone (Table 4). Some older products had less bare ground than the best performers. These included Sahara (Treatment 2), Oust (Treatment 4), and Polaris (Treatment 8) as well as the new product Cleantraxx by itself (Treatment 12). At this assessment, there was considerable amounts of crabgrass in some plots. Interestingly, the control plots that had perennial grass cover did not have crabgrass. The plots with significant crabgrass (12-21%) included Roundup ProMax alone (Treatment 1), Oust XP alone (Treatment 4), Polaris AC Complete (Teatment 8), and Oust + Esplanade (Teatment 9). Treatments with the same amount of broadleaf cover as control were Roundup ProMax alone (Treatment 1), Sahara (Treatment 2), and the treatments with Cleantraxx (Treatments 11 and 12).

Most of the herbicide treatments with residual soil activity performed well over the course of the season. Time of application was a bit late for optimal pre-emerge crabgrass control but some treatments performed better than others.

Table 1. Herbicide treatments, active ingredients and application rates for Guardrail trial near Louisa.

Treatment	Product Name	Rate[1]	Rate Unit	Active Ingredient(s)	ai Rate (per acre)
1	Roundup ProMax	1.3	QT/A	glyphosate	1.5 lb ae
2	Roundup ProMax	1.3	QT/A	glyphosate	1.5 lb ae
	Sahara	10	LB/A	diuron + imazapyr	6.2 lb + 12.4 oz
3	Roundup ProMax	1.3	QT/A	glyphosate	1.5 lb ae
	Hyvar	10	LB/A	bromacil	8 lb
4	Roundup ProMax	1.3	QT/A	glyphosate	1.5 lb ae
	Oust XP	3	OZ/A	sulfometuron	2.3 oz
5	Roundup ProMax	1.3	QT/A	glyphosate	1.5 lb ae
	Perspective	9	OZ/A	aminocyclopyrachlor + chlorsulfuron	3.6 oz + 1.4 oz
	Esplanade	3.5	FL OZ/A	indaziflam	0.7 oz
6	Roundup ProMax	1.3	QT/A	glyphosate	1.5 lb ae
	Perspective	9	OZ/A	aminocyclopyrachlor + chlorsulfuron	3.6 oz + 1.4 oz
	Endurance	2.3	LB/A	prodiamine	1.5 lb
7	Roundup ProMax	1.3	QT/A	glyphosate	1.5 lb ae
	Viewpoint	18	OZ/A	aminocyclopyrachlor + imazapyr + metsulfuron	4.1 oz + 5.7 oz + 1.3 oz
	Esplanade	3.5	FL OZ/A	indaziflam	0.7 oz
8	Roundup ProMax	1.3	QT/A	glyphosate	1.5 lb ae
	Polaris AC Complete	2	PT/A	imazapyr	16 oz ae
9	Roundup ProMax	1.3	QT/A	glyphosate	1.5 lb ae
	Esplanade	3.5	FL OZ/A	indaziflam	0.7 oz
	Oust XP	3	OZ/A	sulfometuron	2.3 oz
10	Roundup ProMax	1.3	QT/A	glyphosate	1.5 lb ae
	Streamline	8	OZ/A	aminocyclopyrachlor + metsulfuron	3.2 oz + 1 oz
	Esplanade	5	FL OZ/A	indaziflam	1.0 oz
	Plateau	5	FL OZ/A	imazapic	1.3 oz ae
11	Rodeo	1.5	QT/A	glyphosate	1.5 lb ae
	Cleantraxx	3	PT/A	penoxsulam + oxyfluorfen	0.5 oz + 23.6 oz
	Milestone VM	7	FL OZ/A	aminopyralid	1.8 oz ae
12	Rodeo	1.5	QT/A	glyphosate	1.5 lb ae
	Cleantraxx	4.5	PT/A	penoxsulam + oxyfluorfen	0.75 oz + 35.4 oz
13	Untreated Check				

[1]All herbicide treatments (except Roundup ProMax alone, Treatment 1) contained the adjuvant, Activator 90 at 0.25% v/v.

Table 2: Results for Guardrail Trial near Louisa 65 DAT[1] (August 5, 2016)

Trt. No.	Product Name	Rate	Rate Unit	% Bare Ground	% Perennial Grass	% Annual Grass	% Broadleaves
				65 DAT			
1	Roundup ProMax	1.3	QT/A	63 b[2]	0 b	5 a	32 a
2	Roundup ProMax	1.3	QT/A	98 a	0 b	1 cd	1 b
	Sahara	10	LB/A				
3	Roundup ProMax	1.3	QT/A	98 a	0 b	0 d	1 b
	Hyvar	10	LB/A				
4	Roundup ProMax	1.3	QT/A	96 a	0 b	4 ab	0 b
	Oust XP	3	OZ/A				
5	Roundup ProMax	1.3	QT/A	98 a	0 b	1 bcd	0 b
	Perspective	9	OZ/A				
	Esplanade	3.5	FL OZ/A				
6	Roundup ProMax	1.3	QT/A	97 a	0 b	3 abcd	0 b
	Perspective	9	OZ/A				
	Endurance	2.3	LB/A				
7	Roundup ProMax	1.3	QT/A	99 a	0 b	1 cd	0 b
	Viewpoint	18	OZ/A				
	Esplanade	3.5	FL OZ/A				
8	Roundup ProMax	1.3	QT/A	97 a	0 b	2 bcd	1 b
	Polaris AC Complete	2	PT/A				
9	Roundup ProMax	1.3	QT/A	97 a	0 b	0 d	2 b
	Esplanade	3.5	FL OZ/A				
	Oust XP	3	OZ/A				
10	Roundup ProMax	1.3	QT/A	99 a	0 b	1 cd	0 b
	Streamline	8	OZ/A				
	Esplanade	5	FL OZ/A				
	Plateau	5	FL OZ/A				
11	Rodeo	1.5	QT/A	98 a	0 b	1 cd	1 b
	Cleantraxx	3	PT/A				
	Milestone VM	7	FL OZ/A				
12	Rodeo	1.5	QT/A	97 a	0 b	1 cd	2 b
	Cleantraxx	4.5	PT/A				
13	Nontreated Check			12 c	43 a	3 abc	42 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 3: Results for Guardrail Trial near Louisa 107 DAT[1] (September 16, 2016)

Trt. No.	Product Name	Rate	Rate Unit	% Bare Ground	% Perennial Grass	% Annual Grass	% Broadleaves
				107 DAT			
1	Roundup ProMax	1.3	QT/A	32 e[2]	0 b	23 a	45 a
2	Roundup ProMax	1.3	QT/A	87 bcd	1 b	3 cd	9 c
	Sahara	10	LB/A				
3	Roundup ProMax	1.3	QT/A	96 ab	0 b	0 d	3 c
	Hyvar	10	LB/A				
4	Roundup ProMax	1.3	QT/A	83 d	0 b	16 b	0 c
	Oust XP	3	OZ/A				
5	Roundup ProMax	1.3	QT/A	93 abcd	0 b	4 cd	3 c
	Perspective	9	OZ/A				
	Esplanade	3.5	FL OZ/A				
6	Roundup ProMax	1.3	QT/A	94 abcd	0 b	3 cd	3 c
	Perspective	9	OZ/A				
	Endurance	2.3	LB/A				
7	Roundup ProMax	1.3	QT/A	96 abc	0 b	4 cd	1 c
	Viewpoint	18	OZ/A				
	Esplanade	3.5	FL OZ/A				
8	Roundup ProMax	1.3	QT/A	85 cd	0 b	9 c	6 c
	Polaris AC Complete	2	PT/A				
9	Roundup ProMax	1.3	QT/A	90 abcd	0 b	6 cd	4 c
	Esplanade	3.5	FL OZ/A				
	Oust XP	3	OZ/A				
10	Roundup ProMax	1.3	QT/A	99 a	0 b	1 d	0 c
	Streamline	8	OZ/A				
	Esplanade	5	FL OZ/A				
	Plateau	5	FL OZ/A				
11	Rodeo	1.5	QT/A	88 abcd	2 b	1 d	9 c
	Cleantraxx	3	PT/A				
	Milestone VM	7	FL OZ/A				
12	Rodeo	1.5	QT/A	88 abcd	0 b	3 cd	9 c
	Cleantraxx	4.5	PT/A				
13	Nontreated Check			13 f	43 a	3 cd	30 b

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 4: Results for Guardrail Trial near Louisa 148 DAT[1] (October 27, 2016)

Trt. No.	Product Name	Rate	Rate Unit	% Bare Ground	% Perennial Grass	% Crabgrass	% Annual Grass	% Broadleaves
				148 DAT				
1	Roundup ProMax	1.3	QT/A	48 c[2]	0 b	17 a	18 a	33 a
2	Roundup ProMax	1.3	QT/A	75 b	0 b	4 bcd	6 bcd	19 ab
	Sahara	10	LB/A					
3	Roundup ProMax	1.3	QT/A	88 ab	0 b	1 cd	1 d	11 b
	Hyvar	10	LB/A					
4	Roundup ProMax	1.3	QT/A	73 b	0 b	21 a	21 a	6 b
	Oust XP	3	OZ/A					
5	Roundup ProMax	1.3	QT/A	85 ab	1 b	3 cd	4 bcd	12 b
	Perspective	9	OZ/A					
	Esplanade	3.5	FL OZ/A					
6	Roundup ProMax	1.3	QT/A	88 ab	0 b	0 d	2 cd	10 b
	Perspective	9	OZ/A					
	Endurance	2.3	LB/A					
7	Roundup ProMax	1.3	QT/A	90 ab	0 b	3 cd	6 bcd	3 b
	Viewpoint	18	OZ/A					
	Esplanade	3.5	FL OZ/A					
8	Roundup ProMax	1.3	QT/A	75 b	0 b	15 ab	15 ab	10 b
	Polaris AC Complete	2	PT/A					
9	Roundup ProMax	1.3	QT/A	82 ab	0 b	12 abc	13 abc	5 b
	Esplanade	3.5	FL OZ/A					
	Oust XP	3	OZ/A					
10	Roundup ProMax	1.3	QT/A	96 a	0 b	1 cd	2 cd	2 b
	Streamline	8	OZ/A					
	Esplanade	5	FL OZ/A					
	Plateau	5	FL OZ/A					
11	Rodeo	1.5	QT/A	78 ab	0 b	1 cd	3 cd	19 ab
	Cleantraxx	3	PT/A					
	Milestone VM	7	FL OZ/A					
12	Rodeo	1.5	QT/A	77 b	0 b	1 cd	4 bcd	19 ab
	Cleantraxx	4.5	PT/A					
13	Nontreated Check			13 d	47 a	0 d	2 d	38 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.*

2016 Cable Barrier 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. In other cases, there may be desirable turf under the cable barriers that also is desirable to retain. 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).

Recently, a number of new products (Perspective, Viewpoint, Esplanade, and Cleantraxx) have become available for bare ground vegetation management. Perspective is a combination of aminocyclopyrachlor and chlorsulfuron. Viewpoint is a combination of aminocyclopyrachlor, imazapyr and metsulfuron. Esplanade is indaziflam. Cleantraxx is a combination of penoxsulam and oxyfluorfen. The objective of this trial was to evaluate the vegetation control efficacy and desirable turf damage potential of these and other herbicides 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 24 treatments and 3 replications were arranged in a randomized complete block design. Treatments were applied at 25 gallons / acre onto 6.5 ft wide by 20 ft long plots on June 8, 2016. All herbicide treatments, except Roundup ProMax alone (Treatment 1) and Control Duo (Treatment 2), included Activator 90 at 0.25% v/v (Tables 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 (Treatments 1-18). The selective treatments (Treatments 19-23) represented some options to control broadleaf weeds in rough turf.

The Louisville weather station reported 0.48 inches of rain on June 12 which would have activated the soil applied preemergence herbicide treatments. Additional rainfall was recorded on June 14 (1.09 inches) and on June 15 (0.22 inches). These rainfall events may have contributed to the movement of some of the herbicides from where they were applied and damaged adjacent turf (Figure 1). Species present at application included Buckhorn plantain, which was flowering, plus tall fescue and Kentucky bluegrass which had mature seed heads.

Ratings of the proportion (%) of bare ground, perennial grasses, annual grasses, and broadleaf weeds were taken 33 (7/11/2016), 65 (8/12/2016), 103 (9/19/2016), and 138 (10/24/2016) days after treatment (DAT). The plot area had been mowed recently before the 33 DAT rating. Data were analyzed using ARM software and treatment means were compared using Fisher's LSD at $p = 0.05$.

Results and Discussion

All the bare ground treatments with soil active herbicides (Treatments 3-18) had more bare ground than the control 33 DAT (Tables 2a and 2b). The treatments with only Roundup ProMax (Treatments 1 and 2) had less bare ground than these treatments. We noted turf damage beyond the sprayed area on some plots indicating movement of the herbicide after application (Figure 1). The extent of this was greatest with the Hyvar treatment (Treatment 4) but was also evident with the Sahara and Oust treatments (Treatments 3 and 5). The selective treatments had the same proportion of bare ground except for Perspective (Treatment 22) which had more. The selective treatments had similar perennial grass cover compared to the control. One of the treatments with only Roundup ProMax (Treatment 1) had the same annual grass cover as the control while many of the selective treatments had less but not zero. The Perspective (Treatment 22) and Streamline (Treatment 23) had less annual grasses than the other selective treatments. The bare ground treatments with soil active herbicides (Treatments 3-18) had less broadleaf cover than the control (Treatment 24), treatments with only Roundup ProMax (Treatments 1 and 2), and the selective treatments (Treatments 19-23).

Later in the season (65 DAT), all the bare ground treatments had more bare ground than the selective treatments which had a similar amount of bare ground as the control (Tables 3a and 3b). The treatments with only Roundup ProMax (Treatments 1 and 2) had less bare ground than these treatments (20-22%). The best group of bare ground treatments with soil residual had 88 to 99% while the next group had 82 to 87%. This group included Hyvar (Treatment 4), Pendulum + Milestone (Treatment 7), Journey + Milestone (Treatment 8), Perspective + Endurance (Treatment 11), and Cleantraxx (Treatment 18). Among the selective treatments the Pyresta + Proclipse (Treatment 19), Perspective (Treatment 22), and Streamline (Treatment. 23) had more perennial grass cover than the control (Table 3b). The predominant annual grass was yellow foxtail and the Roundup ProMax only treatments (Treatments 1-2) were similar to control in this parameter. Among the selective treatments, the Milestone treatment (Treatment 20) had more than control while the Perspective (Treatment 22) and Streamline (Treatment 23) had less annual grass cover. The plots where the perennial grasses had been killed, but without a soil residual herbicide, had the most broadleaf cover (Treatments 1 and 2).

A month later (103 DAT), the bare ground treatments with the most residual activity against the weed spectrum at this site are sorting to the top (Tables 4a and 4b). The top treatments still had 88-94 % bare ground and included all the Esplanade treatments (Treatments 9, 10, 13, 15, and 16). All the selective treatments had more perennial grass cover than the control (Table 4b). All the plots had increasing cover from annual grasses; however, the Roundup ProMax alone (Treatments 1 and 2) and the control had the most. Similarly, most of the plots had more broadleaf weed cover but the most was in the Payload (Treatment 6) and Cleantraxx (Treatment 18) treatments.

By the end of the season (138 DAT), the top treatments still had 88 to 93% bare ground and still included all the Esplanade treatments (Treatments 9, 10, 13, 15, and 16) (Tables 5a and 5b). All the selective treatments still had more perennial grass cover than control (Table 5b). All the plots had increasing cover from annual grasses; however, the Roundup ProMax by itself (Treatments 1 and 2) and the control still had the most. Among the selective treatments,

Perspective (Treatment 22) and Streamline (Treatment 23) had less annual grass cover, which was predominantly yellow foxtail, than the control (Table 5b). Plots with the most broadleaf weed cover included Roundup ProMax alone (Treatment 1), Sahara (Treatment 3), Payload (Treatment 6), Viewpoint (Treatment 12), Polaris AC Complete (Treatment 14), Cleantraxx + Milestone (Treatment 17) and Cleantraxx (Treatment 18).

The vegetation under the cable barrier in this location gave a good test of how well some of these bare ground herbicides can perform as well as some turf management herbicide mixes. These trials will continue to provide information for roadside managers.

Table 1a. Herbicide Treatments, Active Ingredients and Application Rates. (part 1)

Trt. No.	Product Name	Rate	Rate Unit	Active Ingredient(s)	ai Application per Acre
1	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB ae
2	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB ae
	Control Duo	0.5	% V/V		
3	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB ae
	Sahara	10	LB/A	diuron + imazapyr	6.2 LB + 12.4 OZ
4	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB ae
	Hyvar	10	LB/A	bromacil	8 LB
5	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB ae
	Oust XP	3	OZ/A	sulfometuron	2.3 OZ
6	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB ae
	Payload	12	OZ/A	flumioxazin	6.1 OZ
7	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB ae
	Pendulum AquaCap	4	QT/A	pendimethalin	3.8 LB
	Milestone VM	7	FL OZ/A	aminopyralid	1.8 OZ ae
8	Roundup ProMax	1	QT/A	glyphosate	1.1 LB ae
	Journey	1	QT/A	glyphosate + imazapic	0.4 LB AE + 3 OZ AE
	Milestone VM	7	FL OZ/A	aminopyralid	1.8 OZ AE
9	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB AE
	Perspective	9	OZ/A	aminocyclopyrachlor + chlorsulfuron	3.6 OZ + 1.4 OZ
	Esplanade	3.5	FL OZ/A	indaziflam	0.7 OZ
10	Razor Pro	2	QT/A	glyphosate	1.5 LB AE
	Perspective	5	OZ/A	aminocyclopyrachlor + chlorsulfuron	2 OZ + 0.8 OZ
	Esplanade	4	FL OZ/A	indaziflam	0.8 OZ
11	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB AE
	Perspective	9	OZ/A	aminocyclopyrachlor + chlorsulfuron	3.6 OZ + 1.4 OZ
	Endurance	2.3	LB/A	prodiamine	1.5 LB
12	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB AE
	Viewpoint	18	OZ/A	aminocyclopyrachlor + imazapyr + metsulfuron	4.1 OZ + 5.7 OZ + 1.3 OZ
13	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB AE
	Viewpoint	18	OZ/A	aminocyclopyrachlor + imazapyr + metsulfuron	4.1 OZ + 5.7 OZ + 1.3 OZ
	Esplanade	3.5	FL OZ/A	indaziflam	0.7 OZ
14	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB AE
	Polaris AC Complete	2	PT/A	imazapyr	16 OZ AE
15	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB AE
	Esplanade	3.5	FL OZ/A	indaziflam	0.7 OZ
	Oust XP	3	OZ/A	sulfometuron	2.3 OZ

All herbicide treatments (except trt. #1 and 2) contained the adjuvant, Activator 90 at 0.25% v/v.

Table 1b. Herbicide Treatments, Active Ingredients and Application Rates. (part 2)

Trt. No.	Product Name	Rate	Rate Unit	Active Ingredient(s)	ai Application per Acre
16	Roundup ProMax	1.3	QT/A	glyphosate	1.5 LB AE
	Streamline	8	OZ/A	aminocyclopyrachlor + metsulfuron	3.2 OZ + 1 OZ
	Esplanade	5	FL OZ/A	indaziflam	1 OZ
	Plateau	5	FL OZ/A	imazapic	1.3 OZ AE
17	Rodeo	1.5	QT/A	glyphosate	1.5 LB AE
	Cleantraxx	3	PT/A	penoxsulam + oxyfluorfen	0.5 OZ + 23.6 OZ
	Milestone VM	7	FL OZ/A	aminopyralid	1.8 OZ AE
18	Rodeo	1.5	QT/A	glyphosate	1.5 LB AE
	Cleantraxx	4.5	PT/A	penoxsulam + oxyfluorfen	0.7 OZ + 35.4 OZ
19	Pyresta	24	FL OZ/A	2,4-D + pyraflufen-ethyl	0.66 LB AE + 0.05 OZ
	Proclipse	2	LB/A	prodiamine	1.3 LB
20	Milestone VM	7	FL OZ/A	aminopyralid	1.8 OZ AE
21	Opensight	3.3	OZ/A	aminopyralid + metsulfuron	1.7 OZ AE + 0.3 OZ
22	Perspective	4.5	OZ/A	aminocyclopyrachlor + chlorsulfuron	1.8 OZ + 0.7 OZ
23	Streamline	4.5	OZ/A	aminocyclopyrachlor + metsulfuron	1.8 OZ + 0.6 OZ
24	Nontreated Check				

All herbicide treatments (except trt. #1 and 2) contained the adjuvant, Activator 90 at 0.25% v/v.

Table 2a: Results for Cable Barrier Trial 33 DAT[1] (July 11, 2016)(part 1)

Trt. No.	Product Name	Rate	Rate Unit	% Bare Ground	% Perennial Grass	% Annual Grass	% Broadleaves
				33 DAT			
1	Roundup ProMax	1.3	QT/A	67 b[2]	2 c	18 a	13 ab
2	Roundup ProMax	1.3	QT/A	77 b	2 c	10 b	12 ab
	Control Duo	0.5	% V/V				
3	Roundup ProMax	1.3	QT/A	100 a	0 c	0 d	0 c
	Sahara	10	LB/A				
4	Roundup ProMax	1.3	QT/A	97 a	3 c	0 d	0 c
	Hyvar	10	LB/A				
5	Roundup ProMax	1.3	QT/A	99 a	1 c	0 d	0 c
	Oust XP	3	OZ/A				
6	Roundup ProMax	1.3	QT/A	97 a	3 c	0 d	0 c
	Payload	12	OZ/A				
7	Roundup ProMax	1.3	QT/A	92 a	8 c	0 d	0 c
	Pendulum AquaCap	4	QT/A				
	Milestone VM	7	FL OZ/A				
8	Roundup ProMax	1	QT/A	97 a	3 c	0 d	0 c
	Journey	1	QT/A				
	Milestone VM	7	FL OZ/A				
9	Roundup ProMax	1.3	QT/A	98 a	2 c	0 d	0 c
	Perspective	9	OZ/A				
	Esplanade	3.5	FL OZ/A				
10	Razor Pro	2	QT/A	98 a	2 c	0 d	0 c
	Perspective	5	OZ/A				
	Esplanade	4	FL OZ/A				
11	Roundup ProMax	1.3	QT/A	92 a	8 c	0 d	0 c
	Perspective	9	OZ/A				
	Endurance	2.3	LB/A				
12	Roundup ProMax	1.3	QT/A	98 a	2 c	0 d	0 c
	Viewpoint	18	OZ/A				
13	Roundup ProMax	1.3	QT/A	99 a	1 c	0 d	0 c
	Viewpoint	18	OZ/A				
	Esplanade	3.5	FL OZ/A				
14	Roundup ProMax	1.3	QT/A	100 a	0 c	0 d	0 c
	Polaris AC Complete	2	PT/A				
15	Roundup ProMax	1.3	QT/A	98 a	2 c	0 d	0 c
	Esplanade	3.5	FL OZ/A				
	Oust XP	3	OZ/A				

All herbicide treatments (except trt. #1 and 2) 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 2b: Results for Cable Barrier Trial 33 DAT[1] (July 11, 2016)(part 2)

Trt. No.	Product Name	Rate	Rate Unit	% Bare Ground	% Perennial Grass	% Annual Grass	% Broadleaves
				33 DAT			
16	Roundup ProMax	1.3	QT/A	96 a[2]	4 c	0 d	0 c
	Streamline	8	OZ/A				
	Esplanade	5	FL OZ/A				
	Plateau	5	FL OZ/A				
17	Rodeo	1.5	QT/A	93 a	7 c	0 d	0 c
	Cleantraxx	3	PT/A				
	Milestone VM	7	FL OZ/A				
18	Rodeo	1.5	QT/A	97 a	3 c	0 d	0 c
	Cleantraxx	4.5	PT/A				
19	Pyresta	24	FL OZ/A	8 d	80 a	10 b	2 c
	Proclipse	2	LB/A				
20	Milestone VM	7	FL OZ/A	7 d	67 ab	12 b	15 a
21	Opensight	3.3	OZ/A	17 cd	69 ab	7 bc	7 abc
22	Perspective	4.5	OZ/A	23 c	70 ab	0 d	7 bc
23	Streamline	4.5	OZ/A	17 cd	77 a	3 cd	3 c
24	Nontreated Check			7 d	57 b	22 a	15 a

All herbicide treatments (except trt. #1 and 2) 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 3a: Results for Cable Barrier Trial 65 DAT[1] (August 12, 2016)(part 1)

Trt. No.	Product Name	Rate	Rate Unit	% Bare Ground	% Perennial Grass	% Annual Grass	% Broadleaves
				65 DAT			
1	Roundup ProMax	1.3	QT/A	20 de[2]	2 e	55 ab	23 a
2	Roundup ProMax Control Duo	1.3 0.5	QT/A % V/V	22 d	2 e	58 ab	16 ab
3	Roundup ProMax Sahara	1.3 10	QT/A LB/A	96 ab	1 e	1 d	2 cd
4	Roundup ProMax Hyvar	1.3 10	QT/A LB/A	87 bc	8 e	3 d	3 cd
5	Roundup ProMax Oust XP	1.3 3	QT/A OZ/A	95 ab	1 e	2 d	2 cd
6	Roundup ProMax Payload	1.3 12	QT/A OZ/A	90 abc	0 e	6 d	4 cd
7	Roundup ProMax Pendulum AquaCap Milestone VM	1.3 4 7	QT/A QT/A FL OZ/A	82 c	8 e	4 d	5 cd
8	Roundup ProMax Journey Milestone VM	1 1 7	QT/A QT/A FL OZ/A	82 c	8 e	6 d	4 cd
9	Roundup ProMax Perspective Esplanade	1.3 9 3.5	QT/A OZ/A FL OZ/A	98 ab	0 e	1 d	1 cd
10	Razor Pro Perspective Esplanade	2 5 4	QT/A OZ/A FL OZ/A	96 ab	3 e	1 d	0 d
11	Roundup ProMax Perspective Endurance	1.3 9 2.3	QT/A OZ/A LB/A	87 bc	3 e	5 d	5 cd
12	Roundup ProMax Viewpoint	1.3 18	QT/A OZ/A	90 abc	2 e	5 d	4 cd
13	Roundup ProMax Viewpoint Esplanade	1.3 18 3.5	QT/A OZ/A FL OZ/A	98 ab	0 e	2 d	0 d
14	Roundup ProMax Polaris AC Complete	1.3 2	QT/A PT/A	93 abc	0 e	3 d	4 cd
15	Roundup ProMax Esplanade Oust XP	1.3 3.5 3	QT/A FL OZ/A OZ/A	99 a	0 e	1 d	1 cd

All herbicide treatments (except trt. #1 and 2) 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 65 DAT[1] (August 12, 2016)(part 2)

Trt. No.	Product Name	Rate	Rate Unit	% Bare Ground	% Perennial Grass	% Annual Grass	% Broadleaves
				65 DAT			
16	Roundup ProMax	1.3	QT/A	99 a[2]	1 e	0 d	0 d
	Streamline	8	OZ/A				
	Esplanade	5	FL OZ/A				
	Plateau	5	FL OZ/A				
17	Rodeo	1.5	QT/A	88 abc	2 e	7 d	4 cd
	Cleantraxx	3	PT/A				
	Milestone VM	7	FL OZ/A				
18	Rodeo	1.5	QT/A	87 bc	1 e	5 d	8 bcd
	Cleantraxx	4.5	PT/A				
19	Pyresta	24	FL OZ/A	8 ef	47 ab	48 b	0 d
	Proclipse	2	LB/A				
20	Milestone VM	7	FL OZ/A	7 f	23 d	68 a	8 bcd
21	Opensight	3.3	OZ/A	7 f	43 bc	48 b	2 cd
22	Perspective	4.5	OZ/A	12 def	57 ab	28 c	3 cd
23	Streamline	4.5	OZ/A	12 def	60 a	27 c	2 cd
24	Nontreated Check			7 f	30 cd	53 b	10 bc

All herbicide treatments (except trt. #1 and 2) 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 103 DAT[1] (September 19, 2016)(part 1)

Trt. No.	Product Name	Rate	Rate Unit	% Bare Ground	% Perennial Grass	% Annual Grass	% Broadleaves
				103 DAT			
1	Roundup ProMax	1.3	QT/A	25 f[2]	2 d	58 a	15 cdef
2	Roundup ProMax Control Duo	1.3 0.5	QT/A % V/V	20 fg	0 d	60 a	17 bcde
3	Roundup ProMax Sahara	1.3 10	QT/A LB/A	70 b	2 d	12 fg	15 cdef
4	Roundup ProMax Hyvar	1.3 10	QT/A LB/A	56 bcde	10 d	12 fg	22 bc
5	Roundup ProMax Oust XP	1.3 3	QT/A OZ/A	68 bc	0 d	15 efg	15 cdef
6	Roundup ProMax Payload	1.3 12	QT/A OZ/A	50 de	0 d	20 cdefg	30 ab
7	Roundup ProMax Pendulum AquaCap Milestone VM	1.3 4 7	QT/A QT/A FL OZ/A	52 cde	7 d	20 cdefg	20 bcd
8	Roundup ProMax Journey Milestone VM	1 1 7	QT/A QT/A FL OZ/A	48 e	5 d	25 cdef	22 bc
9	Roundup ProMax Perspective Esplanade	1.3 9 3.5	QT/A OZ/A FL OZ/A	89 a	2 d	4 g	4 efg
10	Razor Pro Perspective Esplanade	2 5 4	QT/A OZ/A FL OZ/A	88 a	3 d	5 g	3 efg
11	Roundup ProMax Perspective Endurance	1.3 9 2.3	QT/A OZ/A LB/A	53 bcde	5 d	22 cdefg	20 bcd
12	Roundup ProMax Viewpoint	1.3 18	QT/A OZ/A	67 bcd	3 d	15 efg	17 bcde
13	Roundup ProMax Viewpoint Esplanade	1.3 18 3.5	QT/A OZ/A FL OZ/A	94 a	0 d	4 g	2 fg
14	Roundup ProMax Polaris AC Complete	1.3 2	QT/A PT/A	62 bcde	0 d	20 cdefg	22 bc
15	Roundup ProMax Esplanade Oust XP	1.3 3.5 3	QT/A FL OZ/A OZ/A	93 a	2 d	3 g	2 fg

All herbicide treatments (except trt. #1 and 2) 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 103 DAT[1] (September 19, 2016)(part 2)

Trt. No.	Product Name	Rate	Rate Unit	% Bare Ground	% Perennial Grass	% Annual Grass	% Broadleaves
				103 DAT			
16	Roundup ProMax	1.3	QT/A	94 a[2]	0 d	3 g	2 fg
	Streamline	8	OZ/A				
	Esplanade	5	FL OZ/A				
	Plateau	5	FL OZ/A				
17	Rodeo	1.5	QT/A	61 bcde	1 d	17 defg	22 bc
	Cleantraxx	3	PT/A				
	Milestone VM	7	FL OZ/A				
18	Rodeo	1.5	QT/A	45 e	0 d	18 defg	37 a
	Cleantraxx	4.5	PT/A				
19	Pyresta	24	FL OZ/A	8 fg	53 ab	35 bcd	1 g
	Proclipse	2	LB/A				
20	Milestone VM	7	FL OZ/A	8 fg	43 bc	38 bc	11 cdefg
21	Opensight	3.3	OZ/A	0	48 b	38 bc	2 fg
22	Perspective	4.5	OZ/A	10 fg	52 ab	32 cde	7 defg
23	Streamline	4.5	OZ/A	5 g	62 a	35 bcd	2 fg
24	Nontreated Check			3 g	32 c	53 ab	12 cdefg

All herbicide treatments (except trt. #1 and 2) 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 138 DAT[1] (October 24, 2016)(part 1)

Trt. No.	Product Name	Rate	Rate Unit	% Bare Ground	% Perennial Grass	% Annual Grass	% Broadleaves
				138 DAT			
1	Roundup ProMax	1.3	QT/A	15 f[2]	2 d	55 ab	28 abcd
2	Roundup ProMax Control Duo	1.3 0.5	QT/A % V/V	18 ef	2 d	70 a	10 defgh
3	Roundup ProMax Sahara	1.3 10	QT/A LB/A	53 bcd	2 d	10 d	33 abc
4	Roundup ProMax Hyvar	1.3 10	QT/A LB/A	58 bc	8 d	17 d	18 bcdefgh
5	Roundup ProMax Oust XP	1.3 3	QT/A OZ/A	60 b	0 d	21 cd	20 bcdefgh
6	Roundup ProMax Payload	1.3 12	QT/A OZ/A	35 de	0 d	21 cd	43 a
7	Roundup ProMax Pendulum AquaCap Milestone VM	1.3 4 7	QT/A QT/A FL OZ/A	46 bcd	12 d	20 cd	23 bcdef
8	Roundup ProMax Journey Milestone VM	1 1 7	QT/A QT/A FL OZ/A	47 bcd	10 d	22 cd	22 bcdefg
9	Roundup ProMax Perspective Esplanade	1.3 9 3.5	QT/A OZ/A FL OZ/A	88 a	1 d	2 d	10 defgh
10	Razor Pro Perspective Esplanade	2 5 4	QT/A OZ/A FL OZ/A	88 a	3 d	3 d	6 efgh
11	Roundup ProMax Perspective Endurance	1.3 9 2.3	QT/A OZ/A LB/A	57 bc	5 d	22 cd	20 bcdefgh
12	Roundup ProMax Viewpoint	1.3 18	QT/A OZ/A	57 bc	5 d	12 d	26 abcde
13	Roundup ProMax Viewpoint Esplanade	1.3 18 3.5	QT/A OZ/A FL OZ/A	92 a	0 d	3 d	5 fgh
14	Roundup ProMax Polaris AC Complete	1.3 2	QT/A PT/A	47 bcd	0 d	18 d	35 ab
15	Roundup ProMax Esplanade Oust XP	1.3 3.5 3	QT/A FL OZ/A OZ/A	93 a	2 d	2 d	3 gh

All herbicide treatments (except trt. #1 and 2) 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 138 DAT[1] (October 24, 2016)(part 2)

Trt. No.	Product Name	Rate	Rate Unit	% Bare Ground	% Perennial Grass	% Annual Grass	% Broadleaves
				138 DAT			
16	Roundup ProMax	1.3	QT/A	93 a[2]	1 d	2 d	4 fgh
	Streamline	8	OZ/A				
	Esplanade	5	FL OZ/A				
	Plateau	5	FL OZ/A				
17	Rodeo	1.5	QT/A	47 bcd	6 d	15 d	33 abc
	Cleantraxx	3	PT/A				
	Milestone VM	7	FL OZ/A				
18	Rodeo	1.5	QT/A	40 cd	0 d	17 d	45 a
	Cleantraxx	4.5	PT/A				
19	Pyresta	24	FL OZ/A	3 f	47 bc	48 b	2 h
	Proclipse	2	LB/A				
20	Milestone VM	7	FL OZ/A	3 f	45 bc	40 bc	12 defgh
21	Opensight	3.3	OZ/A	3 f	52 b	40 bc	5 fgh
22	Perspective	4.5	OZ/A	5 f	68 a	20 cd	7 efgh
23	Streamline	4.5	OZ/A	2 f	80 a	15 d	3 fgh
24	Nontreated Check			0 f	35 c	52 ab	14 cdefgh

All herbicide treatments (except trt. #1 and 2) 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: Overall View of Cable Barrier Trial from Rep 1 on July 11, 2016
Note the turf damage beyond the sprayed area on some plots indicating movement of the herbicide after application.

2016 Mowing x PGR Trial

Introduction

Tall fescue is a widely adapted grass species commonly used for roadsides and other unimproved turf areas. Frequent mowing is the most common management regime for departments of transportation but reduced mowing schedules are being used to cut costs. To maintain highway safety, the zone next to the roadway (clear zone) might be mowed three times per season while the remaining right of way (selective zone) is only mowed once per season. 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. This trial was established to examine the interaction between different PGRs and mowing management regimes.

Materials and Methods

This trial was established in 2016 at the Spindletop Research Farm in Lexington KY arranged as a split plot design with 3 mowing regimes, 16 PGR treatments, and three replications. Main plots were 20 ft wide and the mowing regimes were three times per season, once at the end of the season, and unmowed. Sub plots were 10 ft by 20 ft with running unsprayed checks (5 ft wide) between each of the plots. The treatments were five PGRs applied one to two weeks after each of the three mowings plus control. Each set of plots received only one PGR application.

Products tested were Embark 2S (mefluidide [Class C]) at 24 fl oz/A, Plateau (imazapic) (Class D) at 12 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 (Table 1). Plateau should have been applied at the recommended rate of 4 fl oz/A rather than 12 fl/oz A but the error was not noticed until after all the applications had been made. Growth regulator herbicides were included in the treatments, either as part of the product or added as 2,4-D to act as “safeners” to reduce the fescue “yellowing” after application. However, it should be noted that application of even low volatility 2,4-D formulations later in the season carry the risk of damage to sensitive plants nearby. All applications were at 25 gallons per acre and included a non-ionic surfactant (Activator 90) at 0.25% v/v. Application dates were 5/24/2016, 7/19/2016, and 10/6/2016. Mowing dates were 5/16/2016, 7/11/2016, and 9/21/2016.

Tall fescue color was assessed weekly 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 and canopy heights were measured weekly as well. With the Plateau treatment application error, it was decided to analyze the data for each mowing regime separately rather than as the split plot design. Data were analyzed using ARM software and treatment means were compared using Fisher’s LSD at $p = 0.05$.

Results and Discussion

Plots were rated for color and height weekly after PGR / herbicide application which is a lot of data. The tables and figures in this report illustrate the treatment effects at similar times after treatment and trends over the season to provide information useful for managers. Tables 2 and 3 and Figures 1 to 4 present information on treatments within the three mowing per season regime. Table 4 has information about the one mowing per season regime. There were not many measurable treatment effects on the plots without mowing. Figure 5 illustrates the monthly precipitation for the 2016 season and how it was a wetter than average during the summer but drier than average in the fall.

Plateau, Opensight, and Perspective applied after the first mowing resulted in lower color ratings and shorter fescue 21 days after treatment (DAT) (Table 2). The Anuew treatment had shorter fescue with the same color as the control 21 DAT1 (Days after treatment after first mowing). Tall fescue color recovered and then was higher in the Plateau, Opensight, and Perspective treatments 48 and 64 DAT1. These Perspective plots "rebounded" and also had taller fescue 64 DAT1 (Table 2). Interestingly, the tall fescue in the Anuew plots were shorter 112 DAT1 (Table 3).

Similar results were observed with PGR applications after the second mowing. Plateau, Opensight, and Perspective gave lower color and shorter fescue (Table 2) and 20 DAT2 (Days after treatment after second mowing) (Table 3). Again, the color recovered and the Opensight and Perspective treatments actually had higher color than the control 56 DAT2 (Table 3). Embark, Plateau, Anuew, and Perspective resulted in shorter fescue than the control 56 DAT2. The Perspective plots still had higher color than the control 101 DAT2.

There was less response-to PGRs applied after the third mowing as the conditions were drier than average (Figure 5) and the growing season was ending. However, the Plateau and Perspective gave lower color than the control 22 DAT3 (Days after treatment after third mowing) (Table 3).

Turf color data are summarized in Figures 1 and 3 while fescue height data are summarized in Figures 2 and 4. These are the "biological" responses to the treatments and but they may not be practically significant (i.e., you may still need to mow anyway) but they are differences from the control.

Embark and Anuew had no effect on turf color when applied after the first mowing (Figure 1). Plateau (applied at too high a rate), Opensight, and Perspective applications resulted in lower color after the first mowing and it took from 30 to 42 DAT for color to recover. These three PGRs had higher color 48 DAT and the higher color persisted after the second mowing until 69 DAT (Figure 1). Embark did not affect fescue height while all the other treatments had shorter fescue than the control by 8 DAT (Figure 2). How long this growth reduction lasted varied between the treatments. Anuew gave the longest lasting tall fescue growth suppression, up to

112 and 120 DAT, without reducing color (Figure 2). The Plateau and Perspective had taller fescue for a few ratings after the second mowing (Figure 2) even beyond the time when the turf color had recovered (Figure 1).

A similar pattern was observed for the response of turf color after the second mowing (Figure 3). Anuew again had no effect on turf color while Embark resulted in lower color 28 and 34 DAT. Plateau, Opensight, and Perspective had consistently lower color 8 to 20 DAT (Figure 3) with color recovering sometime afterwards. All three of these treatments had higher color than the control 64 DAT and Perspective continued to have higher color after the third mowing up to 101 DAT (Figure 3). Plateau, Opensight, and Perspective had shorter fescue 8 DAT with the effect being intermittently significant up to the third mowing (Figure 4). The Embark and Anuew plots had shorter tall fescue at the 34 and 56 DAT ratings (Figure 4).

In the plots with only one mowing per season, there were no color differences 21 DAT1 for the first application timing (Table 4). The application was later than the application window for seedhead suppression. However, there were height reductions with the Plateau, Opensight, Anuew, and Perspective treatments. Lodging or "leaning" was observed with Opensight and there seemed to be less seedfill with the Perspective treatment (Table 4). At 28 DAT2 after the second application, lower color was observed on the fresh vegetative growth for the Plateau, Opensight, and Perspective plots. These same PGRs plus the Embark produced shorter fescue than the control (Table 4). Plateau, Opensight, and Perspective treatments resulted in lower tall fescue color when applied after the one seasonal mowing and 22 DAT3. These same treatments, plus Anuew, reduced fescue growth (Table 4).

In the three mowing per season regime, the effects of these PGR treatments extended over time, even beyond subsequent mowing. There was a recovery, even a "rebound", in color and growth after application of the Class D (herbicidal) PGR's (Plateau, Opensight, and Perspective). Tall fescue showed good resilience after these applications in a season with good moisture availability. The story may be different in a drought. The Class C (mitotic/cell division inhibitors) (Embark) and Class A (late GA synthesis blockers) (Anuew) PGR's showed little turf yellowing but also reduced fescue growth less. PGR's may have a role as part of an integrated vegetation management system.

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
Formula 40	2 qt	2,4-D amine	1.84 lb ae
Plateau *	12 fl oz	imazapic	3 oz ae
Formula 40	2 qt	2,4-D amine	1.84 lb ae
Opensight	2.5 oz	aminopyralid + metsulfuron methyl	1.3 oz ae + 0.24 oz
Anuew	1 lb	prohexadione calcium	4.4 oz
Formula 40	2 qt	2,4-D amine	1.84 lb ae
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.

* Rate should have been 4 fl oz per acre

Growth regulator herbicides included as “safeners”.

Table 2. Herbicide Treatments, Turf Color and Fescue Height for Plots with 3 Mowing Cycles per Year (Part 1)

Product (s)	Rate (per Acre)	Timing	June 14, 2016		July 11, 2016		July 27, 2016	
			Color (0-9)	Ht (in)	Color (0-9)	Ht (in)	Color (0-9)	Ht (in)
			21 DAT1[1]		48 DAT1		64 DAT1 (8 DAT2[2])	
Embark 2S	24 fl oz	after first mowing	7.8 ab[3]	16 ab	8.0 b	17	8.2 cd	13 bc
Formula 40	2 qt	after second mowing					7.8 de	12 cde
		after third mowing						
Plateau *	12 fl oz	after first mowing	6.5 d	11 cd	8.5 a	14	9.0 a	15 ab
Formula 40	2 qt	after second mowing					7.0 f	9 f
		after third mowing						
Opensight	2.5 oz	after first mowing	7.5 b	9 d	8.3 a	18	8.4 bc	12 cd
		after second mowing					7.5 e	10 ef
		after third mowing						
Anuew	1 lb	after first mowing	8.0 a	13 bc	8.0 b	16	8.0 d	12 cde
Formula 40	2 qt	after second mowing					8.0 d	12 cde
		after third mowing						
Perspective	4.75 oz	after first mowing	7.0 c	11 cd	8.5 a	15	8.7 ab	16 a
		after second mowing					7.5 e	11 def
		after third mowing						
Unsprayed Control			8.0 a	17 a	8.0 b	18	8.0 d	13 bc

* Rate should have been 4 fl oz per acre

[1] *DAT1 = Days after treatment after first mowing*

[2] *DAT2 = Days after application after second mowing*

[3] *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 Height for Plots with 3 Mowing Cycles per Year (Part 2)

Product (s)	Rate (per Acre)	Timing	August 8, 2016		September 13, 2016		October 28, 2016	
			Color (0-9)	Ht (in)	Color (0-9)	Ht (in)	Color (0-9)	Ht (in)
			76 DAT1[1] (20 DAT2[2])		112 DAT1 (56 DAT2)		157 DAT1 (22 DAT3[3])	
Embark 2S	24 fl oz	after first mowing	8.0 ab[4]	17 abc	8.0 c	18 bcd	8.0 b	12 abcd
Formula 40	2 qt	after second mowing	7.5 bc	14 cde	8.1 c	16 cd	8.0 b	11 bcd
		after third mowing					8.0 b	12 abcd
Plateau *	12 fl oz	after first mowing	8.3 a	19 a	8.0 c	20 ab	8.0 b	12 abcd
Formula 40	2 qt	after second mowing	5.3 e	10 f	8.1 bc	15 d	8.0 b	13 ab
		after third mowing					7.8 c	10 d
Opensight	2.5 oz	after first mowing	8.2 a	19 ab	8.0 c	19 abc	8.0 b	11 bcd
		after second mowing	7.0 cd	12 def	8.3 ab	18 bc	8.1 ab	12 abcd
		after third mowing					8.0 b	11 bcd
Anuew	1 lb	after first mowing	8.0 ab	17 abc	8.0 c	16 cd	8.0 b	11 cd
Formula 40	2 qt	after second mowing	8.0 ab	15 bcd	8.0 c	16 cd	8.0 b	12 abcd
		after third mowing					8.0 b	11 bcd
Perspective	4.75 oz	after first mowing	8.5 a	19 a	8.0 c	22 a	8.0 b	11 bcd
		after second mowing	6.8 d	12 ef	8.4 a	16 cd	8.2 a	13 a
		after third mowing					7.8 c	11 cd
Unsprayed Control			8.0 ab	17 abc	8.0 c	21 ab	8.0 b	12 abcd
								ns

* Rate should have been 4 fl oz per acre

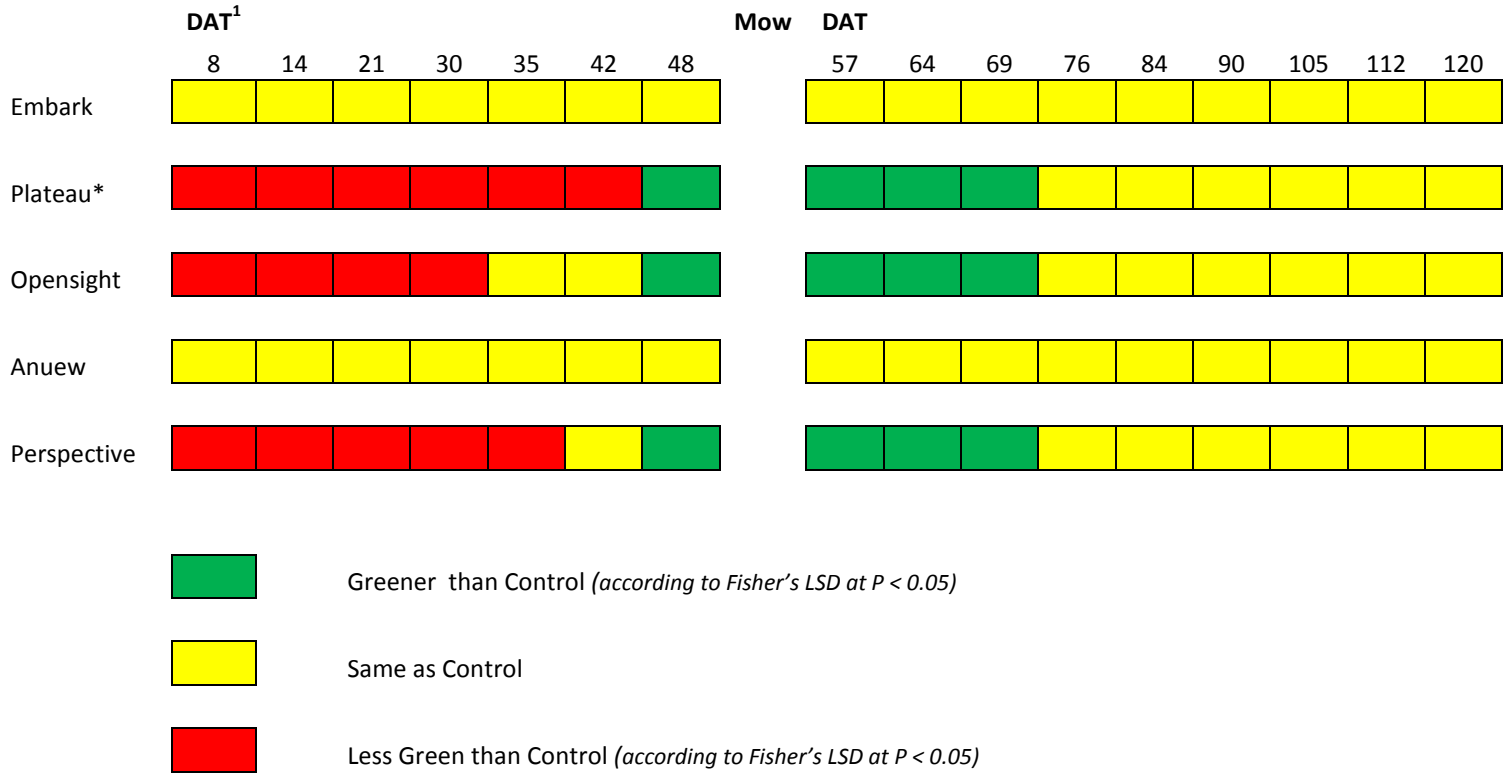
[1] *DAT1 = Days after treatment after first mowing*

[2] *DAT2 = Days after application after second mowing*

[3] *DAT3 = Days after application after third mowing*

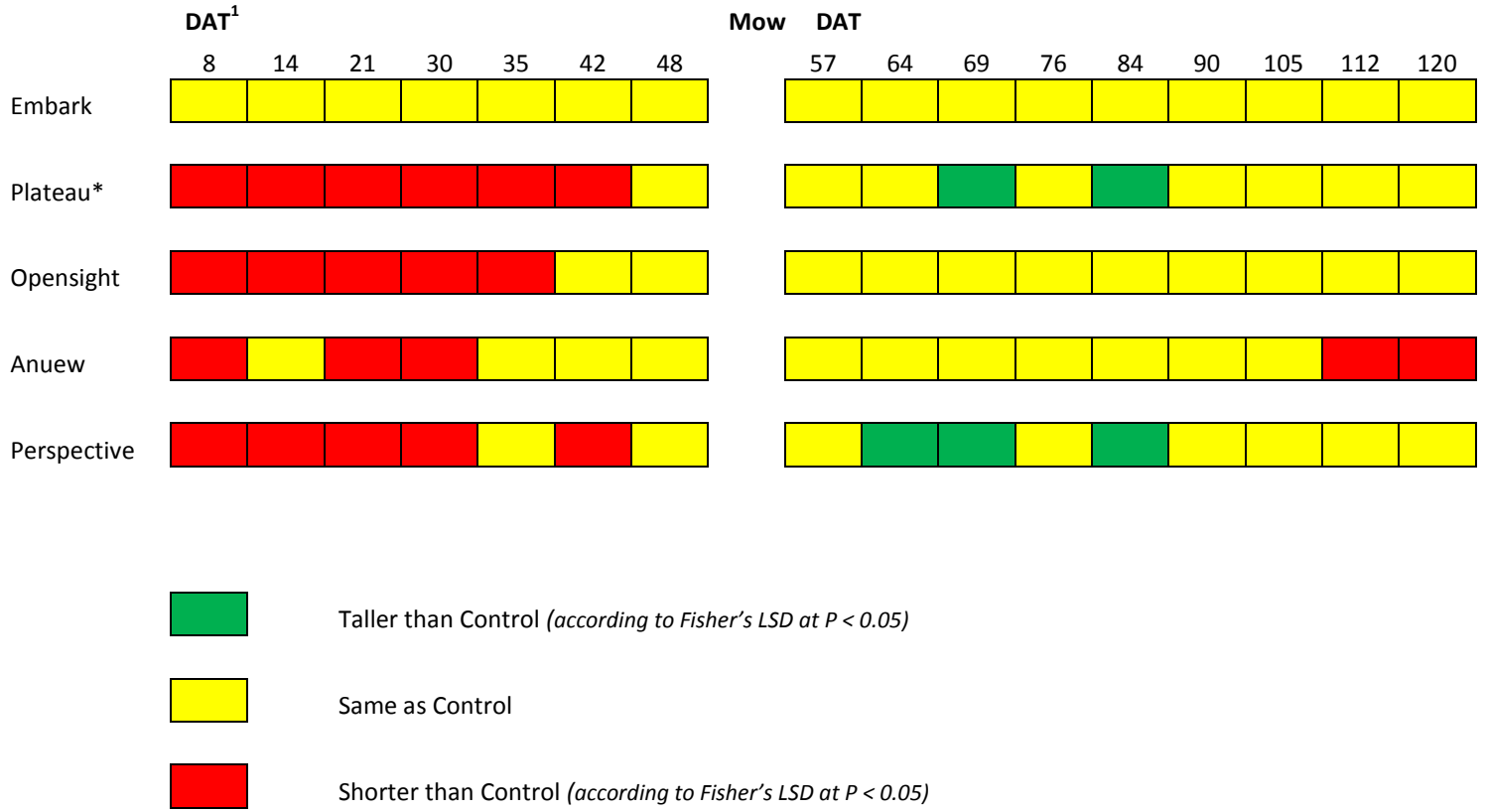
[4] *Means within a column followed by the same letter are not different according to Fisher's LSD at P < 0.05.*

Figure 1. Summary of Turf Color with Application after First Mowing for 3 Mowing Cycles per Year



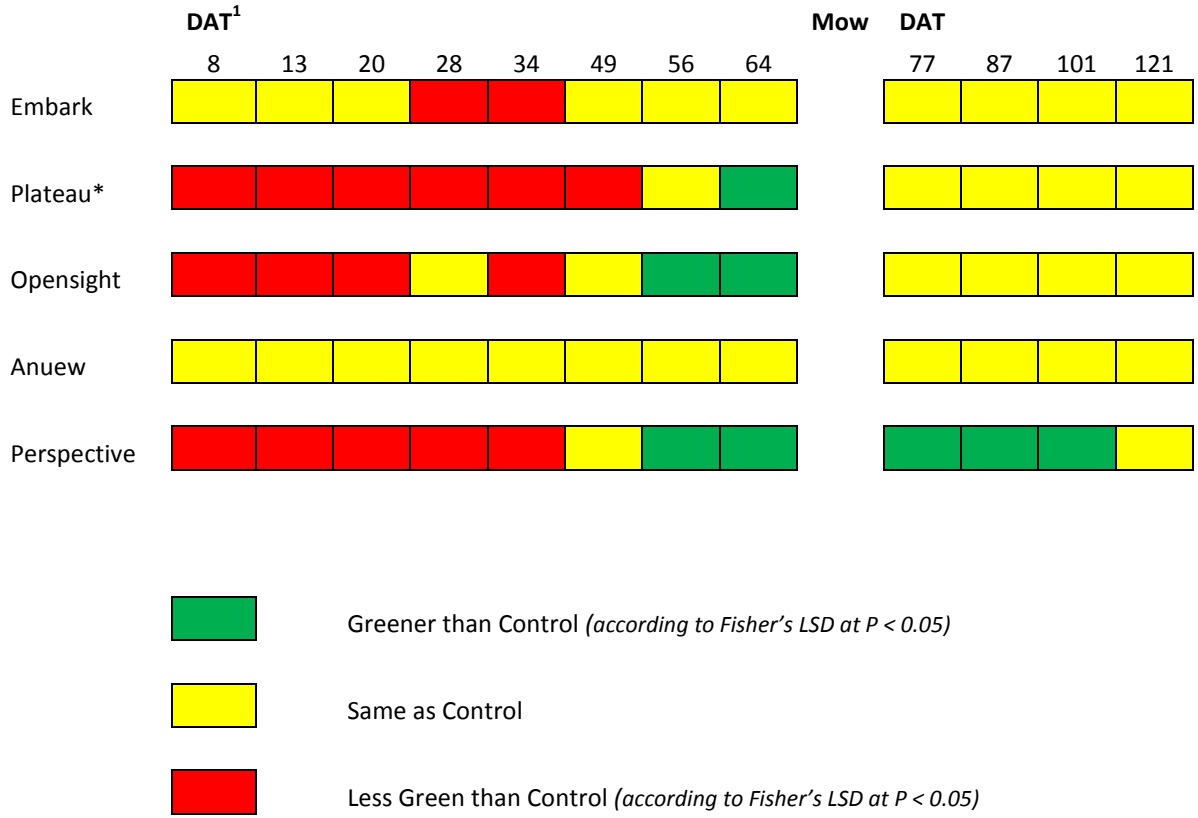
[1] *DAT = Days after treatment*

Figure 2. Summary of Fescue Height with Application after First Mowing for 3 Mowing Cycles per Year



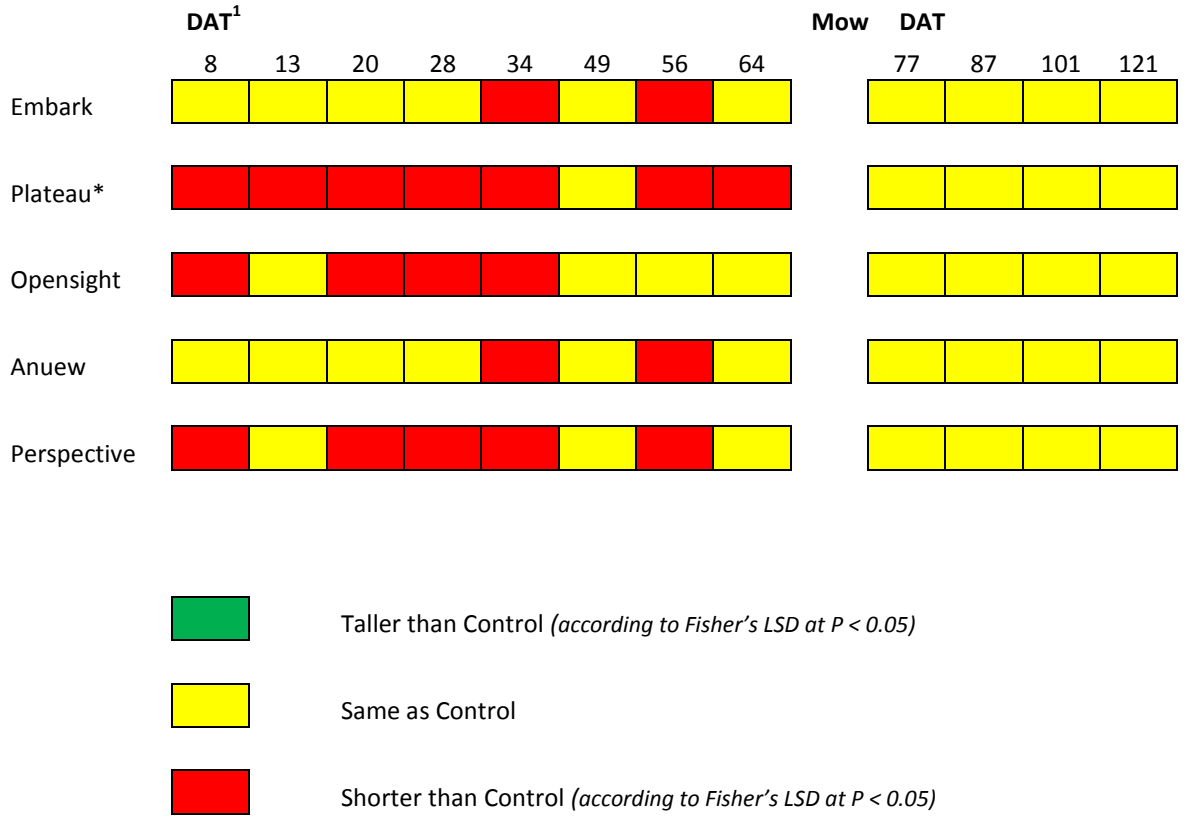
[1] *DAT = Days after treatment*

Figure 3. Summary of Turf Color with Application after Second Mowing for 3 Mowing Cycles per Year



[1] *DAT = Days after treatment*

Figure 4. Summary of Fescue Height with Application after Second Mowing for 3 Mowing Cycles per Year



[1] *DAT = Days after treatment*

Table 4. Herbicide Treatments, Turf Color and Fescue Height for Plots with 1 Mowing Cycles per Year

Product (s)	Rate (per Acre)	Timing	June 14, 2016			August 16, 2016		October 28, 2016	
			Color (0-9)	Ht (in)	Lodging (%)[4]	Color (0-9)	Ht (in)	Color (0-9)	Ht (in)
			21 DAT1[1]			84 DAT1 (28 DAT2[2])		157 DAT1 (22 DAT3[3])	
Embark 2S	24 fl oz	after first mowing	8.0	46 ab[5]	0 b	8.0 a	18 bcd	8.0 ab	14 abc
Formula 40	2 qt	after second mowing				7.7 ab	18 cd	8.0 ab	14 ab
		after third mowing						8.0 ab	14 ab
Plateau *	12 fl oz	after first mowing	8.0	44 bc	0 b	8.0 a	22 a	8.0 ab	14 ab
Formula 40	2 qt	after second mowing				5.0 c	16 d	8.1 a	15 ab
		after third mowing						7.7 d	13 d
Opensight	2.5 oz	after first mowing	8.0	44 bc	21 a	8.0 a	23 a	8.0 ab	14 bcd
		after second mowing				7.0 b	17 d	8.1 a	14 ab
		after third mowing						7.9 bc	14 bcd
Anuew	1 lb	after first mowing	8.0	44 bc	0 b	8.0 a	21 ab	8.0 ab	14 ab
Formula 40	2 qt	after second mowing				8.0 a	21 abc	8.0 ab	15 a
		after third mowing						8.0 ab	14 bcd
Perspective	4.75 oz	after first mowing	8.0	41 c	0 b[6]	8.0 a	21 a	8.0 ab	14 ab
		after second mowing				7.0 b	17 d	8.1 a	15 a
		after third mowing						7.8 c	13 cd
Unsprayed Control			8.0	49 a	0 b	8.0 a	23 a	8.0 ab	15 a

* Rate should have been 4 fl oz

[1] *DAT1 = Days after treatment after first mowing*

[2] *DAT2 = Days after application after second mowing*

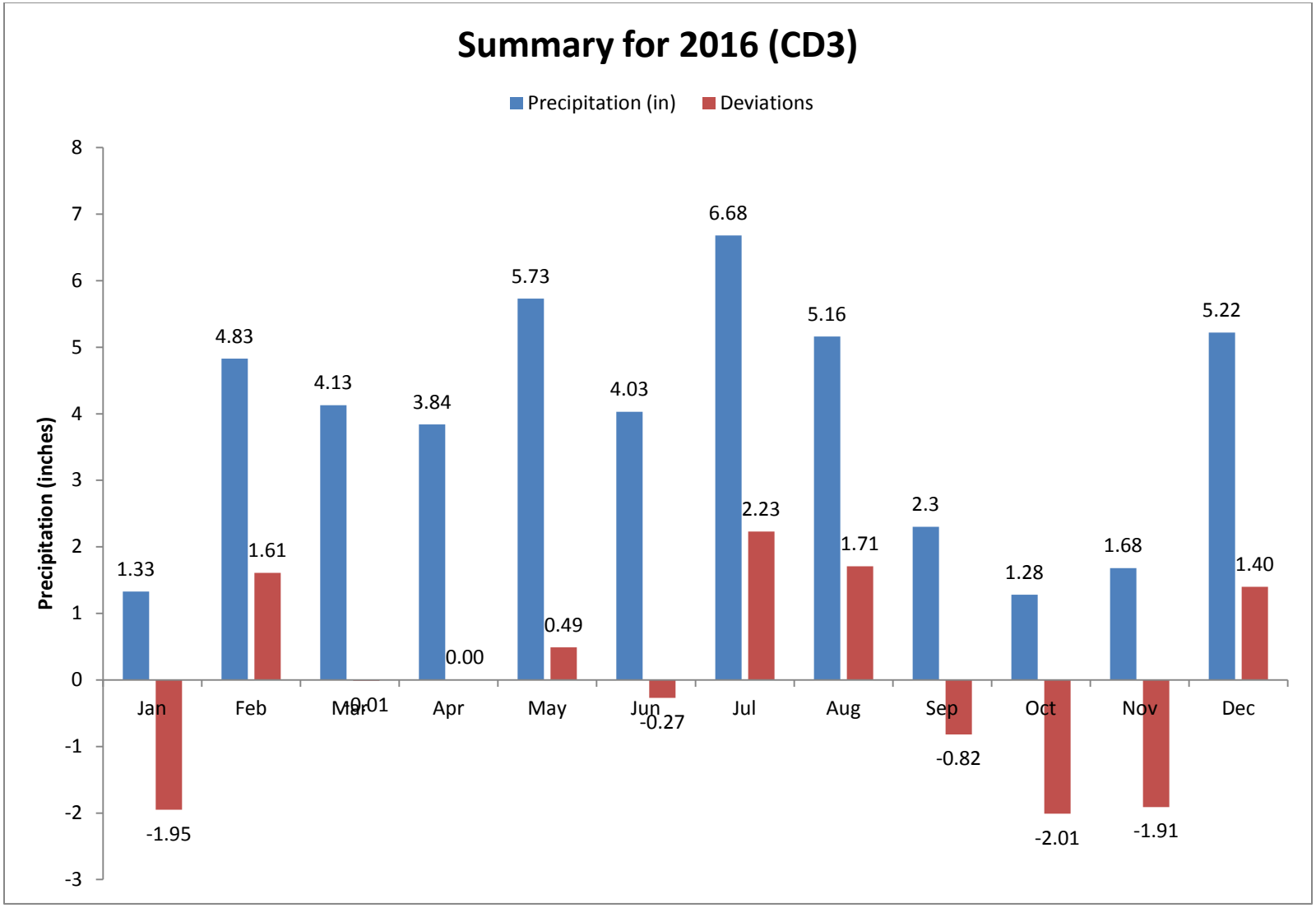
[3] *DAT3 = Days after application after third mowing*

[4] *Lodging (%) range from 0% (erect and full height) to 100% (flat on ground)*

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

[6] *Seedhead fill appeared to be less in these plots*

Figure 5: Monthly Precipitation and Deviations from Long Term Average (inches) for 2016 for Climate Division 3



2016 Knotweed Control Trial (near Smith's Grove)

Introduction

Japanese knotweed (*Polygonum cuspidatum* Siebold & Zucc.) is a problem for land managers and along roadsides due to its aggressive nature and reproductive potential. It is a tall, perennial, canelike shrub 3 to 12 feet (1 to 3.5 m) in height, freely branching in dense, often clonal, infestations. Hollow-jointed, reddish stems like bamboo survive only one season while rhizomes survive decades. Dead tops remain standing during winter. It spreads along streams by stem and rhizome fragments and also along roadsides through maintenance mowing (Miller, et al. 2010).

Materials and Methods

The trial was established beside guardrail along KY 80 (New Bowling Green Road) near Smith's Grove, KY with 5 treatments and 3 replications arranged in a randomized complete block design. On August 24, 2016, treatments were applied at 50 gallons/acre with a directed spray swath over the canopy beside the guardrail for a plot width of 5 ft and length of 12 ft (two areas between guardrail posts per plot). Canopy height was 4 to 5.5 ft. All herbicide treatments included Activator 90 at 0.25% v/v (Table 1). Milestone was applied at the broadcast rate (7 fl oz/ac) but the label allows for a spot treatment rate of 14 fl oz/ac if no more than 50% of the area is treated.

Visual assessments of percent knotweed control were done 26 (9/19/2016) and 56 (10/19/2016) days after treatment (DAT) for the 2015 trial. 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 had some control of knotweed apparent as either leaf damage or leaf drop 26 DAT (Table 2). Rodeo had the greatest control (85%) while the broadcast rate of Milestone had the least (15%). A month later, the Milestone VM Plus, Polaris AC Complete, and Rodeo treatments had similar control ratings (88-95%) while the Milestone plots had 65% control. Additional ratings will be done in 2017.

Literature Cited

Miller, J.H., S.T. Manning, and S.F. Enloe. 2010. A management guide for invasive plants in southern forests. USDA Forest Service Southern Research Station. GTR SRS-131.

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	7	FL OZ/A	aminopyralid	1.8 oz ae
2	Milestone VM Plus	6	PT/A	aminopyralid + triclopyr	1.2 oz ae + 12 oz ae
3	Polaris AC Complete	2	PT/A	imazapyr	1 lb ae
4	Rodeo	8	QT/A	glyphosate	8 lb ae
5	Nontreated Check				

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

Table 2. Herbicide Treatments and % Control Data.

Trt. No.	Product Name	Rate	Rate Unit	% Control	
				26 DAT	56 DAT
1	Milestone	7	FL OZ/A	15 *d*	65 *b*
2	Milestone VM Plus	6	PT/A	53 *b*	90 *a*
3	Polaris AC Complete	2	PT/A	37 *c*	88 *a*
4	Rodeo	8	QT/A	85 *a*	95 *a*
5	Nontreated Check			0 *d*	0 *c*

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

Kudzu Control Options: Preliminary Evaluation

Joe Omielan[1], Dustin Gumm[2], and Michael Barrett[1]
[1] University of Kentucky, [2] Kentucky Transportation Cabinet

INTRODUCTION

Kudzu (*Pueraria montana*) is an invasive deciduous twining, trailing, mat-forming, woody leguminous vine that forms dense infestations along forest edges, rights-of-way, old homesteads, and stream banks. It colonizes by vines rooting at nodes and spreads by seed dispersal. The plants have extensive root systems with large tuberous roots which can be 3 to 10 feet deep. Kudzu can dominate a site to the exclusion of other vegetation. Repeated herbicide applications along with other management measures are required to reduce the infestation. Picloram is used for kudzu control in many states but has not been used extensively in KY in recent years. What are some of the other selective herbicide control options and how effective are they?

OBJECTIVE

The objective of this study was to evaluate the efficacy of herbicide control options for kudzu control.

MATERIALS & METHODS

This study was initiated in June, by mowing a kudzu infested field near Beattyville KY. Plots (9 m x 9 m) with 3 m alleys separating them were arranged in a 10 treatment randomized complete block design with 3 replications. After kudzu regrowth (35 cm canopy), 9 herbicide treatments were applied at 337 L/ha on July 25, 2014. Two repeat treatments were applied on September 25 (Trts 4, 6). These same treatments were applied on July 23 and September 24 in 2015 (Table 1). Final assessments will be taken in 2016. Alleyways were mowed and treated with Milestone VM to prevent vine encroachment (Minogue et al., 2011).

Visual assessments of percent kudzu control and green vegetative cover (0-100%) were done 32 (8/26/2014), and 62 (9/25/2014) DAIT (days after initial treatment). Visual assessments of percent cover for kudzu, grass, other broadleaves, and bare ground were done 363 (7/25/2015)(same day as first 2015 application), 392 (8/21/2015) and 426 (9/24/2015) DAIT. Data were analyzed using ARM software and treatment means were compared using Fisher's LSD at p = 0.05.

Table 1 (a) Herbicide treatments, application rates and timing, active ingredients used in this trial plus % kudzu control and % green vegetation cover in 2014.

Trt. No.	Product(s)	Rate per Ac	Application	Active Ingredient(s)	ai Rate per Ha	% Kudzu Control		% Green Cover	
						32 DAIT	62 DAIT	32 DAIT	62 DAIT
1	Transline	21 fl oz	A	clopyralid	551 g ae	92 *b*	96 *b*	83 *ab*	100 *a*
2	Streamline	11.5 oz	A	aminoclyclopyrachlor + metsulfuron	318 g + 101 g	100 *a*	100 *a*	2 *e*	13 *d*
3	Garlon 3A	3 gal	A	triclopyr	10.1 kg ae	100 *a*	100 *a*	10 *de*	80 *b*
4	Garlon 3A	1.5 gal	A	triclopryr	5 kg ae	98 *a*	100 *a*	38 *c*	97 *a*
	Garlon 3A	1.5 gal	B	triclopyr	5 kg ae				
5	Rodeo	8 qt	A	glyphosate	9 kg ae	100 *a*	99 *ab*	25 *cde*	97 *a*
6	Rodeo	4 qt	A	glyphosate	4.5 kg ae	98 *a*	98 *ab*	30 *cd*	96 *a*
	Rodeo	4 qt	B	glyphosate	4.5 kg ae				
7	Opensight	3.3 oz	A	aminopyralid + metsulfuron	121 g ae + 22 g	98 *a*	99 *a*	18 *cde*	63 *c*
8	BK 800	2 gal	A	2,4-D + 2,4-DP + dicamba	4.2 kg ae + 2.1 kg ae + 1.1 kg ae	99 *a*	98 *ab*	28 *cd*	98 *a*
9	Patron 170	6.9 pt	A	2,4-D + 2,4-DP	1.7 kg ae + 0.8 kg ae	92 *b*	72 *c*	70 *b*	100 *a*
10	Unsprayed Control					0 *c*	0 *d*	100 *a*	100 *a*

Table 1 (b) Herbicide treatments in this trial plus % kudzu, grass, and other broadleaf cover and % bare ground in 2015. First application in 2015 was 363 DAIT.

Trt. No.	Product(s)	% Kudzu Cover			% Grass Cover			% Other Broadleaf Cover			% Bare Ground		
		363 DAIT	392 DAIT	426 DAIT	363 DAIT	392 DAIT	426 DAIT	363 DAIT	392 DAIT	426 DAIT	363 DAIT	392 DAIT	426 DAIT
1	Transline	28 *b*	5 *c*	8 *c*	38 *abc*	73 *a*	65 *b*	33 *abcd*	18 *a*	23 *b*	0 *b*	0 *b*	3 *b*
2	Streamline	4 *c*	1 *d*	0 *d*	35 *abc*	40 *ab*	35 *c*	40 *abcd*	3 *d*	3 *c*	21 *a*	32 *a*	44 *a*
3	Garlon 3A	5 *c*	0 *d*	0 *d*	52 *ab*	62 *a*	77 *ab*	30 *bcd*	6 *cd*	10 *bc*	13 *ab*	2 *b*	13 *b*
4	Garlon 3A	17 *bc*	2 *cd*	0 *d*	65 *a*	70 *a*	88 *ab*	15 *cd*	3 *d*	7 *bc*	3 *ab*	8 *b*	3 *b*
	Garlon 3A												
5	Rodeo	17 *bc*	1 *cd*	3 *cd*	15 *bc*	0 *c*	2 *d*	65 *a*	8 *bcd*	73 *a*	3 *ab*	15 *b*	22 *ab*
6	Rodeo	8 *bc*	1 *d*	2 *cd*	30 *abc*	0 *c*	7 *d*	62 *ab*	15 *abc*	77 *a*	0 *b*	8 *b*	13 *b*
	Rodeo												
7	Opensight	20 *bc*	1 *d*	0 *d*	53 *ab*	73 *a*	93 *a*	17 *cd*	5 *d*	2 *c*	10 *ab*	6 *b*	5 *b*
8	BK 800	20 *bc*	3 *cd*	2 *cd*	68 *a*	70 *a*	80 *ab*	10 *cd*	17 *ab*	9 *bc*	2 *ab*	3 *b*	8 *b*
9	Patron 170	83 *a*	66 *b*	67 *b*	3 *c*	7 *bc*	20 *cd*	13 *cd*	17 *ab*	13 *bc*	0 *b*	0 *b*	0 *b*
10	Unsprayed Control	98 *a*	97 *a*	95 *a*	0 *c*	0 *c*	0 *d*	2 *d*	3 *d*	5 *bc*	0 *b*	0 *b*	0 *b*

All treatments except for #2 included Activator 90 @ 0.5% v/v. Trt. #2 included 1% COC v/v.
Application A was 7/25/2014 and 7/23/2015 (363 DAIT) while Application B was 9/25/2014 and 2/24/2015.
DAIT: Days after initial treatment.
Means followed by the same letter are not different according to Fisher's Protected LSD at P < 0.05..

RESULTS & DISCUSSION

In 2014, all the treatments had kudzu control greater than 92% 32 DAIT (Table 1a). However by 62 DAIT control with Patron 170 had declined to 72%. Green vegetative cover increased from 32 to 62 DAIT and ranged from 63 to 100% for most treatments except for Streamline with only 13% green cover 62 DAIT.

In 2015, Patron 170 had 83% kudzu cover 363 DAIT while the other treatments ranged from 28 to 4% (Table 1b). After this year's applications the kudzu cover was 67% with Patron 170, 8% with Transline and 0-3% for the other herbicide treatments 426 DAIT. At the end of the season (426 DAIT), annual grasses had 77-93% cover in the Garlon 3A, Opensight, and BK 800 treatments. Broadleaves had 73-77% cover in the two Rodeo treatments. This vegetation should help reduce erosion and compete with surviving kudzu plants. Streamline had the least green vegetative cover with 44% bare ground at the end of the 2015 season (Figure 1).

SUMMARY

There are a number of herbicide options which are selective and effective in kudzu control. Final assessments will be done in 2016.

Literature Cited:

Minogue, P.J., S.F. Enloe, A. Osiecka, and D.K. Lauer. 2011 Comparison of aminocyclopyrachlor to common herbicides for kudzu (*Pueraria montana*) management. Invasive Plant Sci. Management. 4: 419-426.

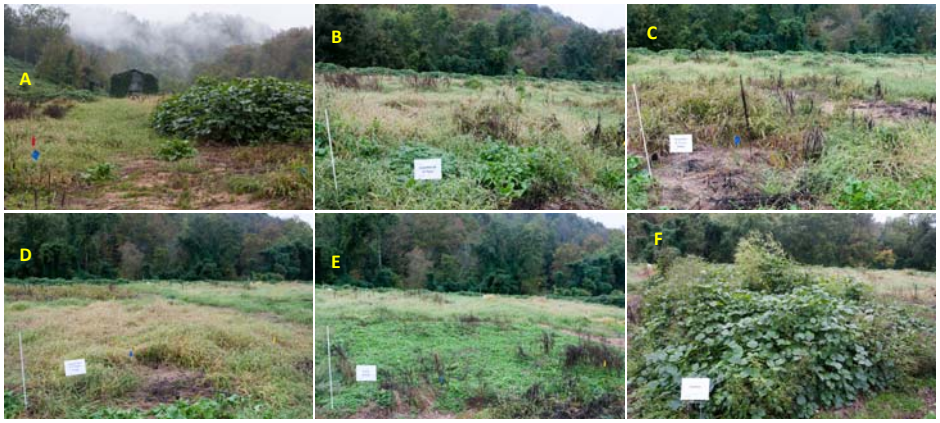


Figure 1. Overall view of trial (**A**), Transline (**B**), Streamline (**C**), Garlon (**D**), Rodeo (**E**), and Control (**F**) plots 431 DAIT (Sept. 29, 2015).

Effect of Mowing Timing on Johnsongrass Herbicide Efficacy

Joe Omielan and Michael Barrett
University of Kentucky

INTRODUCTION

Johnsongrass (*Sorghum halepense*) is a perennial warm season grass, listed as a noxious weed, and a common problem on right-of-way sites. There are a number of herbicides labeled and available to control johnsongrass and most rely on translocation from the leaves to the rhizomes for greatest efficacy. However, mowing is part of roadside management and one question is how long after herbicide application do we need to wait before mowing without reducing herbicide efficacy on johnsongrass control?

OBJECTIVE

The objective of this study was to:

1) Evaluate the effect of mowing timing on the efficacy of johnsongrass control herbicides

MATERIALS & METHODS

This study was initiated August 14, 2014 at an interchange near Bardstown KY. Four herbicide treatments were applied to 10 ft x 60 ft strips at 30 gal/ac (Table 1). Average johnsongrass height was 30 in. Six time of mowing treatments (Table 2) were applied as 10 ft x 40 ft strips across the herbicide treatments (Fig. 1) in a split block design, replicated three times. The mowing height was 5 inches. The herbicide treatments were Outrider (sulfosulfuron), Fusilade II (fluazifop), Acclaim Extra (fenoxaprop), and Fusilade + Acclaim. The time of mowing treatments were as follows: no mowing, same day as herbicide application, as well as 1 day, 2 days, 1week, and 2 weeks after application.

Visual assessments of percent johnsongrass control were done 34 (9/17/2014), 70 (10/23/2014), and 350 (7/30/2015) days after herbicide treatment (DAT). Data were analyzed using ARM software and treatment means were compared using Fisher's LSD at p = 0.05.

RESULTS & DISCUSSION

Differences in johnsongrass regrowth among herbicide treatments with mowing within hours of application were evident 34 DAT (Table 3A) with Outrider providing greater control than other herbicide treatments with the same day mowing treatment. There may have been more soil uptake with Outrider than other herbicide treatments as well as faster translocation to the rhizomes. Acclaim Extra had less control than the other herbicide treatments at many of the shorter mowing intervals (Table 3A & B) (Fig. 2). An overview of the herbicide treatment strips in rep 1 (Fig. 3) illustrates the control ratings in Table 3A.

Johnsongrass regrowth was visible in some of the treatment combinations 70 DAT and resulted in lower control ratings (Table 3B). The control with Outrider with same day mowing was higher than the other herbicide treatments and in the same group as the top treatments. However, only the no mowing and 2 weeks combinations with Acclaim Extra were in this group. By 350 DAT control in the top set of treatment combinations ranged from 40 to 92% with the least control in the Fusilade and Acclaim Extra plots mowed the day of application (Table 3C).

Table 1. Herbicide treatments, application rates, and active ingredients used in this trial.

Trt. No.	Product(s)	Rate per acre	Active Ingredients
1	Outrider	1 oz	sulfosulfuron
	Activator 90	0.25% v/v	
2	Fusilade II	24 fl oz	fluazifop
	Activator 90	0.25% v/v	
3	Acclaim Extra	39 fl oz	fenoxaprop
	Activator 90	0.25% v/v	
4	Acclaim Extra	7 fl oz	fenoxaprop
	Fusilade II	14 fl oz	fluazifop
	COC	1%	

Table 2. Timing of mowing treatments used in this trial.

Trt No.	Timing of Mowing Treatments
1	Same day as herbicide application
2	1 Day after
3	2 Days after
4	1 Week after
5	2 Weeks after
6	No mowing

Table 3. Herbicide x mowing treatment combinations and % johnsongrass control 34 DAT **(A)**, 70 DAT **(B)** and 350 DAT **(C)**.

(A) Mowing Time	Outrider	Fusilade II	Acclaim Extra	Acclaim + Fusilade
Same Day	83 *cd*	39 *gh*	45 *g*	30 *h*
1 Day After	97 *ab*	90 *abcd*	65 *f*	87 *bcd*
2 Days After	98 *a*	91 *abcd*	68 *f*	91 *abcd*
1 Week After	99 *a*	91 *abcd*	72 *ef*	93 *abc*
2 Weeks After	99 *a*	95 *ab*	83 *cd*	93 *abc*
No Mowing	70 *f*	87 *bcd*	82 *de*	87 *bcd*

(B) Mowing Time	Outrider	Fusilade II	Acclaim Extra	Acclaim + Fusilade
Same Day	88 *ab*	0 *f*	17 *ef*	14 *ef*
1 Day After	99 *a*	94 *a*	37 *de*	96 *a*
2 Days After	100 *a*	97 *a*	48 *cd*	98 *a*
1 Week After	100 *a*	97 *a*	67 *bc*	99 *a*
2 Weeks After	100 *a*	100 *a*	94 *a*	99 *a*
No Mowing	93 *a*	99 *a*	92 *a*	97 *a*

(C) Mowing Time	Outrider	Fusilade II	Acclaim Extra	Acclaim + Fusilade
Same Day	55 *a-h*	8 *h*	13 *gh*	40 *b-h*
1 Day After	75 *a-e*	78 *abc*	27 *e-h*	28 *d-h*
2 Days After	68 *a-f*	88 *ab*	35 *c-h*	50 *a-h*
1 Week After	72 *a-e*	92 *a*	43 *a-h*	55 *a-h*
2 Weeks After	72 *a-e*	33 *c-h*	20 *fgh*	38 *c-h*
No Mowing	62 *a-g*	76 *a-d*	58 *a-g*	61 *a-g*

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

Figure 1. Mowing on day of application (August 14, 2014).

Figure 2. Overview of Rep 1 plots 34 DAT. Red flags mark edge of block while yellow and blue flags mark center of herbicide strips.

Figure 3. Overview of herbicide treatment strips 34 DAT in Rep 1: Trt. 1 (**A**), Trt. 2 (**B**), Trt. 3 (**C**), Trt. 4 (**D**). Yellow and blue flags mark the center of the strips while red flags mark the edge of the rep.

SUMMARY

Mowing timing did affect herbicide efficacy. 2014 results suggest that mowing 1 or 2 days after application will not reduce the efficacy of Outrider, Fusilade, or Acclaim + Fusilade. However, one should wait 2 weeks before mowing if Acclaim Extra was applied.

The trial was repeated in 2015 and final assessments will be done in 2016.


Kentucky Pollinator Protection Plan

Some Key Points (March 2016)


Stakeholders

Kentucky Department of Agriculture, University of Kentucky, Kentucky State University, Kentucky State Beekeepers Association, Kentucky Transportation Cabinet, Kentucky Farm Bureau, Kentucky Environmental Foundation, AgriBusiness Association of Kentucky, Kentucky Soybean Growers Association, Kentucky Corn Growers/Small Grain Growers Association, Kentucky State Nature Preserves Commission, Kentucky Conservation Committee, Central Kentucky Audubon Society, United States Department of Agriculture-Farm Security Agency, University of Kentucky Arboretum, Dadant Bee Supply, Kelley's Bee Supply, Roundstone Native Seeds, National Garden Club, Kentucky Women in Agriculture, Kentucky Horticulture Society, USDA-NRCS, Kentucky Department of Fish and Wildlife

Summary

Since 2015, stakeholders have met in an effort to reduce pollinator loss in the Commonwealth by making available best management plans to beekeepers, chemical applicators, and landowners; increasing pollinator habitat; supporting education, extension and outreach, and facilitating communication among landowners, chemical applicators and pollinator advocates. These goals are designed to be inclusive of all pollinators.

The Plan

The major goal of this plan is to bring awareness to the issues faced by all parties and find ways for everyone to be part of solutions. The best management practices were developed with this goal in mind. This plan does not seek to eliminate chemical use, but rather urges responsible use and creates new and easily-accessed lines of communication. Increasing pollinator habitat works in conjunction with federal goals of reducing chemical spray drift, providing more nutrition, and reducing mowing. Including more pollinator awareness education in various outreach agencies and points-of-sale companies can educate general audiences as well as schools. Finally, communication in various formats and education will be needed to make these goals happen for years to come in order to make updates and reassess the success of the plan's goals.

Goal 1: Best Management Practices

The best management practices (BMPs) listed below have been developed to reduce the exposure of honey bees and other pollinators to pesticides. These BMPs are intended to be voluntary, as this issue should be addressed through education and communication.

Beekeepers

- **Document honey bee colony health during all seasons with photographic evidence as well as business receipts from current and previous years.**
- **Establish and maintain contact with your local USDA Farm Service Agency office regarding the ELAP program Consider reporting colony numbers and locations with the Kentucky Department of Agriculture State Apiarist**
- **Using a Bee Flag to communicate approximate hive location with area farmers or urban neighbors will help create much-needed communication between applicator/beekeeper.**
- **Maintain strong healthy colonies using recommended management practices.**
- **Plant diverse flowers for pollinator forage.**
- **Avoid placing honey bee colonies in direct proximity to agricultural fields in such a way that they are vulnerable to spray drift.**
- **Have full-length screens or hive nets "at the ready" to drape over hives and keep bees inside for a brief and limited time.**
- **Understand how to recognize colony loss due to pesticides and properly report to KDA/USDA FSA.**
- **Establish good relations and communication with neighboring farmers and notify them of your colony locations.**
- **Post beekeeper contact information in a prominent location at each apiary.**

Pesticide Applicators

Not all pesticide applications pose a risk to honey bees and other pollinators. The greatest risk occurs during the following conditions: 1. broad-spectrum insecticides are applied to crops or weeds in bloom; 2. pollinators are foraging in the area during daylight hours; and/or 3. chemical spray drifts onto colonies. Tank mixes of certain pesticides can also increase the risk to pollinators.

- **Be aware of honey bee colonies or habitat for other pollinators near fields to be treated with pesticides**
- **Use Integrated Pest Management (IPM) and economic thresholds to determine if insecticides are required to manage pests**
- **Crop consultants, agronomists, points of sale contacts, and others making pesticide recommendations should consider impacts on pollinators.**
- **Always use registered pesticides according to the label**
- **Pesticides toxic to pollinators should be applied when bees are less active.** Pollinators are most active during daylight hours between 9:00 a.m. and 3:00 p.m. and when the temperature is over 55 degrees Fahrenheit.
- **Minimize pesticide drift.**
- **Identify and notify beekeepers in the area prior to applying pesticides if required by label directives.**
- **Document your efforts** (via emails or phone calls) **to contact beekeepers** when applying pesticides that require beekeeper notification.
- **Minimize spraying non-crop areas and buffer zones with insecticides or other pesticides highly toxic to pollinators**
- **Establish good relations and communication with your local beekeepers.**

Goal 2: Increase Pollinator Habitat

An increase in pollinator habitat benefits Kentucky because the state can reduce costs associated with spraying or mowing and increase nutrition or habitat for pollinators, but noxious weeds need to be controlled. But *how* pollinator habitat is constructed is just as important as the goal to increase it.

Kentucky Transportation Cabinet. The Kentucky Transportation Cabinet has approximately 200,000 acres of right-of-way. Of that, it maintains about 100,000 acres with mowing, spraying, re-seeding, etc.

1. Overall, for its Pollinator Protection Zones, the Kentucky Transportation Cabinet has 35 sites in 10 of 12 districts across the state for a total of 71 acres.
2. The cabinet has converted former rest areas to monarch way-stations and provided pollinator plantings in Area 2 (Hardin County)
3. Kentucky passed a Highway Rights of Way law in 2010 allowing local Transportation officials to consider using pollinator habitat at interstate interchanges: www.lrc.ky.gov/record/10RS/SJ177.htm
4. See Appendix for example of seed mixture for monarchs.
5. As a matter of policy, the Kentucky Transportation Cabinet does not spray fence rows.
6. *Ongoing*: The Kentucky Transportation Cabinet is considering delaying some mowing schedules to reduce impact to the late-summer generation of monarchs.

Monarch Butterfly Waystations. Monarch Waystations are places that provide resources necessary for monarchs to produce successive generations and sustain their migration. Without milkweeds throughout their spring and summer breeding areas in North America, monarchs would not be able to produce the successive generations that culminate in the migration each fall. Similarly, without nectar from flowers, these fall migratory monarch butterflies would be unable to make their long journey to overwintering grounds in Mexico. (Adapted from www.monarchwatch.org).

Monarch Watch recommends that each Monarch Waystation have the following:

1. At least 10 milkweed plants (preferably 2 or more species).
2. At least 4 species of recommended nectar plants.
3. A good Monarch Waystation is also a pollinator garden and provides food, shelter and host plants for a variety of pollinator and wildlife species

Conclusion

Kentucky faces a crossroads in the agricultural community as new sectors are emerging that are more heavily-dependent on pollinators, and the nation faces an ecological crisis with its pollinators. This document reflects policies to enhance communication among beekeepers, chemical applicators, and landowners and consider increasing habitat with a goal toward responsible economic development as well as providing nutrition and shelter. The plan should not remain static. Future iterations will appear at regular intervals to evaluate how pollinators are doing in the state, and tailor the Pollinator Protection Plan so that the Commonwealth may not only benefit from the services provided by pollinators but also provide nutrition and sanctuary to pollinators. Our state relies on a diverse agriculture sector. Our agriculture, in turn, relies on the services of a sustainable beekeeping industry and a healthy diverse ecosystem of native pollinators.

Dormant Stem Field Plot Tour

We are having a "Show and Tell" of the dormant stem plots we established near Nortonville, KY (see attached file). We will be meeting at the "Salt Dome" which is next to the State Police post east of the Pennyrile Pkwy and along the Western KY Pkwy at 11 a.m. Central Time Wednesday May 18. We'll start the day with an opportunity to view and discuss the spray equipment used (long arm boom). We'll then view and discuss the replicated small plots with the four spray treatments as well as the large plots. Please let us know if whether or not you'll be able to attend. Thank-you.

Regards,
Joe O.

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Attendance: 9 KYTC, 2 UK, 1 Industry (Dow)

Treatments for Dormant Stem Treatments (large plots) FEB 2016

Trt. No.	Product(s)	Rate per acre	Application Rate	Amount for 3 acres	Location	Small Plots
1	BK800	1.5 gal	50 gpa	4.5 gallons	WK EB Shoulder 38.9 - 41.9mm	101
	Garlon 4 Ultra	0.5 gal		1.5 gallons	mm = Mile Marker	202
	Basal Oil	2 gal		6 gallons	EB = East Bound	303
	Surfactant	1 gal		3 gallons	WB = West Bound	402
2	Garlon 4 Ultra	2 gal	50 gpa	6 gallons	WK EB Median 39.1 - 40.5	102
	Milestone	7 fl oz		21 fl oz	WK EB Shoulder 41 - 41.4	203
	Basal Oil	2 gal		6 gallons		304
	Surfactant	1 gal		3 gallons		405
3	Garlon 4 Ultra	1 gal	50 gpa	3 gallons	WK WB Median 41.4 - 40.9	103
	Viewpoint	12 oz		36 oz	WK EB Shoulder 38.7-38.8	201
	Basal Oil	2 gal		6 gallons		305
	Surfactant	1 gal		3 gallons		403
4	Patron 170	6.9 pt	50 gpa	20.7 pints (2.6 gallons)	WK WB Shoulder 42.1 - 41.1	104
	Garlon 4 Ultra	1 gal		3 gallons		205
	Patriot	3 oz		9 oz		301
	Basal Oil	2 gal		6 gallons		404
	Surfactant	1 gal		3 gallons		

Applied Feb. 26, 2016

Small plots were applied March 8, 2016

Trt 5: Untreated Control 105 204 302 401

Vegetation Management for Highway Rights of Way Workshop
Tuesday July 26, 2016 at Spindletop Research Farm, Lexington KY

Agenda

8:30 – 9:00 a.m. Registration (Agronomy Building)

9:00 – 10:00 a.m. Weeds Garden and Weed ID (Dr. JD Green) (Group A) & Herbicide Injury and 2,4-D Volatility Demo (Dr. Joe Omielan and Dr. Mike Barrett) (Group B)

10:00 – 11:00 a.m. Weeds Garden and Weed ID (Group B) & Herbicide Injury and 2,4-D Volatility Demo (Group A)

11:00 – 12:00 p.m. Update on PGR x Mowing research (Dr. Joe Omielan) plus updates on biocontrol insect releases, wildflower / pollinator plots (KYTC staff)

12:00 – 1:00 p.m. Lunch

1:00 – 2:00 p.m. Pesticide Spill Response (Dr. Ed McCracken) with the assistance of the D7 Crew and their spray truck.

2:00 – 3:00 p.m. Discussion and demonstration of the capabilities of the D7 500 gallon spray truck with the crew and the manufacturer (Keith Hollingsworth from Chemical Containers, Inc.). Greg Ressler from Red River Specialties will speak about their products and programs as well.

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

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

Dr. Joe Omielan and Dr. Mike Barrett will lead the group in an exercise examining herbicide injury symptoms on different crop species and discuss the issues of 2,4-D volatility and herbicide resistance. (Cat. 3, 6, 10)

Dr. Joe Omielan and KYTC Staff will provide updates on PGR x Mowing research, biocontrol insect releases, and wildflower / pollinator plots (General)

Dr. Ed McCracken will provide information on how to respond to and clean up pesticide spills. The D7 Crew and their spray truck will demonstrate how to respond to a spill. (General)

Keith Hollingsworth will discuss and the D7 Crew will demonstrate the capabilities of their sprayer, including how to load and apply herbicides safely and effectively on the roadside. (General)

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

Attendance: 54 KYTC, 5 UK

2016 KYTC Tree Management Workshop
Tuesday September 27, 2016 at Princeton Research and Education Center
1205 Hopkinsville Street, Princeton KY 42445

Agenda

8:30 – 9:00 a.m. Registration along with coffee and donuts

9:00 – 10:00 a.m. The Principles of Good Arboriculture, according to Shigo (Cindy Marquel, KYTC)

10:00 – 11:00 a.m. Insect Pests, Diseases, and other Challenges to Maintaining Healthy Trees (Dr. Bill Fountain, UK)

11:00 – 12:00 p.m. An Overview of the International Society of Arboriculture Tree Risk Assessment Qualification. (Dr. Bill Fountain, UK)

12:00 – 1:00 p.m. Lunch

1:00 – 4:00 p.m. Outdoor Demonstrations (*please bring your hard hats and other safety gear*)

1:00 – 1:45 p.m. Demonstration of Bobcat with Forestry Cutter from District 4 (District 4 crew and Tony Combs from Bobcat)

1:45 – 2:30 p.m. Demonstration of Sky Trim telescoping boom and saw-type cutter head from District 3 (District 3 crew and Mike Balkom from Progress Rail Services)

2:30 – 4:00 p.m. Chainsaw Maintenance, Safety & Ergonomics (Cody Dunkin from Bryan Equipment)

Pesticide CEU's for this workshop: 1 General and 1 Specific (Categories 3, 6, 10) (approved).

Arborist CEU's (5.25 CEUs) (approved).

Engineering PDH's (6 hours) (approved).

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

Topics to be covered in the Workshop

The Principles of Good Arboriculture, according to Shigo (Cindy Marquel, KYTC)

- A discussion of the principles of good arboriculture, including proper tree maintenance and pruning, according to Alex Shigo.

Insect Pests, Diseases, and other Challenges to Maintaining Healthy Trees (Dr. Bill Fountain, UK)

- An update on the current status and what to look for with Emerald Ash Borer, Asian Longhorned Beetle, Hemlock Woolly Adelgid, and Thousand Cankers Disease as well as what practices to avoid that damage roadside trees.

An Overview of the International Society of Arboriculture Tree Risk Assessment Qualification. (Dr. Bill Fountain, UK)

- TRAQ is an ISA qualification program that trains arborists how to use the methodologies outlined in the ISA Best Management Practices for Tree Risk Assessment. This qualification promotes the safety of people and property by providing a standardized and systematic process for assessing tree risk. The results of a tree risk assessment can provide tree owners and risk managers with the information to make informed decisions to enhance tree benefits, health, and longevity.

Outdoor Demonstrations and Hands-On Opportunities (*please bring your hard hats and other safety gear plus your chainsaws*)**:**

Demonstration of Bobcat with Forestry Cutter from District 4 (District 4 crew and Tony Combs from Bobcat)

- See the cutter cut down and grind trees into mulch. Discuss its operation and maintenance.

Demonstration of Sky Trim telescoping boom and saw-type cutter head from District 3 (District 3 crew and Mike Balkom from Progress Rail Services)

- See the saw cut and trim trees. Discuss its operation and maintenance.

Chainsaw Maintenance, Safety & Ergonomics (Cody Dunkin from Bryan Equipment)

- Cody will discuss the safety features of a saw and proper PPE as well as proper starting and handling
- He will demonstrate an open face cut and notching, a plunge cut, and release of a tree under tension

Attendance: 44 KYTC, 4 UK, 2 Industry